Technical Package Cover Page

This file contains the following documents:

1. Summary of application (in plain language)
   - English
   - Alternative Language (Spanish)
2. First notice (NORI-Notice of Receipt of Application and Intent to Obtain a Permit)
   - English
   - Alternative Language (Spanish)
3. Second notice (NAPD-Notice of Preliminary Decision)
   - English
   - Alternative Language (Spanish)
4. Application materials
5. Draft permit
6. Technical summary or fact sheet

Portada de Paquete Técnico

Este archivo contiene los siguientes documentos:

1. Resumen de la solicitud (en lenguaje sencillo)
   - Inglés
   - Idioma alternativo (español)
2. Primer aviso (NORI, Aviso de Recepción de Solicitud e Intención de Obtener un Permiso)
   - Inglés
   - Idioma alternativo (español)
3. Segundo aviso (NAPD, Aviso de Decisión Preliminar)
   - Inglés
   - Idioma alternativo (español)
4. Materiales de la solicitud
5. Proyecto de permiso
6. Resumen técnico u hoja de datos

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PLAIN LANGUAGE SUMMARY FOR TPDES OR TLAP PERMIT APPLICATIONS

ENGLISH TEMPLATE FOR TPDES or TLAP NEW/RENEWAL/AMENDMENT APPLICATIONS DOMESTIC WASTEWATER/STORMWATER

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 TAC Chapter 39. The information provided in this summary may change during the technical review of the application and is not a federal enforceable representation of the permit application.

George & Laura Reagor (2. Enter Customer Number here (i.e., CN6########)) proposes to operate Reagor Tract WWTP (RN), a 0.15MGD wastewater treatment plant. The facility will be located at approximately 0.5 miles South from the intersection of FM 2338 and Indian Springs Road, in Georgetown, Williamson County, Texas 78633. This is a new application to discharge 150,000 gallons per day of processed wastewater on an intermittent and flow-variable basis.

Discharges from the facility are expected to contain five-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), ammonia nitrogen (NH_3-N), total phosphorus (P), and Escherichia Coli. Domestic wastewater will be treated by a future WWTP consisting of a packaged single stage nitrification plant, including headworks (bar screening), aeration, clarification, chlorination, chlorine contact & aerobic digestion. Treated effluent will be stored in a holding tank for six days in the initial phase, three days in the interim phase and three days in the final phase prior to disposal using subsurface drip irrigation near the treatment plant on land owned by the applicant. Sludge will be disposed of by hauling off-site by a licensed hauler, to a permitted landfill.

PLANTILLA EN INGLÉS PARA SOLICITUDES DE NUEVA/RENOVACIÓN/ENMIENDA TPDES o TLAP
AGUAS RESIDUALES DOMÉSTICAS/AGUAS PLUVIALES
El siguiente resumen se proporciona para esta solicitud de permiso de calidad del agua pendiente que está siendo revisada por la Comisión de Calidad Ambiental de Texas según lo exige el Capítulo 39 del 30 TAC. La información proporcionada en este resumen puede cambiar durante la revisión técnica de la solicitud y no es un documento federal ejecutable. representación de la solicitud de permiso.

George & Laura Reagor (2. Ingrese el número de cliente aquí (es decir, CN########)) propone operar la WWTP de Reagor Tract (RN), una planta de tratamiento de aguas residuales de 0.15 MGD. La instalación estará ubicada aproximadamente a 0,5 millas al sur de la intersección de FM 2338 e Indian Springs Road, en Georgetown, condado de Williamson, Texas 78633. Esta es una nueva solicitud para descargar 150,000 galones por día de aguas residuales procesadas de manera intermitente y con flujo base variable.

Se espera que las descargas de la instalación contengan demanda bioquímica de oxígeno carbonoso (CBOD5) de cinco días, sólidos suspendidos totales (SST), nitrógeno amoniacal (NH3-N), fósforo total (P) y Escherichia coli. Las aguas residuales domésticas serán tratadas mediante una futura EDAR que consistirá en una planta de nitrificación de una sola etapa, que incluye obras de captación (cribado de barras), aireación, clarificación, cloración, contacto con cloro y digestión aeróbica. El efluente tratado se almacenará en un tanque de retención durante seis días en la fase inicial, tres días en la fase intermedia y tres días en la fase final antes de su eliminación mediante riego por goteo subterráneo cerca de la planta de tratamiento en un terreno propiedad del solicitante. Los lodos se eliminarán mediante transporte fuera del sitio por parte de un transportista autorizado, a un vertedero autorizado.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

NOTICE OF RECEIPT OF APPLICATION AND INTENT TO OBTAIN WATER QUALITY PERMIT

PROPOSED PERMIT NO. WQ0016685001

APPLICATION. George Reagor, 906 East Sandstone Street, Llano, Texas 78643, and Laura Reagor, 14943 Sandalfoot Street, Houston, Texas 77095, have applied to the Texas Commission on Environmental Quality (TCEQ) for proposed Texas Land Application Permit (TLAP) No. WQ0016685001 to authorize the disposal of treated wastewater at a volume not to exceed a daily average flow of 150,000 gallons per day via subsurface area drip dispersal system on a minimum of 35 acres. The domestic wastewater treatment facility and disposal area will be located approximately 0.59 miles south of the intersection of Indian Springs Road and Ranch-to-Market Road 2338, near the city of Georgetown, in Williamson County, Texas 78633. TCEQ received this application on December 11, 2024. The permit application will be available for viewing and copying at Liberty Hill Public Library, 355 Loop 332, Liberty Hill, in Williamson County, Texas prior to the date this notice is published in the newspaper. The application, including any updates, and associated notices are available electronically at the following webpage: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications. This link to an electronic map of the site or facility's general location is provided as a public courtesy and not part of the application or notice. For the exact location, refer to the application. https://gisweb.tceq.texas.gov/LocationMapper/?marker=-97.793888,30.726111&level=18

ALTERNATIVE LANGUAGE NOTICE. Alternative language notice in Spanish is available at: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

ADDITIONAL NOTICE. TCEQ's Executive Director has determined the application is administratively complete and will conduct a technical review of the application. After technical review of the application is complete, the Executive Director may prepare a draft permit and will issue a preliminary decision on the application. **Notice of the Application and Preliminary Decision will be published and mailed to those who are on the county-wide mailing list and to those who are on the mailing list for this application. That notice will contain the deadline for submitting public comments.**

PUBLIC COMMENT / PUBLIC MEETING. You may submit public comments or request a public meeting on this application. The purpose of a public meeting is to provide the opportunity to submit comments or to ask questions about the application. TCEQ will hold a public meeting if the Executive Director determines that there is a significant degree of public

interest in the application or if requested by a local legislator. A public meeting is not a contested case hearing.

OPPORTUNITY FOR A CONTESTED CASE HEARING. After the deadline for submitting public comments, the Executive Director will consider all timely comments and prepare a response to all relevant and material, or significant public comments. **Unless the application is directly referred for a contested case hearing, the response to comments, and the Executive Director's decision on the application, will be mailed to everyone who submitted public comments and to those persons who are on the mailing list for this application. If comments are received, the mailing will also provide instructions for requesting reconsideration of the Executive Director's decision and for requesting a contested case hearing.** A contested case hearing is a legal proceeding similar to a civil trial in state district court.

TO REQUEST A CONTESTED CASE HEARING, YOU MUST INCLUDE THE FOLLOWING ITEMS IN YOUR REQUEST: your name, address, phone number; applicant's name and proposed permit number; the location and distance of your property/activities relative to the proposed facility; a specific description of how you would be adversely affected by the facility in a way not common to the general public; a list of all disputed issues of fact that you submit during the comment period and, the statement "[I/we] request a contested case hearing." If the request for contested case hearing is filed on behalf of a group or association, the request must designate the group's representative for receiving future correspondence; identify by name and physical address an individual member of the group who would be adversely affected by the proposed facility or activity; provide the information discussed above regarding the affected member's location and distance from the facility or activity; explain how and why the member would be affected; and explain how the interests the group seeks to protect are relevant to the group's purpose.

Following the close of all applicable comment and request periods, the Executive Director will forward the application and any requests for reconsideration or for a contested case hearing to the TCEQ Commissioners for their consideration at a scheduled Commission meeting.

The Commission may only grant a request for a contested case hearing on issues the requestor submitted in their timely comments that were not subsequently withdrawn. **If a hearing is granted, the subject of a hearing will be limited to disputed issues of fact or mixed questions of fact and law relating to relevant and material water quality concerns submitted during the comment period.**

MAILING LIST. If you submit public comments, a request for a contested case hearing or a reconsideration of the Executive Director's decision, you will be added to the mailing list for this specific application to receive future public notices mailed by the Office of the Chief Clerk. In addition, you may request to be placed on: (1) the permanent mailing list for a specific applicant name and permit number; and/or (2) the mailing list for a specific county. If you wish to be placed on the permanent and/or the county mailing list, clearly specify which list(s) and send your request to TCEQ Office of the Chief Clerk at the address below.

INFORMATION AVAILABLE ONLINE. For details about the status of the application, visit the Commissioners' Integrated Database at www.tceq.texas.gov/goto/cid. Search the database using the permit number for this application, which is provided at the top of this notice.

AGENCY CONTACTS AND INFORMATION. All public comments and requests must be submitted either electronically at **https://www14.tceq.texas.gov/epic/eComment/**, or in writing to the Texas Commission on Environmental Quality, Office of the Chief Clerk, MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Please be aware that any contact information you provide, including your name, phone number, email address and physical address will become part of the agency's public record. For more information about this permit application or the permitting process, please call the TCEQ Public Education Program, Toll Free, at 1-800-687-4040 or visit their website at www.tceq.texas.gov/goto/pep. Si desea información en Español, puede llamar al 1-800-687-4040.

Further information may also be obtained from George Reagor and Laura Reagor at the address stated above or by calling Ms. Lauren Crone, P.E., LJA Engineering, Inc., at 512-439-4700.

Issuance Date: March 5, 2025

Comisión de Calidad Ambiental del Estado de Texas

AVISO DE RECIBO DE LA SOLICITUD E
INTENCION DE OBTENER PERMISO PARA LA CALIDAD DEL AGUA

PERMISO PROPUESTO NO. WQ0016685001

SOLICITUD. George Reagor, 906 East Sandstone Street, Llano, Texas 78643, y Laura Reagor, 14943 Sandalfoot Street, Houston, Texas 77095, han solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) para el propuesto Permiso No.WQ0016685001 de disposición de aguas residuales para autorizar la disposición de aguas residuales tratadas en un volumen que no sobrepasa un flujo promedio diario de 150,000 galones por día por medio de Sistema de dispersión por goteo en el área subterránea en un mínimo de 35 acres. La planta de tratamiento de aguas domésticos residuales y el área de disposición estarán ubicados en 0.59 millas al sur de la intersección de Indian Springs Road y Ranch-to-Market Road 2338, cerca de la ciudad de Georgetown en el Condado de Williamson, Texas 78633. La TCEQ recibió esta solicitud el día 11 de diciembre de 2024. La solicitud para el permiso estará disponible para leerla y copiarla en Biblioteca pública de Liberty Hill, 355 Loop 332, Liberty Hill, en el condado de Williamson antes de la fecha de publicación de este aviso en el periódico. La solicitud (cualquier actualización y aviso inclusive) está disponible electrónicamente en la siguiente página web: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications. Este enlace a un mapa electrónico de la ubicación general del sitio o de la instalación es proporcionado como una cortesía y no es parte de la solicitud o del aviso. Para la ubicación exacta, consulte la solicitud.
https://gisweb.tceq.texas.gov/LocationMapper/?marker=-97.793888,30.726111&level=18

AVISO DE IDIOMA ALTERNATIVO. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

AVISO ADICIONAL. El Director Ejecutivo de la TCEQ ha determinado que la solicitud es administrativamente completa y conducirá una revisión técnica de la solicitud. Después de completar la revisión técnica, el Director Ejecutivo puede preparar un borrador del permiso y emitirá una Decisión Preliminar sobre la solicitud. **El aviso de la solicitud y la decisión preliminar serán publicados y enviado a los que están en la lista de correo de las personas a lo largo del condado que desean recibir los avisos y los que están en la lista de correo que desean recibir avisos de esta solicitud. El aviso dará la fecha límite para someter comentarios públicos.**

COMENTARIO PUBLICO / REUNION PUBLICA. Usted puede presentar comentarios públicos o pedir una reunión pública sobre esta solicitud. El propósito de una reunión pública es dar la oportunidad de presentar comentarios o hacer preguntas acerca de la solicitud. La TCEQ realiza una reunión pública si el Director Ejecutivo determina que hay un grado de interés

público suficiente en la solicitud o si un legislador local lo pide. Una reunión pública no es una audiencia administrativa de lo contencioso.

OPORTUNIDAD DE UNA AUDIENCIA ADMINISTRATIVA DE LO CONTENCIOSO. Después del plazo para presentar comentarios públicos, el Director Ejecutivo considerará todos los comentarios apropiados y preparará una respuesta a todo los comentarios públicos esenciales, pertinentes, o significativos. **A menos que la solicitud haya sido referida directamente a una audiencia administrativa de lo contencioso, la respuesta a los comentarios y la decisión del Director Ejecutivo sobre la solicitud serán enviados por correo a todos los que presentaron un comentario público y a las personas que están en la lista para recibir avisos sobre esta solicitud. Si se reciben comentarios, el aviso también proveerá instrucciones para pedir una reconsideración de la decisión del Director Ejecutivo y para pedir una audiencia administrativa de lo contencioso.** Una audiencia administrativa de lo contencioso es un procedimiento legal similar a un procedimiento legal civil en un tribunal de distrito del estado.

PARA SOLICITAR UNA AUDIENCIA DE CASO IMPUGNADO, USTED DEBE INCLUIR EN SU SOLICITUD LOS SIGUIENTES DATOS: su nombre, dirección, y número de teléfono; el nombre del solicitante y número del permiso; la ubicación y distancia de su propiedad/actividad con respecto a la instalación; una descripción específica de la forma cómo usted sería afectado adversamente por el sitio de una manera no común al público en general; una lista de todas las cuestiones de hecho en disputa que usted presente durante el período de comentarios; y la declaración "[Yo/nosotros] solicito/solicitamos una audiencia de caso impugnado". Si presenta la petición para una audiencia de caso impugnado de parte de un grupo o asociación, debe identificar una persona que representa al grupo para recibir correspondencia en el futuro; identificar el nombre y la dirección de un miembro del grupo que sería afectado adversamente por la planta o la actividad propuesta; proveer la información indicada anteriormente con respecto a la ubicación del miembro afectado y su distancia de la planta o actividad propuesta; explicar cómo y porqué el miembro sería afectado; y explicar cómo los intereses que el grupo desea proteger son pertinentes al propósito del grupo.

Después del cierre de todos los períodos de comentarios y de petición que aplican, el Director Ejecutivo enviará la solicitud y cualquier petición para reconsideración o para una audiencia de caso impugnado a los Comisionados de la TCEQ para su consideración durante una reunión programada de la Comisión. La Comisión sólo puede conceder una solicitud de una audiencia de caso impugnado sobre los temas que el solicitante haya presentado en sus comentarios oportunos que no fueron retirados posteriormente. Si se concede una audiencia, el tema de la audiencia estará limitado a cuestiones de hecho en disputa o cuestiones mixtas de hecho y de derecho relacionadas a intereses pertinentes y materiales de calidad del agua que se hayan presentado durante el período de comentarios.

LISTA DE CORREO. Si somete comentarios públicos, un pedido para una audiencia administrativa de lo contencioso o una reconsideración de la decisión del Director Ejecutivo, la Oficina del Secretario Principal enviará por correo los avisos públicos en relación con la solicitud. Ademas, puede pedir que la TCEQ ponga su nombre en una or mas de las listas correos siguientes (1) la lista de correo permanente para recibir los avisos de el solicitante indicado por nombre y número del permiso específico y/o (2) la lista de correo de todas las

solicitudes en un condado especifico. Si desea que se agrega su nombre en una de las listas designe cual lista(s) y envia por correo su pedido a la Oficina del Secretario Principal de la TCEQ.

INFORMACIÓN DISPONIBLE EN LÍNEA. Para detalles sobre el estado de la solicitud, favor de visitar la Base de Datos Integrada de los Comisionados en www.tceq.texas.gov/goto/cid. Para buscar en la base de datos, utilizar el número de permiso para esta solicitud que aparece en la parte superior de este aviso.

CONTACTOS E INFORMACIÓN A LA AGENCIA. Todos los comentarios públicos y solicitudes deben ser presentadas electrónicamente vía http://www14.tceq.texas.gov/epic/eComment/ o por escrito dirigidos a la Comisión de Texas de Calidad Ambiental, Oficial de la Secretaría (Office of Chief Clerk), MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Tenga en cuenta que cualquier información personal que usted proporcione, incluyendo su nombre, número de teléfono, dirección de correo electrónico y dirección física pasarán a formar parte del registro público de la Agencia. Para obtener más información acerca de esta solicitud de permiso o el proceso de permisos, llame al programa de educación pública de la TCEQ, gratis, al 1-800-687-4040. Si desea información en Español, puede llamar al 1-800-687-4040.

También se puede obtener información adicional del George Reagor and Laura Reagor a la dirección indicada arriba o llamando a Senora Lauren Crone, P.E. LJA Engineering Inc., al (512) 439-4700.

Fecha de emisión el 5 de marzo de 2025

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

COMBINED

NOTICE OF PUBLIC MEETING

AND

NOTICE OF APPLICATION AND PRELIMINARY DECISION FOR WATER QUALITY LAND APPLICATION PERMIT FOR MUNICIPAL WASTEWATER

NEW

PROPOSED PERMIT NO. WQ0016685001

APPLICATION AND PRELIMINARY DECISION. George Reagor, 906 East Sandstone Street, Llano, Texas 78643, and Laura Reagor, 14943 Sandalfoot Street, Houston, Texas 77095, have applied to the Texas Commission on Environmental Quality (TCEQ) for a new permit, TCEQ Permit No. WQ0016685001, to authorize the disposal of treated domestic wastewater at a daily average flow not to exceed 150,000 gallons per day via non-public access subsurface area drip dispersal system with a minimum area of 35 acres. This permit will not authorize a discharge of pollutants into waters in the State. TCEQ received this application on December 11, 2024.

The wastewater treatment facility and disposal site will be located approximately 0.59 miles south of the intersection of Indian Springs Road and Ranch-to-Market Road 2338, in Williamson County, Texas 78633. The wastewater treatment facility and disposal site will be located in the drainage basin of San Gabriel/North Fork San Gabriel River in Segment No. 1248 of the Brazos River Basin. This link to an electronic map of the site or facility's general location is provided as a public courtesy and not part of the application or notice. For exact location, refer to application.
https://gisweb.tceq.texas.gov/LocationMapper/?marker=-97.793888,30.726111&level=18

The TCEQ Executive Director has completed the technical review of the application and prepared a draft permit. The draft permit, if approved, would establish the conditions under which the facility must operate. The Executive Director has made a preliminary decision that this permit, if issued, meets all statutory and regulatory requirements. The permit application, Executive Director's preliminary decision, and draft permit are available for viewing and copying at Liberty Hill Public Library, 355 Loop 332, Liberty Hill, in Williamson County, Texas. The application, including any updates, and associated notices are available electronically at the following webpage: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

ALTERNATIVE LANGUAGE NOTICE. Alternative language notice in Spanish is available at https://www.tceq.texas.gov/permitting/wastewater/plain-language-summaries-and-public-notices. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/plain-language-summaries-and-public-notices.

PUBLIC COMMENT / PUBLIC MEETING. You may submit public comments or request a public meeting about this application. The TCEQ will hold a public meeting on this application because it was requested by a local representative.

The purpose of a public meeting is to provide the opportunity to submit comments or to ask questions about the application. A public meeting will be held and will consist of two parts, an Informal Discussion Period and a Formal Comment Period. A public meeting is not a contested case hearing under the Administrative Procedure Act. During the Informal Discussion Period, the public will be encouraged to ask questions of the applicant and TCEQ staff concerning the permit application. The comments and questions submitted orally during the Informal Discussion Period will not be considered before a decision is reached on the permit application and no formal response will be made. Responses will be provided orally during the Informal Discussion Period. During the Formal Comment Period on the permit application, members of the public may state their formal comments orally into the official record. A written response to all timely, relevant and material, or significant comments will be prepared by the Executive Director. All formal comments will be considered before a decision is reached on the permit application. A copy of the written response will be sent to each person who submits a formal comment or who requested to be on the mailing list for this permit application and provides a mailing address. Only relevant and material issues raised during the Formal Comment Period can be considered if a contested case hearing is granted on this permit application.

The Public Meeting is to be held:

Date of Public Meeting at Time of Public Meeting
Address of Public Meeting
Street Address
City, State Zip Code

Persons with disabilities who need special accommodations at the meeting should call the Office of the Chief Clerk at (512) 239-3300 or 1-800-RELAY-TX (TDD) at least one week prior to the meeting.

OPPORTUNITY FOR A CONTESTED CASE HEARING. After the deadline for submitting public comments, the Executive Director will consider all timely comments and prepare a response to all relevant and material, or significant public comments. **Unless the application is directly referred for a contested case hearing, the response to comments will be mailed to everyone who submitted public comments and to those persons who are on the mailing list for this application. If comments are received, the mailing will also provide instructions for requesting a contested case hearing or reconsideration of the Executive Director's decision**. A contested case hearing is a legal proceeding similar to a civil trial in a state district court.

TO REQUEST A CONTESTED CASE HEARING, YOU MUST INCLUDE THE FOLLOWING ITEMS IN YOUR REQUEST: your name, address, phone number; applicant's name and proposed permit number; the location and distance of your

property/activities relative to the proposed facility; a specific description of how you would be adversely affected by the facility in a way not common to the general public; a list of all disputed issues of fact that you submit during the comment period; and the statement "[I/we] request a contested case hearing." If the request for contested case hearing is filed on behalf of a group or association, the request must designate the group's representative for receiving future correspondence; identify by name and physical address an individual member of the group who would be adversely affected by the proposed facility or activity; provide the information discussed above regarding the affected member's location and distance from the facility or activity; explain how and why the member would be affected; and explain how the interests the group seeks to protect are relevant to the group's purpose.

Following the close of all applicable comment and request periods, the Executive Director will forward the application and any requests for reconsideration or for a contested case hearing to the TCEQ Commissioners for their consideration at a scheduled Commission meeting.

The Commission may only grant a request for a contested case hearing on issues the requestor submitted in their timely comments that were not subsequently withdrawn. **If a hearing is granted, the subject of a hearing will be limited to disputed issues of fact or mixed questions of fact and law relating to relevant and material water quality concerns submitted during the comment period.**

EXECUTIVE DIRECTOR ACTION. The Executive Director may issue final approval of the application unless a timely contested case hearing request or request for reconsideration is filed. If a timely hearing request or request for reconsideration is filed, the Executive Director will not issue final approval of the permit and will forward the application and request to the TCEQ Commissioners for their consideration at a scheduled Commission meeting.

MAILING LIST. If you submit public comments, a request for a contested case hearing or a reconsideration of the Executive Director's decision, you will be added to the mailing list for this specific application to receive future public notices mailed by the Office of the Chief Clerk. In addition, you may request to be placed on: (1) the permanent mailing list for a specific applicant name and permit number; and/or (2) the mailing list for a specific county. If you wish to be placed on the permanent and/or the county mailing list, clearly specify which list(s) and send your request to TCEQ Office of the Chief Clerk at the address below.

All written public comments and public meeting requests must be submitted to the Office of the Chief Clerk, MC 105, Texas Commission on Environmental Quality, P.O. Box 13087, Austin, TX 78711-3087 or electronically at www.tceq.texas.gov/goto/comment **within 30 days from the date of newspaper publication of this notice.**

INFORMATION AVAILABLE ONLINE. For details about the status of the application, visit the Commissioners' Integrated Database at www.tceq.texas.gov/goto/cid. Search the database using the permit number for this application, which is provided at the top of this notice.

AGENCY CONTACTS AND INFORMATION. Public comments and requests must be submitted either electronically at www.tceq.texas.gov/goto/comment, or in writing to the Texas Commission on Environmental Quality, Office of the Chief Clerk, MC 105, P.O. Box 13087, Austin, Texas 78711-3087. Any personal information you submit to the TCEQ will become part

of the agency's record; this includes email addresses. For more information about this permit application or the permitting process, please call the TCEQ Public Education Program, Toll Free, at 1-800-687-4040 or visit their website at www.tceq.texas.gov/goto/pep. Si desea información en Español, puede llamar al 1-800-687-4040.

Further information may also be obtained from George Reagor and Laura Reagor at the address stated above or by calling Ms. Lauren Crone, P.E., LJA Engineering, Inc. at 512-439-4700.

Issuance Date: _____

Comisión de Calidad Ambiental de Texas

AVISO DE SOLICITUD Y DECISIÓN PRELIMINAR PARA EL PERMISO DE APLICACIÓN DE TERRENOS PARA LA CALIDAD DEL AGUA PARA AGUAS RESIDUALES MUNICIPALES

NUEVO

No. DE PERMISO WQ0016685001

SOLICITUD Y DECISIÓN PRELIMINAR. George Reagor, 906 East Sandstone Street, Llano, Texas 78643, y Laura Reagor, 14943 Sandalfoot Street, Houston, Texas 77095, han solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) un nuevo permiso, el permiso TCEQ No. WQ0016685001, para autorizar la disposición de aguas residuales domésticas tratadas con un caudal promedio diario que no exceda los 150,000 galones por día mediante un sistema de dispersión por goteo subterráneo de acceso no público con una superficie mínima de 35 acres. Este permiso no autoriza la descarga de contaminantes en las aguas del Estado. La TCEQ recibió esta solicitud el 11 de diciembre de 2024.

La planta de tratamiento de aguas residuales y el vertedero estarán ubicados aproximadamente a 0.59 millas al sur de la intersección de Indian Springs Road y Ranch-to-Market Road 2338, en el condado de Williamson, Texas 78633. La planta de tratamiento de aguas residuales y el vertedero estarán ubicados en la cuenca de drenaje del río San Gabriel/North Fork San Gabriel, en el segmento No. 1248 de la cuenca del río Brazos. Este enlace a un mapa electrónico de la ubicación general del sitio o la planta se proporciona como cortesía pública y no forma parte de la solicitud ni del aviso. Para conocer la ubicación exacta, consulte la solicitud. https://gisweb.tceq.texas.gov/LocationMapper/?marker=-97.793888,30.726111&level=18

El Director Ejecutivo de la TCEQ ha completado la revisión técnica de la solicitud y ha preparado un borrador del permiso. De aprobarse, este borrador establecería las condiciones de funcionamiento de la instalación. El Director Ejecutivo ha determinado preliminarmente que este permiso, de ser emitido, cumple con todos los requisitos legales y reglamentarios. La solicitud de permiso, la decisión preliminar del Director Ejecutivo y el borrador del permiso están disponibles para consulta y copia en la Biblioteca Pública de Liberty Hill, ubicada en 355 Loop 332, Liberty Hill, Condado de Williamson, Texas. La solicitud, incluyendo sus actualizaciones y los avisos correspondientes, está disponible electrónicamente en la siguiente página web: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

AVISO DE IDIOMA ALTERNATIVO. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/plain-language-summaries-and-public-notice. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/plain-language-summaries-and-public-notices.

COMENTARIOS PÚBLICOS / REUNIÓN PÚBLICA. Puede presentar comentarios públicos o solicitar una reunión pública sobre esta solicitud. El propósito de una reunión pública es brindar la oportunidad de presentar comentarios o hacer preguntas sobre la solicitud. La TCEQ celebra una reunión pública si el Director Ejecutivo determina que existe un interés público significativo en la solicitud o si lo solicita un legislador local. Una reunión pública no constituye una audiencia de caso contencioso.

OPORTUNIDAD PARA UNA AUDIENCIA DE CASO CONTENCIADO. Tras la fecha límite para la presentación de comentarios públicos, el Director Ejecutivo considerará todos los comentarios oportunos y preparará una respuesta a todos los comentarios públicos relevantes, sustanciales o significativos. **A menos que la solicitud se remita directamente a una audiencia de caso contencioso, la respuesta a los comentarios se enviará por correo a todos los que presentaron comentarios públicos y a las personas que estén en la lista de correo de esta solicitud. Si se reciben comentarios, el correo también incluirá instrucciones para solicitar una audiencia de caso contencioso o la reconsideración de la decisión del Director Ejecutivo.** Una audiencia de caso contencioso es un procedimiento legal similar a un juicio civil en un tribunal de distrito estatal.

PARA SOLICITAR UNA AUDIENCIA DE CASO CONTROVERTIDO, DEBE INCLUIR LOS SIGUIENTES DATOS EN SU SOLICITUD: su nombre, dirección, número de teléfono; nombre del solicitante y número de permiso propuesto; la ubicación y distancia de su propiedad/actividades con respecto a la instalación propuesta; una descripción específica de cómo la instalación le afectaría negativamente de una manera inusual para el público general; una lista de todas las cuestiones de hecho controvertidas que presente durante el período de comentarios; y la declaración "Solicito/Solicitamos una audiencia de caso controvertido". Si la solicitud de audiencia de caso controvertido se presenta en nombre de un grupo o asociación, la solicitud debe designar al representante del grupo para recibir correspondencia futura; identificar por nombre y dirección física a un miembro del grupo que se vería afectado negativamente por la instalación o actividad propuesta; proporcionar la información mencionada anteriormente sobre la ubicación y distancia del miembro afectado con respecto a la instalación o actividad; explicar cómo y por qué el miembro se vería afectado; y explicar cómo los intereses que el grupo busca proteger son relevantes para su propósito.

Tras el cierre de todos los períodos de comentarios y solicitudes aplicables, el Director Ejecutivo remitirá la solicitud y cualquier solicitud de reconsideración o de audiencia de caso contencioso a los Comisionados de la TCEQ para su consideración en una reunión programada de la Comisión.

La Comisión solo podrá conceder una solicitud de audiencia de caso contencioso sobre cuestiones que el solicitante presentó en sus comentarios oportunos y que no hayan sido posteriormente retiradas. **Si se concede una audiencia, el tema de la misma se limitará a cuestiones de hecho controvertidas o cuestiones mixtas de hecho y derecho relacionadas con preocupaciones relevantes y sustanciales sobre la calidad del**

agua presentadas durante el período de comentarios. La TCEQ podrá resolver una solicitud de renovación de un permiso para la descarga de aguas residuales sin otorgar la oportunidad de una audiencia de caso contencioso si se cumplen ciertos criterios.

ACCIÓN DEL DIRECTOR EJECUTIVO. El Director Ejecutivo podrá emitir la aprobación final de la solicitud a menos que se presente una solicitud de audiencia de caso contencioso o de reconsideración oportuna. Si se presenta una solicitud de audiencia o de reconsideración dentro del plazo establecido, el Director Ejecutivo no emitirá la aprobación final del permiso y remitirá la solicitud a los Comisionados de la TCEQ para su consideración en una reunión programada de la Comisión.

LISTA DE CORREO. Si presenta comentarios públicos, una solicitud de audiencia de caso impugnado o una reconsideración de la decisión del Director Ejecutivo, se le añadirá a la lista de correo de esta solicitud específica para recibir futuras notificaciones públicas enviadas por la Oficina del Secretario General. Además, puede solicitar ser incluido en: (1) la lista de correo permanente para un nombre de solicitante y número de permiso específicos; y/o (2) la lista de correo de un condado específico. Si desea ser incluido en la lista de correo permanente y/o en la lista de correo del condado, especifique claramente cuál(es) lista(s) y envíe su solicitud a la Oficina del Secretario General de la TCEQ a la dirección que figura a continuación.

Todos los comentarios públicos y solicitudes de reuniones públicas por escrito deben enviarse a la Oficina del Secretario General, MC 105, Comisión de Calidad Ambiental de Texas, P.O. Apartado Postal 13087, Austin, TX 78711-3087 o electrónicamente en www.tceq.texas.gov/goto/comment dentro de los 30 días posteriores a la fecha de publicación de este aviso en el periódico.
INFORMACIÓN DISPONIBLE EN LÍNEA. Para obtener detalles sobre el estado de la solicitud, visite la Base de Datos Integrada de los Comisionados en www.tceq.texas.gov/goto/cid. Busque en la base de datos utilizando el número de permiso de esta solicitud, que se encuentra en la parte superior de este aviso.

CONTACTOS E INFORMACIÓN DE LA AGENCIA. Los comentarios y solicitudes del público deben enviarse electrónicamente en www.tceq.texas.gov/goto/comment o por escrito a la Comisión de Calidad Ambiental de Texas, Oficina del Secretario Principal, MC 105, Apartado Postal 13087, Austin, Texas 78711-3087. Toda información personal que envíe a la TCEQ formará parte del registro de la agencia, incluidas las direcciones de correo electrónico. Para obtener más información sobre esta solicitud de permiso o el proceso de obtención de permisos, llame al Programa de Educación Pública de la TCEQ, sin costo, al 1-800-687-4040 o visite su sitio web: www.tceq.texas.gov/goto/pep. Si desea información en español, puede llamar al 1-800-687-4040.

También se puede obtener más información de George Reagor y Laura Reagor en la dirección indicada anteriormente o llamando a la Sra. Lauren Crone, P.E., LJA Engineering, Inc. al 512-439-4700.

Fecha de emission _____

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

FOR

REAGOR TRACT WASTEWATER TREATEMENT PLANT

DECEMBER 2024

PREPARED FOR
George and Laura Reagor
906 E. Sandstone Street
Llano, Texas 78643

PREPARED BY

LJA Engineering, Inc.
7500 RIALTO BLVD
BUILDING II, SUITE 100
Austin, Texas 78735
(512) 439-4700

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EXHIBIT 1

ADMINISTRATIVE REPORT 1.0 AND 1.1

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION CHECKLIST

Complete and submit this checklist with the application.

APPLICANT NAME: George & Laura Reagor

PERMIT NUMBER (If new, leave blank): WQ00 Click to enter text.

Indicate if each of the following items is included in your application.

	Y	N		Y	N
Administrative Report 1.0	☒	☐	Original USGS Map	☒	☐
Administrative Report 1.1	☒	☐	Affected Landowners Map	☒	☐
SPIF	☐	☒	Landowner Disk or Labels	☒	☐
Core Data Form	☒	☐	Buffer Zone Map	☒	☐
Public Involvement Plan Form	☒	☐	Flow Diagram	☒	☐
Technical Report 1.0	☒	☐	Site Drawing	☒	☐
Technical Report 1.1	☒	☐	Original Photographs	☒	☐
Worksheet 2.0	☐	☒	Design Calculations	☒	☐
Worksheet 2.1	☐	☒	Solids Management Plan	☒	☐
Worksheet 3.0	☒	☐	Water Balance	☐	☒
Worksheet 3.1	☐	☒			
Worksheet 3.2	☒	☐			
Worksheet 3.3	☐	☒			
Worksheet 4.0	☐	☒			
Worksheet 5.0	☐	☒			
Worksheet 6.0	☐	☒			
Worksheet 7.0	☒	☐			

For TCEQ Use Only

Segment Number _____County _____
Expiration Date _____Region_____
Permit Number _____

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION ADMINISTRATIVE REPORT 1.0

For any questions about this form, please contact the Applications Review and Processing Team at 512-239-4671.

Section 1. Application Fees (Instructions Page 26)

Indicate the amount submitted for the application fee (check only one).

Flow	New/Major Amendment	Renewal
<0.05 MGD	$350.00 ☐	$315.00 ☐
≥0.05 but <0.10 MGD	$550.00 ☐	$515.00 ☐
≥0.10 but <0.25 MGD	$850.00 ☒	$815.00 ☐
≥0.25 but <0.50 MGD	$1,250.00 ☐	$1,215.00 ☐
≥0.50 but <1.0 MGD	$1,650.00 ☐	$1,615.00 ☐
≥1.0 MGD	$2,050.00 ☐	$2,015.00 ☐

Minor Amendment (for any flow) $150.00 ☐

Payment Information:

Mailed Check/Money Order Number: Click to enter text.

Check/Money Order Amount: Click to enter text.

Name Printed on Check: Click to enter text.

EPAY Voucher Number: Click to enter text.

Copy of Payment Voucher enclosed? Yes ☐

Section 2. Type of Application (Instructions Page 26)

a. Check the box next to the appropriate authorization type.

☐ Publicly-Owned Domestic Wastewater

☐ Privately-Owned Domestic Wastewater

☒ Conventional Wastewater Treatment

b. Check the box next to the appropriate facility status.

☐ Active ☒ Inactive

c. Check the box next to the appropriate permit type.

- ☐ TPDES Permit
- ☒ TLAP
- ☐ TPDES Permit with TLAP component
- ☒ Subsurface Area Drip Dispersal System (SADDS)

d. Check the box next to the appropriate application type

- ☒ New
- ☐ Major Amendment *with* Renewal
- ☐ Major Amendment *without* Renewal
- ☐ Renewal without changes
- ☐ Minor Amendment *with* Renewal
- ☐ Minor Amendment *without* Renewal
- ☐ Minor Modification of permit

e. For amendments or modifications, describe the proposed changes: Click to enter text.

f. For existing permits:

Permit Number: WQ00 Click to enter text.

EPA I.D. (TPDES only): TX Click to enter text.

Expiration Date: Click to enter text.

Section 3. Facility Owner (Applicant) and Co-Applicant Information (Instructions Page 26)

A. The owner of the facility must apply for the permit.

What is the Legal Name of the entity (applicant) applying for this permit?

George Micheal Reagor

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal documents forming the entity.)

If the applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/

CN: Click to enter text.

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

Prefix: Mr. Last Name, First Name: Reagor, George

Title: Owner Credential: Click to enter text.

B. Co-applicant information. Complete this section only if another person or entity is required to apply as a co-permittee.

What is the Legal Name of the co-applicant applying for this permit?

Laura Reagor

(The legal name must be spelled exactly as filed with the TX SOS, with the County, or in the legal documents forming the entity.)

If the co-applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at: http://www15.tceq.texas.gov/crpub/

CN: Click to enter text.

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

Prefix: Ms. Last Name, First Name: Reagor, Laura

Title: Owner Credential: Click to enter text.

Provide a brief description of the need for a co-permittee: Land Owner

C. Core Data Form

Complete the Core Data Form for each customer and include as an attachment. If the customer type selected on the Core Data Form is **Individual**, complete **Attachment 1** of Administrative Report 1.0. Appendix A

Section 4. Application Contact Information (Instructions Page 27)

This is the person(s) TCEQ will contact if additional information is needed about this application. Provide a contact for administrative questions and technical questions.

A. Prefix: Ms. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd Bldg II, Suite 100 City, State, Zip Code: Austin, Texas 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

Check one or both: ☒ Administrative Contact ☒ Technical Contact

B. Prefix: Mr. Last Name, First Name: Reagor, George Michael (Mike)

Title: Owner Credential: Click to enter text.

Organization Name:

Mailing Address: 906 E. Sandstone Street City, State, Zip Code: Llano, Texas 78643

Phone No.: 325-247-6704 E-mail Address: mike_reagor@yahoo.com

Check one or both: ☒ Administrative Contact ☐ Technical Contact

Section 5. Permit Contact Information (Instructions Page 27)

Provide the names and contact information for two individuals that can be contacted throughout the permit term.

A. Prefix: Click to enter text. Last Name, First Name: Reagor, George Michael (Mike)

Title: Owner Credential: Click to enter text.

Organization Name:

Mailing Address: 906 E. Sandstone Street City, State, Zip Code: Llano, Texas 78643

Phone No.: 325-247-6704 E-mail Address: mike_reagor@yahoo.com

B. Prefix: Ms. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd Bldg II Suite 100 City, State, Zip Code: Austin, TX 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

Section 6. Billing Contact Information (Instructions Page 27)

The permittee is responsible for paying the annual fee. The annual fee will be assessed to permits ***in effect on September 1 of each year***. The TCEQ will send a bill to the address provided in this section. The permittee is responsible for terminating the permit when it is no longer needed (using form TCEQ-20029).

Prefix: Mr. Last Name, First Name: Reagor, George Michael (Mike)

Title: Owner Credential: Click to enter text.

Organization Name:

Mailing Address: 906 E. Sandstone Street City, State, Zip Code: Llano, Texas 78643

Phone No.: 325-247-6704 E-mail Address: mike_reagor@yahoo.com

Section 7. DMR/MER Contact Information (Instructions Page 27)

Provide the name and complete mailing address of the person delegated to receive and submit Discharge Monitoring Reports (DMR) (EPA 3320-1) or maintain Monthly Effluent Reports (MER).

Prefix: Mr. Last Name, First Name: Reagor, George Michael (Mike)

Title: Owner Credential: Click to enter text.

Organization Name:

Mailing Address: 906 E. Sandstone Street City, State, Zip Code: Llano, Texas 78643

Phone No.: 325-247-6704 E-mail Address: mike_reagor@yahoo.com

Section 8. Public Notice Information (Instructions Page 27)

A. Individual Publishing the Notices

Prefix: Click to enter text. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd Bldg II Suite 100 City, State, Zip Code: Austin, TX 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

B. Method for Receiving Notice of Receipt and Intent to Obtain a Water Quality Permit Package

Indicate by a check mark the preferred method for receiving the first notice and instructions:

☒ E-mail Address

☐ Fax

☐ Regular Mail

C. Contact permit to be listed in the Notices

Prefix: Click to enter text. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc

Mailing Address: 7500 Rialto Blvd. Bldg II Suite 100 City, State, Zip Code: Austin, TX 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

D. Public Viewing Information

If the facility or outfall is located in more than one county, a public viewing place for each county must be provided.

Public building name: Liberty Hill Public Library

Location within the building: Public Viewing Desk

Physical Address of Building: 355 Loop 332

City: Liberty Hill, TX 78642 County: Williamson

Contact (Last Name, First Name): Click to enter text.

Phone No.: (512) 778-6400 Ext.: Click to enter text.

E. Bilingual Notice Requirements

This information **is required** for **new, major amendment, minor amendment or minor modification, and renewal** applications.

This section of the application is only used to determine if alternative language notices will be needed. Complete instructions on publishing the alternative language notices will be in your public notice package.

Please call the bilingual/ESL coordinator at the nearest elementary and middle schools and obtain the following information to determine whether an alternative language notices are required.

1. Is a bilingual education program required by the Texas Education Code at the elementary or middle school nearest to the facility or proposed facility?

   ☒ Yes ☐ No

   If **no**, publication of an alternative language notice is not required; **skip to** Section 9 below.

2. Are the students who attend either the elementary school or the middle school enrolled in a bilingual education program at that school?

   ☒ Yes ☐ No

3. Do the students at these schools attend a bilingual education program at another location?

   ☐ Yes ☒ No

4. Would the school be required to provide a bilingual education program but the school has waived out of this requirement under 19 TAC §89.1205(g)?

   ☐ Yes ☒ No

5. If the answer is **yes** to **question 1, 2, 3, or 4**, public notices in an alternative language are required. Which language is required by the bilingual program? Spanish

F. Plain Language Summary Template

Complete the Plain Language Summary (TCEQ Form 20972) and include as an attachment.

Attachment: Appendix B

G. Public Involvement Plan Form

Complete the Public Involvement Plan Form (TCEQ Form 20960) for each application for a **new permit or major amendment to a permit** and include as an attachment.

Attachment: Appendix B

Section 9. Regulated Entity and Permitted Site Information (Instructions Page 29)

A. If the site is currently regulated by TCEQ, provide the Regulated Entity Number (RN) issued to this site. **RN** Click to enter text.

Search the TCEQ's Central Registry at http://www15.tceq.texas.gov/crpub/ to determine if the site is currently regulated by TCEQ.

B. Name of project or site (the name known by the community where located):

Reagor Tract Wastewater Treatment Plant

C. Owner of treatment facility: George and Laura Reagor

Ownership of Facility: ☐ Public ☒ Private ☐ Both ☐ Federal

D. Owner of land where treatment facility is or will be:

Prefix: Click to enter text. Last Name, First Name: Reagor, George

Title: Owner Credential: Click to enter text.

Organization Name:

Mailing Address: 906 E. Sandstone Street City, State, Zip Code: Llano, Texas 78643

Phone No.: 325-247-6704 E-mail Address: mike_reagor@yahoo.com

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

E. Owner of effluent disposal site:

Prefix: Click to enter text. Last Name, First Name: Reagor, George

Title: Owner Credential: Click to enter text.

Organization Name:

Mailing Address: 906 E. Sandstone Street City, State, Zip Code: Llano, Texas 78643

Phone No.: 325-247-6704 E-mail Address: mike_reagor@yahoo.com

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

F. Owner sewage sludge disposal site (if authorization is requested for sludge disposal on property owned or controlled by the applicant)::

Prefix: N/A Last Name, First Name: Click to enter text.

Title: Click to enter text. Credential: Click to enter text.

Organization Name: Click to enter text.

Mailing Address: Click to enter text. City, State, Zip Code: Click to enter text.

Phone No.: Click to enter text. E-mail Address: Click to enter text.

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

Section 10. TPDES Discharge Information (Instructions Page 31)

A. Is the wastewater treatment facility location in the existing permit accurate?

☐ Yes ☐ No

If **no**, **or a new permit application**, please give an accurate description:

N/A

B. Are the point(s) of discharge and the discharge route(s) in the existing permit correct?

☐ Yes ☐ No

If **no**, **or a new or amendment permit application**, provide an accurate description of the point of discharge and the discharge route to the nearest classified segment as defined in 30 TAC Chapter 307:

N/A

City nearest the outfall(s): Click to enter text.

County in which the outfalls(s) is/are located: Click to enter text.

C. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or a flood control district drainage ditch?

☐ Yes ☒ No

If **yes**, indicate by a check mark if:

☐ Authorization granted ☐ Authorization pending

For **new and amendment** applications, provide copies of letters that show proof of contact and the approval letter upon receipt.

Attachment: Click to enter text.

D. For all applications involving an average daily discharge of 5 MGD or more, provide the names of all counties located within 100 statute miles downstream of the point(s) of discharge: Click to enter text.

Section 11. TLAP Disposal Information (Instructions Page 32)

A. For TLAPs, is the location of the effluent disposal site in the existing permit accurate?

☐ Yes ☐ No

If **no, or a new or amendment permit application**, provide an accurate description of the disposal site location:

New Permit Application: Southeast corner of the tract, approximately 0.59 miles south from the intersection of FM 2338 and Indian Springs Road in Williamson County, Texas.

B. City nearest the disposal site: Georgetown

C. County in which the disposal site is located: Williamson County

D. For **TLAPs**, describe the routing of effluent from the treatment facility to the disposal site:

Treated effluent will flow to ground storage tanks located on the plant site and then be pumped to disposal areas for subsurface disposal within the property boundary.

E. For **TLAPs**, please identify the nearest watercourse to the disposal site to which rainfall runoff might flow if not contained: Unnamed tributary of Cowan Creek

Section 12. Miscellaneous Information (Instructions Page 32)

A. Is the facility located on or does the treated effluent cross American Indian Land?

☐ Yes ☒ No

B. If the existing permit contains an onsite sludge disposal authorization, is the location of the sewage sludge disposal site in the existing permit accurate?

☐ Yes ☐ No ☒ Not Applicable

If No, or if a new onsite sludge disposal authorization is being requested in this permit application, provide an accurate location description of the sewage sludge disposal site.

Click to enter text.

C. Did any person formerly employed by the TCEQ represent your company and get paid for service regarding this application?

☐ Yes ☒ No

If yes, list each person formerly employed by the TCEQ who represented your company and was paid for service regarding the application: Click to enter text.

D. Do you owe any fees to the TCEQ?

☐ Yes ☒ No

If **yes**, provide the following information:

Account number: Click to enter text.

Amount past due: Click to enter text.

E. Do you owe any penalties to the TCEQ?

☐ Yes ☒ No

If **yes**, please provide the following information:

Enforcement order number: Click to enter text.

Amount past due: Click to enter text.

Section 13. Attachments (Instructions Page 33)

Indicate which attachments are included with the Administrative Report. Check all that apply:

☐ Lease agreement or deed recorded easement, if the land where the treatment facility is located or the effluent disposal site are not owned by the applicant or co-applicant.

☒ Original full-size USGS Topographic Map with the following information:

- Applicant's property boundary
- Treatment facility boundary
- Labeled point of discharge for each discharge point (TPDES only)
- Highlighted discharge route for each discharge point (TPDES only)
- Onsite sewage sludge disposal site (if applicable)
- Effluent disposal site boundaries (TLAP only)
- New and future construction (if applicable)
- 1 mile radius information
- 3 miles downstream information (TPDES only)
- All ponds.

☒ Attachment 1 for Individuals as co-applicants

☐ Other Attachments. Please specify: Click to enter text.

Section 14. Signature Page (Instructions Page 34)

If co-applicants are necessary, each entity must submit an original, separate signature page.

Permit Number: Click to enter text.

Applicant: George Reagor

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code § 305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): George Reagor

Signatory title: Owner

Signature: George Reagor Date: 12/4/2024

(Use blue ink)

Subscribed and sworn to before me by the said George Reagor

on this 4th day of December, 20 24.

My commission expires on the 8th day of March, 20 24.

Nancy K Rainey

Notary Public

[SEAL]

NANCY K. RAINEY
NOTARY PUBLIC
STATE OF TEXAS
Notary ID # 13148279-6
My Commission Expires 03-8-2026

Llano

County, Texas

Section 14. Signature Page (Instructions Page 34)

If co-applicants are necessary, each entity must submit an original, separate signature page.

Permit Number: Click to enter text.

Applicant: Laura Reagor

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code § 305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): Laura Reagor

Signatory title: Owner

Signature: Laura Reagor Date: 12-4-24

(Use blue ink)

Subscribed and Sworn to before me by the said Laura Reagor

on this 4th day of December, 2024.

My commission expires on the 05th day of May, 2026.

Jennifer Camp

Notary Public

Harris

County, Texas

JENNIFER CAMP
Notary Public, State of Texas
Comm. Expires 05-19-2026
Notary ID 1109099

(SEAL)

DOMESTIC WASTEWATER PERMIT APPLICATION ADMINISTRATIVE REPORT 1.0

The following information is required for new and amendment applications.

Section 1. Affected Landowner Information (Instructions Page 36)

A. Indicate by a check mark that the landowners map or drawing, with scale, includes the following information, as applicable:

- ☒ The applicant's property boundaries
- ☒ The facility site boundaries within the applicant's property boundaries
- ☐ The distance the buffer zone falls into adjacent properties and the property boundaries of the landowners located within the buffer zone
- ☒ The property boundaries of all landowners surrounding the applicant's property (Note: if the application is a major amendment for a lignite mine, the map must include the property boundaries of all landowners adjacent to the new facility (ponds).)
- ☐ The point(s) of discharge and highlighted discharge route(s) clearly shown for one mile downstream
- ☐ The property boundaries of the landowners located on both sides of the discharge route for one full stream mile downstream of the point of discharge
- ☐ The property boundaries of the landowners along the watercourse for a one-half mile radius from the point of discharge if the point of discharge is into a lake, bay, estuary, or affected by tides
- ☒ The boundaries of the effluent disposal site (for example, irrigation area or subsurface drainfield site) and all evaporation/holding ponds within the applicant's property
- ☒ The property boundaries of all landowners surrounding the effluent disposal site
- ☐ The boundaries of the sludge land application site (for land application of sewage sludge for beneficial use) and the property boundaries of landowners surrounding the applicant's property boundaries where the sewage sludge land application site is located
- ☐ The property boundaries of landowners within one-half mile in all directions from the applicant's property boundaries where the sewage sludge disposal site (for example, sludge surface disposal site or sludge monofill) is located

B. ☒ Indicate by a check mark that a separate list with the landowners' names and mailing addresses cross-referenced to the landowner's map has been provided.

C. Indicate by a check mark in which format the landowners list is submitted:

☐ USB Drive ☒ Four sets of labels

D. Provide the source of the landowners' names and mailing addresses: Williamson County Central Appraisal District

E. As required by *Texas Water Code § 5.115*, is any permanent school fund land affected by this application?

☐ Yes ☒ No

If **yes**, provide the location and foreseeable impacts and effects this application has on the land(s):

Click to enter text.

Section 2. Original Photographs (Instructions Page 38)

Provide original ground level photographs. Indicate with checkmarks that the following information is provided.

☒ At least one original photograph of the new or expanded treatment unit location

☐ At least two photographs of the existing/proposed point of discharge and as much area downstream (photo 1) and upstream (photo 2) as can be captured. If the discharge is to an open water body (e.g., lake, bay), the point of discharge should be in the right or left edge of each photograph showing the open water and with as much area on each respective side of the discharge as can be captured.

☒ At least one photograph of the existing/proposed effluent disposal site

☒ A plot plan or map showing the location and direction of each photograph

Section 3. Buffer Zone Map (Instructions Page 38)

A. Buffer zone map. Provide a buffer zone map on 8.5 x 11-inch paper with all of the following information. The applicant's property line and the buffer zone line may be distinguished by using dashes or symbols and appropriate labels.

- The applicant's property boundary;
- The required buffer zone; and
- Each treatment unit; and
- The distance from each treatment unit to the property boundaries.

B. Buffer zone compliance method. Indicate how the buffer zone requirements will be met. Check all that apply.

☒ Ownership

☐ Restrictive easement

☐ Nuisance odor control

☐ Variance

C. Unsuitable site characteristics. Does the facility comply with the requirements regarding unsuitable site characteristic found in 30 TAC § 309.13(a) through (d)?

☒ Yes ☐ No

DOMESTIC WASTEWATER PERMIT APPLICATION

SUPPLEMENTAL PERMIT INFORMATION FORM (SPIF)

This form applies to TPDES permit applications only. Complete and attach the Supplemental Permit information Form (SPIF) (TCEQ Form 20971).

Attachment: N/A

DOMESTIC WASTEWATER PERMIT APPLICATION CHECKLIST OF COMMON DEFICIENCIES

Below is a list of common deficiencies found during the administrative review of domestic wastewater permit applications. To ensure the timely processing of this application, please review the items below and indicate by checking Yes that each item is complete and in accordance applicable rules at 30 TAC Chapters 21, 281, and 305. If an item is not required this application, indicate by checking N/A where appropriate. Please do not submit the application until the items below have been addressed.

Core Data Form (TCEQ Form No. 10400) ☒ Yes
(Required for all application types. Must be completed in its entirety and signed. Note: Form may be signed by applicant representative.)

Correct and Current Industrial Wastewater Permit Application Forms ☒ Yes
(TCEQ Form Nos. 10053 and 10054. Version dated 6/25/2018 or later.)

Water Quality Permit Payment Submittal Form (Page 19) ☒ Yes
(Original payment sent to TCEQ Revenue Section. See instructions for mailing address.)

7.5 Minute USGS Quadrangle Topographic Map Attached ☒ Yes
(Full–size map if seeking "New" permit. 8 ½ x 11 acceptable for Renewals and Amendments)

Current/Non-Expired, Executed Lease Agreement or Easement ☒ N/A ☐ Yes

Landowners Map ☐ N/A ☒ Yes
(See instructions for landowner requirements)

Things to Know:

- All the items shown on the map must be labeled.
- The applicant's complete property boundaries must be delineated which includes boundaries of contiguous property owned by the applicant.
- The applicant cannot be its own adjacent landowner. You must identify the landowners immediately adjacent to their property, regardless of how far they are from the actual facility.
- If the applicant's property is adjacent to a road, creek, or stream, the landowners on the opposite side must be identified. Although the properties are not adjacent to applicant's property boundary, they are considered potentially affected landowners. If the adjacent road is a divided highway as identified on the USGS topographic map, the applicant does not have to identify the landowners on the opposite side of the highway.

Landowners Cross Reference List ☐ N/A ☒ Yes
(See instructions for landowner requirements)

Landowners Labels or USB Drive attached ☐ N/A ☒ Yes
(See instructions for landowner requirements)

Original signature per 30 TAC § 305.44 – Blue Ink Preferred ☒ Yes
(If signature page is not signed by an elected official or principle executive officer, a copy of signature authority/delegation letter must be attached)

Plain Language Summary ☒ Yes

EXHIBIT 2

DOMESTIC TECHNICAL REPORT 1.0
DOMESTIC TECHNICAL REPORT 1.1
DOMESTIC TECHNICAL REPORT 3.0
DOMESTIC TECHNICAL REPORT 3.1
DOMESTIC TECHNICAL REPORT 7.0

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION TECHNICAL REPORT 1.0

For any questions about this form, please contact the Domestic Wastewater Permitting Team at 512-239-4671.

The following information is required for all renewal, new, and amendment applications.

Section 1. Permitted or Proposed Flows (Instructions Page 43)

A. Existing/Interim I Phase

Design Flow (MGD): 0.05

2-Hr Peak Flow (MGD): 0.20

Estimated construction start date: September 2027

Estimated waste disposal start date: December 2027

B. Interim II Phase

Design Flow (MGD): 0.10

2-Hr Peak Flow (MGD): 0.40

Estimated construction start date: September 2028

Estimated waste disposal start date: December 2028

C. Final Phase

Design Flow (MGD): 0.15

2-Hr Peak Flow (MGD): 0.60

Estimated construction start date: September 2029

Estimated waste disposal start date: December 2029

D. Current Operating Phase

Provide the startup date of the facility: Not in operation - 2026

Section 2. Treatment Process (Instructions Page 43)

A. Current Operating Phase

Provide a detailed description of the treatment process. **Include the type of treatment plant, mode of operation, and all treatment units.** Start with the plant's head works and

finish with the point of discharge. Include all sludge processing and drying units. **If more than one phase exists or is proposed, a description of *each phase* must be provided**.

The wastewater treatment plant consists of three phases, with each phase treating 50,000 gpd, resulting in a total capacity of 150,000 gpd at full completion. The treatment units include an influent screening system, aeration basin, clarifier, chlorine contact basin and an aerobic digester. Wastewater will be pumped into the plant where it will enter through a screen. The influent will then pass through the aeration zone and flow into a clarifier. From the clarifier, the effluent will flow to a chlorine contact basin for disinfection prior to tertiary filtration. From there the effluent will be routed to an effluent storage tank. The effluent will then be disposed of via subsurface drip irrigation. This facility will also utilize a digester for sludge holding and reduction of solids prior to haul off.

B. Treatment Units

In Table 1.0(1), provide the treatment unit type, the number of units, and dimensions (length, width, depth) **of each treatment unit, accounting for *all* phases of operation.**

Table 1.0(1) - Treatment Units

Treatment Unit Type	Number of Units	Dimensions (L x W x D)
Headworks Screen		**1" x ¼" Bar Sect @ ¾"**
Aeration	3 (1 per phase)	Phase 1: 65'L x 40'W x 10.5'D Phase 2: 65'L x 40'W x 10.5'D Phase 3: 65'L x 40'W x 10.5'D
Clarifier	3 (1 per phase)	Phase 1: 18' dia. x 10.5' D Phase 2: 18' dia. x 10.5' D Phase 3: 18' dia. x 10.5' D
Chlorine Contact	3 (1 per phase)	Phase 1: 12'L X 3'W X 10.5'D Phase 2: 12'L X 3'W X 10.5'D Phase 3: 12'L X 3'W X 10.5'D
Digester	3 (1 per phase)	Phase 1: 40'L X 20'W X 10.5'D Phase 2: 40'L X 20'W X 10.5'D Phase 3: 40'L X 20'W X 10.5'D

C. Process Flow Diagram

Provide flow diagrams for the existing facilities and **each** proposed phase of construction.

Attachment: Appendix G

Section 3. Site Information and Drawing (Instructions Page 44)

Provide the TPDES discharge outfall latitude and longitude. Enter N/A if not applicable.

- Latitude: N/A
- Longitude: N/A

Provide the TLAP disposal site latitude and longitude. Enter N/A if not applicable.

- Latitude: 30°43'34.2"N
- Longitude: 97°47'38.1"W

Provide a site drawing for the facility that shows the following:

- The boundaries of the treatment facility;
- The boundaries of the area served by the treatment facility;
- If land disposal of effluent, the boundaries of the disposal site and all storage/holding ponds; and
- If sludge disposal is authorized in the permit, the boundaries of the land application or disposal site.

Attachment: Appendix H

Provide the name **and** a description of the area served by the treatment facility.

The facility will serve the Reagor Tract subdivision in Williamson County. The area is currently undeveloped but will contain single family lots equaling roughly 615 LUEs.

Collection System Information **for wastewater TPDES permits only**: Provide information for each **uniquely owned** collection system, existing and new, served by this facility, including satellite collection systems. **Please see the instructions for a detailed explanation and examples.**

Collection System Information

Collection System Name	Owner Name	Owner Type	Population Served
N/A		Choose an item.	
		Choose an item.	
		Choose an item.	
		Choose an item.	

Section 4. Unbuilt Phases (Instructions Page 45)

Is the application for a renewal of a permit that contains an unbuilt phase or phases?

☐ Yes ☒ No

If yes, does the existing permit contain a phase that has not been constructed **within five years** of being authorized by the TCEQ?

☐ Yes ☐ No

If yes, provide a detailed discussion regarding the continued need for the unbuilt phase. **Failure to provide sufficient justification may result in the Executive Director recommending denial of the unbuilt phase or phases**.

Click to enter text.

Section 5. Closure Plans (Instructions Page 45)

Have any treatment units been taken out of service permanently, or will any units be taken out of service in the next five years?

☐ Yes ☒ No

If yes, was a closure plan submitted to the TCEQ?

☐ Yes ☐ No

If yes, provide a brief description of the closure and the date of plan approval.

N/A

Section 6. Permit Specific Requirements (Instructions Page 45)

For applicants with an existing permit, check the Other Requirements or Special Provisions of the permit.

A. Summary transmittal

Have plans and specifications been approved for the existing facilities and each proposed phase?

☐ Yes ☒ No

If yes, provide the date(s) of approval for each phase: Click to enter text.

Provide information, including dates, on any actions taken to meet a *requirement or provision* pertaining to the submission of a summary transmittal letter. **Provide a copy of an approval letter from the TCEQ, if applicable**.

Click to enter text.

B. Buffer zones

Have the buffer zone requirements been met?

☒ Yes ☐ No

Provide information below, including dates, on any actions taken to meet the conditions of the buffer zone. If available, provide any new documentation relevant to maintaining the buffer zones.

150' Buffer Zone is proposed around the treatment plant, 150' Well buffer from all domestic wells.

C. Other actions required by the current permit

Does the *Other Requirements* or *Special Provisions* section in the existing permit require submission of any other information or other required actions? Examples include Notification of Completion, progress reports, soil monitoring data, etc.

☐ Yes ☒ No

If yes, provide information below on the status of any actions taken to meet the conditions of an *Other Requirement* or *Special Provision*.

D. Grit and grease treatment

1. Acceptance of grit and grease waste

Does the facility have a grit and/or grease processing facility onsite that treats and decants or accepts transported loads of grit and grease waste that are discharged directly to the wastewater treatment plant prior to any treatment?

☐ Yes ☒ No

If No, stop here and continue with Subsection E. Stormwater Management.

2. Grit and grease processing

Describe below how the grit and grease waste is treated at the facility. In your description, include how and where the grit and grease is introduced to the treatment

works and how it is separated or processed. Provide a flow diagram showing how grit and grease is processed at the facility.

Click to enter text.

3. *Grit disposal*

Does the facility have a Municipal Solid Waste (MSW) registration or permit for grit disposal?

☐ Yes ☐ No

If No, contact the TCEQ Municipal Solid Waste team at 512-239-2335. Note: A registration or permit is required for grit disposal. Grit shall not be combined with treatment plant sludge. See the instruction booklet for additional information on grit disposal requirements and restrictions.

Describe the method of grit disposal.

Click to enter text.

4. *Grease and decanted liquid disposal*

Note: A registration or permit is required for grease disposal. Grease shall not be combined with treatment plant sludge. For more information, contact the TCEQ Municipal Solid Waste team at 512-239-2335.

Describe how the decant and grease are treated and disposed of after grit separation.

Click to enter text.

E. Stormwater management

1. *Applicability*

Does the facility have a design flow of 1.0 MGD or greater in any phase?

☐ Yes ☒ No

Does the facility have an approved pretreatment program, under 40 CFR Part 403?

☐ Yes ☒ No

If no to both of the above, then skip to Subsection F, Other Wastes Received.

2. ***MSGP coverage***

Is the stormwater runoff from the WWTP and dedicated lands for sewage disposal currently permitted under the TPDES Multi-Sector General Permit (MSGP), TXR050000?

☐ Yes ☐ No

If yes, please provide MSGP Authorization Number and skip to Subsection F, Other Wastes Received:

TXR05 Click to enter text. or TXRNE Click to enter text.

If no, do you intend to seek coverage under TXR050000?

☐ Yes ☐ No

3. ***Conditional exclusion***

Alternatively, do you intend to apply for a conditional exclusion from permitting based TXR050000 (Multi Sector General Permit) Part II B.2 or TXR050000 (Multi Sector General Permit) Part V, Sector T 3(b)?

☐ Yes ☐ No

If yes, please explain below then proceed to Subsection F, Other Wastes Received:

Click to enter text.

4. ***Existing coverage in individual permit***

Is your stormwater discharge currently permitted through this individual TPDES or TLAP permit?

☐ Yes ☐ No

If yes, provide a description of stormwater runoff management practices at the site that are authorized in the wastewater permit then skip to Subsection F, Other Wastes Received.

Click to enter text.

5. ***Zero stormwater discharge***

Do you intend to have no discharge of stormwater via use of evaporation or other means?

☐ Yes ☐ No

If yes, explain below then skip to Subsection F. Other Wastes Received.

Click to enter text.

Note: If there is a potential to discharge any stormwater to surface water in the state as the result of any storm event, then permit coverage is required under the MSGP or an individual discharge permit. This requirement applies to all areas of facilities with treatment plants or systems that treat, store, recycle, or reclaim domestic sewage, wastewater or sewage sludge (including dedicated lands for sewage sludge disposal located within the onsite property boundaries) that meet the applicability criteria of above. You have the option of obtaining coverage under the MSGP for direct discharges, (recommended), or obtaining coverage under this individual permit.

6. Request for coverage in individual permit

Are you requesting coverage of stormwater discharges associated with your treatment plant under this individual permit?

☐ Yes ☐ No

If yes, provide a description of stormwater runoff management practices at the site for which you are requesting authorization in this individual wastewater permit and describe whether you intend to comingle this discharge with your treated effluent or discharge it via a separate dedicated stormwater outfall. Please also indicate if you intend to divert stormwater to the treatment plant headworks and indirectly discharge it to water in the state.

Click to enter text.

Note: Direct stormwater discharges to waters in the state authorized through this individual permit will require the development and implementation of a stormwater pollution prevention plan (SWPPP) and will be subject to additional monitoring and reporting requirements. Indirect discharges of stormwater via headworks recycling will require compliance with all individual permit requirements including 2-hour peak flow limitations. All stormwater discharge authorization requests will require additional information during the technical review of your application.

F. Discharges to the Lake Houston Watershed

Does the facility discharge in the Lake Houston watershed?

☐ Yes ☒ No

If yes, attach a Sewage Sludge Solids Management Plan. See Example 5 in the instructions. Click to enter text.

G. Other wastes received including sludge from other WWTPs and septic waste

1. Acceptance of sludge from other WWTPs

Does or will the facility accept sludge from other treatment plants at the facility site?

☐ Yes ☒ No

If yes, attach sewage sludge solids management plan. See Example 5 of instructions.

In addition, provide the date the plant started or is anticipated to start accepting sludge, an estimate of monthly sludge acceptance (gallons or millions of gallons), an estimate of the BOD_5 concentration of the sludge, and the design BOD_5 concentration of the influent from the collection system. Also note if this information has or has not changed since the last permit action.

Click to enter text.

Note: Permits that accept sludge from other wastewater treatment plants may be required to have influent flow and organic loading monitoring.

2. ***Acceptance of septic waste***

Is the facility accepting or will it accept septic waste?

☐ Yes ☒ No

If yes, does the facility have a Type V processing unit?

☐ Yes ☐ No

If yes, does the unit have a Municipal Solid Waste permit?

☐ Yes ☐ No

If yes to any of the above, provide the date the plant started or is anticipated to start accepting septic waste, an estimate of monthly septic waste acceptance (gallons or millions of gallons), an estimate of the BOD_5 concentration of the septic waste, and the design BOD_5 concentration of the influent from the collection system. Also note if this information has or has not changed since the last permit action.

Click to enter text.

Note: Permits that accept sludge from other wastewater treatment plants may be required to have influent flow and organic loading monitoring.

3. ***Acceptance of other wastes (not including septic, grease, grit, or RCRA, CERCLA or as discharged by IUs listed in Worksheet 6)***

Is or will the facility accept wastes that are not domestic in nature excluding the categories listed above?

☐ Yes ☒ No

If yes, provide the date that the plant started accepting the waste, an estimate how much waste is accepted on a monthly basis (gallons or millions of gallons), a description of the entities generating the waste, and any distinguishing chemical or

other physical characteristic of the waste. Also note if this information has or has not changed since the last permit action.

Click to enter text.

Section 7. Pollutant Analysis of Treated Effluent (Instructions Page 50)

Is the facility in operation?

☐ Yes ☒ No

If no, this section is not applicable. Proceed to Section 8.

If yes, provide effluent analysis data for the listed pollutants. ***Wastewater treatment facilities*** complete Table 1.0(2). W***ater treatment facilities*** discharging filter backwash water, complete Table 1.0(3). Provide copies of the laboratory results sheets. **These tables are not applicable for a minor amendment without renewal.** See the instructions for guidance.

Note: The sample date must be within 1 year of application submission.

Table1.0(2) – Pollutant Analysis for Wastewater Treatment Facilities

Pollutant	Average Conc.	Max Conc.	No. of Samples	Sample Type	Sample Date/Time
$CBOD_5$, mg/l					
Total Suspended Solids, mg/l					
Ammonia Nitrogen, mg/l					
Nitrate Nitrogen, mg/l					
Total Kjeldahl Nitrogen, mg/l					
Sulfate, mg/l					
Chloride, mg/l					
Total Phosphorus, mg/l					
pH, standard units					
Dissolved Oxygen*, mg/l					
Chlorine Residual, mg/l					
E.coli (CFU/100ml) freshwater					
Entercocci (CFU/100ml) saltwater					
Total Dissolved Solids, mg/l					
Electrical Conductivity, µmohs/cm, †					

Oil & Grease, mg/l					
Alkalinity ($CaCO_3$)*, mg/l					

*TPDES permits only
†TLAP permits only

Table1.0(3) – Pollutant Analysis for Water Treatment Facilities

Pollutant	Average Conc.	Max Conc.	No. of Samples	Sample Type	Sample Date/Time
Total Suspended Solids, mg/l					
Total Dissolved Solids, mg/l					
pH, standard units					
Fluoride, mg/l					
Aluminum, mg/l					
Alkalinity ($CaCO_3$), mg/l					

Section 8. Facility Operator (Instructions Page 50)

Facility Operator Name: Crossroads Utility Services

Facility Operator's License Classification and Level: Wastewater Operator A

Facility Operator's License Number: OC0000182

Section 9. Sludge and Biosolids Management and Disposal (Instructions Page 51)

A. WWTP's Biosolids Management Facility Type

Check all that apply. See instructions for guidance

- ☐ Design flow>= 1 MGD
- ☐ Serves >= 10,000 people
- ☐ Class I Sludge Management Facility (per 40 CFR § 503.9)
- ☒ Biosolids generator
- ☐ Biosolids end user – land application (onsite)
- ☐ Biosolids end user – surface disposal (onsite)
- ☐ Biosolids end user – incinerator (onsite)

B. WWTP's Biosolids Treatment Process

Check all that apply. See instructions for guidance.

- ☒ Aerobic Digestion
- ☐ Air Drying (or sludge drying beds)
- ☐ Lower Temperature Composting
- ☐ Lime Stabilization
- ☐ Higher Temperature Composting

- ☐ Heat Drying
- ☐ Thermophilic Aerobic Digestion
- ☐ Beta Ray Irradiation
- ☐ Gamma Ray Irradiation
- ☐ Pasteurization
- ☐ Preliminary Operation (e.g. grinding, de-gritting, blending)
- ☐ Thickening (e.g. gravity thickening, centrifugation, filter press, vacuum filter)
- ☐ Sludge Lagoon
- ☐ Temporary Storage (< 2 years)
- ☐ Long Term Storage (>= 2 years)
- ☐ Methane or Biogas Recovery
- ☐ Other Treatment Process: Click to enter text.

C. Biosolids Management

Provide information on the *intended* biosolids management practice. Do not enter every management practice that you want authorized in the permit, as the permit will authorize all biosolids management practices listed in the instructions. Rather indicate the management practice the facility plans to use.

Biosolids Management

Management Practice	Handler or Preparer Type	Bulk or Bag Container	Amount (dry metric tons)	Pathogen Reduction Options	Vector Attraction Reduction Option
Disposal in Landfill	Off-site Third-Party Handler or Preparer	Choose an item.		Choose an item.	Choose an item.
Choose an item.	Choose an item.	Choose an item.		Choose an item.	Choose an item.
Choose an item.	Choose an item.	Choose an item.		Choose an item.	Choose an item.

If “Other” is selected for Management Practice, please explain (e.g. monofill or transport to another WWTP): Click to enter text.

D. Disposal site

Disposal site name: Click to enter text.

TCEQ permit or registration number: Click to enter text.

County where disposal site is located: Click to enter text.

E. Transportation method

Method of transportation (truck, train, pipe, other): Truck

Name of the hauler: Cap-Tex

Hauler registration number: 20745

Sludge is transported as a:

Liquid ☐ semi-liquid ☒ semi-solid ☐ solid ☐

Section 10. Permit Authorization for Sewage Sludge Disposal (Instructions Page 53)

A. Beneficial use authorization

Does the existing permit include authorization for land application of sewage sludge for beneficial use?

☐ Yes ☒ No

If yes, are you requesting to continue this authorization to land apply sewage sludge for beneficial use?

☐ Yes ☐ No

If yes, is the completed **Application for Permit for Beneficial Land Use of Sewage Sludge (TCEQ Form No. 10451)** attached to this permit application (see the instructions for details)?

☐ Yes ☐ No

B. Sludge processing authorization

Does the existing permit include authorization for any of the following sludge processing, storage or disposal options?

Sludge Composting	☐ Yes	☒ No
Marketing and Distribution of sludge	☐ Yes	☒ No
Sludge Surface Disposal or Sludge Monofill	☐ Yes	☒ No
Temporary storage in sludge lagoons	☐ Yes	☒ No

If yes to any of the above sludge options and the applicant is requesting to continue this authorization, is the completed **Domestic Wastewater Permit Application: Sewage Sludge Technical Report (TCEQ Form No. 10056)** attached to this permit application?

☐ Yes ☐ No

Section 11. Sewage Sludge Lagoons (Instructions Page 53)

Does this facility include sewage sludge lagoons?

☐ Yes ☒ No

If yes, complete the remainder of this section. If no, proceed to Section 12.

A. Location information

The following maps are required to be submitted as part of the application. For each map, provide the Attachment Number.

- Original General Highway (County) Map:

Attachment: Click to enter text.

- USDA Natural Resources Conservation Service Soil Map:

  Attachment: Click to enter text.

- Federal Emergency Management Map:

  Attachment: Click to enter text.

- Site map:

  Attachment: Click to enter text.

Discuss in a description if any of the following exist within the lagoon area. Check all that apply.

- ☐ Overlap a designated 100-year frequency flood plain
- ☐ Soils with flooding classification
- ☐ Overlap an unstable area
- ☐ Wetlands
- ☐ Located less than 60 meters from a fault
- ☐ None of the above

Attachment: Click to enter text.

If a portion of the lagoon(s) is located within the 100-year frequency flood plain, provide the protective measures to be utilized including type and size of protective structures:

Click to enter text.

B. Temporary storage information

Provide the results for the pollutant screening of sludge lagoons. These results are in addition to pollutant results in *Section 7 of Technical Report 1.0.*

Nitrate Nitrogen, mg/kg: Click to enter text.

Total Kjeldahl Nitrogen, mg/kg: Click to enter text.

Total Nitrogen (=nitrate nitrogen + TKN), mg/kg: Click to enter text.

Phosphorus, mg/kg: Click to enter text.

Potassium, mg/kg: Click to enter text.

pH, standard units: Click to enter text.

Ammonia Nitrogen mg/kg: Click to enter text.

Arsenic: Click to enter text.

Cadmium: Click to enter text.

Chromium: Click to enter text.

Copper: Click to enter text.

Lead: Click to enter text.

Mercury: Click to enter text.

Molybdenum: Click to enter text.

Nickel: Click to enter text.

Selenium: Click to enter text.

Zinc: Click to enter text.

Total PCBs: Click to enter text.

Provide the following information:

Volume and frequency of sludge to the lagoon(s): Click to enter text.

Total dry tons stored in the lagoons(s) per 365-day period: Click to enter text.

Total dry tons stored in the lagoons(s) over the life of the unit: Click to enter text.

C. Liner information

Does the active/proposed sludge lagoon(s) have a liner with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec?

☐ Yes ☐ No

If yes, describe the liner below. Please note that a liner is required.

Click to enter text.

D. Site development plan

Provide a detailed description of the methods used to deposit sludge in the lagoon(s):

Click to enter text.

Attach the following documents to the application.

- Plan view and cross-section of the sludge lagoon(s)

  Attachment: Click to enter text.
- Copy of the closure plan

  Attachment: Click to enter text.
- Copy of deed recordation for the site

  Attachment: Click to enter text.
- Size of the sludge lagoon(s) in surface acres and capacity in cubic feet and gallons

Attachment: Click to enter text.

- Description of the method of controlling infiltration of groundwater and surface water from entering the site

  Attachment: Click to enter text.

- Procedures to prevent the occurrence of nuisance conditions

  Attachment: Click to enter text.

E. Groundwater monitoring

Is groundwater monitoring currently conducted at this site, or are any wells available for groundwater monitoring, or are groundwater monitoring data otherwise available for the sludge lagoon(s)?

☐ Yes ☐ No

If groundwater monitoring data are available, provide a copy. Provide a profile of soil types encountered down to the groundwater table and the depth to the shallowest groundwater as a separate attachment.

Attachment: Click to enter text.

Section 12. Authorizations/Compliance/Enforcement (Instructions Page 55)

A. Additional authorizations

Does the permittee have additional authorizations for this facility, such as reuse authorization, sludge permit, etc?

☐ Yes ☒ No

If yes, provide the TCEQ authorization number and description of the authorization:

Click to enter text.

B. Permittee enforcement status

Is the permittee currently under enforcement for this facility?

☐ Yes ☒ No

Is the permittee required to meet an implementation schedule for compliance or enforcement?

☐ Yes ☒ No

If yes to either question, provide a brief summary of the enforcement, the implementation schedule, and the current status:

Click to enter text.

Section 13. RCRA/CERCLA Wastes (Instructions Page 55)

A. RCRA hazardous wastes

Has the facility received in the past three years, does it currently receive, or will it receive RCRA hazardous waste?

☐ Yes ☒ No

B. Remediation activity wastewater

Has the facility received in the past three years, does it currently receive, or will it receive CERCLA wastewater, RCRA remediation/corrective action wastewater or other remediation activity wastewater?

☐ Yes ☒ No

C. Details about wastes received

If yes to either Subsection A or B above, provide detailed information concerning these wastes with the application.

Attachment: Click to enter text.

Section 14. Laboratory Accreditation (Instructions Page 56)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*, which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review 30 TAC Chapter 25 for specific requirements.

The following certification statement shall be signed and submitted with every application. See the Signature Page section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: George Michael Reagor

Title: Owner

Signature: _____

Date: _____

Section 14. Laboratory Accreditation (Instructions Page 56)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*, which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review 30 TAC Chapter 25 for specific requirements.

The following certification statement shall be signed and submitted with every application. See the Signature Page section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: George Michael Reagor

Title: Owner

Signature: George Michael Reagor

Date: 12/4/2024

Section 14. Laboratory Accreditation (Instructions Page 56)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*, which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review 30 TAC Chapter 25 for specific requirements.

The following certification statement shall be signed and submitted with every application. See the Signature Page section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: Laura Reagor

Title: Owner

Signature: Laura Reagor

Date: 12-4-24

Section 14. Laboratory Accreditation (Instructions Page 56)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*, which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review 30 TAC Chapter 25 for specific requirements.

The following certification statement shall be signed and submitted with every application. See the Signature Page section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: Laura Reagor

Title: Owner

Signature: _____

Date: _____

DOMESTIC WASTEWATER PERMIT APPLICATION TECHNICAL REPORT 1.1

The following information is required for new and amendment major applications.

Section 1. Justification for Permit (Instructions Page 57)

A. Justification of permit need

Provide a detailed discussion regarding the need for any phase(s) not currently permitted. Failure to provide sufficient justification may result in the Executive Director recommending denial of the proposed phase(s) or permit.

The wastewater treatment plant will serve the proposed development. No organized wastewater treatment facilities exist that can provide wastewater service to this area, and the use of a central collection treatment and disposal system is being preferred to an equivalent number of private residential septic tank/drain field units. Design flows are based on expecting Living Unit Equivalents (LUE) or connections associated with the service area. A basis of 245 gallons of wastewater per day per connection (maximum 30-day wet weather average) was assumed for flow projections.

B. Regionalization of facilities

For additional guidance, please review TCEQ's Regionalization Policy for Wastewater Treatment[1].

Provide the following information concerning the potential for regionalization of domestic wastewater treatment facilities:

1. Municipally incorporated areas

If the applicant is a city, then Item 1 is not applicable. Proceed to Item 2 Utility CCN areas.

Is any portion of the proposed service area located in an incorporated city?

☐ Yes ☒ No ☐ Not Applicable

If yes, within the city limits of: Click to enter text.

If yes, attach correspondence from the city.

Attachment: Click to enter text.

If consent to provide service is available from the city, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the city versus the cost of the proposed facility or expansion attached.

Attachment: Click to enter text.

2. Utility CCN areas

Is any portion of the proposed service area located inside another utility's CCN area?

[1] https://www.tceq.texas.gov/permitting/wastewater/tceq-regionalization-for-wastewater

☐ Yes ☒ No

If yes, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the CCN facilities versus the cost of the proposed facility or expansion.

Attachment: Click to enter text.

3. Nearby WWTPs or collection systems

Are there any domestic permitted wastewater treatment facilities or collection systems located within a three-mile radius of the proposed facility?

☒ Yes ☐ No

If yes, attach a list of these facilities and collection systems that includes each permittee's name and permit number, and an area map showing the location of these facilities and collection systems.

Attachment: Appendix Q

If yes, attach proof of mailing a request for service to each facility and collection system, the letters requesting service, and correspondence from each facility and collection system.

Attachment: Appendix R

If the facility or collection system agrees to provide service, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the facility or collection system versus the cost of the proposed facility or expansion.

Attachment: Appendix S

Section 2. Proposed Organic Loading (Instructions Page 59)

Is this facility in operation?

☐ Yes ☒ No

If no, proceed to Item B, Proposed Organic Loading.

If yes, provide organic loading information in Item A, Current Organic Loading

A. Current organic loading

Facility Design Flow (flow being requested in application): Click to enter text.

Average Influent Organic Strength or BOD_5 Concentration in mg/l: Click to enter text.

Average Influent Loading (lbs/day = total average flow X average BOD_5 conc. X 8.34): Click to enter text.

Provide the source of the average organic strength or BOD_5 concentration.

Click to enter text.

B. Proposed organic loading

This table must be completed if this application is for a facility that is not in operation or if this application is to request an increased flow that will impact organic loading.

Table 1.1(1) – Design Organic Loading

Source	Total Average Flow (MGD)	Influent BOD5 Concentration (mg/l)
Municipality		
Subdivision	0.15	400
Trailer park – transient		
Mobile home park		
School with cafeteria and showers		
School with cafeteria, no showers		
Recreational park, overnight use		
Recreational park, day use		
Office building or factory		
Motel		
Restaurant		
Hospital		
Nursing home		
Other		
TOTAL FLOW from all sources	0.15	
AVERAGE BOD_5 from all sources		400

Section 3. Proposed Effluent Quality and Disinfection (Instructions Page 59)

A. Existing/Interim I Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: 10.0

Total Suspended Solids, mg/l: 15.0

Ammonia Nitrogen, mg/l: Click to enter text.

Total Phosphorus, mg/l: Click to enter text.

Dissolved Oxygen, mg/l: Click to enter text.

Other: Click to enter text.

B. Interim II Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: 10.0

Total Suspended Solids, mg/l: 15.0

Ammonia Nitrogen, mg/l: Click to enter text.

Total Phosphorus, mg/l: Click to enter text.

Dissolved Oxygen, mg/l:

Other: Click to enter text.

C. Final Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: 10.0

Total Suspended Solids, mg/l: 15.0

Ammonia Nitrogen, mg/l: Click to enter text.

Total Phosphorus, mg/l: Click to enter text.

Dissolved Oxygen, mg/l: Click to enter text.

Other: Click to enter text.

D. Disinfection Method

Identify the proposed method of disinfection.

☒ Chlorine: 1 mg/l after 20 minutes detention time at peak flow

Dechlorination process: N/A

☐ Ultraviolet Light: Click to enter text. seconds contact time at peak flow

☐ Other: Click to enter text.

Section 4. Design Calculations (Instructions Page 59)

Attach design calculations and plant features for each proposed phase. Example 4 of the instructions includes sample design calculations and plant features.

Attachment: APPENDIX I

Section 5. Facility Site (Instructions Page 60)

A. 100-year floodplain

Will the proposed facilities be located above the 100-year frequency flood level?

☒ Yes ☐ No

If no, describe measures used to protect the facility during a flood event. Include a site map showing the location of the treatment plant within the 100-year frequency flood level. If applicable, provide the size and types of protective structures.

Provide the source(s) used to determine 100-year frequency flood plain.

FEMA Map #48491c0275E (See Appendix J)

For a new or expansion of a facility, will a wetland or part of a wetland be filled?

☐ Yes ☒ No

If yes, has the applicant applied for a US Corps of Engineers 404 Dredge and Fill Permit?

☐ Yes ☐ No

If yes, provide the permit number: Click to enter text.

If no, provide the approximate date you anticipate submitting your application to the Corps: Click to enter text.

B. Wind rose

Attach a wind rose: Appendix K

Section 6. Permit Authorization for Sewage Sludge Disposal (Instructions Page 60)

A. Beneficial use authorization

Are you requesting to include authorization to land apply sewage sludge for beneficial use on property located adjacent to the wastewater treatment facility under the wastewater permit?

☐ Yes ☒ No

If yes, attach the completed **Application for Permit for Beneficial Land Use of Sewage Sludge (TCEQ Form No. 10451)**: Click to enter text.

B. Sludge processing authorization

Identify the sludge processing, storage or disposal options that will be conducted at the wastewater treatment facility:

☐ Sludge Composting

☐ Marketing and Distribution of sludge

☐ Sludge Surface Disposal or Sludge Monofill

If any of the above, sludge options are selected, attach the completed **Domestic Wastewater Permit Application: Sewage Sludge Technical Report (TCEQ Form No. 10056)**: Click to enter text.

Section 7. Sewage Sludge Solids Management Plan (Instructions Page 61)

Attach a solids management plan to the application.

Attachment: Appendix K

The sewage sludge solids management plan must contain the following information:

- Treatment units and processes dimensions and capacities
- Solids generated at 100, 75, 50, and 25 percent of design flow
- Mixed liquor suspended solids operating range at design and projected actual flow

- Quantity of solids to be removed and a schedule for solids removal
- Identification and ownership of the ultimate sludge disposal site
- For facultative lagoons, design life calculations, monitoring well locations and depths, and the ultimate disposal method for the sludge from the facultative lagoon

An example of a sewage sludge solids management plan has been included as Example 5 of the instructions.

DOMESTIC WASTEWATER PERMIT APPLICATION WORKSHEET 3.0: LAND DISPOSAL OF EFFLUENT

The following is required for renewal, new, and amendment permit applications.

Section 1. Type of Disposal System (Instructions Page 68)

Identify the method of land disposal:

- ☐ Surface application
- ☐ Subsurface application
- ☐ Irrigation
- ☐ Subsurface soils absorption
- ☐ Drip irrigation system
- ☒ Subsurface area drip dispersal system
- ☐ Evaporation
- ☐ Evapotranspiration beds
- ☐ Other (describe in detail): Click to enter text.

NOTE: All applicants without authorization or proposing new/amended subsurface disposal MUST complete and submit Worksheet 7.0.

For existing authorizations, provide Registration Number: Click to enter text.

Section 2. Land Application Site(s) (Instructions Page 68)

In table 3.0(1), provide the requested information for the land application sites. Include the agricultural or cover crop type (wheat, cotton, alfalfa, bermuda grass, native grasses, etc.), land use (golf course, hayland, pastureland, park, row crop, etc.), irrigation area, amount of effluent applied, and whether or not the public has access to the area. Specify the amount of land area and the amount of effluent that will be allotted to each agricultural or cover crop, if more than one crop will be used.

Table 3.0(1) – Land Application Site Crops

Crop Type & Land Use	Irrigation Area (acres)	Effluent Application (GPD)	Public Access? Y/N
Green Space, Bermuda	PH1: 11.7 PH2: 23.3 PH3: 35.0	PH1: 50,000 PH2: 100,000 PH3: 150,000	N
Green Space, Winter Rye	PH1: 11.7 PH2: 23.3 PH3: 35.0	PH1: 50,000 PH2: 100,000 PH3: 150,000	N

Section 3. Storage and Evaporation Lagoons/Ponds (Instructions Page 68)

Table 3.0(2) – Storage and Evaporation Ponds

Pond Number	Surface Area (acres)	Storage Volume (acre-feet)	Dimensions	Liner Type
1	To Be Designed	1.38	To Be Designed	Bolted Steel Tanks

Attach a copy of a liner certification that was prepared, signed, and sealed by a Texas licensed professional engineer for each pond.

Attachment:

Section 4. Flood and Runoff Protection (Instructions Page 68)

Is the land application site within the 100-year frequency flood level?

☐ Yes ☒ No

If yes, describe how the site will be protected from inundation.

Click to enter text.

Provide the source used to determine the 100-year frequency flood level:

FEMA FIRM No. 48491C0275E, Dated September 26, 2008

Provide a description of tailwater controls and rainfall run-on controls used for the land application site.

Karst/Critical environmental features will be excluded from the irrigation areas by buffering based on TCEQ criteria. In addition, earthen berms will be provided to divert flows from the buffers. No irrigation across drainage ways or concentrated flow areas is proposed.

Section 5. Annual Cropping Plan (Instructions Page 68)

Attach an Annual Cropping Plan which includes a discussion of each of the following items. If not applicable, provide a detailed explanation indicating why. **Attachment**: APPENDIX L

- Soils map with crops
- Cool and warm season plant species
- Crop yield goals
- Crop growing season
- Crop nutrient requirements
- Additional fertilizer requirements
- Minimum/maximum harvest height (for grass crops)
- Supplemental watering requirements
- Crop salt tolerances
- Harvesting method/number of harvests
- Justification for not removing existing vegetation to be irrigated

Section 6. Well and Map Information (Instructions Page 69)

Attach a USGS map with the following information shown and labeled. If not applicable, provide a detailed explanation indicating why. **Attachment**: APPENDIX M

- The boundaries of the land application site(s)
- Waste disposal or treatment facility site(s)
- On-site buildings
- Buffer zones
- Effluent storage and tailwater control facilities
- All water wells within 1-mile radius of the disposal site or property boundaries
- All springs and seeps onsite and within 500 feet of the property boundaries
- All surface waters in the state onsite and within 500 feet of the property boundaries
- All faults and sinkholes onsite and within 500 feet of the property

List and cross reference all water wells located within a half-mile radius of the disposal site or property boundaries shown on the USGS map in the following table. Attach additional pages as necessary to include all of the wells.

Table 3.0(3) – Water Well Data

Well ID	Well Use	Producing? Y/N	Open, cased, capped, or plugged?	Proposed Best Management Practice
			Choose an item.	See Attachment

Well ID	Well Use	Producing? Y/N	Open, cased, capped, or plugged?	Proposed Best Management Practice
			Choose an item.	
			Choose an item.	
			Choose an item.	
			Choose an item.	

If water quality data or well log information is available please include the information in an attachment listed by Well ID.

Attachment: APPENDIX M

Section 7. Groundwater Quality (Instructions Page 69)

Attach a Groundwater Quality Technical Report which assesses the impact of the wastewater disposal system on groundwater. This report shall include an evaluation of the water wells (including the information in the well table provided in Item 6. above), the wastewater application rate, and pond liners. Indicate by a check mark that this report is provided.

Attachment: APPENDIX N

Are groundwater monitoring wells available onsite? ☐ Yes ☒ No

Do you plan to install ground water monitoring wells or lysimeters around the land application site? ☐ Yes ☒ No

If yes, provide the proposed location of the monitoring wells or lysimeters on a site map.

Attachment: Click to enter text.

Section 8. Soil Map and Soil Analyses (Instructions Page 70)

A. Soil map

Attach a USDA Soil Survey map that shows the area to be used for effluent disposal.

Attachment: APPENDIX O

B. Soil analyses

Attach the laboratory results sheets from the soil analyses. **Note**: for renewal applications, the current annual soil analyses required by the permit are acceptable as long as the test date is less than one year prior to the submission of the application.

Attachment: APPENDIX O

List all USDA designated soil series on the proposed land application site. Attach additional pages as necessary.

Table 3.0(4) – Soil Data

Soil Series	Depth from Surface	Permeability	Available Water Capacity	Curve Number
Doss silty clay (DoC), 1-5% slopes	11-20 inches	0.48 in/hr	0.14 cm/cm	80
Eckrant stony clay (EeB), 0-3% slopes	4 to 20 inches	0.38 in/hr	0.08 cm/cm	80
Eckrant-rock outcrop (ErE), 1-10% slopes	4 to 20 inches	0.38 in/hr	0.09 cm/cm	80
Fairlie clay (FaB), 1-2% slopes	40 to 60 inches	0.03 in/hr	0.17 cm/cm	80
Georgetown stony clay loam (GsB), 1-3% slopes	20 to 40 inches	0.45 in/hr	0.11 cm/cm	80

Section 9. Effluent Monitoring Data (Instructions Page 71)

Is the facility in operation?

☐ Yes ☒ No

If no, this section is not applicable and the worksheet is complete.

If yes, provide the effluent monitoring data for the parameters regulated in the existing permit. If a parameter is not regulated in the existing permit, enter N/A.

Table 3.0(5) – Effluent Monitoring Data

Date	30 Day Avg Flow MGD	BOD5 mg/l	TSS mg/l	pH	Chlorine Residual mg/l	Acres irrigated

Date	30 Day Avg Flow MGD	BOD5 mg/l	TSS mg/l	pH	Chlorine Residual mg/l	Acres irrigated

Provide a discussion of all persistent excursions above the permitted limits and any corrective actions taken.

Click to enter text.

DOMESTIC WASTEWATER PERMIT APPLICATION WORKSHEET 3.3: SUBSURFACE AREA DRIP DISPERSAL (SADDS) LAND DISPOSAL OF EFFLUENT

The following **is required** for **new and major amendment** subsurface area drip dispersal system permit applications. Renewal and minor amendments applicants may be asked for the worksheet on a case by case basis.

NOTE: All applicants proposing new/amended subsurface disposal MUST complete and submit Worksheet 7.0. This worksheet applies to any subsurface disposal system that **meets** the definition of a subsurface area drip dispersal system as defined in *30 TAC Chapter 222, Subsurface Area Drip Dispersal System.*

Section 1. Administrative Information (Instructions Page 75)

A. Provide the legal name of all corporations or other business entities managed, owned, or otherwise closely related to the owner of the treatment facility:

B. George and Laura Reagor Is the owner of the land where the treatment facility is located the same as the owner of the treatment facility?

☒ Yes ☐ No

If **no**, provide the legal name of all corporations or other business entities managed, owned, or otherwise closely related to the owner of the land where the treatment facility is located.

Click to enter text.

C. Owner of the subsurface area drip dispersal system: George and Laura Reagor

D. Is the owner of the subsurface area drip dispersal system the same as the owner of the wastewater treatment facility or the site where the wastewater treatment facility is located?

☒ Yes ☐ No

If **no**, identify the names of all corporations or other business entities managed, owned, or otherwise closely related to the entity identified in Item 1.C.

Click to enter text.

E. Owner of the land where the subsurface area drip dispersal system is located: George and Laura Reagor

F. Is the owner of the land where the subsurface area drip dispersal system is located the same as owner of the wastewater treatment facility, the site where the wastewater treatment facility is located, or the owner of the subsurface area drip dispersal system?

☒ Yes ☐ No

If **no**, identify the name of all corporations or other business entities managed, owned, or otherwise closely related to the entity identified in item 1.E.

Click to enter text.

Section 2. Subsurface Area Drip Dispersal System (Instructions Page 75)

A. Type of system

☒ Subsurface Drip Irrigation

☐ Surface Drip Irrigation

☐ Other, specify: Click to enter text.

B. Irrigation operations

Application area, in acres: 35.0

Infiltration Rate, in inches/hour: 0.20-0.63

Average slope of the application area, percent (%): 2.0

Maximum slope of the application area, percent (%): 15

Storage volume, in gallons: 450,000

Major soil series: Fairlie clay (FaB) and Eckrant stony clay (EeB)

Depth to groundwater, in feet: Approximately 230'

C. Application rate

Is the facility located **west** of the boundary shown in *30 TAC § 222.83* **and** also using a vegetative cover of non-native grasses over seeded with cool season grasses during the winter months (October-March)?

☒ Yes ☐ No

If yes, then the facility may propose a hydraulic application rate not to exceed 0.1 gal/square foot/day.

Is the facility located **east** of the boundary shown in *30 TAC § 222.83* **or** in any part of the state when the vegetative cover is any crop other than non-native grasses?

☐ Yes ☒ No

If **yes**, the facility must use the formula in *30 TAC §222.83* to calculate the maximum hydraulic application rate.

Do you plan to submit an alternative method to calculate the hydraulic application rate for approval by the executive director?

☐ Yes ☒ No

Hydraulic application rate, in gal/square foot/day: 0.10

Nitrogen application rate, in lbs/gal/day: Click to enter text.

D. Dosing information

Number of doses per day: 3

Dosing duration per area, in hours: 0.467

Rest period between doses, in hours: 8 hrs

Dosing amount per area, in inches/day: 0.16

Number of zones: 36

Does the proposed subsurface drip irrigation system use tree vegetative cover as a crop?

☐ Yes ☒ No

If **yes**, provide a vegetation survey by a certified arborist. Please call the Water Quality Assessment Team at (512) 239-4671 to schedule a pre-application meeting.

Attachment: Click to enter text.

Section 3. Required Plans (Instructions Page 75)

A. Recharge feature plan

Attach a Recharge Feature Plan with all information required in *30 TAC §222.79*.

Attachment: Appendix P

B. Soil evaluation

Attach a Soil Evaluation with all information required in *30 TAC §222.73*.

Attachment: Appendix O

C. Site preparation plan

Attach a Site Preparation Plan with all information required in *30 TAC §222.75*.

Attachment: Appendix T

D. Soil sampling/testing

Attach soil sampling and testing that includes all information required in *30 TAC §222.157*.

Attachment: Appendix O

Section 4. Floodway Designation (Instructions Page 76)

A. Site location

Is the existing/proposed land application site within a designated floodway?

☐ Yes ☒ No

B. Flood map

Attach either the FEMA flood map or alternate information used to determine the floodway.

Attachment: Appendix J

Section 5. Surface Waters in the State (Instructions Page 76)

A. Buffer Map

Attach a map showing appropriate buffers on surface waters in the state, water wells, and springs/seeps.

Attachment: Appendix F

B. Buffer variance request

Do you plan to request a buffer variance from water wells or waters in the state?

☐ Yes ☒ No

If yes, then attach the additional information required in *30 TAC § 222.81(c).*

Attachment: Click to enter text.

Section 6. Edwards Aquifer (Instructions Page 76)

A. Is the SADDS located over the Edwards Aquifer Recharge Zone as mapped by TCEQ?

☐ Yes ☒ No

B. Is the SADDS located over the Edwards Aquifer Transition Zone as mapped by TCEQ?

☐ Yes ☒ No

If yes to either question, then the SADDS may be prohibited by *30 TAC §213.8*. Please call the Municipal Permits Team at 512-239-4671 to schedule a pre-application meeting.

WORKSHEET 7.0

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

CLASS V INJECTION WELL INVENTORY/AUTHORIZATION FORM

Submit the completed form to:

TCEQ
IUC Permits Team
Radioactive Materials Division
MC-233
PO Box 13087
Austin, Texas 78711-3087
512-239-6466

For TCEQ Use Only
Reg. No._____
Date Received_____
Date Authorized_____

Section 1. General Information (Instructions Page 92)

1. TCEQ Program Area

Program Area (PST, VCP, IHW, etc.): Water Quality Division; Wastewater Permitting

Program ID: Click to enter text.

Contact Name: Click to enter text.

Phone Number: Click to enter text.

2. Agent/Consultant Contact Information

Contact Name: Lauren Crone, P.E.

Address: 7500 Rialto Boulevard Building II, Suite 100

City, State, and Zip Code: Austin, Texas 78735

Phone Number: 512-439-4700

3. Owner/Operator Contact Information

☒ Owner ☐ Operator

Owner/Operator Name: George Michael Reagor

Contact Name: George Michael Reagor

Address: 906 E. Sandstone Street

City, State, and Zip Code: Llano, Texas 78643

Phone Number: 325-247-6704

4. Facility Contact Information

Facility Name: Reagor Tract Wastewater Plant

Address: Click to enter text.

City, State, and Zip Code: Click to enter text.

Location description (if no address is available): 0.59 miles south of the intersection of FM 2338 and Indian Springs Road in Williamson County, Texas.

Facility Contact Person: George Michael Reagor

Phone Number: 325-247-6704

5. **Latitude and Longitude, in degrees-minutes-seconds**

Latitude: 30°43'34.2"N

Longitude: 97°47'38.1"W

Method of determination (GPS, TOPO, etc.): Based on State Plane Coordinates

Attach topographic quadrangle map as attachment A.

6. **Well Information**

Type of Well Construction, select one:

- ☐ Vertical Injection
- ☒ Subsurface Fluid Distribution System
- ☐ Infiltration Gallery
- ☐ Temporary Injection Points
- ☐ Other, Specify: Click to enter text.

Number of Injection Wells: N/A

7. **Purpose**

Detailed Description regarding purpose of Injection System:

Disposal of treated domestic wastewater from the Reagor Tract WWTP via drip irrigation areas.

Attach a Site Map as Attachment B (Attach the Approved Remediation Plan, if appropriate.)

8. **Water Well Driller/Installer**

Water Well Driller/Installer Name: N/A

City, State, and Zip Code: Click to enter text.

Phone Number: Click to enter text.

License Number: Click to enter text.

Section 2. Proposed Down Hole Design

Attach a diagram signed and sealed by a licensed engineer as Attachment C.

Table 7.0(1) – Down Hole Design Table

Name of String	Size	Setting Depth	Sacks Cement/Grout – Slurry Volume – Top of Cement	Hole Size	Weight (lbs/ft) PVC/Steel
Casing	N/A	N/A	N/A	N/A	N/A
Tubing	N/A	N/A	N/A	N/A	N/A
Screen	N/A	N/A	N/A	N/A	N/A

Section 3. Proposed Trench System, Subsurface Fluid Distribution System, or Infiltration Gallery

Attach a diagram signed and sealed by a licensed engineer as Attachment D.

System(s) Dimensions: 35.0 Acres

System(s) Construction: Subsurface drip irrigation system.

Section 4. Site Hydrogeological and Injection Zone Data

1. Name of Contaminated Aquifer: N/A
2. Receiving Formation Name of Injection Zone: Subsurface drip irrigation system
3. Well/Trench Total Depth: 6 inches
4. Surface Elevation: 940-960 MSL
5. Depth to Ground Water: 230' (based on driller logs)
6. Injection Zone Depth: 12"
7. Injection Zone vertically isolated geologically? ☒ Yes ☐ No

   Impervious Strata between Injection Zone and nearest Underground Source of Drinking Water:

   Name: Comanche Peak Limestone

   Thickness: Unknown
8. Provide a list of contaminants and the levels (ppm) in contaminated aquifer

   Attach as Attachment E.
9. Horizontal and Vertical extent of contamination and injection plume

   Attach as Attachment F.
10. Formation (Injection Zone) Water Chemistry (Background levels) TDS, etc.

    Attach as Attachment G.
11. Injection Fluid Chemistry in PPM at point of injection

    Attach as Attachment H.
12. Lowest Known Depth of Ground Water with < 10,000 PPM TDS: N/A
13. Maximum injection Rate/Volume/Pressure: 0.1 gpd/sf/day, 150,000 gpd, pressure is negligible (drip irrigation system)
14. Water wells within 1/4 mile radius (attach map as Attachment I): Please refer to attached USGS map
15. Injection wells within 1/4 mile radius (attach map as Attachment J): Please refer to attached USGS map.
16. Monitor wells within 1/4 mile radius (attach drillers logs and map as Attachment K): Please refer to attached USGS map
17. Sampling frequency: Once per week as required by TCEQ TLAP permit
18. Known hazardous components in injection fluid: None

Section 5. Site History

1. Type of Facility: Wastewater Treatment Plant
2. Contamination Dates: N/A
3. Original Contamination (VOCs, TPH, BTEX, etc.) and Concentrations (attach as Attachment L): N/A
4. Previous Remediation (attach results of any previous remediation as attachment M): N/A

NOTE: Authorization Form should be completed in detail and authorization given by the TCEQ before construction, operation, and/or conversion can begin. Attach additional pages as necessary.

Class V Injection Well Designations

5A07 Heat Pump/AC return (IW used for groundwater to heat and/or cool buildings)
5A19 Industrial Cooling Water Return Flow (IW used to cool industrial process equipment)
5B22 Salt Water Intrusion Barrier (IW used to inject fluids to prevent the intrusion of salt water into an aquifer)
5D02 Storm Water Drainage (IW designed for the disposal of rain water)
5D04 Industrial Stormwater Drainage Wells (IW designed for the disposal of rain water associated with industrial facilities)
5F01 Agricultural Drainage (IW that receive agricultural runoff)
5R21 Aquifer Recharge (IW used to inject fluids to recharge an aquifer)
5S23 Subsidence Control Wells (IW used to control land subsidence caused by ground water withdrawal)
5W09 Untreated Sewage
5W10 Large Capacity Cesspools (Cesspools that are designed for 5,000 gpd or greater)
5W11 Large Capacity Septic systems (Septic systems designed for 5,000 gpd or greater)
5W12 WTTP disposal
5W20 Industrial Process Waste Disposal Wells
5W31 Septic System (Well Disposal method)
5W32 Septic System Drainfield Disposal
5X13 Mine Backfill (IW used to control subsidence, dispose of mining byproducts, and/or fill sections of a mine)
5X25 Experimental Wells (Pilot Test) (IW used to test new technologies or tracer dye studies)
5X26 Aquifer Remediation (IW used to clean up, treat, or prevent contamination of a USDW)
5X27 Other Wells
5X28 Motor Vehicle Waste Disposal Wells (IW used to dispose of waste from a motor vehicle site - These are currently banned)
5X29 Abandoned Drinking Water Wells (waste disposal)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PLAIN LANGUAGE SUMMARY FOR TPDES OR TLAP PERMIT APPLICATIONS

ENGLISH TEMPLATE FOR TPDES or TLAP NEW/RENEWAL/AMENDMENT APPLICATIONS DOMESTIC WASTEWATER/STORMWATER

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 TAC Chapter 39. The information provided in this summary may change during the technical review of the application and is not a federal enforceable representation of the permit application.

George & Laura Reagor (2. Enter Customer Number here (i.e., CN6########)) proposes to operate Reagor Tract WWTP (RN), a 0.15MGD wastewater treatment plant. The facility will be located at approximately 0.5 miles South from the intersection of FM 2338 and Indian Springs Road, in Georgetown, Williamson County, Texas 78633. This is a new application to discharge 150,000 gallons per day of processed wastewater on an intermittent and flow-variable basis.

Discharges from the facility are expected to contain five-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), ammonia nitrogen (NH_3-N), total phosphorus (P), and Escherichia Coli. Domestic wastewater will be treated by a future WWTP consisting of a packaged single stage nitrification plant, including headworks (bar screening), aeration, clarification, chlorination, chlorine contact & aerobic digestion. Treated effluent will be stored in a holding tank for six days in the initial phase, three days in the interim phase and three days in the final phase prior to disposal using subsurface drip irrigation near the treatment plant on land owned by the applicant. Sludge will be disposed of by hauling off-site by a licensed hauler, to a permitted landfill.

PLANTILLA EN INGLÉS PARA SOLICITUDES DE NUEVA/RENOVACIÓN/ENMIENDA TPDES o TLAP
AGUAS RESIDUALES DOMÉSTICAS/AGUAS PLUVIALES
El siguiente resumen se proporciona para esta solicitud de permiso de calidad del agua pendiente que está siendo revisada por la Comisión de Calidad Ambiental de Texas según lo exige el Capítulo 39 del 30 TAC. La información proporcionada en este resumen puede cambiar durante la revisión técnica de la solicitud y no es un documento federal ejecutable. representación de la solicitud de permiso.

George & Laura Reagor (2. Ingrese el número de cliente aquí (es decir, CN########)) propone operar la WWTP de Reagor Tract (RN), una planta de tratamiento de aguas residuales de 0.15 MGD. La instalación estará ubicada aproximadamente a 0,5 millas al sur de la intersección de FM 2338 e Indian Springs Road, en Georgetown, condado de Williamson, Texas 78633. Esta es una nueva solicitud para descargar 150,000 galones por día de aguas residuales procesadas de manera intermitente y con flujo base variable.

Se espera que las descargas de la instalación contengan demanda bioquímica de oxígeno carbonoso (CBOD5) de cinco días, sólidos suspendidos totales (SST), nitrógeno amoniacal (NH3-N), fósforo total (P) y Escherichia coli. Las aguas residuales domésticas serán tratadas mediante una futura EDAR que consistirá en una planta de nitrificación de una sola etapa, que incluye obras de captación (cribado de barras), aireación, clarificación, cloración, contacto con cloro y digestión aeróbica. El efluente tratado se almacenará en un tanque de retención durante seis días en la fase inicial, tres días en la fase intermedia y tres días en la fase final antes de su eliminación mediante riego por goteo subterráneo cerca de la planta de tratamiento en un terreno propiedad del solicitante. Los lodos se eliminarán mediante transporte fuera del sitio por parte de un transportista autorizado, a un vertedero autorizado.

APPENDIX A

CORE DATA FORM

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions on completing this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission (*If other is checked please describe in space provided.*)

☒ New Permit, Registration or Authorization (*Core Data Form should be submitted with the program application.*)

☐ Renewal *(Core Data Form should be submitted with the renewal form)* ☐ Other

2. Customer Reference Number *(if issued)*	Follow this link to search for CN or RN numbers in Central Registry**	**3. Regulated Entity Reference Number** *(if issued)*
CN		**RN**

SECTION II: Customer Information

4. General Customer Information | **5. Effective Date for Customer Information Updates** (mm/dd/yyyy) 12/30/1992

☒ New Customer ☐ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).

6. Customer Legal Name *(If an individual, print last name first: eg: Doe, John)* *If new Customer, enter previous Customer below:*

Reagor, George

7. TX SOS/CPA Filing Number	**8. TX State Tax ID** (11 digits)	**9. Federal Tax ID** (9 digits)	**10. DUNS Number** *(if applicable)*

11. Type of Customer: ☐ Corporation ☒ Individual Partnership: ☐ General ☒ Limited
Government: ☐ City ☐ County ☐ Federal ☐ Local ☐ State ☐ Other ☐ Sole Proprietorship ☐ Other:

12. Number of Employees
☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

13. Independently Owned and Operated?
☒ **Yes** ☐ **No**

14. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ VCP/BSA Applicant ☐ Other:

15. Mailing Address: 906 E. Sandstone Street

City	Llano	**State**	TX	**ZIP**	78643	**ZIP + 4**	

16. Country Mailing Information *(if outside USA)*	**17. E-Mail Address** *(if applicable)*

18. Telephone Number	**19. Extension or Code**	**20. Fax Number** *(if applicable)*

( ) -		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information *(If 'New Regulated Entity" is selected, a new permit application is also required.)*

☒ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated, in order to meet TCEQ Core Data Standards (removal of organizational endings such as Inc, LP, or LLC).

22. Regulated Entity Name *(Enter name of the site where the regulated action is taking place.)*

Reagor Tract WWTP

23. Street Address of the Regulated Entity: ***(No PO Boxes)***	**906 E. Sandstone Street**							
	City	Llano	**State**	TX	**ZIP**	78643	**ZIP + 4**	
24. County								

If no Street Address is provided, fields 25-28 are required.

25. Description to Physical Location:	Southeast corner of the tract, approximately 0.59 miles south from the intersection of FM 2338 and Indian Springs Road in Georgetown, Texas 78633.				
26. Nearest City			**State**	**Nearest ZIP Code**	
Georgetown			TX		

Latitude/Longitude are required and may be added/updated to meet TCEQ Core Data Standards. (Geocoding of the Physical Address may be used to supply coordinates where none have been provided or to gain accuracy).

27. Latitude (N) In Decimal:			**28. Longitude (W) In Decimal:**		
30.726167			-97.793917		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
30	43	34.2	97	47	38.1

29. Primary SIC Code (4 digits)	**30. Secondary SIC Code** (4 digits)	**31. Primary NAICS Code** (5 or 6 digits)	**32. Secondary NAICS Code** (5 or 6 digits)
4952		22132	

33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)*

Wastewater Treatment Facility

34. Mailing Address:	**906 E. Sandstone Street**							
	City	Llano	**State**	TX	**ZIP**	78633	**ZIP + 4**	
35. E-Mail Address:								

36. Telephone Number	**37. Extension or Code**	**38. Fax Number** *(if applicable)*
( ) -		( ) -

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☒ Wastewater	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:

SECTION IV: Preparer Information

40. Name:	Lauren Crone, P.E.	41. Title:	Senior Project Manager

42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(512) 439-4700		( )	lcrone@lja.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:		Job Title:	Owner
Name *(In Print)*:	George Reagor	Phone:	( ) -
Signature:	George Reagor	Date:	12/4/2024

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions on completing this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission (*If other is checked please describe in space provided.*)

☒ New Permit, Registration or Authorization (*Core Data Form should be submitted with the program application.*)

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2. Customer Reference Number *(if issued)*	Follow this link to search for CN or RN numbers in Central Registry**	**3. Regulated Entity Reference Number** *(if issued)*
CN		**RN**

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4. General Customer Information | **5. Effective Date for Customer Information Updates** (mm/dd/yyyy)

☒ New Customer ☐ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).

6. Customer Legal Name *(If an individual, print last name first: eg: Doe, John)* | *If new Customer, enter previous Customer below:*

Reagor, Laura

7. TX SOS/CPA Filing Number	**8. TX State Tax ID** (11 digits)	**9. Federal Tax ID** (9 digits)	**10. DUNS Number** *(if applicable)*

11. Type of Customer: ☐ Corporation ☒ Individual Partnership: ☐ General ☒ Limited

Government: ☐ City ☐ County ☐ Federal ☐ Local ☐ State ☐ Other ☐ Sole Proprietorship ☐ Other:

12. Number of Employees

☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

13. Independently Owned and Operated?

☒ **Yes** ☐ **No**

14. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ VCP/BSA Applicant ☐ Other:

15. Mailing Address:

14943 Sandalfoot Street

City	Houston	**State**	TX	**ZIP**	77095	**ZIP + 4**	

16. Country Mailing Information *(if outside USA)*	**17. E-Mail Address** *(if applicable)*
	laura@laurareagor.com

18. Telephone Number	**19. Extension or Code**	**20. Fax Number** *(if applicable)*

(713) 805-4039		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information *(If 'New Regulated Entity" is selected, a new permit application is also required.)*

☒ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated, in order to meet TCEQ Core Data Standards (removal of organizational endings such as Inc, LP, or LLC).

22. Regulated Entity Name *(Enter name of the site where the regulated action is taking place.)*

Reagor Tract WWTP

23. Street Address of the Regulated Entity: ***(No PO Boxes)***	906 E. Sandstone Street							
	City	Llano	**State**	TX	**ZIP**	78643	**ZIP + 4**	
24. County								

If no Street Address is provided, fields 25-28 are required.

25. Description to Physical Location:	Southeast corner of the tract, approximately 0.59 miles south from the intersection of FM 2338 and Indian Springs Road in Georgetown, Texas 78633.

26. Nearest City	**State**	**Nearest ZIP Code**
Georgetown	TX	

Latitude/Longitude are required and may be added/updated to meet TCEQ Core Data Standards. (Geocoding of the Physical Address may be used to supply coordinates where none have been provided or to gain accuracy).

27. Latitude (N) In Decimal:	30.726167		**28. Longitude (W) In Decimal:**	-97.793917	
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
30	43	34.2	97	47	38.1

29. Primary SIC Code (4 digits)	**30. Secondary SIC Code** (4 digits)	**31. Primary NAICS Code** (5 or 6 digits)	**32. Secondary NAICS Code** (5 or 6 digits)
4952		22132	

33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)*

Wastewater Treatment Facility

34. Mailing Address:	**906 E. Sandstone Street**							
	City	**Llano**	**State**	**TX**	**ZIP**	**78633**	**ZIP + 4**	
35. E-Mail Address:								

36. Telephone Number	**37. Extension or Code**	**38. Fax Number** *(if applicable)*
( ) -		( ) -

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☒ Wastewater	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:

SECTION IV: Preparer Information

40. Name:	Lauren Crone, P.E.	**41. Title:**	Senior Project Manager

42. Telephone Number	**43. Ext./Code**	**44. Fax Number**	**45. E-Mail Address**
(512) 439-4700		( ) -	lcrone@lja.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:		**Job Title:**	Owner
Name *(In Print):*	Laura Reagor	**Phone:**	(713) 805- **4039**
Signature:	Laura Reagor	**Date:**	12-4-24

APPENDIX B

PUBLIC INVOLVEMENT PLAN

Texas Commission on Environmental Quality

Public Involvement Plan Form for Permit and Registration Applications

The Public Involvement Plan is intended to provide applicants and the agency with information about how public outreach will be accomplished for certain types of applications in certain geographical areas of the state. It is intended to apply to new activities; major changes at existing plants, facilities, and processes; and to activities which are likely to have significant interest from the public. This preliminary screening is designed to identify applications that will benefit from an initial assessment of the need for enhanced public outreach.

All applicable sections of this form should be completed and submitted with the permit or registration application. For instructions on how to complete this form, see TCEQ-20960-inst.

Section 1. Preliminary Screening

☒ New Permit or Registration Application

☐ New Activity – modification, registration, amendment, facility, etc. (see instructions)

If neither of the above boxes are checked, completion of the form is not required and does not need to be submitted.

Section 2. Secondary Screening

☒ Requires public notice,

☒ Considered to have significant public interest, **and**

☒ Located within any of the following geographical locations:

- Austin
- Dallas
- Fort Worth
- Houston
- San Antonio
- West Texas
- Texas Panhandle
- Along the Texas/Mexico Border
- Other geographical locations should be decided on a case-by-case basis

If all the above boxes are not checked, a Public Involvement Plan is not necessary. Stop after Section 2 and submit the form.

☐ Public Involvement Plan not applicable to this application. Provide **brief** explanation.

Section 3. Application Information

Type of Application (check all that apply):

Air ☐ Initial ☐ Federal ☐ Amendment ☐ Standard Permit ☐ Title V

Waste ☐ Municipal Solid Waste ☐ Industrial and Hazardous Waste ☐ Scrap Tire
☐ Radioactive Material Licensing ☐ Underground Injection Control

Water Quality

☐ Texas Pollutant Discharge Elimination System (TPDES)

☒ Texas Land Application Permit (TLAP)

☐ State Only Concentrated Animal Feeding Operation (CAFO)

☐ Water Treatment Plant Residuals Disposal Permit

☐ Class B Biosolids Land Application Permit

☐ Domestic Septage Land Application Registration

Water Rights New Permit

☐ New Appropriation of Water

☐ New or existing reservoir

Amendment to an Existing Water Right

☐ Add a New Appropriation of Water

☐ Add a New or Existing Reservoir

☐ Major Amendment that could affect other water rights or the environment

Section 4. Plain Language Summary

Provide a brief description of planned activities.

George & Laura Reagor, propose to operate Reagor Tract Wastewater Treatment Plant, a 0.15 MGD WWTP facility. The facility will be located approximately 0.5 miles Southeast from the intersection approximately 0.5 miles South from the intersection of FM 2338 and Indian Springs Road, in Georgetown, Williamson County, Texas 78633. This application is for a new TLAP Permit.

The wastewater treatment plant consists of three phases, with each phase treating 50,000 gpd, resulting in a total capacity of 150,000 gpd at full completion. The treatment units include an influent screening system, aeration basin, clarifier, chlorine contact basin and an aerobic digester. Wastewater will be pumped into the plant where it will enter through a screen. The influent will then pass through the aeration zone and flow into a clarifier. From the clarifier, the effluent will flow to a chlorine contact basin for disinfection prior to tertiary filtration. From there the effluent will be routed to an effluent storage tank. The effluent will then be disposed of via subsuface drip irrigation. This facility will also utilize a digester for sludge holding and reduction of solids prior to haul off.

Section 5. Community and Demographic Information

Community information can be found using EPA's EJ Screen, U.S. Census Bureau information, or generally available demographic tools.

Information gathered in this section can assist with the determination of whether alternative language notice is necessary. Please provide the following information.

Georgetown

(City)

Williamson

(County)

0202.05

(Census Tract)

Please indicate which of these three is the level used for gathering the following information.

☐ City ☒ County ☐ Census Tract

(a) Percent of people over 25 years of age who at least graduated from high school

97%

(b) Per capita income for population near the specified location

$68,778

(c) Percent of minority population and percent of population by race within the specified location

30.0% Minority population; 24.0% Hispanic or Latino; 1% Black or African American; 2.0% Asian; 4.0% Two or more races, 0% Other

(d) Percent of Linguistically Isolated Households by language within the specified location

0% Spanish; 0% Asian and Pacific Islander Languages; 0% Other languages

(e) Languages commonly spoken in area by percentage

86% English, 11% Spanish; 2.0% German or other West Germanic, 1.0% Asian and Pacific Island Languages;

(f) Community and/or Stakeholder Groups

City of Georgetown, adjacent property owners

(g) Historic public interest or involvement

N/A

Section 6. Planned Public Outreach Activities

(a) Is this application subject to the public participation requirements of Title 30 Texas Administrative Code (30 TAC) Chapter 39?

☒ Yes ☐ No

(b) If yes, do you intend at this time to provide public outreach other than what is required by rule?

☐ Yes ☐ No

If Yes, please describe.

If you answered "yes" that this application is subject to 30 TAC Chapter 39, answering the remaining questions in Section 6 is not required.

(c) Will you provide notice of this application in alternative languages?

☐ Yes ☐ No

Please refer to Section 5. If more than 5% of the population potentially affected by your application is Limited English Proficient, then you are required to provide notice in the alternative language.

If yes, how will you provide notice in alternative languages?

☐ Publish in alternative language newspaper

☐ Posted on Commissioner's Integrated Database Website

☐ Mailed by TCEQ's Office of the Chief Clerk

☐ Other (specify)

(d) Is there an opportunity for some type of public meeting, including after notice?

☐ Yes ☐ No

(e) If a public meeting is held, will a translator be provided if requested?

☐ Yes ☐ No

(f) Hard copies of the application will be available at the following (check all that apply):

☐ TCEQ Regional Office ☐ TCEQ Central Office

☐ Public Place (specify)

Section 7. Voluntary Submittal

For applicants voluntarily providing this Public Involvement Plan, who are not subject to formal public participation requirements.

Will you provide notice of this application, including notice in alternative languages?

☒ Yes ☐ No

What types of notice will be provided?

☒ Publish in alternative language newspaper

☐ Posted on Commissioner's Integrated Database Website

☐ Mailed by TCEQ's Office of the Chief Clerk

☐ Other (specify)

APPENDIX C

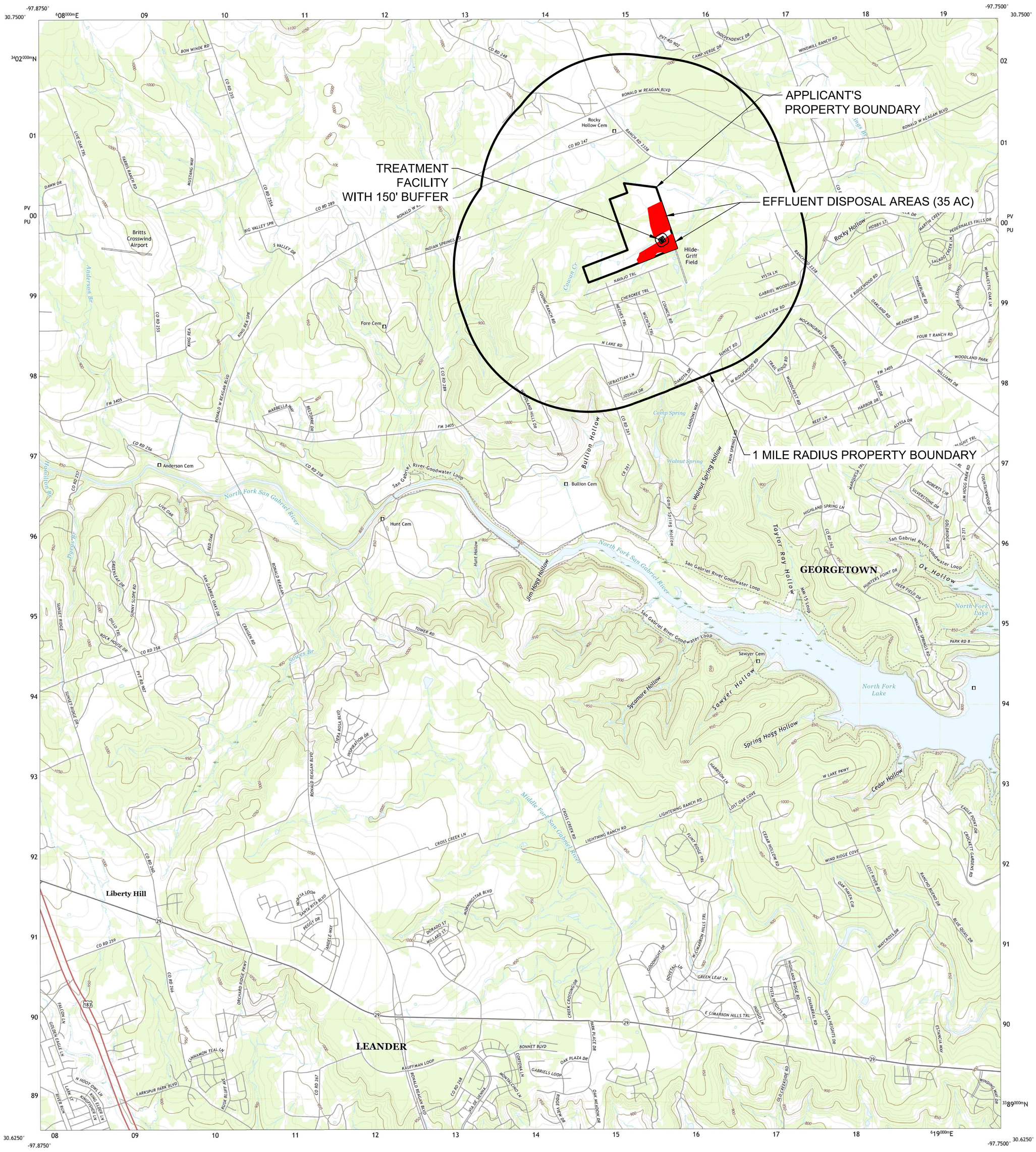
USGS MAP

USGS science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

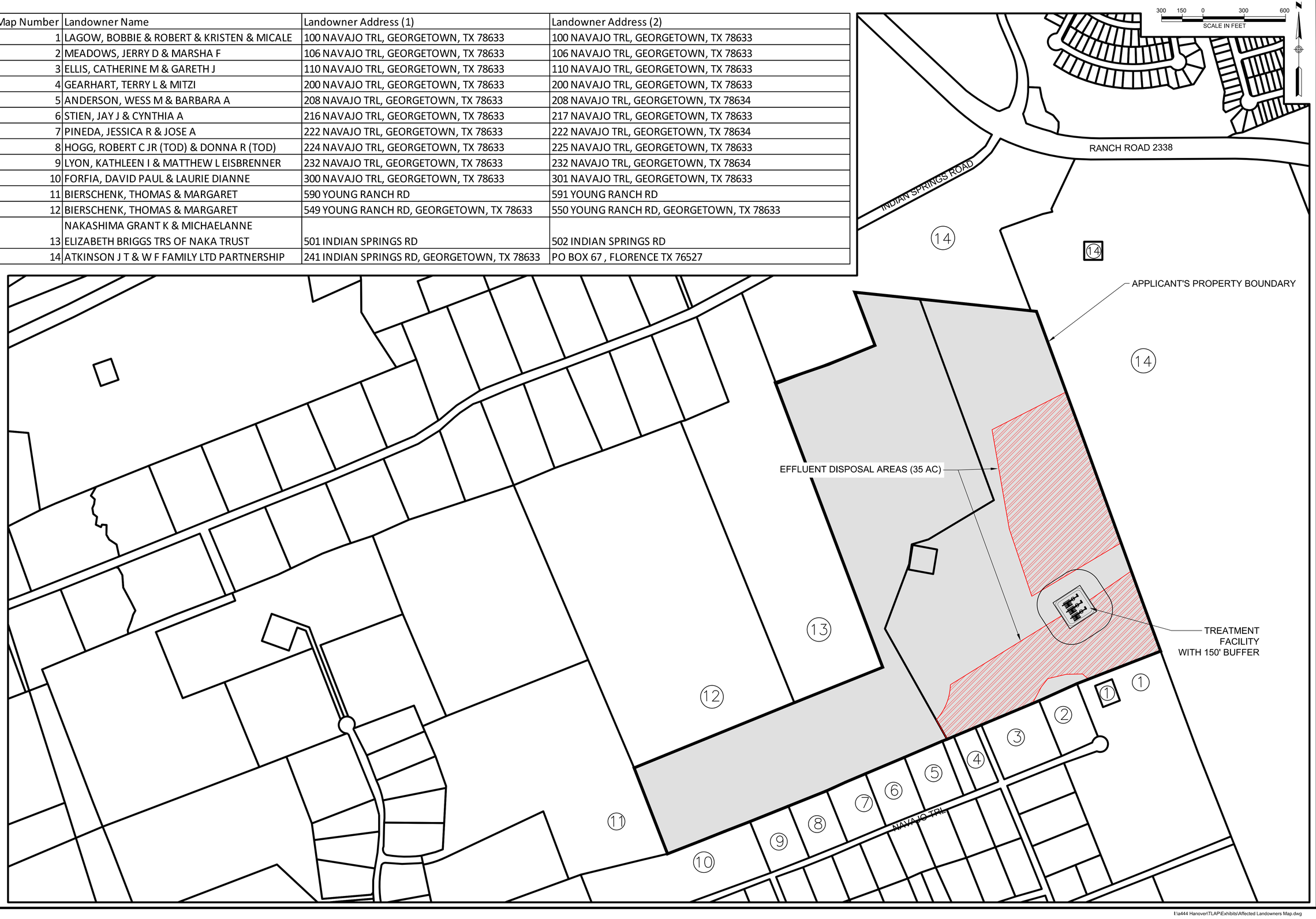
LEANDER NE QUADRANGLE
TEXAS - WILLIAMSON COUNTY
7.5-MINUTE SERIES


APPLICANT'S PROPERTY BOUNDARY
TREATMENT FACILITY WITH 150' BUFFER
EFFLUENT DISPOSAL AREAS (35 AC)
1 MILE RADIUS PROPERTY BOUNDARY
-97.8750°
-97.7500°
30.7500°
30.6250°
GEORGETOWN
LEANDER
Liberty Hill
Britts Crosswind Airport
Hilde-Griff Field
Rocky Hollow Cem
Fore Cem
Anderson Cem
Bullion Cem
Hunt Cem
Sawyer Cem
North Fork San Gabriel River
Middle Fork San Gabriel River
Camp Spring
Walnut Spring
Bullion Hollow
Jim Hogg Hollow
Sawyer Hollow
Taylor Roy Hollow
Ox Hollow
Sycamore Hollow
Spring Hogg Hollow
Cedar Hollow
North Fork Lake
Anderson Br
Humilton Br
Davis Br
Soules Br
Cowan Cr
Rocky Hollow
FM 3405
CO RD 258
CO RD 259
CO RD 247
CO RD 248
CO RD 255
CO RD 256
CO RD 257
CO RD 281
CO RD 289
CO RD 355A
CO RD 242
CO RD 247
CO RD 267
CO RD 946
CO RD 960
RONALD W REAGAN BLVD
RONALD REAGAN BLVD
SAN GABRIEL OAK DR
San Gabriel River Goodwater Loop
BON WINDE RD
BIG VALLEY SPR
INDIAN SPRINGS RD
S VALLEY DR
KING REA SPR
KING REA
S CO RD 289
MARBELLA WAY
BELTDORE DR
HIGHLAND HILLS DR
LIVE OAK TRL
FARRIS RANCH RD
MUSTANG WAY
DAWN DR
LIVE OAK
RED OAK
GREENLEAF DR
SUNNY SLOPE RD
SUNSET RIDGE
SUNSET RIDGE DR
DILLO TRL
ROCK HOUSE DR
PVT RD 907
CRAUGEN RD
TOWER RD
ITERA ROSA BLVD
INSPIRATION DR
CAMP VERDE DR
INDEPENDENCE DR
PVT RD 902
WINDMILL RANCH RD
RANCH RD 2338
RANCH RD 2338B
NAVAJO TRL
CHEROKEE TRL
MECHEE TRL
WICHITA TRL
COUNCIL RD
YOUNG RANCH RD
N LAKE RD
SEBASTIAN LN
JOSHUA DR
DAKOTA DR
SUNSET RD
VALLEY VIEW RD
VISTA LN
GABRIEL WOODS DR
MOCKINGBIRD LN
REDBIRD TRL
W RIDGEWOOD RD
TRAIL RIDGE DR
WOODCREST RD
E RIDGEWOOD RD
OAKLAND RD
MEADOW DR
FOUR T RANCH RD
TIMBERLINE RD
SUNSET RIDGE
W MAJESTIC OAK LN
WOODLAND PARK
WILLIAMS DR
FM 3405
BUOY DR
HARBOR DR
REEF LN
ALYSSA DR
TWIN SPRINGS RD
LANDONS WAY
CR 261
CAMP SPRING HOLLOW
WALNUT SPRING HOLLOW
HIGHLAND SPRING LN
MARGUECA TRL
ROBERTS CIR
SILVERSTONE DR
JIM HOGG PARK RD
FOUNTAINWOOD DR
GOLDRIDGE DR
LIZ LN
HUNTERS POINT DR
DEER FIELD DR
WALNUT SPRINGS RD
PARK RD 8
MARTIN CREEK DR
HOBBY ST
PEDERNALES FALLS DR
SALADO CREEK LN
MANOR LOOP
TOWER RD
CROSS CREEK LN
CROSS CREEK RD
LIGHTNING RANCH RD
HARRISON LN
LOST OAK COVE
W LAKE PKWY
CEDAR HOLLOW RD
WIND RIDGE COVE
EAGLE POINT DR
CROCKETT GARDENS RD
LOST RIVER RD
OAK HAVEN CIR
RANCHO BUENO DR
BLUE QUAIL DR
WAYCROSS DR
ESTANCIA WAY
WINDING WAY DR
MORNINGSTAR BLVD
DORADO ST
MILLARD ST
MORCIA LOOP
SANTA RITA BLVD
REGGY DR
JADE E WAY
ORCHARD RIDGE PKWY
CREEK CROSSING DR
GOODNIGHT DR
DOVETAIL LN
W CIMARRON HILLS TRL
GREEN LEAF LN
E CIMARRON HILLS TRL
INDIGO LN
HIGHLAND RIDGE RD
VISTA HEIGHTS RD
CHAPARRAL RD
VISTA HEIGHTS DR
FALCON LN
GOLDEN EAGLE LN
N HOOT OWL LN
LARK ST
KINGFISHER LN
KING ELDER LN
RIVER RUN
CINNAMON TEAL LN
LARKSPUR PARK BLVD
RUSK BLUFF AVE
KAUFFMAN LOOP
BONNET BLVD
CORTONA LN
MONTALCINO LN
PARK PLACE DR
OAK PLAZA DR
GABRIELS LOOP
RIDGE VIEW DR
OAK MEADOW DR
VIA DE SIENNA
OLD CREEKSIDE RD
MAPLE LOOP
MAPLE LN
MAPLE RUN
MAPLE RUN DR
MAPLE RUN CIR
MAPLE RUN TRL
MAPLE RUN PL
MAPLE RUN CV
MAPLE RUN WAY
MAPLE RUN CT
MAPLE RUN LOOP
MAPLE RUN PKWY
MAPLE RUN BLVD

APPENDIX D

AFFECTED LANDOWNER MAP

Map Number	Landowner Name	Landowner Address (1)	Landowner Address (2)
1	LAGOW, BOBBIE & ROBERT & KRISTEN & MICALE	100 NAVAJO TRL, GEORGETOWN, TX 78633	100 NAVAJO TRL, GEORGETOWN, TX 78633
2	MEADOWS, JERRY D & MARSHA F	106 NAVAJO TRL, GEORGETOWN, TX 78633	106 NAVAJO TRL, GEORGETOWN, TX 78633
3	ELLIS, CATHERINE M & GARETH J	110 NAVAJO TRL, GEORGETOWN, TX 78633	110 NAVAJO TRL, GEORGETOWN, TX 78633
4	GEARHART, TERRY L & MITZI	200 NAVAJO TRL, GEORGETOWN, TX 78633	200 NAVAJO TRL, GEORGETOWN, TX 78633
5	ANDERSON, WESS M & BARBARA A	208 NAVAJO TRL, GEORGETOWN, TX 78633	208 NAVAJO TRL, GEORGETOWN, TX 78634
6	STIEN, JAY J & CYNTHIA A	216 NAVAJO TRL, GEORGETOWN, TX 78633	217 NAVAJO TRL, GEORGETOWN, TX 78633
7	PINEDA, JESSICA R & JOSE A	222 NAVAJO TRL, GEORGETOWN, TX 78633	222 NAVAJO TRL, GEORGETOWN, TX 78634
8	HOGG, ROBERT C JR (TOD) & DONNA R (TOD)	224 NAVAJO TRL, GEORGETOWN, TX 78633	225 NAVAJO TRL, GEORGETOWN, TX 78633
9	LYON, KATHLEEN I & MATTHEW L EISBRENNER	232 NAVAJO TRL, GEORGETOWN, TX 78633	232 NAVAJO TRL, GEORGETOWN, TX 78634
10	FORFIA, DAVID PAUL & LAURIE DIANNE	300 NAVAJO TRL, GEORGETOWN, TX 78633	301 NAVAJO TRL, GEORGETOWN, TX 78633
11	BIERSCHENK, THOMAS & MARGARET	590 YOUNG RANCH RD	591 YOUNG RANCH RD
12	BIERSCHENK, THOMAS & MARGARET	549 YOUNG RANCH RD, GEORGETOWN, TX 78633	550 YOUNG RANCH RD, GEORGETOWN, TX 78633
13	NAKASHIMA GRANT K & MICHAELANNE ELIZABETH BRIGGS TRS OF NAKA TRUST	501 INDIAN SPRINGS RD	502 INDIAN SPRINGS RD
14	ATKINSON J T & W F FAMILY LTD PARTNERSHIP	241 INDIAN SPRINGS RD, GEORGETOWN, TX 78633	PO BOX 67 , FLORENCE TX 76527



AFFECTED LANDOWNER'S MAP

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

1 OF 1

I:\a444 Hanover\TLAP\Exhibits\Affected Landowners Map.dwg

Map Number	Landowner Name	Landowner Address (1)	Landowner Address (2)
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9	LYON, KATHLEEN I & MATTHEW L EISBRENNER	232 NAVAJO TRL, GEORGETOWN, TX 78633	232 NAVAJO TRL, GEORGETOWN, TX 78634
10	FORFIA, DAVID PAUL & LAURIE DIANNE	300 NAVAJO TRL, GEORGETOWN, TX 78633	301 NAVAJO TRL, GEORGETOWN, TX 78633
11	BIERSCHENK, THOMAS & MARGARET	590 YOUNG RANCH RD	591 YOUNG RANCH RD
12	BIERSCHENK, THOMAS & MARGARET	549 YOUNG RANCH RD, GEORGETOWN, TX 78633	550 YOUNG RANCH RD, GEORGETOWN, TX
13	NAKASHIMA GRANT K & MICHAELANNE ELIZABETH BRIGGS TRS OF NAKA TRUST	501 INDIAN SPRINGS RD	502 INDIAN SPRINGS RD
14	ATKINSON J T & W F FAMILY LTD PARTNERSHIP	241 INDIAN SPRINGS RD, GEORGETOWN, TX 78633	PO BOX 67 , FLORENCE TX 76527

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APPENDIX E

ORIGINAL PHOTOGRAPHS

300 150 0 300 600
SCALE IN FEET

RANCH ROAD 2338

INDIAN SPRINGS ROAD

APPLICANT'S PROPERTY BOUNDARY

EFFLUENT DISPOSAL AREAS (35 AC)

TREATMENT FACILITY WITH 150' BUFFER

NAVAJO TRL

PHOTO MAP

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

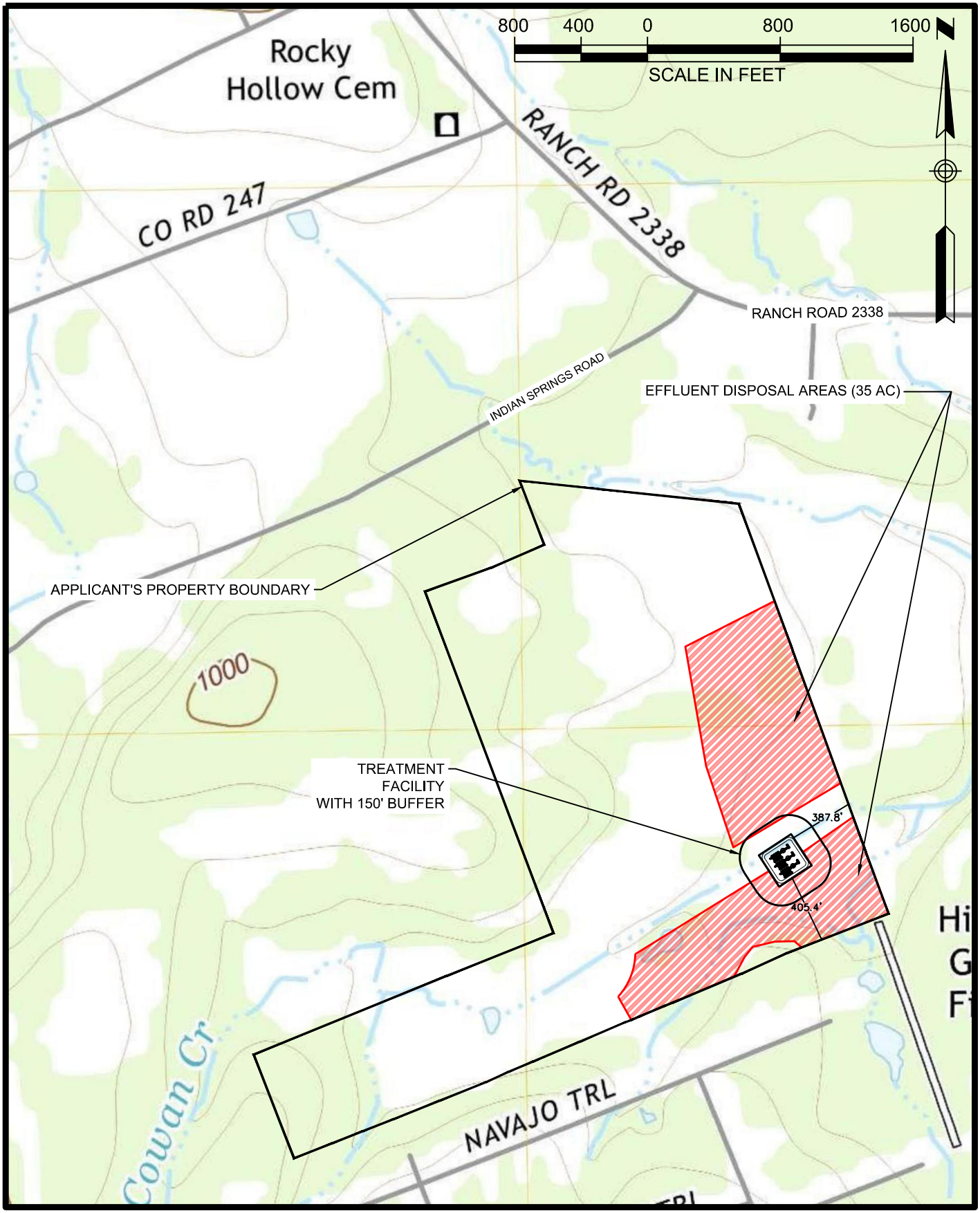
LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735

LJA
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

I:\a444 Hanover\TLAP\Exhibits\Affected Landowners Map.dwg

APPENDIX F

BUFFER ZONE MAP



LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

REAGOR TRACT WWTP
WILLIAMSON COUNTY, TX

BUFFER ZONE MAP

300 150 0 300 600
SCALE IN FEET

N

RANCH ROAD 2338

INDIAN SPRINGS ROAD

EDWARDS AQUIFER CONTRIBUTING ZONE

APPLICANT'S PROPERTY BOUNDARY

EDWARDS AQUIFER CONTRIBUTING ZONE

EFFLUENT DISPOSAL AREAS (35 AC)

EDWARDS AQUIFER RECHARGE ZONE

TREATMENT FACILITY WITH 150' BUFFER

EDWARDS AQUIFER CONTRIBUTING ZONE

NAVAJO TRL

BUFFER ZONE MAP
EDWARDS AQUIFER

REAGOR TRACT WWTP
WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

1 OF 1

I:\a444 Hanover\TLAP\Exhibits\Buffer zone Ed Aquifer.dwg

APPENDIX G

PROCESS FLOW DIAGRAM

FOR PLANNING PURPOSES ONLY

INTERIM I PHASE

PROCESS FLOW DIAGRAM

1 OF 1

REAGOR TRACT WWTP
WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

FOR PLANNING PURPOSES ONLY

INTERIM II PHASE

PROCESS FLOW DIAGRAM

1 OF 1

REAGOR TRACT WWTP
WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

FOR PLANNING PURPOSES ONLY

FINAL PHASE

PROCESS FLOW DIAGRAM

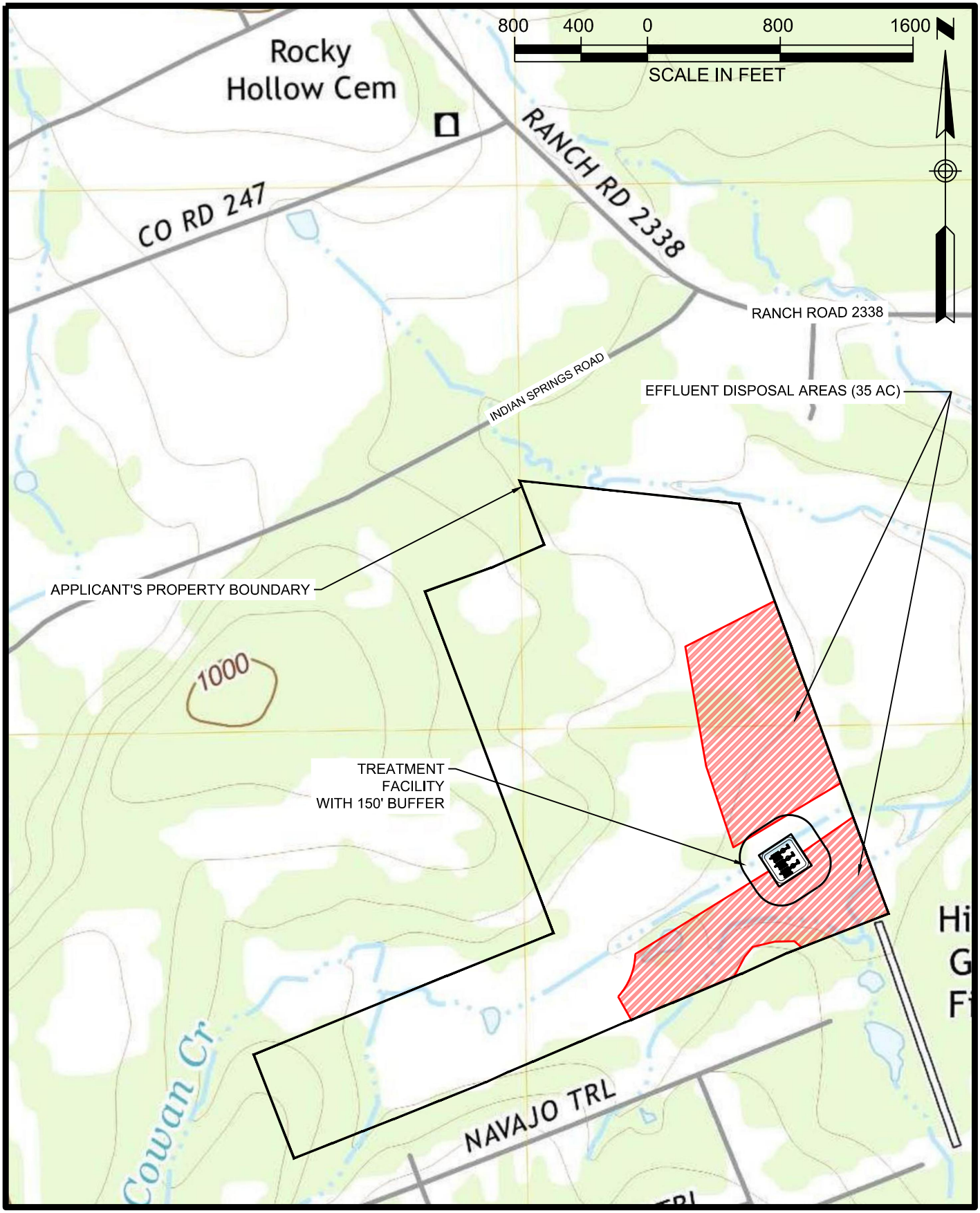
1 OF 1

REAGOR TRACT WWTP
WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

APPENDIX H

SITE DRAWING



LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

SITE MAP

1 OF 1

APPENDIX I

DESIGN CALCULATIONS

Reagor Tract WWTP Design (TCEQ Checklist)

Phase 1

Design Flow (from Summary Sheet)	0.050	mgd
Peak Flow (from Summary Sheet)	0.200	mgd
Design Organic Load	400	lb BOD / day

Clarifier Design

(Criteria)

Maximum Surface Loading @ Peak Flow	900	gpd/ft^2
Minimum Detention Time @ Peak Flow	2	hrs
Maximum Surface Loading @ Design Flow	450	gpd/ft^2
Minimum Detention Time @ Design Flow	4	hrs
Surface Area Required (Peak Flow)	222.2	ft^2
Surface Area Required (Design Flow)	111.1	ft^2
Volume Required (Peak Flow)	2,228	ft^3
Volume Required (Design Flow)	1,114	ft^3
Depth Required (Peak Flow)	10.0	ft
Depth Required (Design Flow)	10.0	ft
Maximum Return Sludge Underflow Rate	400.0	gpd/ft^2
Minimum Return Sludge Underflow Rate	200.0	gpd/ft^2

(Calculations)

Proposed Sidewater Depth	10.5	ft
Proposed Clarifier Diameter	18	ft
Clarifier Surface Area	254	ft^2
Clarifier Volume	2,672	ft^3

Note - Min SWD is 8 ft, 10 ft if area > 1250 ft^2

Maximum Return Sludge Underflow Rate	71	gpm
Minimum Return Sludge Underflow Rate	35	gpm
RAS Line Size (min 3 ft/sec velocity)	4	inches

Aeration System Design

(Criteria)

Organic Loading	15	lb BOD/day/1000 ft^3	
Actual Design Load	400		
Required Volume	26667	ft^3	
Required Air Flow	3200	scf / lb BOD	(assumes 4.0% transfer efficiency)

(Calculations)

Proposed Sidewater Depth	10.5	ft	*Note - Min SWD is 8 ft*
Surface Area	2,540	ft^2	
Air Flow	889	scfm	

Aerobic Digester Design

(Criteria)

Volume Required	20	ft^3 / lb BOD
or	15	days SRT
Air Required	30	scfm/ 1000 ft^3 volume

(Calculations)

Proposed Volume	8,000	ft^3
Proposed Sidewater Depth	10.5	ft
Surface Area	762	ft^2
Required Air Flow	240	scfm

Chlorine Contact Design

(Criteria)

Minimum Contact Time	20	minutes @ Peak Flow

(Calculations)

Proposed Volume	371	ft^3
Proposed Sidewater Depth	10.5	ft
Surface Area	35	ft^2

Reagor Tract WWTP Design (TCEQ Checklist)

Phase 2

Design Flow (from Summary Sheet)	0.050	mgd
Peak Flow (from Summary Sheet)	0.200	mgd
Design Organic Load	400	lb BOD / day

Clarifier Design

(Criteria)

Maximum Surface Loading @ Peak Flow	900	gpd/ft^2
Minimum Detention Time @ Peak Flow	2	hrs
Maximum Surface Loading @ Design Flow	450	gpd/ft^2
Minimum Detention Time @ Design Flow	4	hrs
Surface Area Required (Peak Flow)	222.2	ft^2
Surface Area Required (Design Flow)	111.1	ft^2
Volume Required (Peak Flow)	2,228	ft^3
Volume Required (Design Flow)	1,114	ft^3
Depth Required (Peak Flow)	10.0	ft
Depth Required (Design Flow)	10.0	ft
Maximum Return Sludge Underflow Rate	400.0	gpd/ft^2
Minimum Return Sludge Underflow Rate	200.0	gpd/ft^2

(Calculations)

Proposed Sidewater Depth	10.5	ft
Proposed Clarifier Diameter	20	ft
Clarifier Surface Area	314	ft^2
Clarifier Volume	3,299	ft^3

Note - Min SWD is 8 ft, 10 ft if area > 1250 ft^2

Maximum Return Sludge Underflow Rate	87	gpm
Minimum Return Sludge Underflow Rate	44	gpm
RAS Line Size (min 3 ft/sec velocity)	4	inches

Aeration System Design

(Criteria)

Organic Loading	15	lb BOD/day/1000 ft^3
Actual Design Load	400	lb BOD/day
Required Volume	26667	ft^3
Required Air Flow	3200	scf / lb BOD (assumes 4.0% transfer efficiency)

(Calculations)

Proposed Sidewater Depth	10.5	ft
Surface Area	2,540	ft^2
Air Flow	889	scfm

Note - Min SWD is 8 ft

Aerobic Digester Design

(Criteria)

Volume Required	20	ft^3 / lb BOD
or	15	days SRT
Air Required	30	scfm/ 1000 ft^3 volume

(Calculations)

Proposed Volume	8,000	ft^3
Proposed Sidewater Depth	10.5	ft
Surface Area	762	ft^2
Required Air Flow	240	scfm

Chlorine Contact Design

(Criteria)

Minimum Contact Time	20	minutes @ Peak Flow

(Calculations)

Proposed Volume	371	ft^3
Proposed Sidewater Depth	10.5	ft
Surface Area	35	ft^2

Reagor Tract WWTP Design (TCEQ Checklist)

Phase 3

Design Flow (from Summary Sheet)	0.050	mgd
Peak Flow (from Summary Sheet)	0.200	mgd
Design Organic Load	400	lb BOD / day

Clarifier Design

(Criteria)

Maximum Surface Loading @ Peak Flow	900	gpd/ft^2
Minimum Detention Time @ Peak Flow	2	hrs
Maximum Surface Loading @ Design Flow	450	gpd/ft^2
Minimum Detention Time @ Design Flow	4	hrs
Surface Area Required (Peak Flow)	222.2	ft^2
Surface Area Required (Design Flow)	111.1	ft^2
Volume Required (Peak Flow)	2,228	ft^3
Volume Required (Design Flow)	1,114	ft^3
Depth Required (Peak Flow)	10.0	ft
Depth Required (Design Flow)	10.0	ft
Maximum Return Sludge Underflow Rate	400.0	gpd/ft^2
Minimum Return Sludge Underflow Rate	200.0	gpd/ft^2

(Calculations)

Proposed Sidewater Depth	10.5	ft
Proposed Clarifier Diameter	20	ft
Clarifier Surface Area	314	ft^2
Clarifier Volume	3,299	ft^3

Note - Min SWD is 8 ft, 10 ft if area > 1250 ft^2

Maximum Return Sludge Underflow Rate	87	gpm
Minimum Return Sludge Underflow Rate	44	gpm
RAS Line Size (min 3 ft/sec velocity)	4	inches

Aeration System Design

(Criteria)

Organic Loading	15	lb BOD/day/1000 ft^3
Actual Design Load	400	lb BOD/day
Required Volume	26667	ft^3
Required Air Flow	3200	scf / lb BOD (assumes 4.0% transfer efficiency)

(Calculations)

Proposed Sidewater Depth	10.5	ft
Surface Area	2,540	ft^2
Air Flow	889	scfm

Note - Min SWD is 8 ft

Aerobic Digester Design

(Criteria)

Volume Required	20	ft^3 / lb BOD
or	15	days SRT
Air Required	30	scfm/ 1000 ft^3 volume

(Calculations)

Proposed Volume	8,000	ft^3
Proposed Sidewater Depth	10.5	ft
Surface Area	762	ft^2
Required Air Flow	240	scfm

Chlorine Contact Design

(Criteria)

Minimum Contact Time	20	minutes @ Peak Flow

(Calculations)

Proposed Volume	371	ft^3
Proposed Sidewater Depth	10.5	ft
Surface Area	35	ft^2

APPENDIX J

FEMA MAPS AND WIND ROSE

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole–foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Texas State Plane central zone (FIPSZONE 4203). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC–3, #9202
1315 East–West Highway
Silver Spring, MD 20910–3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713–3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by CAPCOG. This information was digitized at a scale of at least 1:2,400 from aerial photography dated 2002.

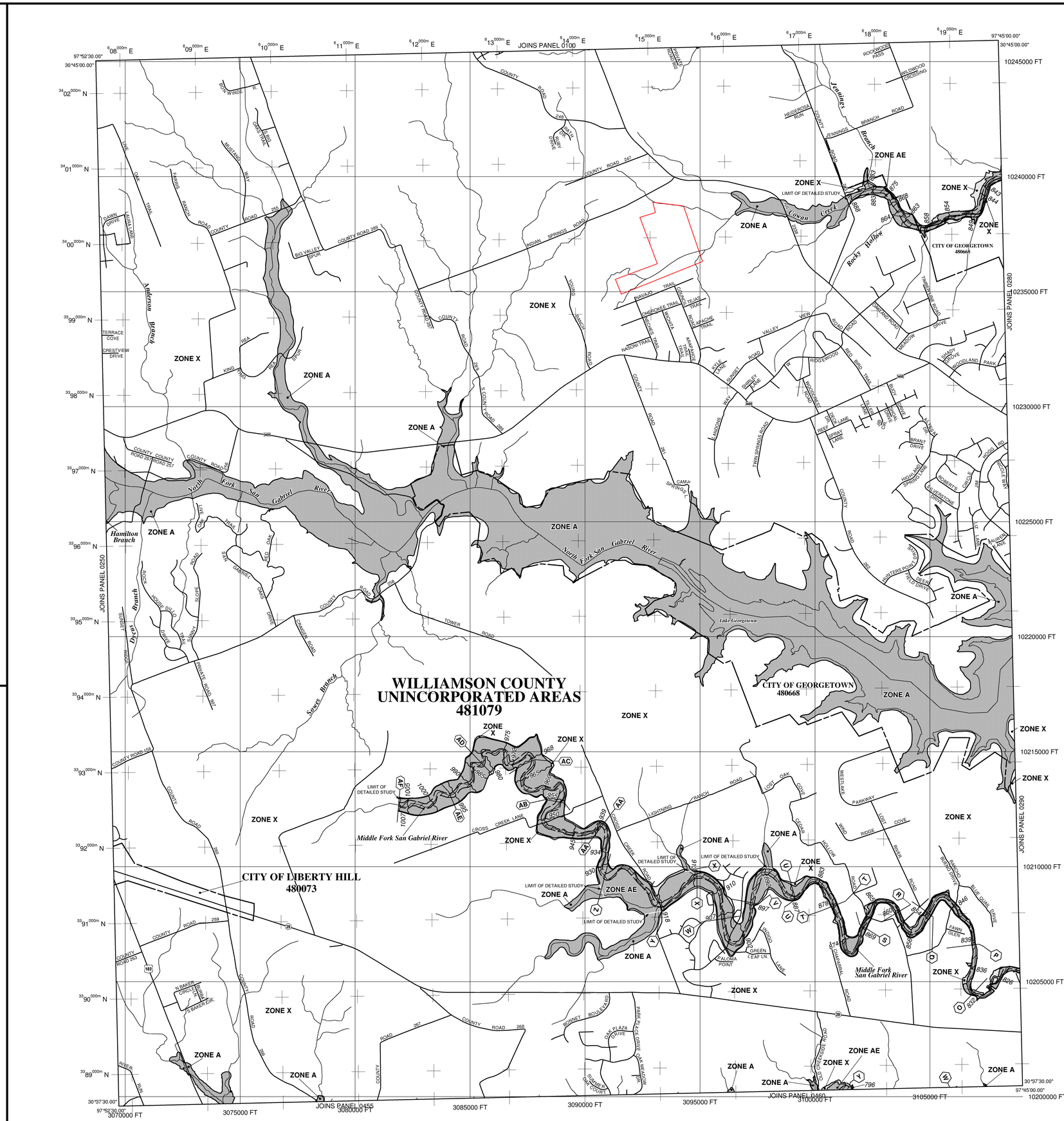
This map reflects more detailed and up–to–date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de–annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1–800–358–9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1–800–358–9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1–877–FEMA MAP**(1–877–336–2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A–A Cross section line

23–23 Transect line

97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4275000mN 1000-meter Universal Transverse Mercator grid , zone 14

6000000 FT 5000-foot grid : Texas State Plane coordinate system, central zone (FIPSZONE 4203), Lambert Conformal Conic

DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 27, 1991
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
November 2, 1995, January 3, 1997
September 26, 2008 - to update corporate limits, to update map format, to add roads and road names, to incorporate previously issued Letters of Map Revisions, to reflect updated topographic information.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0275E

FIRM
FLOOD INSURANCE RATE MAP
WILLIAMSON COUNTY, TEXAS
AND INCORPORATED AREAS

PANEL 275 OF 750
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

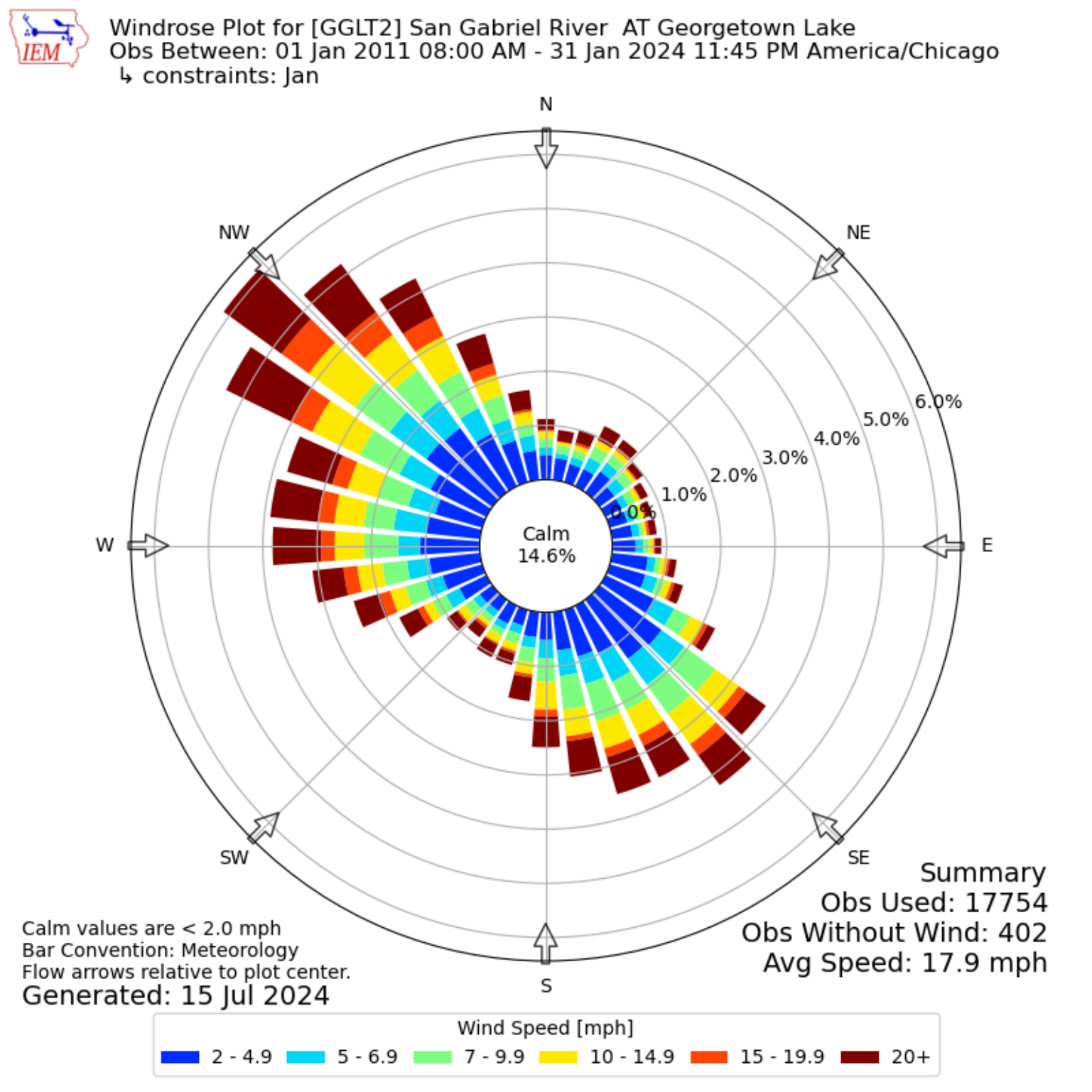
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WILLIAMSON COUNTY	481079	0275	E
GEORGETOWN, CITY OF	480668	0275	E
LIBERTY HILL, CITY OF	480073	0275	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
48491C0275E
MAP REVISED
SEPTEMBER 26, 2008

Federal Emergency Management Agency


Windrose Plot for [GGLT2] San Gabriel River AT Georgetown Lake
Obs Between: 01 Jan 2011 08:00 AM - 31 Jan 2024 11:45 PM America/Chicago
↳ constraints: Jan
N
NE
E
SE
S
SW
W
NW
1.0%
2.0%
3.0%
4.0%
5.0%
6.0%
Calm
14.6%
Summary
Obs Used: 17754
Obs Without Wind: 402
Avg Speed: 17.9 mph
Calm values are < 2.0 mph
Bar Convention: Meteorology
Flow arrows relative to plot center.
Generated: 15 Jul 2024
Wind Speed [mph]
2 - 4.9
5 - 6.9
7 - 9.9
10 - 14.9
15 - 19.9
20+

APPENDIX K

SEWAGE SOLIDS MANAGEMENT PLAN

REAGOR TRACT WWTP SOLIDS MANAGEMENT PLAN

Interim I Phase

Design Flow *gpd*	**Vol Dig** *ft³ (gal)*	**Percentage**	**Flow** *gpd*	**P_x** *lbs VSS/day*	**$P_{x\ (ss)}$** *lbs SS/day*	**Q_{Sldg}** *gpd*	**HRT_{Sldg}** *days*
50,000	8,000	25%	12,500	11	14	205	292
		50%	25,000	22	27	410	146
	59,844	75%	37,500	33	41	614	97
		100%	50,000	44	55	819	73

Interim II Phase

Design Flow *gpd*	**Vol Dig** *ft³ (gal)*	**Percentage**	**Flow** *gpd*	**P_x** *lbs VSS/day*	**$P_{x\ (ss)}$** *lbs SS/day*	**Q_{Sldg}** *gpd*	**HRT_{Sldg}** *days*
100,000	16,000	25%	25,000	22	27	410	292
		50%	50,000	44	55	819	146
	119,680	75%	75,000	66	82	1,229	97
		100%	100,000	87	109	1,639	73

Final Phase

Design Flow *gpd*	**Vol Dig** *ft³ (gal)*	**Percentage**	**Flow** *gpd*	**P_x** *lbs VSS/day*	**$P_{x\ (ss)}$** *lbs SS/day*	**Q_{Sldg}** *gpd*	**HRT_{Sldg}** *days*
150,000	24,000	25%	37,500	33	41	614	292
		50%	75,000	66	82	1,229	146
	179,520	75%	112,500	98	123	1,843	97
		100%	150,000	131	164	2,458	73

Sludge will be wasted from the clarifier underflow to the digester. Sludge will stay in the digester with the decant returned to the headworks of the plant. Sludge will be removed from the digester on a schedule approximate to the HRT of the digester. The liquid sludge will be hauled by truck for further treatment.

APPENDIX L

ANNUAL CROPPING PLAN

CROPPING PLAN

FOR

REAGOR TRACT WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

December 2024

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD, BUILDING II, SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

CROPPING PLAN

The proposal for the wastewater application areas is to remove the smaller ashe juniper trees, import soil, construct grading, install the Subsurface Area Drip Disposal System and overseed with Bermuda and Winter Rye Grass. The irrigation areas will be over seeded with turf grasses year-round to ensure consistent uptake of water and nutrients. The irrigation areas will be mowed regularly, and maintain a height of approximately 0-2 inches, to ensure that the grasses will be actively growing at all times. No supplemental irrigation will be needed.

There are no plans to fertilize the grasses other than germination. Fertility recommendations for the grasses to be used at this site are generally 100-150 lbs/arcre of N. The grasses will be fertilized for germination and it is not anticipated to fertilize in the future.

Bermuda and Winter Rye grasses are very salt tolerant, and this site is not expected to develop any salinity problems.

Site Preparation
Preparing the site involves removing trees and debris, planning for drainage, and grading the site.

1. Remove debris. Insist that the builder not use the site as a dumping ground for paint, concrete, and other materials.
2. Remove trees and surface rocks and debris from the site.
3. Soil depth of 19 inches minimum is required. Measure soil depths and import as necessary.
4. Plan for easy maintenance and a pleasing appearance. Avoid terraces, steep grades, poorly drained areas, and heavily shaded spots. Grading shall not exceed 8% on areas to be irrigated.
5. Shape the underlying subsoil to the desired contour and redistribute topsoil uniformly above the subsoil. A percent slope minimum is needed for proper drainage away from buildings. Make certain the soil is firmed after shaping. There should be no visible footprints after walking on it.
6. Water the area to enhance settling. Fill areas that settle unevenly to avoid standing water.

Soil Preparation
Well-prepared soil with adequate nutrients for growing grass encourages the development of a healthy field.

1. Take soil samples from the irrigation areas to determine soil pH and nutrient requirements. A single soil test may be all that is necessary if there are no obvious differences in soil texture, terrain, or troubled areas of the front yard and backyard. If the soils seem different, collect soil samples to a depth of 3 to 4 inches from several (10-15) locations and mix them together to produce a composite sample.

2. Based on the soil test report recommendations of the fertilization guidelines presented below, incorporate lime and fertilizer into the top 6 to 8 inches of the soil using a disk or rototiller. Regardless of the region, a deeper root system is able to extract more moisture and nutrients from the soil, improving drought tolerance and overall health of the plant.

3. Rake or harrow the site to establish a smooth and level final grade. Soil particles should be no larger than marble size, and pea gravel size is even better. Hand raking is the best way to level the soil and work out hills and hollows. Allow time for rain or irrigation to settle the soil and roll or cultipack lightly to firm the soil before planting seed. Hand rake again to break up the crusty surface before planting.

4. Prior to irrigation, a minimum of 19 inches of soil must be present in all proposed irrigation areas.

Winter Rye and Bermuda

Winter Rye grass is mainly used as a permanent lawn grass in cooler northern climates and as winter grass for dormant Bermuda grass or to overseed Bermuda grass lawns in southern climates. is highly resistant to foot traffic so it is popular for residential and commercial lawns and turfs.

Common Bermudagrass, which is the most coarsely textured, can be seeded. Several newer cultivars, however, can also be seeded that have a medium texture. Bermudagrass should be seeded at 1 to 2 pounds per 1,000 sq ft.

Establishing a healthy, attractive field means planting the best grass for your site at the right time and in a careful manner. Grass can be seeded or established using vegetation in the form of sprigs, plugs, or sod. The type of grass and the planting method you select will determine the best time of year to plant. Site and soil preparation, including fertilization, are especially important.

Mowing

Use a rotary (centrifugal) mower.

1. Keep the mower blades sharp and balanced. The leanest cut and best mowing are obtained when the mower blades are sharp. Dull mower blades reduce field quality by tearing instead of cleanly cutting the grass. Tearing creates many ragged leaf ends that quickly wither and bleach and are easy ports of entry for disease. Using a sharp mower is especially important for difficult-to-mow grasses, such as Bermudagrass. A properly sharpened and balanced mower blade will also reduce mower vibration, lengthen mower life, and reduce fuel consumption by as much as 22 percent.

2. Mow at the proper height. The frequency of mowing is governed by the desired grass height and by the amount of growth, which depends on temperature, fertility, moisture conditions, season, and the natural growth rate of the grass. In most instances, this may amount to biweekly and weekly mowing. To maintain a high-quality field, turfgrass should be cut often enough that less than 50 percent of the leaf surface is removed with each mowing. If the field gets too high during wet seasons, rise the mower and cut off a fourth to a half of the present growth. Then lower the mower to its proper height and mow again in a day or two.

3. Rake, bag, and remove the clippings when harvesting is required. If prolonged periods of rainfall prevent mowing, clippings may be long enough to shade or smother the grass. In this case, rake, bag, and remove clippings. Collected clippings can be used as mulch around trees and shrubs or added to compost.

Fertilization

As recommended above, its best to submit a soil sample for testing when establishing a new field to determine how much lime fertilizer should be added to your soil. Fertilize before planting. Apply fertilizer and lime when soil is prepared based on these guidelines:

If you obtained a soil test: Apply the amount of line and fertilizer recommended for your soil by the soil testing laboratory.

1. Apply 75 pounds of ground limestone per 1,000 sq ft.
2. Apply a starter type fertilizer (one that is high in phosphorous based on the type of grass and the planting method. Fertilizer bags have a three-number system indicating the primary nutrients, such as 8-8-8 or 5-10-10. These numbers denote the N-P0K ratio – the percentage of each nutrient in a fertilizer. The percentages are always noted in the following order:
    a. N Nitrogen for green color and growth
    b. P2O5 Phosphorous for good establishment and rooting
    c. K20 Potassium to enhance past and environmental stress tolerance.

Some common examples of starter type fertilizers required for a 1,000 sq ft area include 40 pounds of 5-10-10, 20 pounds of 10-20-20, or 16 pounds of 18-24-6. For sandy soils, fertilizer rates should be increased by 20 percent.

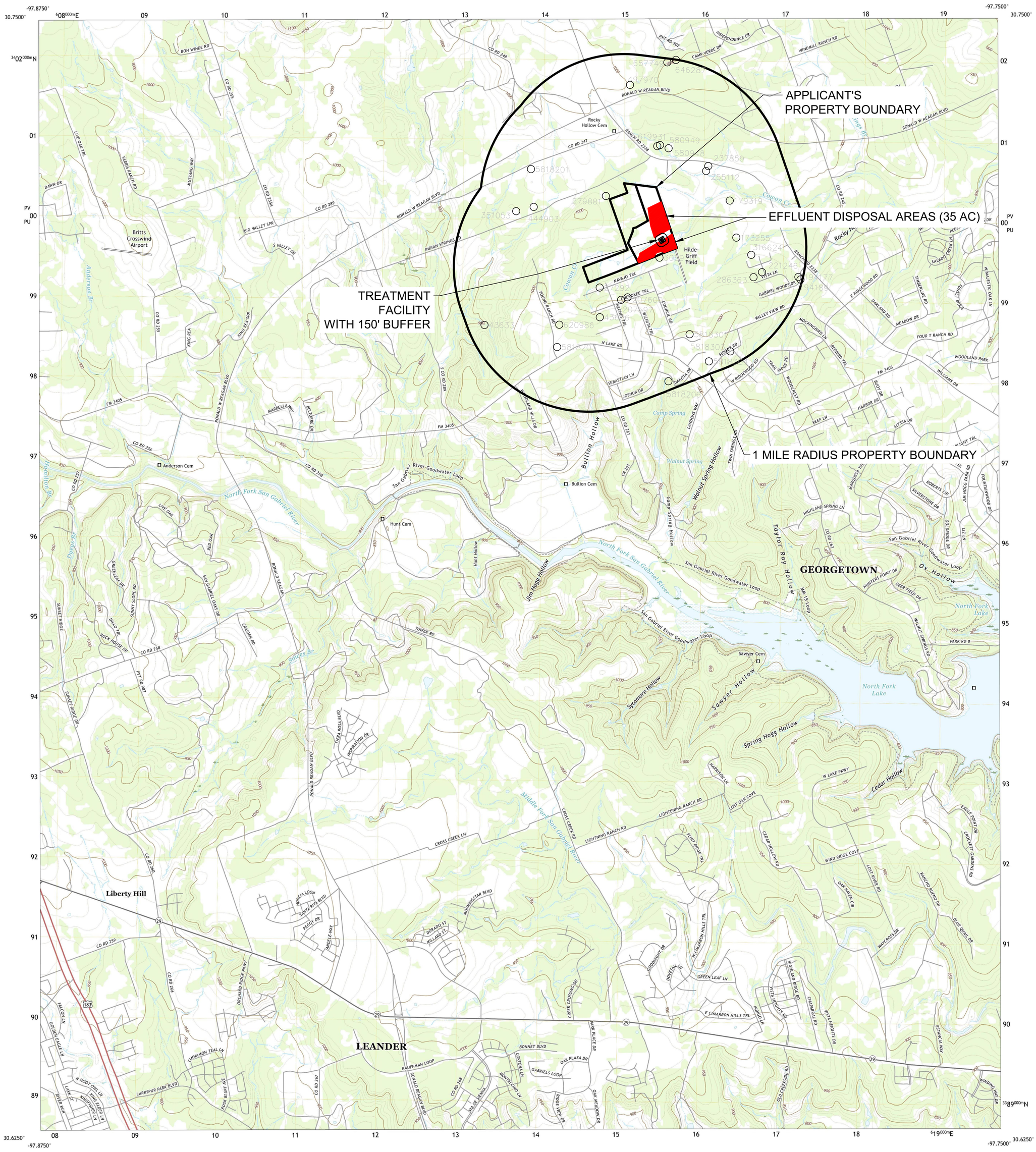
APPENDIX M

USGS WELL MAP AND WELL INFORMATION

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

LEANDER NE QUADRANGLE
TEXAS - WILLIAMSON COUNTY
7.5-MINUTE SERIES


APPLICANT'S PROPERTY BOUNDARY
EFFLUENT DISPOSAL AREAS (35 AC)
TREATMENT FACILITY WITH 150' BUFFER
1 MILE RADIUS PROPERTY BOUNDARY
Hilde-Griff Field
Britts Crosswind Airport
Rocky Hollow Cem
Anderson Cem
Bullion Cem
Hunt Cem
Sawyer Cem
GEORGETOWN
LEANDER
Liberty Hill
Camp Spring
Walnut Spring
Bullion Hollow
Walnut Spring Hollow
Taylor Roy Hollow
Jim Hogg Hollow
Ox Hollow
Sawyer Hollow
Sycamore Hollow
Spring Hogg Hollow
Cedar Hollow
North Fork San Gabriel River
Middle Fork San Gabriel River
North Fork Lake
Anderson Br
Hamilton Br
Davis Br
Soules Br
Cowan Cr
RONALD W REAGAN BLVD
CO RD 248
CO RD 247
CO RD 255
CO RD 289
CO RD 258
CO RD 256
CO RD 259
CO RD 281
CO RD 242
FM 3405
WINDMILL RANCH RD
CAMP VERDE DR
INDEPENDENCE DR
RANCH RD 2338
E RIDGEWOOD RD
OAKLAND RD
MEADOW DR
FOUR T RANCH RD
WOODLAND PARK
VALLEY VIEW RD
N LAKE RD
SUNSET RD
W RIDGEWOOD RD
FM 3405
BULLION HOLLOW RD
SAN GABRIEL RIVER GOODWATER LOOP
HIGHLAND SPRING LN
GREEN LEAF LN
E CIMARRON HILLS TRL
W CIMARRON HILLS TRL
CROSS CREEK LN
LIGHTNING RANCH RD
W LAKE PKWY
WIND RIDGE COVE
CEDAR HOLLOW RD
KAUFFMAN LOOP
BONNET BLVD
OAK PLAZA DR
GABRIELS LOOP
PARK PLACE DR
LARKSPUR PARK BLVD
CUNNAMON TEAL LN
FALCON LN
GOLDEN EAGLE LN
N HOOT OWL LN
RIVER RUN
LARK ST
KINGFISHER LN
KING ELDER LN
SUNSET RIDGE
SUNSET RIDGE DR
ROCK HOUSE DR
DILLO TRL
SUNNY SLOPE RD
GREENLEAF DR
SAN GABRIEL OAK DR
LIVE OAK
RED OAK
CRAUGER RD
TOWER RD
PARK RD 8
DEER FIELD DR
HUNTERS POINT DR
HIGHLAND RIDGE RD
VISTA HEIGHTS DR
CHAPARRAL RD
ESTANCIA WAY
WAYCROSS DR
BLUE QUAIL DR
RANCHO BUENO DR
LOST RIVER RD
OAK HAVEN CIR
WINDING WAY DR
EAGLE POINT DR
CROCKETT GARDENS RD
LOST OAK COVE
HARRISON LN
FLINT RIDGE TRL
GOODNIGHT DR
DOVEEYE LN
INDIGO LN
CREEK CROSSING DR
ORCHARD RIDGE PKWY
SANTA RITA BLVD
MORNINGSTAR BLVD
DORADO ST
MILLARD ST
PEGGY DR
JADE E WAY
MARCELLA LOOP
MONTALCINO LN
VIA DE SIENNA
RIDGE VIEW DR
OAK MEADOW DR
CROSS CREEK RD
TIERRA ROSA BLVD
INSPIRATION DR
MARBELLA WAY
BEITORE DR
HIGHLAND HILLS DR
LANDONS WAY
TWIN SPRINGS RD
REEF LN
ALYSSA DR
WOODCREST RD
TRAIL RIDGE RD
REDBIRD TRL
MOCKINGBIRD LN
MAJESTIC OAK LN
SUNSET RIDGE
TIMBERLINE RD
SALADO CREEK LN
ROBERTS CIR
SILVERSTONE DR
JIM HOGG PARK RD
FOUNTAINWOOD DR
GOLDRIDGE DR
LIZ LN
MARGUECA TRL
PVT RD 907
PVT RD 902
KING REA
KING REA SPUR
BON WINDE RD
MUSTANG WAY
FABRI RANCH RD
DAWN DR
BIG VALLEY SPR
S VALLEY DR
INDIAN SPRINGS RD
NAVAJO TRL
CHEROKEE TRL
WICHITA TRL
YOUNG RANCH RD
COUNCIL RD
GABRIEL WOODS DR
VISTA LN
SALADO CREEK LN
S CO RD 289
JOSHUA DR
SEBASTIAN LN
DAKOTA DR
CO RD 360
CO RD 367
CO RD 368
CO RD 369
CO RD 345
CO RD 346
CO RD 227
CO RD 255
CO RD 255A
CO RD 289
CO RD 247
CO RD 248
CO RD 258
CO RD 259
CO RD 281
CO RD 242
CO RD 345
CO RD 346
CO RD 360
CO RD 367
CO RD 368
CO RD 369
29
183
1000
1050
1100
950
900
850
800
1000
1050
1100
950
900
850
800
1000
1050
1100
950
900
850
800

Well Number	Well ID	Well use	Producing (Y/N)	Open, Cased, Capped, or Plugged?	Proposed Best Management Practice
1	5755603.00	Domestic	Y	Open	150' Buffer Zone
2	5755608.00	Unknown	N	Open	150' Buffer Zone
3	5755604.00	Domestic	Y	Open	150' Buffer Zone
4	194293.00	Irrigation	N	Plugged	N/A
5	9656.00	Domestic	N	Open	150' Buffer Zone
6	291940.00	Domestic	Y	Cased	150' Buffer zone
7	134724.00	Domestic	Y	Open	150' Buffer zone
8	637727.00	Domestic	Y	Open	150' Buffer Zone
9	429314.00	Domestic	Y	Open	150' Buffer Zone
10	593151.00	Domestic	Y	Open	150' Buffer Zone
11	661941.00	Domestic	Y	Open	150' Buffer Zone
12	661939.00	Domestic	Y	Open	150' Buffer Zone
13	414065.00	Domestic	Y	Open	150' Buffer Zone
14	121328.00	Domestic	Y	Open	150' Buffer Zone
15	315105.00	Domestic	Y	Open	150' Buffer Zone
16	134717.00	Domestic	Y	Open	150' Buffer Zone
17	126822.00	Domestic	Y	Open	150' Buffer Zone
18	483084.00	Domestic	Y	Open	150' Buffer Zone
19	114248.00	Domestic	Y	Open	150' Buffer Zone
20	92895.00	Domestic	Y	Open	150' Buffer Zone
21	370728.00	Domestic	Y	Open	150' Buffer Zone
22	210625.00	Domestic	Y	Open	150' Buffer Zone
23	108740.00	Domestic	Y	Open	150' Buffer Zone
24	92896.00	Domestic	Y	Open	150' Buffer Zone
25	395292.00	Domestic	Y	Open	150' Buffer Zone
26	531668.00	Domestic	Y	Open	150' Buffer Zone
27	245885.00	Domestic	Y	Open	150' Buffer Zone
28	245886.00	Domestic	Y	Open	150' Buffer Zone
29	99835	Domestic	Y	Open	150' Buffer Zone
30	109316.00	Domestic	Y	Open	150' Buffer Zone
31	75851.00	Domestic	Y	Open	150' Buffer Zone

32	116181.00	Domestic	Y	Open	150' Buffer Zone
33	103821.00	Domestic	Y	Open	150' Buffer Zone
34	103822.00	Domestic	Y	Open	150' Buffer Zone
35	283035.00	Domestic	Y	Open	150' Buffer Zone
36	270767.00	Domestic	Y	Open	150' Buffer Zone
37	264829.00	Domestic	Y	Open	150' Buffer Zone
38	511617.00	Domestic	Y	Open	150' Buffer Zone
39	52215.00	Closed-Loop Geothermal	Y	Open	150' Buffer Zone
40	411152.00	Domestic	Y	Open	150' Buffer Zone
41	396119.00	Domestic	Y	Open	150' Buffer Zone
42	395753.00	Domestic	Y	Open	150' Buffer Zone
43	347707.00	Domestic	Y	Open	150' Buffer Zone
44	315872.00	Domestic	Y	Open	150' Buffer Zone
45	341242.00	Domestic	Y	Open	150' Buffer Zone
46	495543.00	Domestic	Y	Open	150' Buffer Zone
47	256943.00	Domestic	Y	Open	150' Buffer Zone
48	189402.00	Domestic	Y	Open	150' Buffer Zone
49	433218.00	Domestic	Y	Open	150' Buffer Zone
50	108227.00	Domestic	Y	Open	150' Buffer Zone
51	194328.00	Irrigation	Y	Open	150' Buffer Zone
52	316447.00	Domestic	Y	Open	150' Buffer Zone
53	603471.00	Domestic	Y	Open	150' Buffer Zone

Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-206

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818206
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.709167
Latitude (degrees minutes seconds)	30° 42' 33" N
Longitude (decimal degrees)	-97.793056
Longitude (degrees minutes seconds)	097° 47' 35" W
Coordinate Source	+/- 1 Second
Aquifer Code	218TVPK - Travis Peak Formation
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	975
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	770
Well Depth Source	Geophysical Log
Drilling Start Date	
Drilling End Date	11/0/1982
Drilling Method	Mud (Hydraulic) Rotary
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Unused
Water Level Observation	Miscellaneous Measurements
Water Quality Available	No
Pump	None
Pump Depth (feet below land surface)	
Power Type	
Annular Seal Method	
Surface Completion	
Owner	North Lake Subd.
Driller	Associated Drlg.
Other Data Available	Caliper; Electric Log; Gamma Ray; Gamma-Gamma; Neutron
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Reported yield 175 GPM.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
8	Blank	Steel			0	3
	Open Hole				3	770

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

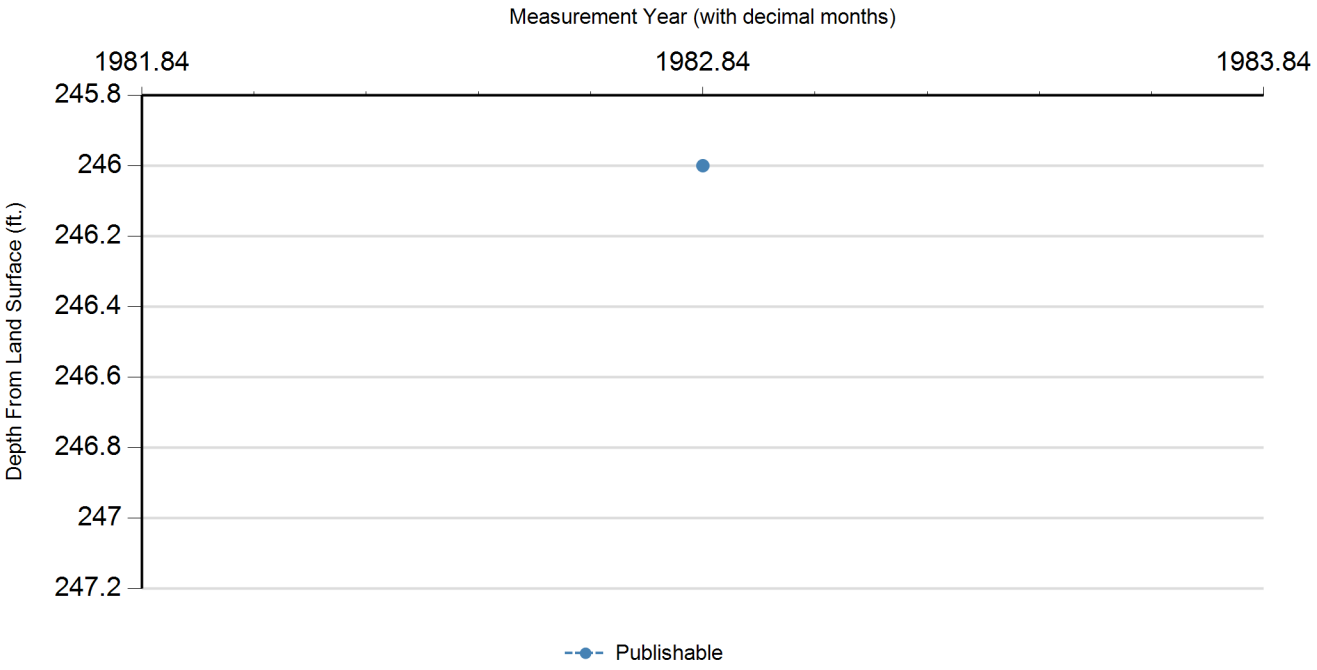
Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements



Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	11/8/1982		246		729	1	Texas Water Development Board	Logging Sonde		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis - No Data Available

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-301

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818301
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.714445
Latitude (degrees minutes seconds)	30° 42' 52" N
Longitude (decimal degrees)	-97.790278
Longitude (degrees minutes seconds)	097° 47' 25" W
Coordinate Source	+/- 5 Seconds
Aquifer Code	218GLRH - Glen Rose Limestone and Hensell Member of Pearsall Formation
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	1002
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	856
Well Depth Source	Driller's Log
Drilling Start Date	
Drilling End Date	2/12/1972
Drilling Method	Cable Tool
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Unused
Water Level Observation	Miscellaneous Measurements
Water Quality Available	Yes
Pump	Submersible
Pump Depth (feet below land surface)	
Power Type	Electric Motor
Annular Seal Method	
Surface Completion	
Owner	North Lake Estates
Driller	Powell Drilling
Other Data Available	Drillers Log
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Unused public supply well. Measured yield 26.5 GPM with 58 feet draw- down after 2 hours in 1972. Cemented from 0 to 856 feet.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
6	Blank	Plastic (PVC)			0	105
6	Open Hole				105	856

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

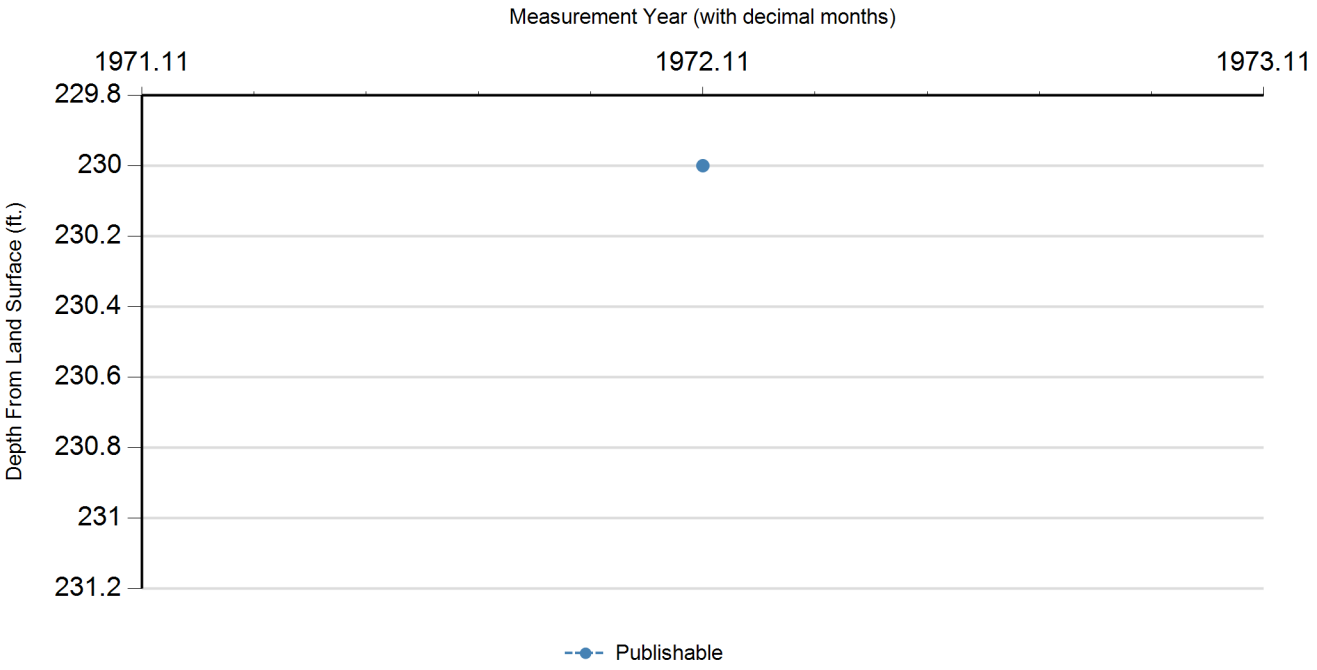
Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements



Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	2/12/1972		230		772	1	Registered Water Well Driller	Unknown		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis

Sample Date: 7/25/1973 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Not indicative of aquifer quality.

Collection Remarks: sampled using drilling rig

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		367	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		447.87	mg/L	
00910	CALCIUM (MG/L)		42	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		124	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		7.6	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		302	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		48	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		7	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		7.7	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		12	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.29		
00955	SILICA, DISSOLVED (MG/L AS SI02)		11	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		9.73		
00932	SODIUM, CALCULATED, PERCENT		73	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		389	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2646	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		600	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1460	mg/L	

Water Quality Analysis

Sample Date: 1/7/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Department of Health

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: raw supply

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		367	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		447.87	mg/L	
00910	CALCIUM (MG/L)		44	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		123	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		7.4	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		282	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		400	ug/L	
00920	MAGNESIUM (MG/L)		42	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)	<	50	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		30	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.69		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		9.47		
00932	SODIUM, CALCULATED, PERCENT		73	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		366	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2480	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		530	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1363	mg/L	

Water Quality Analysis

Sample Date: 3/20/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Department of Health

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: raw supply

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		348	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		424.68	mg/L	
00910	CALCIUM (MG/L)		42	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		117	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		5.6	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		249	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		960	ug/L	
00920	MAGNESIUM (MG/L)		35	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)	<	50	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)	<	0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		7.9	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		24	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.98		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		8.27		
00932	SODIUM, CALCULATED, PERCENT		72	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		300	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2048	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		393	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1125	mg/L	

Water Quality Analysis

Sample Date: 12/6/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: No Data

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		332	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		405.15	mg/L	
00910	CALCIUM (MG/L)		44	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		117	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		5.1	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		241	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		32	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		3.9	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		27	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.81		
00955	SILICA, DISSOLVED (MG/L AS SI02)		15	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		7.5		
00932	SODIUM, CALCULATED, PERCENT		70	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		268	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		1890	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		336	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1047	mg/L	

Water Quality Analysis

Sample Date: 10/22/1978 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Department of Health

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: raw supply

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		368	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		449.09	mg/L	
00910	CALCIUM (MG/L)		41	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		121	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		7.2	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		271	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		940	ug/L	
00920	MAGNESIUM (MG/L)		41	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)		30	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)	<	0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8	SU	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.94		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		9.65		
00932	SODIUM, CALCULATED, PERCENT		74	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		365	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2432	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		514	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1310	mg/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-303

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818303
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.712501
Latitude (degrees minutes seconds)	30° 42' 45" N
Longitude (decimal degrees)	-97.785
Longitude (degrees minutes seconds)	097° 47' 06" W
Coordinate Source	+/- 1 Second
Aquifer Code	218TVPK - Travis Peak Formation
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	990
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	620
Well Depth Source	Another Government Agency
Drilling Start Date	
Drilling End Date	9/0/1981
Drilling Method	Air Rotary
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	De-watering
Water Level Observation	Miscellaneous Measurements
Water Quality Available	No
Pump	Submersible
Pump Depth (feet below land surface)	
Power Type	Electric Motor
Annular Seal Method	
Surface Completion	
Owner	Leroy Goerdel
Driller	Kyle Harrison
Other Data Available	Electric Log; Gamma Ray
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Reported yield 40 GPM. Depth measured as 618'.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
6	Blank	Plastic (PVC)			0	117
6	Open Hole				117	620

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	9/28/1981		174		816	1	Texas Water Development Board	Unknown		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis - No Data Available

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-304

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818304
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.711389
Latitude (degrees minutes seconds)	30° 42' 41" N
Longitude (decimal degrees)	-97.787778
Longitude (degrees minutes seconds)	097° 47' 16" W
Coordinate Source	+/- 1 Second
Aquifer Code	218GLRS - Glen Rose Limestone
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	1004
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	310
Well Depth Source	Measured
Drilling Start Date	
Drilling End Date	
Drilling Method	Cable Tool
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Stock
Water Level Observation	Miscellaneous Measurements
Water Quality Available	No
Pump	Piston
Pump Depth (feet below land surface)	
Power Type	Windmill
Annular Seal Method	
Surface Completion	
Owner	Mr. Whitaker
Driller	
Other Data Available	
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	

Casing - No Data

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	12/6/1974		205.7		798.3	1	Texas Water Development Board	Steel Tape		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis - No Data Available

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STATE OF TEXAS WELL REPORT for Tracking #27292

Owner:	**David Forfia**	Owner Well #:	**No Data**
Address:	**300 Navajo Trail Georgetown, TX**	Grid #:	**58-18-2**
Well Location:	**300 Navajo Trail Georgetown, TX**	Latitude:	**30° 43' 11" N**
		Longitude:	**097° 48' 07" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Closed-Loop Geothermal**

Drilling Start Date: **10/7/2003** Drilling End Date: **10/7/2003**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
4.75	**0**	**300**

Drilling Method: **Air Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
30	**300**	**Gravel**	

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**30**	**3 Bentonite**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **70**

Distance to Septic Field or other concentrated contamination (ft.): **165**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Alternative Procedure Used**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Unknown**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Ball Drilling Company**

P. O. Box 201717
Austin, TX 78720

Driller Name: **Lonnie C. Ball** License Number: **2298**

Comments: **5 Closed Loop Geothermal Wells**

Longitude entered as 98487 was assumed to be 984807
Changed by TWDB - RQ 12/18/03

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**20**	**Hard White Limestone**
20	**300**	**Hard White Limestone with Streaks of Gray Shale**
		5 Closed Loop Wells

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
1-inch	**New**	**PE Loop**	**-4 to 300**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #187465

Owner:	**Kevin Nesmith**	Owner Well #:	**No Data**
Address:	**636 CR 261 Georgetown, TX 78613**	Grid #:	**58-18-5**
Well Location:	**636 CR 261 Georgetown, TX 78613**	Latitude:	**30° 42' 16" N**
		Longitude:	**097° 48' 20" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **1/9/2006** Drilling End Date: **1/16/2006**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
10	**0**	**29**
6.5	**29**	**745**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**29**	**10**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **151**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Slab Installed**

Water Level: **292 ft.** below land surface on **2006-01-16** Measurement Method: **Unknown**

Packers: **Shale Trap 725**

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

1147 CR 170
Roundrock, TX 78664

Driller Name: **Tommy D Arnold** License Number: **2096**

Comments: **$amh**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0-1-Loose Rock
1-25-Brown Limestone
25-40-Blue Limestone
40-210-Gray Limestone
210-225-Brown Limestone
225-411-Gray Limestone
411-419-Blue Limestone & Shale
419-600-Gray Limestone
600-626-Blue Limestone & Shale
626-665-Gray Limestone
665-690-Gray Sandstone & Sand Strips
690-700-Brown Sandstone
700-715-Gray Sandstone
715-745-Gray Sand & Sandstone

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 29
4.5 New Plastic 0 - 745
Perf 725 - 745

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207600

Owner:	**Russell Langbein**	Owner Well #:	**No Data**
Address:	**1801 Williams Drive Georgetown, TX 78628**	Grid #:	**58-18-2**
Well Location:	**202 Cherokee Trail Georgetown, TX 78628**	Latitude:	**30° 43' 07" N**
		Longitude:	**097° 47' 54" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **9/10/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**50**
6.5	**50**	**765**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**50**	**15**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **190**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **185 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 712', 705', 685'**

Type of Pump: **None**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Loose Rock & Top Soil**
1	**20**	**Brown Limestone**
20	**41**	**Brown & White Limestone**
41	**50**	**Brown Limestone**
50	**150**	**Gray Limestone**
150	**165**	**Brown Limestone**
165	**240**	**Gray Limestone**
240	**277**	**Brown Limestone**
277	**284**	**Blue Limestone**
284	**390**	**Gray Limestone**
390	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**690**	**Gray Limestone**
690	**717**	**Gray Sandstone**
717	**723**	**Brown Sandstone**
723	**726**	**Gray Sand**
726	**740**	**Green Sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 50
4 1/2 New Plastic 0 - 765
Perf. 725 - 765

740	**750**	**Gray Sandstone & Sand Strips**
750	**765**	**White & Gray Coarse Sand**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207597

Owner:	**Kellon Nieman**	Owner Well #:	**No Data**
Address:	**212 Cherokee Trail Georgetown, TX 78633**	Grid #:	**58-18-2**
Well Location:	**212 Cherokee Trail Georgetown, TX 78633**	Latitude:	**30° 43' 06" N**
		Longitude:	**097° 47' 57" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **9/4/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**60**
6.5	**60**	**585**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**9**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **155**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **366 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 565', 545', 20'**

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**Brown Limestone & Red Clay**
2	**16**	**Brown Limestone**
16	**50**	**Brown Limestone & Fractures**
50	**190**	**Gray Limestone**
190	**200**	**Brown Limestone**
200	**315**	**Gray Limestone**
315	**322**	**Blue Limestone**
322	**340**	**Brown Limestone**
340	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**582**	**Fracture**
582	**585**	**Gray Limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 60
4 1/2 New Plastic 0 - 585
Perf. 565 - 585

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P.O. Box 12157
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STATE OF TEXAS WELL REPORT for Tracking #221246

Owner:	**David Steinbach**	Owner Well #:	**No Data**
Address:	**200 Vista Lane Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**200 Vista Lane Georgetown, TX 78633**	Latitude:	**30° 43' 17" N**
		Longitude:	**097° 46' 51" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Irrigation**

Drilling Start Date: **7/22/2009** Drilling End Date: **8/13/2009**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**60**
6.5	**60**	**805**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**15**	**11**

Seal Method: **hand poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **145**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **tape measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **525 ft.** below land surface on **2009-08-13** Measurement Method: **Unknown**

Packers: **Shale trap 730', 725', 20'**

Type of Pump: **Submersible none** Pump Depth (ft.): **620**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments:

^NK

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**white limestone**
18	**45**	**brown limestone with red clay streaks**
45	**60**	**brown limestone**
60	**166**	**gray limestone**
166	**183**	**brown limestone**
183	**375**	**gray limestone**
375	**408**	**blue limestone and shale**
408	**660**	**gray limestone**
660	**710**	**gray sandstone**
710	**730**	**gray sandstone and sand strips**
730	**765**	**gray sand and sandstone**
765	**785**	**white sand and sandstone**
785	**805**	**gray sandstone and sand strips**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0-60
4.5 New Plastic 0-805
4.5 New Perf. 765-805

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STATE OF TEXAS WELL REPORT for Tracking #286363

Owner:	**Mike & Darlene Darr**	Owner Well #:	**1**
Address:	**204 Vista Lane Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**204 Vista Lane Georgetown, TX 78633**	Latitude:	**30° 43' 15" N**
		Longitude:	**097° 46' 55" W**
Well County:	**Williamson**	Elevation:	**990 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **3/27/2012** Drilling End Date: **3/30/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9.75	**0**	**60**
6.25	**20**	**800**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**120**	**18**

Seal Method: **PRESSURE CEMENTED**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: **449 ft.** below land surface on **2012-03-29** Measurement Method: **Unknown**

Packers: **RUBBER 120'**
RUBBER 700'
RUBBER 760'

Type of Pump: **Submersible** Pump Depth (ft.): **660**

Well Tests: **Jetted** **Yield: 70 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
449	**TRINITY**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **HILL COUNTRY WATER WELL**

POBOX 220
BRIGGS, TX 78608

Driller Name: **JOE MCDEARMON** License Number: **2334**

Comments: **SLAB & SLEEVE INSTALLED**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**3**	**TOP SOIL**
3	**6**	**RED CLAY**
6	**30**	**WHITE LIME**
30	**35**	**CAVE**
35	**45**	**LIME SLICK**
45	**60**	**WHITE LIME**
60	**220**	**GRAY LIME**
220	**320**	**BROWN LIME**
320	**460**	**GRAY LIME**
460	**520**	**BROWN LIME**
520	**525**	**GRAY SHALE**
525	**620**	**SANDSTONE**
620	**630**	**TRINITY SAND**
630	**745**	**SANDSTONE**
745	**750**	**GRAY SHALE**
750	**770**	**SANDSTONE**
770	**775**	**TRINITY**
775	**782**	**TRINITY SAND**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
4.5 NEW PLASTIC 0/740 SDR17
4.5 NEW SCREEN 630/780/800 .032

782	**800**	**SANDSTONE**

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STATE OF TEXAS WELL REPORT for Tracking #316624

Owner:	**Glen Lupenitz**	Owner Well #:	**No Data**
Address:	**201 Gabriel Vista Ct. Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**201 Gabriel Vista Ct. Georgetown, TX 78633**	Latitude:	**30° 43' 24" N**
		Longitude:	**097° 46' 56" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Irrigation**

Drilling Start Date: **11/12/2012** Drilling End Date: **11/30/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**26**
8	**26**	**105**
6.5	**105**	**790**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**26**	**12**
0	**105**	**21**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **103**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **477 ft.** below land surface on **2012-11-30** Measurement Method: **Unknown**

Packers: **Shale Trap 730', 710', 105'**

Type of Pump: **Submersible** Pump Depth (ft.): **600**

Well Tests: **Estimated** **Yield: 75 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 S Q. W. Grimes Blvd.
Roundrock, TX 78664

Driller Name: **Tommy D. Arnold** License Number: **2096**

Comments: **See note in late report file.**
^EAD

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**loose rock & topsoil**
1	**26**	**brown limestone**
26	**121**	**gray limestone**
121	**126**	**brown limestone**
126	**254**	**gray limestone**
254	**261**	**brown limestone**
261	**282**	**gray limestone**
282	**290**	**brown limestone**
290	**351**	**gray limestone**
351	**360**	**blue limestone & shale**
360	**590**	**gray limestone**
590	**700**	**gray sandstone**
700	**710**	**gray sandstone & sand strips**
710	**720**	**gray sandstone**
720	**735**	**brown sandstone**
735	**780**	**gray sandstone & sand strips**
780	**790**	**gray sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
8" N Plastic 0'-26'			
4 1/2" N Plastic 0'-790'			
Perf. 730'-770'			

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STATE OF TEXAS WELL REPORT for Tracking #27292

Owner:	**David Forfia**	Owner Well #:	**No Data**
Address:	**300 Navajo Trail Georgetown, TX**	Grid #:	**58-18-2**
		Latitude:	**30° 43' 11" N**
Well Location:	**300 Navajo Trail Georgetown, TX**	Longitude:	**097° 48' 07" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Closed-Loop Geothermal**

Drilling Start Date: **10/7/2003** Drilling End Date: **10/7/2003**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**4.75**	**0**	**300**

Drilling Method: **Air Rotary**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**30**	**300**	**Gravel**	

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**30**	**3 Bentonite**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **70**

Distance to Septic Field or other concentrated contamination (ft.): **165**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Alternative Procedure Used**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Unknown**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Ball Drilling Company**

P. O. Box 201717
Austin, TX 78720

Driller Name: **Lonnie C. Ball** License Number: **2298**

Comments: **5 Closed Loop Geothermal Wells**

Longitude entered as 98487 was assumed to be 984807
Changed by TWDB - RQ 12/18/03

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**20**	**Hard White Limestone**
20	**300**	**Hard White Limestone with Streaks of Gray Shale**
		5 Closed Loop Wells

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
1-inch	**New**	**PE Loop**	**-4 to 300**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #275194

Owner:	**Ryan Alowitz**	Owner Well #:	**1**
Address:	**238 Gabriel Vista West Georgetown, TX**	Grid #:	**58-18-3**
Well Location:	**238 Gabriel Vista West Georgetown, TX**	Latitude:	**30° 43' 23" N**
		Longitude:	**097° 46' 57" W**
Well County:	**Williamson**	Elevation:	**939 ft. above sea level**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **11/5/2011** Drilling End Date: **11/8/2011**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9.75	**0**	**20**
6.25	**20**	**800**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**5**

Seal Method: **MIXED**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: **480 ft.** below land surface on **2011-11-08** Measurement Method: **Unknown**

Packers: **RUBBER 40'**
RUBBER 700'

Type of Pump: **Submersible**

Well Tests: **Jetted** **Yield: 60 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**TRINITY**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **HILL COUNTRY WATER WELL**

POBOX 220
BRIGGS, TX 78608

Driller Name: **JOE MCDEARMON** License Number: **2334**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**TOP SOIL**
2	**30**	**WHITE LIME**
30	**230**	**GRAY LIME**
230	**255**	**BROWN LIME**
255	**310**	**GRAY LIME**
310	**312**	**GRAY SHALE**
312	**420**	**GRAY LIME**
420	**480**	**BROWN LIME**
480	**540**	**GRAY LIME**
540	**545**	**GRAY SHALE**
545	**620**	**GRAY LIME**
620	**710**	**SANDSTONE**
712	**745**	**SANDSTONE**
720	**712**	**TINITY SAND**
745	**747**	**TRINITY SAND**
747	**760**	**SANDSTONE**
760	**763**	**TRINITY SAND**
763	**780**	**SANDSTONE**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4.5	**NEW**	**PLASTIC**	**0/800**
4.5	**NEW**	**SCREEN**	**760/800 .032**

780	**783**	**TRINITY SAND**
783	**800**	**SANDSTONE**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207600

Owner:	**Russell Langbein**	Owner Well #:	**No Data**
Address:	**1801 Williams Drive Georgetown, TX 78628**	Grid #:	**58-18-2**
Well Location:	**202 Cherokee Trail Georgetown, TX 78628**	Latitude:	**30° 43' 07" N**
		Longitude:	**097° 47' 54" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **9/10/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**50**
6.5	**50**	**765**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**50**	**15**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **190**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **185 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 712', 705', 685'**

Type of Pump: **None**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Loose Rock & Top Soil**
1	**20**	**Brown Limestone**
20	**41**	**Brown & White Limestone**
41	**50**	**Brown Limestone**
50	**150**	**Gray Limestone**
150	**165**	**Brown Limestone**
165	**240**	**Gray Limestone**
240	**277**	**Brown Limestone**
277	**284**	**Blue Limestone**
284	**390**	**Gray Limestone**
390	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**690**	**Gray Limestone**
690	**717**	**Gray Sandstone**
717	**723**	**Brown Sandstone**
723	**726**	**Gray Sand**
726	**740**	**Green Sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 50
4 1/2 New Plastic 0 - 765
Perf. 725 - 765

740	**750**	**Gray Sandstone & Sand Strips**
750	**765**	**White & Gray Coarse Sand**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

APPENDIX N

GROUNDWATER QUALITY TECHNICAL REPORT

GROUNDWATER QUALITY ASSESSMENT

FOR

REAGOR TRACT WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

December 2024

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD, BUILDING II, SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

GROUNDWATER QUALITY ASSESSMENT

The purpose of this report is to assess the impact of the disposal of treated effluent on uses of local groundwater resources, as a part of the requirements of Title 30 of the Texas Administrative Code, Chapter 309, Subchapter C, Rule §309.20(a)(4). This report is provided as a supplement to the information included in the Domestic Worksheet 3.0, Section 7.

(A) All water wells within a half mile radius of the disposal areas have been identified using the current Texas Water Development Board (TWDB) database. Where available, the uses of the wells have been identified. It should be noted that several of the wells labeled as public supply on the driller's logs appear to be for private use currently.

There is no water quality data is available for the nearby wells. All wells are part of the Edwards Aquifer, which is the predominant aquifer in the area used for groundwater supply. Depth ranges from 220 ft to 480 ft.

Based on the data for the driller's logs, the wells were tested at various dates between 1977 and 2024. Given the similarity in data between the available water quality tests, it is reasonable to assume the water quality in this formation is generally similar for this area.

There are no anticipated impacts to the existing groundwater resources quality as a result of this proposed plan due to the measures required by rule and additional voluntary measures taken by the applicant to prevent effluent from reaching potential recharge areas. These include creek setbacks, weather stations to prevent irrigation during wet conditions and a reduced application rate.

(B) Groundwater resources serving as sources or potential sources of domestic raw water supply by limiting wastewater application rates. Application rates will be limited to the values calculated in the attached water balance. In addition, moisture sensors will be installed to allow for preventive warning of saturated conditions and prevent irrigation in this condition.

Treated effluent will be held in in an onsite storage tank until routed to the subsurface drip irrigation areas near the treatment plant.

Well Data

Well Number	Well ID	Well use	Producing (Y/N)	Open, Cased, Capped, or Plugged?	Proposed Best Management Practice
1	5755603.00	Domestic	Y	Open	150' Buffer Zone
2	5755608.00	Unknown	N	Open	150' Buffer Zone
3	5755604.00	Domestic	Y	Open	150' Buffer Zone
4	194293.00	Irrigation	N	Plugged	N/A
5	9656.00	Domestic	N	Open	150' Buffer Zone
6	291940.00	Domestic	Y	Cased	150' Buffer zone
7	134724.00	Domestic	Y	Open	150' Buffer zone
8	637727.00	Domestic	Y	Open	150' Buffer Zone
9	429314.00	Domestic	Y	Open	150' Buffer Zone
10	593151.00	Domestic	Y	Open	150' Buffer Zone
11	661941.00	Domestic	Y	Open	150' Buffer Zone
12	661939.00	Domestic	Y	Open	150' Buffer Zone
13	414065.00	Domestic	Y	Open	150' Buffer Zone
14	121328.00	Domestic	Y	Open	150' Buffer Zone
15	315105.00	Domestic	Y	Open	150' Buffer Zone
16	134717.00	Domestic	Y	Open	150' Buffer Zone
17	126822.00	Domestic	Y	Open	150' Buffer Zone
18	483084.00	Domestic	Y	Open	150' Buffer Zone
19	114248.00	Domestic	Y	Open	150' Buffer Zone
20	92895.00	Domestic	Y	Open	150' Buffer Zone
21	370728.00	Domestic	Y	Open	150' Buffer Zone
22	210625.00	Domestic	Y	Open	150' Buffer Zone
23	108740.00	Domestic	Y	Open	150' Buffer Zone
24	92896.00	Domestic	Y	Open	150' Buffer Zone
25	395292.00	Domestic	Y	Open	150' Buffer Zone
26	531668.00	Domestic	Y	Open	150' Buffer Zone
27	245885.00	Domestic	Y	Open	150' Buffer Zone
28	245886.00	Domestic	Y	Open	150' Buffer Zone
29	99835	Domestic	Y	Open	150' Buffer Zone
30	109316.00	Domestic	Y	Open	150' Buffer Zone
31	75851.00	Domestic	Y	Open	150' Buffer Zone

32	116181.00	Domestic	Y	Open	150' Buffer Zone
33	103821.00	Domestic	Y	Open	150' Buffer Zone
34	103822.00	Domestic	Y	Open	150' Buffer Zone
35	283035.00	Domestic	Y	Open	150' Buffer Zone
36	270767.00	Domestic	Y	Open	150' Buffer Zone
37	264829.00	Domestic	Y	Open	150' Buffer Zone
38	511617.00	Domestic	Y	Open	150' Buffer Zone
39	52215.00	Closed-Loop Geothermal	Y	Open	150' Buffer Zone
40	411152.00	Domestic	Y	Open	150' Buffer Zone
41	396119.00	Domestic	Y	Open	150' Buffer Zone
42	395753.00	Domestic	Y	Open	150' Buffer Zone
43	347707.00	Domestic	Y	Open	150' Buffer Zone
44	315872.00	Domestic	Y	Open	150' Buffer Zone
45	341242.00	Domestic	Y	Open	150' Buffer Zone
46	495543.00	Domestic	Y	Open	150' Buffer Zone
47	256943.00	Domestic	Y	Open	150' Buffer Zone
48	189402.00	Domestic	Y	Open	150' Buffer Zone
49	433218.00	Domestic	Y	Open	150' Buffer Zone
50	108227.00	Domestic	Y	Open	150' Buffer Zone
51	194328.00	Irrigation	Y	Open	150' Buffer Zone
52	316447.00	Domestic	Y	Open	150' Buffer Zone
53	603471.00	Domestic	Y	Open	150' Buffer Zone

Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-206

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818206
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.709167
Latitude (degrees minutes seconds)	30° 42' 33" N
Longitude (decimal degrees)	-97.793056
Longitude (degrees minutes seconds)	097° 47' 35" W
Coordinate Source	+/- 1 Second
Aquifer Code	218TVPK - Travis Peak Formation
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	975
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	770
Well Depth Source	Geophysical Log
Drilling Start Date	
Drilling End Date	11/0/1982
Drilling Method	Mud (Hydraulic) Rotary
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Unused
Water Level Observation	Miscellaneous Measurements
Water Quality Available	No
Pump	None
Pump Depth (feet below land surface)	
Power Type	
Annular Seal Method	
Surface Completion	
Owner	North Lake Subd.
Driller	Associated Drlg.
Other Data Available	Caliper; Electric Log; Gamma Ray; Gamma-Gamma; Neutron
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Reported yield 175 GPM.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
8	Blank	Steel			0	3
	Open Hole				3	770

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

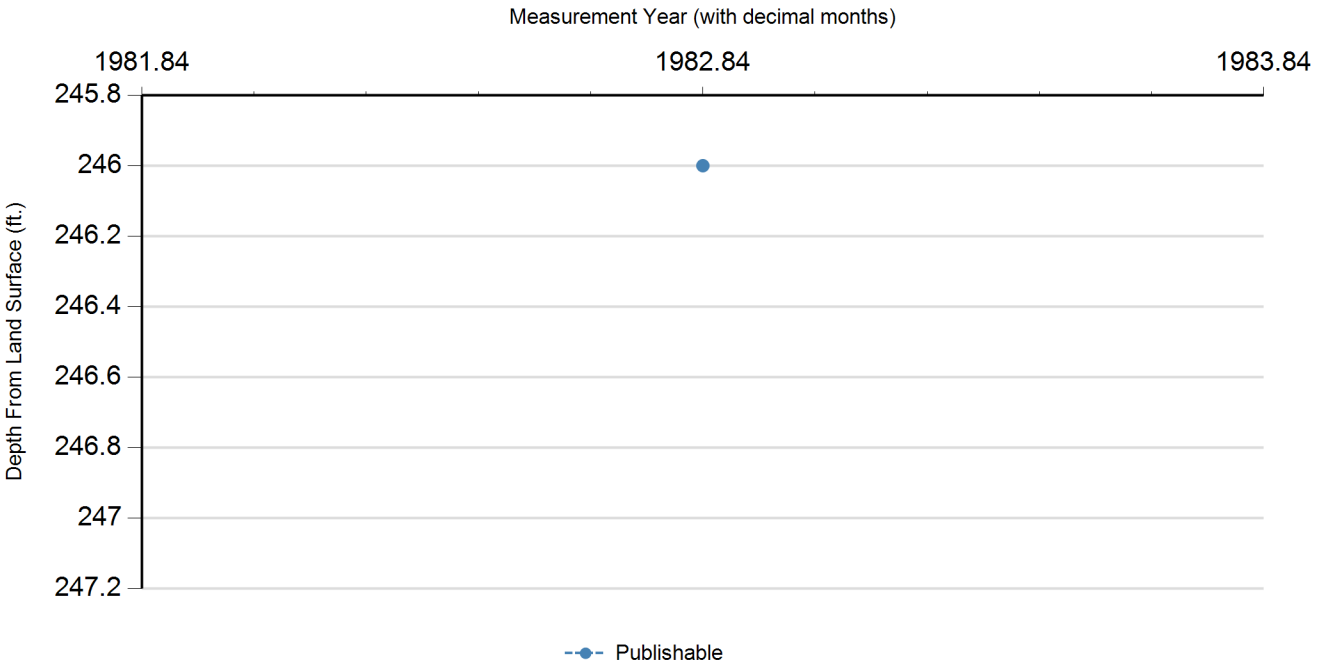
Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements



Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	11/8/1982		246		729	1	Texas Water Development Board	Logging Sonde		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis - No Data Available

GWDB DISCLAIMER: Except where noted, all of the information provided in the Texas Water Development Board (TWDB) Groundwater Database (https://www.twdb.texas.gov/groundwater/data/gwdbrpt.asp) is believed to be accurate and reliable; however, the TWDB assumes no responsibility for any errors appearing in rules or otherwise. Further, TWDB assumes no responsibility for the use of the information provided. PLEASE NOTE that users of these data are responsible for checking the accuracy, completeness, currency and/or suitability of all information themselves. TWDB makes no guarantees or warranties as to the accuracy, completeness, currency, or suitability of the information provided via the Groundwater Database (GWDB). TWDB specifically disclaims any and all liability for any claims or damages that may result from providing GWDB data or the information it contains. For additional information or answers to questions concerning the TWDB GWDB, contact the Groundwater Data Team at GroundwaterData@twdb.texas.gov.

Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-301

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818301
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.714445
Latitude (degrees minutes seconds)	30° 42' 52" N
Longitude (decimal degrees)	-97.790278
Longitude (degrees minutes seconds)	097° 47' 25" W
Coordinate Source	+/- 5 Seconds
Aquifer Code	218GLRH - Glen Rose Limestone and Hensell Member of Pearsall Formation
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	1002
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	856
Well Depth Source	Driller's Log
Drilling Start Date	
Drilling End Date	2/12/1972
Drilling Method	Cable Tool
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Unused
Water Level Observation	Miscellaneous Measurements
Water Quality Available	Yes
Pump	Submersible
Pump Depth (feet below land surface)	
Power Type	Electric Motor
Annular Seal Method	
Surface Completion	
Owner	North Lake Estates
Driller	Powell Drilling
Other Data Available	Drillers Log
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Unused public supply well. Measured yield 26.5 GPM with 58 feet draw- down after 2 hours in 1972. Cemented from 0 to 856 feet.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
6	Blank	Plastic (PVC)			0	105
6	Open Hole				105	856

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

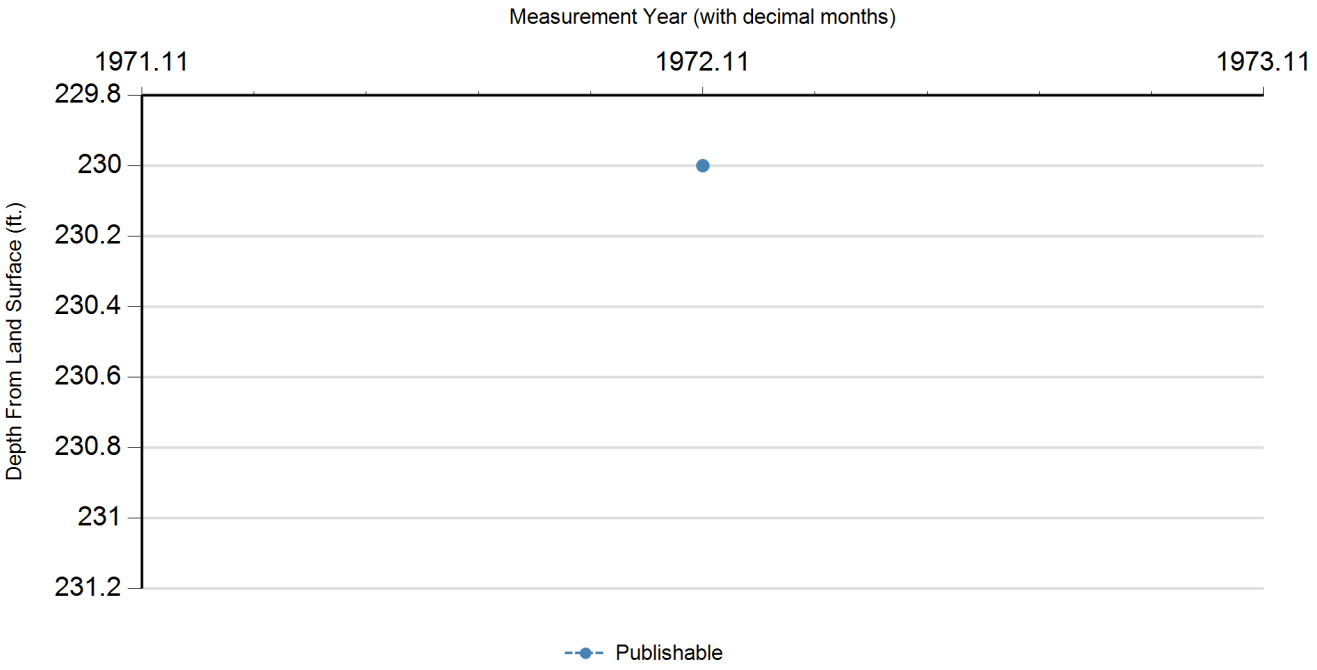
Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements



Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	2/12/1972		230		772	1	Registered Water Well Driller	Unknown		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis

Sample Date: 7/25/1973 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Not indicative of aquifer quality.

Collection Remarks: sampled using drilling rig

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		367	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		447.87	mg/L	
00910	CALCIUM (MG/L)		42	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		124	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		7.6	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		302	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		48	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		7	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		7.7	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		12	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.29		
00955	SILICA, DISSOLVED (MG/L AS SI02)		11	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		9.73		
00932	SODIUM, CALCULATED, PERCENT		73	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		389	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2646	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		600	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1460	mg/L	

Water Quality Analysis

Sample Date: 1/7/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Department of Health

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: raw supply

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		367	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		447.87	mg/L	
00910	CALCIUM (MG/L)		44	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		123	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		7.4	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		282	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		400	ug/L	
00920	MAGNESIUM (MG/L)		42	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)	<	50	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		30	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.69		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		9.47		
00932	SODIUM, CALCULATED, PERCENT		73	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		366	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2480	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		530	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1363	mg/L	

Water Quality Analysis

Sample Date: 3/20/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Department of Health

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: raw supply

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		348	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		424.68	mg/L	
00910	CALCIUM (MG/L)		42	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		117	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		5.6	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		249	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		960	ug/L	
00920	MAGNESIUM (MG/L)		35	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)	<	50	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)	<	0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		7.9	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		24	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.98		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		8.27		
00932	SODIUM, CALCULATED, PERCENT		72	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		300	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2048	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		393	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1125	mg/L	

Water Quality Analysis

Sample Date: 12/6/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: No Data

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		332	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		405.15	mg/L	
00910	CALCIUM (MG/L)		44	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		117	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		5.1	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		241	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		32	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		3.9	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		27	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.81		
00955	SILICA, DISSOLVED (MG/L AS SI02)		15	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		7.5		
00932	SODIUM, CALCULATED, PERCENT		70	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		268	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		1890	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		336	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1047	mg/L	

Water Quality Analysis

Sample Date: 10/22/1978 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Department of Health

Sampled Aquifer: Glen Rose Limestone and Hensell Member of Pearsall Formation

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: raw supply

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		368	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		449.09	mg/L	
00910	CALCIUM (MG/L)		41	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		121	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		7.2	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		271	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		940	ug/L	
00920	MAGNESIUM (MG/L)		41	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)		30	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)	<	0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8	SU	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		1.94		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		9.65		
00932	SODIUM, CALCULATED, PERCENT		74	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		365	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2432	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		514	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1310	mg/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-303

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818303
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.712501
Latitude (degrees minutes seconds)	30° 42' 45" N
Longitude (decimal degrees)	-97.785
Longitude (degrees minutes seconds)	097° 47' 06" W
Coordinate Source	+/- 1 Second
Aquifer Code	218TVPK - Travis Peak Formation
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	990
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	620
Well Depth Source	Another Government Agency
Drilling Start Date	
Drilling End Date	9/0/1981
Drilling Method	Air Rotary
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	De-watering
Water Level Observation	Miscellaneous Measurements
Water Quality Available	No
Pump	Submersible
Pump Depth (feet below land surface)	
Power Type	Electric Motor
Annular Seal Method	
Surface Completion	
Owner	Leroy Goerdel
Driller	Kyle Harrison
Other Data Available	Electric Log; Gamma Ray
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Reported yield 40 GPM. Depth measured as 618'.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
6	Blank	Plastic (PVC)			0	117
6	Open Hole				117	620

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	9/28/1981		174		816	1	Texas Water Development Board	Unknown		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis - No Data Available

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-304

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818304
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.711389
Latitude (degrees minutes seconds)	30° 42' 41" N
Longitude (decimal degrees)	-97.787778
Longitude (degrees minutes seconds)	097° 47' 16" W
Coordinate Source	+/- 1 Second
Aquifer Code	218GLRS - Glen Rose Limestone
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	1004
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	310
Well Depth Source	Measured
Drilling Start Date	
Drilling End Date	
Drilling Method	Cable Tool
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Stock
Water Level Observation	Miscellaneous Measurements
Water Quality Available	No
Pump	Piston
Pump Depth (feet below land surface)	
Power Type	Windmill
Annular Seal Method	
Surface Completion	
Owner	Mr. Whitaker
Driller	
Other Data Available	
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	

Casing - No Data

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	12/6/1974		205.7		798.3	1	Texas Water Development Board	Steel Tape		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis - No Data Available

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STATE OF TEXAS WELL REPORT for Tracking #27292

Owner:	**David Forfia**	Owner Well #:	**No Data**
Address:	**300 Navajo Trail Georgetown, TX**	Grid #:	**58-18-2**
Well Location:	**300 Navajo Trail Georgetown, TX**	Latitude:	**30° 43' 11" N**
		Longitude:	**097° 48' 07" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Closed-Loop Geothermal**

Drilling Start Date: **10/7/2003** Drilling End Date: **10/7/2003**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
4.75	**0**	**300**

Drilling Method: **Air Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
30	**300**	**Gravel**	

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**30**	**3 Bentonite**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **70**

Distance to Septic Field or other concentrated contamination (ft.): **165**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Alternative Procedure Used**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Unknown**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Ball Drilling Company**

P. O. Box 201717
Austin, TX 78720

Driller Name: **Lonnie C. Ball** License Number: **2298**

Comments: **5 Closed Loop Geothermal Wells**

Longitude entered as 98487 was assumed to be 984807
Changed by TWDB - RQ 12/18/03

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**20**	**Hard White Limestone**
20	**300**	**Hard White Limestone with Streaks of Gray Shale**
		5 Closed Loop Wells

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
1-inch	**New**	**PE Loop**	**-4 to 300**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #187465

Owner:	**Kevin Nesmith**	Owner Well #:	**No Data**
Address:	**636 CR 261 Georgetown, TX 78613**	Grid #:	**58-18-5**
Well Location:	**636 CR 261 Georgetown, TX 78613**	Latitude:	**30° 42' 16" N**
		Longitude:	**097° 48' 20" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **1/9/2006** Drilling End Date: **1/16/2006**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
10	**0**	**29**
6.5	**29**	**745**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**29**	**10**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **151**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Slab Installed**

Water Level: **292 ft.** below land surface on **2006-01-16** Measurement Method: **Unknown**

Packers: **Shale Trap 725**

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

1147 CR 170
Roundrock, TX 78664

Driller Name: **Tommy D Arnold** License Number: **2096**

Comments: **$amh**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0-1-Loose Rock
1-25-Brown Limestone
25-40-Blue Limestone
40-210-Gray Limestone
210-225-Brown Limestone
225-411-Gray Limestone
411-419-Blue Limestone & Shale
419-600-Gray Limestone
600-626-Blue Limestone & Shale
626-665-Gray Limestone
665-690-Gray Sandstone & Sand Strips
690-700-Brown Sandstone
700-715-Gray Sandstone
715-745-Gray Sand & Sandstone

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 29
4.5 New Plastic 0 - 745
Perf 725 - 745

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207600

Owner:	**Russell Langbein**	Owner Well #:	**No Data**
Address:	**1801 Williams Drive Georgetown, TX 78628**	Grid #:	**58-18-2**
Well Location:	**202 Cherokee Trail Georgetown, TX 78628**	Latitude:	**30° 43' 07" N**
		Longitude:	**097° 47' 54" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **9/10/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**50**
6.5	**50**	**765**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**50**	**15**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **190**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **185 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 712', 705', 685'**

Type of Pump: **None**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Loose Rock & Top Soil**
1	**20**	**Brown Limestone**
20	**41**	**Brown & White Limestone**
41	**50**	**Brown Limestone**
50	**150**	**Gray Limestone**
150	**165**	**Brown Limestone**
165	**240**	**Gray Limestone**
240	**277**	**Brown Limestone**
277	**284**	**Blue Limestone**
284	**390**	**Gray Limestone**
390	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**690**	**Gray Limestone**
690	**717**	**Gray Sandstone**
717	**723**	**Brown Sandstone**
723	**726**	**Gray Sand**
726	**740**	**Green Sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 50
4 1/2 New Plastic 0 - 765
Perf. 725 - 765

740	**750**	**Gray Sandstone & Sand Strips**
750	**765**	**White & Gray Coarse Sand**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207597

Owner:	**Kellon Nieman**	Owner Well #:	**No Data**
Address:	**212 Cherokee Trail Georgetown, TX 78633**	Grid #:	**58-18-2**
Well Location:	**212 Cherokee Trail Georgetown, TX 78633**	Latitude:	**30° 43' 06" N**
		Longitude:	**097° 47' 57" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **9/4/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**60**
6.5	**60**	**585**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**9**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **155**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **366 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 565', 545', 20'**

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**Brown Limestone & Red Clay**
2	**16**	**Brown Limestone**
16	**50**	**Brown Limestone & Fractures**
50	**190**	**Gray Limestone**
190	**200**	**Brown Limestone**
200	**315**	**Gray Limestone**
315	**322**	**Blue Limestone**
322	**340**	**Brown Limestone**
340	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**582**	**Fracture**
582	**585**	**Gray Limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 60
4 1/2 New Plastic 0 - 585
Perf. 565 - 585

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #221246

Owner:	**David Steinbach**	Owner Well #:	**No Data**
Address:	**200 Vista Lane Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**200 Vista Lane Georgetown, TX 78633**	Latitude:	**30° 43' 17" N**
		Longitude:	**097° 46' 51" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Irrigation**

Drilling Start Date: **7/22/2009** Drilling End Date: **8/13/2009**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**60**
6.5	**60**	**805**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**15**	**11**

Seal Method: **hand poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **145**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **tape measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **525 ft.** below land surface on **2009-08-13** Measurement Method: **Unknown**

Packers: **Shale trap 730', 725', 20'**

Type of Pump: **Submersible none** Pump Depth (ft.): **620**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments:

^NK

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**white limestone**
18	**45**	**brown limestone with red clay streaks**
45	**60**	**brown limestone**
60	**166**	**gray limestone**
166	**183**	**brown limestone**
183	**375**	**gray limestone**
375	**408**	**blue limestone and shale**
408	**660**	**gray limestone**
660	**710**	**gray sandstone**
710	**730**	**gray sandstone and sand strips**
730	**765**	**gray sand and sandstone**
765	**785**	**white sand and sandstone**
785	**805**	**gray sandstone and sand strips**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0-60
4.5 New Plastic 0-805
4.5 New Perf. 765-805

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #286363

Owner:	**Mike & Darlene Darr**	Owner Well #:	**1**
Address:	**204 Vista Lane Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**204 Vista Lane Georgetown, TX 78633**	Latitude:	**30° 43' 15" N**
		Longitude:	**097° 46' 55" W**
Well County:	**Williamson**	Elevation:	**990 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **3/27/2012** Drilling End Date: **3/30/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9.75	**0**	**60**
6.25	**20**	**800**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**120**	**18**

Seal Method: **PRESSURE CEMENTED**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: **449 ft.** below land surface on **2012-03-29** Measurement Method: **Unknown**

Packers: **RUBBER 120'**
RUBBER 700'
RUBBER 760'

Type of Pump: **Submersible** Pump Depth (ft.): **660**

Well Tests: **Jetted** **Yield: 70 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
449	**TRINITY**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **HILL COUNTRY WATER WELL**

POBOX 220
BRIGGS, TX 78608

Driller Name: **JOE MCDEARMON** License Number: **2334**

Comments: **SLAB & SLEEVE INSTALLED**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**3**	**TOP SOIL**
3	**6**	**RED CLAY**
6	**30**	**WHITE LIME**
30	**35**	**CAVE**
35	**45**	**LIME SLICK**
45	**60**	**WHITE LIME**
60	**220**	**GRAY LIME**
220	**320**	**BROWN LIME**
320	**460**	**GRAY LIME**
460	**520**	**BROWN LIME**
520	**525**	**GRAY SHALE**
525	**620**	**SANDSTONE**
620	**630**	**TRINITY SAND**
630	**745**	**SANDSTONE**
745	**750**	**GRAY SHALE**
750	**770**	**SANDSTONE**
770	**775**	**TRINITY**
775	**782**	**TRINITY SAND**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
4.5 NEW PLASTIC 0/740 SDR17
4.5 NEW SCREEN 630/780/800 .032

782	**800**	**SANDSTONE**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #316624

Owner:	**Glen Lupenitz**	Owner Well #:	**No Data**
Address:	**201 Gabriel Vista Ct. Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**201 Gabriel Vista Ct. Georgetown, TX 78633**	Latitude:	**30° 43' 24" N**
		Longitude:	**097° 46' 56" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Irrigation**

Drilling Start Date: **11/12/2012** Drilling End Date: **11/30/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**26**
8	**26**	**105**
6.5	**105**	**790**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**26**	**12**
0	**105**	**21**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **103**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **477 ft.** below land surface on **2012-11-30** Measurement Method: **Unknown**

Packers: **Shale Trap 730', 710', 105'**

Type of Pump: **Submersible** Pump Depth (ft.): **600**

Well Tests: **Estimated** **Yield: 75 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 S Q. W. Grimes Blvd.
Roundrock, TX 78664

Driller Name: **Tommy D. Arnold** License Number: **2096**

Comments: **See note in late report file.**
^EAD

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**loose rock & topsoil**
1	**26**	**brown limestone**
26	**121**	**gray limestone**
121	**126**	**brown limestone**
126	**254**	**gray limestone**
254	**261**	**brown limestone**
261	**282**	**gray limestone**
282	**290**	**brown limestone**
290	**351**	**gray limestone**
351	**360**	**blue limestone & shale**
360	**590**	**gray limestone**
590	**700**	**gray sandstone**
700	**710**	**gray sandstone & sand strips**
710	**720**	**gray sandstone**
720	**735**	**brown sandstone**
735	**780**	**gray sandstone & sand strips**
780	**790**	**gray sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
8" N Plastic 0'-26'			
4 1/2" N Plastic 0'-790'			
Perf. 730'-770'			

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #27292

Owner:	**David Forfia**	Owner Well #:	**No Data**
Address:	**300 Navajo Trail Georgetown, TX**	Grid #:	**58-18-2**
		Latitude:	**30° 43' 11" N**
Well Location:	**300 Navajo Trail Georgetown, TX**	Longitude:	**097° 48' 07" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Closed-Loop Geothermal**

Drilling Start Date: **10/7/2003** Drilling End Date: **10/7/2003**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**4.75**	**0**	**300**

Drilling Method: **Air Rotary**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**30**	**300**	**Gravel**	

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**30**	**3 Bentonite**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **70**

Distance to Septic Field or other concentrated contamination (ft.): **165**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Alternative Procedure Used**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Unknown**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Ball Drilling Company**

P. O. Box 201717
Austin, TX 78720

Driller Name: **Lonnie C. Ball** License Number: **2298**

Comments: **5 Closed Loop Geothermal Wells**

Longitude entered as 98487 was assumed to be 984807
Changed by TWDB - RQ 12/18/03

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**20**	**Hard White Limestone**
20	**300**	**Hard White Limestone with Streaks of Gray Shale**
		5 Closed Loop Wells

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
1-inch	**New**	**PE Loop**	**-4 to 300**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #275194

Owner:	**Ryan Alowitz**	Owner Well #:	**1**
Address:	**238 Gabriel Vista West Georgetown, TX**	Grid #:	**58-18-3**
Well Location:	**238 Gabriel Vista West Georgetown, TX**	Latitude:	**30° 43' 23" N**
		Longitude:	**097° 46' 57" W**
Well County:	**Williamson**	Elevation:	**939 ft. above sea level**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **11/5/2011** Drilling End Date: **11/8/2011**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9.75	**0**	**20**
6.25	**20**	**800**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**5**

Seal Method: **MIXED**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: **480 ft.** below land surface on **2011-11-08** Measurement Method: **Unknown**

Packers: **RUBBER 40'**
RUBBER 700'

Type of Pump: **Submersible**

Well Tests: **Jetted** **Yield: 60 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**TRINITY**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **HILL COUNTRY WATER WELL**

POBOX 220
BRIGGS, TX 78608

Driller Name: **JOE MCDEARMON** License Number: **2334**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**TOP SOIL**
2	**30**	**WHITE LIME**
30	**230**	**GRAY LIME**
230	**255**	**BROWN LIME**
255	**310**	**GRAY LIME**
310	**312**	**GRAY SHALE**
312	**420**	**GRAY LIME**
420	**480**	**BROWN LIME**
480	**540**	**GRAY LIME**
540	**545**	**GRAY SHALE**
545	**620**	**GRAY LIME**
620	**710**	**SANDSTONE**
712	**745**	**SANDSTONE**
720	**712**	**TINITY SAND**
745	**747**	**TRINITY SAND**
747	**760**	**SANDSTONE**
760	**763**	**TRINITY SAND**
763	**780**	**SANDSTONE**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4.5	**NEW**	**PLASTIC**	**0/800**
4.5	**NEW**	**SCREEN**	**760/800 .032**

780	**783**	**TRINITY SAND**
783	**800**	**SANDSTONE**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207600

Owner:	**Russell Langbein**	Owner Well #:	**No Data**
Address:	**1801 Williams Drive Georgetown, TX 78628**	Grid #:	**58-18-2**
Well Location:	**202 Cherokee Trail Georgetown, TX 78628**	Latitude:	**30° 43' 07" N**
		Longitude:	**097° 47' 54" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **9/10/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**50**
6.5	**50**	**765**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**50**	**15**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **190**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **185 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 712', 705', 685'**

Type of Pump: **None**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Loose Rock & Top Soil**
1	**20**	**Brown Limestone**
20	**41**	**Brown & White Limestone**
41	**50**	**Brown Limestone**
50	**150**	**Gray Limestone**
150	**165**	**Brown Limestone**
165	**240**	**Gray Limestone**
240	**277**	**Brown Limestone**
277	**284**	**Blue Limestone**
284	**390**	**Gray Limestone**
390	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**690**	**Gray Limestone**
690	**717**	**Gray Sandstone**
717	**723**	**Brown Sandstone**
723	**726**	**Gray Sand**
726	**740**	**Green Sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 50
4 1/2 New Plastic 0 - 765
Perf. 725 - 765

740	**750**	**Gray Sandstone & Sand Strips**
750	**765**	**White & Gray Coarse Sand**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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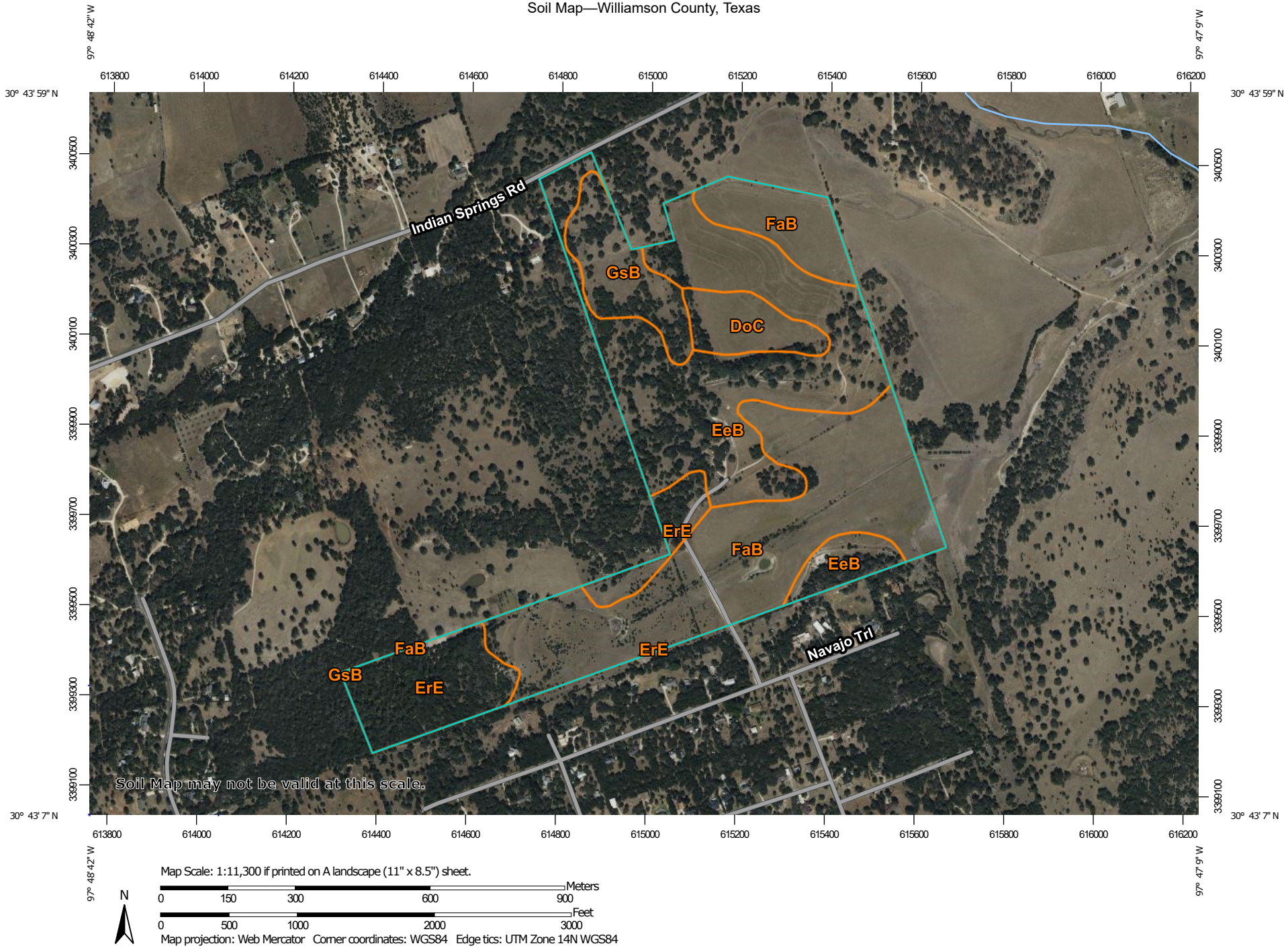
Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

APPENDIX O

USDA SOIL SURVEY AND SOIL ANALYSIS

Soil Map—Williamson County, Texas



Map Scale: 1:11,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Texas
Survey Area Data: Version 25, Aug 30, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DoC	Doss silty clay, moist, 1 to 5 percent slopes	8.4	4.8%
EeB	Eckrant stony clay, 0 to 3 percent slopes, stony	61.6	35.4%
ErE	Eckrant-Rock outcrop association, 1 to 10 percent slopes	22.1	12.7%
FaB	Fairlie clay, 1 to 2 percent slopes	69.2	39.7%
GsB	Georgetown stony clay loam, 1 to 3 percent slopes	12.8	7.4%
Totals for Area of Interest		**174.1**	**100.0%**

LEGEND

SOIL GROUP GsB
1 to 3 percent slopes

SOIL GROUP DoC
1 to 5 percent slopes

SOIL GROUP FaB
1 to 2 percent slopes

SOIL GROUP EeB
0 to 3 percent slopes

SOIL GROUP ErE
1 to 10 percent slopes

RANCH ROAD 2338

INDIAN SPRINGS ROAD

NAVAJO TRL

250 125 0 250 500
SCALE IN FEET

N

APPLICANT'S PROPERTY BOUNDARY

EFFLUENT DISPOSAL AREAS (35 AC)

TREATMENT
FACILITY
WITH 150' BUFFER

SOILS MAP

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735

Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

1 OF 1

E:\a444 Hanover\TLAP\Exhibits\Soil Map.dwg

APPENDIX P

RECHARGE FEATURE PLAN

RECHARGE FEATURE PLAN

FOR

REAGOR TRACT WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

DECEMBER 2024

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD. BUILDING II SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

RECHARGE FEATURE PLAN

The purpose of this report is to document the presence of any recharge features on any tracts of land owned, operated, controlled, rented, or leased by the applicant and to be used as a part of the facility to satisfy the requirements of Title 30 of the Texas Administrative Code, Chapter 222, Subchapter C, Rule §222.79.

(1) The following recharge features, as defined in 30 TAC Chapter 222.5 were identified on land owned, operated, controlled, rented, or leased by the applicant and proposed to be used as a part of the facility. Due to the location of the project in the Edwards Aquifer Contributing Zone, existing water courses, including stock ponds are considered recharge features. Existing water wells are considered artificial recharge features. The watercourses located within and around the project connect to Cowan Creek.

(2) The following sources were used to document the presence of natural and artificial recharge features on the applicant's property:

A. Railroad Commission of Texas

The Railroad Commission of Texas online Public GIS Map Viewer was used to search for artificial recharge features (gas wells). No artificial recharge features were found through this search except existing water wells, as shown on the attached map (Appendix A).

B. A groundwater conservation district

Not applicable.

C. Texas Water Development Board

The locations of all water wells within one mile of the site were located using the Texas Water Development Board's Water Information Integration and Dissemination (WIID) GIS database. Well information and well locations shown on the USGS Map are included as Appendix M.

D. Texas Commission on Environmental Quality

Per our conversations with TCEQ staff, there are no maps produced by TCEQ that would show the presence of any recharge features on the applicant's site. The site is located within the contributing zone for the Edwards Aquifer.

LJA also reviewed wells located within a one mile radius of the disposal site are shown on the USGS map presented as Appendix M.

E. Natural Resources Conservation Service

A map showing the NRCS soil types for the proposed irrigation areas is presented as Appendix O.

F. On-site inspection

No direct recharge features were found during onsite inspections by LJA Engineering, Inc.

Because the site overlies the contributing zone for the Edwards Aquifer, watercourses including the existing ponds are treated as potential recharge features as defined in 30 TAC 222.5.

No exposed limestone was observed onsite.

(3) A narrative description of the site-specific geology and groundwater at the facility is provided below:

A. The proposed project is located southwest of the intersection of FM 2338 and Indian Springs Road and is underlain by the Edwards Formation. This Cretaceous formation is composed of alternating layers of hard limestone and soft marl which typically erode into a stairstep topography. Two soil units are mapped within the proposed irrigation areas according to the NRCS Soil Survey. Fairlie clay (FaB) soils generally are very deep, clayey soils overlying limestone. Eckrant stony clay (EeB) are generally deep, well drained soils developed in slope alluvium.

The project location is situated on the Austin Sheet of the Geologic Atlas of Texas published by the University of Texas at Austin, Bureau of Economic Geology.

A copy of TWDB Report 358 Groundwater Availability Modeling: Northern Segment of the Edwards Aquifer, Texas, is also enclosed as it is the most recent study of the Northern Edwards Aquifer underlying the project, having been published in 2003. This report identifies recharge to the Edwards Aquifer from stream beds located within the study area. The study also indicates that hydraulic conductivity is greater over the Balcones Fault Zone compared to the rest of the aquifer system. This project is located within the Fault Zone. The Edwards Aquifer in this area is generally located between elevation 500 ft-msl and 100 ft-msl in this area. Overall, the model indicated a recharge rate of 20 percent for the aquifer (page 49, TWDB Report 358).

B. Depth to groundwater is approximately 230', based on well driller reports. This matches the levels predicted by the TWDB Report 358.

C. Groundwater generally flows downdip southeast and east in this area. See Figure 1 from TWDB Report 358 attached.

D. The only known uses for groundwater are the existing domestic water wells shown on the attached USGS map (Appendix M).

E. Well drillers' logs and water quality data are included as Appendix M.

(4) Measures to prevent impact to groundwater include:

A. Protective Measures:

a. All wells, will be protected with a 150’ minimum buffer.

b. Stream buffers will be provided from watercourses which could convey runoff to Cowan Creek. Drainage ways depicted on the USGS map must have a 100 foot buffer from the creek centerline to irrigation fields. There are no creeks identified on the USGS map within this tract.

c. The proposed drip irrigation fields have been located to minimize the opportunities for stormwater to run on to the fields; however, berms to prevent run-on of stormwater will be located along the perimeter of fields where there is localized upstream drainage.

d. Existing off-channel stock ponds that are located within the proposed irrigation areas will be filled in to ensure there are no opportunities for ponding of stormwater over the field.

B. The combination of run-on control and moisture monitoring in the drip system will prevent any runoff of effluent. No direct recharge features were located on the applicant’s property, and a review of available literature on groundwater in the area indicates recharge through surface runoff is minimal in this area. With this in mind, and with the safeguards proposed above, a groundwater monitoring plan is not provided.

Appendix A
Texas Railroad Commission Map

December 2, 2024

1:72,224

0 0.5 1 2 mi

0 0.75 1.5 3 km

County of Williamson, Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Appendix B
Texas Water Development Board Report 358

Texas Water Development Board

Report 358

Groundwater Availability Modeling: Northern Segment of the Edwards Aquifer, Texas

by
Ian C. Jones, Ph.D., P.G.

December 2003

Geoscientist Seal

The contents of this report (including figures and tables) document the work of the Following Licensed Texas Geoscientist:

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Dr. Ian Jones was responsible for all original work documented in this publication.

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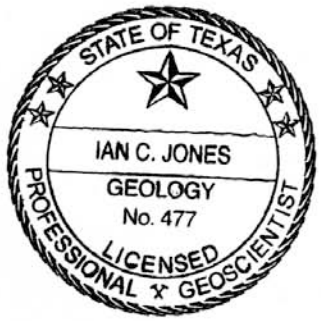

Report 358 - Groundwater Availability Model: Northern Segment of the Edwards Aquifer, Texas, 2003

Texas Water Development Board

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1.0 Executive Summary

The northern segment of the Edwards aquifer covers an area that includes some of the fastest growing counties in Texas. As a result of rapid population growth, demand for water in this region is also rising. A groundwater availability model simulating flow through this segment of the Edwards aquifer was constructed as a groundwater resource management tool. The purpose of this tool is to aid groundwater conservation districts, regional water planning groups, and others in evaluating groundwater resource management strategies to meet projected groundwater demands. This model was constructed by calibrating to steady-state conditions for 1980 and historical transient conditions for the period 1980-2000. The calibrated model can be used to predict future water-level changes that may result from projected pumping rates and/or climatic conditions.

The model results indicate that (1) no historical regional-scale cones-of-depression exist in the northern Edwards aquifer, (2) 60-80 percent of natural discharge is baseflow to perennial streams that cross the aquifer outcrop, (3) pumping is less than 20 percent of total discharge, (4) the flow system is more active in the unconfined part of the aquifer than in downdip portions, and (5) gradual long-term water-level decline is occurring in the Pflugerville-Georgetown area. Historical pumping trends indicate steadily increasing municipal, rural domestic, and industrial pumping, rising from 20,000 to 30,000 acre-feet/year over the past 20 years. Regional-scale drawdown associated with increasing pumping has not been observed, so far, largely because pumping is a relatively small portion of the total water budget of this segment of the Edwards aquifer. However, pumping results in local drawdown.

2.0 Introduction

The northern segment of the Edwards aquifer is an important source of groundwater for municipalities, industries, and landowners in central Texas. Rapid population growth in this part of Texas has increased interest in the northern segment of the Edwards aquifer and heightened concerns about groundwater availability in the aquifer.

This is the first published model to simulate groundwater flow in the northern segment of the Edwards aquifer. The San Antonio and Barton Springs segments have received higher priority because groundwater flow models were needed to address pressing issues related to conflicts over groundwater demand for municipal, agricultural, recreational, and ecological uses (fig. 2-1). The San Antonio segment has been given highest priority because historically it has been the sole source of water for many municipalities, including San Antonio, a city with a population exceeding 1 million. The San Antonio segment is also an important source of irrigation water in that region. Increasing pumping associated with municipal and irrigation demands, together with the effects of drought, lowers spring discharge in Barton, San Marcos, and Comal springs. Declines in spring discharge affect recreation, flora, and fauna associated with the springs. These issues have made understanding groundwater flow through the respective segments of the Edwards aquifer of vital importance.

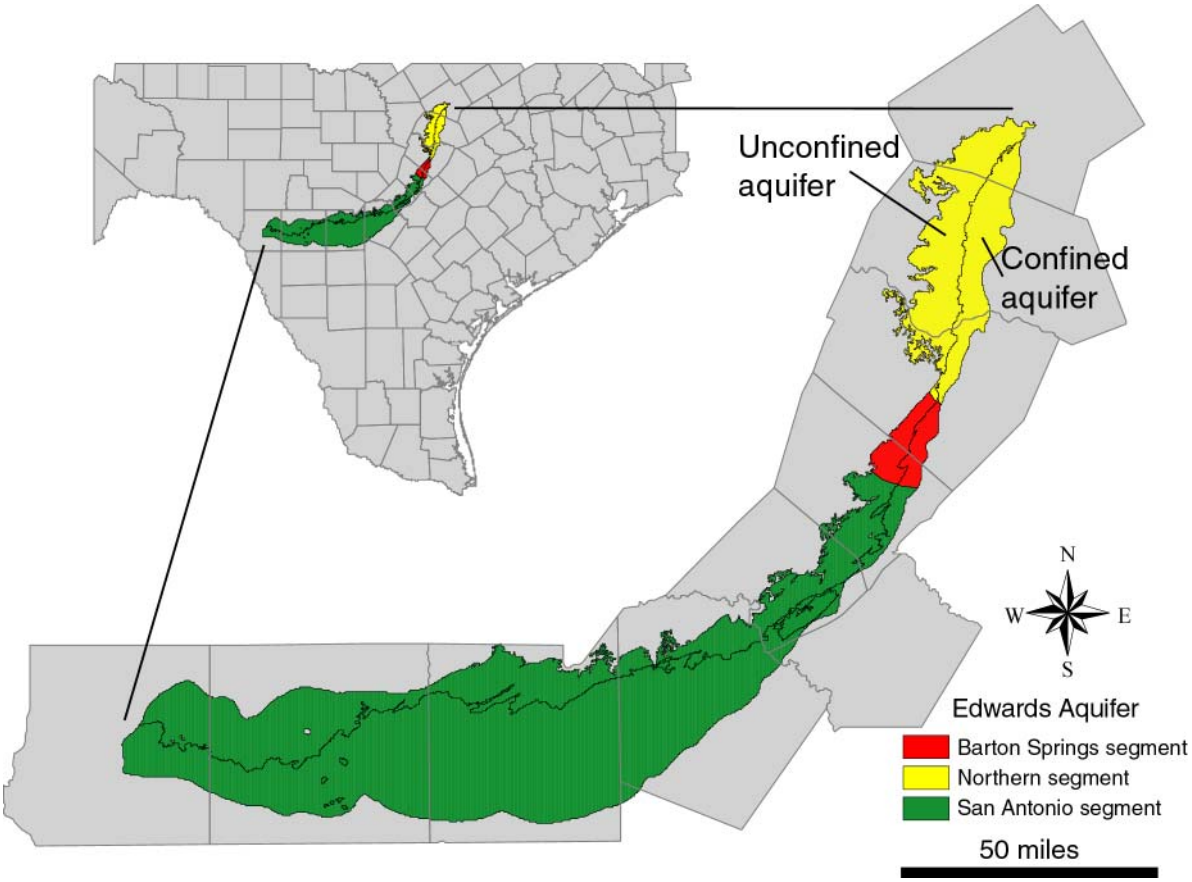

Figure 2-1. Segments of the Edwards (Balcones Fault Zone) aquifer.

The northern segment has received lower priority largely because the largest city in the region, Austin, does not rely on the northern segment of the Edwards aquifer for groundwater to meet its water demands. However, other smaller municipalities, such as Georgetown, Pflugerville, and Round Rock, use groundwater from the Edwards aquifer. Rapid population growth in these and adjacent municipalities is likely to be accompanied by rapid growth in demand for groundwater from the Edwards aquifer. This growth necessitates our gaining a better understanding of the hydrology of this segment of the Edwards aquifer and the potential effects of future population growth. This understanding can be achieved through groundwater availability modeling (GAM)—development of a state-of-the-art, publicly available, numerical groundwater flow model that will provide reliable information on groundwater availability in this aquifer.

The general approach used in developing this model involved (1) developing a conceptual model, (2) organizing and distributing aquifer information for input into the model, (3) calibrating a steady-state model for 1980, (4) calibrating a historical transient model for the years 1980 through 2000, and (5) making predictive simulations. This report describes (1) the study area, previous work, and hydrogeologic setting used to develop the conceptual model; (2) the code, grid, and model parameters assigned during model construction; (3) calibration and sensitivity analysis of steady-state and transient models; (4) predictions of water-level changes; (5) limitations of the current model; and (6) suggestions for future improvements.

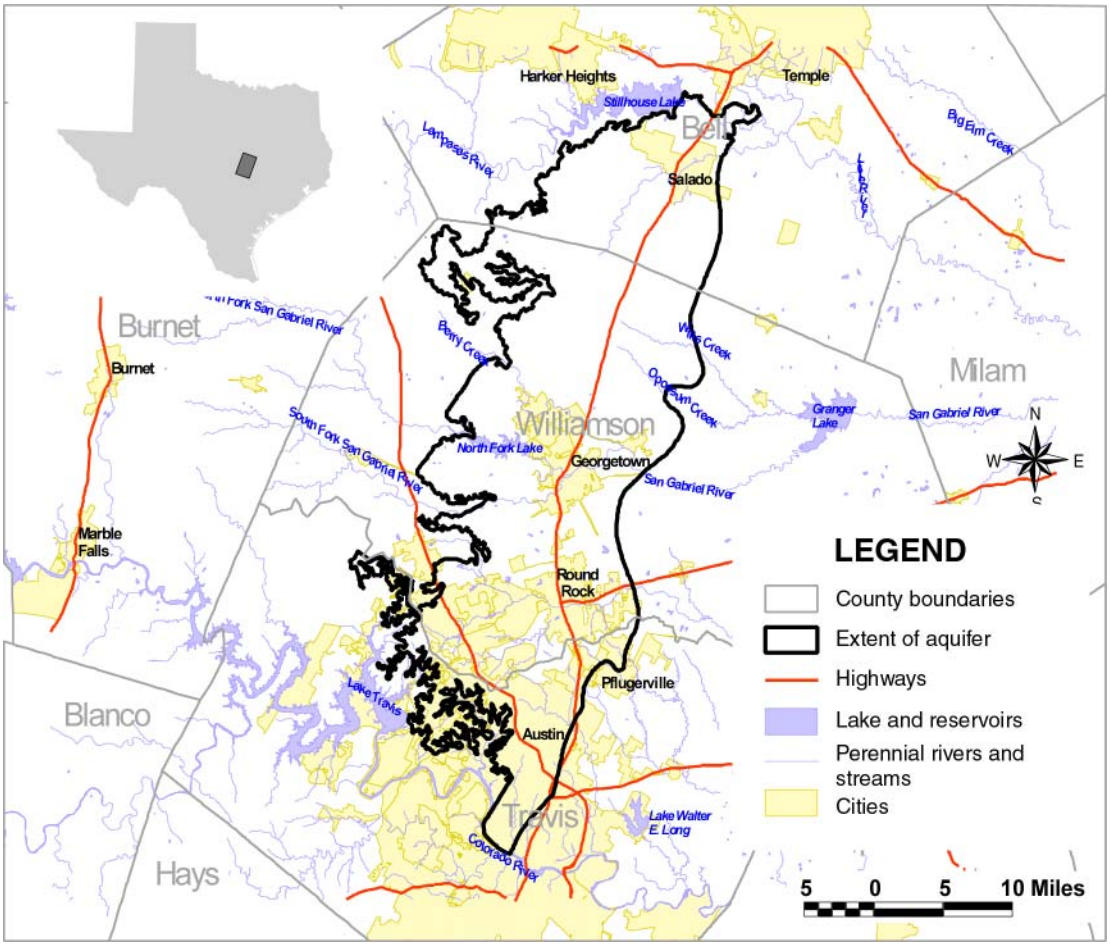

Figure 3-1. Location of the study area.

3.0 Study Area

The northern segment of the Edwards aquifer is located in central Texas (fig. 3-1). It is the northernmost of the three segments that make up the Edwards (Balcones Fault Zone) aquifer (fig. 2-1). The study area underlies parts of Bell, Travis, and Williamson counties and extends over parts of two regional water planning areas, the Lower Colorado (K) and Brazos (G) Regional Water Planning Areas (fig. 3-2). The northern part of the study area also lies within the Clearwater Underground Water Conservation District (fig. 3-3). The northern segment of the Edwards aquifer extends from the Colorado River in Travis County to the Lampasas River in southern Bell County. This segment of the Edwards aquifer is bounded by the Colorado River to the south, the western margin of the Edwards and associated limestones outcrop to the west and north, and to the east by the easternmost extent of fresh groundwater, referred to as the bad water line.

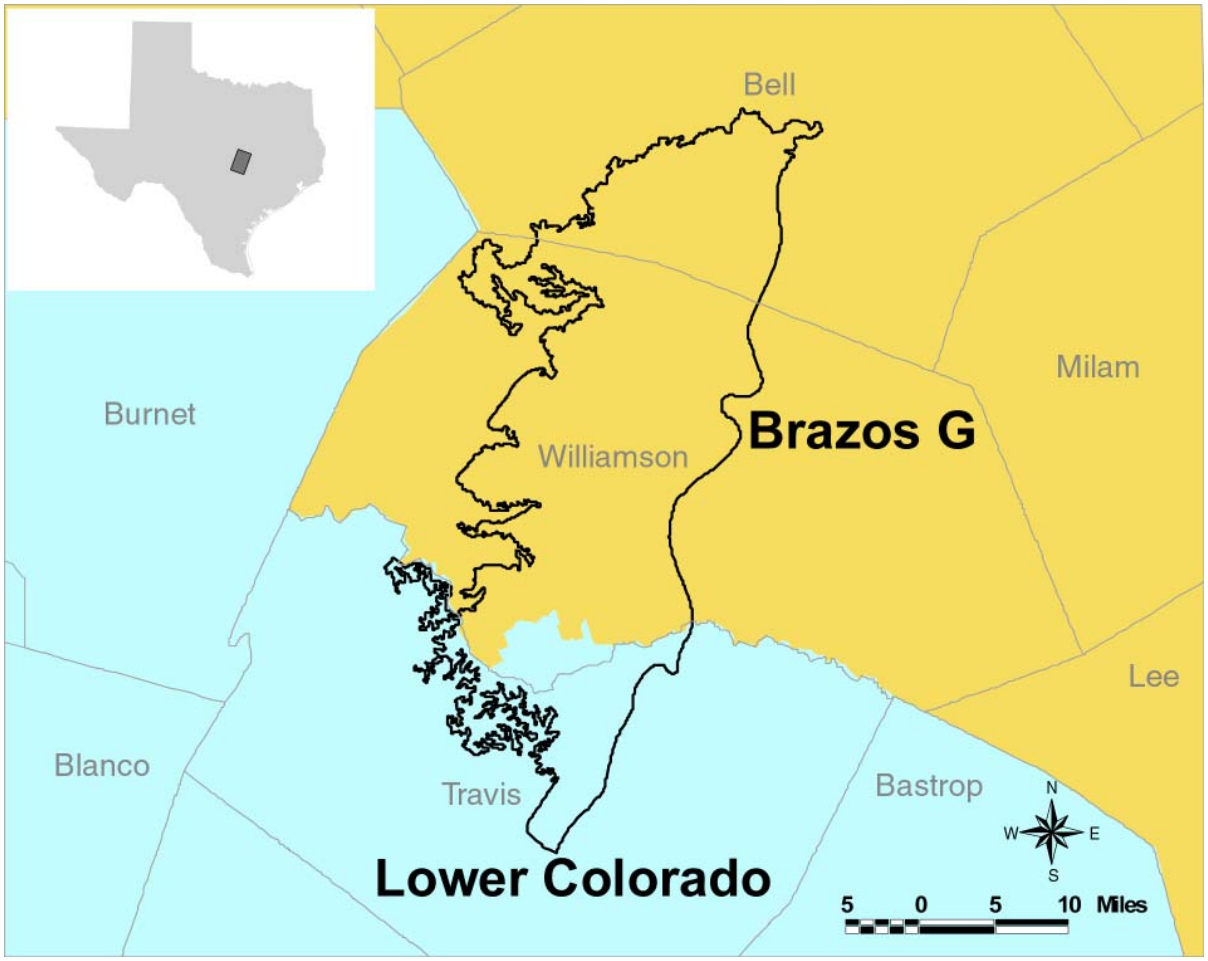

Figure 3-2. Location of regional water planning group boundaries in the study area.

3.1 Physiography and Climate

The topography of central Texas is relatively flat, with an elevation range of 500 to 1,000 feet above sea level (fig. 3-4). There are three physiographic provinces in the study area, the Edwards Plateau, Rolling Prairie, and Blackland Prairie (fig. 3-5). The occurrence of these three physiographic provinces is related to the underlying geology that will be discussed in more detail later in this section.

In the study area, the Edwards Plateau is composed of the Hill Country, Jollyville Plateau, and Lampasas Cutplains. The Jollyville Plateau has been separated from the Hill Country by erosion that resulted in the formation of the Colorado River valley. The Hill Country and Jollyville Plateau are characterized by highly dissected canyonland, while the Lampasas Cutplains is characterized by gently rolling terrain. The Rolling Prairie developed in the Balcones Fault Zone and coincides with the outcrop of limestone rocks that overlie the aquifer. The Blackland Prairie occurs where the limestones are overlain by younger alluvial units that occur along the margin of the Gulf Coastal Plain (Senger and others, 1990). The most prominent topographic feature is the Balcones Escarpment, a product of normal faulting in this region. This escarpment forms the

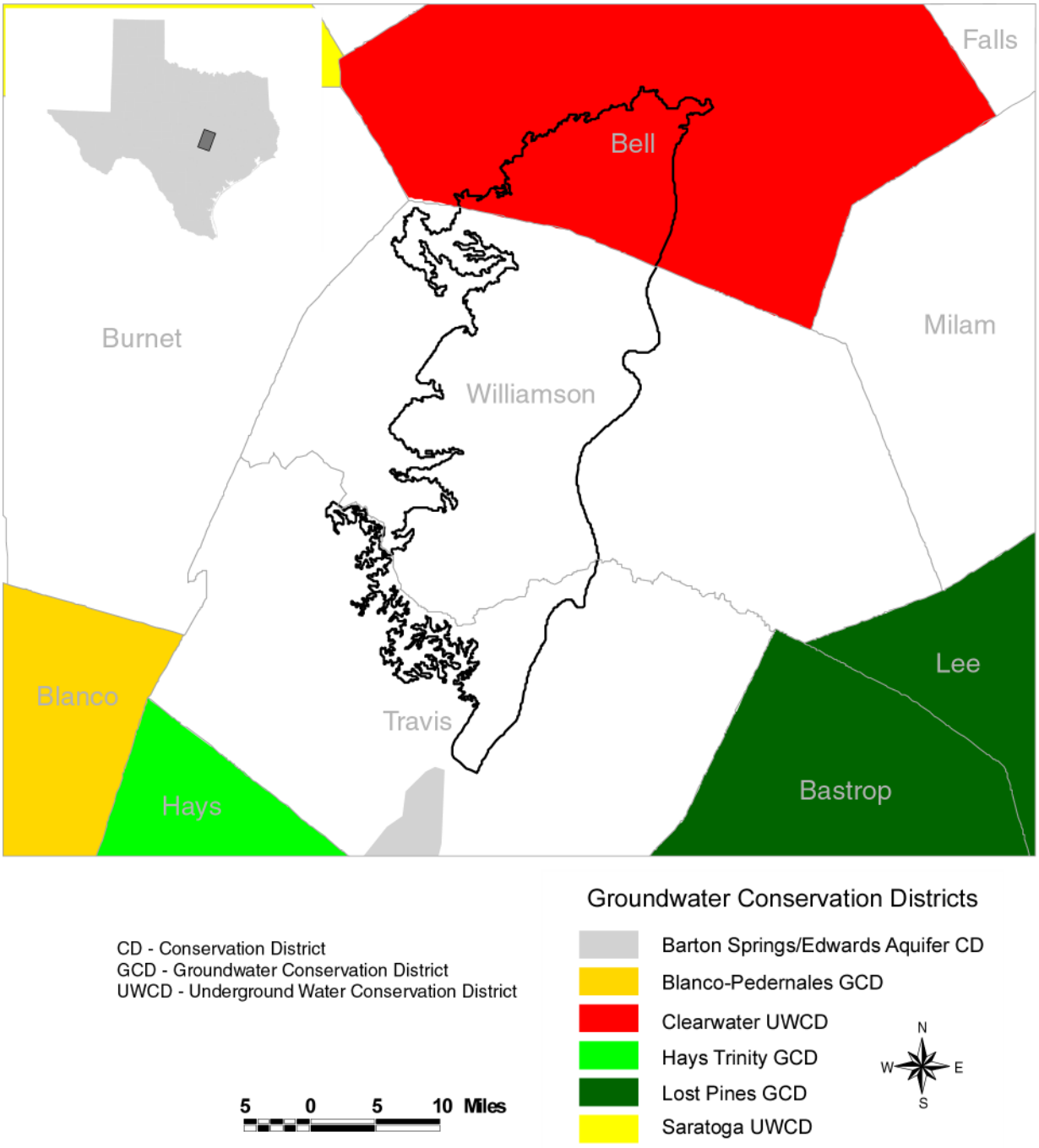

Figure 3-3. Location of groundwater conservation districts in the study area.

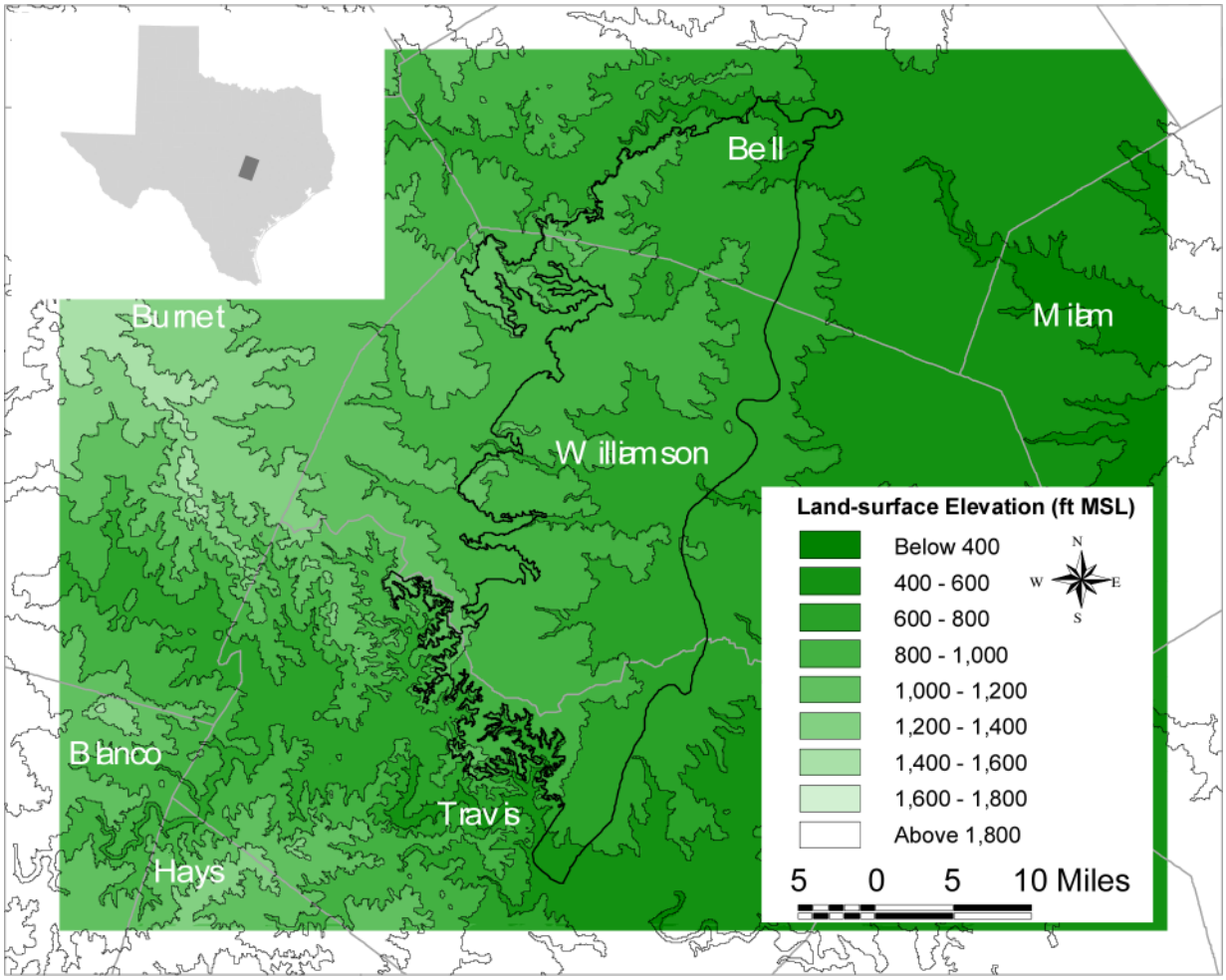

Figure 3-4. Land-surface elevation in the study area.

boundary between the Jollyville Plateau and Hill Country parts of the Edwards Plateau and the Rolling Prairie (Trippet and Garner, 1976). This boundary becomes more subdued to the north in the Lampasas Cutplains.

Central Texas has a sub-humid climate. At weather stations located within the study area, median annual precipitation ranges from 20 to 30 inches (fig. 3-6). Approximately 60 percent of annual precipitation falls in April through June and September through October (fig. 3-7). Some of this precipitation takes the form of severe thunderstorms. These thunderstorms frequently produce major flash floods that have the potential to generate recharge to the underlying aquifer (Senger and others, 1990). Monthly precipitation is typically lowest during July and August. Precipitation data display a wide range of annual precipitation in the study area. Data for the period 1930 through 1997 indicate annual precipitation ranging from 10 to 55 inches (fig. 3-8). Lowest annual precipitation occurred during 1954 through 1956 at some stations. This coincides with the drought of the 1950s, which affected the entire state.

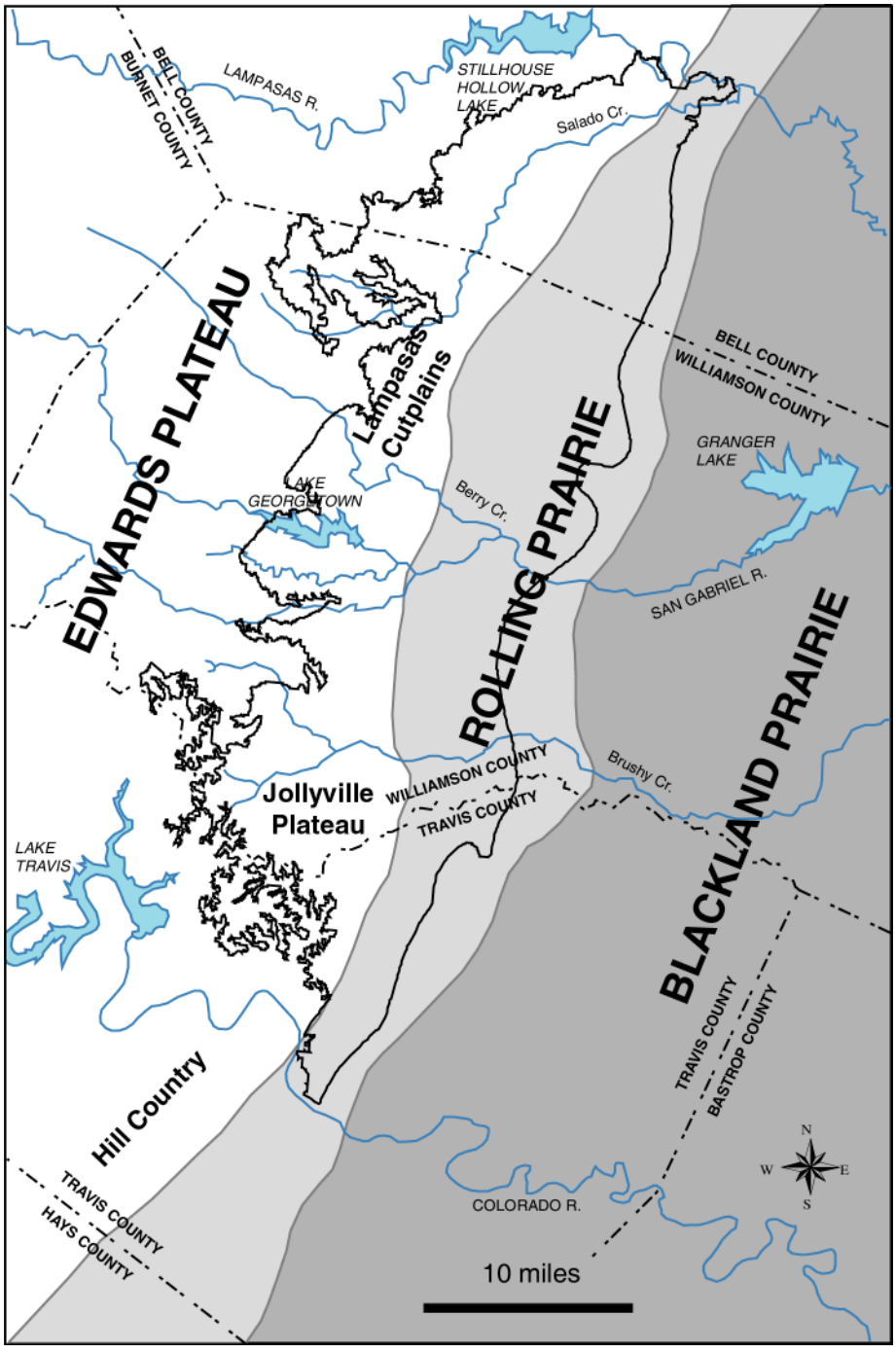

Figure 3-5. Physiographic provinces in the study area (modified from Senger and others, 1990).

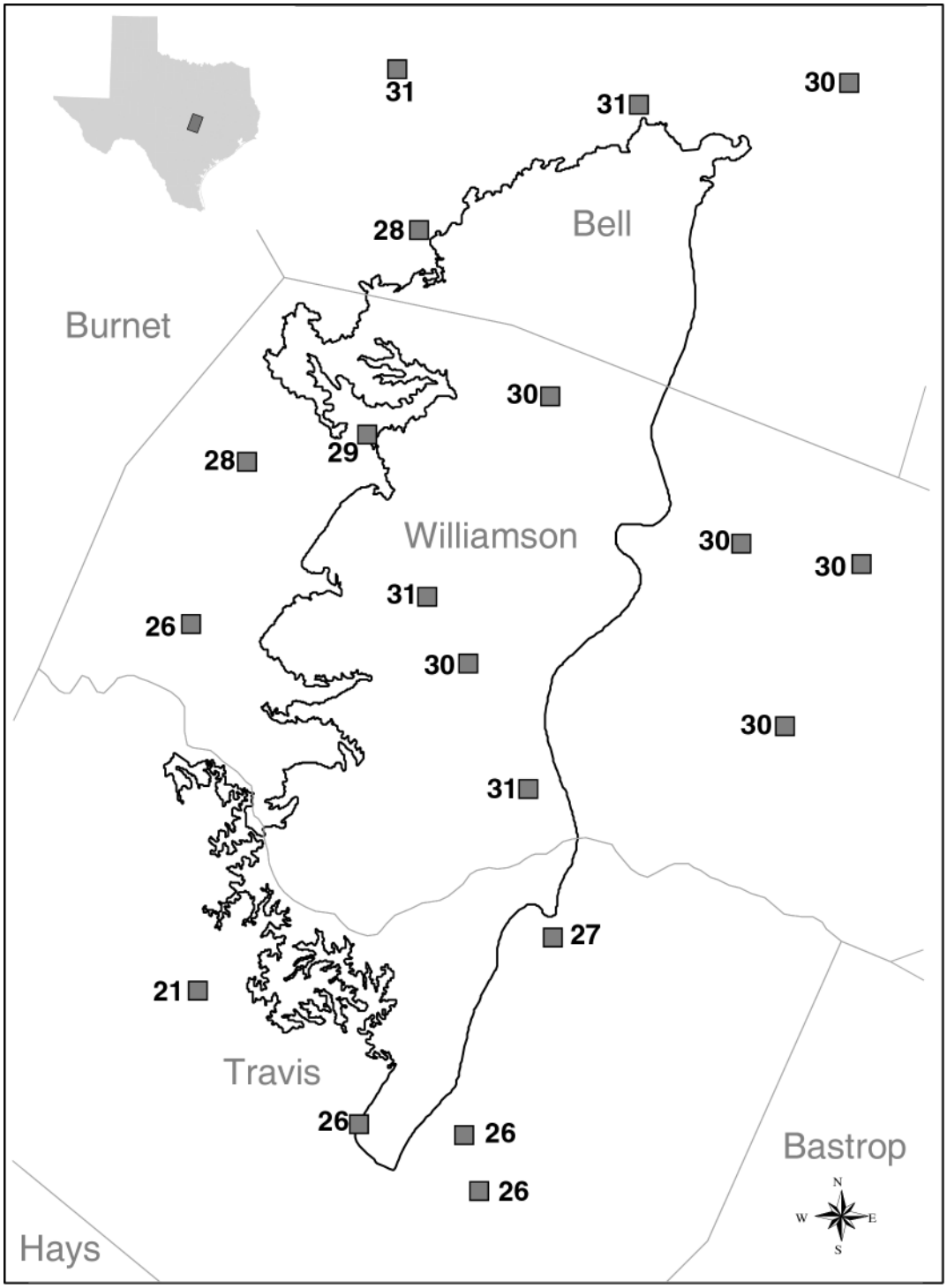

Figure 3-6. Mean annual precipitation (inches) in the study area, from National Climate Data Center.

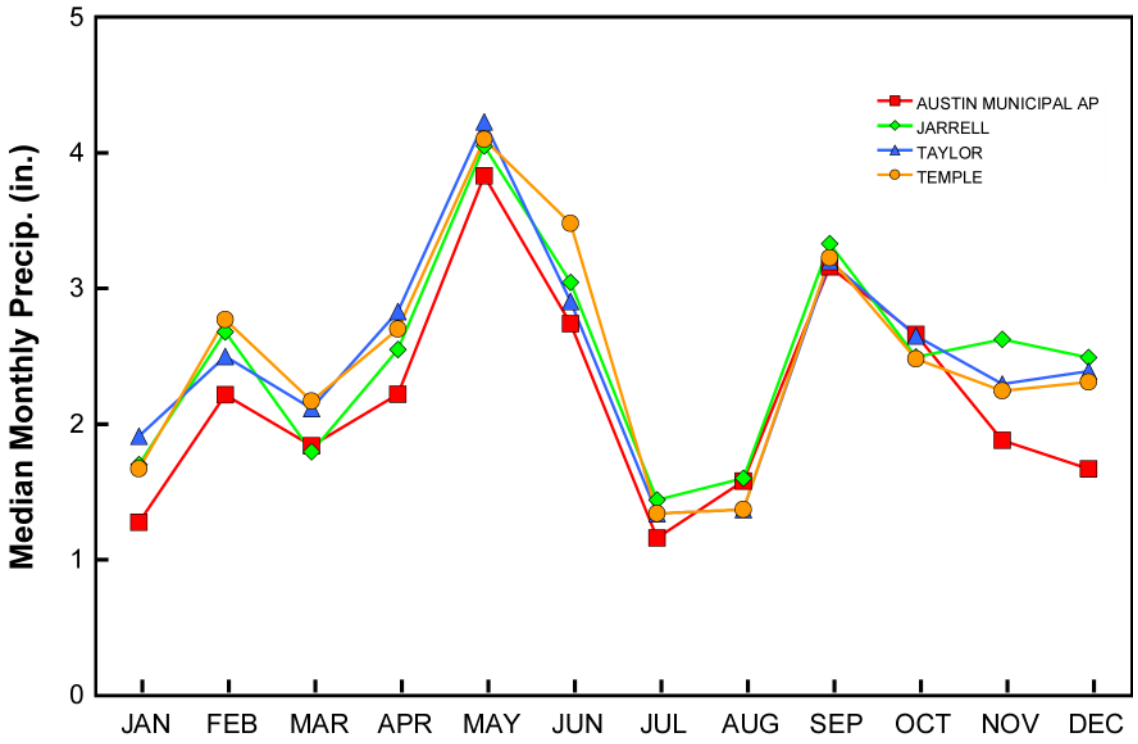

Figure 3-7. Mean monthly precipitation at selected stations in the study area, from National Climate Data Center.

Average monthly lake-surface evaporation in this region ranges between 2 and 8 inches (fig. 3-9). Lake-surface evaporation is typically highest during summer months (June through August) and lowest during winter months (December through February), when precipitation exceeds evaporation. The average annual temperature in this region is 68 °F, with mean maximum and minimum temperatures of 95 °F and 41 °F, respectively (Brune and Duffin, 1983).

3.2 Geology

Stratigraphic units underlying the study area range in age from the Paleozoic Ellenburger Group to Recent alluvium (Brune and Duffin, 1983). Only Cretaceous and younger rocks are exposed at the surface (fig. 3-10). Most of these stratigraphic units crop out along the Balcones Fault Zone, a zone of normal faulting that trends northeast-southwest through the study area (Trippet and Garner, 1976). Total displacement of the Balcones Fault Zone is up to 1,200 feet. Stratigraphic units in the study area are composed mainly of limestone and shale or clay. The oldest rock units, the Ordovician Ellenburger Group and the Pennsylvanian Bend and Strawn groups, occur at great depth and are not known to yield usable water in the study area (Brune and Duffin, 1983). The most important aquifer units in the study area occur in the Cretaceous Trinity, Fredericksburg, and Washita Groups (fig. 3-11). These Cretaceous units are approximately 2,000 feet thick and dip gently toward the southeast (Trippet and Garner, 1976).

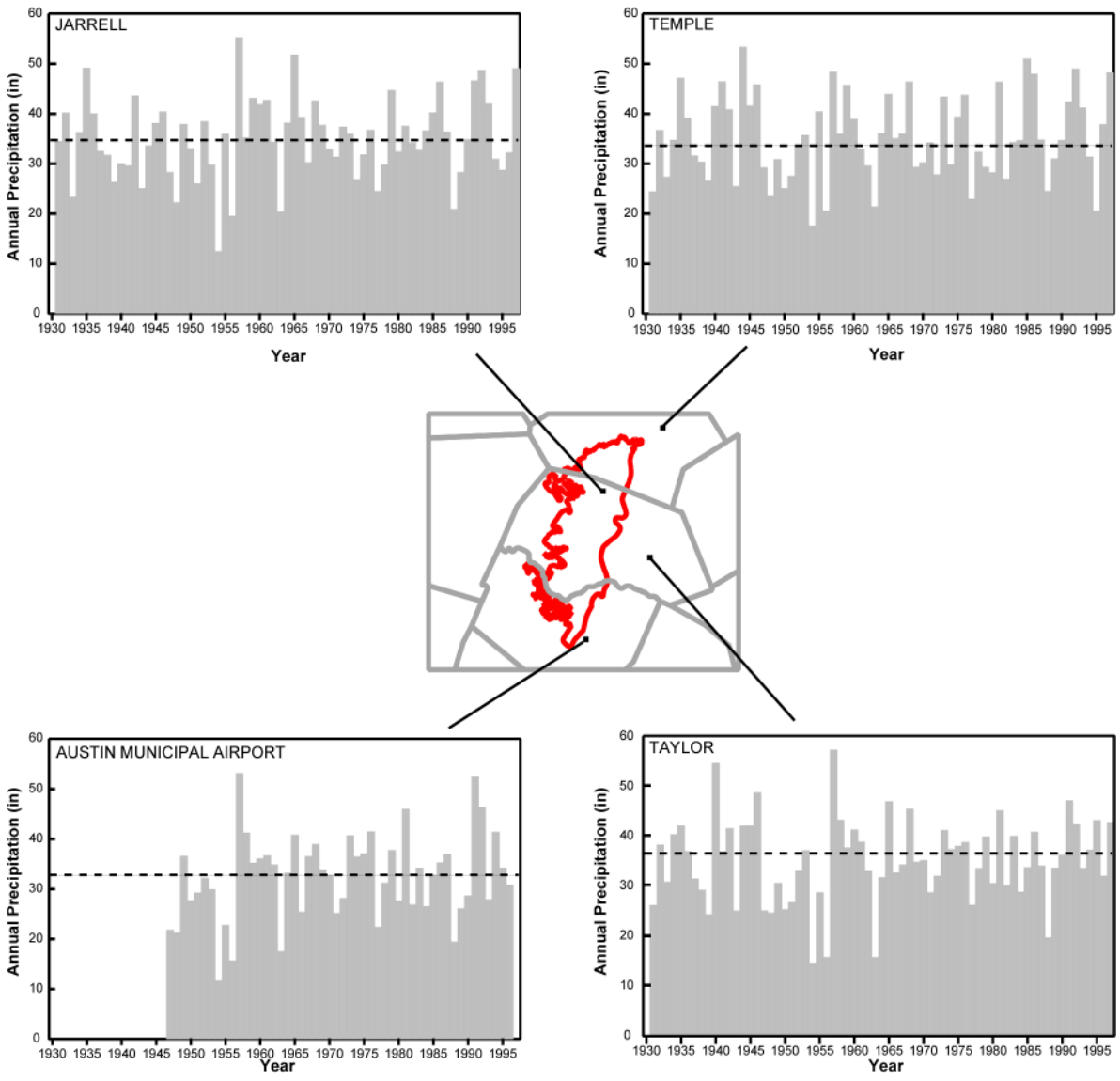

Figure 3-8. Historical annual precipitation at selected stations in the study area, from National Climate Data Center. The dashed lines represents the mean average precipitation for each station.

The Trinity Group is divided into the Travis Peak, Glen Rose, and Paluxy Formations (Brune and Duffin, 1983). The Travis Peak Formation consists primarily of limestone, sand, and shale. The Glen Rose Formation is predominantly composed of alternating layers of limestone and dolomite at the top and massive layers of limestone and dolomite at the base. The Paluxy Formation is composed of fine quartz sand cemented by calcium carbonate. In the study area, this formation is relatively thin, up to 10 feet thick.

The Fredericksburg Group is divided into the Walnut Formation, Comanche Peak Limestone, and Edwards Limestone (Brune and Duffin, 1983). The Walnut and Comanche Peak Formations

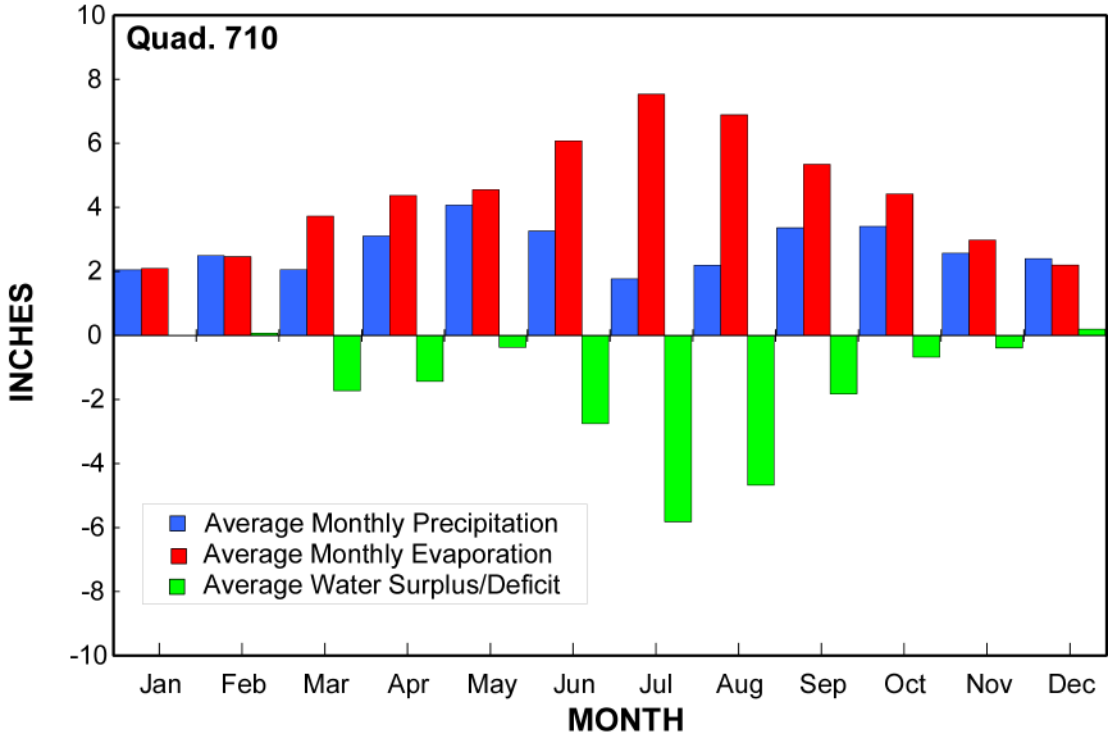

Figure 3-9. Mean monthly precipitation and pan evaporation from TWDB database.

are composed of fine-grained limestone and shale. The Walnut and Comanche Peak Formations occur primarily in the subsurface in the northern part of the study area. The Edwards Limestone is composed of massive vuggy limestone with fine-grained marl at the top of the formation. This marl is very thin in the study area and tends to become thicker toward the north.

The Washita Group is divided into the Georgetown Formation, Del Rio Clay, and Buda Limestone (Brune and Duffin, 1983). The Georgetown Formation thins southward and is composed of fine-grained limestone that in places is hydraulically connected to the Edwards Limestone. The Del Rio Clay and Buda Limestone are composed of shale and fine-grained limestone, respectively (Brune and Duffin, 1983).

The stratigraphic nomenclature of units that compose the Edwards aquifer differs north and south of the Colorado River. South of the river, the “Edwards” is treated as a group composed of two formations, the Kainer and Person Formations (Rose, 1972). The Kainer Formation is equivalent to the Walnut Formation, Comanche Peak Limestone, and lower parts of the Edwards Limestone. Equivalents of the Person Formation are largely absent north of the Colorado River. North of the Colorado River, the uppermost parts of the Edwards Limestone are equivalent to the basal members of the Person Formation.

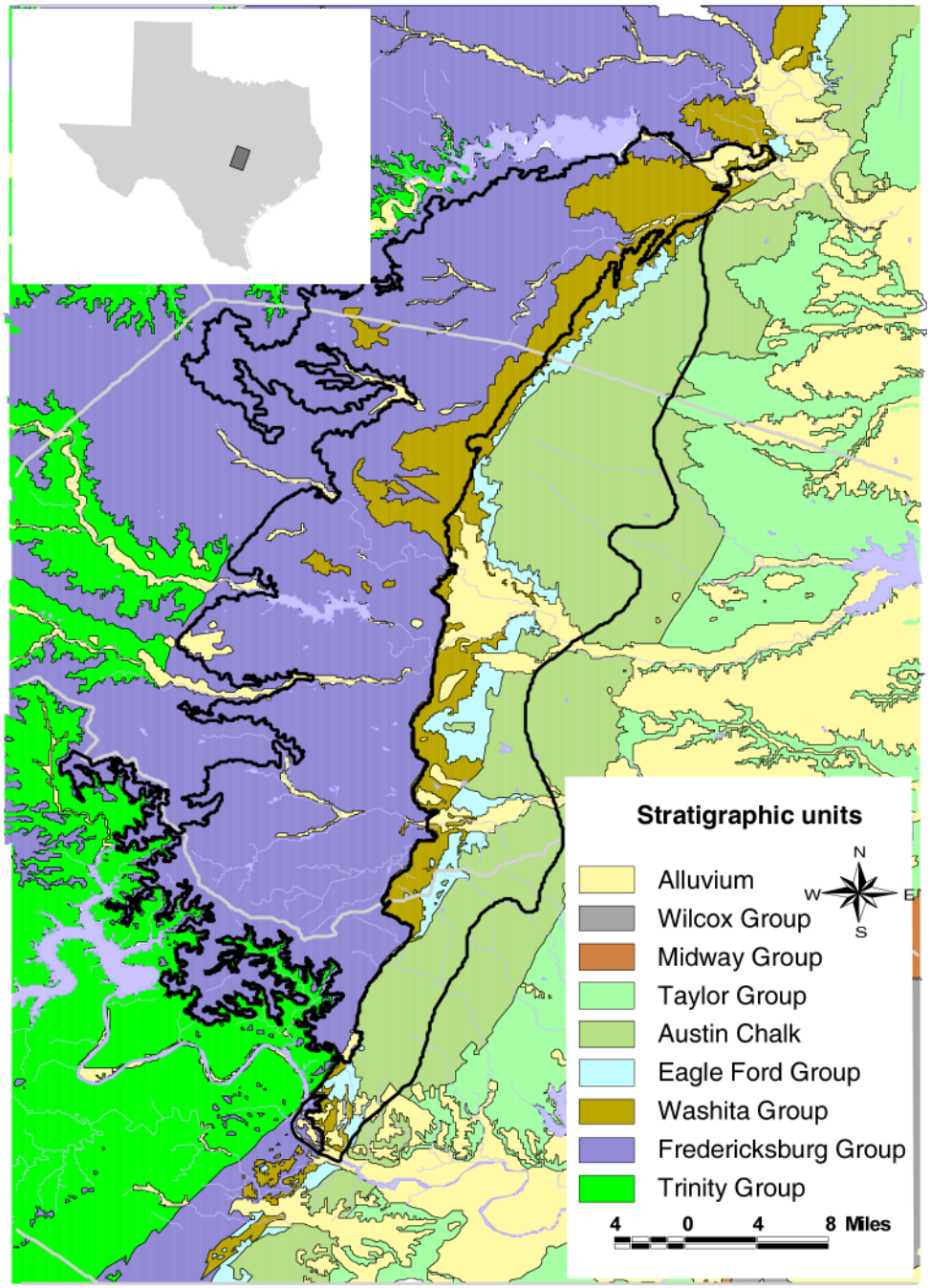

Figure 3-10. Surface geology in the study area.

Series	Group	Stratigraphic Unit		Hydrologic Unit	Maximum Thickness (feet)
Gulf	Navarro			Navarro and Taylor Group	850
	Taylor				
	Austin			Austin Chalk	450
Comanche	Eagle Ford				50
	Washita	Buda Limestone			50
		Del Rio Clay			60
		Georgetown Formation		Edwards aquifer	100
	Fredericksburg	Edwards Limestone			200
		Comanche Peak Limestone			50
		Walnut Formation			150
	Trinity	Paluxy Formation		Upper Trinity	10
		Glen Rose	Upper Member		450
			Lower Member	Middle Trinity	450
		Travis Peak	Hensell Sand Member		100
			Cow Cr. Limestone Member		100
			Hammett Shale Member		50
			Sligo Member	Lower Trinity	150
			Hosston Member		850

Figure 3-11. Stratigraphic and hydrostratigraphic units in the study area.

4.0 Previous Work

Many geologic and hydrogeologic reports include the northern segment of the Edwards aquifer. Studies of the stratigraphy and structure of the area include Tucker (1962), Proctor and others (1974), Collins (1987), and Kreitler and others (1987). Woodruff and others (1985) and Yelderman and others (1987) are compendia that provide information on different aspects of the hydrogeology of the northern segment, such as water supply development, transmissivity distribution, and pump-test analysis. More detailed hydrogeologic studies include Klemt and others (1975), Brune and Duffin (1983), Senger and Kreitler (1984), Baker and others (1986), Kreitler and others (1987), Flores (1990), Duffin and Musick (1991), and Ridgeway and Petrini (1999). Senger and others (1990) discussed both the groundwater geochemistry and hydrology of the northern segment. The review of groundwater flow models conducted in Texas by Mace (2001b) indicates that there are no published models for the northern segment of Edwards aquifer.

Several regional and sub-regional models have simulated groundwater flow in the San Antonio and Barton Springs segments of the Edwards aquifer (Campana, 1975; Knowles and Klemt, 1978; Mahin, 1978; Klemt and others, 1979; Mahin and Campana, 1983; Slade and others, 1985; Maclay and Land, 1988; Kuniansky, 1993; Kuniansky and Holligan, 1994; Barrett, 1996; Uliana

and Sharp, 1996; Scanlon and others, 2001). However, none of these models extended north of the Colorado River.

5.0 Hydrogeology

The hydrogeologic setting of the northern segment of the Edwards aquifer is described by hydrostratigraphy, structure, water levels, recharge, discharge, surface-water features, and hydraulic properties. Each of these factors is described in more detail below.

5.1. Hydrostratigraphy

The northern segment of the Edwards aquifer generally consists of the Comanche Peak Limestone, Edwards Limestone, and Georgetown Formation (fig. 5-1). These stratigraphic units constitute the upper Fredericksburg and lower Washita Groups and are collectively referred to as the Edwards and associated limestones (Brune and Duffin, 1983). The aquifer overlies older Cretaceous rock of the Walnut and Glen Rose formations and is overlain by younger units that consist of the Del Rio Clay, Buda Limestone, Austin Chalk, Taylor Marl, and Navarro Group. The Walnut Formation and Del Rio Clay are recognized as confining units (Brune and Duffin, 1983; Baker and others, 1986). The base of the aquifer is defined as the base of rocks having greater water-yielding capabilities (Baker and others, 1986). In most areas, this excludes the Walnut Formation, although in other areas the Walnut Formation is composed of potentially permeable shell beds and may thus be included in the Edwards aquifer. Karstification in the form of honeycombing, sinkholes, and caves allows rapid infiltration and percolation of water through the aquifer.

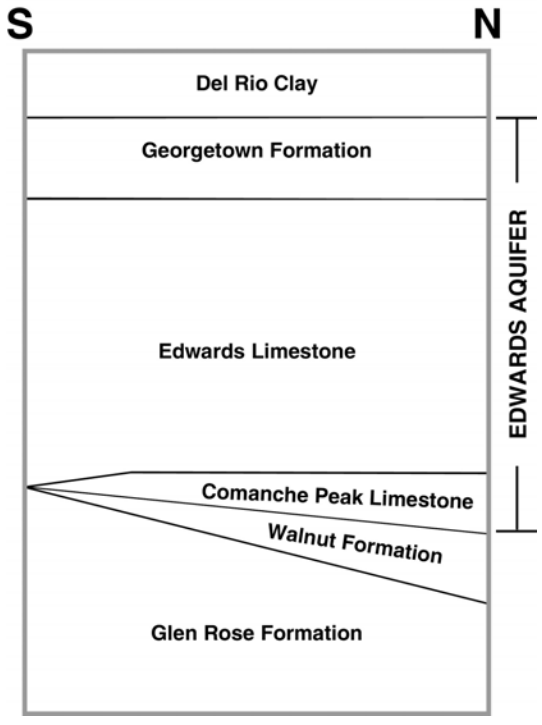

Figure 5-1. Schematic stratigraphic column of the study area.

The Comanche Peak Limestone is composed of nodular and fossiliferous marly limestone. This unit is characterized by considerable jointing (Brune and Duffin, 1983). The Edwards Limestone is composed of 200 to 350 feet of highly fractured and thickly bedded to massive limestone or dolomite, with minor shale, clay, and siliceous limestone. The Edwards Limestone consists of the Kainer, Person, Kiamichi, and Duck Creek formations. The Person and Kainer formations are composed of brittle, massive limestone that is sometimes dolomitic (Flores, 1990). The Edwards Limestone is vuggy in places because of the occurrence of solution-collapse zones (Brune and Duffin, 1983). These zones, parallel to bedding planes, are the result of dissolution of gypsum beds that formerly occurred in this stratigraphic unit. They are cavernous and iron stained and contain brecciated limestone, chert, crystalline calcite, and residual clay. They occur mainly 60 to 80 feet above the base of the Edwards Limestone, within the Person and Kainer formations, and are often referred to as the Kirschberg solution zone (Brune and Duffin, 1983; Flores, 1990). These solution-collapse zones, as much as 20 feet thick, are the main water-bearing horizons in the aquifer, with well yields greater than 300 gallons per minute (Brune and Duffin, 1983; Flores, 1990). The Kiamichi and Duck Creek formations constitute the Regional Dense Member near the top of the Edwards Limestone, especially in the northern part of the study area. The Regional Dense Member separates the Edwards aquifer into upper and lower units that may be circumvented by fault displacement (Flores, 1990). The Georgetown Formation is a massive nodular limestone that is often hydrologically connected to the underlying Edwards Limestone (Brune and Duffin, 1983).

In addition to solution-collapse zones, groundwater in the Edwards aquifer flows through a network of steeply dipping faults and joints (Brune and Duffin, 1983). Field measurements indicate that effective porosity is greatest in the Comanche Peak Limestone and decreases in the overlying Edwards Limestone and Georgetown Formation (Dahl, 1990; Flores, 1990). This trend has been attributed to limestone in the Comanche and Edwards being more brittle than that in the Georgetown Formation. Additionally, the lower units of the Edwards aquifer display greater effects of karstification (Dahl, 1990; Flores, 1990). Fracture porosity of the Edwards aquifer ranges from 0.4 to 2.5 percent away from major faults, to 1.5 to 4.25 percent adjacent to faults (Dahl, 1990). These porosity values are lower than porosities (4 to 42 percent) measured in the San Antonio segment of the Edwards aquifer (Hovorka and others, 1996).

5.2 Structure

The structural features that most influence groundwater flow in the study area are regional dip and the occurrence of the Balcones Fault Zone. Cretaceous rock overlies Paleozoic rock, forming an angular unconformity (Brune and Duffin, 1983), indicating that the Cretaceous rock was deposited on an erosional surface over steeply westward-dipping Paleozoic rock. The Cretaceous rock dips toward the southeast at 10 to 300 feet per mile, generally increasing with depth (Figure 4-2; Brune and Duffin, 1983). This dip angle excludes the effects of faulting.

The unconfined portion of the northern segment of the Edwards aquifer consists of the outcrop of the Edwards and associated limestones, which is wider in the north than in Travis County, near the Colorado River (fig. 3-10). This narrowing of the outcrop in the south occurs as a result of the combined effects of intense faulting and large topographic variations (fig. 5-2 and 5-3)

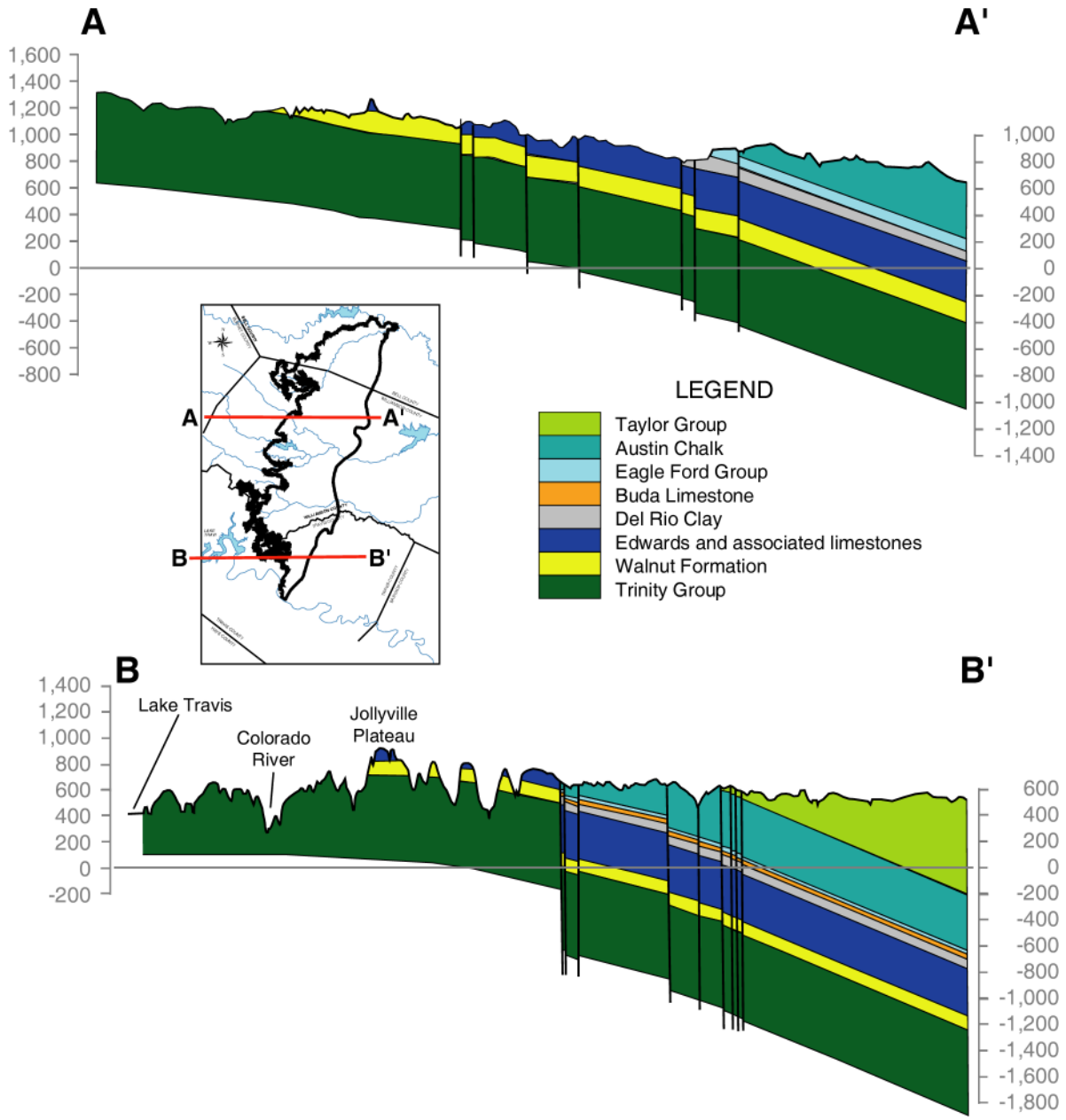

Figure 5-2. Geologic cross sections of the northern segment of the Edwards aquifer.

(Baker and others, 1986). Fracturing of the limestone also enhances the porosity of the limestone and plays a role in the development of karst features. Normal faulting, common in the southern portion of the study area, generally decreases toward the north (Baker and others, 1986). It is associated with the Balcones Fault Zone, a zone of faults about 6 to 8 miles wide that extends from Del Rio in south-central Texas to Dallas. This zone of normal faulting is characterized by major faults that strike north-south to northeast-southwest and dip 40 to 80° to the east, with a

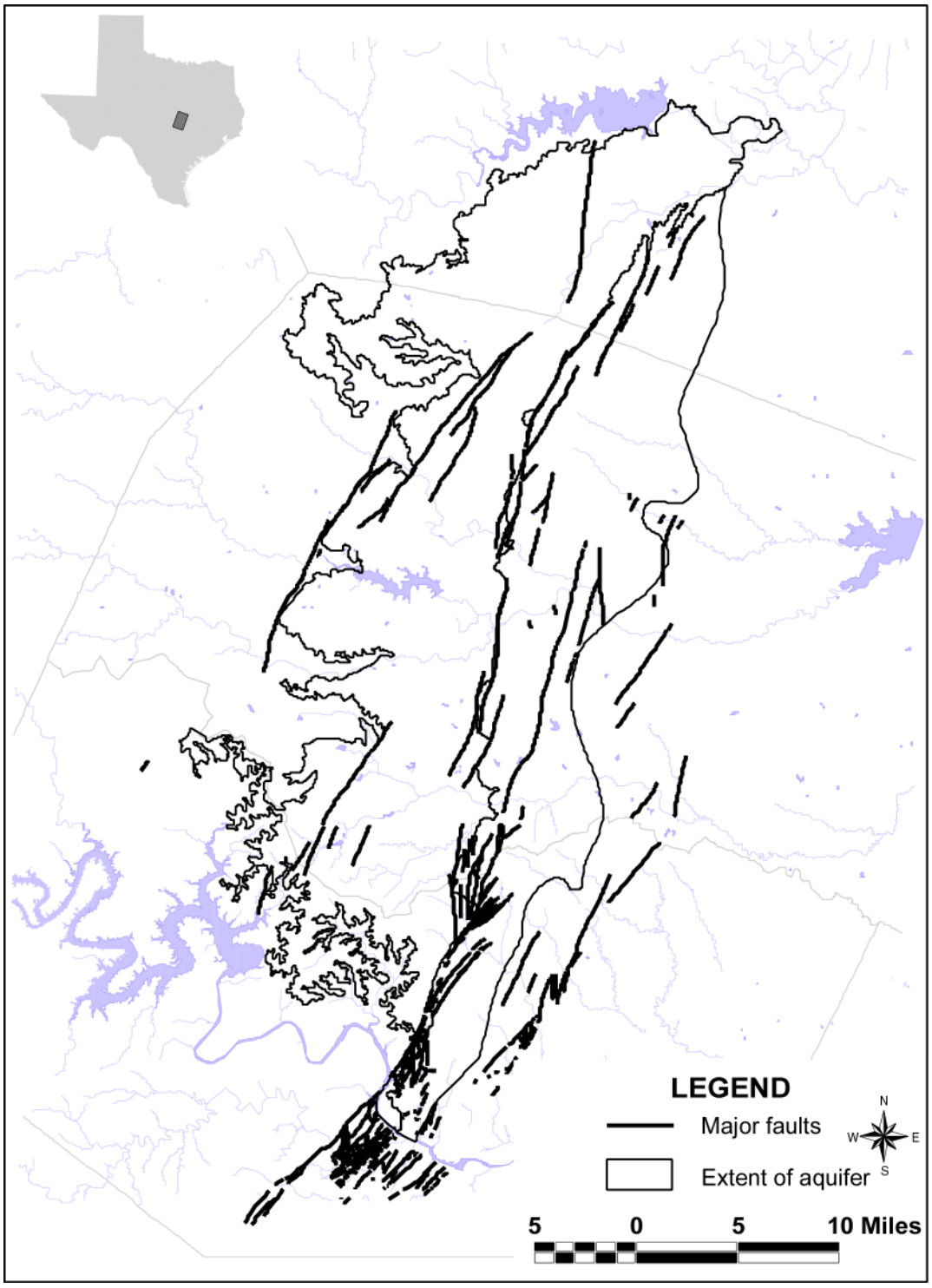

Figure 5-3. Major faults in the study area (adapted from Bureau of Economic Geology, 1981).

net displacement of 600 to 1,000 feet (Brune and Duffin, 1983; Collins, 1987). Cross faults, sub-perpendicular to major faults, are also common (Collins, 1987). In the Balcones Fault Zone, minor faults and joints occur mainly adjacent to the major faults and flexures. These minor faults, characterized by displacement of less than 6 feet, tend to form fracture zones up to 1 mile wide. Fracture densities in these zones lie in the range of 6 to 120 joints per 100 feet. Many of these minor faults are filled partly by calcite. However, the joints that occur in this area do not have mineral fillings, and abutting relationships suggest that these minor faults formed before the joints (Collins, 1987). Fracture apertures vary with stratigraphic units in the Edwards aquifer. Fracture apertures are generally less than 0.04 inches in Comanche Peak and Georgetown Formations and are up to several inches wide in the Edwards Limestone (Collins, 1987). These faults influence groundwater flow in two ways: faults provide preferential flow paths, and fault displacement in some cases produces barriers to groundwater flow (Brune and Duffin, 1983). Preferential groundwater flow along faults and joints in this aquifer often results in formation of solution cavities such as caves (Brune and Duffin, 1983).

Evaluation of fracture and lineament orientations in the northern part of the study area at different scales by Dahl (1990) shows different orientations of fractures varying in size from mapped major faults to field-observed fractures. The orientations of these fractures play a role in determining anisotropy in the aquifer. Dahl (1990) divided fractures into four groups: major mapped faults, high-altitude Landsat lineaments, field fractures, and topographic map lineaments. Major faults generally trend northeast-southwest. High-altitude Landsat lineaments are sparsely distributed and, together with the field fractures, are preferentially oriented northwest-southeast and northeast-southwest. The topographic map lineaments are generally randomly oriented, with only a slight northeast-southwest trend (Dahl, 1990). Adjacent to major faults, fractures are oriented generally northeast-southwest, approximately parallel to major faults of the Balcones Fault Zone. Away from major faults, fractures are oriented generally northwest-southeast. This trend of northwest-southeast- and northeast-southwest-oriented fractures is also observed in the more intensely faulted parts of the aquifer farther south (Kreitler and others, 1987).

The Edwards aquifer dips to the east at an average slope of 60 to 75 feet per mile (fig. 5-4 and 5-5). The slope varies generally because of faulting that produces a stair-step configuration downdip (Baker and others, 1986). The thickness of the northern segment of the Edwards aquifer increases generally toward the east, varying from less than 100 feet along the southern and western margins of the aquifer to more than 500 feet in the east (fig. 5-6).

5.3 Water Levels and Regional Groundwater Flow

In the northern segment of the Edwards aquifer, the potentiometric surface slopes generally toward the east and south adjacent to the Colorado River (fig. 5-7). Hydraulic gradients in the aquifer decrease east of the main faults of the Balcones Fault Zone (Senger and others, 1990). Intense fracturing in the Balcones Fault Zone suggests that the aquifer is anisotropic because of preferential flow through the generally northeast-southwest-oriented fractures (Baker and others, 1986; Duffin and Musick, 1991). Groundwater flow along fractures is responsible for the southward flow in the southern part of the study area, where fracturing is most intense. Senger and others (1990) suggested that some of the major faults, especially in the south, also act as

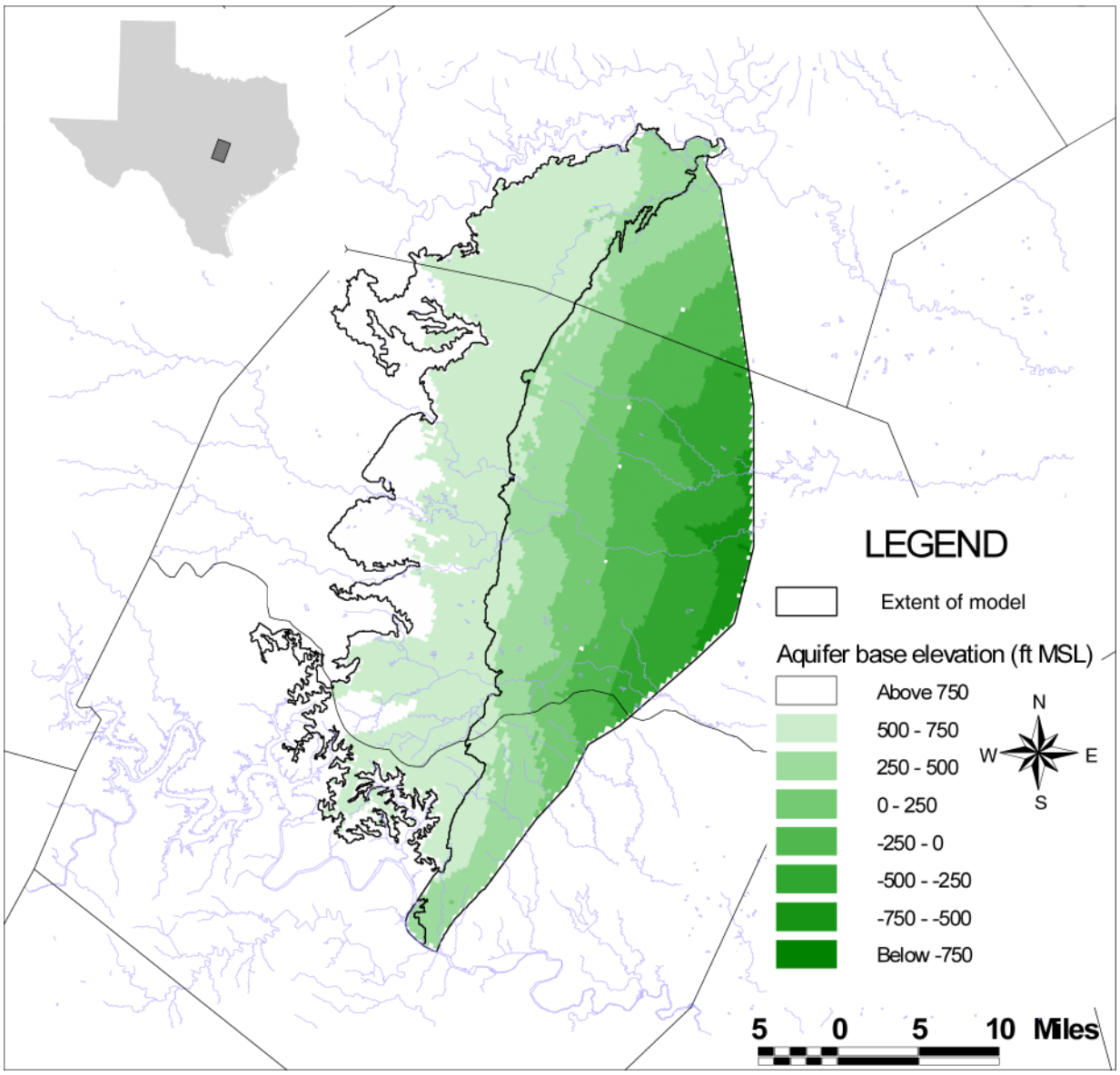

Figure 5-4. Elevation of the base of the Edwards aquifer (based on data from Collins and others, 2002).

hydraulic barriers, restricting west-to-east groundwater flow. In the central and northern parts of the aquifer, where faulting is less intense, the influence of fractures on regional groundwater flow is less apparent (Senger and others, 1990).

In the unconfined part of the aquifer, the water table occurs generally less than 100 feet below land surface and may approach land surface along incised streams (Senger and others, 1990). In the confined part of the aquifer, water levels approach or may in some cases exceed land surface, resulting in flowing wells. Water-level fluctuations observed in this aquifer are responses to changes in recharge and discharge rates associated with rapid recharge during wet periods (Baker and others, 1986). Adjacent to the Colorado River, water-level fluctuations are relatively small

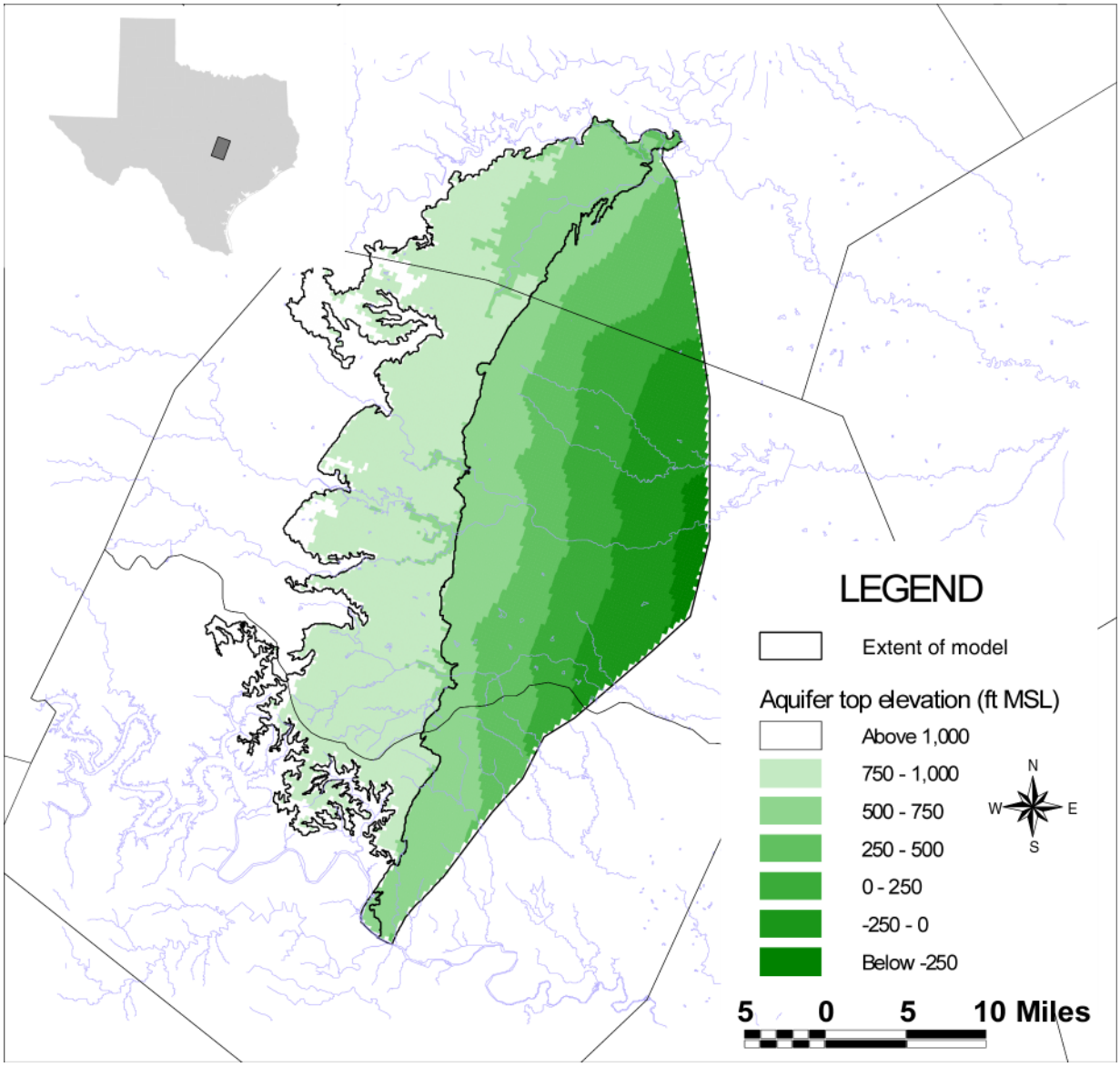

Figure 5-5. Elevation of the top of the Edwards aquifer (based on data from Collins and others, 2002).

because of the stabilizing effect of adjacent Lake Austin and Town Lake. Water-level declines have been observed during severe drought periods, such as the mid-1950s, 1983-84, and 1996 (Ridgeway and Petrini, 1999). A few available hydrographs indicate effects of pumping resulting in gradual long-term water-level decline. These hydrographs are from wells located mostly in the Pflugerville-Georgetown area. However, most hydrographs indicate a general balance between recharge and discharge in the aquifer (Baker and others, 1986; Dahl, 1990; Duffin and Musick, 1991; Ridgeway and Petrini, 1999).

Hydrographs in the unconfined part of the aquifer show generally synchronous water-level variations at many locations and a close correlation between precipitation and water-level

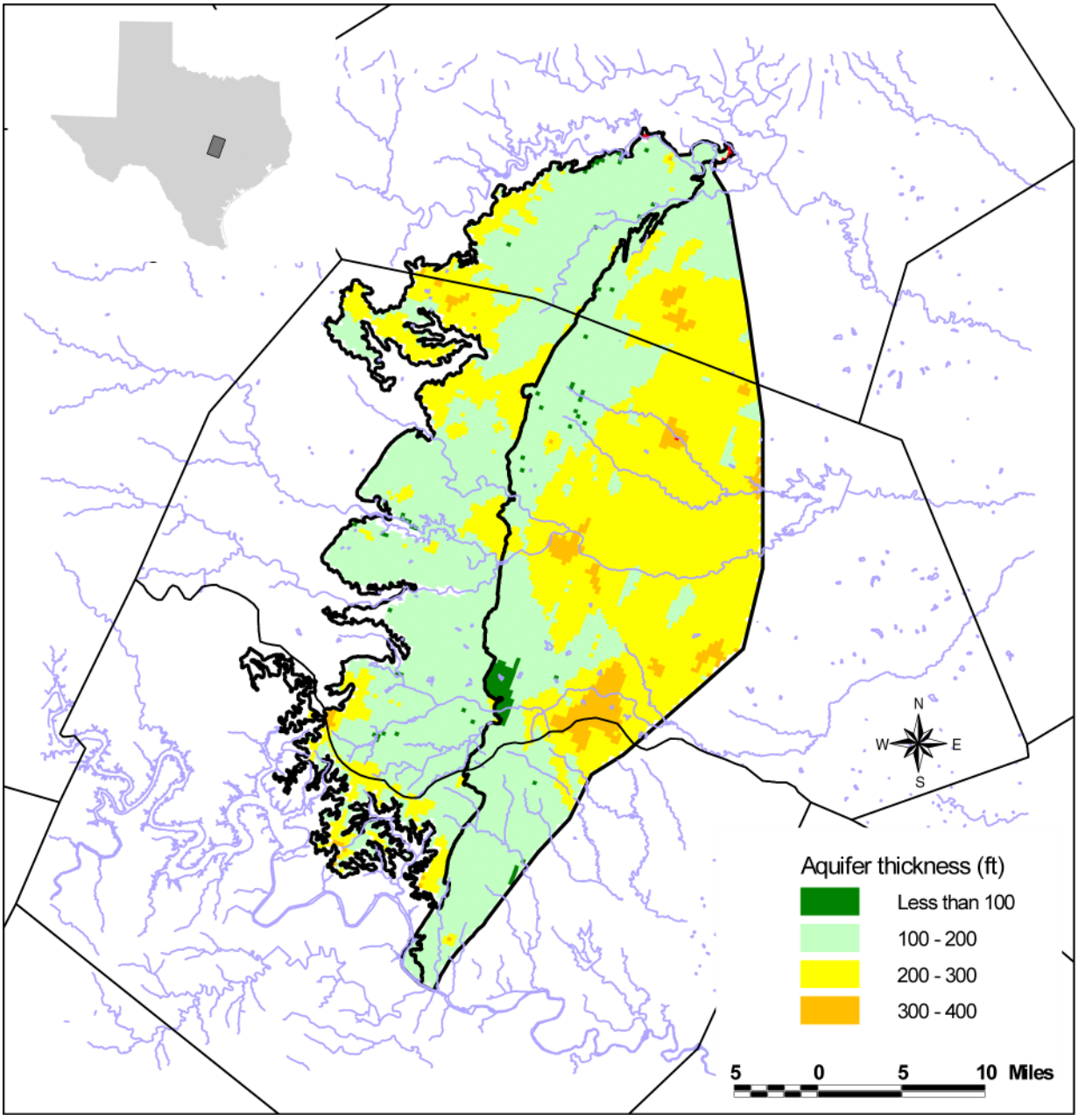

Figure 5-6. Thickness of the Edwards aquifer (based on data from Collins and others, 2002).

variation (Senger and others, 1990). Rapid water-level rises coincide with major rainfall events, especially during late spring and fall (fig. 5-8). The rate of water-level decline depends on the amount of recharge occurring during the recession period and the amount of nearby pumping (Senger and others, 1990). Continued rainfall tends to retard water-level declines, whereas pumping results in accelerated water-level declines. Hydrographs for wells in the confined part of the aquifer indicate a lag between major recharge events and water-level responses (Senger and others, 1990). In some parts of the aquifer, reversal of hydraulic gradients, partly related to increased pumping, has been observed during drought periods. This reversal suggests a potential

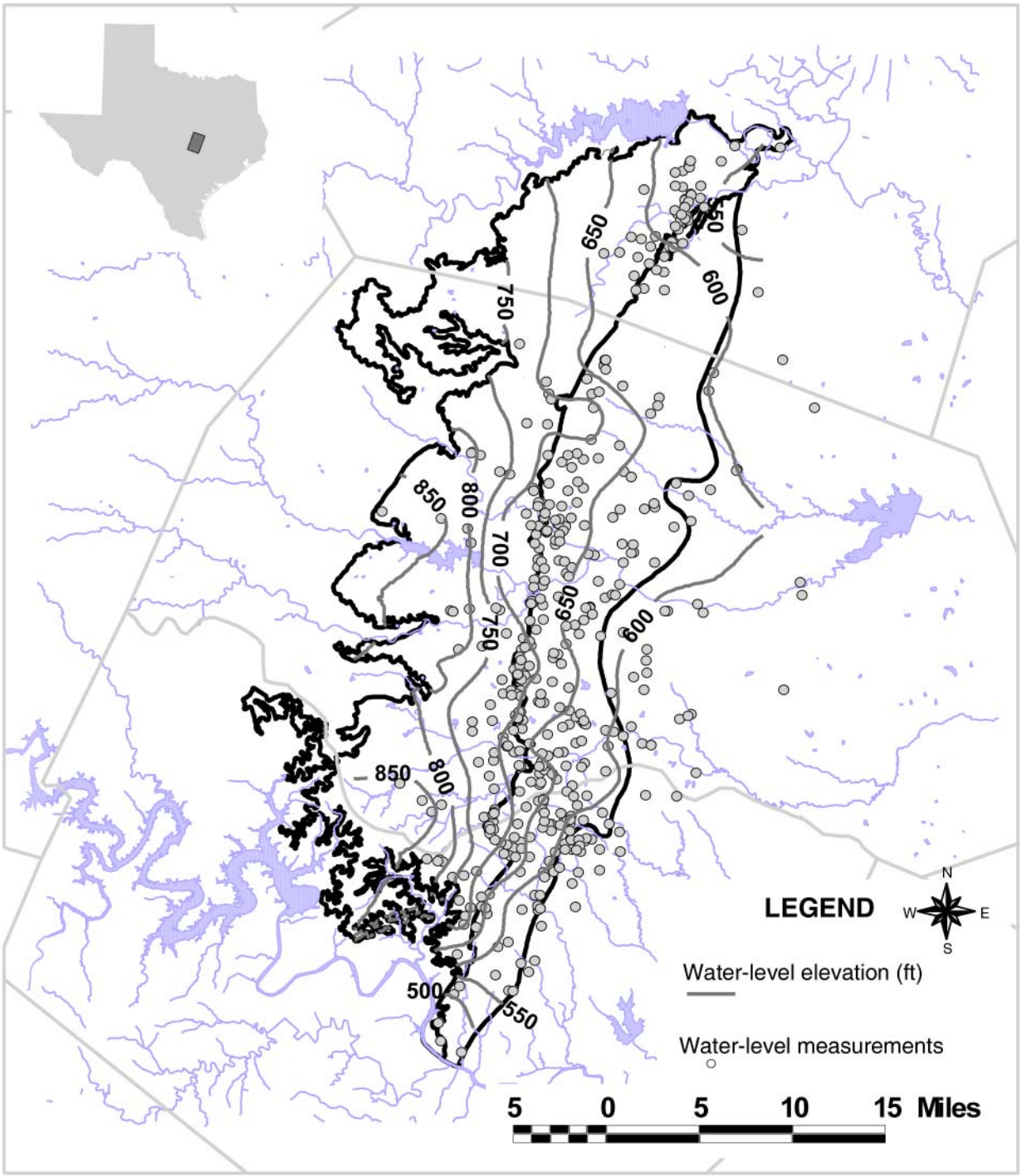

Figure 5-7. Water-level elevations in the northern segment of the Edwards aquifer.

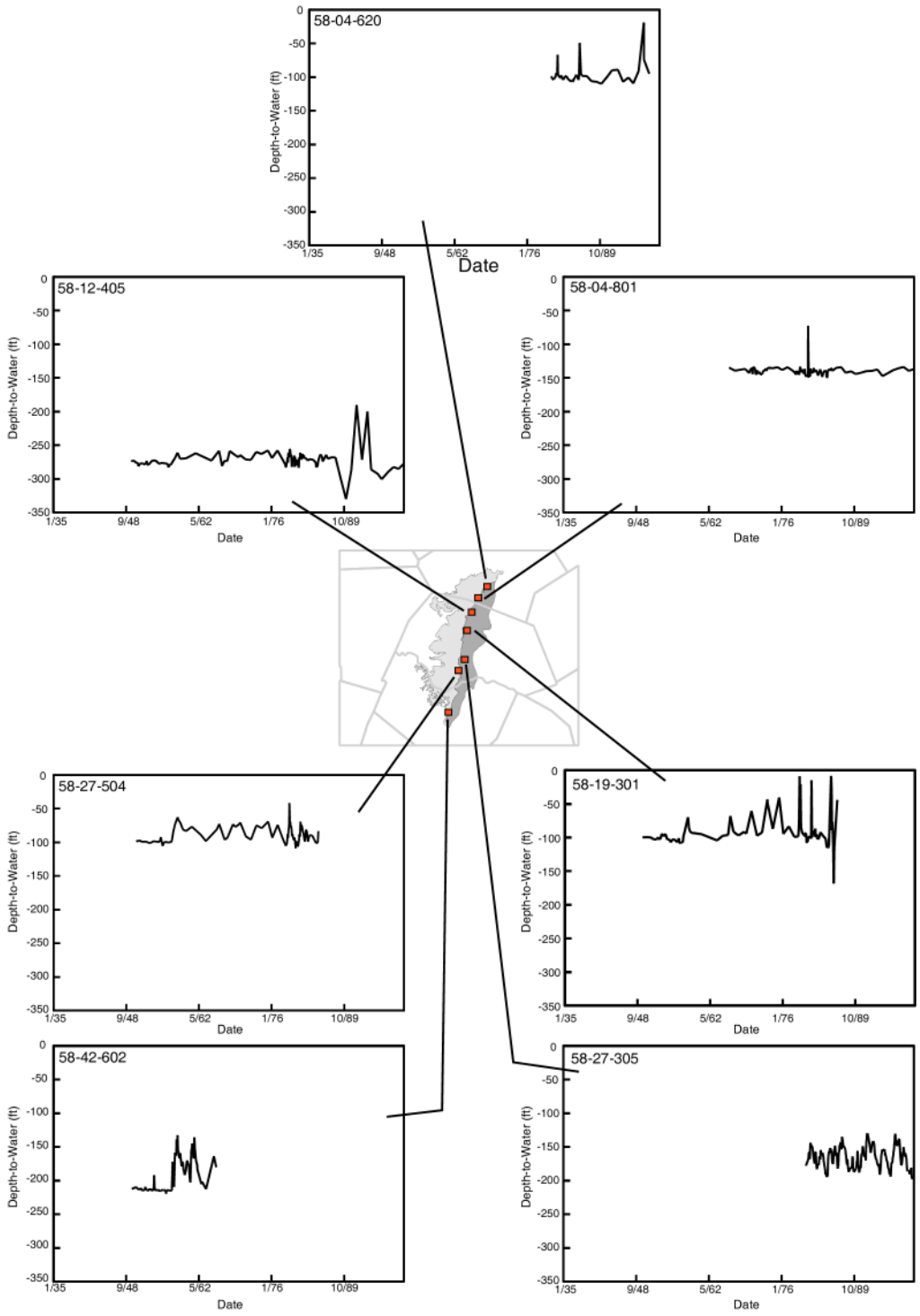

Figure 5-8. Groundwater hydrographs from selected wells in the study area.

for the influx of saline groundwater from depth. However, large, persistent cones of depression that could potentially produce this influx of saline groundwater have not been identified (Senger and others, 1990).

5.4 Recharge

Recharge to the Edwards aquifer takes the form of infiltration of precipitation that falls on the outcrop of the aquifer or infiltration of runoff derived from watershed areas upstream from the aquifer outcrop. The recharge zone in the northern part of the study area consists mainly of gently rolling terrain of the Lampasas Cutplains (fig. 3-5). In the south, the recharge zone is characterized by steeper, more highly dissected terrain of the Jollyville Plateau (Duffin and Musick, 1991). Both areas are characterized by the occurrence of numerous scattered karst features, such as dissolution-enhanced fractures, sinkholes, and caves, which are potential recharge sites. Sinkholes that occur in the Jollyville Plateau can transmit large amounts of water to the aquifer following heavy rainfall events (Kreitler and others, 1987). Recharge also takes the form of infiltration along faults and joints that intersect losing segments of perennial and intermittent streams that cross the study area. These fractures are often enlarged by karstification (Brune and Duffin, 1983). Infiltrating water tends to perch within the Georgetown Formation because of the occurrence of low-permeability shale members. Resultant lateral flow often discharges from small seeps and springs. Rapid recharge occurs when underlying Edwards and Comanche Peak limestones are encountered (Dahl, 1990).

Recharge processes are more complex in the north, where whether stream segments are gaining or losing depends on relative elevations of the water table and streambeds and thus may vary seasonally (Duffin and Musick, 1991). Streamflow studies by the United States Geological Survey (USGS) in 1978 and 1979 indicate that, in the north, streams generally act as points of groundwater discharge rather than recharge (fig. 5-9); (Senger and others, 1990; Duffin and Musick, 1991; Slade and others, 2002). Recharge in the north occurs primarily by intermittent streams and by infiltration of precipitation on the outcrop. Recharge also occurs in losing segments of the major rivers that occur along the western margin of the aquifer (Dahl, 1990; Slade and others, 2002). This recharge results in the formation of groundwater mounds along the upstream margin of the aquifer (fig. 5-7). Potential for recharge by cross-formational flow also exists from the underlying Trinity aquifer (Duffin and Musick, 1991).

Recharge estimates in the Salado Creek basin by Dahl (1990) indicate recharge of 15 percent of precipitation over the aquifer outcrop and 60 percent of storm runoff originating from upstream of the aquifer outcrop. These estimates of precipitation recharge were based on groundwater-level responses and an assumption of 2 percent porosity. The storm-runoff recharge was estimated based on stream discharge measurements above and below losing stream segments. Dahl (1990) indicated that recharge of precipitation in the Salado Creek basin contributes much larger volumes of water to the aquifer (about 29,000 acre-feet in 1985) than storm runoff (about 2,700 acre-feet).

Recharge due to cross-formational flow from the underlying Trinity aquifer is a possibility. However, it is unlikely that such cross-formational flow would contribute significantly to the Edwards aquifer because the two aquifers are separated by low-permeability units of the Glen Rose Formation hundreds of feet thick.

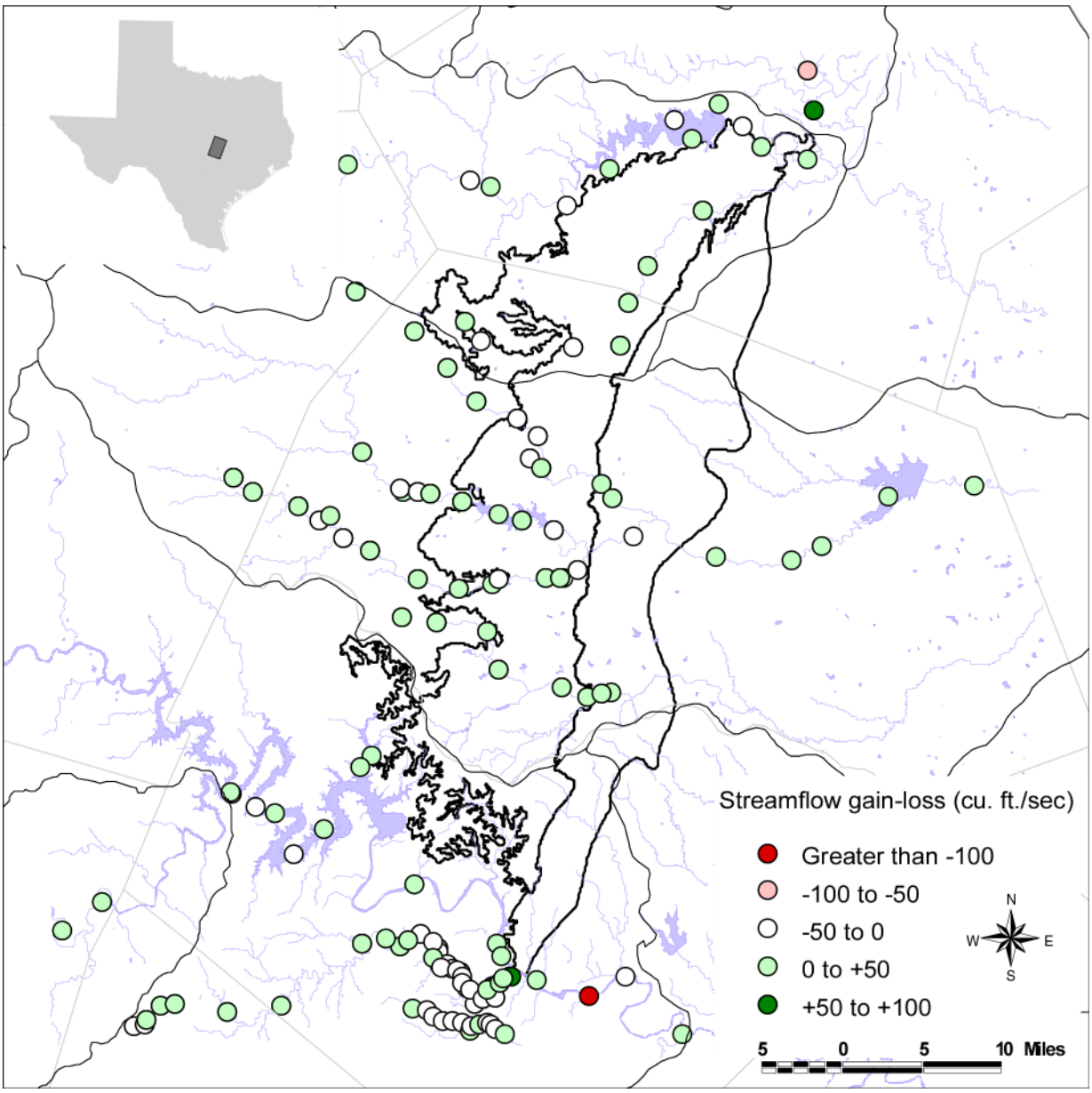

Figure 5-9. Streamflow gain-loss data from Slade and others (2002).

5.5 Rivers, Streams, Springs and Lakes

The northern segment of the Edwards aquifer is bisected by the hydrologic divide between the Colorado and Brazos River basins (fig. 5-10). This hydrologic divide coincides approximately with the boundary between Travis and Williamson counties. Consequently, surface water flows to the north and east toward the Brazos River in Bell and Williamson counties and toward the south to the Colorado River in Travis County. The Lampasas and Colorado rivers that form the northern and southern boundaries of the study area are the largest rivers in the area. Smaller rivers and creeks, such as Brushy Creek, Berry Creek, Salado Creek, and San Gabriel River,

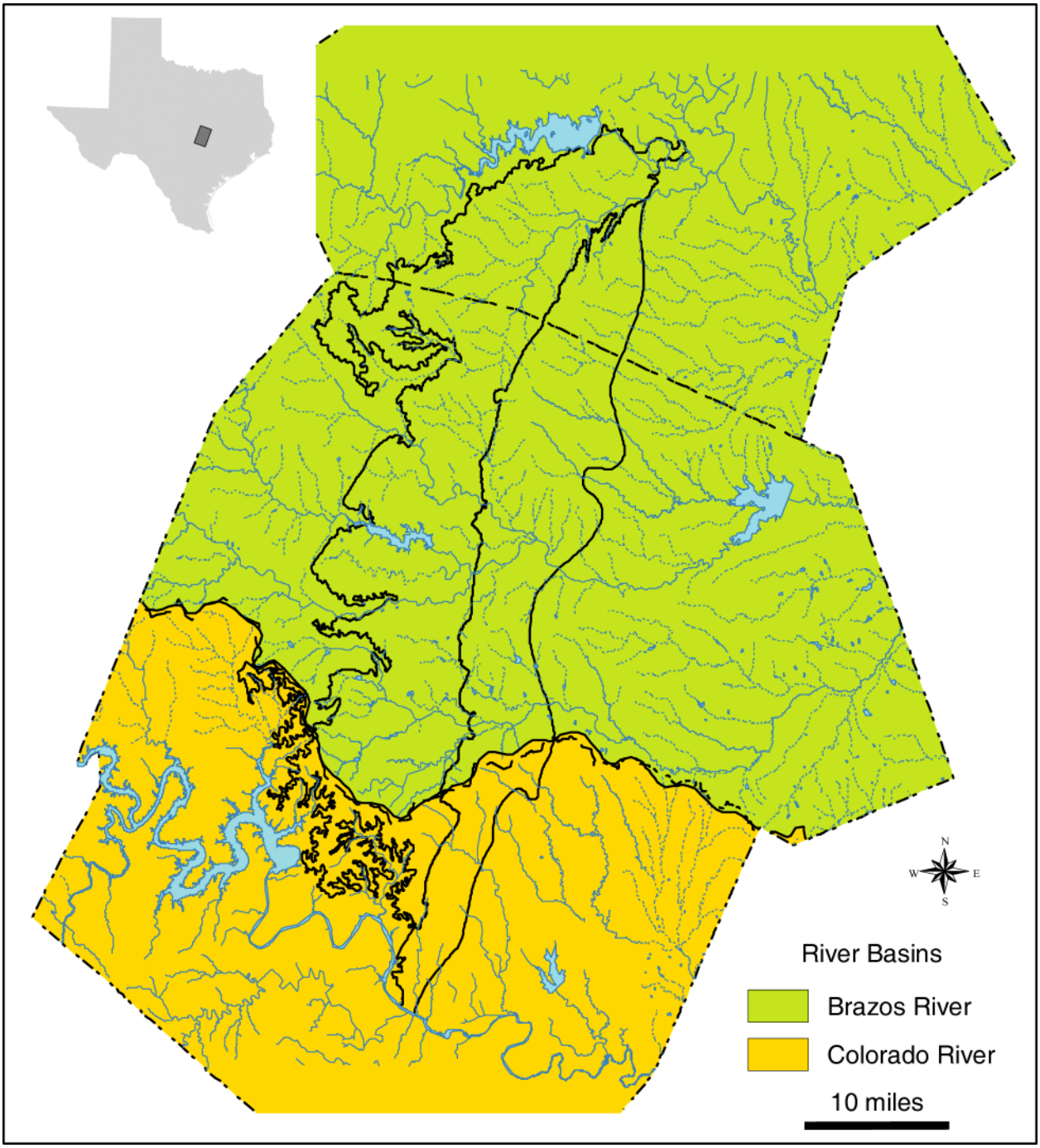

Figure 5-10. Location of river-basin boundaries in the study area.

cross the outcrop of the aquifer and are likely recipients of groundwater discharge, indicated by their perennial flow. Smaller tributaries of these rivers and creeks often flow intermittently as a result of storm-related runoff. Groundwater and surface-water systems are closely related in recharge and discharge zones, where interchange occurs as a result of recharge and discharge processes, respectively (Baker and others, 1986). Groundwater-surface-water interaction along gaining and losing stream segments of major rivers and creeks varies by location and hydrologic conditions because of significant hydrologic connections between streams and the underlying aquifer (Land and Dorsey, 1988).

In the study area, the relative impact on streamflow of storm-related runoff and groundwater discharge in the form of baseflow varies. Streams in which streamflow is dominated by baseflow are characterized by relatively small flow-rate fluctuations. Salado Creek, which is dominated by spring discharge, especially from Salado Springs, is an example of this type of stream (fig. 5-11). Streams dominated by storm runoff, such as Shoal Creek, are characterized by rapid recession after storms and low baseflow. Streamflow in Berry Creek is more representative of the streams in the study area, and streamflow fluctuations indicate inputs from both baseflow and storm-related runoff. Comparison of streamflow at pairs of stream gages can be used to indicate whether the stream is losing flow owing to recharge or receiving groundwater discharge (fig. 5-12). Decreased downstream flow commonly indicates a losing stream because of recharge to the underlying aquifer, whereas consistent increases in flow are quite often the result of groundwater discharge entering the stream. In the study area, decreased streamflow in downstream parts of Shoal Creek is consistent with recharge to the aquifer, whereas increased downstream flow in Berry Creek and the San Gabriel River can be attributed to groundwater discharge through numerous springs and seeps that occur in the area (fig. 5-12).

Spring and seeps in the western part of the aquifer discharge mostly from fractures or cavities in the Edwards Limestone or along the contact between the Edwards and Comanche Peak Limestones (Kreitler and others, 1987). In the east, major springs are associated with major faults, generally occurring some distance east of these faults.

5.6 Hydraulic Properties

As one would expect in a karst system, the hydraulic properties of Edwards aquifer rocks are highly variable. This variability can be attributed to many factors, such as (1) limestone primary porosity due to facies changes within or between individual stratigraphic units, (2) fracture densities, and (3) development of karst features. Hovorka and others (1996) showed that limestones deposited in subtidal environments exhibit lower porosities than carbonate sandstones or dolomite. On the basis of outcrop descriptions, Hovorka and others (1998) showed that fractures and karst features make up 1 to 3 percent of the outcrop area, and karst features develop preferentially adjacent to faults and in dolomitized limestone. Matrix permeability accounts for only about 1 percent of the flow through the aquifer, and the remainder is contributed by fractures and karst features.

Transmissivity estimates for the Edwards and associated limestones in the northern segment of the Edwards aquifer vary widely, lying in the range of 0.5 to 4×10^6 ft^2/day, seven orders of magnitude (fig. 5-13). These transmissivity estimates are calculated from specific-capacity data from the Texas Water Development Board (TWDB) well database using methods outlined in

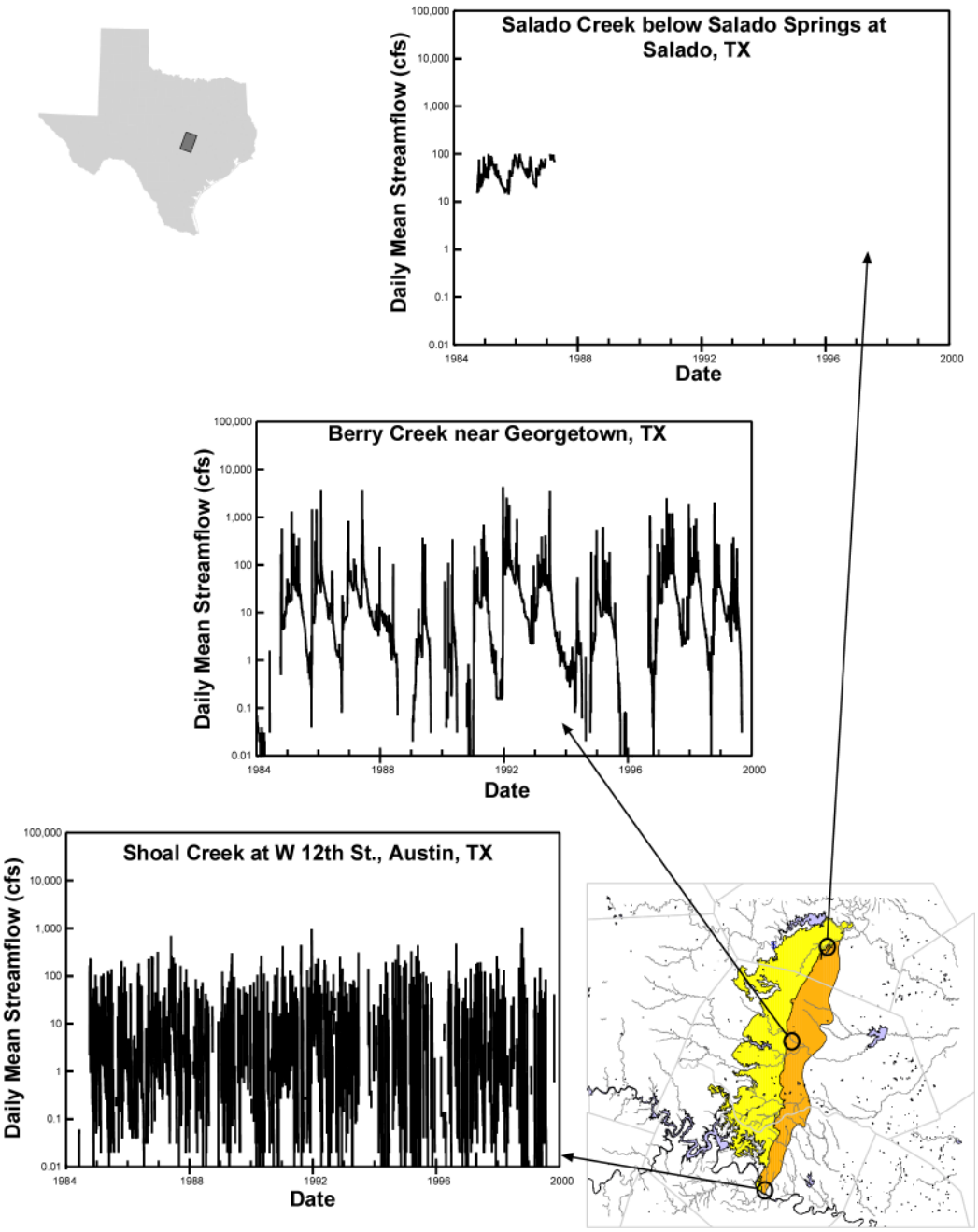

Figure 5-11. Historical mean daily streamflow at selected USGS gaging stations in the study area.

Mace (2001a). The highest transmissivities can be attributed to cave systems, whereas solution-enhanced fracture porosity and intergranular porosity produce intermediate and low transmissivities, respectively (Hovorka and others, 1998). In the aquifer, transmissivity in the central part of the unconfined aquifer is generally higher than along the eastern or western boundaries. This phenomenon is attributed to fracture densities that are associated with the major faults of the Balcones Fault Zone.

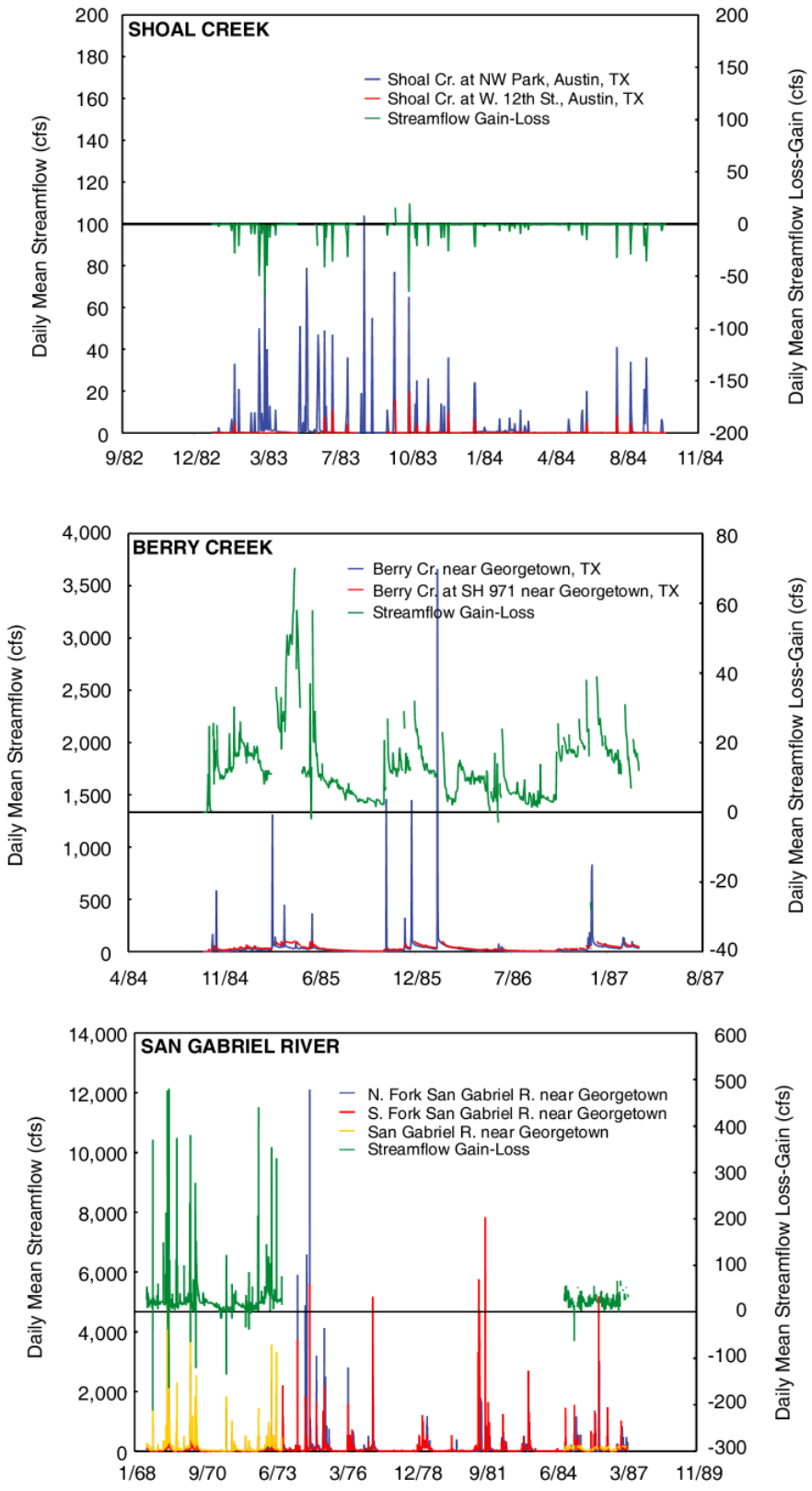

Figure 5-12. Mean daily streamflow and streamflow gain-loss at upstream-downstream

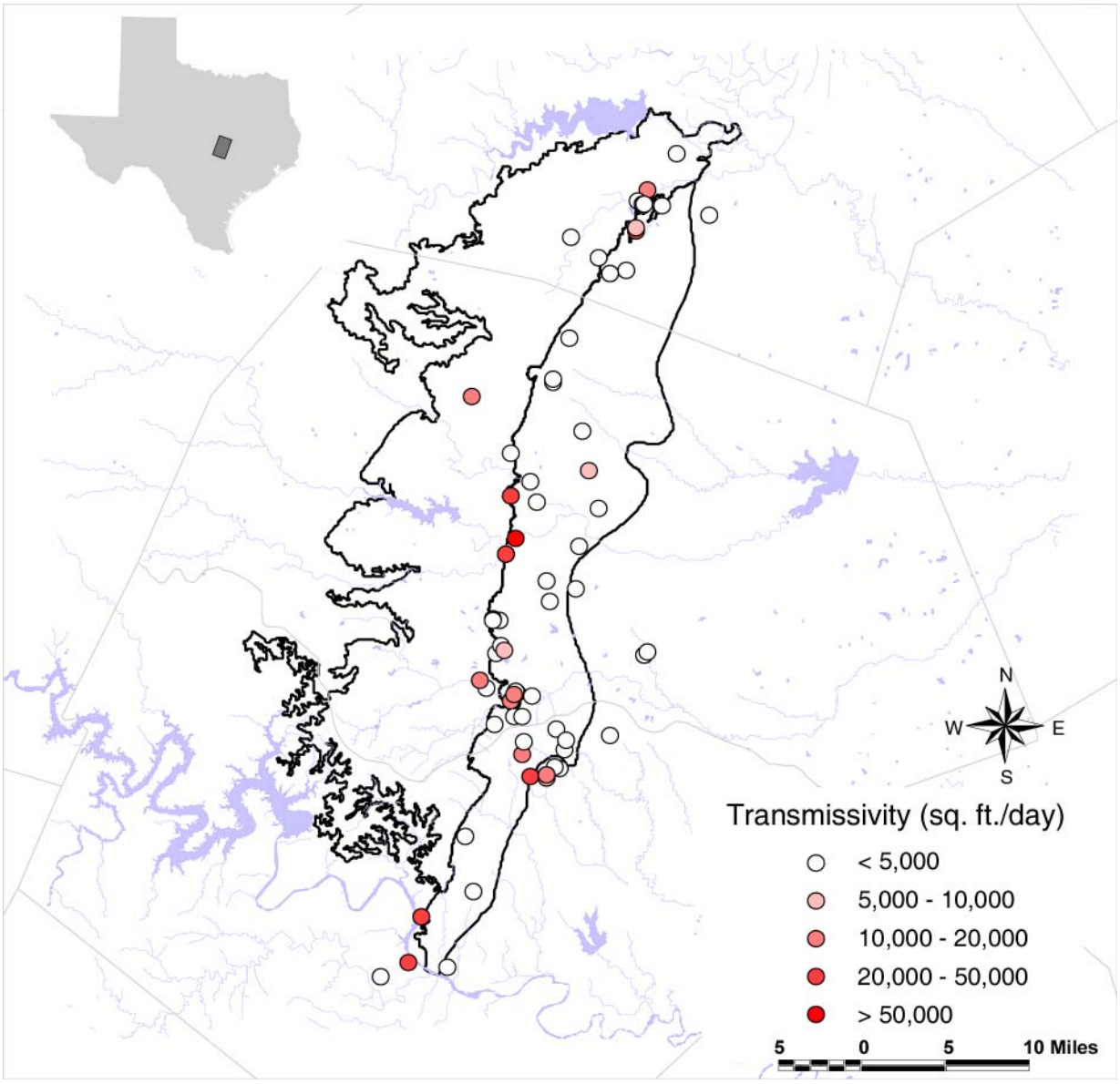

Figure 5-13. Transmissivity estimates based on specific capacity data.

There is little hydraulic conductivity data that are based on pumping tests for the northern segment of the Edwards aquifer. Transmissivity data from the available specific capacity test data were converted to hydraulic conductivity based on aquifer thickness (fig. 5-14). Resultant hydraulic conductivity values range between 0.01 and more than 30,000 ft/day, and median and geometric mean values are 9 ft/day. These values overlap with hydraulic conductivity data (2.7×10^{-5} to 13 ft/day) for the San Antonio segment of the Edwards aquifer (Hovorka and others, 1996). There is very little hydraulic conductivity data on the unconfined part of the aquifer. Spatial distribution of the data suggests no trends, with the highest hydraulic conductivity occurring within a few hundred feet of very low hydraulic conductivity values. Initially it was decided to distribute hydraulic conductivity in the model in three zones, the Jollyville Plateau

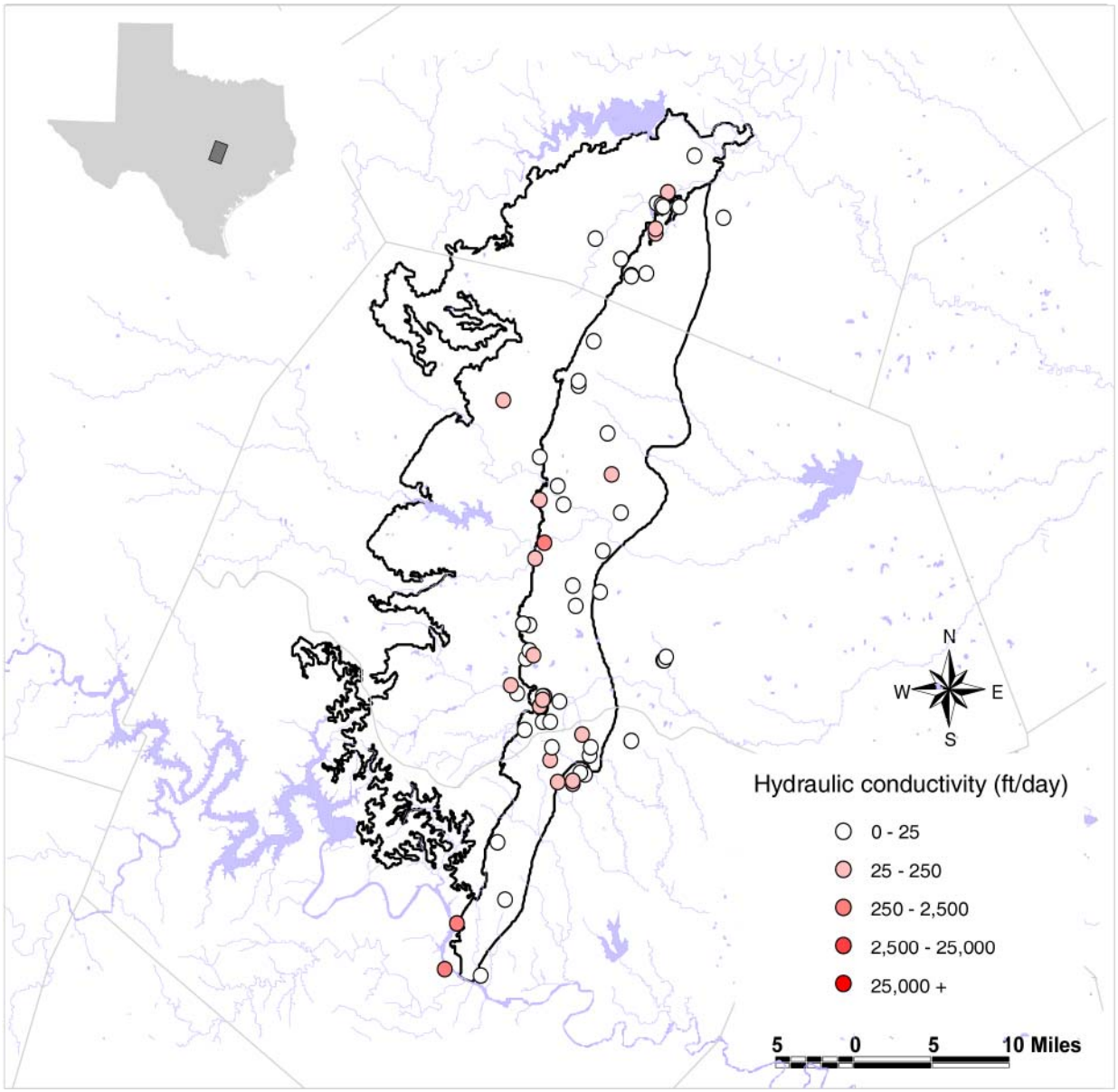

Figure 5-14. Hydraulic conductivity estimates based on specific capacity data.

outcrop, the remainder of the Edwards aquifer outcrop, and the confined part of the aquifer. The Jollyville Plateau zone coincided with the outcrop of relatively low permeability stratigraphic units, such as the Keys Valley Marl, Comanche Peak Limestone, and Cedar Park Limestone. The remainder of the aquifer outcrop is composed of the Edwards Limestone and Georgetown Formation, which have generally higher permeability than the Jollyville Plateau. The lower hydraulic gradients in the downdip part of the aquifer were initially thought to indicate higher permeability.

No published storativity data exist for the northern segment of the Edwards aquifer. Consequently, specific yield and specific storage values from the groundwater availability model

for the adjacent Barton Spring segment of the Edwards aquifer were used to represent storage in the northern segment of the Edwards aquifer (Scanlon and others, 2001).

5.7 Discharge

Groundwater discharge from aquifers can take the form of pumping, discharge to springs or seeps, or cross-formational flow to an adjacent aquifer.

The northern segment of the Edwards aquifer is only slightly to moderately developed. Consequently, natural discharge through springs and seeps is thought to be much larger than well pumping (Duffin and Musick, 1991). TWDB pumping estimates indicate total groundwater pumping of 30,000 acre-feet during 1999 (fig. 5-15). Municipal and rural domestic pumping together account for almost 90 percent of the groundwater withdrawn from the aquifer. Unlike in the San Antonio segment, irrigation pumping is insignificant in the northern segment of the Edwards aquifer. Municipalities that use northern Edwards groundwater are located mainly in the northern part of the aquifer segment and include Salado, Georgetown, Pflugerville, and Round Rock. During the 1980s and 1990s, rural domestic pumping fluctuated between 10,000 and 15,000 acre-feet per year (fig. 5-16). During the same period, irrigation pumping estimates rose rapidly from 1 to 3 acre-feet per year in the early 1980s to approximately 18 acre-feet per year in the early 1990s. Municipal pumping also fluctuated, ranging from 6,000 to 13,000 acre-feet per year. In both rural domestic and municipal pumping, pumping generally increased over the time period. Irrigation pumping in the study area apparently ceased in 1994. Manufacturing pumping increased gradually through the 1980s and 1990s, from 1,500 acre-feet per year to 2,500 acre-feet per year. Livestock pumping increased during the early 1980s, from less than 50 acre-feet per year to about 150 acre-feet per year, and has remained generally constant since then. Overall, total pumping from the northern segment of the Edwards aquifer increased rapidly during the early 1980s, from less than 20,000 acre-feet per year to about 25,000 acre-feet per year (fig. 5-15). In subsequent years, pumping from the northern Edwards aquifer has increased gradually.

The spatial distribution of pumping has been determined based on the spatial distribution of respective users: rural domestic, municipal, irrigation, manufacturing, and livestock (fig. 5-17). For example, rangeland used for rearing livestock is located primarily on the western side of the study area. Consequently, one would expect that pumping for livestock would be concentrated on the western, unconfined part of the aquifer. Pumping for rural domestic uses is a function of population density outside city limits. Consequently, the spatial distribution of rural domestic pumping varies with population density. Municipal and manufacturing wells extracting water from the northern segment of the Edwards aquifer are located primarily adjacent to the boundary between the confined and unconfined parts of the aquifer. These wells are located mostly in southern and central Williamson County and are associated with the municipalities that depend on Edwards aquifer groundwater, such as Georgetown, Round Rock, and Pflugerville. Irrigation pumping is relatively minor in the study area. Cultivated farmland and associated irrigation are located primarily in the eastern part of the aquifer. Seasonally, pumping peaks during the dry summer months and declines from fall through spring, when most rainfall occurs (Kreitler and others, 1987).

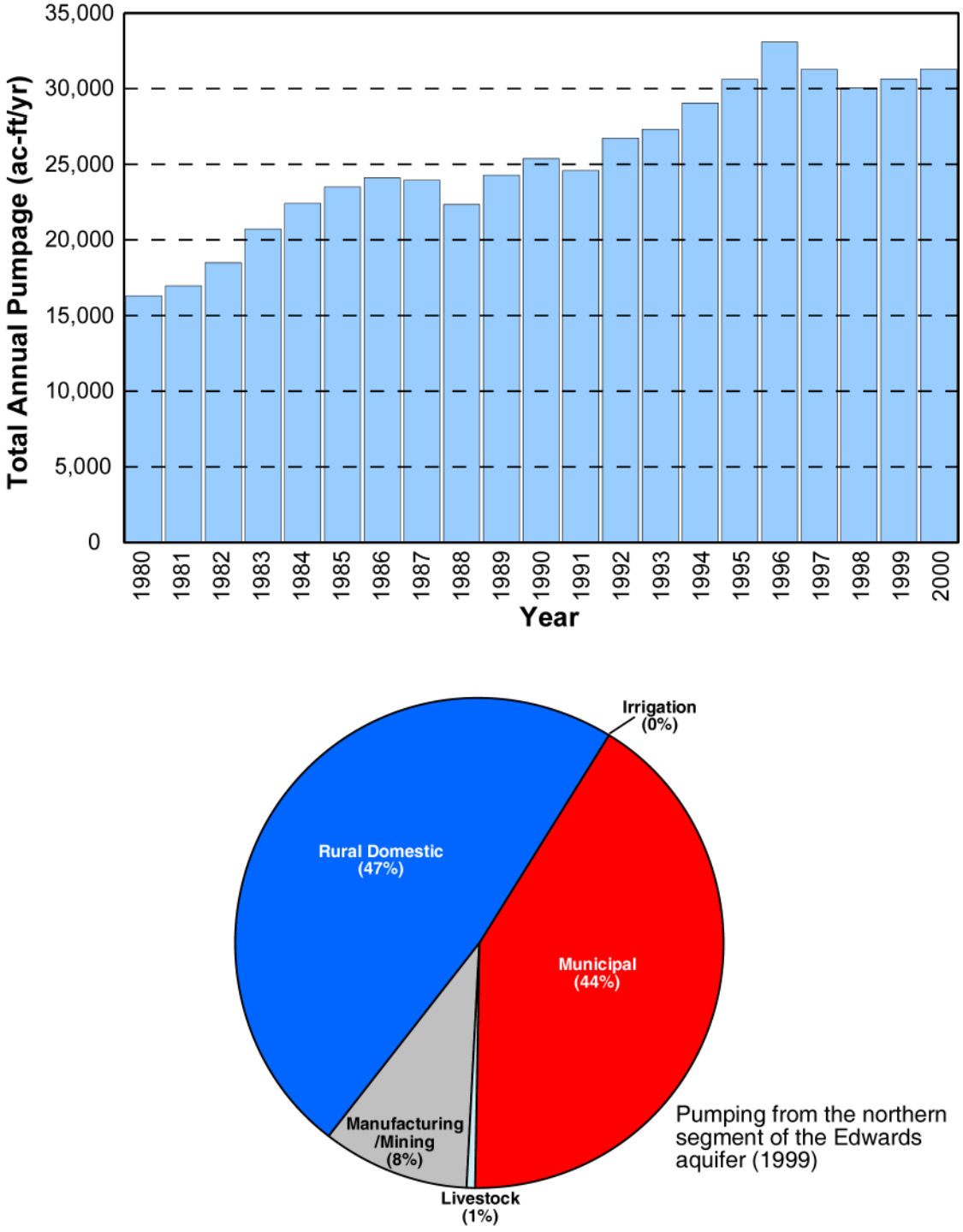

Figure 5-15. Total annual groundwater withdrawals from Edwards aquifer (1980-2000).

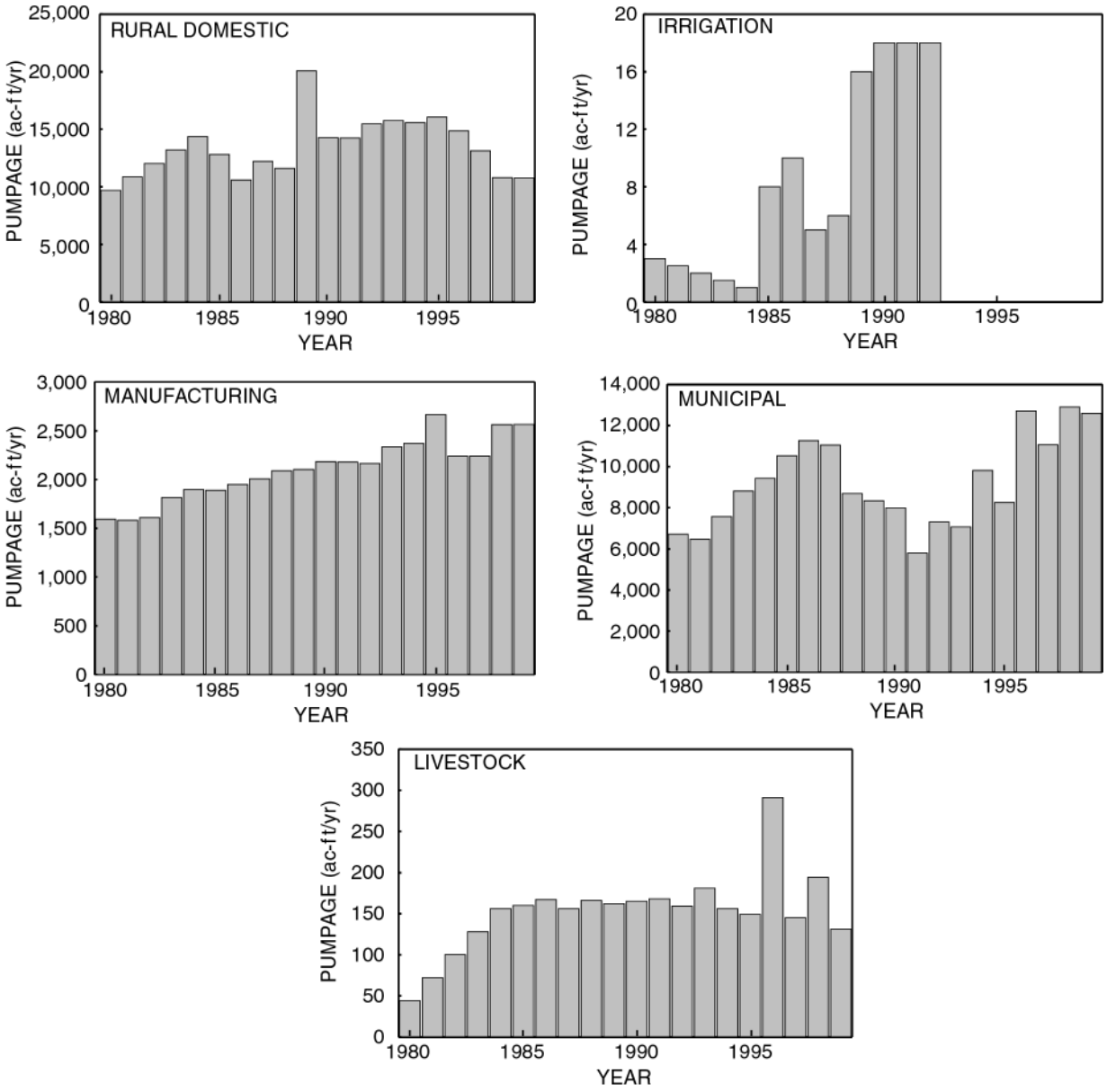

Figure 5-16. Annual groundwater withdrawals for rural domestic, irrigation, manufacturing, municipal, and livestock uses.

Precipitation over the recharge zone and the upstream contributing zone results in rapid increases in spring discharge. The lag time between precipitation events and spring response varies from almost immediate to more than 1 week (Brune and Duffin, 1983). Faulting frequently results in the juxtaposition of relatively impermeable Del Rio Clay and Buda Limestone and Edwards aquifer rock. This juxtaposition restricts groundwater flow across faults and often results in upward flow along the fault and discharge through springs (Brune and Duffin, 1983; Land and Dorsey, 1988; Senger and others, 1990). Hence the occurrence of several major springs—for example, Mount Bonnell, Salado, San Gabriel, and Berry springs, adjacent to the boundary between unconfined and confined parts of the aquifer (fig. 5-18). Other major springs occurring

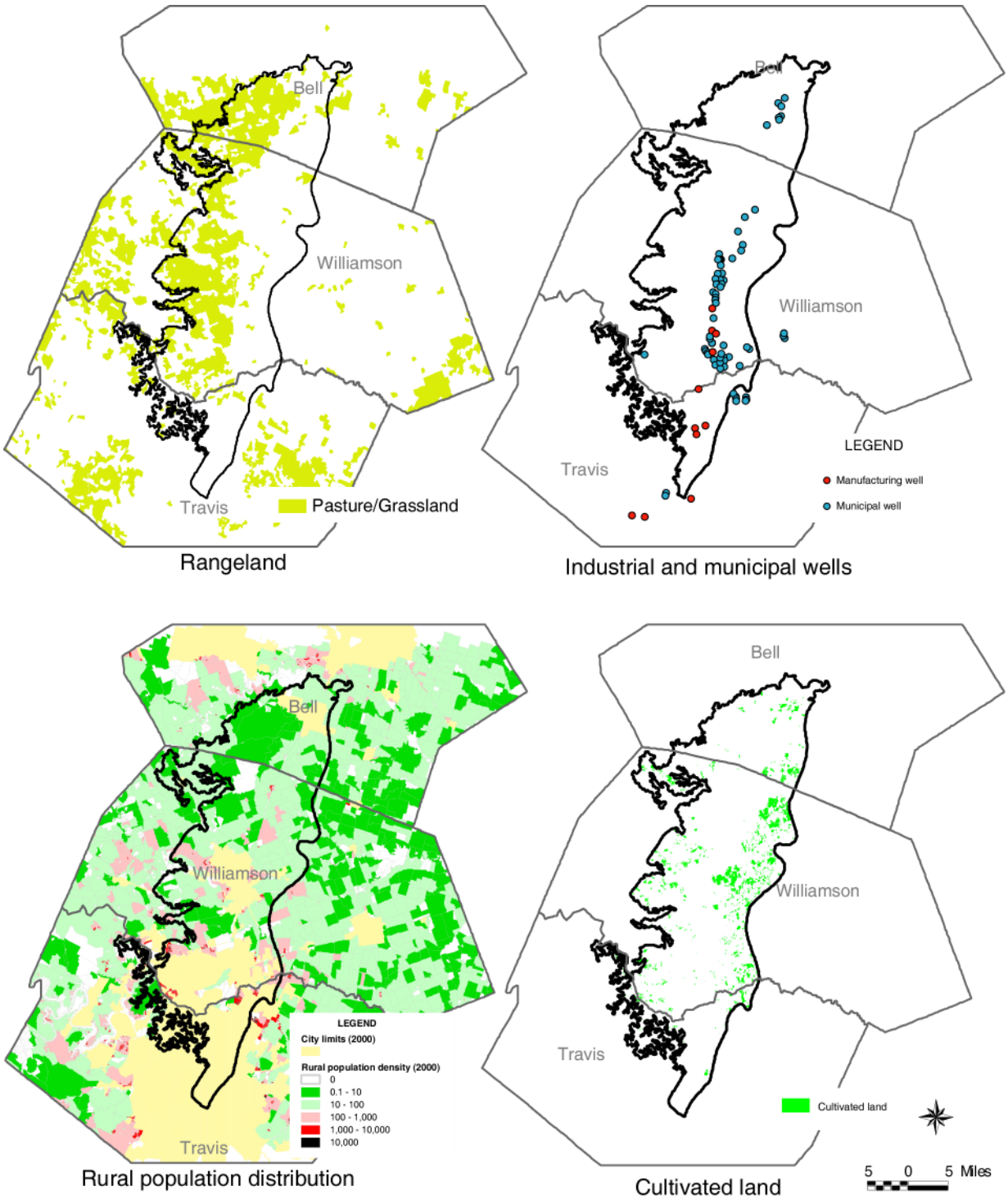

Figure 5-17. Spatial distribution of pumping for rural domestic, irrigation, manufacturing, municipal, and livestock uses.

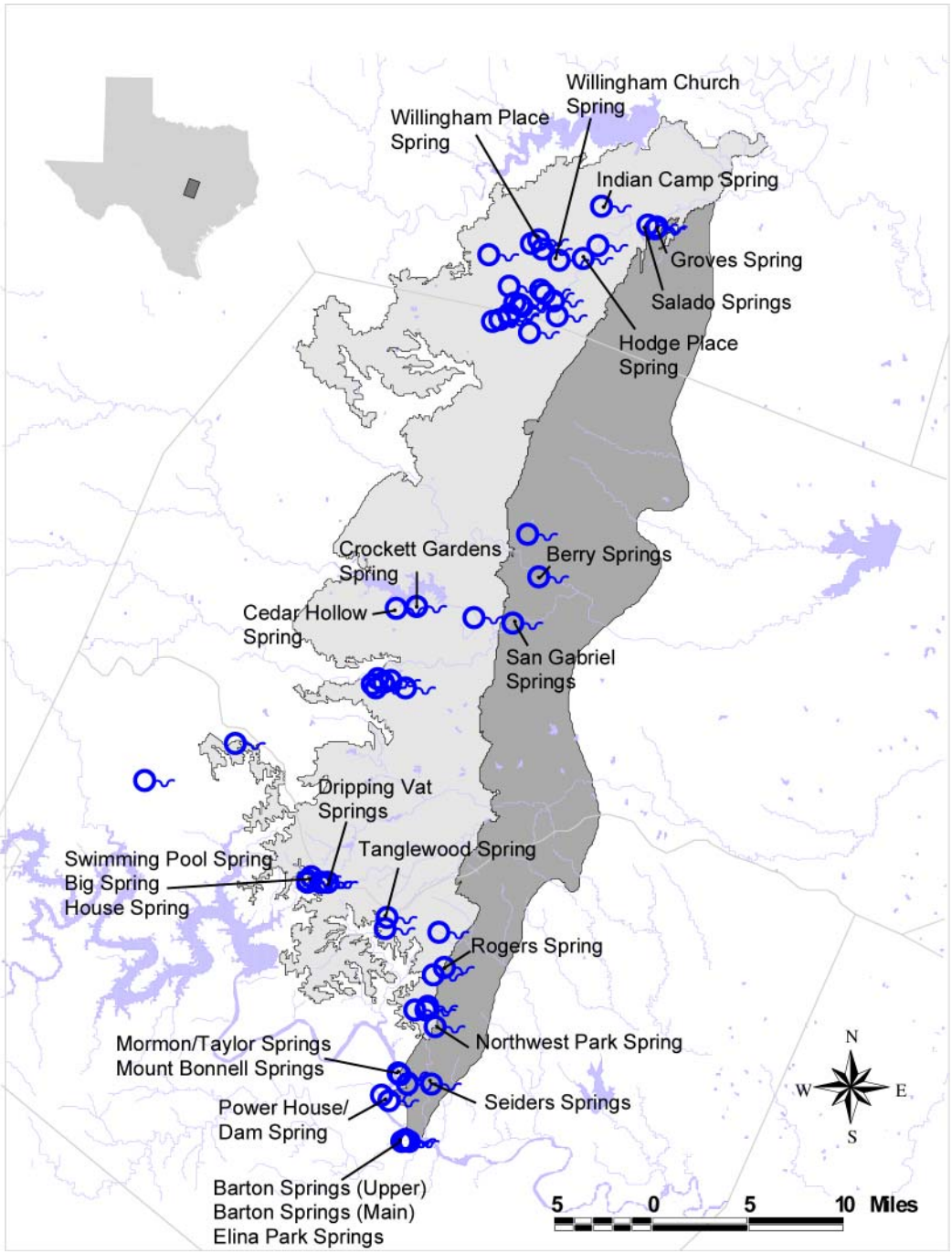

Figure 5-18. Location of major springs discharging from the Edwards aquifer in the study area.

in the study area include Childers Springs in Bell County; Deep Eddy, Mormon, Power House, and Seiders springs in Travis County; and Berry, Knight, San Gabriel, and Manske springs in Williamson County (Brune, 1975). Along the southern margin of the study area, discharge from

the aquifer often takes the form of numerous small springs or seeps located along the southern margin of the Jollyville Plateau (Senger and others, 1990).

Discharge through springs and seeps is most likely to occur within or adjacent to the unconfined part of the aquifer. Discharge in the confined part of the aquifer takes the form of cross-formational flow from the Edwards aquifer, through the Del Rio Clay, into overlying aquifer units such as the Austin Chalk.

5.8 Water Quality

Geochemical compositions of groundwater in the Edwards aquifer are used in defining the downdip margin of the aquifer. This boundary, referred to as the bad-water line, is defined as the easternmost extent of freshwater in the aquifer. Freshwater is defined as water with total dissolved solids (TDS) of less than 1,000 mg/l. Use of the bad-water line as the eastern boundary of the aquifer is justified because high-TDS groundwater is associated with restricted groundwater circulation (Ridgeway and Petrini, 1999), which has been confirmed by the occurrence of relatively low concentrations of tritium compared with those of updip parts of the aquifer.

Groundwater in the northern segment of the Edwards aquifer becomes progressively more mineralized from the outcrop recharge zone in the west to downdip parts of the aquifer in the east (Figure 4-19). Groundwater TDS varies from 200 to 400 mg/l in the recharge zone and increases to more than 3,000 mg/l downdip (Baker and others, 1986). Intense faulting in the south creates barriers to eastward groundwater flow and results in the occurrence of slightly to moderately saline groundwater within 1 to 2 miles of the recharge zone. This distance is much less than that of parts of the aquifer farther north, where faulting is less intense and saline groundwater occurs more than 10 miles from the recharge zone. In addition to variations of TDS across the aquifer, groundwater geochemical compositions also vary downdip from Ca-HCO_3- to Na-SO_4-type waters and Na-Cl-type water (fig 5-19); (Brune and Duffin, 1983). These hydrochemical patterns indicate hydrochemical evolution of groundwater along flow paths. In the south, where faults are more abundant, hydrochemical zones are much narrower than in the north. The large faults that disrupt groundwater flow may also provide pathways for an influx of deep saline groundwater, especially in the south (Senger and others, 1990).

The spatial distribution of groundwater having different geochemical compositions reflects the interaction of two main flow systems in the aquifer. These flow systems involve (1) rapid circulation of fresh groundwater from the recharge zone and (2) a slow influx of saline groundwater from downdip (Senger and others, 1990). The Ca-HCO_3-type water that occurs within or adjacent to the recharge zone is characterized by high tritium of 7 to 11 Tritium Units (TU). The slowly circulating groundwater is characterized by low tritium (< 1 TU) and mixed-cation-HCO_3-, Na-HCO_3-, and Na-mixed-anion-type groundwater (fig. 5-19). The contrasting low and high tritium in confined and unconfined parts of the aquifer, respectively, indicate that most groundwater circulation in the aquifer occurs in the unconfined part of the aquifer. The boundary between low- and high-tritium groundwater coincides with the bad-water line, indicating relatively little circulation of recently recharged groundwater in the saline parts of the aquifer. The bad-water line also follows the downdip boundary of the Na-HCO_3 zone in the north. In the south, where the Na-HCO_3 zone disappears, the bad-water line forms an irregular

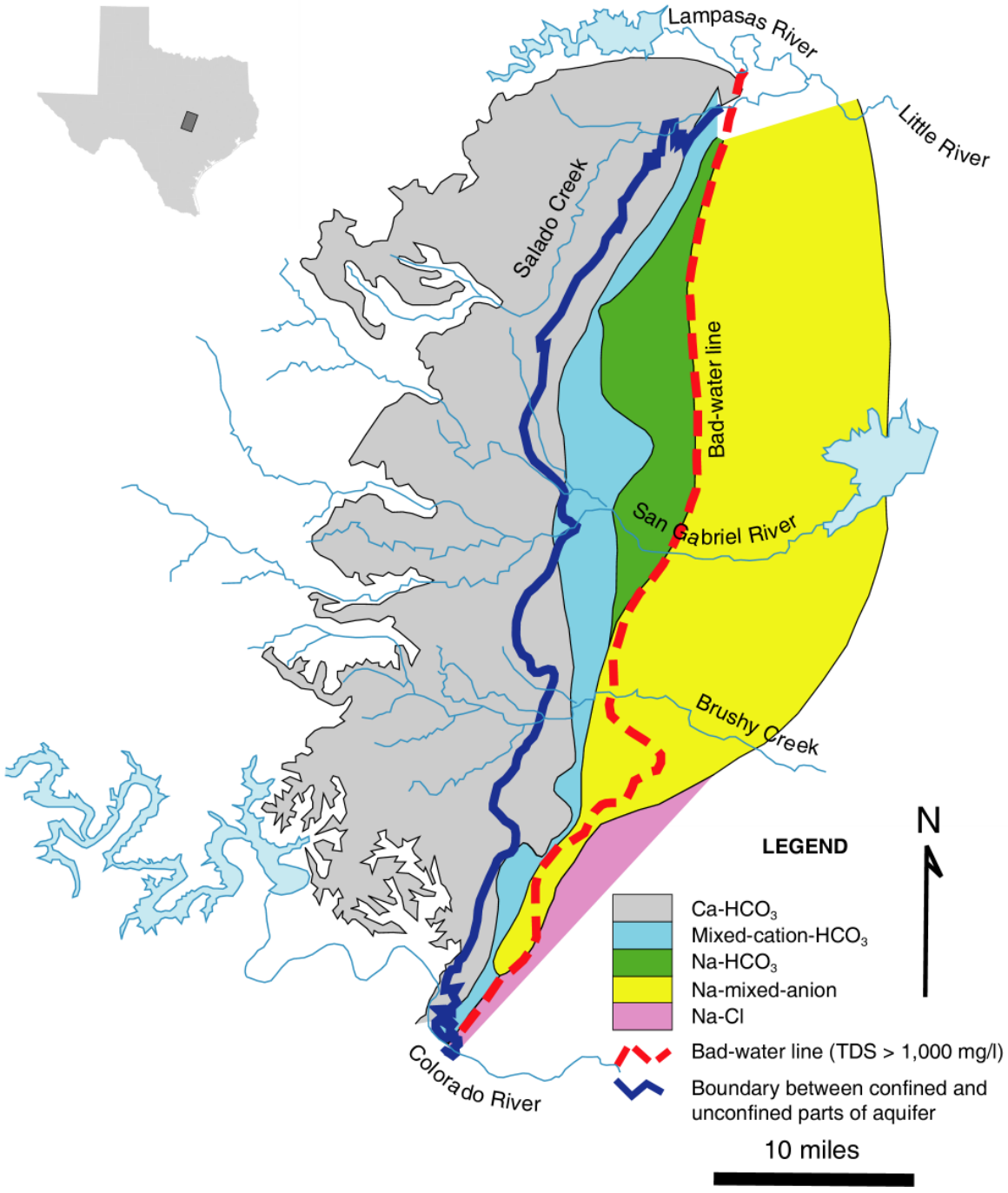

Figure 5-19. Variation of Edwards aquifer groundwater chemical compositions in the study area (modified from Senger and others, 1990).

pattern partly because of localized recharge along faults. At the Colorado River, the bad-water line coincides with the updip boundary of the Na-Cl zone. The north-south variation of groundwater geochemical zones can be explained by the relative influence of fresh and saline groundwater flow systems. In the south, where the influx of freshwater is restricted because of faulting, groundwater geochemical compositions are influenced largely by updip movement of Na-Cl brines from the Gulf Coast Basin. In the north, groundwater geochemical compositions are influenced by downdip hydrochemical evolution of fresh groundwater (Senger and others, 1990). Groundwater compositions do not apparently vary with fluctuating water levels (Baker and others, 1986). However, Flores (1990) suggested less fresh to slightly saline groundwater in the aquifer as compared with that indicated by a 1986 study. This difference suggests a slightly westward shift of the bad-water line over time (Flores, 1990).

6.0 Conceptual Model of Flow in the Aquifer

The conceptual model reflects our best understanding of the hydrology of the aquifer. The model describes predicted groundwater flow paths, as well as the processes, such as recharge and discharge, that constitute the water budget of the aquifer.

Precipitation that falls on the outcrop of the northern segment of the Edwards aquifer is the primary source of recharge water (fig. 6-1). This widespread recharge takes the form of direct infiltration through soil and rock and infiltration from numerous intermittent streams. Additional recharge results from infiltration of water from streams that cross the aquifer outcrop. Groundwater flows generally toward the east, except along the southern margin of the aquifer, where there is southward flow toward the Colorado River. Water quality parameters such as tritium indicate that there is very little groundwater flow beyond the bad-water line. The groundwater potentiometric surface indicates groundwater flow converging on Brushy and Salado Creeks, indicating discharge to these streams. This discharge is confirmed by the fact that both streams are perennially gaining streams. Other major discharge zones occur on the Colorado River along the southern margin of the aquifer, the San Gabriel River, and the Lampasas River along the northern margin of the aquifer. This discharge takes the form of springs and seeps that flow into the perennial rivers and streams that cross or are adjacent to the aquifer.

The northern segment of the Edwards aquifer is used primarily as a source of water for municipalities located mostly in the central and northern parts of the study area, such as the cities of Round Rock, Georgetown, Salado, and Pflugerville. Consequently, groundwater use is greater in Williamson and Bell counties than in Travis County. Despite annual increases in groundwater pumping averaging 5 percent per year over the past decade, total pumping in the northern segment of the Edwards aquifer is relatively small compared with that of the much larger San Antonio segment. Estimated pumping for 1999 was approximately 30,000 acre-feet in the northern segment of the Edwards aquifer, compared with pumping in excess of 400,000 acre-feet per year in the San Antonio segment. In addition to discharge to streams and pumping, groundwater discharge from the northern segment of the Edwards aquifer also occurs by cross-formational flow. Cross-formational flow occurs in the confined part of the aquifer, where groundwater discharges by upward flow from the Edwards aquifer to overlying units, such as the Austin Chalk.

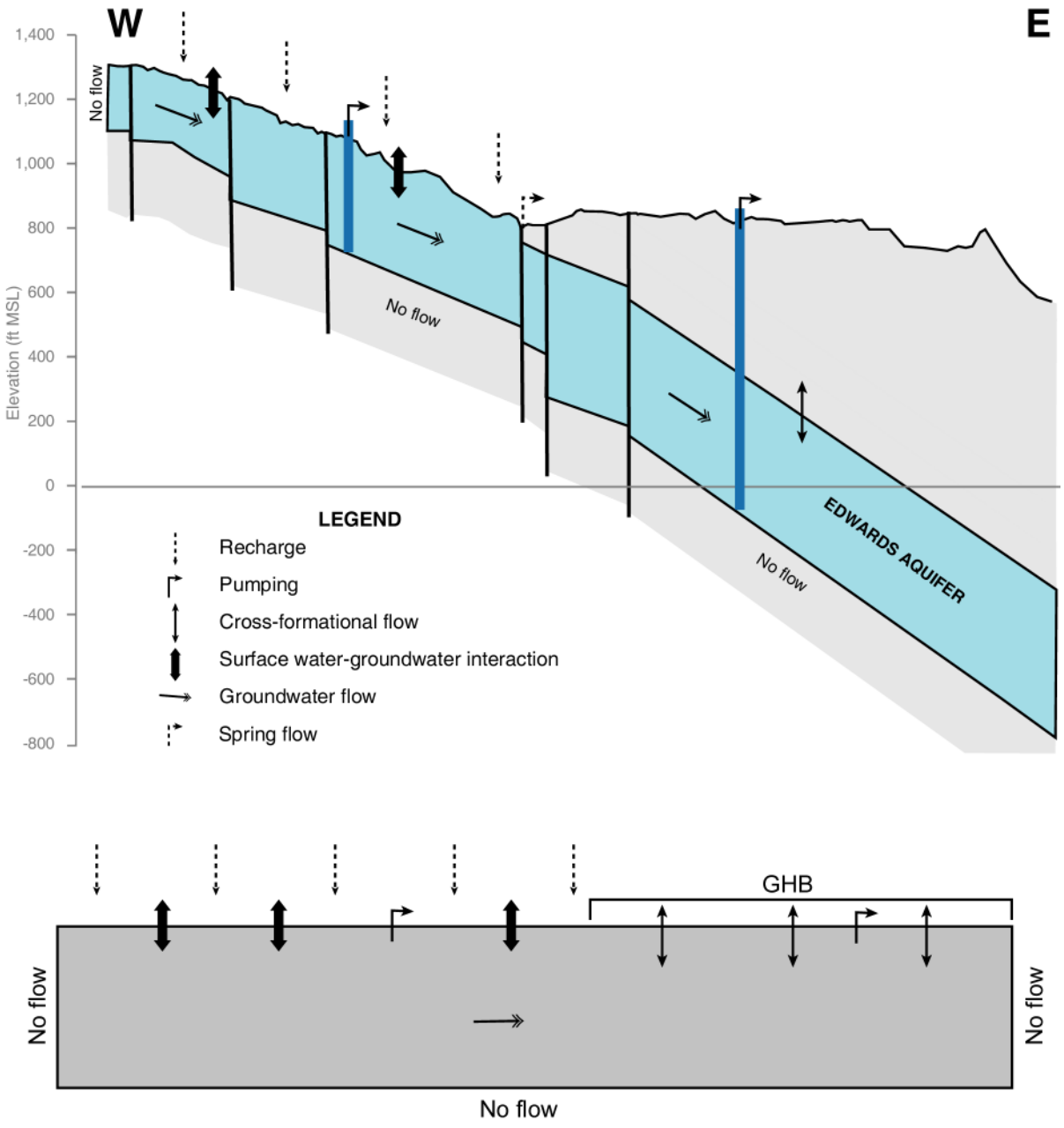

Figure 6-1. Conceptual model of groundwater flow in the study area.

7.0 Model Design

Model design includes (1) choice of code and processor, (2) discretization of the aquifer into layers and cells, and (3) assignment of model parameters. The model design must agree as much as possible with the conceptual model of groundwater flow in the aquifer.

7.1 Code and Processor

Groundwater flow through the northern segment of the Edwards aquifer was simulated using MODFLOW-96, a widely used modular finite-difference groundwater flow code written by USGS (Harbaugh and McDonald, 1996). This code was selected because of (1) its capabilities of simulating regional-scale groundwater processes in the Edwards aquifer, (2) its documentation and wide use (McDonald and Harbaugh, 1988; Anderson and Woessner, 1992), (3) the availability of a number of third-party pre- and post-processors for facilitating easy use of the modeling software, and (4) its easily available public domain software. Processing MODFLOW for Windows (PMWIN) version 5.3 aided in our loading data into the model and viewing model outputs (Chiang and Kinzelbach, 2001). Other pre- and post-processors should be able to read source files for MODFLOW-96. This model was developed and run on a Dell Optiplex GX150 with a 930 MHz Pentium III processor and 256 MB RAM running Microsoft Windows 2000 (v. 5).

7.2 Layers and Grid

The lateral extent of the model differs slightly from those of the previously defined aquifer boundaries. The eastern boundary of the model coincides with the easternmost occurrence of groundwater with TDS of less than 3,000 mg/l (fig. 7-1). These data differ from the TWDB definition of the northern segment of the Edwards aquifer, where the eastern boundary is the bad-water line, as defined by a TDS of 1,000 mg/l. As a precaution, the downdip boundary of the model was moved eastward to test whether groundwater flowed beyond the previously defined aquifer boundary. This model has one layer that is composed of the undifferentiated Edwards and associated limestones. The model grid has 160 columns and 250 rows, for a total of 40,000 cells. Of these cells, 15,076 are active. The model grid is oriented 20° east of north. The cells have uniform dimensions of 1,320 feet by 1,320 feet. This cell size was selected to reflect the density of input data while providing adequate output resolution. The uniform cell size facilitates the use of spreadsheets and grid-based contouring software for easy data manipulation.

7.3 Model Parameters

The model layer was assigned as a confined/unconfined layer type, allowing MODFLOW to calculate transmissivity and storativity from simulated saturated thickness and assigned hydraulic conductivity and specific storage values. The length and time units used in this model were feet and days, respectively. ArcView® was used to distribute model parameters spatially, such as aquifer base and top elevations, hydraulic conductivity, specific yield, and specific storage.

The top and base of the aquifer were based on structural data compiled by the Bureau of Economic Geology (fig. 5-4 and 5-5); (Collins and others, 2002). The top of the aquifer was defined as land surface in the unconfined part of the aquifer and the top of the Georgetown Formation in the confined part of the aquifer. The base of the aquifer was defined as the base of the Comanche Peak Limestone.Hydraulic conductivity was initially assigned to different zones in the model. These zones represented the Jollyville Plateau, aquifer outcrop, and downdip parts

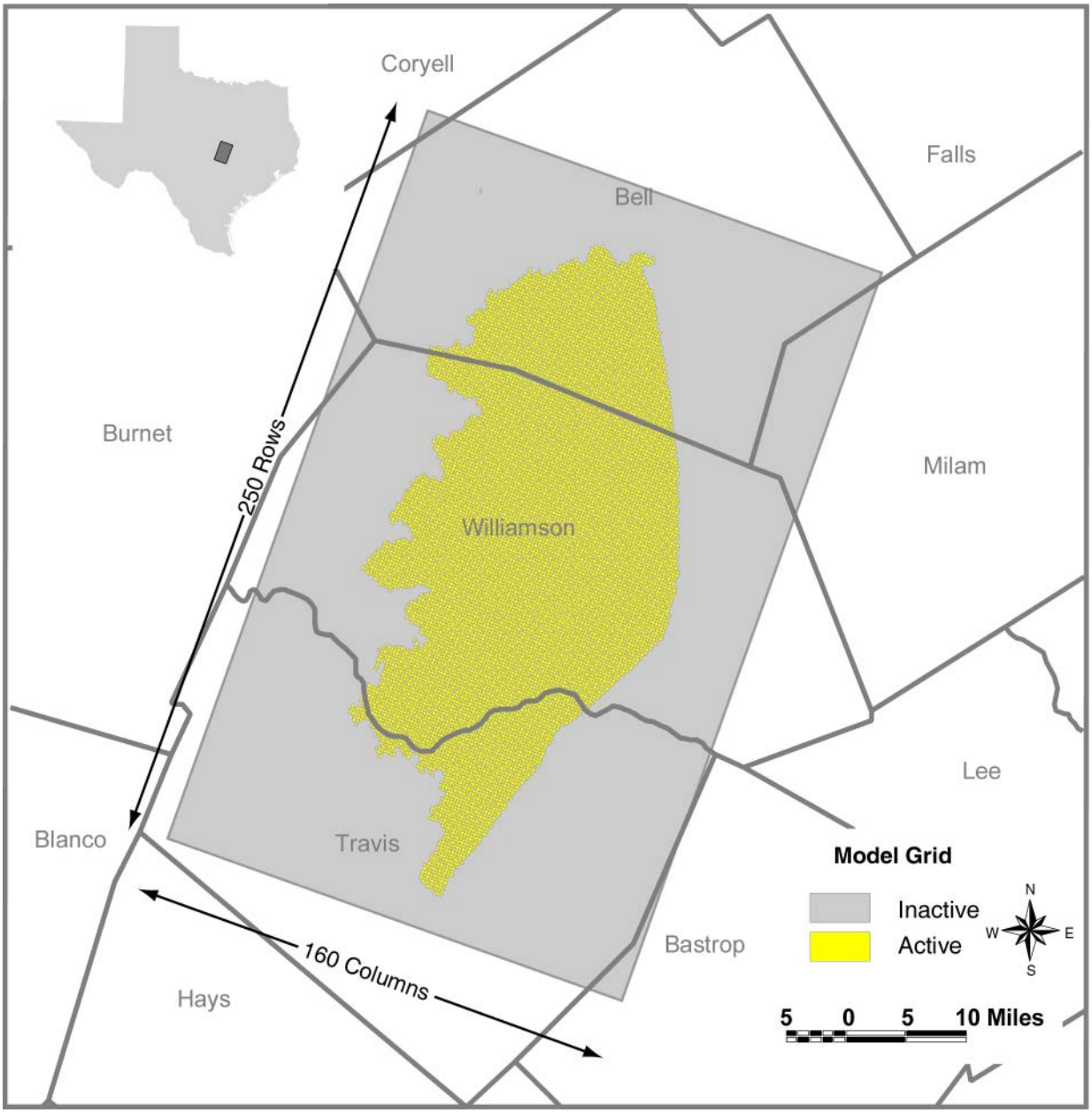

Figure 7-1. Model grid.

of the aquifer and were initially assigned hydraulic conductivity values to zones based on the geology.

Specific yield and specific storage were assigned uniformly throughout the model grid using values similar to those used in the groundwater availability model for the Barton Springs segment of the Edwards aquifer (Scanlon and others, 2001). The values for specific yield and specific storage used in this model were 0.005 and 5×10^{-6} per foot, respectively.

The Slice Successive Over-Relaxation (SSOR) package was used to solve the groundwater flow equation. The convergence criterion for iterations was set at 0.01 foot.

7.4 Model Boundaries

Model boundaries were assigned for (1) recharge, (2) pumping, (3) streams and springs, and (4) initial conditions. ArcView® was used to distribute model boundaries spatially, such as initial water-level elevations, drains, general-head boundaries (GHB), recharge, and pumping.

Initial water-level elevations were interpolated from average water levels for respective wells in the TWDB Well Database (fig. 4-7). These water-level elevations represent water-level measurements made during the month of January during the years 1990 through 1999. Average water levels were used because (1) the aquifer responds rapidly to precipitation, resulting in water-level fluctuations of up to 100 feet and (2) there is no apparent long-term regional-scale water-level decline in the northern segment of the Edward aquifer.

The Drain package in MODFLOW was used to simulate groundwater discharge to seeps, springs, and perennial streams (fig. 7-2). Discharge from the aquifer takes place only when simulated water levels in the drain cells exceed set elevations that represent streambed or spring orifice elevations. Discharge through drains is also a function of hydraulic conductance. In this model, initial drain hydraulic conductance was set at 1,000,000 ft^2/day— a value set high so that resistance to flow from the aquifer into the streams could be minimized. This action is justifiable because in the study area streambeds sediments are often composed of highly permeable gravel or fractured limestone. Drains were used to simulate discharge to perennial streams because in this segment of the Edwards aquifer, few losing segments are in the perennial streams (fig. 3-1).

The GHB Package was used to simulate cross-formational groundwater flow between the Edwards aquifer and overlying units. The GHB cells are located primarily in the downdip margin of the model and along major topographic lows formed by the major river valleys that cross the aquifer (fig. 7-3). These topographic lows have the greatest potential for groundwater discharge by cross-formational flow. Discharge through the GHB is head-dependent, as determined by the elevation of simulated hydraulic heads relative to GHB heads. The GHB heads were set to represent hydraulic heads in an overlying unit. In this model, GHB heads were set to an elevation 90 feet below land surface to simulate hydraulic heads in overlying stratigraphic units, such as the Eagle Ford Group and Buda Limestone. If simulated hydraulic heads exceeded GHB heads, groundwater flowed upward out of the aquifer. Otherwise, cross-formational flow entered the aquifer. In addition to relative heads, cross-formational flow discharge was also influenced by hydraulic conductance initially being set at 3,500 ft^2/day. The initial GHB conductance value was based on assumption of a very low confining-unit hydraulic conductivity factored over the area of each cell.

Recharge to the northern segment of the Edwards aquifer was spatially distributed based on assumptions that (1) recharge takes the form of widespread infiltration from numerous intermittent streams and through soils that overlie the aquifer outcrop and (2) recharge is a fraction of annual precipitation. Recharge in the model was set initially at 0.000343 ft/day, or 5 percent of average annual precipitation.

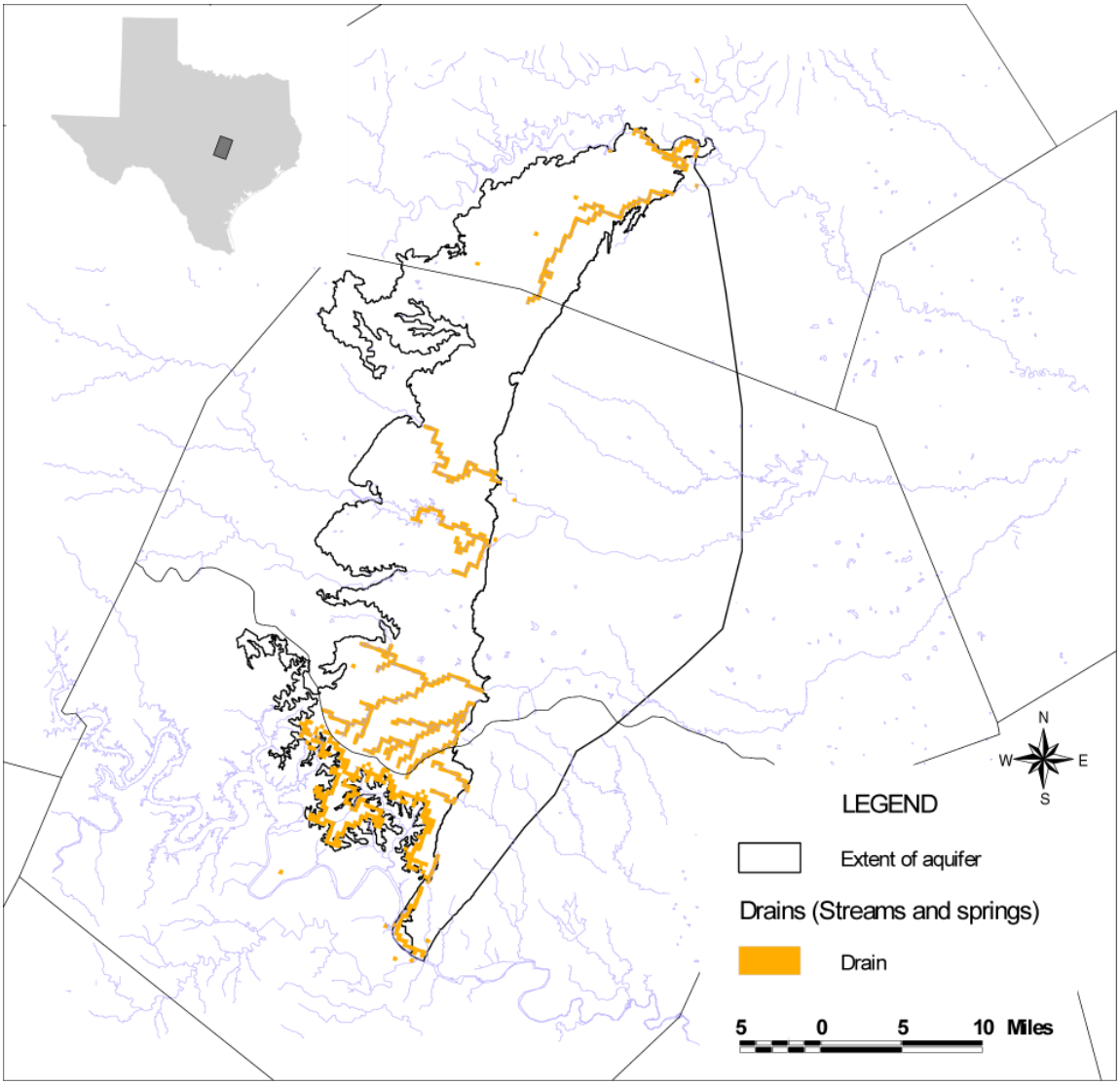

Figure 7-2. Distribution of drain cells in the model grid.

This model simulates the regional effects of pumping for rural domestic, municipal, irrigation, industrial, and livestock uses (table 7-1 and 7-2). Municipal and manufacturing pumping was distributed based on known well locations and pumping data from the TWDB Water Use Survey (fig.5-16 and 7-4). The other uses (domestic, irrigation, and livestock) were distributed throughout the model grid, reflecting the spatial distribution of associated land use. Rural domestic pumping was distributed based on the spatial distribution of population outside major urban areas that lie within the model grid. Pumping was distributed based on population data for the respective counties from 1990 and 2000 censuses such that pumping is proportional to the population within each active model cell. Irrigation pumping was distributed based on 1:250,000-scale Land Use and Land Cover data from USGS. Irrigation was assumed to occur on all land classified as orchards, row crops, or small grains. Livestock pumping was also distributed based on 1:250,000-scale Land Use and Land Cover data from USGS. Livestock pumping was assumed on all rangeland.

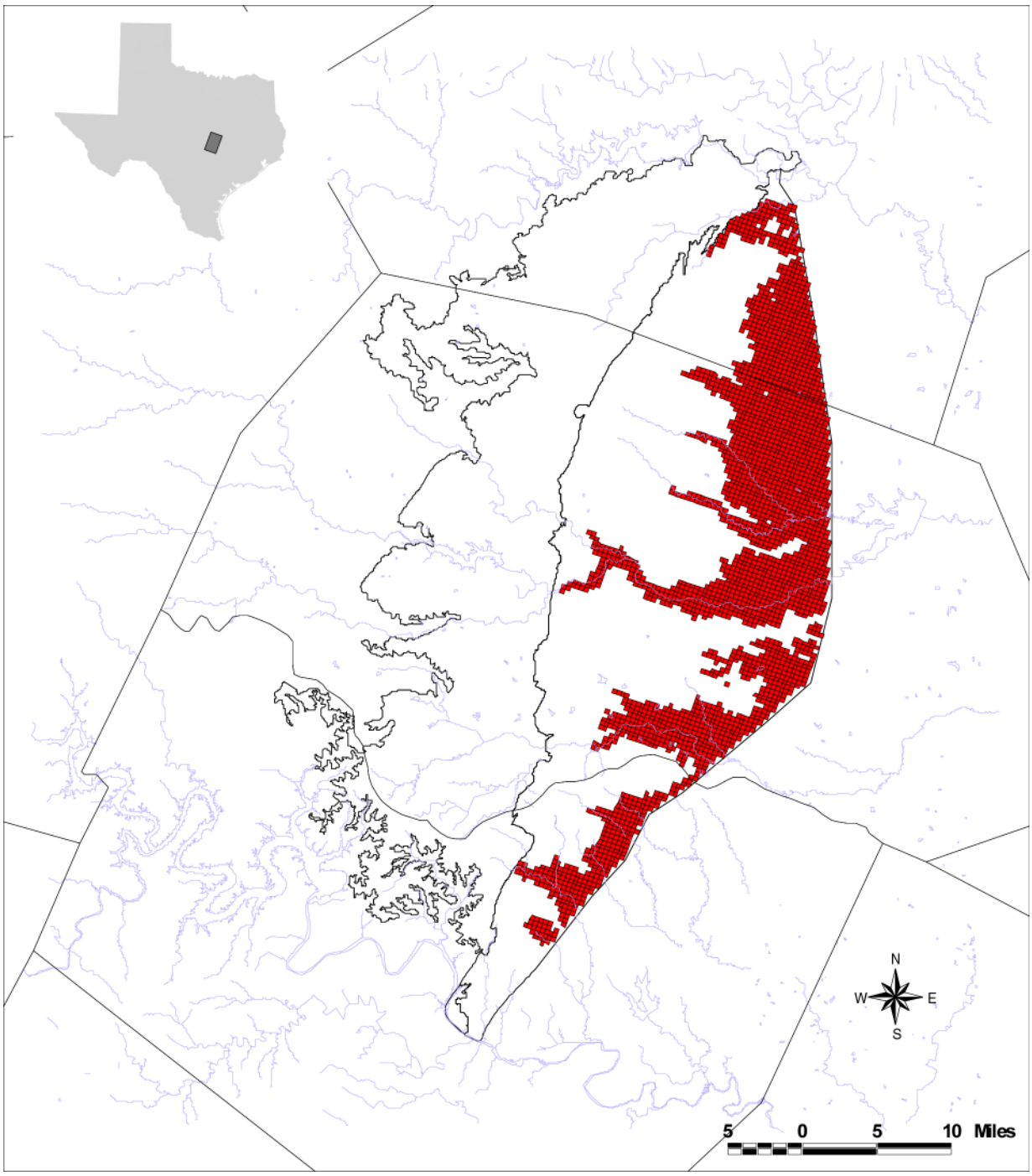

Figure 7-3. General-head boundary cells in the model.

Table 7-1. Rate of total groundwater withdrawal from the northern segment of the Edwards aquifer. Values expressed in acre-feet per year (data for 1980 through 2000 from TWDB water use surveys, 2001 through 2050 from regional water planning groups).

County	Bell	Travis	Williamson
Year			
1980	1,200	3,900	11,200
1981	1,100	4,500	11,400
1982	1,100	4,700	12,700
1983	1,100	5,200	14,400
1984	1,200	6,100	15,100
1985	1,100	6,200	16,200
1986	1,100	5,600	17,400
1987	1,100	5,700	17,200
1988	1,100	6,400	14,900
1989	1,700	7,000	15,500
1990	1,800	7,600	15,900
1991	1,800	8,000	14,800
1992	2,000	8,100	16,700
1993	2,100	8,800	16,400
1994	2,100	9,100	17,800
1995	2,100	9,700	18,800
1996	2,300	10,100	20,700
1997	2,100	9,000	20,100
1998	2,300	9,500	18,300
1999	2,400	9,700	18,600
2000	2,400	9,600	19,300
2010	470	2,600	2,900
2020	530	3,000	2,800
2030	590	4,400	2,900
2040	640	4,500	3,200
2050	690	4,700	3,100

Table 7-2. Rate of rural domestic, irrigation, livestock, manufacturing, and municipal groundwater withdrawal from the northern segment of the Edwards aquifer. Values expressed in acre-feet per year (data for 1980 through 2000 from TWDB water use surveys, 2001 through 2050 from regional water planning groups).

	Rural Domestic			Irrigation			Manufacturing/Mining			Municipal			Livestock		
County	Bell	Travis	Williamson	Bell	Travis	Williamson	Bell	Travis	Williamson	Bell	Travis	Williamson	Bell	Travis	Williamson
Year															
1980	1,000	3,400	3,600	3	0	0	0	240	1,300	140	260	6,300	20	10	20
1981	910	3,900	3,900	2	0	0	0	200	1,400	160	280	6,100	10	40	20
1982	920	4,100	4,200	1	0	0	0	150	1,500	180	360	7,000	10	70	20
1983	910	4,600	4,500	1	0	1	0	150	1,700	200	400	8,200	10	100	20
1984	920	5,200	4,900	0	0	1	0	230	1,700	260	570	8,500	10	130	20
1985	800	5,100	5,000	6	0	2	0	220	1,700	250	740	9,500	10	130	20
1986	800	4,400	6,600	7	0	2	0	280	1,700	250	860	10,100	10	140	20
1987	810	4,400	5,600	3	0	2	0	320	1,700	260	860	9,900	10	130	20
1988	810	4,800	5,900	5	0	1	0	400	1,700	300	1,100	7,300	10	140	20
1989	1,300	5,500	6,900	0	0	16	0	400	1,700	460	1,000	6,800	10	140	20
1990	1,400	6,000	7,500	0	0	18	0	480	1,700	450	970	6,700	10	140	20
1991	1,300	6,500	7,500	0	0	18	0	430	1,800	480	900	5,500	10	140	20
1992	1,400	6,400	7,400	0	0	18	0	460	1,700	580	1,100	7,500	10	140	10
1993	1,500	6,800	8,000	0	0	0	0	500	1,800	610	1,400	6,600	10	160	10
1994	1,400	6,900	8,500	0	0	0	0	580	1,800	640	1,600	7,500	10	130	20
1995	1,400	7,200	8,600	0	0	0	0	660	2,000	700	1,800	8,100	10	130	10
1996	1,500	7,200	9,300	0	0	0	0	480	1,700	820	2,200	9,700	10	260	20
1997	1,300	6,300	6,800	0	0	0	0	470	1,700	780	2,100	11,600	10	120	10
1998	1,400	6,300	6,800	0	0	0	0	570	2,000	890	2,400	9,500	10	140	10
1999	1,400	6,300	6,800	0	0	0	0	580	2,000	990	2,600	9,800	10	140	10
2000	1,400	6,300	6,800	0	0	0	0	580	2,000	990	2,600	10,500	10	140	10
2010	20	770	850	0	280	0	0	1,100	310	350	300	1,800	110	150	0
2020	20	1,100	1,000	0	250	0	0	1,100	260	410	370	1,500	110	150	0
2030	20	2,400	940	0	230	0	0	1,100	260	470	440	1,700	110	150	0
2040	20	2,500	1,000	0	210	0	0	1,200	260	520	490	2,000	110	150	0
2050	20	2,600	920	0	200	0	0	1,200	260	560	540	2,000	110	150	0

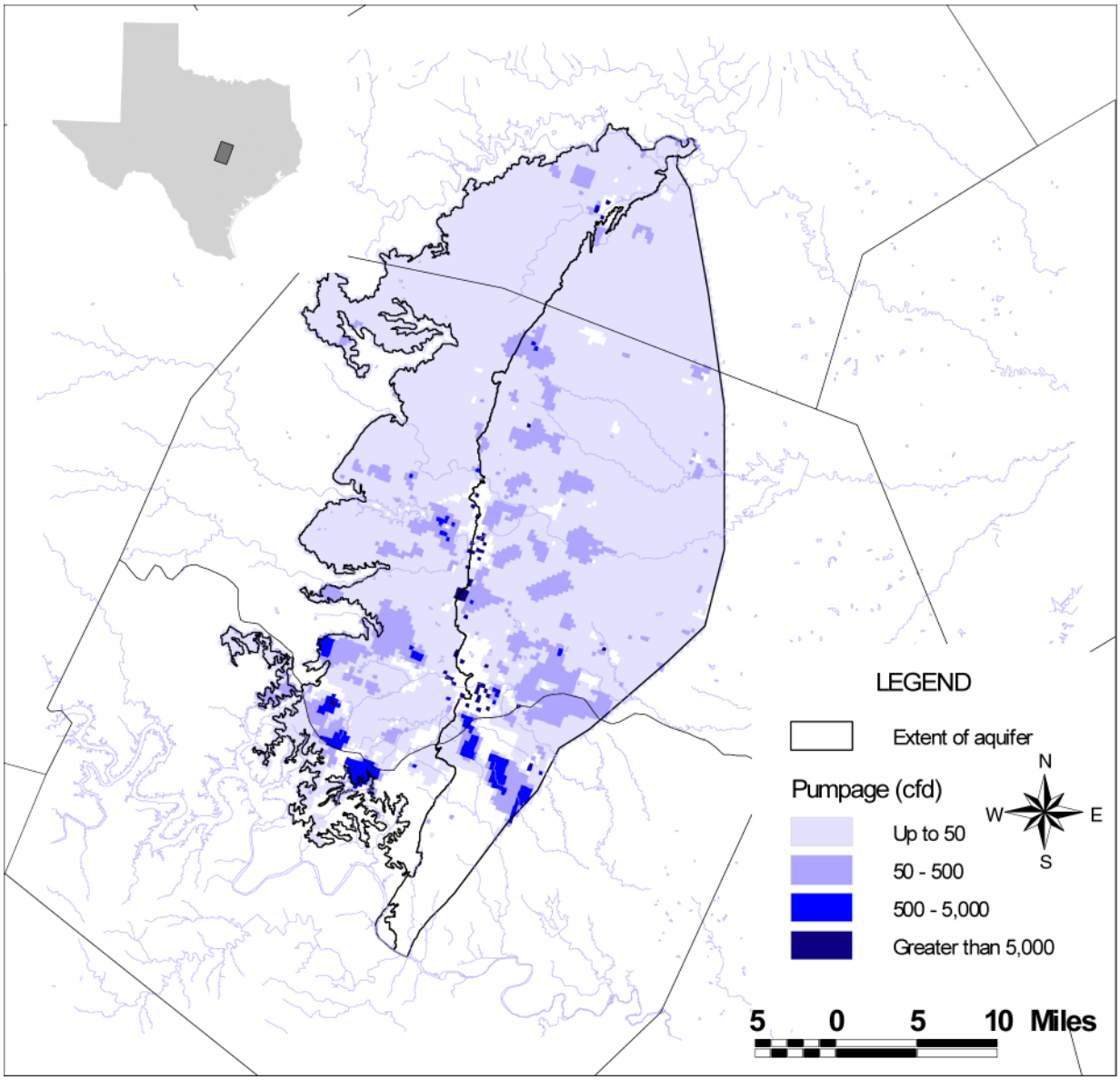

Figure 7-4. Distribution of total pumping in the model for 1980.

8.0 Modeling Approach

The process of modeling the northern segment of the Edwards aquifer included (1) steady-state model calibration, (2) historical transient model calibration, and (3) predictions of water-level variations over a 50-year planning period based on the transient model and pumping predictions developed by the Brazos G and Lower Colorado Regional Water Planning Groups. The steady-state model was developed first to facilitate easier calibration because some parameters, such as aquifer storage and water-level variations over time, do not need to be taken into consideration.

In the steady-state model, calibration requires consideration only of spatial variations in the aquifer.

The steady-state model was calibrated to reproduce water levels for early 1980. The steady-state model was used to investigate (1) recharge rates, (2) hydraulic properties, (3) boundary conditions, and (4) flow budget. Model calibration in the steady-state model involved matching simulated water levels and streamflow with available measurement data. Steady-state calibration was quantified using the root mean square error (RMSE) between measured and simulated water levels,

$$RMSE = \left[\frac{1}{n} \sum_{i=1}^{n} \left(h_m - h_s \right)_i^2 \right]^{0.5},$$

where n is the number of calibration points and h_m and h_s are measured and simulated water-level elevations, respectively, at point i. The calibration process for the steady-state model is designed to minimize the RMSE of the model with a target RMSE less than 10 percent of the range of measured water-level values.

Once steady-state calibration was achieved, the resultant model was the basis for the historical transient model. In the historical transient model, calibration involved matching water-level and streamflow fluctuations with available measurements. After the historical transient model was calibrated, it was used to predict how water levels may change over the next 50 years in response to predicted pumping and drought.

9.0 Steady-State Model

After input data were assembled and the model framework was constructed, the steady-state model was calibrated to fit measured parameters. Upon successful calibration, sensitivity of the model to selected input parameters was assessed.

9.1 Steady-State Calibration

Recharge, hydraulic conductivity, and GHB conductance were adjusted to calibrate the steady-state model. Minor adjustments were also made to aquifer base elevations to reduce very large elevation changes between adjacent cells that otherwise resulted in unrealistic dry cells during model simulations.

Recharge was varied during the calibration process, resulting in a final uniform recharge rate of 0.0012 ft/day, or 20 percent of average annual precipitation in the model area. Effects of recharge were greatest in the recharge zone. Hydraulic conductivity of the model was adjusted by varying values in zones that make up the confined part of the aquifer, as well as different parts of the unconfined part of the aquifer. The model was relatively insensitive to hydraulic conductivity. Therefore, a uniform hydraulic conductivity of 25 ft/day was assigned to active cells in the calibrated model. This value is close to the median hydraulic conductivity (9 ft/day) but differs from initial zoned values that varied from 5 to 2,000 ft/day. The use of zones could not be justified because of (1) the insensitivity of the model, (2) the RMSE not changing whether

hydraulic conductivity was uniform or distributed in zones, and (3) the zones not being supported by available hydraulic conductivity data that were restricted mostly to the confined part of the aquifer. The GHB conductance in the calibrated model was reduced from the initial value of 3,500 ft^2/day to 20 ft^2/day. The effects of varying GHB conductance are greatest in the downdip parts of the aquifer. Recharge and GHB conductance have the combined effect of influencing the hydraulic gradient across the model.

Simulated water levels from the calibrated steady-state model are fairly close to measured water levels (fig. 9-1). The RMSE of the calibrated model is 32 feet, which is approximately 9 percent of the 343-foot range of measured water levels (fig. 9-2). This fact indicates that the average difference between measured and simulated water levels in the model is ±32 feet —acceptable because the result lies within the 10-percent target for model calibration.

In addition to the comparison of measured and simulated water levels, a comparison of measured streamflow and simulated drain discharge was used to indicate how well the model reproduces groundwater discharge to major streams and springs in the study area (fig. 9-3). There is general agreement between measured stream discharge of Shoal Creek, Lampasas River, Salado Creek, San Gabriel River, and Berry Creek, indicating that the steady-state model does a good job of reproducing baseflow to springs and streams.

The water budget of the steady-state model indicates that total groundwater flow through the model is approximately 80,000 acre-feet per year (table 9-1). Of this flow, 55 percent discharges to streams, 30 percent discharges through cross-formational flow, and 15 percent is pumped mostly for municipal and rural domestic uses. The water budget indicates that most natural discharge (~65 percent) and almost all recharge takes place in the unconfined part of the aquifer. This fact indicates that most groundwater circulation in the northern segment of the Edwards aquifer takes place in the unconfined part of the aquifer.

9.2 Steady-State Sensitivity Analysis

After calibration of the steady-state model was completed, the input parameters were analyzed to assess the sensitivity of model results to respective input parameters, that is, hydraulic conductivity, GHB conductance, pumping, and recharge. Sensitivity analysis is a method of quantifying uncertainty of the calibrated model related to uncertainty in the estimates of respective aquifer parameters, stresses, and boundary conditions (Anderson and Woessner, 1992). Determining the sensitivity of the model to specific parameters offers insights into the uniqueness of the calibrated model. Sensitivity analysis identifies which parameters have the greatest influence on water levels and groundwater discharge to springs and streams. A model is sensitive to a specified input parameter if relatively small changes in that parameter result in relatively large changes in simulated water levels. In other words, calibration is possible only over a narrow range of values and, consequently, model uncertainties are relatively low. A model is insensitive if relatively large changes of a specific input parameter produce relatively small water-level changes. Insensitivity results in higher uncertainties because the model will calibrate over a large range of input parameter values.

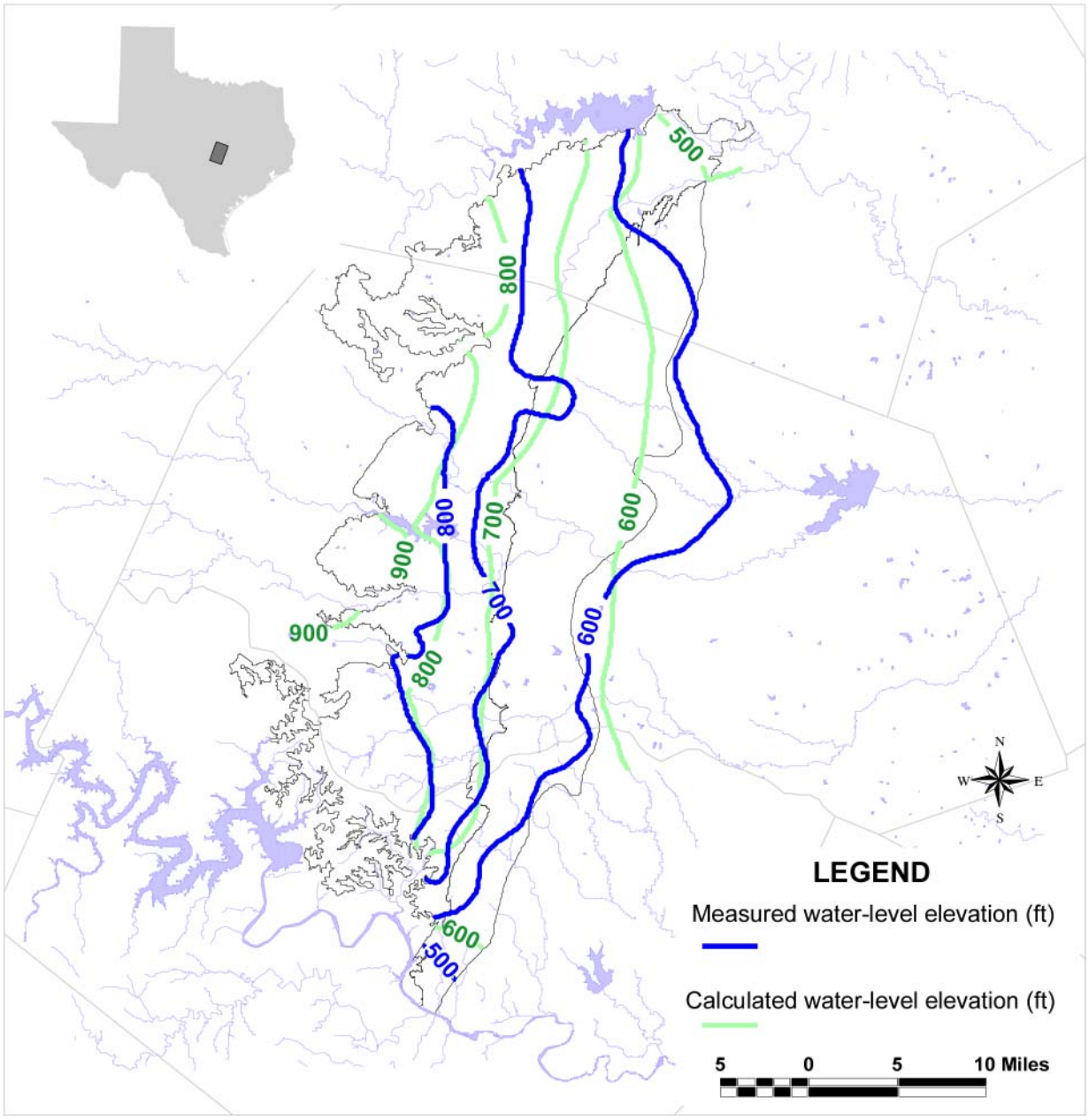

Figure 9-1. Distribution of measured and calculated water levels from the steady-state model.

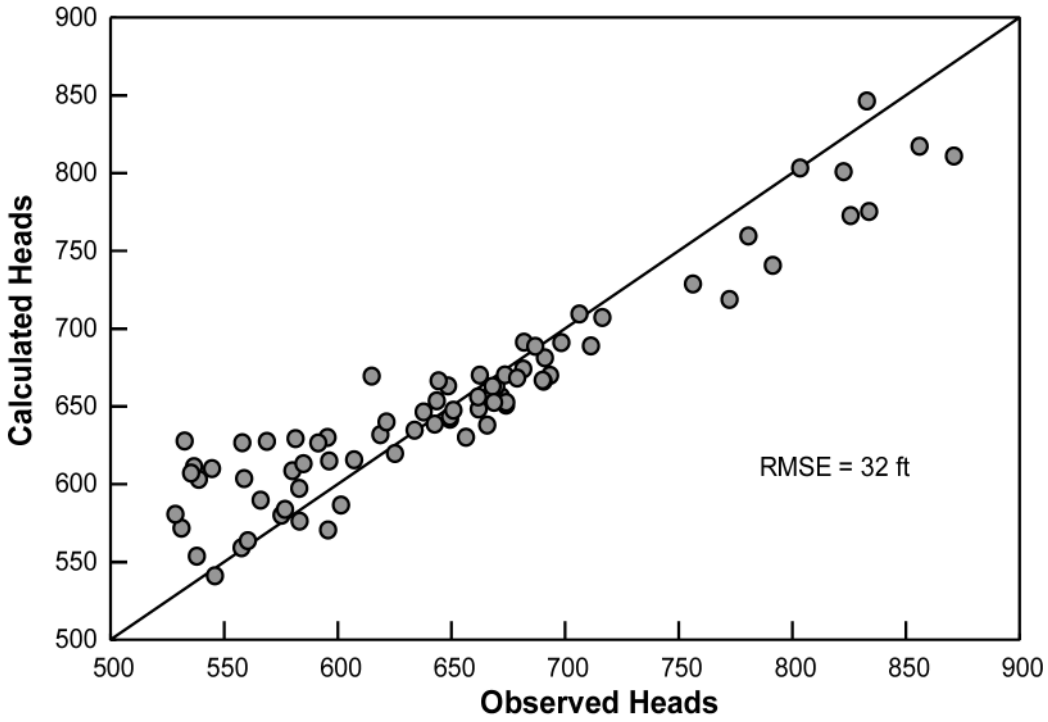

Figure 9-2. Measured and calculated water levels from the steady-state model.

Sensitivity is analyzed by systematically varying a parameter value and noting changes in water levels at the well locations used to calibrate the model. The water-level changes are quantified by calculating the Mean Difference as follows:

$$MD = \frac{1}{n}\sum_{i=1}^{n}\left(h_{sen} - h_{cal}\right)$$

where: n is the number of points, h_{sen} is the simulated water level for the sensitivity analysis, and h_{cal} is the calibrated water level. The Mean Difference is positive if water levels are higher than calibrated values and negative if they are lower than calibrated values.

Water levels in the model of the northern segment of the Edwards aquifer are most sensitive to recharge, and, to a lesser extent, to GHB conductance and pumping (fig. 9-4). The insensitivity of the model to hydraulic conductivity can be explained partly by the drain cells that simulate groundwater discharge to springs and streams in the unconfined part of the aquifer. Drain cells reduce the variation of water levels in the unconfined part of the aquifer. Discharge from the drains varies, counteracting the effects of hydraulic conductivity changes on water levels. Effects of recharge are greatest in the unconfined part of the aquifer because recharge is restricted to areas where aquifer rock is exposed at land surface. Effects of GHB conductance are greatest in the downdip parts of the aquifer, where GHB cells are located. General-Head Boundary conductance and recharge regulate the regional gradient of the aquifer. Varying recharge and GHB conductance raises and lowers water levels in up-gradient and down-gradient parts of the aquifer, respectively.

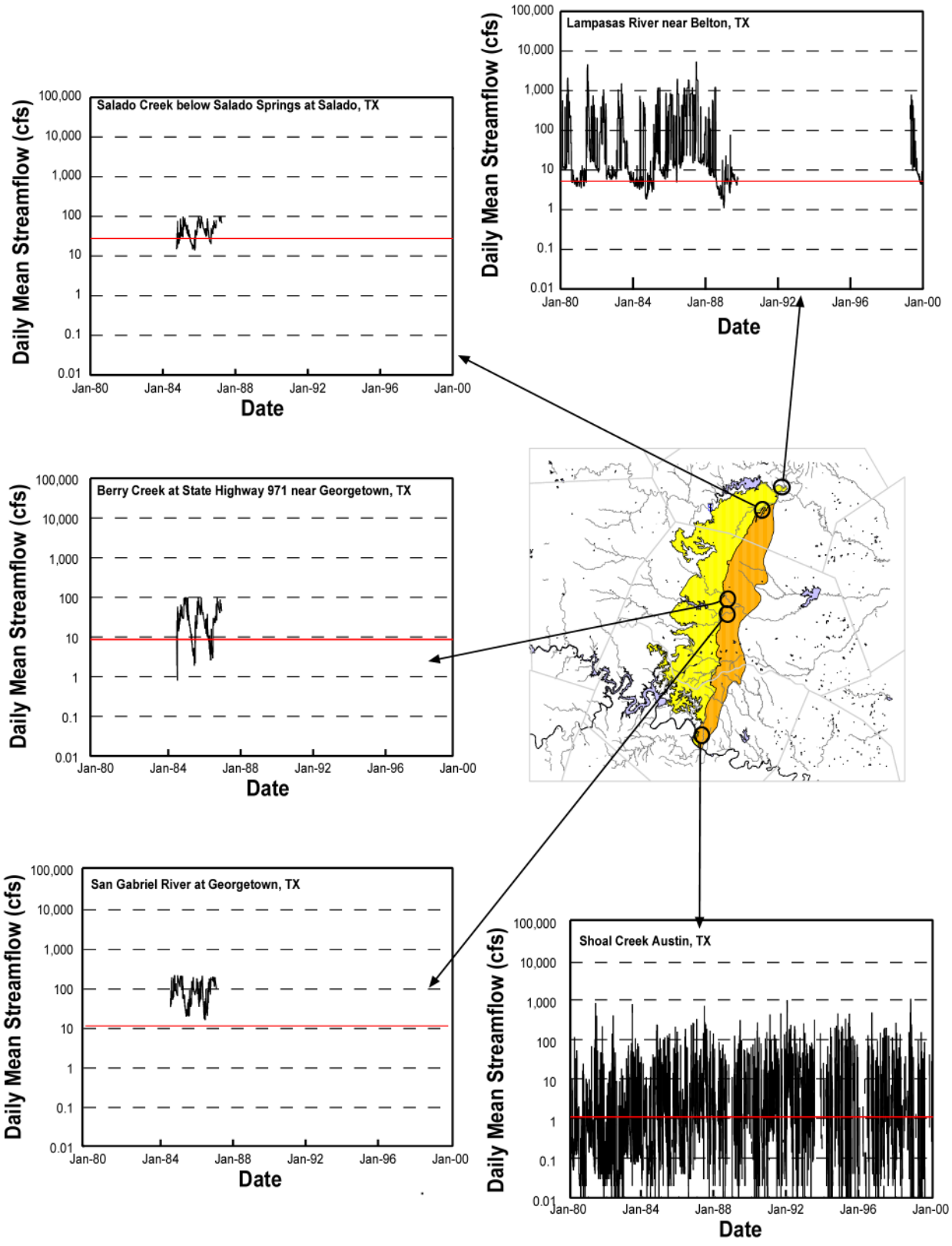

Figure 9-3. Measured (black) and calculated (red) streamflow from the steady-state model.

Table 9-1. Water budget for the calibrated steady-state model for 1980. Values expressed in acre-feet per year.

	In	Out	Net
Wells	-	13,000	-13,000
Drains	-	44,000	-44,000
Recharge	79,000	-	79,000
GHB	160	24,000	-24,000
% Difference			0.4%

County	Bell	Travis	Williamson
Recharge	23,000	53,000	4,000
Rivers	-24,000	-19,000	-1,400
GHB	-3,800	-18,000	-1,700
Wells	-400	-12,000	-600
Lateral Inflow	5,000	1,800	1,500
Lateral Outflow	-130	-6,600	-1,600
Total In	28,000	54,000	5,600
Total Out	-28,000	-55,000	-5,400
% Difference	-0.6%	-0.7%	3.3%

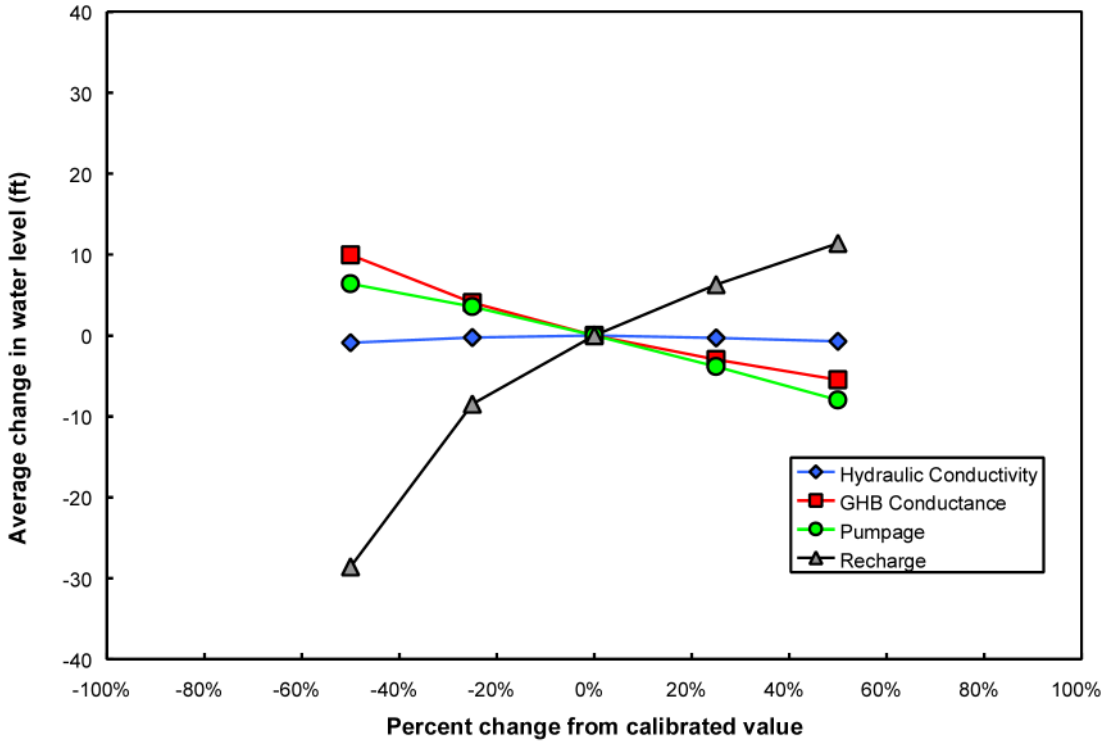

Figure 9-4. Sensitivity of numerically predicted water levels for 1980.

10.0 Transient Model

After calibration of the steady-state model to conditions in 1980, the model was then calibrated to simulate transient conditions during the period 1980 through 2000.

10.1 Transient Calibration

Water-level fluctuations during the period 1980 through 2000 were simulated using monthly stress periods. Calibration was achieved by adjusting storage parameter values, specific storage, and specific yield until the model responses approximated water-level fluctuations observed in wells in the model area. Specific yield is applicable to the unconfined part of the aquifer and is defined as the volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in the water level. Specific storage is applicable to the confined part of the aquifer and is defined as a measure of the volume of water per unit volume of aquifer rock that enters or leaves storage per unit change in water level. Specific storage and specific yield are important factors in transient calibration because they influence water-level responses to changes in recharge and discharge. Low specific storage or specific yield values result in water-level fluctuations that are larger and more rapid than those of higher specific storage or specific yield values. This difference occurs because less water is required to produce a given water-level change.

Best results were obtained using a specific storage of 5×10^{-6} per foot and a specific yield of 0.0005. In a small area in the western part of the model, characterized by very small water-level fluctuations over the transient period, a much higher specific yield of 0.05 was used (fig. 10-1). The specific storage value is the same as the value used in the groundwater availability model for the Barton Springs segment of the Edwards aquifer (Scanlon and others, 2001), which is not surprising because of the proximity of the two segments of the Edwards aquifer. The calibrated specific yield values (0.0005 to 0.05) in this model, although generally lower, overlap with the range of previous specific yield estimates in the region of 0.005 to 0.06 (Brune and Duffin, 1983; Slade and others, 1985; Scanlon and others, 2001). Overall, this model does a good job matching observed seasonal and interannual water-level and streamflow fluctuations (fig. 10-2 and 10-3). Differences between simulated and observed water-level fluctuations can be attributed to the influence of local-scale conditions that are not represented in this regional-scale model.

Over the calibration period, water-level fluctuations are generally greater in the unconfined part of the aquifer than in the confined part of the aquifer. This difference can be attributed to water-level responses to seasonal and interannual variation of recharge, coupled with the fact that most discharge from the aquifer also takes place in the unconfined part of the aquifer.

Comparison of model results and observations by Ridgeway and Petrini (1999) indicated general similarities. Despite rapid water-level fluctuations, the general trend over time indicates gradual water-level declines in the southern part of the model area, especially in the Pflugerville-Georgetown area (fig. 10-2). No long-term water-level declines occur in the less-populated, northern part of the model area.

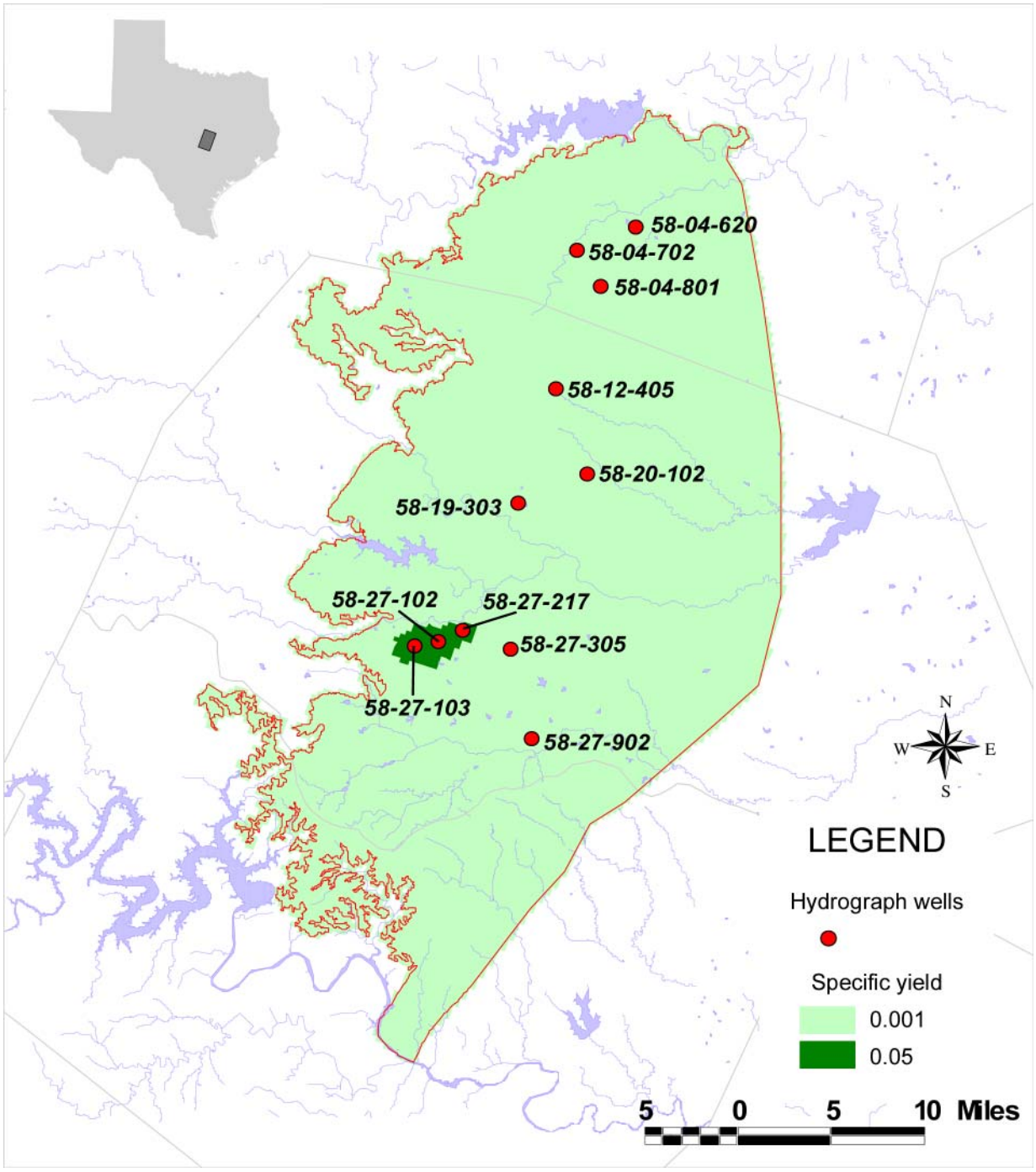

Figure 10-1. Distribution of specific yield in the model.

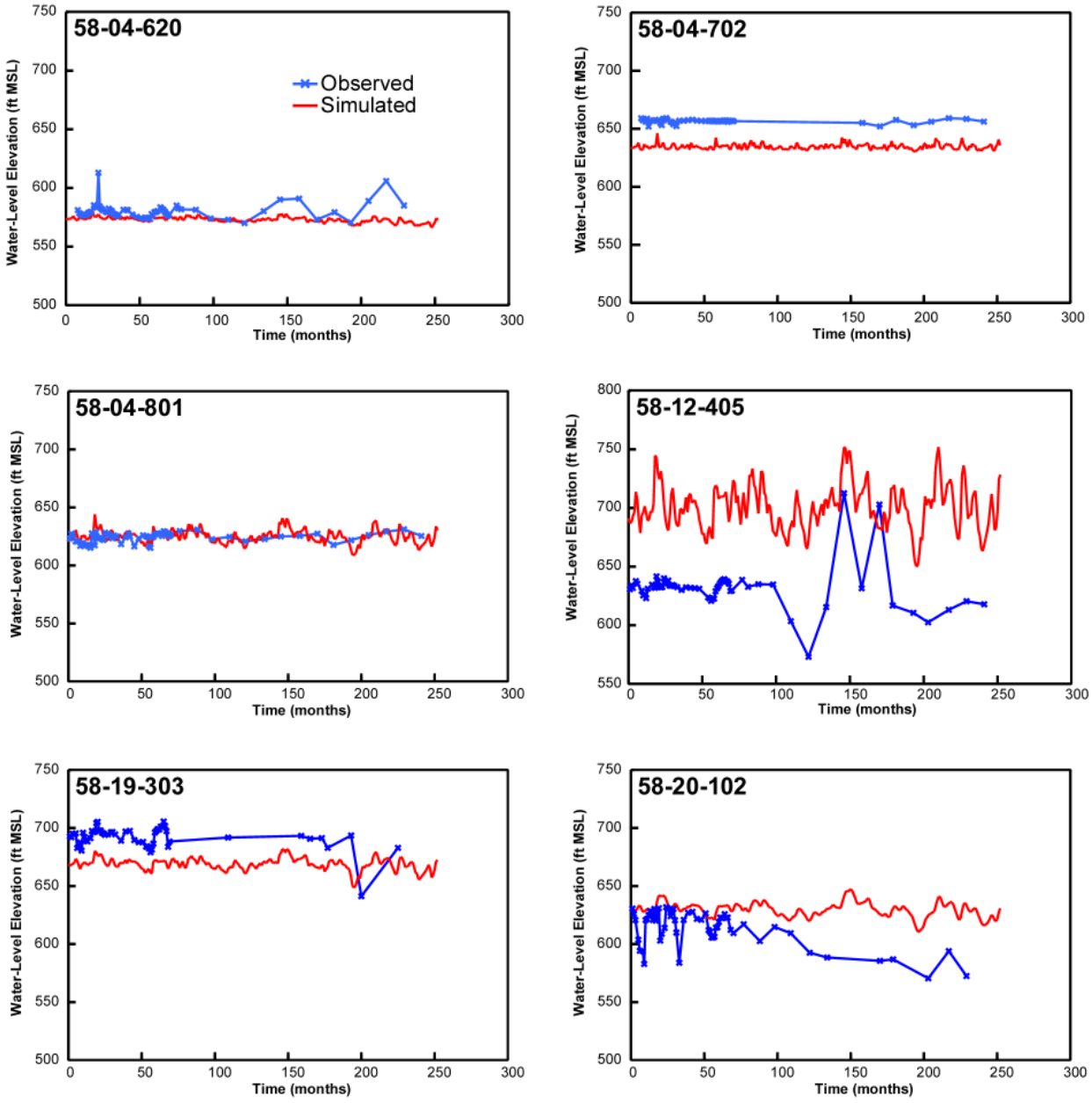

Figure 10-2. Measured and calculated water-level fluctuations for the period 1980 through 2000.

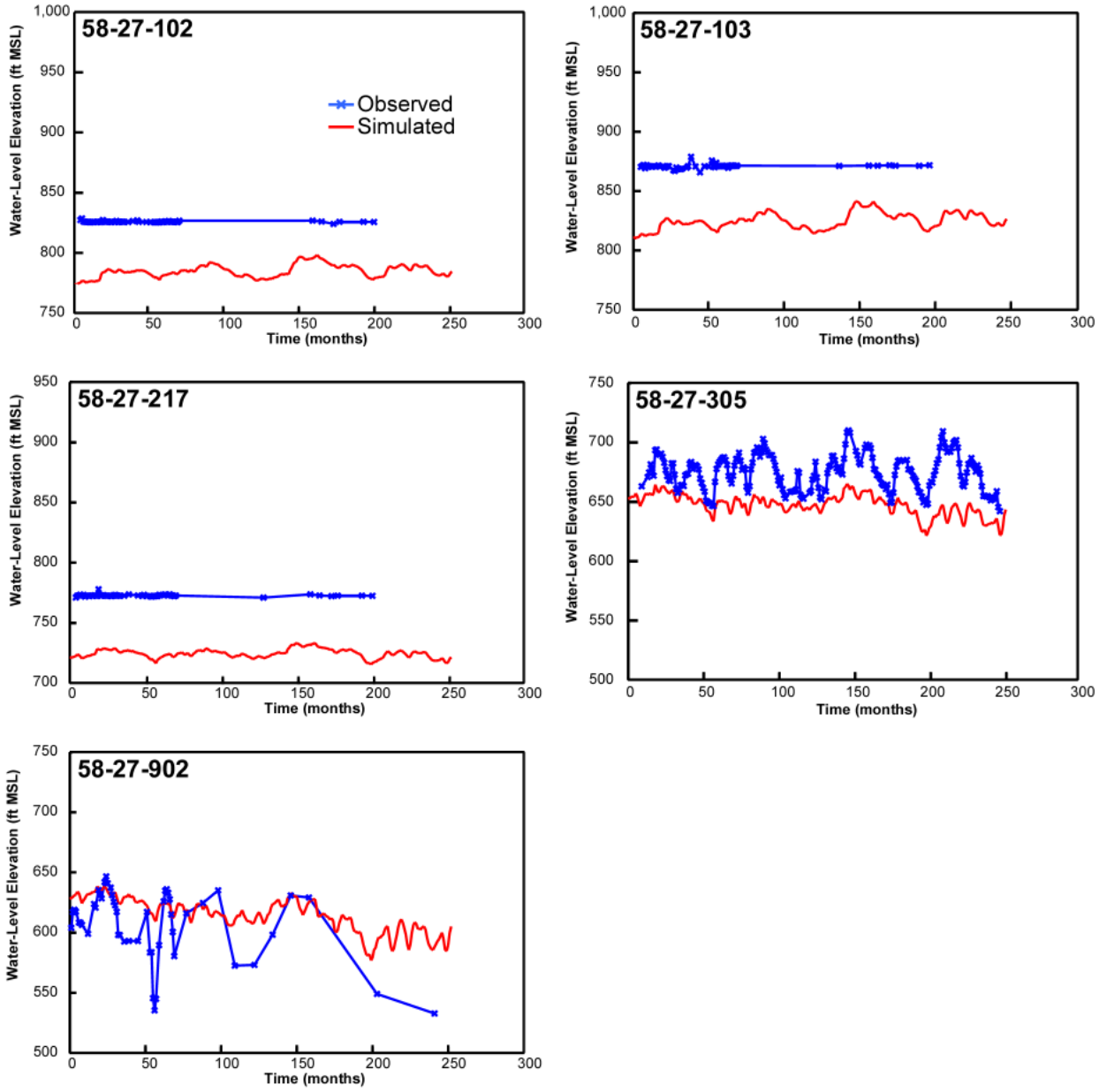

Figure 10-2. (cont.).

10.2 Transient Sensitivity Analysis

Upon completion of transient model calibration, the storage parameters were assessed to determine the sensitivity of the model to specific yield and specific storage. Sensitivity was analyzed by systematically varying specific yield and specific storage to determine associated changes in aquifer response over the transient model run.

Sensitivity analysis indicates that the overall model is more sensitive to variation of specific yield than specific storage. Variation of specific storage values ranging from 5×10^{-7} to 5×10^{-5}

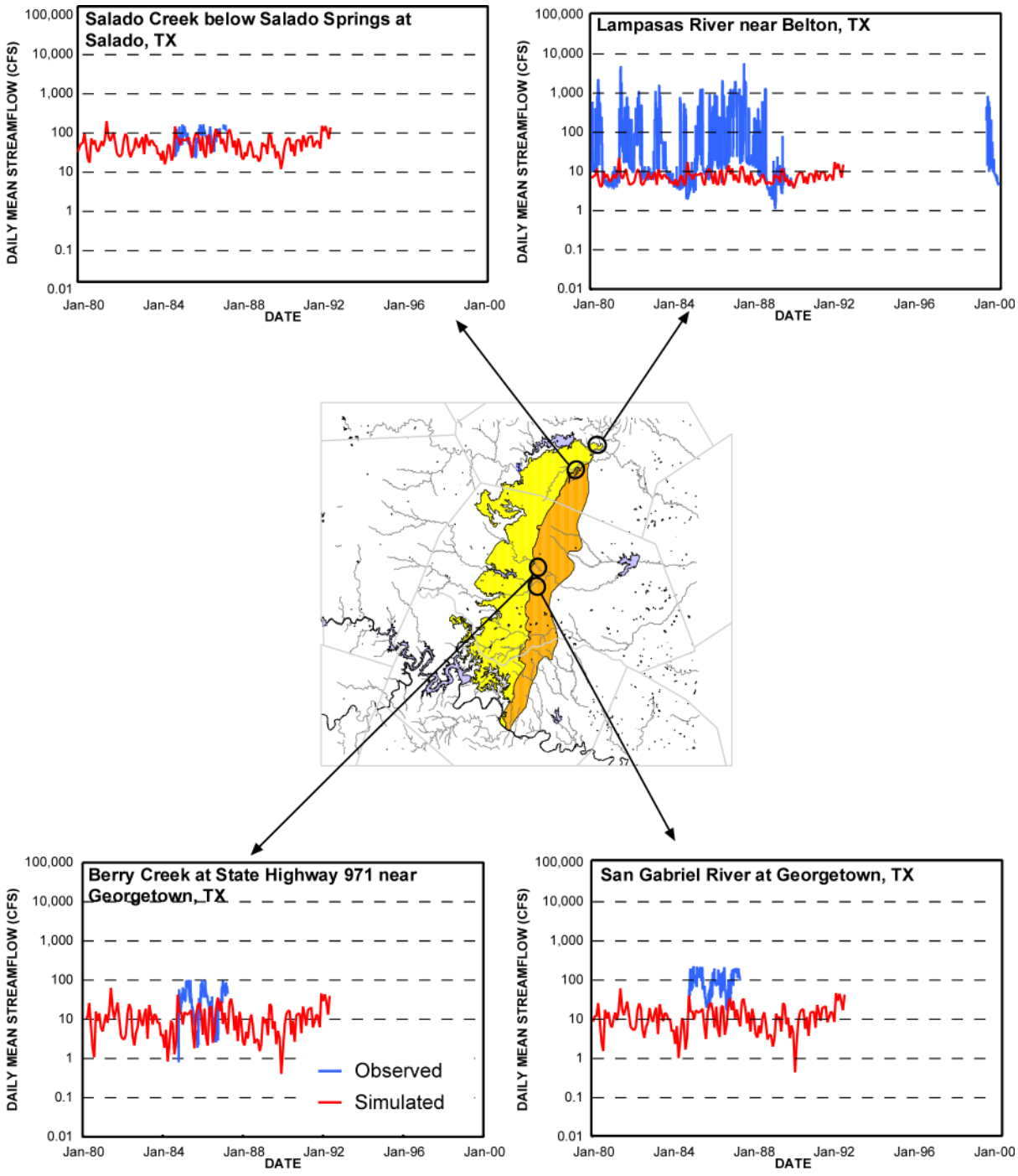

Figure 10-3. Measured and calculated streamflow fluctuations for the period 1980 through 2000.

per foot resulted in significant changes in simulated water-level responses only at calibration sites within the confined part of the aquifer (fig. 10-4). Variation of specific yield from 0.0005 to 0.05 produced significant variation of simulated water levels at calibration sites throughout the model area (fig. 10-5).

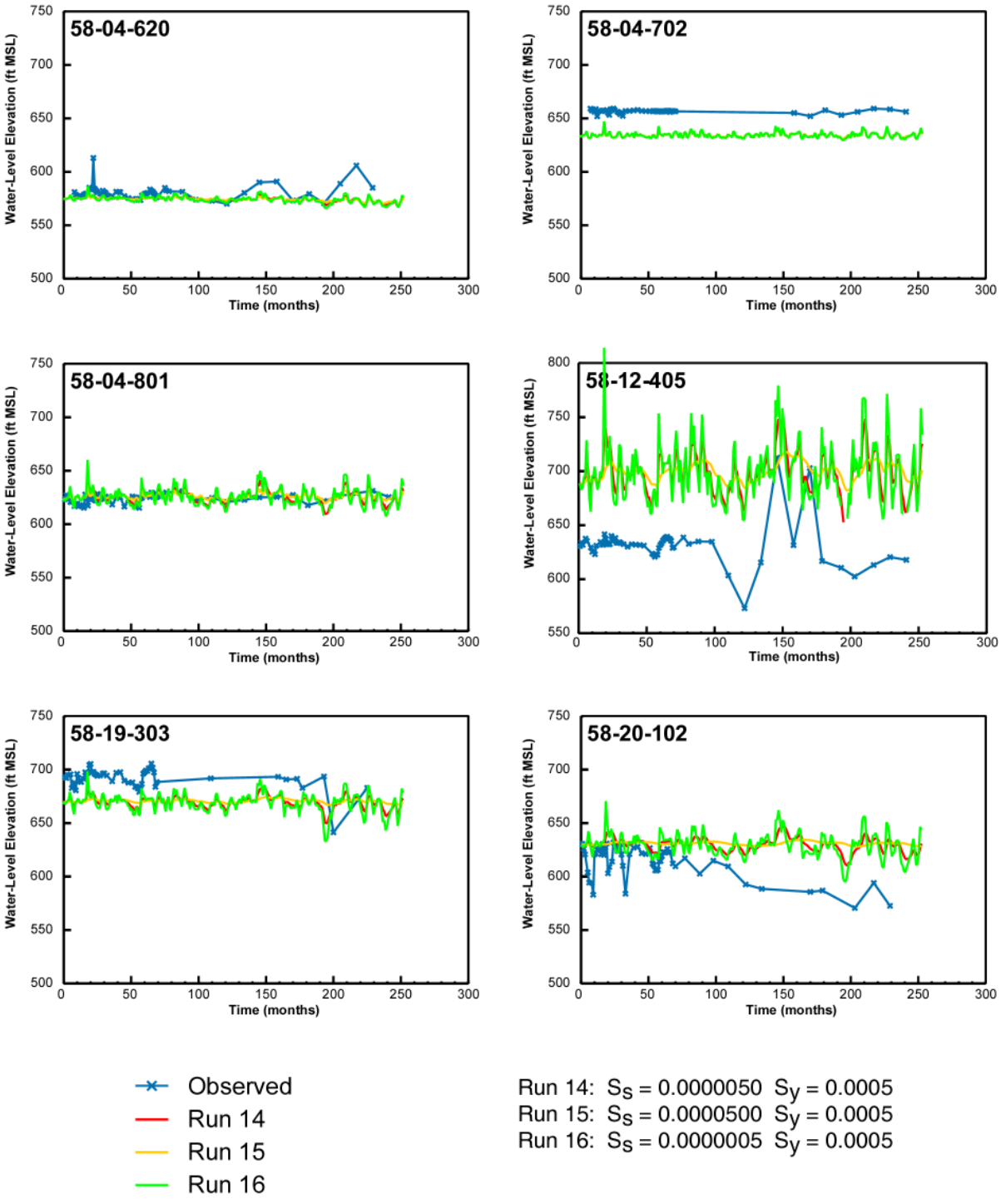

Figure 10-4. Sensitivity of model to specific storage.

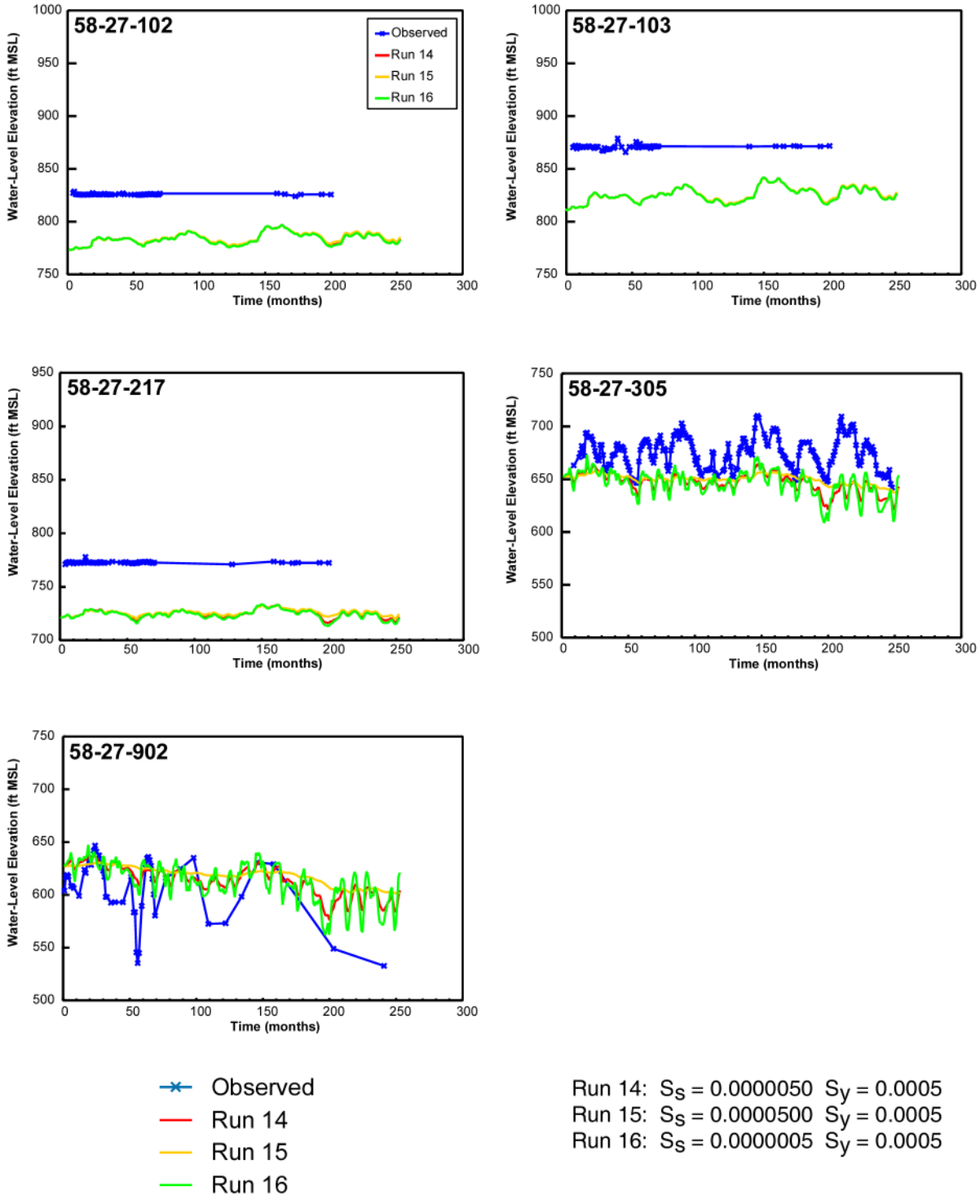

Figure 10-4. (cont.).

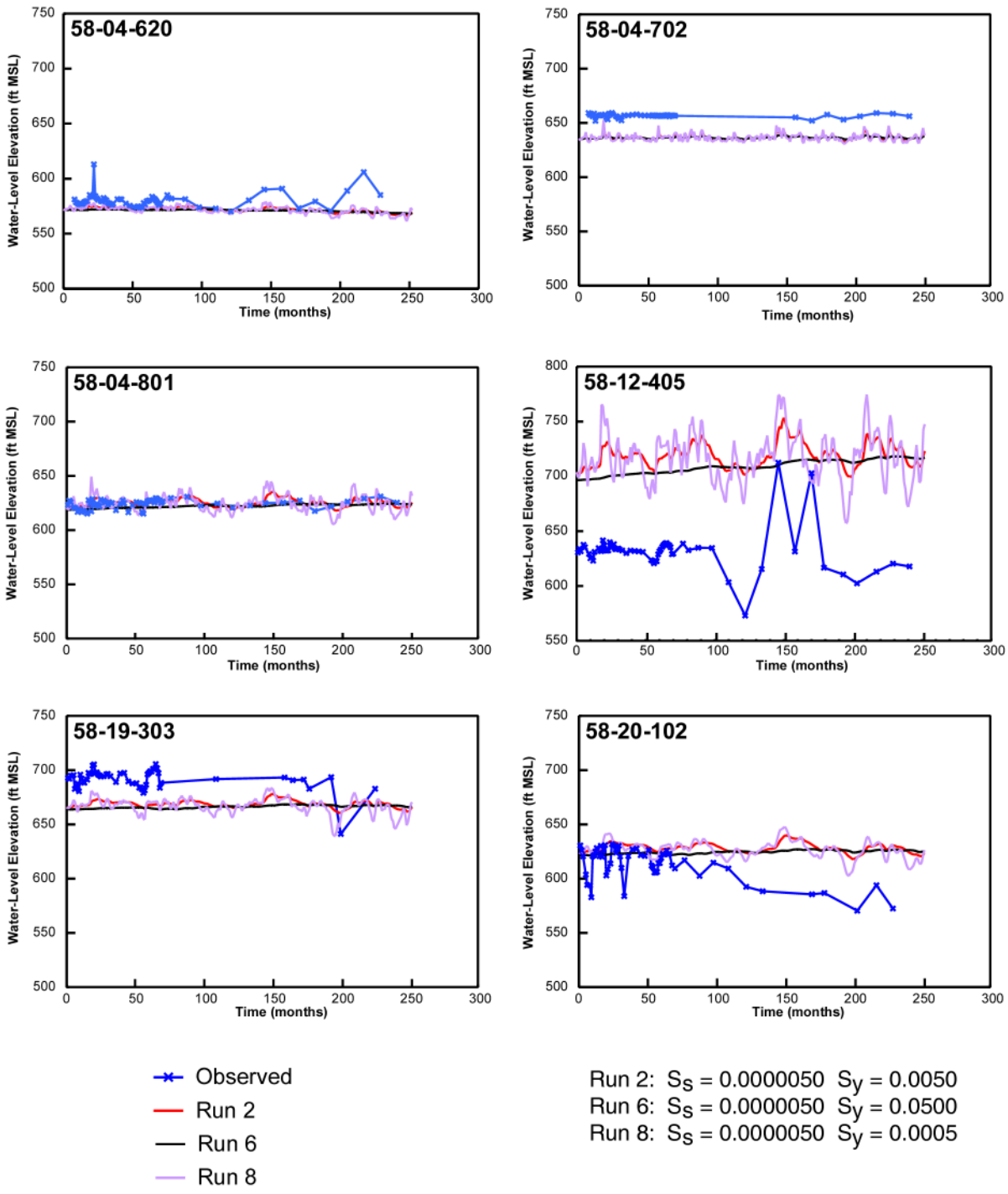

Figure 10-5. Sensitivity of model to specific yield.

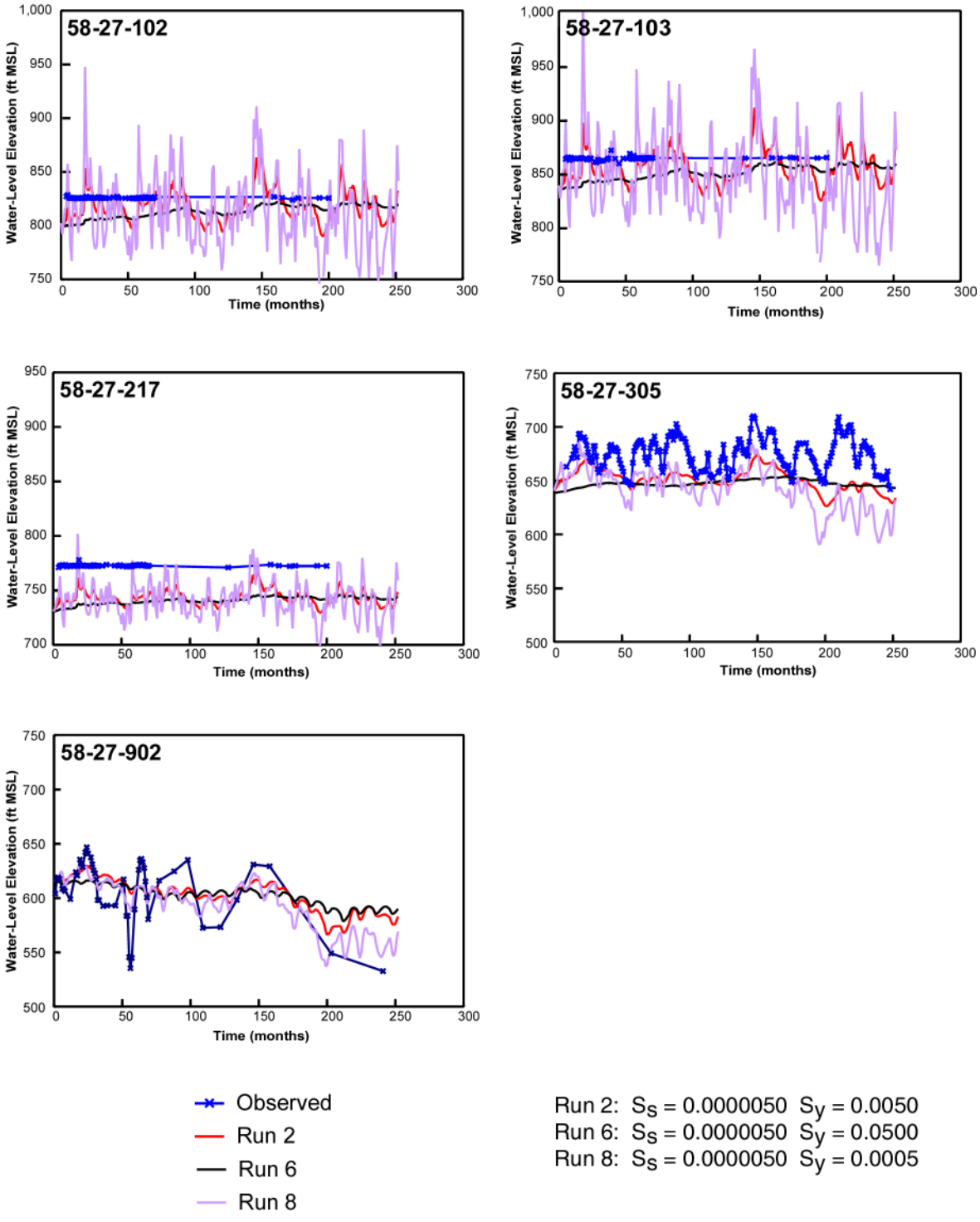

Figure 10-5. (cont.).

11.0 Predictions

As part of regional water planning, the regions assessed water demand and current supplies. If water demand exceeded current supplies, then there was a need for water. The regions then developed and recommended water management strategies to meet any water needs. In general, recommended water management strategies exceeded the needs for water. In these cases, the volume of water from current supplies plus recommended water management strategies exceeded projected demands. We decided that pumping assigned in the model needed to reflect projected demands more and not the full capacity of all recommended water management strategies. Therefore, in cases where demand exceeded current supplies and recommended water management strategies, we proportionally lowered the water needed from the different recommended water management strategies. We used a proportional approach because regions did not prioritize the different water management strategies and because a proportional approach does not favor one strategy over another.

To assess future availability of groundwater in the northern segment of the Edwards aquifer, the calibrated model was used to predict future water levels under average recharge and drought-of-record conditions. These simulations used projected groundwater pumping that took into account projected demand and water management strategies set by the regional planning groups in the study area. Water planning under drought conditions is a requirement of Senate Bill 1 water planning. The purpose of this water resources planning is to ensure that the state's future water needs are met, even during times of severe drought.

A drought can be defined as a period of deficient rainfall sufficient in length and severity to cause at least partial crop failure or to impair the ability to meet a normal water demand (Wilson and Moore, 1998). A drought of record is the most severe drought during the period of record in terms of duration and severity. For this model, the drought of record was determined by evaluating precipitation records for four stations in the model area. These stations are located at the Austin airport, Jarrell, Taylor, and Temple (fig. 3-8). The period of record for three of these stations began in the late 1920s and early 1930s, whereas records for the fourth station, Temple, extend back to 1900. Evaluation of these precipitation data indicates that the drought of record occurred during the period of 1954 through 1956. This drought coincides with the drought of record that affected most of Texas during the 1950s. At three of the four stations, 1954 is the driest year on record, although the drought of record in the study area was probably not as severe as in other parts of Texas. In the study area, the drought lasted only 3 years, and the precipitation during the second year of the drought (1955) approached, and in some cases exceeded, average annual precipitation.

In predictive model runs, the drought of record was simulated by recharge equivalent to 20 percent of the average of precipitation at the four stations during the years 1954, 1955, and 1956. These recharge rates are 0.0006, 0.0013, and 0.0008 ft/day, respectively. For non-drought years, average recharge (0.0012 ft/day) was used. To simulate future water levels in the aquifer over the period 2001 through 2050, six scenarios were run: (1) the 2010 Run, average recharge through 2007 and drought of record for the remaining 3 years; (2) the 2020 Run, average recharge through 2017 and drought of record for the remaining 3 years; (3) the 2030 Run, average recharge through 2027 and drought of record for the remaining 3 years; (4) the 2040 Run,

Table 11-1. Water budgets for the steady-state, transient, and predictive model runs expressed in acre-feet per year.

Year	Storage	Wells	Drains	Recharge	GHB
1980	-	-13,000	-44,000	79,000	-23,000
1990	-5,000	-18,000	-51,000	96,000	-21,000
2000	-9,500	-24,000	-68,000	120,000	-18,000
2010	3,300	-5,100	-29,000	53,000	-24,000
2020	3,400	-5,200	-29,000	53,000	-24,000
2030	3,400	-6,000	-28,000	53,000	-23,000
2040	3,400	-6,500	-28,000	53,000	-23,000
2050	3,400	-6,600	-28,000	53,000	-23,000
2050*	0	-6,600	-49,000	79,000	-25,000

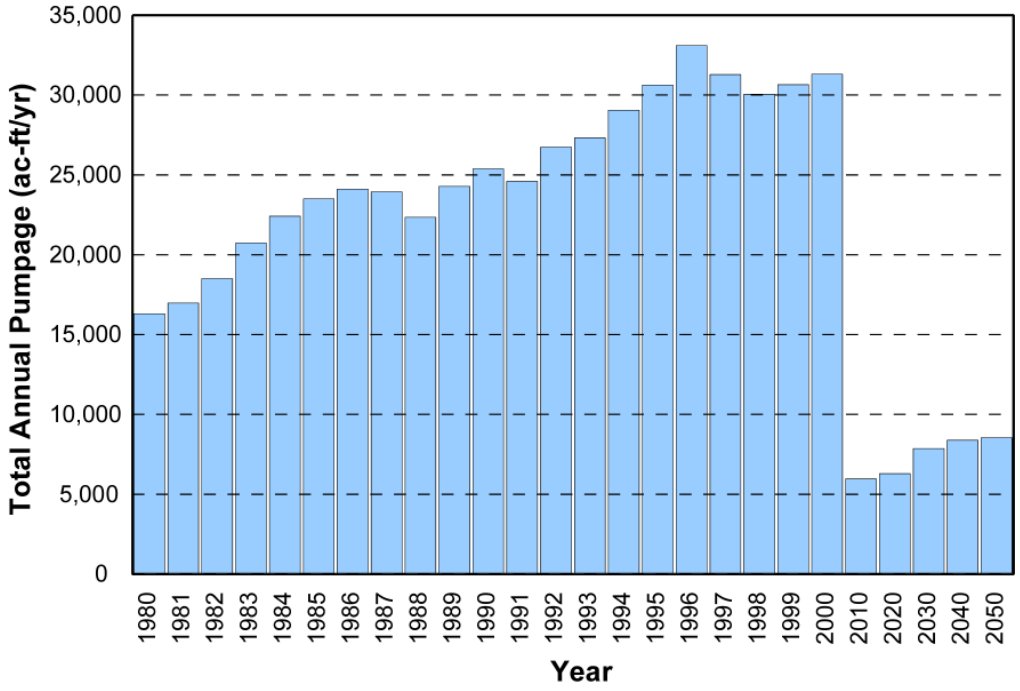

Figure 11-1. Historical and projected total pumping in the study area.

average recharge through 2037 and drought of record for the remaining 3 years; (5) the 2050 Drought Run, average recharge through 2047 and drought of record for the remaining 3 years; and (6) the 2050 Average Run, average recharge through 2050 (table 11-1). Predicted pumping data used in this model were obtained from the respective regional water planning groups. These data indicate projected pumping from the northern segment of the Edwards aquifer at much lower rates than at present (fig. 11-1). This difference is the result of conversion from the use of Edwards aquifer groundwater to surface water from reservoirs such as the Stillhouse Hollow Lake.

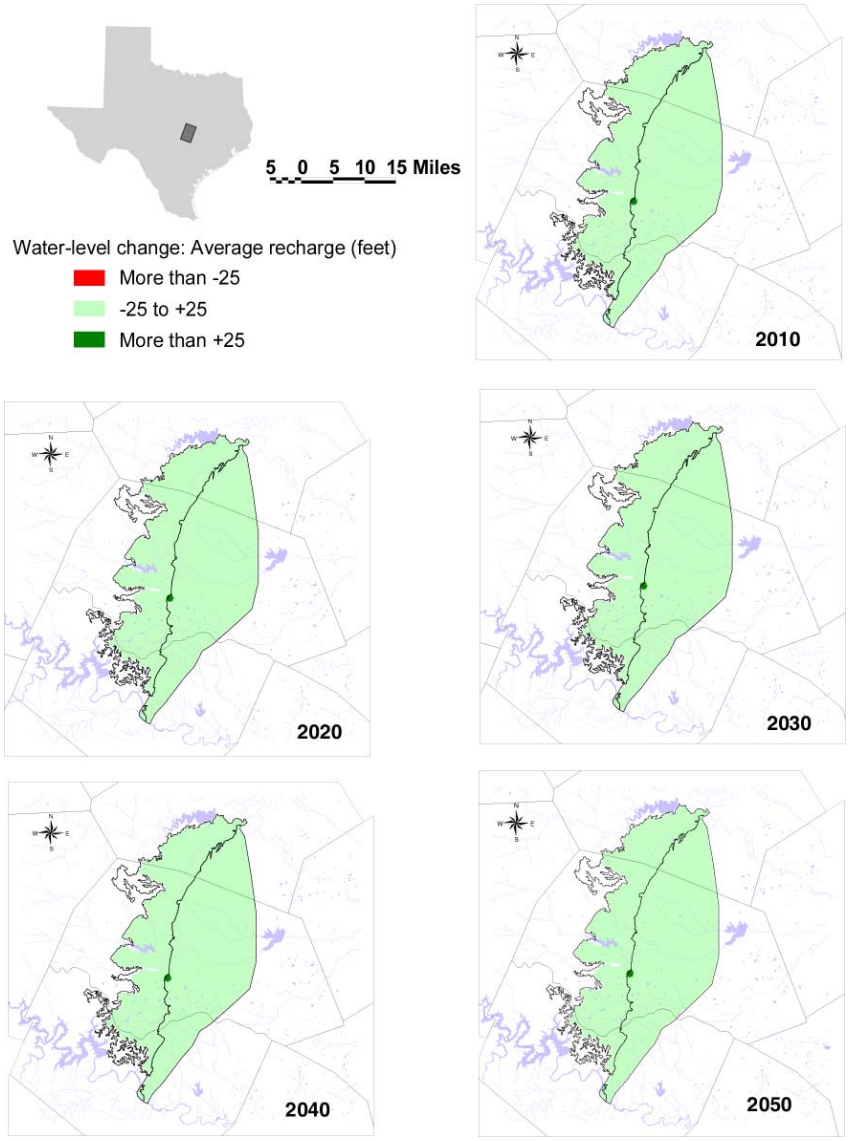

Figure 11-2. Simulated water-level changes 2010 through 2050, with average recharge.

Projected water-level changes for each decade were calculated by subtracting predicted water levels at the end of each decade from 1980 water levels, the beginning of transient calibration. Water levels from 1980 were selected as the baseline for determining predicted water-level change because they were characterized by average recharge. Consequently, differences in water levels between 1980 and future decades can not be attributed to differences in recharge rates except during drought years.

Under conditions of average recharge, predictive modeling indicates that future water levels in the northern segment of the Edwards aquifer will change less than 25 feet, compared with 1980 water levels (fig. 11-2). Under drought-of-record conditions, water-level declines occur primarily along the western margin of the aquifer (fig. 11-3).

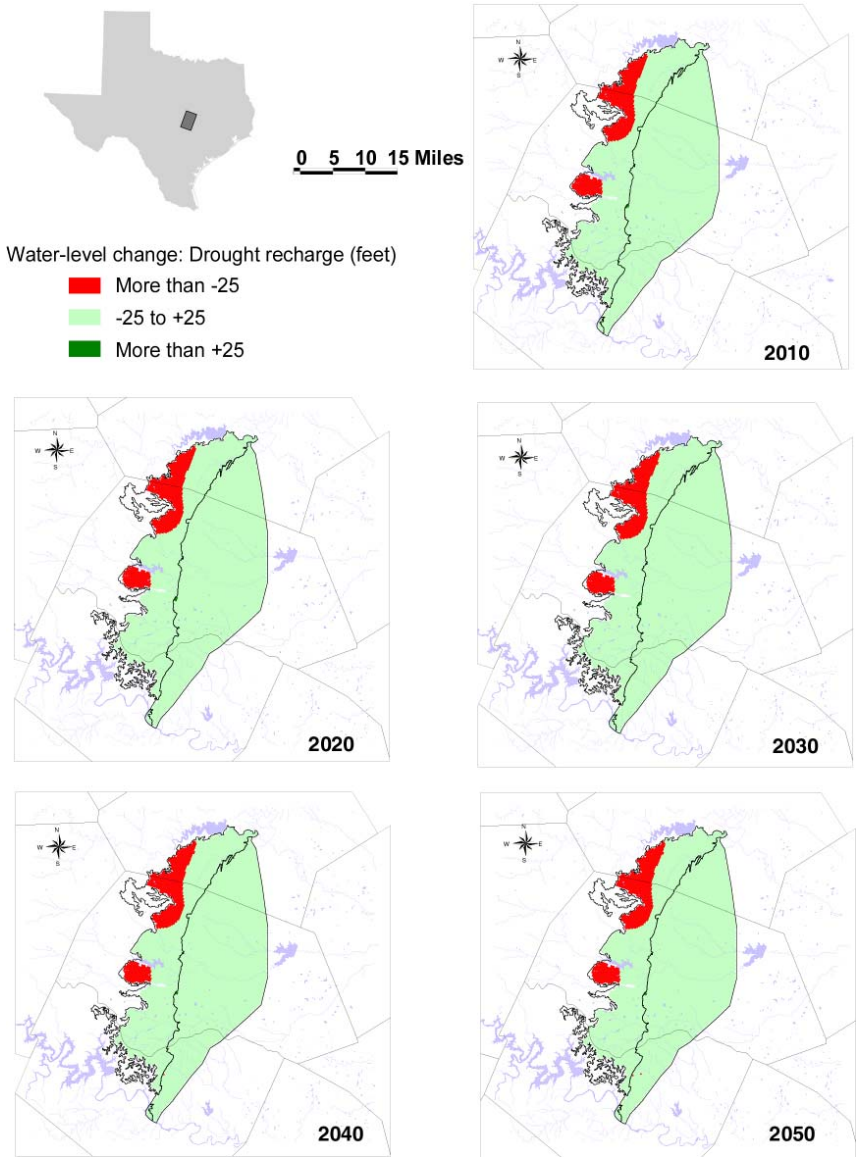

Figure 11-3. Simulated water-level changes 2010 through 2050, with drought-of-record recharge.

12.0 Limitations of the Model

All numerical groundwater flow models have limitations. These limitations are usually associated with (1) the extent of current understanding of the workings of the aquifer, (2) availability and accuracy of input data, and (3) assumptions and simplifications used in developing the conceptual and numerical models. The limitations determine the spatial and temporal variation of uncertainties in the model because calibration uncertainty decreases with increased availability of input data. Additionally, many of the assumptions, degree of simplification, and spatial resolution of groundwater flow models are influenced by availability of input data.

12.1 Input Data

Several input parameter data sets for the model are based on limited information. These include recharge, water-level and streamflow data, hydraulic conductivity, specific storage, and specific yield.

No information on the spatial or seasonal distribution of recharge to the northern segment of the Edwards aquifer has been published. Calibrated recharge rates of 20 percent of annual precipitation were obtained by trial-and-error. Application of this recharge rate to the transient model assumes that (1) a linear relationship exists between precipitation and recharge and (2) no threshold must be exceeded before recharge occurs. This assumption suggests the possibility of overestimating recharge during dry periods, when all precipitation may be taken up by evapotranspiration or absorbed by dry soils. A uniform spatial distribution of recharge to the aquifer was assumed for the model. This assumption follows the literature that suggests that recharge to the northern segment of the Edwards aquifer takes the form of generally diffuse recharge through soils, fractures, and intermittent streams in the aquifer outcrop (Duffin and Musick, 1991). The relatively good correlation between observed and simulated water levels and stream discharge suggests that, despite recharge uncertainties, the model water budget approximates the aquifer water budget.

Information on the spatial distribution of water levels in the northern segment of the Edwards aquifer is limited, especially along the updip and downdip margins of the aquifer. There is also model uncertainty associated with the number of wells with annual or more frequent water-level measurements. This uncertainty is especially apparent during the 1990s, when water-level measurements were made less frequently in the aquifer.

Uncertainty results from the paucity of streamflow data for the perennial streams that cross the aquifer outcrop. Available streamflow data for Berry Creek, Salado Creek, and the San Gabriel River are only for a few years during the mid- to late1980s. Streamflow data for the 1990s are absent for the Lampasas River. Uncertainty in stream discharge in the southern part of the model exists because (1) no streamflow data are available for Brushy Creek and (2) calibrating the model to stream discharge is difficult in perennial streams, such as Shoal and Walnut creeks, because they have low baseflow components.

Available transmissivity and hydraulic conductivity data for the northern segment of the Edwards aquifer is derived primarily from specific-capacity data obtained from wells located mostly in the central and southern parts of the model area. Most of these wells are located adjacent to the boundary between the confined and unconfined parts of the aquifer. No data exist from the unconfined part of the aquifer. These limited data are apparently random, suggesting local influences. Consequently, we decided to use a uniform hydraulic conductivity, based initially on the geometric mean of the available data, in this regional-scale model.

12.2 Assumptions

Several assumptions were made in the construction of this model. The most important assumptions were that (1) no groundwater flows between the northern segment of the Edwards

aquifer and the underlying Trinity aquifer; (2) recharge is restricted to the aquifer outcrop; (3) the Drain package of MODFLOW can be used to simulate discharge to streams flowing over the aquifer outcrop; (4) the GHB package of MODFLOW can be used to simulate cross-formational flow between the Edwards aquifer and overlying units, such as the Austin Chalk; and (5) negligible groundwater flow beyond the 3,000 mg/l isocon.

The northern segment of the Edwards aquifer is underlain by the Walnut Formation, which is reported to yield little or no water in the study area (Duffin and Musick, 1991). Consequently, it is unlikely that the Walnut Formation transmits significant amounts of groundwater between the Edwards and Trinity aquifers.

The Drain package of MODFLOW was used to simulate groundwater discharge to perennial streams in the study area. The Drain package allows water to move from the aquifer to rivers or streams, but not the reverse. Use of this package implies the assumption that the perennial streams are always gaining. This assumption is supported by streamflow gain-loss studies by Slade and others (2002). Additionally, steady-state and transient calibration results indicate overall agreement between measured and simulated discharge to perennial streams.

The GHB package was used to simulate cross-formational flow between the Edwards aquifer and overlying units. The spatial distribution of GHB cells in the model is based on the assumption that cross-formational flow takes place in downdip parts of the aquifer and along some valleys (Figure 6-3). It is also assumed that the hydraulic head on the boundary is equivalent to 90 feet below land surface and does not vary over time.

12.3 Scale of Application

The limitations described earlier and the nature of regional groundwater flow models affect the scale of application of the model. This model is most accurate in assessing regional-scale groundwater issues, such as predicting aquifer-wide water-level changes over the next 50 years that may result from different proposed water management strategies. Accuracy and applicability of the model decreases when moving from addressing regional- to local-scale issues because of limitations of the information used in model construction and the model cell size that determines spatial resolution of the model. Consequently, this model is not likely to accurately predict water-level declines associated with a single well because (1) these water-level declines depend on site-specific hydrologic properties not included in detail in regional-scale models and (2) the cell size used in the model is too large to resolve changes in water levels that occur over relatively short distances. Addressing local-scale issues requires a more detailed model, with local estimates of hydrologic properties, or an analytical model. This model is more useful in determining the impacts of groups of wells distributed over a few square miles. The model predicts changes in ambient water levels rather than actual water-level changes at a specific location, such as an individual well.

13.0 Future Improvements

The TWDB plans periodically to update, and thus improve, groundwater availability models. This model can be improved by incorporating greater complexity or hydrologic information that

was not available initially. Model uncertainty can be reduced with additional information on aquifer hydraulic properties, streamflow, water-level elevations, and recharge.

Additional streamflow data are required in order for us to better determine the seasonal and spatial distribution of stream discharge gain and loss. This ability will facilitate the use of the streamflow package of MODFLOW as a potentially superior alternative to the Drain package and to provide additional data for model calibration.

Additional hydraulic head measurements and aquifer-test data are required for the northern segment of the Edwards aquifer, especially the unconfined part of aquifer. This information can be used to improve calibration of the model by increasing the number and spatial distribution of sites for comparing measured and simulated water levels. Water-level data are needed for the stratigraphic units overlying the Edwards aquifer in order for the GHB to be better constrained. Aquifer tests will facilitate determination of whether improving the model by spatially distributing hydraulic conductivity, specific storage, and specific yield can be justified.

This model can also be improved by an investigation of the spatial and temporal distribution of recharge. Determination of the hydrologic conditions required for the occurrence of recharge to the northern segment of the Edwards aquifer will facilitate better constraints on the seasonal distribution of recharge to the aquifer.

14.0 Conclusions

A numerical groundwater flow model was constructed to simulate groundwater flow through the northern segment of the Edwards aquifer. It is to be used as a tool to evaluate groundwater resource management strategies by predicting water-level changes in response to pumping and drought. Model construction was based on available hydrologic and geologic data for the northern Edwards aquifer. The model is composed of one layer with 40,000 cells, 12,877 of which are active. The modeling approach included construction and calibration of steady-state (1980) and historical transient (1980 through 2000) models and using the resultant calibrated transient model to predict aquifer responses through 2050 under average recharge and drought-of-record conditions. The predictive model runs used projected pumping developed by the Brazos G and Lower Colorado Regional Water Planning Groups.

The calibrated model does a good job of matching water-level distribution and fluctuations in the aquifer and stream discharge. The RMSE for the steady-state model is 32 feet, about 9 percent of the hydraulic-head drop across the study area. Calibration of the steady-state and transient models resulted in (1) an average recharge rate of 20 percent of mean annual precipitation, (2) hydraulic conductivity of 25 ft/day, (3) specific yields of 0.05 to 0.0005, and (4) specific storage of 5×10^{-6} per foot. The model is most sensitive to changes in specific yield, recharge, and GHB conductance. This model indicates that approximately 50 to 70 percent of groundwater flow occurs within the unconfined part of the aquifer, resulting in discharge to perennial streams. Pumping, mostly for municipal, rural domestic, and industrial uses, accounts for less than 20 percent of groundwater discharge from the aquifer; the remaining 10 to 30 percent is discharge by cross-formational flow in the confined parts of the aquifer. The much larger water-level fluctuations in the unconfined compared with the confined part of the aquifer can be attributed to

a more active groundwater flow system, with almost all of the recharge and most of the groundwater discharge occurring from the unconfined part of the aquifer. Calibration of the transient model indicates that the model is able to reproduce historical water-level fluctuations that indicate gradual water-level declines in the Georgetown-Pflugerville area.

Predictive model runs indicate that under average recharge conditions, water levels will rise slightly relative to 1980 water levels throughout most of the study area over the 50-year planning period as a result of reduced pumping starting in 2001. Under drought-of-record conditions, water levels in the northern segment of the Edwards aquifer will decline, especially along the updip margin of the aquifer. In the predictive scenarios run, higher water levels occur in the central part of the study area. These higher water levels are the result of projected municipal and industrial pumping rates in the Round Rock-Georgetown area that are much lower than historical pumping rates. Pumping rates are expected to rise over the 2001 through 2050 period but will still be much lower than pre-2000 pumping rates. These lower pumping rates will result from conversion from the use of Edwards aquifer groundwater to surface water to meet water demands. Effects of these rising pumping rates are most apparent in the southern part of the study area.

15.0 Acknowledgements

In this modeling effort, many people should be acknowledged for their assistance. First and foremost, I would like to thank the Clearwater Underground Water Conservation District for its support and interest during the model development. A number of TWDB staff members have also been helpful in providing assistance and advice, including Roberto Anaya, Ali Chowdhury, Cindy Ridgeway, Richard Smith, and Shirley Wade. The support of TWDB management, including Robert Mace, William Mullican, and Kevin Ward, has been helpful in ensuring the successful completion of this project.

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Appendix C
Austin Sheet – Geologic Atlas of Texas

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
W. L. FISHER, DIRECTOR

EXPLANATION

Recent
- Qal — Alluvium
- Qt (Qa | Qhg) — Fluviatile terrace deposits
- Ql — Lissie Formation undivided

Pleistocene
- Qw (Qwl | Qwc) — Willis Formation

Miocene
- Mf — Fleming Formation
- Mo — Oakville Sandstone
- Mc — Catahoula Formation

Eocene or Oligocene
- Ewb — Wellborn Formation
- Ecs — Caddell Formation
- Ey — Yegua Formation
- Ecm — Cook Mountain Formation
- Es — Sparta Sand
- Ew — Weches Formation
- Eqc — Queen City Sand
- Er — Reklaw Formation
- Ec — Carrizo Sand

Eocene
- Ecb (Ewc | Esb | Ewn | Eh) — Wilcox Group

Upper Cretaceous
- Emi — Midway Group
- Ki — Cretaceous igneous rocks
- Knm (Kpg | Kns | Kpg | Ko) — Navarro Group and Marlbrook Marl ("upper Taylor marl"), Pecan Gap Chalk, and Ozan Formation ("lower Taylor marl")
- Kau — Austin Chalk
- Keb (Kef | Kbu) — Eagle Ford Group and Buda Limestone
- Kdg (Kdr | Kgt) — Del Rio Clay ("Grayson Marl") and Georgetown Formation
- Kfr (Ked | Kc | Kkc | Kcp | Kwd | Kbc) — Fredericksburg Group
- Kpa — Paluxy Sand

Lower Cretaceous
- Kgr(u) (Kgr(l)) — Glen Rose Formation
- Kh — Hensell Sand

Fault — U / D

U, upthrown side; D, downthrown side; dashed where inferred

QUATERNARY
TERTIARY
CRETACEOUS

Prepared by the Army Map Service (AJSX), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1954 by photogrammetric methods. Horizontal and vertical control by USGS and USC&GS. Aerial photography 1952-53. Photography field annotated 1954. Limited revision by U. S. Geological Survey 1963.

100,000-foot grids based on Texas coordinate system, central and south central zones.

10,000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue.

Partially funded by Texas Department of Water Resources

VIRGIL E. BARNES, PROJECT DIRECTOR

Geologic mapping by Shell Oil Company, Humble Oil & Refining Company, Mobil Oil Company, Shell Development Company, C. V. Proctor, Jr., T. E. Brown, J. H. McGowen, N. B. Waechter, and sources shown on the Index of Geologic Mapping. C. V. Proctor, Jr., T. E. Brown, J. H. McGowen, and N. B. Waechter compiled the geologic mapping on high altitude aerial photographs, compiled unmapped areas photogeologically, and field checked all mapping. Geologic mapping reviewed by Austin Geological Society, Geologic Atlas Committee, D. H. Eargle, Chairman, and E. T. Baker, Jr. (U. S. Geological Survey) and R. C. Peckham and R. L. Bluntzer (Texas Water Development Board). Geology scribed by J. W. Macon.

LOCATION MAP

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 Nautical Miles

CONTOUR INTERVAL 50 FEET

TRANSVERSE MERCATOR PROJECTION

1960 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 9°30' EASTERLY FOR THE CENTER OF THE WEST EDGE TO 8°30' EASTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 0°05' WESTERLY.

GEOLOGIC ATLAS OF TEXAS, AUSTIN SHEET

FRANCIS LUTHER WHITNEY MEMORIAL EDITION

REPRINTED 1981

INDEX OF GEOLOGIC MAPPING

Numbers in outlined areas refer to items in bibliography in "Index to Areal Geologic Maps in Texas, 1891-1961," by T. E. Brown (1963), Bureau of Economic Geology, The University of Texas at Austin. For area A, see G. L. Dawe, L. E. Garner, and P. U. Rodda (MS.) Geology of the Mansfield Dam quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area B, see M. A. C. Rogers, G. L. Dawe, and P. U. Rodda (MS.) Geology of the Jollyville quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area C, see K. P. Young (MS.) Geology of the Pflugerville West quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area D, see G. L. Dawe, L. E. Garner, and P. U. Rodda (MS.) Geology of the Bee Cave quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area E, see P. U. Rodda, L. E. Garner, and G. L. Dawe (1970) Geology of the Austin West quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map No. 38; for area F, see K. P. Young and L. E. Garner (MS.) Geology of the Austin East quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area G, see K. P. Young and L. E. Garner (MS.) Geology of the Manor quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area H, see K. P. Young and L. E. Garner (MS.) Geology of the Montopolis quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area I, see L. E. Garner and K. P. Young (MS.) Geology of the Oak Hill quadrangle, Travis County, Texas, Univ. Texas, Austin, Bur. Econ. Geology Geol. Quad. Map; and area J from E. T. Baker, Jr., and J. A. Watson (MS map by Baker) Quantity of low flow in Barton Creek, Texas, July 6-8 and October 1-3, 1970. Prepared by the U. S. Geological Survey in cooperation with the Texas Water Development Board.

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APPENDIX Q

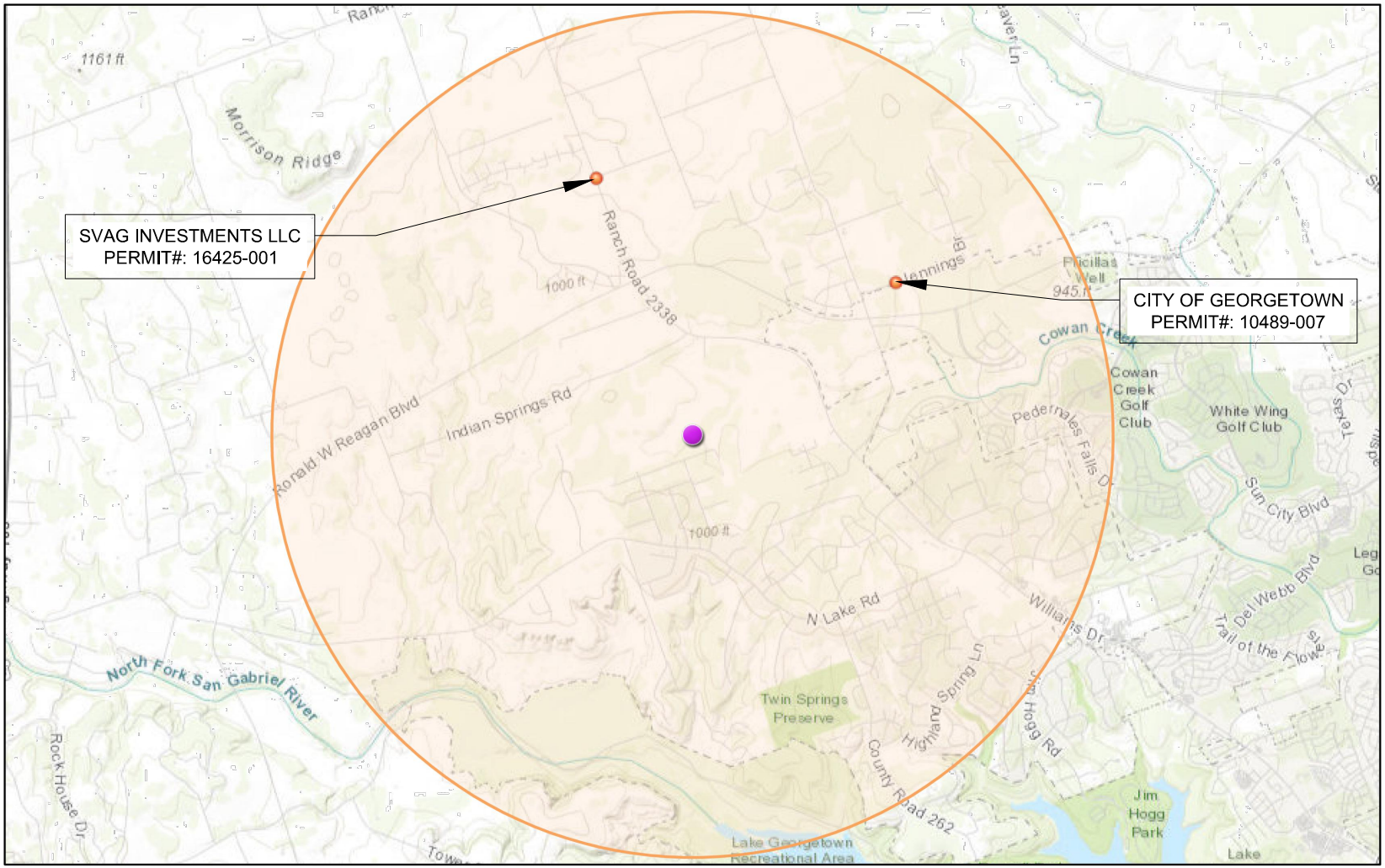
3-MILE RADIUS MAP

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

REAGOR TRACT WWTP
WILLIAMSON COUNTY, TX

APPENDIX R
NEARBY FACILITIES MAP

Wastewater Outfalls in Texas (TCEQ) Custom Print



12/2/2024, 2:15:56 PM

Wastewater Outfalls

1:72,224

0 0.5 1 2 mi

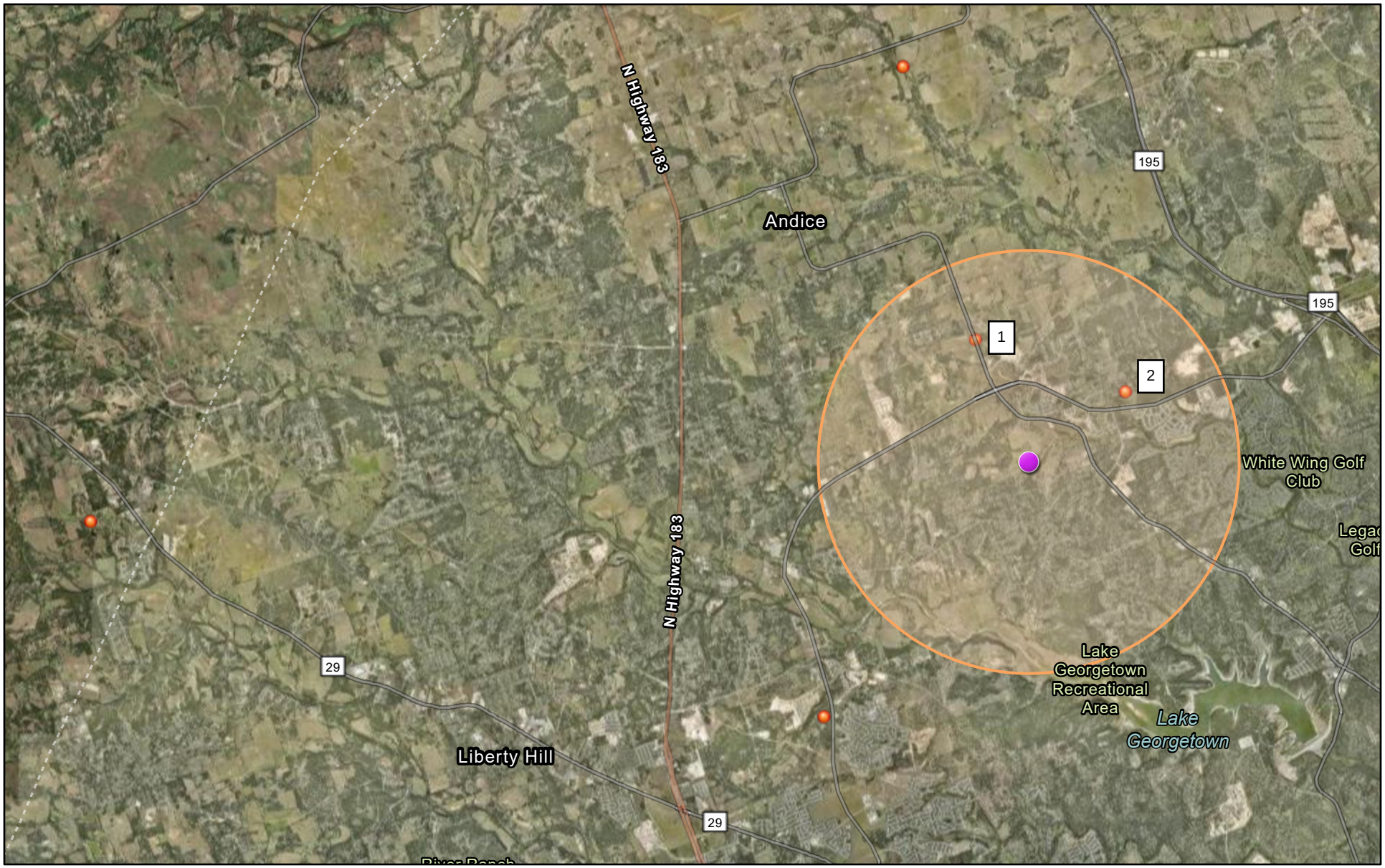
0 0.75 1.5 3 km

County of Williamson, Texas Parks & Wildlife, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA, TCEQ

Web AppBuilder for ArcGIS

County of Williamson, Texas Parks & Wildlife, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA | TCEQ |

Wastewater Outfalls in Texas (TCEQ) Custom Print



12/2/2024, 11:36:16 AM

Wastewater Outfalls

1	SVAG Investments, LLC	WQ0016425-001
2	City of Georgetown	WQ0010489-007

1:144,448

0 1 2 4 mi

0 1.75 3.5 7 km

County of Williamson, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS,

Web AppBuilder for ArcGIS

TCEQ | Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community | County of Williamson, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS |

APPENDIX R

CERTIFIED MAIL RECEIPTS

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

December 2, 2024

SVAG INVESTMENTS LLC
101 PARKLANE BLVD STE 102
SUGAR LAND, TX 77478 -5521

We are working on a TLAP Permit application for a neighboring single family development. Your existing wastewater treatment permit 16425-001 is within a 3-mile radius of the development's proposed outfall. The proposed development is anticipated to have an average daily flow of 0.150 MGD.

Do you have capacity to potentially serve the development?

Yes _____

No _____

_____ _____
Signature Date

Sincerely,

Lauren Crone, P.E.
Sr. Project Manager
LJA Engineering, Inc.
7500 Rialto Blvd, Bldg II, Suite 100
Austin, TX 78735
P: (512) 439-4700
D: (512) 439-4737
lcrone@lja.com

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

December 2, 2024

CITY OF GEORGETOWN
12357 RIATA TRACE PKWY STE 210
AUSTIN, TX 78727 -7171

We are working on a TLAP Permit application for a neighboring single family development. Your existing wastewater treatment permit 10489-007 is within a 3-mile radius of the development's proposed outfall. The proposed development is anticipated to have an average daily flow of 0.150 MGD.

Do you have capacity to potentially serve the development?

Yes _____

No _____

_____ _____
Signature Date

Sincerely,

Lauren Crone, P.E.
Sr. Project Manager
LJA Engineering, Inc.
7500 Rialto Blvd, Bldg II, Suite 100
Austin, TX 78735
P: (512) 439-4700
D: (512) 439-4737
lcrone@lja.com

A 444- 2401, 299

U.S. Postal Service
Certified Mail Receipt

OUTBOUND TRACKING NUMBER
9414 7118 9956 1598 6696 88

RETURN RECEIPT TRACKING NUMBER
9490 9118 9956 1598 6696 37

FEES

Postage per piece	$0.690
Certified Fee	$4.850
Return Receipt Fee	$4.100
Total Postage & Fees:	**$9.640**

ARTICLE ADDRESS TO:

CITY OF GEORGETOWN
12357 RIATA TRACE PKWY STE 210
AUSTIN TX 78727-7171

USPS OAKHILL STATION
DEC 02 2024
Postmark Here
AUSTIN, TX 78749-9998

U.S. Postal Service
Certified Mail Receipt

OUTBOUND TRACKING NUMBER
9414 7118 9956 1598 6910 23

RETURN RECEIPT TRACKING NUMBER
9490 9118 9956 1598 6910 03

FEES

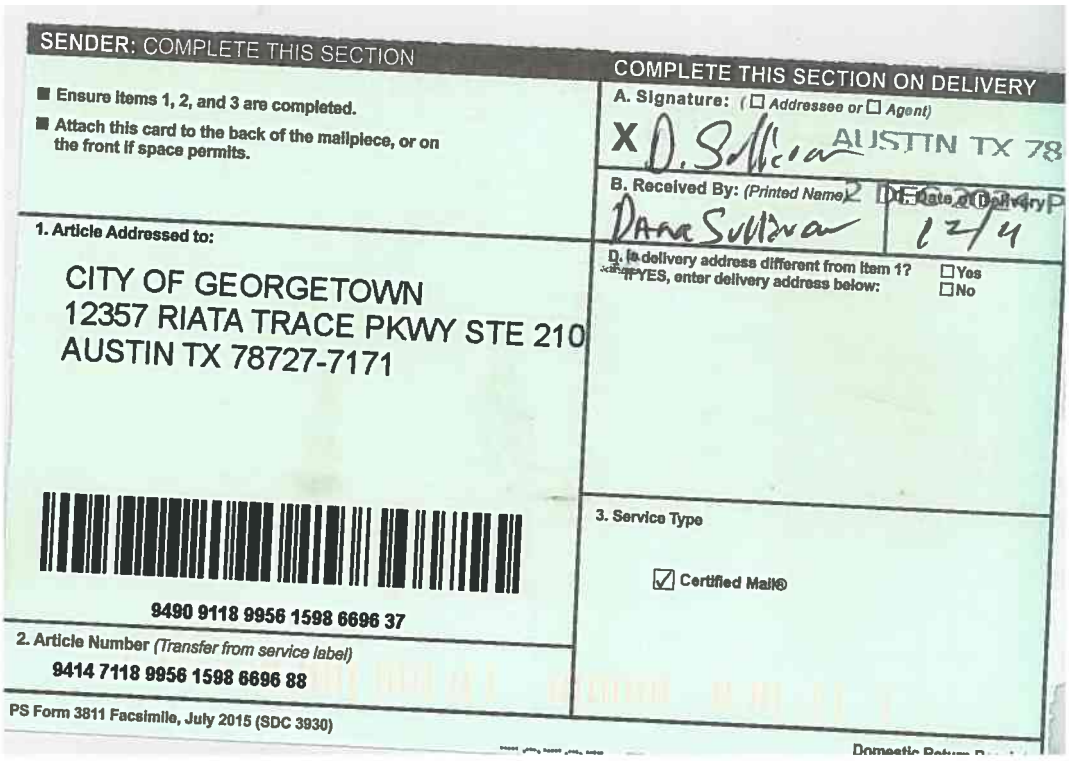
Postage per piece	$0.690
Certified Fee	$4.850
Return Receipt Fee	$4.100
Total Postage & Fees:	**$9.640**

ARTICLE ADDRESS TO:

SVAG INVESTMENTS LLC
101 Parklane Blvd Ste 102
SUGAR LAND TX 77478-5521

USPS OAKHILL STATION
DEC 02 2024
Postmark Here
AUSTIN, TX 78749-9998

USPS TRACKING #
AUSTIN TX 786
9490 9118 9956 1598 6696 37
First-Class Mail
Postage & Fees Paid
USPS
Permit No.G-10
UNITED STATES
POSTAL SERVICE
PS Form 3811 Facsimile, July 2015 (SDC 3930)
LJA Engineering, EN A444-2401
7500 Rialto Blvd Ste 2-100
Austin TX 78735-8510


SENDER: COMPLETE THIS SECTION
Ensure items 1, 2, and 3 are completed.
Attach this card to the back of the mailpiece, or on the front if space permits.
1. Article Addressed to:
CITY OF GEORGETOWN
12357 RIATA TRACE PKWY STE 210
AUSTIN TX 78727-7171
9490 9118 9956 1598 6696 37
2. Article Number (Transfer from service label)
9414 7118 9956 1598 6696 88
PS Form 3811 Facsimile, July 2015 (SDC 3930)
COMPLETE THIS SECTION ON DELIVERY
A. Signature: ☐ Addressee or ☐ Agent)
X D. Sullivan AUSTIN TX 78
B. Received By: (Printed Name) Dana Sullivan
C. Date of Delivery 12/4
D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No
3. Service Type
☑ Certified Mail®

APPENDIX S

REGIONALIZATION ANALYSIS

REAGOR TRACT WWTP REGIONALIZATION & COST ANALYSIS SUMMARY

The proposed subdivision lies within Williamson County, northwest of the City of Georgetown and northeast of the City of Liberty Hill. The subdivision will have approximately 624 equivalent single family connections, along with area for greenspace, rights of way, and utilities. While the property is located within 3 miles of the City of Georgetown's Wastewater Treatment Plant (Permit WQ0010489-007), the area within the property proposed for development is located outside of the City of Georgetown CCN. Under the Legislature's authorization in TWC Sec. 13.254, the landowner has chosen another utility to provide service. Georgetown's provision of service is uneconomical - see attached cost comparison showing that the initial construction cost for the off-site line is significantly higher than on-site facilities.

Connection to the Georgetown Wastewater System would cost an estimated $14.9 million. This connection includes all offsite line extensions, lift station improvements and impact fees from the City of Georgetown for connection. In addition, the Wastewater Utility Evaluation included several projects which would be included in the City's Capital Improvement Plan, which leads to uncertainty with the timing of the City's ability to serve the tract.

The proposed alternative is to construct an on-site wastewater treatment system to serve the entire Reagor Tract Subdivision. The on-site wastewater system would cost an estimated $11.5 million and would include a 150,000 GPD wastewater treatment plant, a lift station and the main wastewater line through the property. Internal wastewater facilities would be the same cost for both alternatives and therefore are not included in the construction costs.

Construction of an on-site wastewater system is not only more feasible but is also a more cost-effective way of providing wastewater service to the proposed subdivision. Furthermore, acquisition of easements for the offsite improvements adds uncertainty to the schedule and cost of construction.

Engineering, Inc.

Engineer's Estimate of Cost and Quantities

Project: Reagor Tract WWTP
Client:

Date: 12/2/2024
By: L.Crone

				On-Site Wastewater System	
Item	Description	Quantity	Unit	Unit Cost	Cost
	Wastewater Improvements				
WW-1	50,000 gal/day WWTP	3	EA	$1,000,000.00	$ 3,000,000.00
WW-2	Influent Lift Station	1	EA	$750,000.00	$ 750,000.00
WW-3	Subsurface Irrigation System	35	AC	$150,000.00	$ 5,250,000.00
WW-4	WWTP Access Drive	1	EA	$90,000.00	$ 90,000.00
WW-5	12" PVC SDR 26 WW Line (Cross Country)	600	LF	$100.00	$ 60,000.00
WW-6	12" PVC SDR 26 WW Line (Pavement)	1,900	LF	$80.00	$ 152,000.00
WW-7	4' Diameter Manhole	6	EA	$6,500.00	$ 39,000.00
WW-8	Extend 3-Phase Power	1,000	LF	$100.00	$ 100,000.00
				SUBTOTAL	**$ 9,441,000.00**
				10% CONTINGENCY	**$ 944,100.00**
				12% ENGINEERING AND SURVEYING	**$ 1,132,920.00**
				GRAND TOTAL	**$ 11,518,020.00**

Engineering, Inc.

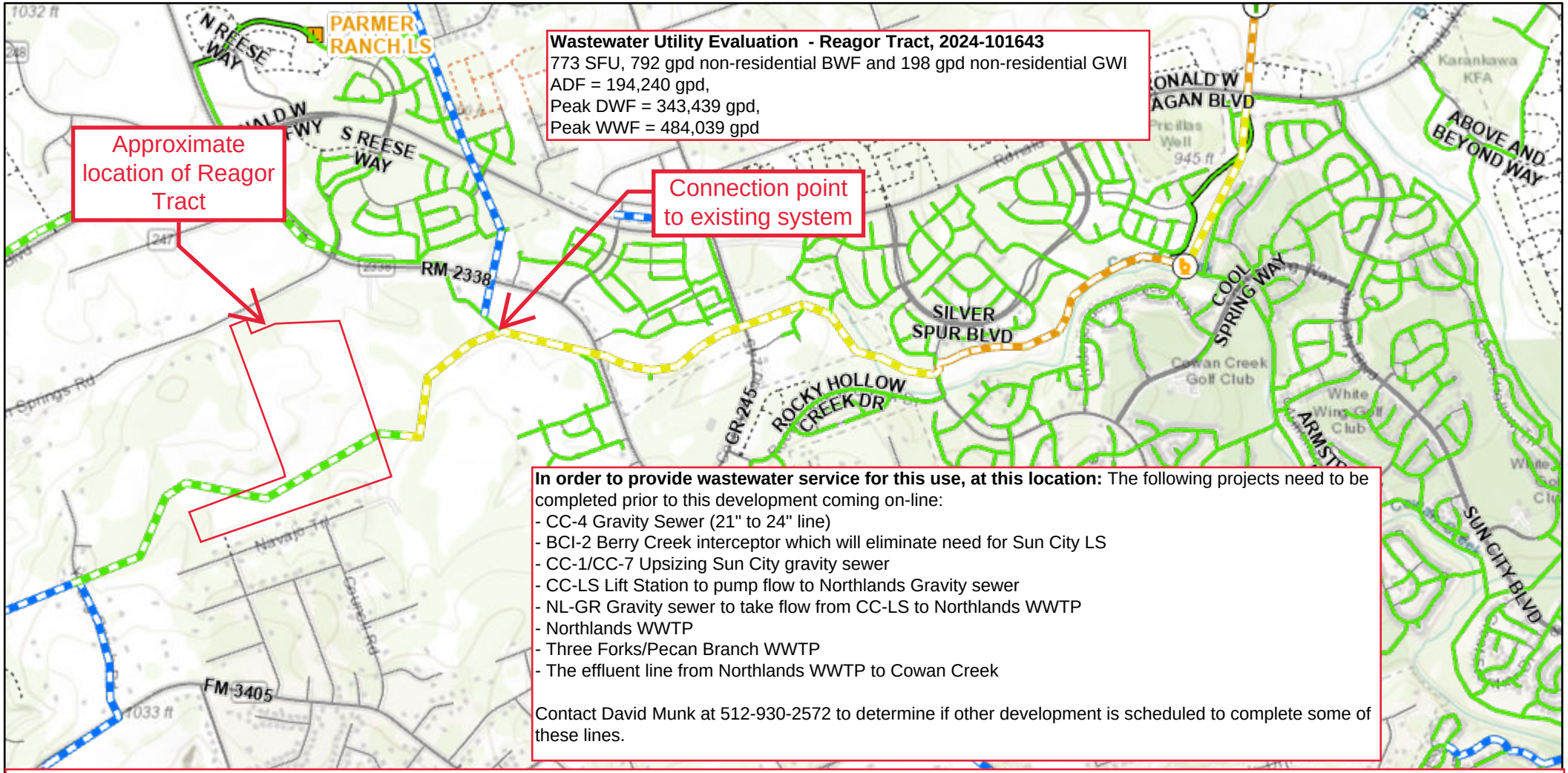
Engineer's Estimate of Cost and Quantities

Project: Reagor Tract WWTP
Client:

Date: 12/2/2024
By: L.Crone

				Off-Site Wastewater System	
Item	Description	Quantity	Unit	Unit Cost	Cost
	Wastewater Improvements				
WW-1	CC-4 Gravity Sewer 21" to 24"	11,955	LF	$200.00	$ 2,391,000.00
WW-2	BCI-2 Berry Creek Interceptor (Eliminate Sun City LS)	11,435	LF	$200.00	$ 2,287,000.00
WW-3	CC-1/CC-7 Upsizing Sun City gravity sewer	14,315	LF	$200.00	$ 2,863,000.00
WW-4	CC-LS Lift Station to pump to Northlands Gravity Sewer	1	EA	$800,000.00	$ 800,000.00
WW-5	Impact Fees	612	EA	$6,129.00	$ 3,750,948.00
WW-6	Extend 3-Phase Power	1,000	LF	$100.00	$ 100,000.00
				SUBTOTAL	**$ 12,191,948.00**
				10% CONTINGENCY	**$ 1,219,194.80**
				12% ENGINEERING AND SURVEYING	**$ 1,463,033.76**
				GRAND TOTAL	**$ 14,874,176.56**

2024-101643 Reagor Tract Wastewater Utility Evaluation



Wastewater Utility Evaluation - Reagor Tract, 2024-101643
773 SFU, 792 gpd non-residential BWF and 198 gpd non-residential GWI
ADF = 194,240 gpd,
Peak DWF = 343,439 gpd,
Peak WWF = 484,039 gpd

In order to provide wastewater service for this use, at this location: The following projects need to be completed prior to this development coming on-line:
- CC-4 Gravity Sewer (21" to 24" line)
- BCI-2 Berry Creek interceptor which will eliminate need for Sun City LS
- CC-1/CC-7 Upsizing Sun City gravity sewer
- CC-LS Lift Station to pump flow to Northlands Gravity sewer
- NL-GR Gravity sewer to take flow from CC-LS to Northlands WWTP
- Northlands WWTP
- Three Forks/Pecan Branch WWTP
- The effluent line from Northlands WWTP to Cowan Creek

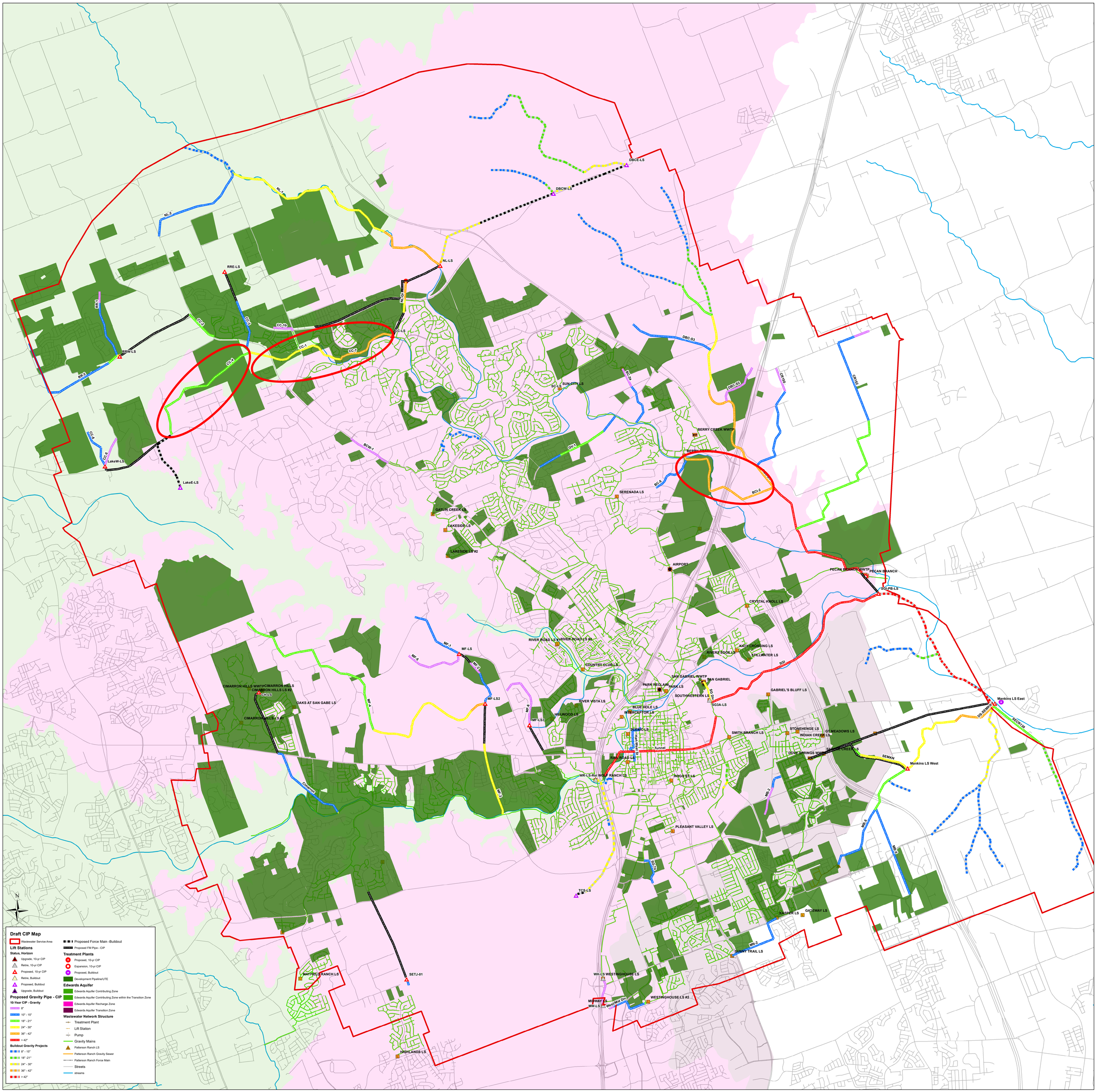
Contact David Munk at 512-930-2572 to determine if other development is scheduled to complete some of these lines.

If during the development review process a different variation of use, max day water usage or fire flow is needed than what is proposed above for this site, the City requires that a new utility evaluation be submitted for review. It is also recommended that the developer contact the local Fire District to confirm fire flow requirements. Should those requirements differ from what is listed within this document, additional evaluation and improvements may be required. Additionally, remaining on-site and off-site improvements needed to serve your project will be determined during the plan review process. In general, the following provisions apply to secure water capacity for the project:

1) Extension of utilities to the property is the responsibility of the developer.
2) Required to tie to existing stubs
3) Extend along the ROW to all property boundaries.
4) Additional off-site improvements may be necessary based upon the timing of the City's Capital Improvement Plan (CIP) and developer need.
5) Design and Construction of the facility and utilities must be inspected and approved in accordance with the appropriate City codes and ordinances.

Any change in your proposed use or changes in our water system would require a resubmittal of the evaluation. The water system for this development must meet all City of Georgetown requirements and inspections.

You may contact me or the Systems Engineering Director at (512)-930-3558, if you have any further questions, regarding the information provided or if you need help submitting plans and the required fees.


DBCE-LS
DBCW-LS
NL-1
NL-2
NL-LS
RRE-LS
RE-1
RRW-LS
RR-2
CC-3
CC-2
CC-1b
CC-1
CC-7
CC-LS
CC-4
CC-6
CC-5
LakeW-LS
LakeE-LS
BCW-1
DBC-S3
DBC-2a
SC-LS
SUN CITY LS
DBC-S2
BERRY CREEK WWTP
GV-1
BC-5
BCI-2
CR-1b2
CR-1b1
SERENADA LS
GATLIN CREEK LS
LAKESIDE LS
LAKESIDE LS #2
AIRPORT
PECAN BRANCH WWTP
PECAN BRANCH
SGI-PB-LS
CRYSTAL KNOLL LS
KATY CROSSING LS
STILLWATER LS
RIVERS EDGE LS
SGI
RIVER ROAD LS
RIVER ROAD LS #2
MF-1
MF-LS
MF-5
MF-3
COUNTRY CLUB LS
SAN GABRIEL WWTP
SAN GABRIEL
PARK RECLAIM
PARK LS
SOUTHWESTERN LS
SG-DS
SG3A-LS
GABRIEL'S BLUFF LS
CIMARRON HILLS WWTP
CIMARRON HILLS LS #2
CH-LS
OAKS AT SAN GABE LS
CIMARRON HILLS LS #1
MF-4
MF-LS2
MF-6
MF-LS3
HILLWOOD LS
RIVER VISTA LS
BLUE HOLE LS
INTERCEPTOR LS
SCENIC LS
Hart-Beard-SI
Tunnel
RAIL ROAD LS
WR-LS-Ret WOLF RANCH LS
HOGG ST LS
SMITH BRANCH LS
STONEHENGE LS
INDIAN CREEK LS
GT MEADOWS LS
SAGE CREEK LS
DOVE SPRINGS WWTP
SEMKN
Mankins LS West
Mankins LS East
DS-SEMKN
SECR-3b
MB-3
MB-5
MB-5.1
PLEASANT VALLEY LS
SG-3a
TCS-LS
KASPER LS
GATEWAY LS
MN-2
SUNNY TRAIL LS
Cimarron
MAYFIELD RANCH LS
SETJ-01
HIGHLANDS LS
WH-LS WESTINGHOUSE LS
MIDWAY LS
MW-LS
Westfield Div
WESTINGHOUSE LS #2
N
Draft CIP Map
Wastewater Service Area
Lift Stations
Status, Horizon
Upgrade, 10-yr CIP
Retire, 10-yr CIP
Proposed, 10-yr CIP
Retire, Buildout
Proposed, Buildout
Upgrade, Buildout
Proposed Gravity Pipe - CIP
10-Year CIP - Gravity
8"
10" - 15"
18" - 21"
24" - 30"
36" - 42"
> 42"
Buildout Gravity Projects
8" - 15"
18" -21"
24" - 30"
36" - 42"
> 42"
Proposed Force Main -Buildout
Proposed FM Pipe - CIP
Treatment Plants
Proposed, 10-yr CIP
Expansion, 10-yr CIP
Proposed, Buildout
Development Pipeline/UTE
Edwards Aquifer
Edwards Aquifer Contributing Zone
Edwards Aquifer Contributing Zone within the Transition Zone
Edwards Aquifer Recharge Zone
Edwards Aquifer Transition Zone
Wastewater Network Structure
Treatment Plant
Lift Station
Pump
Gravity Mains
Patterson Ranch LS
Patterson Ranch Gravity Sewer
Patterson Ranch Force Main
Streets
streams

APPENDIX T

SITE PREPARATION PLAN

SITE PREPARATION PLAN

FOR

REAGOR TRACT WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

DECEMBER 2024

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD. BUILDING II SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

SITE PREPARATION PLAN

All site preparations will be made so that any potential site-specific limitations will be alleviated and suitability for the subsurface drip irrigation system will be ensured.

No restrictive horizons within the soil columns were discovered so no unusual design criteria are planned to compensate. Soil importation is not currently planned due to the results of the soil investigation, but the applicant plans to mine soil during project construction and may use that to enhance irrigation areas.

Minimal amounts of existing vegetation will be removed during installation of the subsurface drip irrigation system. Existing vegetation in open areas will be supplemented with bermuda and winter rye grasses.

The applicant also plans to construct berms as necessary to spread and divert concentrated run-on around the irrigation areas. Refer to the site plan (Appendix H) for location of irrigation areas and demonstration that concentrated flows are routed around the proposed irrigation areas.

Leah Whallon

From: Lauren Crone <lcrone@lja.com>
Sent: Monday, January 6, 2025 12:35 PM
To: Leah Whallon
Cc: mike_reagor@yahoo.com
Subject: RE: Application for Proposed Permit No. WQ0016685001; George Reagor and Laura Reagor; Reagor Tract WWTF
Attachments: WQ0016685001 NOD 1 .pdf; 5160 format Landowner Labels.docx; Municipal Disposal New Spanish NORI.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Leah,

Please see the NOD response including the Spanish NORI, landowner labels and payment receipt. If you need anything else, please let me know.

Thank you,

Lauren Crone, P.E. | Senior Project Manager
Central Texas Land Development
O: 512.439.4700 | C: 512.971.7693
7500 Rialto Blvd. Building II, Suite 100 Austin, TX 78735
EMPLOYEE-OWNED. CLIENT FOCUSED.
www.lja.com

From: Leah Whallon <Leah.Whallon@Tceq.Texas.Gov>
Sent: Friday, December 20, 2024 4:34 PM
To: Lauren Crone <lcrone@lja.com>
Cc: mike_reagor@yahoo.com
Subject: Application for Proposed Permit No. WQ0016685001; George Reagor and Laura Reagor; Reagor Tract WWTF

[EXTERNAL EMAIL]

Good Afternoon,

Please see the attached Notice of Deficiency letter dated December 20, 2024 requesting additional information needed to declare the application administratively complete. Please send the complete response by January 3, 2025.

Please let me know if you have any questions.

Thank you,

Leah Whallon
Texas Commission on Environmental Quality
Water Quality Division
512-239-0084
leah.whallon@tceq.texas.gov

How is our customer service? Fill out our online customer satisfaction survey at www.tceq.texas.gov/customersurvey

[EXTERNAL EMAIL] Exercise caution. Do not open attachments or click links from unknown senders or unexpected email

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

January 6th, 2025

Leah Whallon
Applications Review and Processing Team
Water Quality Division – TCEQ, MC 148
12100 Park 35 Circle
Austin, Texas 78753

Re: Reagor Tract Wastewater Treatment Plant
Proposed by George Reagor, Laura Reagor
Application No. WQ0016685001
George Reagor (CN606333367); Laura Reagor (CN606333375)
RN112098769
LJA Project No. A444-2401

Dear Rachel:

Please find the responses related to the permit application for Reagor Tract WWTP received December 11th, 2024 below.

1. Administrative Report 1.0, Section 1
Please provide a revised page to include the check or voucher information to confirm the application fee payment.
Response: The fee was paid using the ePay system. The voucher is attached.

2. Administrative Report 1.1, Section 1
Please provide the affected landowner list formatted for mailing labels (Avery 5160) in a Microsoft Word document.
Response: Please see the attached landowner labels in Word Format.

3. The following is a portion of the NORI which contains information relevant to your application. Please read it carefully and indicate if it contains any errors or omissions. The complete notice will be sent to you once the application is declared administratively complete.
APPLICATION. George Reagor, 906 East Sandstone Street, Llano, Texas 78643, and Laura Reagor,14943 Sandalfoot Street, Houston, Texas 77095, have applied to the Texas Commission on Environmental Quality (TCEQ) for proposed Texas Land Application Permit (TLAP) No. WQ0016685001 to authorize the disposal of treated wastewater at a volume not to exceed a daily average flow of 150,000 gallons per day via subsurface area drip dispersal system on a minimum of 35 acres. The domestic wastewater treatment facility and disposal area will be located approximately 0.59 miles south of the intersection of Indian Springs Road and Ranch-to-Market Road 2338, near the city of Georgetown, in Williamson County, Texas 78633. TCEQ received this application on December 11, 2024. The permit application will be available for viewing and copying at Liberty Hill Public Library, 355 Loop 332, Liberty Hill, in Williamson County, Texas prior to the date this notice is published in the newspaper.

The application, including any updates, and associated notices are available electronically at the following webpage:
https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

This link to an electronic map of the site or facility's general location is provided as a public courtesy and not part of the application or notice. For the exact location, refer to the application. https://gisweb.tceq.texas.gov/LocationMapper/?marker=-97.793888,30.726111&level=18

Further information may also be obtained from George Reagor and Laura Reagor at the address stated above or by calling Ms. Lauren Crone, P.E., LJA Engineering, Inc., at 512-439-4700.

Response: The NORI is considered complete, No errors or omissions were found in the notice above.

4. The application indicates that public notices in Spanish are required. After confirming the portion of the NORI above does not contain any errors or omissions, please use the attached template to translate the NORI into Spanish. Only the first and last paragraphs are unique to this application and require translation. Please provide the translated Spanish NORI in a Microsoft Word document.
Response: The Spanish version of the NORI is completed and attached to this response.

Should you have any questions or need any additional information, please do not hesitate to call.

Sincerely,

Lauren Crone

Lauren Crone, P.E.

Your transaction is complete. Thank you for using TCEQ ePay.

Note: It may take up to 3 working days for this electronic payment to be processed and be reflected in the TCEQ ePay system. Print this receipt and the vouchers for your records. An email receipt has also been sent.

Transaction Information

Trace Number:	582EA000641763
Date:	01/06/2025 09:24 AM
Payment Method:	CC - Authorization 0000006691
ePay Actor:	LAUREN CRONE
Actor Email:	lcrone0728@gmail.com
IP:	170.55.94.226
TCEQ Amount:	$850.00
Texas.gov Price:	$869.38*

* This service is provided by Texas.gov, the official website of Texas. The price of this service includes funds that support the ongoing operations and enhancements of Texas.gov, which is provided by a third party in partnership with the State.

Payment Contact Information

Name:	LAUREN CRONE
Company:	LJA ENGINEERING INC
Address:	3300 W SAM HOUSTON PKWY S, HOUSTON, TX 77042
Phone:	512-439-4700

Cart Items

Click on the voucher number to see the voucher details.

Voucher	Fee Description	AR Number	Amount
738910	WW PERMIT - FACILITY WITH FLOW >= .10 & < .25 MGD - NEW AND MAJOR AMENDMENTS		$800.00
738911	30 TAC 305.53B WQ NOTIFICATION FEE		$50.00
		TCEQ Amount:	$850.00

ePay Again Exit ePay

Note: It may take up to 3 working days for this electronic payment to be processed and be reflected in the TCEQ ePay system. Print this receipt for your records.

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Statewide Links: Texas.gov | Texas Homeland Security | TRAIL Statewide Archive | Texas Veterans Portal

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LAGOW, BOBBIE & ROBERT,
KRISTEN,MICALE
100 NAVAJO TRL, GEORGETOWN, TX
78633

MEADOWS, JERRY D & MARSHA F
106 NAVAJO TRL,
GEORGETOWN, TX 78633

ELLIS, CATHERINE M & GARETH J
110 NAVAJO TRL,
GEORGETOWN, TX 78633

GEARHART, TERRY L & MITZI
200 NAVAJO TRL, GEORGETOWN, TX
78633

ANDERSON, WESS M & BARBARA A
208 NAVAJO TRL, GEORGETOWN,
TX 78633

STIEN, JAY J & CYNTHIA A
216 NAVAJO TRL, GEORGETOWN, TX
78633

PINEDA, JESSICA R & JOSE A
222 NAVAJO TRL, GEORGETOWN, TX
78633"

HOGG, ROBERT C JR (TOD) &
DONNA R (TOD)
224 NAVAJO TRL,
GEORGETOWN, TX 78633

LYON, KATHLEEN I &
MATTHEW L EISBRENNER
232 NAVAJO TRL, GEORGETOWN, TX
78633

FORFIA, DAVID PAUL & LAURIE DIANNE
300 NAVAJO TRL, GEORGETOWN, TX
78633

BIERSCHENK, THOMAS & MARGARET
590 YOUNG RANCH RD,
GEORGETOWN, TX 78633

NAKASHIMA GRANT K & MICHAELANNE
ELIZABETH BRIGGS TRS OF NAKA TRUST
501 INDIAN SPRINGS RD, GEORGETOWN,
TX 78633

ATKINSON J T & W F FAMILY LTD
PARTNERSHIP 241 INDIAN SPRINGS RD,
GEORGETOWN, TX 78633

Comisión de Calidad Ambiental del Estado de Texas

AVISO DE RECIBO DE LA SOLICITUD E
INTENCION DE OBTENER PERMISO PARA LA CALIDAD DEL AGUA

PERMISO PROPUESTO NO. WQ00_____

SOLICITUD. George Reagor, 906 East Sandstone Street, Llano, Texas 78643, and Laura Reagor, 14943 Sandalfoot Street, Houston, Texas 77095 ha solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) para el propuesto Permiso No.WQ0016685001 de disposición de aguas residuales para autorizar la disposición de aguas residuales tratadas en un volumen que no sobrepasa un flujo promedio diario de 150,000 galones por día por medio de Sistema de dispersión por goteo en el área subterránea en un mínimo de 35 acres. La planta de tratamiento de aguas domésticos residuales y el área de disposición están ubicados en 0.59 millas al sur de la intersección de Indian Springs Road y Ranch-to-Market
Road 2338, cerca de la ciudad de Georgetown en el Condado de Williamson, Texas. La TCEQ recibió esta solicitud el día Diciembre 11, 2024. La solicitud para el permiso estará disponible para leerla y copiarla en Biblioteca pública de Liberty Hill, 355 Loop 332, Liberty Hill, en el condado de Williamson antes de la fecha de publicación de este aviso en el periódico. Este enlace a un mapa electrónico de la ubicación general del sitio o de la instalación es proporcionado como una cortesía y no es parte de la solicitud o del aviso. Para la ubicación exacta, consulte la solicitud.
https://gisweb.tceq.texas.gov/LocationMapper/?marker=-97.793888,30.726111&level=18

Include the following non-italicized sentence if the facility is located in the Coastal Management Program boundary. The Coastal Management Program boundary is the area along the Texas Coast of the Gulf of México as depicted on the map in 31 TAC §503.1 and includes part or all of the following counties: Cameron, Willacy, Kenedy, Kleberg, Nueces, San Patricio, Aransas, Refugio, Calhoun, Victoria, Jackson, Matagorda, Brazoria, Galveston, Harris, Chambers, Jefferson y Orange. El Director Ejecutivo de la TCEQ ha revisado esta medida para ver si está de acuerdo con los objetivos y las regulaciones del Programa de Administración Costero de Texas (CMP) de acuerdo con las regulaciones del Consejo Coordinador de la Costa (CCC) y ha determinado que la acción es conforme con las metas y regulaciones pertinentes del CMP.

AVISO ADICIONAL. El Director Ejecutivo de la TCEQ ha determinado que la solicitud es administrativamente completa y conducirá una revisión técnica de la solicitud. Después de completar la revisión técnica, el Director Ejecutivo puede preparar un borrador del permiso y emitirá una Decisión Preliminar sobre la solicitud. **El aviso de la solicitud y la decisión preliminar serán publicados y enviado a los que están en la lista de correo de las personas a lo largo del condado que desean recibir los avisos y los que están en la lista de correo que desean recibir avisos de esta solicitud. El aviso dará la fecha límite para someter comentarios públicos.**

COMENTARIO PUBLICO / REUNION PUBLICA. Usted puede presentar comentarios públicos o pedir una reunión pública sobre esta solicitud. El propósito de una reunión pública es dar la oportunidad de presentar comentarios o hacer preguntas acerca de la solicitud. La TCEQ realiza una reunión pública si el Director Ejecutivo determina que hay un grado de interés público suficiente en la solicitud o si un legislador local lo pide. Una reunión pública no es una audiencia administrativa de lo contencioso.

OPORTUNIDAD DE UNA AUDIENCIA ADMINISTRATIVA DE LO CONTENCIOSO. Después del plazo para presentar comentarios públicos, el Director Ejecutivo considerará todos los comentarios apropiados y preparará una respuesta a todo los comentarios públicos esenciales, pertinentes, o significativos. **A menos que la solicitud haya sido referida directamente a una audiencia administrativa de lo contencioso, la respuesta a los comentarios y la decisión del Director Ejecutivo sobre la solicitud serán enviados por correo a todos los que presentaron un comentario público y a las personas que están en la lista para recibir avisos sobre esta solicitud. Si se reciben comentarios, el aviso también proveerá instrucciones para pedir una reconsideración de la decisión del Director Ejecutivo y para pedir una audiencia administrativa de lo contencioso.** Una audiencia administrativa de lo contencioso es un procedimiento legal similar a un procedimiento legal civil en un tribunal de distrito del estado.

PARA SOLICITAR UNA AUDIENCIA DE CASO IMPUGNADO, USTED DEBE INCLUIR EN SU SOLICITUD LOS SIGUIENTES DATOS: su nombre, dirección, y número de teléfono; el nombre del solicitante y número del permiso; la ubicación y distancia de su propiedad/actividad con respecto a la instalación; una descripción específica de la forma cómo usted sería afectado adversamente por el sitio de una manera no común al público en general; una lista de todas las cuestiones de hecho en disputa que usted presente durante el período de comentarios; y la declaración "[Yo/nosotros] solicito/solicitamos una audiencia de caso impugnado". Si presenta la petición para una audiencia de caso impugnado de parte de un grupo o asociación, debe identificar una persona que representa al grupo para recibir correspondencia en el futuro; identificar el nombre y la dirección de un miembro del grupo que sería afectado adversamente por la planta o la actividad propuesta; proveer la información indicada anteriormente con respecto a la ubicación del miembro afectado y su distancia de la planta o actividad propuesta; explicar cómo y porqué el miembro sería afectado; y explicar cómo los intereses que el grupo desea proteger son pertinentes al propósito del grupo.

Después del cierre de todos los períodos de comentarios y de petición que aplican, el Director Ejecutivo enviará la solicitud y cualquier petición para reconsideración o para una audiencia de caso impugnado a los Comisionados de la TCEQ para su consideración durante una reunión programada de la Comisión. La Comisión sólo puede conceder una solicitud de una audiencia de caso impugnado sobre los temas que el solicitante haya presentado en sus comentarios oportunos que no fueron retirados posteriormente. Si se concede una audiencia, el tema de la audiencia estará limitado a cuestiones de hecho en disputa o cuestiones mixtas de hecho y de derecho relacionadas a intereses pertinentes y materiales de calidad del agua que se hayan presentado durante el período de comentarios.

LISTA DE CORREO. Si somete comentarios públicos, un pedido para una audiencia administrativa de lo contencioso o una reconsideración de la decisión del Director Ejecutivo, la

Oficina del Secretario Principal enviará por correo los avisos públicos en relación con la solicitud. Ademas, puede pedir que la TCEQ ponga su nombre en una or mas de las listas correos siguientes (1) la lista de correo permanente para recibir los avisos de el solicitante indicado por nombre y número del permiso específico y/o (2) la lista de correo de todas las solicitudes en un condado especifico. Si desea que se agrega su nombre en una de las listas designe cual lista(s) y envia por correo su pedido a la Oficina del Secretario Principal de la TCEQ.

CONTACTOS E INFORMACIÓN A LA AGENCIA. Todos los comentarios públicos y solicitudes deben ser presentadas electrónicamente vía http://www14.tceq.texas.gov/epic/eComment/ o por escrito dirigidos a la Comisión de Texas de Calidad Ambiental, Oficial de la Secretaría (Office of Chief Clerk), MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Tenga en cuenta que cualquier información personal que usted proporcione, incluyendo su nombre, número de teléfono, dirección de correo electrónico y dirección física pasarán a formar parte del registro público de la Agencia. Para obtener más información acerca de esta solicitud de permiso o el proceso de permisos, llame al programa de educación pública de la TCEQ, gratis, al 1-800-687-4040. Si desea información en Español, puede llamar al 1-800-687-4040.

También se puede obtener información adicional del George Reagor and Laura Reagor a la dirección indicada arriba o llamando a Senora Lauren Crone, P.E. LJA Engineering Inc., al (512) 439-4700.

Fecha de emisión _____ *[Date notice issued]*

Alan Barraza

From: Lauren Crone <lcrone@lja.com>
Sent: Tuesday, April 15, 2025 12:51 PM
To: Alan Barraza
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit
Attachments: image001.png; image002.png; image003.png; image004.png; image005.png; image006.png; image007.gif; image008.jpg; image009.png; image010.png; Mimecast Large File Send Instructions

I'm using Mimecast to share large files with you. Please see the attached instructions.

Alan,

Please see the attached soil evaluation report associated with this TLAP application. If you have any questions, please let me know.

Thank you,

Lauren Crone, P.E. | Senior Project Manager
CENTRAL TEXAS LAND DEVELOPMENT
O: 512.439.4700 | C: 512.971.7693
7500 Rialto Blvd. Building II, Suite 100 Austin, TX 78735
EMPLOYEE-OWNED. CLIENT FOCUSED.
www.lja.com

From: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Sent: Monday, March 31, 2025 1:09 PM
To: Lauren Crone <lcrone@lja.com>
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

[EXTERNAL EMAIL]

Thank you for the update Lauren. Extension granted though April 14th. Please reach out if I can be of assistance.

Alan Barraza
Agronomist | Water Quality Assessment
TCEQ | Water Quality Division | MC 150
Direct: 512-239-4642
Fax: 512-239-4420

12100 Park 35 Circle
Austin, TX 78753

From: Lauren Crone <lcrone@lja.com>
Sent: Monday, March 31, 2025 8:39 AM
To: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Cc: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

Alan,

We would like to request an extension to the deadline listed below. We are actively working to schedule excavations necessary for the requested report and anticipate having the requested information to you within the next 2 weeks.

Please let me know if you have any questions or need any additional information.

Thank you,

Lauren Crone, P.E. | Senior Project Manager
CENTRAL TEXAS LAND DEVELOPMENT
O: 512.439.4700 | C: 512.971.7693
7500 Rialto Blvd. Building II, Suite 100 Austin, TX 78735
EMPLOYEE-OWNED. CLIENT FOCUSED.
www.lja.com

From: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Sent: Monday, March 17, 2025 4:25 PM
To: Lauren Crone <lcrone@lja.com>
Cc: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Subject: Re: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

[EXTERNAL EMAIL]

Good afternoon Lauren,

Upon reviewing the submitted information, I noticed two missing pieces of information that must be submitted so the technical review be completed. The submittal references the soil evaluation required in Worksheet 3.3, but it was not included in the submittal. Please reference 30 TAC 222.73 if you need guidance. Also, please submit a USDA soil map depicting only the application field. The submitted soil map depicts the entire property. Please submit this information within 14 days (March 31) of this email. Thank you.

Best,

Alan Barraza
Agronomist | Water Quality Assessment
TCEQ | Water Quality Division | MC 150
Direct: 512-239-4642
Fax: 512-239-4420
12100 Park 35 Circle
Austin, TX 78753

From: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Sent: Wednesday, February 26, 2025 8:28:32 AM
To: Lauren Crone <lcrone@lja.com>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: Re: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

The link worked for me - thank you Lauren.

-Andy

Andrew Gorton, P.G.

Texas Commission on Environmental Quality

MC-150

PO Box 13087

Austin, TX 78711-3087

512.239.4585

Andrew.Gorton@tceq.texas.gov

From: Lauren Crone <lcrone@lja.com>
Sent: Tuesday, February 25, 2025 2:34 PM
To: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

Andy,

I just sent you the updated material via a download link. Please let me know if you do not receive it shortly.

Thank you,

Lauren Crone, P.E. | Senior Project Manager

CENTRAL TEXAS LAND DEVELOPMENT
O: 512.439.4700 | C: 512.971.7693
7500 Rialto Blvd. Building II, Suite 100 Austin, TX 78735
EMPLOYEE-OWNED. CLIENT FOCUSED.
www.lja.com

From: Lauren Crone
Sent: Friday, February 21, 2025 11:38 AM
To: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

Andy,

I have received soil samples and will get the update to you ASAP. I wanted to give you a status update from our end.

Thank you,

Lauren Crone, P.E. | Senior Project Manager
CENTRAL TEXAS LAND DEVELOPMENT
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From: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Sent: Thursday, January 16, 2025 8:38 AM
To: Lauren Crone <lcrone@lja.com>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: Re: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

[EXTERNAL EMAIL]

Ok, thanks Lauren, I believe we can work with that schedule.

Thank you,

-Andy

Andrew Gorton, P.G.

Texas Commission on Environmental Quality

MC-150

PO Box 13087

Austin, TX 78711-3087

512.239.4585

Andrew.Gorton@tceq.texas.gov

From: Lauren Crone <lcrone@lja.com>
Sent: Thursday, January 16, 2025 8:29 AM
To: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

Andrew,

I'm told that we will have the soil samples back by February 7.

Lauren Crone, P.E. | Senior Project Manager
Central Texas Land Development
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From: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Sent: Thursday, January 16, 2025 8:29 AM
To: Lauren Crone <lcrone@lja.com>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: Re: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

[EXTERNAL EMAIL]

Hi Lauren, how much more time do you need?

Thank you,

-Andy

Andrew Gorton, P.G.

Texas Commission on Environmental Quality

MC-150

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Andrew.Gorton@tceq.texas.gov

From: Lauren Crone <lcrone@lja.com>
Sent: Wednesday, January 15, 2025 2:50 PM
To: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: RE: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

Andrew,

We have not yet received the soil sampling results for this project from the lab. Can we extend the deadline for the comment response, while keeping this application on hold? Please let me know the best way to handle this.

Thank you,

Lauren Crone, P.E. | Senior Project Manager
Central Texas Land Development
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From: Andrew Gorton <Andrew.Gorton@Tceq.Texas.Gov>
Sent: Friday, January 10, 2025 8:58 AM
To: Lauren Crone <lcrone@lja.com>
Cc: Alan Barraza <Alan.Barraza@tceq.texas.gov>
Subject: Reagor Tract WWTP, WQ0016685001, Application for a New Permit

[EXTERNAL EMAIL]

Good morning Lauren,

The Water Quality Assessment (WQA) Team of the Texas Commission on Environmental Quality has completed a preliminary review of the permit application information and identified deficiencies (attached) that must be addressed before the WQA Team can continue with the technical review. The deficient item(s) will require your response in a timely, complete, and accurate manner.

An accurate and complete revised permit application is essential for making recommendations to the commission regarding whether this permit should be issued. Based on the information provided in the application, the executive director does not have sufficient information to make a recommendation. Therefore, you must send updated technically complete and accurate information within **14 days** (January 24, 2025) of the date of this email.

Any revisions can be sent electronically to me (WQA Team Geologist) or Alan Barraza (WQA Team Agronomist). If you have any questions, please feel free to contact either me or Alan.

Thank you,

-Andy

Andrew Gorton, P.G.

Texas Commission on Environmental Quality

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

SOIL EVALUATION
FOR
REAGOR TRACT WASTEWATER TREATMENT PLANT

APRIL 2025

PREPARED FOR
GEORGE AND LAURA REAGOR
906 E. SANDSTONE STREET
LLANO, TEXAS 78643

PREPARED BY
LJA ENGINEERING, INC.
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512-439-4700

Site Investigation for the Reagor Tract TLAP
Williamson County, Texas

Introduction

This report is being submitted in support of a Texas Land Application Permit application submitted to TCEQ for the subject tract. The tract is located northwest of the City of Georgetown in Williamson County, Texas, near the intersection of Navajo Trail and Council Road. The development will be a single family housing development. A portion of the tract is within the Edward Aquifer Recharge Zone, but effluent disposal is not proposed on this portion of the tract. No municipal wastewater services are available in this area; therefore, the development will need a Municipal Wastewater Treatment and Disposal System.

In environmentally sensitive areas, wastewater treatment systems can surface irrigate (spray systems), use drip irrigation technology, or low pressure pipe systems. Due to site characteristics, such as some areas of shallow soils and environmentally sensitive areas, if is being proposed to utilize and engineered onsite sewage facility for this tract.

Due to site characteristics, it is being proposed to utilize subsurface drip irrigation for the ultimate treated effluent disposal system for the Reagor Tract Wastewater Treatment Plant. The treated effluent irrigation system will utilize a drip irrigation management system to allow for accurate control of the proposed subsurface drip treated effluent irrigation system. The subsurface drip irrigation system will utilize drip tubing that is embedded with compensating drip emitters to ensure accurate and uniform dosing of the irrigation sites. The site will retain all of the trees that are present now. The tubing will be buried 6” – 8” below the surface of the ground.

A site investigation was performed to obtain information that would assist in the design of the drip irrigation system. This report summarized the results and will be utilized to assist in the development of the drip fields to be used for treated effluent application.

Management Plan

The proposal for the treated effluent application areas is to utilize Bermuda grass and Winter Rye for establishing a cover crop. Herbaceous vegetation will be used to vegetate the areas where soils will be imported and areas where clearing will occur.

In developing the irrigation areas, upslope surface drainage will be diverted to prevent run-on onto the treated effluent application areas. Areas where drainage appears to be concentrated and active should be buffered from application to treated effluent.

Where soils are not sufficient, a suitable material will need to be imported to ensure that there is at least one food of rootable material beneath the dripper lines. This will ensure that there is sufficient rooting depth to allow for the growth of herbaceous vegetation that will utilize the treated effluent.

All areas will be seeded with high performance turf grass vegetation and will include warm season and cool season vegetation. This will help ensure that there is a viable cover crop growing at all times to uptake the water and nutrients associated with the treated effluent. Most species can and will utilize nitrogen levels much greater than 100-150 lbs of N/acre/year. These areas will be mowed to ensure that the vegetation continues to exhibit vigorous growth habits and to maximize the uptake potentials and to ensure that a standing crop does not interfere with the establishment of the following season's vegetation emergence.

Site Details

Geology

According to the Geologic Atlas of Texas, the site is located on the Fredericksburg Group. The official description of this unit is limestone, dolomite and chert; limestone aphanitic to fine grained, massive to thin bedded, hard, brittle,; dolomite fine to very fine grained, porous, medium gray to grayish brown; chert, nodules and plates common, varies in amount from bed to bed, some intervals of free chert, mostly white to light gray; in zone of weathering considerably recrystallized, "honeycombed", and cavernous forming an aquifer; forms flat areas and plateaus bordered by scarps; thickness 60-350 feet, thins northward.

USDA-Soil Survey

A soils map is located in Appendix II of this document.

Climate

According to the USDA-SCS Soil Survey for Williamson County, Texas, the climate is Williamson County is humid subtropical an dis characterized by hot summers and relatively mild winters. Temperature and rainfall are climatic factors that have the greatest influence on the formation of soils in this area. The pattern of rainfall consists of interspersed wet and dry periods.

Vegetation

Vegetation within the areas to be utilized for the initial phases of the project will be planted to improved turf grasses. These areas will be mowed and managed to ensure that the vegetation is actively growing at all times.

Soils

According to the Soil Survey, soils of the treated effluent application site consists of the following soils:

Williamson County, Texas

DoC—Doss silty clay, moist, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2s0st
Elevation: 630 to 1,840 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 66 to 68 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Doss and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Doss

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from limestone

Typical profile

A - 0 to 9 inches: silty clay
Bk - 9 to 17 inches: silty clay
Cr - 17 to 80 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 11 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 70 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R081CY574TX - Shallow 29-35 PZ
Hydric soil rating: No

Minor Components

Brackett

Percent of map unit: 7 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R081CY362TX - Steep Adobe 29-35 PZ
Hydric soil rating: No

Bolar

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R081CY357TX - Clay Loam 29-35 PZ
Hydric soil rating: No

Eckrant

Percent of map unit: 1 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R081CY360TX - Low Stony Hill 29-35 PZ
Hydric soil rating: No

Purves

Percent of map unit: 1 percent
Landform: Plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R081CY574TX - Shallow 29-35 PZ
Hydric soil rating: No

Denton

Percent of map unit: 1 percent
Landform: Plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R081CY357TX - Clay Loam 29-35 PZ
Hydric soil rating: No

EeB—Eckrant stony clay, 0 to 3 percent slopes, stony

Map Unit Setting

National map unit symbol: djpv
Elevation: 650 to 1,320 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 65 to 69 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Eckrant, stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eckrant, Stony

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from limestone

Typical profile

A1 - 0 to 4 inches: stony clay
A2 - 4 to 11 inches: extremely stony clay
R - 11 to 80 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 0.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D

Ecological site: R081CY360TX - Low Stony Hill 29-35 PZ
Hydric soil rating: No

Minor Components

Georgetown
Percent of map unit: 8 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R081CY361TX - Redland 29-35 PZ
Hydric soil rating: No

Doss
Percent of map unit: 7 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R081CY355TX - Adobe 29-35 PZ
Hydric soil rating: No

FaB—Fairlie clay, 1 to 2 percent slopes

Map Unit Setting
National map unit symbol: djq1
Elevation: 550 to 850 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 230 to 260 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Fairlie and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fairlie

Setting
Landform: Ridges
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from austin chalk formation

Typical profile
H1 - 0 to 8 inches: clay

H2 - 8 to 46 inches: clay
H3 - 46 to 54 inches: bedrock

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: R086AY011TX - Southern Blackland
Hydric soil rating: No

Test Hole Selection

Lauren Crone, P.E. selected 3 representative sites within the proposed development. The holes were located to represent each of the soil types within the proposed disposal area.

It is virtually impossible to try and establish a sampling regime that will sufficiently allow for coverage of inclusional features within the applications areas. However, if any of these features are discovered at the time of construction, these areas will be noted and sufficiently evaluated to determine their relevance to the construction and ultimate performance of the treated effluent application sites. The soil descriptions will be followed by photos of each hole.

Test Hole #1

Vegetation Characteristics

There was 60% herbaceous plant growth in the immediate area of this hole. Surficial stoniness was estimated at 0%. The litter layer coverage was estimated at 0%. Slope of this areas was 0-5%.

Soil Characteristics

Total soil depth was 28” where refusal was achieved. The profile consisted of two horizons. The primary rooting depth in the hole was 6 inches with the secondary rooting depth extending down to 9 inches.

Depth of the first horizon was 9 inches. The first horizon consisted of a silty clay material that was granular in texture and structure and brown in color. There was not mottling evident in the first horizon and consisted of <10% limestone fragments.

Depth of the second horizon was 19 inches. The first horizon consisted of a caliche material that was granular in texture and structure and tan in color. There was not mottling evident in the first horizon and consisted of 50% limestone fragments.

The boundary between the first and second horizon was level. The boundary between the 2nd horizon and the restrictive horizon was level. The restrictive horizon was reached at 28”. In this hole, no active or potential water bearing zones were encountered.

CAT

Test Hole #2

Vegetation Characteristics

There was 60% herbaceous plant growth in the immediate area of this hole. Surficial stoniness was estimated at 0%. The litter layer coverage was estimated at 0%. Slope of this areas was 0-5%.

Soil Characteristics

Total soil depth was 28” where refusal was achieved. The profile consisted of two horizons. The primary rooting depth in the hole was 6 inches with the secondary rooting depth extending down to 8 inches.

Depth of the first horizon was 20 inches. The first horizon consisted of a silty clay material that was granular in texture and structure and brown in color. There was not mottling evident in the first horizon and consisted of <10% limestone fragments.

Depth of the second horizon was 8 inches. The first horizon consisted of a caliche material that was granular in texture and structure and tan in color. There was not mottling evident in the first horizon and consisted of 50% limestone fragments.

The boundary between the first and second horizon was level. The boundary between the 2nd horizon and the restrictive horizon was level. The restrictive horizon was reached at 28”. In this hole, no active or potential water bearing zones were encountered.

Test Hole #3

Vegetation Characteristics

There was 60% herbaceous plant growth in the immediate area of this hole. Surficial stoniness was estimated at 0%. The litter layer coverage was estimated at 0%. Slope of this areas was 0-5%.

Soil Characteristics

Total soil depth was 24” where refusal was achieved. The profile consisted of two horizons. The primary rooting depth in the hole was 6 inches with the secondary rooting depth extending down to 8 inches.

Depth of the first horizon was 16 inches. The first horizon consisted of a silty clay material that was granular in texture and structure and brown in color. There was not mottling evident in the first horizon and consisted of <10% limestone fragments.

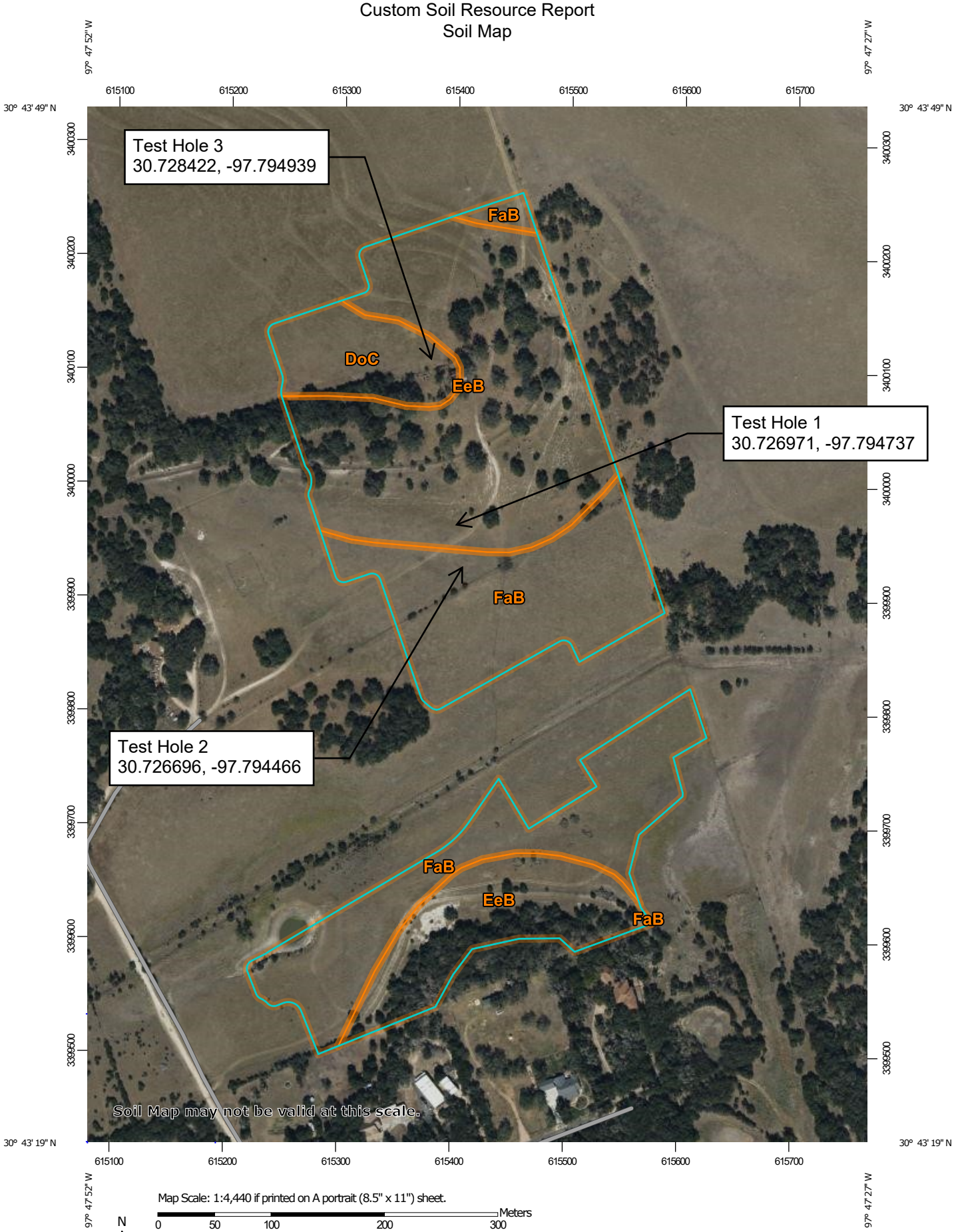
Depth of the second horizon was 8 inches. The first horizon consisted of a caliche material that was granular in texture and structure and white in color. There was not mottling evident in the first horizon and consisted of 30% limestone fragments.

The boundary between the first and second horizon was level. The boundary between the 2nd horizon and the restrictive horizon was level. The restrictive horizon was reached at 24”. In this hole, no active or potential water bearing zones were encountered.

CAT

APPENDIX I

SITE MAP



Map Scale: 1:4,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

APPENDIX II

USDA SOIL SURVEY MAP

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Williamson County, Texas

March 19, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Texas
Survey Area Data: Version 25, Aug 30, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DoC	Doss silty clay, moist, 1 to 5 percent slopes	2.8	7.9%
EeB	Eckrant stony clay, 0 to 3 percent slopes, stony	18.1	52.2%
FaB	Fairlie clay, 1 to 2 percent slopes	13.8	39.9%
Totals for Area of Interest		**34.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Williamson County, Texas

DoC—Doss silty clay, moist, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2s0st
Elevation: 630 to 1,840 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 66 to 68 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Doss and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Doss

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from limestone

Typical profile

A - 0 to 9 inches: silty clay
Bk - 9 to 17 inches: silty clay
Cr - 17 to 80 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 11 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 70 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R081CY574TX - Shallow 29-35 PZ
Hydric soil rating: No

Minor Components

Brackett

Percent of map unit: 7 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R081CY362TX - Steep Adobe 29-35 PZ
Hydric soil rating: No

Bolar

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R081CY357TX - Clay Loam 29-35 PZ
Hydric soil rating: No

Eckrant

Percent of map unit: 1 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R081CY360TX - Low Stony Hill 29-35 PZ
Hydric soil rating: No

Purves

Percent of map unit: 1 percent
Landform: Plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R081CY574TX - Shallow 29-35 PZ
Hydric soil rating: No

Denton

Percent of map unit: 1 percent
Landform: Plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R081CY357TX - Clay Loam 29-35 PZ
Hydric soil rating: No

EeB—Eckrant stony clay, 0 to 3 percent slopes, stony

Map Unit Setting

National map unit symbol: djpv
Elevation: 650 to 1,320 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 65 to 69 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Eckrant, stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eckrant, Stony

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from limestone

Typical profile

A1 - 0 to 4 inches: stony clay
A2 - 4 to 11 inches: extremely stony clay
R - 11 to 80 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 0.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D

Ecological site: R081CY360TX - Low Stony Hill 29-35 PZ
Hydric soil rating: No

Minor Components

Georgetown
Percent of map unit: 8 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R081CY361TX - Redland 29-35 PZ
Hydric soil rating: No

Doss
Percent of map unit: 7 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R081CY355TX - Adobe 29-35 PZ
Hydric soil rating: No

FaB—Fairlie clay, 1 to 2 percent slopes

Map Unit Setting
National map unit symbol: djq1
Elevation: 550 to 850 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 230 to 260 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Fairlie and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fairlie

Setting
Landform: Ridges
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from austin chalk formation

Typical profile
H1 - 0 to 8 inches: clay

H2 - 8 to 46 inches: clay
H3 - 46 to 54 inches: bedrock

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: R086AY011TX - Southern Blackland
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Williamson County, Texas														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
DoC—Doss silty clay, moist, 1 to 5 percent slopes														
Doss	85	D	0-9	Silty clay	CH	A-7-6	0- 0- 0	0- 1- 15	70-96-100	69-96-100	65-95-100	62-91-99	48-55-62	20-29-34
			9-17	Silty clay loam, clay loam, silty clay	CH, CL	A-7-6	0- 0- 0	0- 2- 16	68-92-100	67-92-100	60-91-100	57-87-99	41-53-61	15-27-34
			17-80	Bedrock	—	—	—	—	—	—	—	—	—	—
EeB—Eckrant stony clay, 0 to 3 percent slopes, stony														
Eckrant, stony	85	D	0-4	Stony clay	CH	A-7-6	10-17-24	6- 8- 15	76-88-93	75-88-93	67-84-92	59-74-83	50-60-73	25-32-45
			4-11	Extremely cobbly clay, extremely cobbly silty clay, very cobbly silty clay, very stony clay, extremely stony clay	CH, GC	A-7-6, A-2-7	0-25- 49	17-31-47	26-45-63	23-43-62	21-41-62	18-36-58	50-60-73	27-32-45
			11-80	Bedrock	—	—	—	—	—	—	—	—	—	—

Engineering Properties–Williamson County, Texas														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
FaB—Fairlie clay, 1 to 2 percent slopes														
Fairlie	100	D	0-8	Clay	CL, CH	A-7	0- 0- 0	0- 0- 0	95-98-100	90-95-100	90-95-100	85-93-100	41-56-70	25-35-45
			8-46	Silty clay, clay	CH	A-7	0- 0- 0	0- 0- 0	95-98-100	95-98-100	90-95-100	85-93-100	51-66-80	28-41-53
			46-54	Bedrock	—	—	—	—	—	—	—	—	—	—

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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APPENDIX III

PROFILE HOLE INFORMATION SHEETS

Project Reagor Tract TLAP | Profile Hole 1 | County Williamson | Date 4/9/2025

1	Total Depth of Profile Hole	28"
2	Primary Rooting Depth	6"
3	Secondary Rooting Depth	9"
4	Horizons Descriptions Shall Include	

A	Depth of Horizon	9"	A	Depth of Horizon	19"
B	Soil Texture	Silty Clay	B	Soil Texture	Caliche
C	Soil Structure	Gran	C	Soil Structure	Gran
D	Soil Color	Brown	D	Soil Color	Tan
E	Mottling	NO	E	Mottling	No
F	Percent Coarse Fragments	<10%	F	Percent Coarse Fragments	50%

5	Boundray Description	Level
6	Restricitve Horizons	28"
7	Potential Water Bearing Zones	NO
8	Active Water Bearing Zones	NO

SITE CHARACTERISTICS

Vegetation					Surface Fragments		Litter		Slope Type		
Large Oak %	0	0	% Woody	60 % Herbaceous	0	% Visible	0	%	0	% to	5 %
Juniper %	0	0	% Canopy Cover	75 % Cover							
Small Oak %	0										

Project Reagor Tract TLAP | Profile Hole 2 | County Williamson | Date 4/9/2025

1	Total Depth of Profile Hole	28"
2	Primary Rooting Depth	6"
3	Secondary Rooting Depth	8"
4	Horizons Descriptions Shall Include	

A	Depth of Horizon	20"	A	Depth of Horizon	8"
B	Soil Texture	Silty Clay	B	Soil Texture	Caliche
C	Soil Structure	Gran	C	Soil Structure	Gran
D	Soil Color	Brown	D	Soil Color	Tan
E	Mottling	NO	E	Mottling	No
F	Percent Coarse Fragments	<10%	F	Percent Coarse Fragments	50%

5	Boundray Description	Level
6	Restricitve Horizons	28"
7	Potential Water Bearing Zones	NO
8	Active Water Bearing Zones	NO

SITE CHARACTERISTICS

Vegetation					Surface Fragments		Litter		Slope Type		
Large Oak %	0	0	% Woody	60 % Herbaceous	0	% Visible	0	%	0	% to	5 %
Juniper %	0	0	% Canopy Cover	75 % Cover							
Small Oak %	0										

Project Reagor Tract TLAP | Profile Hole 3 | County Williamson | Date 4/9/2025

1	Total Depth of Profile Hole	24"
2	Primary Rooting Depth	6"
3	Secondary Rooting Depth	8"
4	Horizons Descriptions Shall Include	

A	Depth of Horizon	16"	A	Depth of Horizon	8"
B	Soil Texture	Silty Clay	B	Soil Texture	Caliche
C	Soil Structure	Gran	C	Soil Structure	Gran
D	Soil Color	Brown	D	Soil Color	White
E	Mottling	NO	E	Mottling	No
F	Percent Coarse Fragments	<10%	F	Percent Coarse Fragments	30%

5	Boundray Description	Level
6	Restricitve Horizons	24"
7	Potential Water Bearing Zones	NO
8	Active Water Bearing Zones	NO

SITE CHARACTERISTICS

Vegetation					Surface Fragments		Litter		Slope Type		
Large Oak %	0	0	% Woody	60 % Herbaceous	0	% Visible	0	%	0	% to	5 %
Juniper %	0	0	% Canopy Cover	75 % Cover							
Small Oak %	0										

APPENDIX IV

GEOLOGIC ATLAS OF TEXAS

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
W. L. FISHER, DIRECTOR

EXPLANATION

Recent
- Qal — Alluvium
- Qt (Qa | Qhg) — Fluviatile terrace deposits
- Ql — Lissie Formation undivided

Pleistocene
- Qw (Qwl | Qwc) — Willis Formation

Miocene
- Mf — Fleming Formation
- Mo — Oakville Sandstone
- Mc — Catahoula Formation

Eocene or Oligocene
- Ewb — Wellborn Formation
- Ecs — Caddell Formation
- Ey — Yegua Formation
- Ecm — Cook Mountain Formation
- Es — Sparta Sand
- Ew — Weches Formation
- Eqc — Queen City Sand
- Er — Reklaw Formation
- Ec — Carrizo Sand

Eocene
- Ecb (Ewc | Esb | Ewn | Eh) — Wilcox Group

Upper Cretaceous
- Emi — Midway Group
- Ki — Cretaceous igneous rocks
- Knm (Kpg | Kns | Kpg | Ko) — Navarro Group and Marlbrook Marl ("upper Taylor marl"), Pecan Gap Chalk, and Ozan Formation ("lower Taylor marl")
- Kau — Austin Chalk
- Keb (Kef | Kbu) — Eagle Ford Group and Buda Limestone
- Kdg (Kdr | Kgt) — Del Rio Clay ("Grayson Marl") and Georgetown Formation
- Kfr (Ked | Kc | Kkc | Kcp | Kwd | Kbc) — Fredericksburg Group
- Kpa — Paluxy Sand

Lower Cretaceous
- Kgr(u) (Kgr(l)) — Glen Rose Formation
- Kh — Hensell Sand

Fault — U / D

U, upthrown side; D, downthrown side; dashed where inferred

QUATERNARY
TERTIARY
CRETACEOUS

Prepared by the Army Map Service (AJSX), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1954 by photogrammetric methods. Horizontal and vertical control by USGS and USC&GS. Aerial photography 1952-53. Photography field annotated 1954. Limited revision by U. S. Geological Survey 1963.

100,000-foot grids based on Texas coordinate system, central and south central zones.

10,000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue.

Partially funded by Texas Department of Water Resources

VIRGIL E. BARNES, PROJECT DIRECTOR

Geologic mapping by Shell Oil Company, Humble Oil & Refining Company, Mobil Oil Company, Shell Development Company, C. V. Proctor, Jr., T. E. Brown, J. H. McGowen, N. B. Waechter, and sources shown on the Index of Geologic Mapping. C. V. Proctor, Jr., T. E. Brown, J. H. McGowen, and N. B. Waechter compiled the geologic mapping on high altitude aerial photographs, compiled unmapped areas photogeologically, and field checked all mapping. Geologic mapping reviewed by Austin Geological Society, Geologic Atlas Committee, D. H. Eargle, Chairman, and E. T. Baker, Jr. (U. S. Geological Survey) and R. C. Peckham and R. L. Bluntzer (Texas Water Development Board). Geology scribed by J. W. Macon.

LOCATION MAP

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 Nautical Miles

CONTOUR INTERVAL 50 FEET

TRANSVERSE MERCATOR PROJECTION

1960 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 9°30' EASTERLY FOR THE CENTER OF THE WEST EDGE TO 8°30' EASTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 0°05' WESTERLY.

GEOLOGIC ATLAS OF TEXAS, AUSTIN SHEET

FRANCIS LUTHER WHITNEY MEMORIAL EDITION

REPRINTED 1981

INDEX OF GEOLOGIC MAPPING

Numbers in outlined areas refer to items in bibliography in "Index to Areal Geologic Maps in Texas, 1891-1961," by T. E. Brown (1963), Bureau of Economic Geology, The University of Texas at Austin. For area A, see G. L. Dawe, L. E. Garner, and P. U. Rodda (MS.) Geology of the Mansfield Dam quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area B, see M. A. C. Rogers, G. L. Dawe, and P. U. Rodda (MS.) Geology of the Jollyville quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area C, see K. P. Young (MS.) Geology of the Pflugerville West quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area D, see G. L. Dawe, L. E. Garner, and P. U. Rodda (MS.) Geology of the Bee Cave quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area E, see P. U. Rodda, L. E. Garner, and G. L. Dawe (1970) Geology of the Austin West quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map No. 38; for area F, see K. P. Young and L. E. Garner (MS.) Geology of the Austin East quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area G, see K. P. Young and L. E. Garner (MS.) Geology of the Manor quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area H, see K. P. Young and L. E. Garner (MS.) Geology of the Montopolis quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area I, see L. E. Garner and K. P. Young (MS.) Geology of the Oak Hill quadrangle, Travis County, Texas, Univ. Texas, Austin, Bur. Econ. Geology Geol. Quad. Map; and area J from E. T. Baker, Jr., and J. A. Watson (MS map by Baker) Quantity of low flow in Barton Creek, Texas, July 6-8 and October 1-3, 1970. Prepared by the U. S. Geological Survey in cooperation with the Texas Water Development Board.

Other publications consulted:

(K) Templin, E. H., Bean, A. H., Huckabee, J. W., Jr., Smith, L. H., and Layton, M. H. (1938) Soil Survey of Williamson County, Texas: U. S. Dept. Agriculture, Bureau of Chemistry & Soils in cooperation with Texas Agricultural Experiment Station, No. 10, ser. 1934.

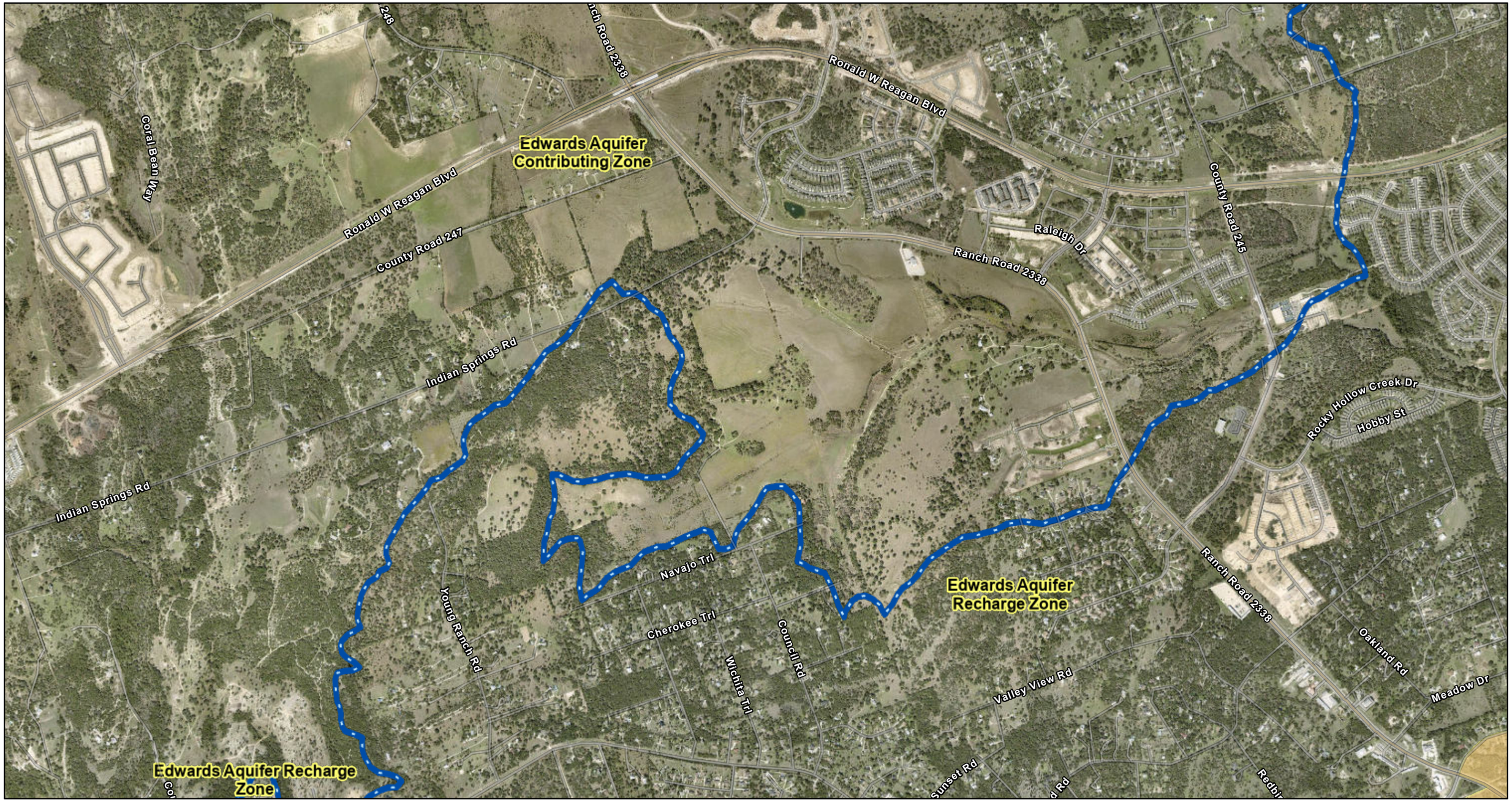
(L) Rodda, P. U., Fisher, W. L., Payne, W. R., and Schofield, D. A. (1966) Limestone and dolomite resources, Lower Cretaceous rocks, Texas: Univ. Texas Austin, Bur. Econ. Geology Rept. Inv. 56, pl. 1.

(M) Moore, C. H., Jr. (1964) Stratigraphy of the Fredericksburg Division, south-central Texas: Univ. Texas Austin, Bur. Econ. Geology Rept. Inv. 52, fig. 4.

APPENDIX V

EDWARDS AQUIFER MAPS

Edwards Aquifer Viewer Custom Print



4/15/2025, 1:13:11 PM

1:19,849

- ArcGIS World Geocoding Service
- TCEQ_EDWARDS_OFFICIAL_MAPS
- 7.5 Minute Quad Grid
- TX Counties
- City/Place
- Edwards Aquifer Boundary central line
- Edwards Aquifer Boundary
- Edwards Aquifer Label

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, TCEQ

APPENDIX VI

SOIL TESTING DATA

TEXAS A&M AGRILIFE EXTENSION

Soil Analysis Report

Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478

Visit our website: http://soiltesting.tamu.edu

Report generated for:
Wastewater Solutions
Reagor Ranch
9217 Hwy 290 West - Ste 100
AUSTIN, TX 78736

Sample received on: 1/31/2025
Printed on: 2/11/2025
Area Represented: not provided

Ellis County
Laboratory Number: 676255
Customer Sample ID: 12-18
Crop Grown: IMPROVED AND HYBRID BERMUDA GRASS (3 HAY CUTTINGS-2 TONS/A AVG.)

Analysis	Results	CL*	Units	ExLow	VLow	Low	Mod	High	VHigh	Excess.	Fertilizer Recommended
pH	**8.1**	(5.8)	-	**Mod. Alkaline**							
Conductivity	**136**	(-)	umho/cm	**None**				CL*			
Nitrate-N	**2**	(-)	ppm**								**95** lbs N/acre
Phosphorus	**1**	(50)	ppm								**120** lbs P2O5/acre
Potassium	**76**	(150)	ppm								**120** lbs K20/acre
Calcium	**49,754**	(180)	ppm								**0** lbs Ca/acre
Magnesium	**207**	(50)	ppm								**0** lbs Mg/acre
Sulfur	**259**	(13)	ppm								**0** lbs S/acre
Sodium	**14**	(-)	ppm								
Iron											
Zinc											
Manganese											
Copper											
Boron											
Limestone Requirement											**0.00** tons 100ECCE/acre

			Detailed Salinity Test (Saturated Paste Extract)			
			pH	**7.2**		
			Conductivity	**0.40**	mmhos/cm	
			Sodium	**11**	ppm	**0.479** meq/L
			Potassium	**1**	ppm	**0.033** meq/L
			Calcium	**69**	ppm	**3.463** meq/L
TKN	**583**	ppm	**Magnesium**	**2**	ppm	**0.160** meq/L
TN	**807**	ppm	**SAR**	**0.36**		
Ammonium-N	**3.7**	ppm	**SSP**	**11.58**		

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Nitrogen: Apply an additional 100 lbs/A of nitrogen for each subsequent hay cuttings.

Potassium: Split apply potassium fertilizer if recommendation is for more than 75 lbs K2O per acre.

Online fertilizer calculators to determine appropriate fertilizers and application rates.
http://soiltesting.tamu.edu

Methods: pH and conductivity/ 2:1; nitrate-N/Cd-red.; P, K, Ca, Mg, Na, and S/Mehlich 3 by ICP; Fe, Zn, Mn, and Cu/DTPA by ICP; and B/hot water by ICP.

Soil Analysis Report

Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478

Visit our website: http://soiltesting.tamu.edu

Report generated for:
Wastewater Solutions
Reagor Ranch
9217 Hwy 290 West - Ste 100
AUSTIN, TX 78736

Sample received on: 1/31/2025
Printed on: 2/11/2025
Area Represented: not provided

Ellis County
Laboratory Number: 676256
Customer Sample ID: 18-30
Crop Grown: IMPROVED AND HYBRID BERMUDA GRASS (3 HAY CUTTINGS-2 TONS/A AVG.)

Analysis	Results	CL*	Units	ExLow	VLow	Low	Mod	High	VHigh	Excess.	Fertilizer Recommended
pH	8.0	(5.8)	-	Mod. Alkaline							
Conductivity	351	(-)	umho/cm	None							
Nitrate-N	0	(-)	ppm**								95 lbs N/acre
Phosphorus	2	(50)	ppm	III							120 lbs P2O5/acre
Potassium	201	(150)	ppm								0 lbs K20/acre
Calcium	42,663	(180)	ppm								0 lbs Ca/acre
Magnesium	398	(50)	ppm								0 lbs Mg/acre
Sulfur	256	(13)	ppm								0 lbs S/acre
Sodium	38	(-)	ppm								
Iron											
Zinc											
Manganese											
Copper											
Boron											
Limestone Requirement											0.00 tons 100ECCE/acre

			Detailed Salinity Test (Saturated Paste Extract)			
			pH	7.1		
			Conductivity	0.42	mmhos/cm	
			Sodium	9	ppm	0.376 meq/L
			Potassium	2	ppm	0.044 meq/L
			Calcium	82	ppm	4.067 meq/L
TKN	768	ppm	Magnesium	1	ppm	0.122 meq/L
TN	1066	ppm	SAR	0.26		
Ammonium-N	3.7	ppm	SSP	8.15		

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Nitrogen: Apply an additional 100 lbs/A of nitrogen for each subsequent hay cuttings.

Online fertilizer calculators to determine appropriate fertilizers and application rates.
http://soiltesting.tamu.edu

Methods: pH and conductivity/ 2:1; nitrate-N/Cd-red.; P, K, Ca, Mg, Na, and S/Mehlich 3 by ICP; Fe, Zn, Mn, and Cu/DTPA by ICP; and B/hot water by ICP.

Soil Analysis Report

Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478

Visit our website: http://soiltesting.tamu.edu

Report generated for:
Wastewater Solutions
Reagor Ranch
9217 Hwy 290 West - Ste 100
AUSTIN, TX 78736

Sample received on: 1/31/2025
Printed on: 2/11/2025
Area Represented: not provided

Ellis County
Laboratory Number: 676254
Customer Sample ID: 0-6
Crop Grown: IMPROVED AND HYBRID BERMUDA GRASS (3 HAY CUTTINGS-2 TONS/A AVG.)

Analysis	Results	CL*	Units	ExLow VLow Low Mod High VHigh Excess.	Fertilizer Recommended
pH	**7.8**	(5.8)	-	**Mod. Alkaline**	
Conductivity	**206**	(-)	umho/cm	**None**	
Nitrate-N	**4**	(-)	ppm**		**90** lbs N/acre
Phosphorus	**12**	(50)	ppm		**90** lbs P2O5/acre
Potassium	**230**	(150)	ppm		**0** lbs K20/acre
Calcium	**33,062**	(180)	ppm		**0** lbs Ca/acre
Magnesium	**154**	(50)	ppm		**0** lbs Mg/acre
Sulfur	**206**	(13)	ppm		**0** lbs S/acre
Sodium	**7**	(-)	ppm		
Iron					
Zinc					
Manganese					
Copper					
Boron					
Limestone Requirement					**0.00** tons 100ECCE/acre

			Detailed Salinity Test (Saturated Paste Extract)		
			pH	**7.1**	
			Conductivity	**0.69** mmhos/cm	
			Sodium	**3** ppm	**0.134** meq/L
			Potassium	**13** ppm	**0.335** meq/L
			Calcium	**146** ppm	**7.285** meq/L
TKN	**2685**	ppm	**Magnesium**	**3** ppm	**0.260** meq/L
TN	**3541**	ppm	**SAR**	**0.07**	
Ammonium-N	**9.5**	ppm	**SSP**	**1.68**	

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Nitrogen: Apply an additional 100 lbs/A of nitrogen for each subsequent hay cuttings.

Online fertilizer calculators to determine appropriate fertilizers and application rates.
http://soiltesting.tamu.edu

Methods: pH and conductivity/ 2:1; nitrate-N/Cd-red.; P, K, Ca, Mg, Na, and S/Mehlich 3 by ICP; Fe, Zn, Mn, and Cu/DTPA by ICP; and B/hot water by ICP.

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

February 24th, 2025

Andrew Gorton, P.G.
Texas Commission on Environmental Quality
MC-150
PO Box 13087
Austin, TX 78711-3087
512.239.4585

Re: Reagor Tract Wastewater Treatment Plant
Proposed by George Reagor, Laura Reagor
Application No. WQ0016685001
George Reagor (CN606333367); Laura Reagor (CN606333375)
RN112098769
LJA Project No. A444-2401

Dear Andrew,

Please find the responses related to the permit application for Reagor Tract WWTP received by TCEQ on December 11th, 2024 below.

GEOLOGY/GROUNDWATER ITEMS

1. Domestic Wastewater Permit Application Checklist: Worksheet 3.3 was submitted with the application, so this Checklist should reflect this (it currently indicates that the Worksheet was not submitted).

Response: The checklist has been updated to reflect Worksheet 3.3 as included with the permit application.

2. Subsurface Area Drip Dispersal Systems are prohibited on the Edwards Aquifer Recharge Zone. Please clarify if this proposed facility is located on the Edwards Aquifer Recharge Zone.

Response: The proposed facility and the Subsurface Area Drip Dispersal System is not located on the Edwards Aquifer Recharge Zone. Please see the attached Edwards Aquifer Buffer Zone Map.

3. Domestic Worksheet 3.0, Section 6. Well and Map Information and Appendices M and N: A "spot check" of water wells listed in the well tables lists wells in Dripping Springs, TX area. Please provide a well data table for wells within one-half mile of the proposed facility. Please ensure well logs for these wells are also provided for this section and for the Groundwater Technical Report (Appendix N).

Response: The Well and Map information has been updated to reflect the correct wells for the area. The groundwater technical report has the correct wells provided for.

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

4. Appendix P: The Recharge Feature Plan (RPF) is not signed or sealed by a Texas-licensed professional geoscientist or engineer. The RFP also does not indicate if the previous or current owner of the site was contacted regarding the presence of recharge features at the proposed facility. Please provide water well logs and any water quality data for wells on or the within 500 feet of property in the RFP. The RFP is intended to be a stand-alone document and not refer back to previous portions of the application for this information.

Response: The Recharge feature plan has been sealed and updated to reflect the owner's knowledge of the current features. All water wells within a half mile radius of the property boundary have been identified on the USGS Map and the well logs have been attached.

SOILS/AGRONOMY ITEMS

1. Domestic Worksheet 3.0, Section 8.A: Please submit a soil map depicting the final 35-acre application area.
   Response: A soil map depicting the 35 acre area has been attached, it is listed as Soils Map and attached to this response.

2. Domestic Worksheet 3.0, Section 8.B: Please submit laboratory results sheets from the soil analyses.
   Response: The included soil laboratory results have been attached to this response.

3. Domestic Worksheet 3.3, Section 2.B: Slopes of greater than 10% are disallowed in the application area. Please verify on ground slope does not exceed 10%. Areas of 10% or greater must be excluded from the application area. Please resubmit any maps and/or figures that may be adjusted due to exclusion of high slope areas.
   Response: The proposed area does not contain a ground slope that is greater than 10%.

4. Domestic Worksheet 3.3, Section 3.B: Please submit a soil evaluation of all information required in 30 TAC §222.73.
   Response: The soil evaluation has been attached to this response.

5. Domestic Worksheet 3.3, Section 3.D: Please submit soil sampling and testing that includes all information required in 30 TAC §222.157.
   Response: The soil evaluation has been attached to this response.

Should you have any questions or need any additional information, please do not hesitate to call.

Sincerely,

Lauren Crone

Lauren Crone, P.E.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION CHECKLIST

Complete and submit this checklist with the application.

APPLICANT NAME: George & Laura Reagor

PERMIT NUMBER (If new, leave blank): WQ00 Click to enter text.

Indicate if each of the following items is included in your application.

	Y	N		Y	N
Administrative Report 1.0	☒	☐	Original USGS Map	☒	☐
Administrative Report 1.1	☒	☐	Affected Landowners Map	☒	☐
SPIF	☐	☒	Landowner Disk or Labels	☒	☐
Core Data Form	☒	☐	Buffer Zone Map	☒	☐
Public Involvement Plan Form	☒	☐	Flow Diagram	☒	☐
Technical Report 1.0	☒	☐	Site Drawing	☒	☐
Technical Report 1.1	☒	☐	Original Photographs	☒	☐
Worksheet 2.0	☐	☒	Design Calculations	☒	☐
Worksheet 2.1	☐	☒	Solids Management Plan	☒	☐
Worksheet 3.0	☒	☐	Water Balance	☐	☒
Worksheet 3.1	☐	☒			
Worksheet 3.2	☒	☐			
Worksheet 3.3	☒	☐			
Worksheet 4.0	☐	☒			
Worksheet 5.0	☐	☒			
Worksheet 6.0	☐	☒			
Worksheet 7.0	☒	☐			

For TCEQ Use Only

Segment Number _____County _____
Expiration Date _____Region_____
Permit Number _____

300 150 0 300 600
SCALE IN FEET

LEGEND

EDWARDS AQUIFER CONTRIBUTING ZONE

EDWARDS AQUIFER RECHARGE ZONE

EDWARDS AQUIFER CONTRIBUTING ZONE

RANCH ROAD 2338

INDIAN SPRINGS ROAD

APPLICANT'S PROPERTY BOUNDARY

EFFLUENT DISPOSAL AREAS (35 AC)

TREATMENT FACILITY WITH 150' BUFFER

EDWARDS AQUIFER RECHARGE ZONE

NAVAJO TRL

BUFFER ZONE MAP
EDWARDS AQUIFER

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

I:\a444 Hanover\TLAP\Exhibits\Buffer zone Ed Aquifer.dwg

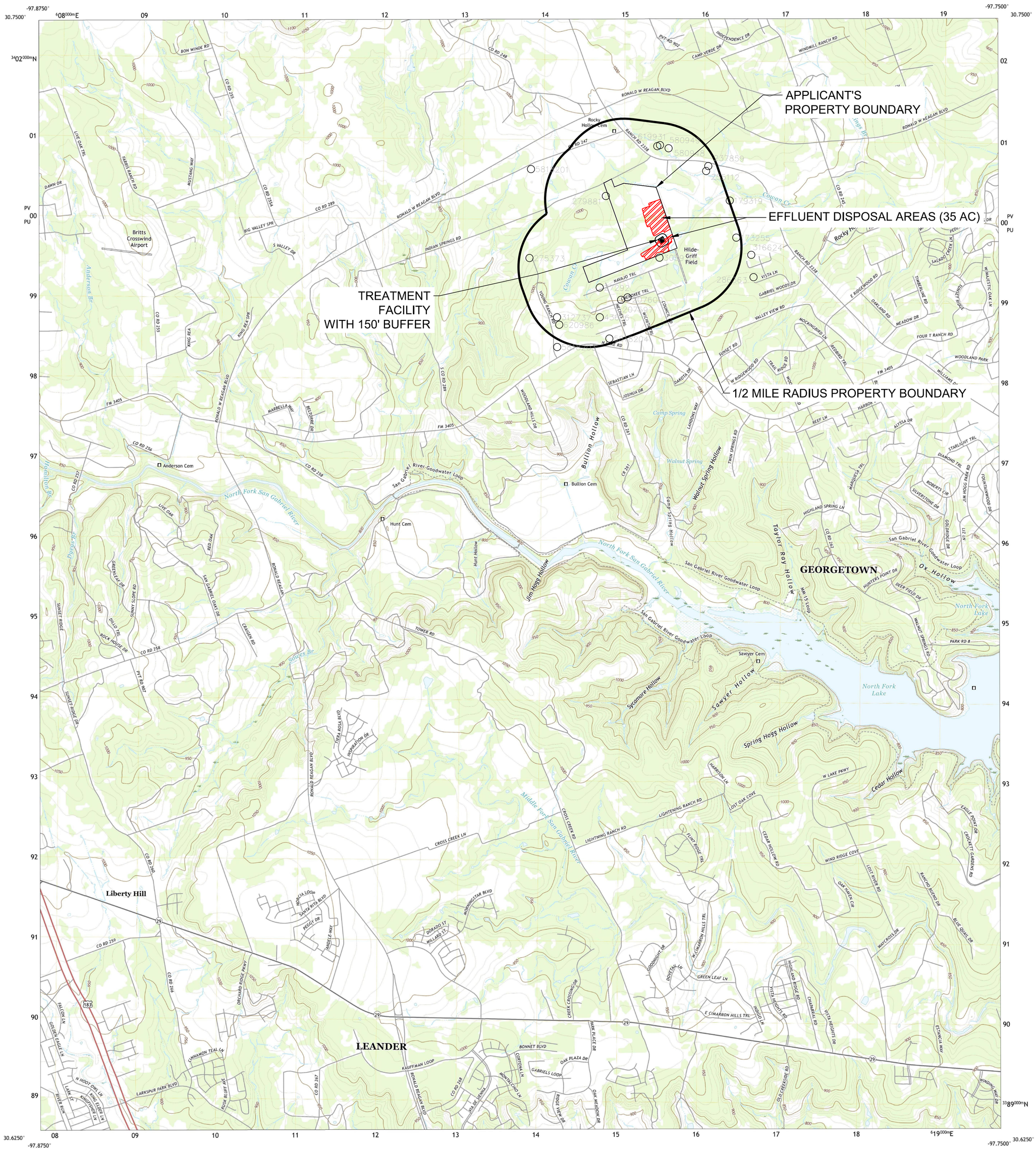
Reagor TLAP Well Information

Well Number	Well ID	Well use	Producing (Y/N)	Open Cased Capped or Plugged?	Proposed Best Management Practice
1	5818203	Stock	Y	Open	150' Buffer zone
2	620986	Irrigation	Y	Open	150' Buffer zone
3	43636	Domestic	Y	Open	150' Buffer zone
4	207597	Domestic	Y	Open	150' Buffer zone
5	207600	Domestic	Y	Open	150' Buffer zone
6	27292	Closed-Loop Geothermal	Y	Open	150' Buffer zone
7	305920	Domestic	Y	Open	150' Buffer zone
8	286363	Domestic	Y	Open	150' Buffer zone
9	316624	Irrigation	Y	Open	150' Buffer zone
10	179319	Domestic	Y	Open	150' Buffer zone
11	279881	Domestic	Y	Open	150' Buffer zone
12	255112	Domestic	Y	Open	150' Buffer zone
13	237859	Domestic	Y	Open	150' Buffer zone
14	5818201	Domestic	Y	Open	150' Buffer zone
15	619931	Irrigation	Y	Open	150' Buffer zone
16	580949	Domestic	Y	Open	150' Buffer zone
17	580948	Domestic	Y	Open	150' Buffer zone
18	275373	Domestic	Y	Open	150' Buffer zone
19	312737	Domestic	Y	Open	150' Buffer zone
20	5818204	Stock	Y	Open	150' Buffer zone

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

LEANDER NE QUADRANGLE
TEXAS - WILLIAMSON COUNTY
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 14R
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, August 2016 - November 2016
Roads.....U.S. Census Bureau, 2015
Names.....GNIS, 1979 - 2018
Hydrography.....National Hydrography Dataset, 2002 - 2011
Contours.....National Elevation Dataset, 2002 - 2004
Boundaries.....Multiple sources; see metadata file 2016 - 2017

Wetlands.....FWS National Wetlands Inventory 1982

MN
GN
3°43' 66 MILS
0°36' 11 MILS
UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
PV
PU
Grid Zone Designation 14R

SCALE 1:24 000
1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1 MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.18

TEXAS
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Mahomet
2 Florence
3 Cobbs Cavern
4 Liberty Hill
5 Georgetown
6 Nameless
7 Leander
8 Round Rock
ADJOINING QUADRANGLES

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

LEANDER NE, TX
2019

NSN 7643016396982
NGA REF NO. USGSX24K25239

LEGEND

- 150' DOMESTIC WELL BUFFER

1 OF 1

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

WELL MAP
LEANDER NE, TX

113,95

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer Glen Rose ½ Travis Pk. Fm. Field No. 13 State Well No. 2K 58-18-201

Owner's Well No. County Williamson

1. Location: 1/4, 1/4 Sec., Block, Survey approx. 9 mi. NW of Georgetown on FM. 2338
2. Owner: Mr. Nolan Harvey Address: Austin, TX.
   Tenant: Address:
   Driller: Curley H. Hunt Address: Hunt Drilling Co.
3. Elevation of land surface is 962± ft. above msl, determined by Leander NE Quad.
4. Drilled: April 19 69; Dug, Cable Tool, Rotary,
5. Depth: Rept. 580 ft. Meas. ft.
6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed
7. Pump: Mfgr. Type Submersible
   No. Stages, Bowls Diam. in., Setting 227 ft.
   Column Diam. in., Length Tailpipe ft.
8. Motor: Fuel elec. Make & Model HP. 1
9. Yield: Flow gpm, Pump gpm, Meas., Rept., Est.
10. Performance Test: Date 4-69 Length of Test 8 hrs. Made by Hunt
    Static Level 180 ft. Pumping Level 227 ft. Drawdown 47 ft.
    Production 10 gpm Specific Capacity gpm/ft.
11. Water Level: 113.78 ft. rept. meas. 5-27 19 72 above below top of casing which is 0.6 ft. above below surface.
    ft. rept. meas. 19 above below which is ft. above below surface.
    ft. rept. meas. 19 above below which is ft. above below surface.
    ft. rept. meas. 19 above below which is ft. above below surface.
12. Use: Dom., Stock, Public Supply, Ind., Irr., Waterflooding, Observation, Not Used,
13. Quality: (Remarks on taste, odor, color, etc.) H_2S odor, clear
    Temp. 70 °F, Date sampled for analysis 5-27-72 Laboratory TSDH
    Temp. °F, Date sampled for analysis Laboratory
    Temp. °F, Date sampled for analysis Laboratory
14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log,
    Formation Samples, Pumping Test,
15. Record by: D. Evans Date 5-27 1972
    Source of Data obs., driller's log; Mr. Harvey
16. Remarks:

CASING & BLANK PIPE

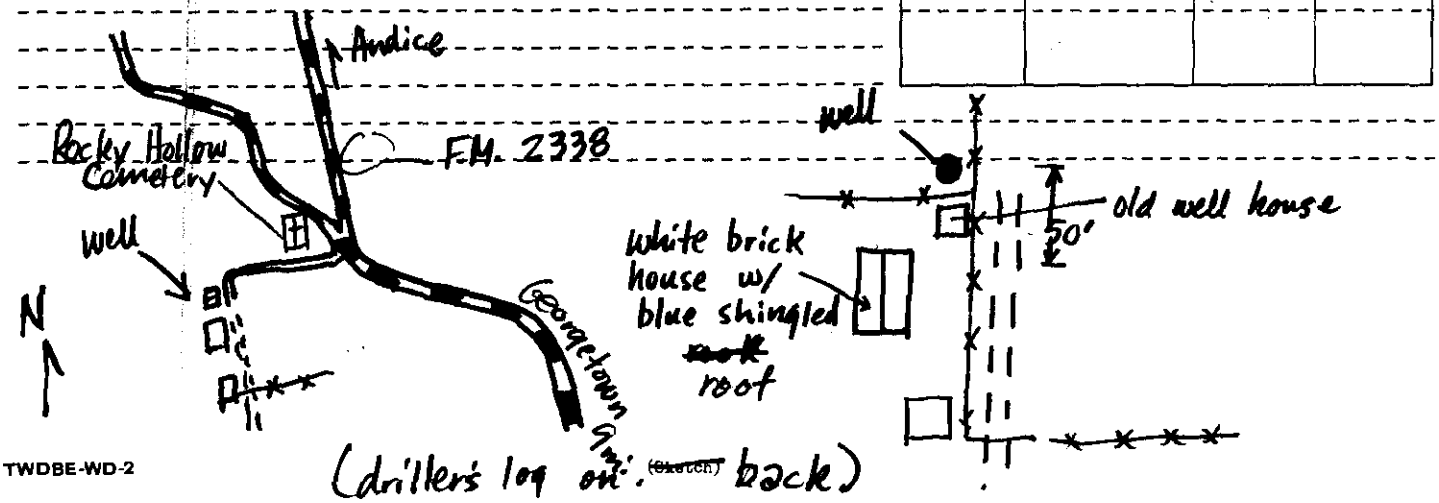
Cemented From 10 ft. to 21 ft.

Diam. (in.)	Type	Setting, ft. from	to
7	Steel	0	21

WELL SCREEN

Screen Openings

Diam. (in.)	Type	Setting, ft. from	to



(driller's log on back)

TWDBE-WD-2

Drillers' log

From	To	Description
0	10	Yellow clay w/ rock
10	200	Hard, white rock
200	255	Grey rock
255	265	white rock, sandy - some water
265	300	Grey rock strips - shale
300	365	Blue rock "
365	465	Blue rock
465	535	Blue rock "
535	545	Hard blue rock, sandy
545	555	Hard sandy rock
555	565	Fine sand, loose
565	580	Coarse sand, water

File copy with Texas Water Commission
P. O. Box 12311, Capitol Station
Austin, Texas 78711

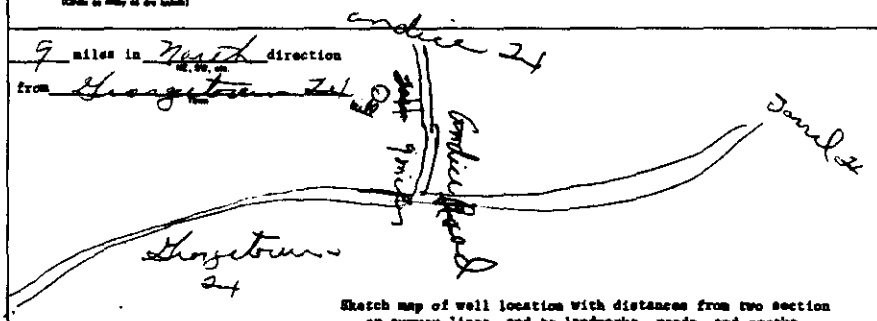
State of Texas

DRILLERS LOG AND WELL DATA REPORT

For use by TWC only
Well No. 58-18-201
Located on map
By [illegible] Date
Map no.

1) Well Owner: Helen Harvey (Name) [illegible] (Street or RFD) Austin (City) Texas (State) 78704
2) Land Owner: Helen Harvey (Name) [illegible] (Street or RFD) Austin (City) Texas (State) 78704
3) Intended use: Industrial ☐ Municipal ☐ Irrigation ☐ Other ☐
4) Location of well: County Williamson Labor ____ League ____ Abstract No. ____
NW¼ NE¼ SW¼ SE¼ (Circle as many as are known) of Section ____ Block No. ____ Survey ____

9 miles in North (NE, SW, etc.) direction
from Georgetown



Sketch map of well location with distances from two section or survey lines, and to landmarks, roads, and creeks.

DRILLERS LOG OF WELL

Method of drilling: Cable Tool Diameter of hole 6¼ in. Date drilled April 69

All measurements made from ____ ft. above ground level.

From (ft)	To (ft)	Description and color of formation material	From (ft)	To (ft)	Description and color of formation material
0	10	Yellow Clay & Rock.	365	465	Blue Rock
10	200	Hard White Rock.	465	535	Blue Rock. stripe
200	255	Gray Rock.			Blue Shale
255	265	White Rock sandy.	535	545	Hard Blue Rock. Sand
		some water	545	555	Hard Sandy Rock.
265	300	Gray Rock stripe	555	565	Fine Sand. Loose
		Shale	565	580	Coarse Sand Wat
300	365	Blue Rock stripe Shale			(Use continuation sheets if necessary)

COMPLETION DATA

COMPLETION

Straight wall ☒
Under reamed ☐
Gravel packed ☐
Open hole ☒
Other ____

CASING

Type: Old ☐ New ☒
Cemented from 0 ft.
to 21 ft.

Diameter (inches)	Setting from (ft)	Setting to (ft)
7 OD	0	21

SCREEN

Type ____
Perforated ☐ Slotted ☐

Diameter (inches)	Setting from (ft)	Setting to (ft)

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief.

Lucius J. Hunt (Signature) [illegible] Drilling Co. (Company Name) Reg. No. 3[illegible]

Please attach electric log, chemical analysis, and other pertinent information if available.

If well was tested by your company or if you installed the permanent pump please complete the following:

WATER LEVEL AND PUMP DATA

Static water level 180 ft. below ____

Pumping level

feet	hours	gpm
327	3	15

Pump type Submersible
Designed pumping rate 15 gpm ☒ gph ☐
Type power unit Elec.
Horsepower 5
Depth to bowls, cylinder, jet, etc., 327 ft. below pump base.

Name of contractor testing well or installing permanent pump if other than your company: ____

58-18-201

C-34 (62-4)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TDWR ONLY
Organization No. _____ Lab No. _____
Work No. 6040-410

CHEMICAL WATER ANALYSIS REPORT

Send report to:

Data Collection and Evaluation Section
Texas Department of Water Resources
P.O. Box 13087
Austin, Texas 78711

County 246 WILLIAMSON
State Well No. 58-18-201
Well No. _____
Date Collected 08-22-80

Location _____ Sample No. _____ By J. Derton

Source (type of well) Subm., Elec Owner NOLAN HARVEY 1308 Alto Vista Austin, TX 787

Date Drilled 1969 Depth 580 ft. WBF Glen Rose-Travis Pk

Producing intervals 21-580 Water level _____ ft. Sample depth _____ ft.

Sampled after pumping pumped recently hrs. Yield _____ GPM meas. est. Temperature 76 °F _____ °C

Point of collection faucet near well Appearance ☒ clear ☐ turbid ☐ colored ☐ other

Use Dom/Stk Remarks _____

(FOR LABOR

Laboratory No. CO16497

CHEMICAL ANALYSIS

Date Received AUG 26 1980

KEY PUNCHED

Date Reported SEP 26 '80

		MG/L	ME/L
Silica	00955	12	
Calcium	00915	66	3.32
Magnesium	00925	64	5.29
Sodium	00929	352	15.30
	Total		23.91
☐ Potassium	00937	40.	1.02
			24.93
[3] ☐ Manganese	01055	.	%Na _____
☐ Boron	01022	.	SAR _____
[3] ☐ Total Iron	01045	.	RSC _____
☐ (other) _____		MG/L	
Specific Conductance (micromhos/cm[3])	00095	1750	
Diluted Conductance (micromhos/cm[3])		16 x 176 = 2816	

" ☐ " items will be analyzed if checked.

		MG/L	ME/L
Carbonate	00445	0	
Bicarbonate	00440	202 → 411	6.74
Sulfate	00945	558	11.62
Chloride	00940	221	6.23
Fluoride	00951	4.7	0.25
Nitrate	71850	0.4	—
pH	00403	8.3	Total 24.84
[1] Dissolved Solids (residue at 180°C)	70300		1540
Phenolphthalein Alkalinity as $CaCO_3$	00415		0
Total Alkalinity as $CaCO_3$ (6.74)	00410		332
Total Hardness as $CaCO_3$ (8.61)	00900		430
[2] Nitrogen Cycle			
Ammonia - N	00610		
Nitrite - N	00615		
Nitrate - N	00620		
Organic Nitrogen	00605		

[1] The bicarbonate reported in this analysis can be converted by computation (multiplying by 0.4917) to an equivalent amount of carbonate, and the carbonate figure used in the computation of dissolved solids.
[2] Nitrogen cycle requires separate sample.
[3] Total Iron and Manganese require separate sample.

Analyst _____ Checked By _____

TDWR-0148 (Rev. 1-8-80)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas State Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB USE ONLY
Program No. 429
Proj. No. _____

CHEMICAL WATER ANALYSIS REPORT

-0-

Send report to:

Ground Water Data and Protection Division
Texas Water Development Board
P.O. Box 13087
Austin, Texas 78711

County 2K Williamson
State Well No. 58-18-201
field Well No. 13
Date Collected 05-27-72
By D. Evans for A. Wyatt

Location approx. 9 mi. NW of Georgetown on F.M. 2338
Source (type of well) drilled; subm. Owner Mr. Nolan Harvey
Date Drilled Apr. '69 Depth 580 ft. WBF Glen Rose, Trauts Pk.
Producing intervals 21-580 Water level 113.18 ft.
Sampled after pumping 5 min. hrs. Yield 10 GPM (meas. / est.) Temperature 70 °F 25 °C
Point of collection faucet at pressure tank Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use dom., stk Remarks H_2S odor

(FOR LABORATORY USE ONLY)

KEY PUNCHED

CHEMICAL ANALYSIS

Laboratory No. 230697 Date Received MAY 31 1972 Date Reported JUN 15 1972

	MG/L	ME/L
Silica	16	
Calcium	51	2.53
Magnesium	45	3.69
Sodium	244	10.60
Total		16.82
☑ Potassium	29.0	0.74
		17.56
☐ Manganese		%Na
☐ Boron		SAR
3/ ☐ Total Iron		RSC
☐ (other) _____	MG/L	
Specific Conductance (micromhos/cm³)	1600	
Diluted Conductance (micromhos/cm³)	13½ x 143 = 1931	

" ☐ " items will be analyzed if checked.

	MG/L	ME/L
Carbonate		0
1/ Bicarbonate	186	
	379	6.22
Sulfate	334	6.95
Chloride	157	4.43
Fluoride	2.9	0.15
Nitrate	<0.4	
pH	7.6	
Total		17.75
1/ Dissolved Solids (sum in MG/L)		1070
Phenolphthalein Alkalinity as $CaCO_3$		0
Total Alkalinity as $CaCO_3$	(6.22)	311
Total Hardness as $CaCO_3$	(6.22)	311

2/ Nitrogen Cycle

Ammonia - N	
Nitrite - N	
Nitrate - N	
Organic Nitrogen	

1/ The bicarbonate reported in this analysis is converted by computation (multiplying by 0.4917) to an equivalent amount of carbonate, and the carbonate figure is used in the computation of this sum.
2/ Nitrogen cycle requires separate sample.
3/ Total Iron requires separate sample.

TWDBS-SI-27

Analyst _____ Checked By _____

TEXAS WATER DEVELOPMENT BOARD

CI- 7505

WELL SCHEDULE

Aquifer Glen Rose / Hensel

Field No. 4

2K

State Well No. 58-1A-203

Owner's Well No. _____

County Williamson

1. Location: ___ 1/4, ___ 1/4 Sec. _____, Block _____ Survey _____
   - See map on reverse -
2. Owner: Rex Hawes Address: Rt. 5 Georgetown
   Tenant: _____ Address: _____
   Driller: Virley Hunt Address: Georgetown
3. Elevation of land surface is 1033± ft. above msl, determined by Leander NE Quad 7½'
4. Drilled: -no rec.- 19___; Dug, Cable Tool, Rotary, _____
5. Depth: Rept. 740 ft. Meas. _____ ft.
6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed no rec.
7. Pump: Mfgr. _____ Type cylinder windmill
   No. Stages _____, Bowls Diam. ___ in., Setting _____ ft.
   Column Diam. _____ in., Length Tailpipe _____ ft.
8. Motor: Fuel wind Make & Model _____ HP. _____
9. Yield: Flowing/Pump _____ gpm, Meas., Rept., Est. varies
10. Performance: _____ Length of Test _____ Made by _____
    Static Level _____ Pumping Level ___ ft. Drawdown _____ ft.
    Production _____ gpm Specific Capacity _____ gpm/ft.
11. Water Level: Meas. _____ 19 73 above/below _____ which is ___ ft. above/below surface.
    Rept. 12-5 19 74 above/below _____ which is ___ ft. above/below surface.
    Meas. _____ 19___ above/below _____ which is ___ ft. above/below surface.
    Rept. _____ 19___ above/below _____ which is ___ ft. above/below surface.
12. Use: Dom., Supply, Ind., Irr., Waterflooding, Observation, Not used _____
13. Quality: (Odor, color, etc.) clear
    Temp. _____ Sampled for analysis 12-5-74 Laboratory TSDH
    Temp. _____ Sampled for analysis _____ Laboratory _____
    Temp. _____ Sampled for analysis _____ Laboratory _____
14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log, Formation Samples, Pumping Test, _____
15. Record by: D. Evans Date 12-5 19 74
    Source of Data obs., Mr. Hawes
16. Remarks: _____

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. from	to
6 5/8	steel	0.±	-?-

SCREEN

Diam. (in.)	Type	Slot Size	Setting, ft. from	to

TWDBE-WD-2

(Sketch)

1" = ½ mi.

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas State Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDBE-GW ONLY

Program No. 6522-50

Proj. No. CI-7505

CHEMICAL WATER ANALYSIS REPORT

Send report to:

Ground Water Data and Protection Division
Texas Water Development Board
P.O. Box 13087
Austin, Texas 78711

County ZK Williamson

State Well No. 58-16-203

Well No. 34

Date Collected 12-05-74

By D. Evans

Location approx. 10 mi. NW of Georgetown, see map w/ well schedule.

Source (type of well) cylinder, windmill Owner Rex Hawes

Date Drilled old Depth 740± ft. WBF Glen Rose / Hensel

Producing intervals unknown Water level UTM ft.

Sampled after pumping was pumping hrs. Yield – varies – GPM meas. est. Temperature °F °C

Point of collection faucet at well head Appearance ☑ clear ☐ turbid ☐ colored ☐ other

Use Stock Remarks

(FOR LABORATORY USE ONLY)

Laboratory No. 280807

CHEMICAL ANALYSIS

Date Received DEC 9 1974 KEY PUNCHED Date Reported

	MG/L	ME/L
Silica	15	
Calcium	62	3.09
Magnesium	40	3.28
Sodium	209	9.10
Total		15.47
☑ Potassium	26.0	0.66
		16.13
☐ Manganese	.	%Na
☐ Boron	.	SAR
3/ ☐ Total Iron	.	RSC
☐ (other)	MG/L	

	MG/L	ME/L
Carbonate	14	0.48
Bicarbonate	168 / 342	5.60
Sulfate	304	6.33
Chloride	110	3.11
Fluoride	4.1	0.22
Nitrate	16.0	0.26
pH	8.6	Total 16.00
1/ Dissolved Solids (sum in MG/L)		970
Phenolphthalein Alkalinity as C aCO3	0.24	12
Total Alkalinity as C aCO3	6.08	304
Total Hardness as C aCO3	6.37	319

Specific Conductance (micromhos/cm3) 1410

Diluted Conductance (micromhos/cm3) 11 x 160 = 1760

2/ Nitrogen Cycle

Ammonia - N	.
Nitrite - N	.
Nitrate - N	.
Organic Nitrogen	.

" ☐ " items will be analyzed if checked.

1/ The bicarbonate reported in this analysis is converted by computation (multiplying by 0.4917) to an equivalent amount of carbonate, and the carbonate figure is used in the computation of this sum.

2/ Nitrogen cycle requires separate sample.

3/ Total Iron requires separate sample.

TWDBE-WD-1 (Rev. 1-25-72)

Analyst _____ Checked By _____

-0-

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer Edwards / Glen Rose Field No. 8 State Well No. 21K 58-16-204

Owner's Well No. _____ County Williamson

1. Location: ____ 1/4, ____ 1/4 Sec. _____, Block _____ Survey _____

2. Owner: Mr. Behrens Address: North Lake Estates (NW of Georgetown)

   Tenant: _____ Address: _____

   Driller: -unknown- Address: _____

3. Elevation of land surface is 1033 ± ft. above msl, determined by Leander NE Quad 7½' USGS

4. Drilled: -?- 19____; Dug, Cable Tool, Rotary, _____

5. Depths: Rept. _____ ft. Meas. 170 ft.

6. Completion: Open Hole, Straight Wall, Underreamed, Gravel Packed _____

7. Pump: Mfgr. Aeromotor Type Cylinder, Windmill

   No. Stages _____, Bowls Diam. ____ in., Setting _____ ft.

   Column Diam. _____ in., Length Tailpipe _____ ft.

8. Motor: Fuel wind Make & Model _____ HP. _____

9. Yield: Flow ____ gpm, Pump _____ gpm, Meas., Rept., Est. varies

10. Performance Test: Date _____ Length of Test _____ Made by _____

    Static Level ____ ft. Pumping Level ____ ft. Drawdown ____ ft.

    Production _____ gpm Specific Capacity _____ gpm/ft.

11. Water Level: 57.6 ft. rept. (meas.) 12-06 1974 above (below) top of casing which is 0.5 ft. (above) below surface.

    _____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

    _____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

    _____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

12. Use: Dom., (Stock), Public Supply, Ind., Irr., Waterflooding, Observation, Not Used, _____

13. Quality: (Remarks on taste, odor, color, etc.) Water did not pump to surface after 30 min. pumping.

    Temp. ____ °F, Date sampled for analysis UTS Laboratory _____

    Temp. ____ °F, Date sampled for analysis _____ Laboratory _____

    Temp. ____ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log,

    Formation Samples, Pumping Test, _____

15. Record by: D. Evans Date 12-06 1974

    Source of Data observation, Mr. Larry Glave - Salesman w/ North Lake Corporation.

16. Remarks: _____

CASING & BLANK PIPE

Cemented From _____ ft. to _____ ft.

Diam. (in.)	Type	Setting, ft. from	to
8	steel	+0.5	-?-

WELL SCREEN

Screen Openings _____

Diam. (in.)	Type	Setting, ft. from	to

TWDBE-WD-2 (Sketch)

GEORGETOWN-10 mi.
FM 2338
4
8
7
6
5
1
3
2
9
Button Cem.
Button
Hollis
Spring
Hollis
Spring
EAST FORK SAN GABRIEL RIVER
NORTH FOR.

1" = ½ mi.

N

All requests must be signed by the person requesting the analysis. Chemical analyses are limited to samples of water from public supplies the examination of which is requested by a proper official. If the supply being sampled is of public interest and not presently serving the public, an explanation of the reason for requesting the analysis should be furnished under "Remarks" or by attaching a company explanatory sheet. Please complete the form with typewriter (black ribbon) or print plainly using soft pencil or black ink. A ball point pen should not be used.

Send report to:

North Lake Corporation
P.O. Box 169
Georgetown Texas 78626

LOCATION North Lake Sub
COUNTY Williamson
DATE COLLECTED 3-20-74
OWNERSHIP OF SUPPLY:

IF FROM WELL
Depth 100 ft
Age ?
Well No. Behrens Well

POINT OF COLLECTION
Raw Supply ✓
Plant Discharge
Distribution
Other

PHYSICAL APPEARANCE
Clear ✓
Turbid
Colored
Odor

IF SURFACE SUPPLY
Name of source

REMARKS:

Signature of Public Official, Water Utility Official, or authorized representative requesting the analysis

Stephen P. Ellis (Signature)

TSDH Water Section (Address of Official)

FOR LABORATORY USE ONLY

CHEMICAL ANALYSIS REPORT

(Values reported are for minerals in solution)

265305

Laboratory No.

MAR 22 1974

Date Received

APR - 2 1974

Date Reported

	Milligrams per Liter		Milligrams per Liter		Milligrams per Liter
Calcium	129	Carbonate	0	Dissolved solids	1070
Magnesium	46	Bicarbonate	431	Phenolphthalein Alkalinity as $CaCO_3$	0
Sodium	150	Sulphate	64	Total Alkalinity as $CaCO_3$	353
Manganese	<0.05	Chloride	257	Total Hardness as $CaCO_3$	485
Iron	0.46	Fluoride	0.5		
C_6O^4		Nitrate	12		

pH 7.9

Dilated Conductance Micromhos/cm 1716

RECOMMENDED LIMITS FOR DRINKING WATER IN MILLIGRAMS PER LITER.

IRON	0.3	FLUORIDE	0.8-1.0
MANGANESE	0.05	NITRATE	45
SULPHATE	300	TOTAL SOLIDS	500

FORM NO. P-458

Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-201

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818201
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.733055
Latitude (degrees minutes seconds)	30° 43' 59" N
Longitude (decimal degrees)	-97.810834
Longitude (degrees minutes seconds)	097° 48' 39" W
Coordinate Source	+/- 5 Seconds
Aquifer Code	218TRNT - Trinity Group
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	962
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	580
Well Depth Source	Driller's Log
Drilling Start Date	
Drilling End Date	4/0/1969
Drilling Method	Cable Tool
Borehole Completion	Open Hole

Well Type	Withdrawal of Water
Well Use	Domestic
Water Level Observation	Miscellaneous Measurements
Water Quality Available	Yes
Pump	Submersible
Pump Depth (feet below land surface)	
Power Type	Electric Motor
Annular Seal Method	
Surface Completion	
Owner	Nolan Harvey
Driller	Hunt Drlg.
Other Data Available	Drillers Log; Specific Capacity
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	Measured yield 10 GPM with 47 feet drawdown after pumping 8 hours in 1969. Specific capacity 0.21 GPM/ft Cemented from 10 to 21 feet. Pump set at 227 feet.

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
7	Blank	Steel			0	21
7	Open Hole				21	580

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	5/27/1972		113.18		848.82	1	Texas Water Development Board	Steel Tape		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis

Sample Date: 5/27/1972 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Trinity Group

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: No Data

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		311	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		379.53	mg/L	
00910	CALCIUM (MG/L)		51	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		157	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		2.9	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		312	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		45	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)	<	0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		7.6	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		29	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		0		
00955	SILICA, DISSOLVED (MG/L AS SI02)		16	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		6.01		
00932	SODIUM, CALCULATED, PERCENT		62	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		244	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		1931	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		334	mg/L as SO4	
00010	TEMPERATURE, WATER (CELSIUS)		25	C	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1065	mg/L	

Water Quality Analysis

Sample Date: 8/22/1980 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Trinity Group

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: No Data

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		337	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		411.26	mg/L	
00910	CALCIUM (MG/L)		66	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		221	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		4.7	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		427	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		64	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		0.4	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8.3	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		40	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		0		
00955	SILICA, DISSOLVED (MG/L AS SI02)		12	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		7.4		
00932	SODIUM, CALCULATED, PERCENT		64	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		352	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		2816	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		558	mg/L as SO4	
00010	TEMPERATURE, WATER (CELSIUS)		24	C	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1520	mg/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-203

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818203
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.713056
Latitude (degrees minutes seconds)	30° 42' 47" N
Longitude (decimal degrees)	-97.807501
Longitude (degrees minutes seconds)	097° 48' 27" W
Coordinate Source	+/- 1 Second
Aquifer Code	218TRNT - Trinity Group
Aquifer	Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	1033
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	740
Well Depth Source	Memory of Owner
Drilling Start Date	
Drilling End Date	
Drilling Method	
Borehole Completion	

Well Type	Withdrawal of Water
Well Use	Stock
Water Level Observation	None
Water Quality Available	Yes
Pump	Piston
Pump Depth (feet below land surface)	
Power Type	Windmill
Annular Seal Method	
Surface Completion	
Owner	Rex Hawes
Driller	Hunt Drlg.
Other Data Available	
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/3/1994
Last Update Date	3/4/2020

Remarks	

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
7	Blank	Steel				

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

No Data Available

Texas Water Development Board

Texas Water Development Board (TWDB) Groundwater Database (GWDB) Well Information Report for State Well Number 58-18-203

groundwater division

Water Quality Analysis

Sample Date: 12/5/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Texas Water Development Board

Sampled Aquifer: Trinity Group

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: No Data

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		12	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		304	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		341.7	mg/L	
00910	CALCIUM (MG/L)		62	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		14.4	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		110	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		4.1	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		319	mg/L as CACO3	
00920	MAGNESIUM (MG/L)		40	mg/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		16	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		8.6	SU	
00937	POTASSIUM, TOTAL (MG/L AS K)		26	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		0		
00955	SILICA, DISSOLVED (MG/L AS SI02)		15	mg/L as SIO2	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		5.09		
00932	SODIUM, CALCULATED, PERCENT		58	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		209	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		1760	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		304	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		968	mg/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

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Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 58-18-204

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5818204
County	Williamson
River Basin	Brazos
Groundwater Management Area	8
Regional Water Planning Area	G - Brazos G
Groundwater Conservation District	GCD Does Not Exist
Latitude (decimal degrees)	30.714167
Latitude (degrees minutes seconds)	30° 42' 51" N
Longitude (decimal degrees)	-97.800834
Longitude (degrees minutes seconds)	097° 48' 03" W
Coordinate Source	+/- 1 Second
Aquifer Code	218EDGR - Edwards and Associated Limestones and Glen Rose Limestone
Aquifer	Edwards (Balcones Fault Zone)/Trinity
Aquifer Pick Method	
Land Surface Elevation (feet above sea level)	1033
Land Surface Elevation Method	Interpolated From Topo Map
Well Depth (feet below land surface)	170
Well Depth Source	Measured
Drilling Start Date	
Drilling End Date	
Drilling Method	
Borehole Completion	

Well Type	Withdrawal of Water
Well Use	Stock
Water Level Observation	Miscellaneous Measurements
Water Quality Available	Yes
Pump	Piston
Pump Depth (feet below land surface)	
Power Type	Windmill
Annular Seal Method	
Surface Completion	
Owner	Mr. Behrens
Driller	
Other Data Available	
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Texas Water Development Board
Created Date	11/2/1994
Last Update Date	3/4/2020

Remarks	

Casing

Diameter (in.)	Casing Type	Casing Material	Schedule	Gauge	Top Depth (ft.)	Bottom Depth (ft.)
8	Blank	Steel				

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

Water Level Measurements

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	12/6/1974		57.1		975.9	1	Texas Water Development Board	Steel Tape		

Code Descriptions

Status Code	Status Description
P	Publishable

Water Quality Analysis

Sample Date: 3/20/1974 **Sample Time:** 0000 **Sample Number:** 1 **Collection Entity:** Municipal Water Agency or Public Water Supply Corp

Sampled Aquifer: Edwards and Associated Limestones and Glen Rose Limestone

Analyzed Lab: Texas Department of Health **Reliability:** Collected from pumped well, but not filtered or preserved

Collection Remarks: No Data

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		353	mg/L as CACO3	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		430.78	mg/L	
00910	CALCIUM (MG/L)		109	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00940	CHLORIDE, TOTAL (MG/L AS CL)		257	mg/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		0.5	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		461	mg/L as CACO3	
01045	IRON, TOTAL (UG/L AS FE)		460	ug/L	
00920	MAGNESIUM (MG/L)		46	mg/L	
01055	MANGANESE, TOTAL (UG/L AS MN)	<	50	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		12	mg/L as NO3	
00400	PH (STANDARD UNITS), FIELD		7.9	SU	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		0		
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		3.04		
00932	SODIUM, CALCULATED, PERCENT		41	PCT	
00929	SODIUM, TOTAL (MG/L AS NA)		150	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		1716	MICR	
00945	SULFATE, TOTAL (MG/L AS SO4)		64	mg/L as SO4	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		850	mg/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

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STATE OF TEXAS WELL REPORT for Tracking #27292

Owner:	**David Forfia**	Owner Well #:	**No Data**
Address:	**300 Navajo Trail Georgetown, TX**	Grid #:	**58-18-2**
		Latitude:	**30° 43' 11" N**
Well Location:	**300 Navajo Trail Georgetown, TX**	Longitude:	**097° 48' 07" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Closed-Loop Geothermal**

Drilling Start Date: **10/7/2003** Drilling End Date: **10/7/2003**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**4.75**	**0**	**300**

Drilling Method: **Air Rotary**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**30**	**300**	**Gravel**	

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**30**	**3 Bentonite**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **70**

Distance to Septic Field or other concentrated contamination (ft.): **165**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Alternative Procedure Used**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Unknown**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Ball Drilling Company**

P. O. Box 201717
Austin, TX 78720

Driller Name: **Lonnie C. Ball** License Number: **2298**

Comments: **5 Closed Loop Geothermal Wells**

Longitude entered as 98487 was assumed to be 984807
Changed by TWDB - RQ 12/18/03

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**20**	**Hard White Limestone**
20	**300**	**Hard White Limestone with Streaks of Gray Shale**
		5 Closed Loop Wells

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
1-inch	**New**	**PE Loop**	**-4 to 300**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #43636

Owner:	**Tom Bierscher**	Owner Well #:	**No Data**
Address:	**Georgetown, TX 78628**	Grid #:	**58-18-2**
Well Location:	**Georgetown, TX 78628**	Latitude:	**30° 42' 59" N**
		Longitude:	**097° 48' 07" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **7/8/2003** Drilling End Date: **7/10/2003**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9	**0**	**20**
6	**20**	**720**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**4**

Seal Method: **Gravity Feed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **200**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Owner**

Surface Completion: **Surface Sleeve Installed**

Water Level: **360 ft.** below land surface on **2003-07-10** Measurement Method: **Unknown**

Packers: **Rubber 40**
Rubber 100
Rubber 650

Type of Pump: **Submersible** Pump Depth (ft.): **560**

Well Tests: **Estimated** **Yield: 50 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Alpine Water Well**

10121 IH 35
Jarrell, TX 76537

Driller Name: **Bobby Stork** License Number: **2912**

Comments: **Logged by DT$**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**Top Soil**
2	**24**	**Limestone**
24	**29**	**Caliche**
29	**140**	**Gray Limestone**
140	**380**	**Gray Lime and Shale**
380	**680**	**Limestone**
680	**700**	**Water Sand**
700	**720**	**Limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
6	**N**	**Steel**	**0/20**
4.5	**N**	**PVC**	**+2/680**
4.5	**N**	**PVC Slotted**	**680/720**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #179319

Owner:	**Gary L Baker**	Owner Well #:	**No Data**
Address:	**8201 RR 2338 Georgetown, TX 78628**	Grid #:	**58-18-3**
Well Location:	**8201 RR 2338 Georgetown, TX 78628**	Latitude:	**30° 43' 46" N**
		Longitude:	**097° 47' 06" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **10/26/2004** Drilling End Date: **10/27/2004**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**21**
6.75	**21**	**600**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**5**	**2 Cement**
5	**40**	**3 1/2 Cement**

Seal Method: **Gravity Feed**

Sealed By: **Driller**

Distance to Property Line (ft.): **> 50**

Distance to Septic Field or other concentrated contamination (ft.): **>100**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Surface Sleeve Installed**

Water Level: **260 ft.** below land surface on **2004-10-27** Measurement Method: **Unknown**

Packers: **Shale 520**
Cement 40

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Unknown** **Yield: 55 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
525-600	**Trinity**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Lovelace Water Well Service**

4997 Elm Grove Rd
Belton, TX 76513

Driller Name: **Jimmy Okun** License Number: **55015**

Comments: **$amh**
updated latitude by TWDB on 2/4/2013.

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Overburden**
5	**485**	**Gray Lime & Shale**
485	**502**	**Tan & Gray Lime**
502	**525**	**Tan & Brown Lime**
525	**526**	**Water Sand**
526	**540**	**Sandstone, Green Shale**
540	**580**	**Tan & Gray Lime**
580	**600**	**Tan Soap Lime**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4 1/2	**New**	**Solid Plastic**	**+2 - 520**
4 1/2	**New**	**Plastic mfg Mill Screen**	**520 - 600 .032**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #207597

Owner:	**Kellon Nieman**	Owner Well #:	**No Data**
Address:	**212 Cherokee Trail Georgetown, TX 78633**	Grid #:	**58-18-2**
		Latitude:	**30° 43' 06" N**
Well Location:	**212 Cherokee Trail Georgetown, TX 78633**	Longitude:	**097° 47' 57" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **9/4/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**60**
6.5	**60**	**585**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**9**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **155**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **366 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 565', 545', 20'**

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**Brown Limestone & Red Clay**
2	**16**	**Brown Limestone**
16	**50**	**Brown Limestone & Fractures**
50	**190**	**Gray Limestone**
190	**200**	**Brown Limestone**
200	**315**	**Gray Limestone**
315	**322**	**Blue Limestone**
322	**340**	**Brown Limestone**
340	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**582**	**Fracture**
582	**585**	**Gray Limestone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 60
4 1/2 New Plastic 0 - 585
Perf. 565 - 585

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STATE OF TEXAS WELL REPORT for Tracking #207600

Owner:	**Russell Langbein**	Owner Well #:	**No Data**
Address:	**1801 Williams Drive Georgetown, TX 78628**	Grid #:	**58-18-2**
Well Location:	**202 Cherokee Trail Georgetown, TX 78628**	Latitude:	**30° 43' 07" N**
		Longitude:	**097° 47' 54" W**
Well County:	**Williamson**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **9/10/2008** Drilling End Date: **9/12/2008**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**50**
6.5	**50**	**765**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**50**	**15**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **190**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **185 ft.** below land surface on **2008-09-12** Measurement Method: **Unknown**

Packers: **Shale Trap 712', 705', 685'**

Type of Pump: **None**

Well Tests: **Estimated** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 South A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Loose Rock & Top Soil**
1	**20**	**Brown Limestone**
20	**41**	**Brown & White Limestone**
41	**50**	**Brown Limestone**
50	**150**	**Gray Limestone**
150	**165**	**Brown Limestone**
165	**240**	**Gray Limestone**
240	**277**	**Brown Limestone**
277	**284**	**Blue Limestone**
284	**390**	**Gray Limestone**
390	**540**	**Gray Limestone**
540	**580**	**Gray Sandstone**
580	**690**	**Gray Limestone**
690	**717**	**Gray Sandstone**
717	**723**	**Brown Sandstone**
723	**726**	**Gray Sand**
726	**740**	**Green Sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
8 New Plastic 0 - 50
4 1/2 New Plastic 0 - 765
Perf. 725 - 765

740	**750**	**Gray Sandstone & Sand Strips**
750	**765**	**White & Gray Coarse Sand**

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STATE OF TEXAS WELL REPORT for Tracking #237859

Owner:	**Kent Burkhart**	Owner Well #:	**5**
Address:	**8701 CR 2338 Georgetown, TX 78628**	Grid #:	**58-18-3**
Well Location:	**8701 CR 2338 Georgetown, TX 78628**	Latitude:	**30° 44' 00" N**
		Longitude:	**097° 47' 16" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **3/7/2007** Drilling End Date: **3/13/2007**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**6.75**	**0**	**300**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
5	**10**	**3 cement**
10	**300**	**12 benseal**

Seal Method: **Tremmie Pipe**

Sealed By: **Driller**

Distance to Property Line (ft.): **50+**

Distance to Septic Field or other concentrated contamination (ft.): **100+**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Unknown**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Lovelace Water Well Service**

4997 Elm Grove Rd
Belton, TX 76513

Driller Name: **Jimmy Okun** License Number: **55015**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**Overburden**
10	**300**	**Gray Lime & Shale**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4 1/2	**New**	**Fiberglass Solid**	**-5 - 300**

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STATE OF TEXAS WELL REPORT for Tracking #255112

Owner:	**Kent Burkhart**	Owner Well #:	**1**
Address:	**8701 CR 2338 Georgetown, TX 78628**	Grid #:	**58-18-3**
		Latitude:	**30° 43' 58" N**
Well Location:	**8701 CR 2338 Georgetown, TX 78628**	Longitude:	**097° 47' 17" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **10/14/2005** Drilling End Date: **10/14/2005**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**19**
6.75	**19**	**720**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**5**	**2 1/2 cement**
5	**40**	**3 1/2 benseal**

Seal Method: **Gravity Feed**

Sealed By: **Driller**

Distance to Property Line (ft.): **> 50**

Distance to Septic Field or other concentrated contamination (ft.): **> 100**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Surface Sleeve Installed**

Water Level: **325 ft.** below land surface on **2005-10-14** Measurement Method: **Unknown**

Packers: **Shale 640'**
Cement 40'

Type of Pump: **Submersible** Pump Depth (ft.): **500**

Well Tests: **Jetted** **Yield: 100 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
605 - 720	**Trinity**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Lovelace Water Well Service**

4997 Elm Grove Rd
Belton, TX 76513

Driller Name: **Jimmy Okun** License Number: **55015**

Comments: **$mew**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**15**	**Overburden**
15	**445**	**Gray Lime & Shale**
445	**450**	**Sandy Brown Lime**
450	**480**	**Gray & Brown Lime**
480	**595**	**Tan & Brown Lime**
595	**605**	**Gray Shale**
605	**655**	**Tan & White Lime**
655	**710**	**Green Shale Water Sand**
710	**720**	**Tan Lime**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4 1/2	**New**	**Plastic**	**Solid +2 - 660**
4 1/2	**New**	**Plastic Mfg. Mill**	**Screen 660 - 720 .032**

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STATE OF TEXAS WELL REPORT for Tracking #275373

Owner:	**Leland Cahill**	Owner Well #:	**No Data**
Address:	**610 Young Ranch Road Georgetown, TX 78633**	Grid #:	**58-18-2**
		Latitude:	**30° 43' 22" N**
Well Location:	**610 Young Ranch Rd. Georgetown, TX 78633**	Longitude:	**097° 48' 39" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **9/7/2011** Drilling End Date: **9/7/2011**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9	**0**	**100**
6	**100**	**745**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**100**	**21**

Seal Method: **Pressure Trimmy**

Sealed By: **Driller**

Distance to Property Line (ft.): **40**

Distance to Septic Field or other concentrated contamination (ft.): **100+**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Owner**

Surface Completion: **Surface Sleeve Installed**

Water Level: **No Data**

Packers: **3 Packers, PVC & Burlap, 100',600',620'**

Type of Pump: **Submersible**

Well Tests: **Jetted** **Yield: 30-40 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
60	**Hensell**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Western Water Wells**

500 Southland Dr.
Burnet, TX 78611

Driller Name: **Frank Glass** License Number: **1313**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Top Soil**
1	**19**	**Caliche & Lime**
19	**75**	**Blue Lime**
75	**135**	**Gray Lime**
135	**170**	**Brown & White Lime**
170	**410**	**Gray Lime**
410	**435**	**Brown Lime**
435	**605**	**Gray & Brown Lime**
605	**745**	**Hensell Sand 30-40 GPM**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
5" OD, New, Plastic, +2'-745', 17 Gauge			

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STATE OF TEXAS WELL REPORT for Tracking #279881

Owner:	**Grant Nakashima**	Owner Well #:	**No Data**
Address:	**501 Indian Springs Georgetown, TX 78633**	Grid #:	**58-18-2**
Well Location:	**501 Indian Springs Georgetown, TX 78633**	Latitude:	**30° 43' 48" N**
Well County:	**Williamson**	Longitude:	**097° 48' 04" W**
		Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Domestic**

Drilling Start Date: **9/25/2011** Drilling End Date: **9/25/2011**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**20**
6.5	**20**	**705**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**4 of Portland**

Seal Method: **Slurry**

Sealed By: **Driller**

Distance to Property Line (ft.): **50+**

Distance to Septic Field or other concentrated contamination (ft.): **100+**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Landowner**

Surface Completion: **Surface Sleeve Installed**

Water Level: **No Data**

Packers: **Burlap/Neoprene 640, 620, 20**

Type of Pump: **No Data**

Well Tests: **Jetted** **Yield: 60 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
640-675	**Trinity**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Apex Drilling, Inc.**

P O Box 867
Marble Falls, TX 78654

Driller Name: **Michael G. Becker, P. G.** License Number: **54516**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Top Soil**
1	**33**	**Tan Limestone**
33	**640**	**Grey/Tan Limestone**
640	**673**	**Sand**
673	**675**	**Grey Limestone**
675	**705**	**Grey Clay**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
4.5'' (5'' OD) New PVC + 2' to 645' SDR17
4.5'' (5'' OD) New Slotted PVC 645' to 705' .035

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STATE OF TEXAS WELL REPORT for Tracking #286363

Owner:	**Mike & Darlene Darr**	Owner Well #:	**1**
Address:	**204 Vista Lane Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**204 Vista Lane Georgetown, TX 78633**	Latitude:	**30° 43' 15" N**
		Longitude:	**097° 46' 55" W**
Well County:	**Williamson**	Elevation:	**990 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **3/27/2012** Drilling End Date: **3/30/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9.75	**0**	**60**
6.25	**20**	**800**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**120**	**18**

Seal Method: **PRESSURE CEMENTED**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: **449 ft.** below land surface on **2012-03-29** Measurement Method: **Unknown**

Packers: **RUBBER 120'**
RUBBER 700'
RUBBER 760'

Type of Pump: **Submersible** Pump Depth (ft.): **660**

Well Tests: **Jetted** **Yield: 70 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
449	**TRINITY**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **HILL COUNTRY WATER WELL**

POBOX 220
BRIGGS, TX 78608

Driller Name: **JOE MCDEARMON** License Number: **2334**

Comments: **SLAB & SLEEVE INSTALLED**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**3**	**TOP SOIL**
3	**6**	**RED CLAY**
6	**30**	**WHITE LIME**
30	**35**	**CAVE**
35	**45**	**LIME SLICK**
45	**60**	**WHITE LIME**
60	**220**	**GRAY LIME**
220	**320**	**BROWN LIME**
320	**460**	**GRAY LIME**
460	**520**	**BROWN LIME**
520	**525**	**GRAY SHALE**
525	**620**	**SANDSTONE**
620	**630**	**TRINITY SAND**
630	**745**	**SANDSTONE**
745	**750**	**GRAY SHALE**
750	**770**	**SANDSTONE**
770	**775**	**TRINITY**
775	**782**	**TRINITY SAND**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
4.5 NEW PLASTIC 0/740 SDR17
4.5 NEW SCREEN 630/780/800 .032

782	**800**	**SANDSTONE**

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STATE OF TEXAS WELL REPORT for Tracking #305920

Owner:	**Jerry Meadows**	Owner Well #:	**No Data**
Address:	**106 Navajo Trail Georgetown, TX 78626**	Grid #:	**58-18-2**
Well Location:	**106 Navajo Trail Georgetown, TX 78626**	Latitude:	**30° 43' 23" N**
		Longitude:	**097° 47' 39" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **11/21/2011** Drilling End Date: **11/23/2011**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
9	**0**	**103**
6.5	**103**	**765**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**103**	**21**

Seal Method: **Tremie Tube**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **120**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **489 ft.** below land surface on **2011-10-22** Measurement Method: **Unknown**

Packers: **Shale Trap 705', 685', 125', 103'**

Type of Pump: **Not installed until next year.**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 A. W. Grimes Blvd.
Round Rock, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **^EAD**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**topsoil & loose rock**
1	**16**	**yellow limestone**
16	**38**	**brown limestone**
38	**61**	**blue limestone & shale**
61	**222**	**gray limestone**
222	**246**	**brown limestone**
246	**470**	**gray limestone**
470	**488**	**gray sandstone**
488	**515**	**gray limestone**
515	**550**	**brown limestone**
550	**565**	**gray sandstone**
565	**619**	**blue limestone & shale**
619	**623**	**blue clay**
623	**640**	**gray sandstone**
640	**660**	**gray limestone**
660	**685**	**gray sandstone**
685	**710**	**gray sandstone & sand strips**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4 1/2	**N**	**Plastic**	**0-765**
Perf.			**705-765**

710	**726**	**brown sandstone & sand strips**
726	**745**	**gray sand**
745	**765**	**gray sandstone & sand strips**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #312737

Owner:	**Fred Sides**	Owner Well #:	**1**
Address:	**PO Box 2049** **Cedar Park, TX 78630**	Grid #:	**58-18-2**
Well Location:	**350 Young Ranch Rd.** **Georgetown, TX 78633**	Latitude:	**30° 42' 58" N**
		Longitude:	**097° 48' 29" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Start Date: **4/10/2012** Drilling End Date: **4/12/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**80**
6.5	**80**	**780**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**6 cement**

Seal Method: **Poured Slurry**

Sealed By: **Josh Dickinson**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: **470 ft.** below land surface on **2012-04-12** Measurement Method: **Unknown**

Packers: **Rubber 40, 620**

Type of Pump: **Submersible** Pump Depth (ft.): **680**

Well Tests: **Estimated** **Yield: 30+ GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**Trinity**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **B & B Water Well Service, Inc**

PO Box 232
Bertram, TX 78605

Driller Name: **Joshua Dickinson** License Number: **54204**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**Topsoil**
2	**20**	**Caliche**
20	**75**	**Blue Lime**
75	**140**	**Grey Lime**
140	**170**	**Brown & White Lime**
170	**400**	**Grey Lime**
400	**440**	**Brown Lime**
440	**600**	**Grey & Brown Lime**
600	**740**	**Trinity Sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.) New/Used Type Setting From/To (ft.)
6.25" SDR 17 PVC Casing 0-80
4.5" SDR 17 PVC Casing 0-780
4.5" Factory Slotted Screen 680-760

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #316624

Owner:	**Glen Lupenitz**	Owner Well #:	**No Data**
Address:	**201 Gabriel Vista Ct. Georgetown, TX 78633**	Grid #:	**58-18-3**
Well Location:	**201 Gabriel Vista Ct. Georgetown, TX 78633**	Latitude:	**30° 43' 24" N**
		Longitude:	**097° 46' 56" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Irrigation**

Drilling Start Date: **11/12/2012** Drilling End Date: **11/30/2012**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**26**
8	**26**	**105**
6.5	**105**	**790**

Drilling Method: **Air Hammer**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**26**	**12**
0	**105**	**21**

Seal Method: **Hand Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **103**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Tape Measure**

Surface Completion: **Surface Sleeve Installed**

Water Level: **477 ft.** below land surface on **2012-11-30** Measurement Method: **Unknown**

Packers: **Shale Trap 730', 710', 105'**

Type of Pump: **Submersible** Pump Depth (ft.): **600**

Well Tests: **Estimated** **Yield: 75 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Tom Arnold Drilling**

2750 S Q. W. Grimes Blvd.
Roundrock, TX 78664

Driller Name: **Tommy D. Arnold** License Number: **2096**

Comments: **See note in late report file.**
^EAD

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**loose rock & topsoil**
1	**26**	**brown limestone**
26	**121**	**gray limestone**
121	**126**	**brown limestone**
126	**254**	**gray limestone**
254	**261**	**brown limestone**
261	**282**	**gray limestone**
282	**290**	**brown limestone**
290	**351**	**gray limestone**
351	**360**	**blue limestone & shale**
360	**590**	**gray limestone**
590	**700**	**gray sandstone**
700	**710**	**gray sandstone & sand strips**
710	**720**	**gray sandstone**
720	**735**	**brown sandstone**
735	**780**	**gray sandstone & sand strips**
780	**790**	**gray sandstone**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
8" N Plastic 0'-26'			
4 1/2" N Plastic 0'-790'			
Perf. 730'-770'			

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #580948

Owner:	**UTZ Environmental**	Owner Well #:	**No Data**
Address:	**1000 Garret Oaks Lane Georgetown, TX 78633**	Grid #:	**58-18-2**
Well Location:	**1000 Garret Oaks Lane Georgetown, TX 78633**	Latitude:	**30° 44' 07.26" N**
		Longitude:	**097° 47' 34.56" W**
Well County:	**Williamson**	Elevation:	**988 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Irrigation**

Drilling Start Date: **8/3/2021** Drilling End Date: **8/3/2021**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
11	**0**	**20**
6.25	**20**	**750**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
-1	**30**	**3 cement Bags/Sacks**
0	**20**	**2 cement 2 holeplug Bags/Sacks**

Seal Method: **Slurry**

Sealed By: **Driller**

Distance to Property Line (ft.): **+100**

Distance to Septic Field or other concentrated contamination (ft.): **N/A**

Distance to Septic Tank (ft.): **N/A**

Method of Verification: **owner/contractor**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **530 ft.** below land surface on **2021-08-03** Measurement Method: **Sonic/Radar**

Packers: **burlap 20', 30'**
burlap and plastic 650', 630'

Type of Pump: **Submersible**

Well Tests: **Estimated** **Yield: 20-25 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
220	**hensell**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Associated Drilling Inc**

PO BOX 673
Dripping Springs, TX 78620

Driller Name: **James Benoit** License Number: **4064**

Comments: **Drilled for Marx Pump Service**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**65**	**white limestone**
65	**600**	**blue lime**
600	**635**	**grey lime and shale**
635	**665**	**blue white limetone**
665	**750**	**tan white brown limestone and some sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4.5	**Blank**	**New Plastic (PVC)**	**sdr17**	**-3**	**670**
6.25	**Blank**	**New Plastic (PVC)**	**sch 40**	**0**	**20**
4.5	**Screen**	**New Plastic (PVC)**	**sdr17 0.020**	**670**	**730**
4.5	**Blank**	**New Plastic (PVC)**	**sdr17**	**730**	**750**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #580949

Owner:	**UTZ Environmental**	Owner Well #:	**No Data**
Address:	**1000 Garret Oaks Lane Georgetown, TX 78633**	Grid #:	**58-18-2**
Well Location:	**1000 Garret Oaks Lane Georgetown, TX 78633**	Latitude:	**30° 44' 08.52" N**
		Longitude:	**097° 47' 38.58" W**
Well County:	**Williamson**	Elevation:	**949 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Irrigation**

Drilling Start Date: **7/30/2021** Drilling End Date: **7/30/2021**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
11	**0**	**20**
6.25	**20**	**750**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
-1	**30**	**3 cement Bags/Sacks**
0	**20**	**2 cement 2 holeplug Bags/Sacks**

Seal Method: **Slurry**

Sealed By: **Driller**

Distance to Property Line (ft.): **+100**

Distance to Septic Field or other concentrated contamination (ft.): **N/A**

Distance to Septic Tank (ft.): **N/A**

Method of Verification: **owner/contractor**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **526 ft.** below land surface on **2021-07-30** Measurement Method: **Sonic/Radar**

Packers: **burlap 20', 30'**
burlap and plastic 650', 630'

Type of Pump: **Submersible**

Well Tests: **Estimated** **Yield: 20-25 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
224	**Hensell**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Associated Drilling Inc**

PO BOX 673
Dripping Springs, TX 78620

Driller Name: **James Benoit** License Number: **4064**

Comments: **Drilled for Marx Pump Services**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**65**	**white limestone**
65	**615**	**blue lime**
615	**640**	**grey lime and clay**
640	**660**	**blue white limestone**
660	**750**	**tan white limesone and some sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4.5	**Blank**	**New Plastic (PVC)**	**sdr17**	**-3**	**690**
6.25	**Blank**	**New Plastic (PVC)**	**sch 40**	**0**	**20**
4.5	**Screen**	**New Stainless Steel**	**sdr17 0.020**	**690**	**750**

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P.O. Box 12157
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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #619931

Owner:	**Utz Environmental**	Owner Well #:	**3**
Address:	**10948 E Crystal Falls Pkwy Leander, TX 78641**	Grid #:	**58-18-2**
Well Location:	**Parmer Ranch 1000 Garret Oaks Lane Georgetown, TX 78633**	Latitude:	**30° 44' 08.09" N**
		Longitude:	**097° 47' 39.84" W**
Well County:	**Williamson**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Irrigation**

Drilling Start Date: **9/15/2022** Drilling End Date: **9/15/2022**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8.75	**0**	**20**
6.25	**20**	**750**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
-1	**30**	**4 cement, 1 Benseal Bags/Sacks**

Seal Method: **Slurry**

Sealed By: **Driller**

Distance to Property Line (ft.): **100+**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Owner**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **595 ft.** below land surface on **2022-09-15** Measurement Method: **Sonic/Radar**

Packers: **Burlap & PVC 650, 630 ft.**
Burlap 30 ft.

Type of Pump: **Submersible**

Well Tests: **Estimated** **Yield: 25 GPM**

Water Quality:

Strata Depth (ft.)	Water Type
595 - 750	**Hensel**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Associated Drilling Inc**

PO BOX 673
Dripping Springs, TX 78620

Driller Name: **Frank Glass** License Number: **1313**

Comments: **Drilled for Marx Pump Service Inc.**

Report Amended on 10/4/2022 by Request #37653

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**4**	**top soil**
4	**55**	**white caliche**
55	**605**	**blue lime**
605	**660**	**tan lime**
660	**690**	**tan white limestone**
690	**710**	**gray sandstone**
710	**730**	**gray limestone**
730	**750**	**gray limestone & clay**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4.5	**Blank**	**New Plastic (PVC)**	**SDR17**	**-3**	**670**
4.5	**Screen**	**New Plastic (PVC)**	**SDR 17 0.020**	**670**	**730**
4.5	**Blank**	**New Plastic (PVC)**	**SDR17**	**730**	**750**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #620986

Owner:	**Shane Ingwersen**	Owner Well #:	**No Data**
Address:	**190 Young Ranch Road Georgetown, TX 78633**	Grid #:	**58-18-2**
Well Location:	**190 Young Ranch Road Georgetown, TX 78633**	Latitude:	**30° 42' 56" N**
		Longitude:	**097° 48' 26" W**
Well County:	**Williamson**	Elevation:	**1030 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Irrigation**

Drilling Start Date: **7/25/2022** Drilling End Date: **7/27/2022**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12	**0**	**56**
6.5	**56**	**790**

Drilling Method: **Air Rotary**

Borehole Completion: **Straight Wall**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**20**	**Cement 9 Bags/Sacks**
50	**56**	**Cement 3 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **58**

Distance to Septic Field or other concentrated contamination (ft.): **221**

Distance to Septic Tank (ft.): **200**

Method of Verification: **Tape**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **Rubber at 410 ft.**
Rubber at 710 ft.
Rubber at 730 ft.

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **TOM ARNOLD DRILLING**

2750 SOUTH A. W. GRIMES BLVD
ROUND ROCK, TX 78664

Driller Name: **Tommy Arnold** License Number: **2096**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**Loose Rock & Top Soil**
1	**20**	**Brown Limestone**
20	**44**	**White Limestone**
44	**56**	**No Returns**
56	**250**	**Gray Limestone**
250	**277**	**Brown Limestone**
277	**320**	**Brown Limestone**
320	**330**	**Blue Limestne & Shale**
330	**630**	**Gray Limestone**
630	**720**	**Gray Sandstone**
720	**790**	**Gray Sandstone & Sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
8	**Blank**	**New Plastic (PVC)**	**40**	**0**	**56**
4.5	**Blank**	**New Plastic (PVC)**	**SDR17**	**0**	**730**
4.5	**Screen**	**New Plastic (PVC)**	**SDR17**	**730**	**790**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

RECHARGE FEATURE PLAN

FOR

REAGOR TRACT WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT

February 2025

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD. BUILDING II SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

RECHARGE FEATURE PLAN

The purpose of this report is to document the presence of any recharge features on any tracts of land owned, operated, controlled, rented, or leased by the applicant and to be used as a part of the facility to satisfy the requirements of Title 30 of the Texas Administrative Code, Chapter 222, Subchapter C, Rule §222.79.

(1) The following recharge features, as defined in 30 TAC Chapter 222.5 were identified on land owned, operated, controlled, rented, or leased by the applicant and proposed to be used as a part of the facility. Due to the location of the project in the Edwards Aquifer Contributing Zone and partially in the Recharge Zone, existing water courses, including stock ponds are considered recharge features. Existing water wells are considered artificial recharge features. The watercourses located within and around the project connect to Cowan Creek.

(2) The following sources were used to document the presence of natural and artificial recharge features on the applicant's property:

A. Railroad Commission of Texas

The Railroad Commission of Texas online Public GIS Map Viewer was used to search for artificial recharge features (gas wells). No artificial recharge features were found through this search except existing water wells, as shown on the attached map (Appendix N).

B. A groundwater conservation district

Not applicable.

C. Texas Water Development Board

The locations of all water wells within a half mile of the site were located using the Texas Water Development Board's Water Information Integration and Dissemination (WIID) GIS database. Well information and well locations are shown on the USGS Map.

D. Texas Commission on Environmental Quality

Per our conversations with TCEQ staff, there are no maps produced by TCEQ that would show the presence of any recharge features on the applicant's site. The site is located within the contributing zone for the Edwards Aquifer.

LJA also reviewed wells located within a half mile radius of the disposal site are shown on the USGS map presented as Appendix M.

E. Natural Resources Conservation Service

A map showing the NRCS soil types for the proposed irrigation areas is presented as Appendix O.

F. On-site inspection
The current property owner is unaware of any recharge features that may be found on the property.

No direct recharge features were found during onsite inspections by LJA Engineering, Inc.

Because the site overlies the contributing zone for the Edwards Aquifer, watercourses including the existing ponds are treated as potential recharge features as defined in 30 TAC 222.5.

No exposed limestone was observed onsite.

(3) A narrative description of the site-specific geology and groundwater at the facility is provided below:

A. The proposed project is located southwest of the intersection of FM 2338 and Indian Springs Road and is underlain by the Edwards Formation. This Cretaceous formation is composed of alternating layers of hard limestone and soft marl which typically erode into a stairstep topography. Two soil units are mapped within the proposed irrigation areas according to the NRCS Soil Survey. Fairlie clay (FaB) soils generally are very deep, clayey soils overlying limestone. Eckrant stony clay (EeB) are generally deep, well drained soils developed in slope alluvium.

The project location is situated on the Austin Sheet of the Geologic Atlas of Texas published by the University of Texas at Austin, Bureau of Economic Geology.

A copy of TWDB Report 358 Groundwater Availability Modeling: Northern Segment of the Edwards Aquifer, Texas, is also enclosed as it is the most recent study of the Northern Edwards Aquifer underlying the project, having been published in 2003. This report identifies recharge to the Edwards Aquifer from stream beds located within the study area. The study also indicates that hydraulic conductivity is greater over the Balcones Fault Zone compared to the rest of the aquifer system. This project is located within the Fault Zone. The Edwards Aquifer in this area is generally located between elevation 500 ft-msl and 100 ft-msl in this area. Overall, the model indicated a recharge rate of 20 percent for the aquifer (page 49, TWDB Report 358).

B. Depth to groundwater is approximately 230', based on well driller reports. This matches the levels predicted by the TWDB Report 358.

C. Groundwater generally flows downdip southeast and east in this area. See Figure 1 from TWDB Report 358 attached.

D. The only known uses for groundwater are the existing domestic water wells shown on the attached USGS map.

E. Well drillers' logs and water quality data are included as Appendix M.

(4) Measures to prevent impact to groundwater include:

A. Protective Measures:

a. All wells, will be protected with a 150’ minimum buffer.

b. Stream buffers will be provided from watercourses which could convey runoff to Cowan Creek. Drainage ways depicted on the USGS map must have a 100 foot buffer from the creek centerline to irrigation fields. There are no creeks identified on the USGS map within this tract.

c. The proposed drip irrigation fields have been located to minimize the opportunities for stormwater to run on to the fields; however, berms to prevent run-on of stormwater will be located along the perimeter of fields where there is localized upstream drainage.

d. Existing off-channel stock ponds that are located within the proposed irrigation areas will be filled in to ensure there are no opportunities for ponding of stormwater over the field.

B. The combination of run-on control and moisture monitoring in the drip system will prevent any runoff of effluent. No direct recharge features were located on the applicant’s property, and a review of available literature on groundwater in the area indicates recharge through surface runoff is minimal in this area. With this in mind, and with the safeguards proposed above, a groundwater monitoring plan is not provided.

Appendix A
Texas Railroad Commission Map

December 2, 2024

1:72,224

0 0.5 1 2 mi

0 0.75 1.5 3 km

County of Williamson, Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Appendix B
Texas Water Development Board Report 358

Texas Water Development Board

Report 358

Groundwater Availability Modeling: Northern Segment of the Edwards Aquifer, Texas

by
Ian C. Jones, Ph.D., P.G.

December 2003

Geoscientist Seal

The contents of this report (including figures and tables) document the work of the Following Licensed Texas Geoscientist:

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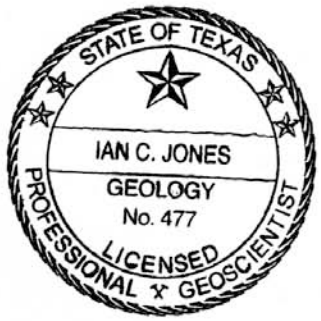

Report 358 - Groundwater Availability Model: Northern Segment of the Edwards Aquifer, Texas, 2003

Texas Water Development Board

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1.0 Executive Summary

The northern segment of the Edwards aquifer covers an area that includes some of the fastest growing counties in Texas. As a result of rapid population growth, demand for water in this region is also rising. A groundwater availability model simulating flow through this segment of the Edwards aquifer was constructed as a groundwater resource management tool. The purpose of this tool is to aid groundwater conservation districts, regional water planning groups, and others in evaluating groundwater resource management strategies to meet projected groundwater demands. This model was constructed by calibrating to steady-state conditions for 1980 and historical transient conditions for the period 1980-2000. The calibrated model can be used to predict future water-level changes that may result from projected pumping rates and/or climatic conditions.

The model results indicate that (1) no historical regional-scale cones-of-depression exist in the northern Edwards aquifer, (2) 60-80 percent of natural discharge is baseflow to perennial streams that cross the aquifer outcrop, (3) pumping is less than 20 percent of total discharge, (4) the flow system is more active in the unconfined part of the aquifer than in downdip portions, and (5) gradual long-term water-level decline is occurring in the Pflugerville-Georgetown area. Historical pumping trends indicate steadily increasing municipal, rural domestic, and industrial pumping, rising from 20,000 to 30,000 acre-feet/year over the past 20 years. Regional-scale drawdown associated with increasing pumping has not been observed, so far, largely because pumping is a relatively small portion of the total water budget of this segment of the Edwards aquifer. However, pumping results in local drawdown.

2.0 Introduction

The northern segment of the Edwards aquifer is an important source of groundwater for municipalities, industries, and landowners in central Texas. Rapid population growth in this part of Texas has increased interest in the northern segment of the Edwards aquifer and heightened concerns about groundwater availability in the aquifer.

This is the first published model to simulate groundwater flow in the northern segment of the Edwards aquifer. The San Antonio and Barton Springs segments have received higher priority because groundwater flow models were needed to address pressing issues related to conflicts over groundwater demand for municipal, agricultural, recreational, and ecological uses (fig. 2-1). The San Antonio segment has been given highest priority because historically it has been the sole source of water for many municipalities, including San Antonio, a city with a population exceeding 1 million. The San Antonio segment is also an important source of irrigation water in that region. Increasing pumping associated with municipal and irrigation demands, together with the effects of drought, lowers spring discharge in Barton, San Marcos, and Comal springs. Declines in spring discharge affect recreation, flora, and fauna associated with the springs. These issues have made understanding groundwater flow through the respective segments of the Edwards aquifer of vital importance.

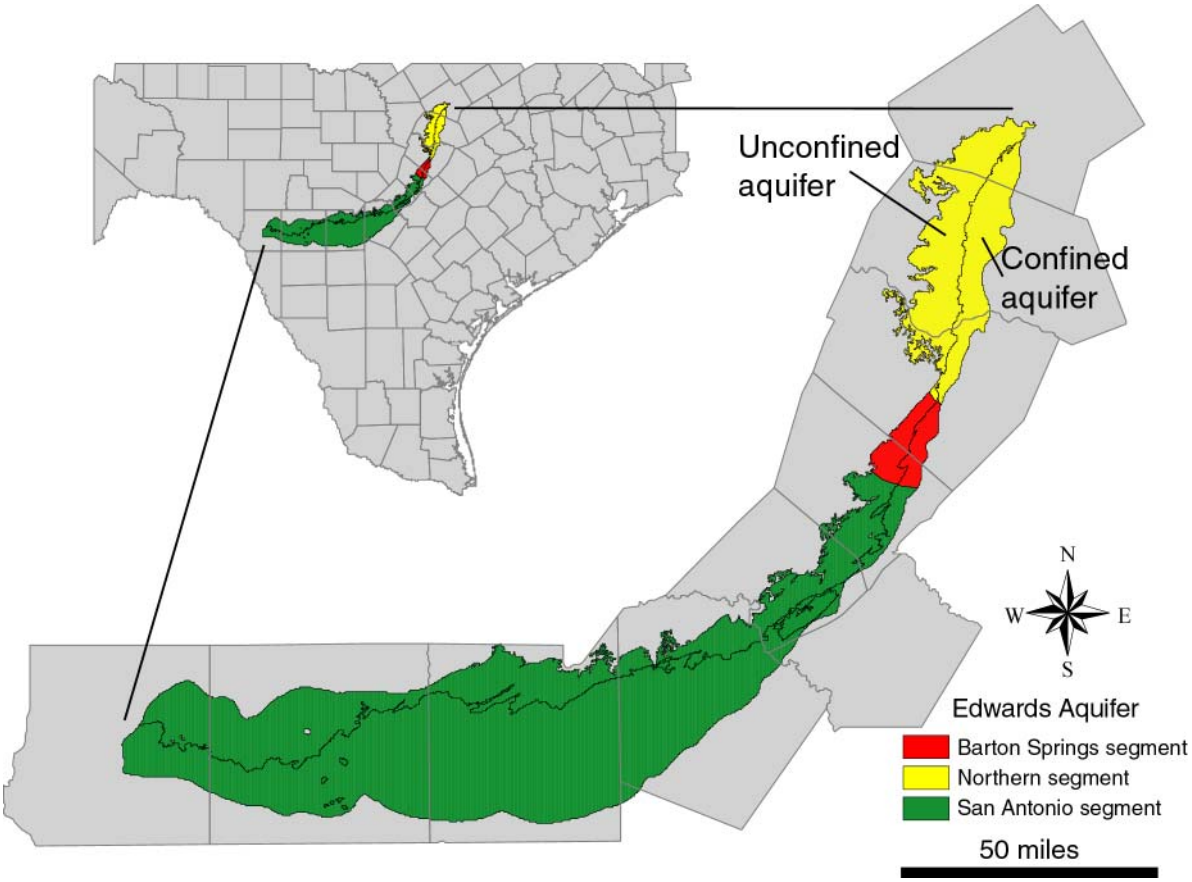

Figure 2-1. Segments of the Edwards (Balcones Fault Zone) aquifer.

The northern segment has received lower priority largely because the largest city in the region, Austin, does not rely on the northern segment of the Edwards aquifer for groundwater to meet its water demands. However, other smaller municipalities, such as Georgetown, Pflugerville, and Round Rock, use groundwater from the Edwards aquifer. Rapid population growth in these and adjacent municipalities is likely to be accompanied by rapid growth in demand for groundwater from the Edwards aquifer. This growth necessitates our gaining a better understanding of the hydrology of this segment of the Edwards aquifer and the potential effects of future population growth. This understanding can be achieved through groundwater availability modeling (GAM)—development of a state-of-the-art, publicly available, numerical groundwater flow model that will provide reliable information on groundwater availability in this aquifer.

The general approach used in developing this model involved (1) developing a conceptual model, (2) organizing and distributing aquifer information for input into the model, (3) calibrating a steady-state model for 1980, (4) calibrating a historical transient model for the years 1980 through 2000, and (5) making predictive simulations. This report describes (1) the study area, previous work, and hydrogeologic setting used to develop the conceptual model; (2) the code, grid, and model parameters assigned during model construction; (3) calibration and sensitivity analysis of steady-state and transient models; (4) predictions of water-level changes; (5) limitations of the current model; and (6) suggestions for future improvements.

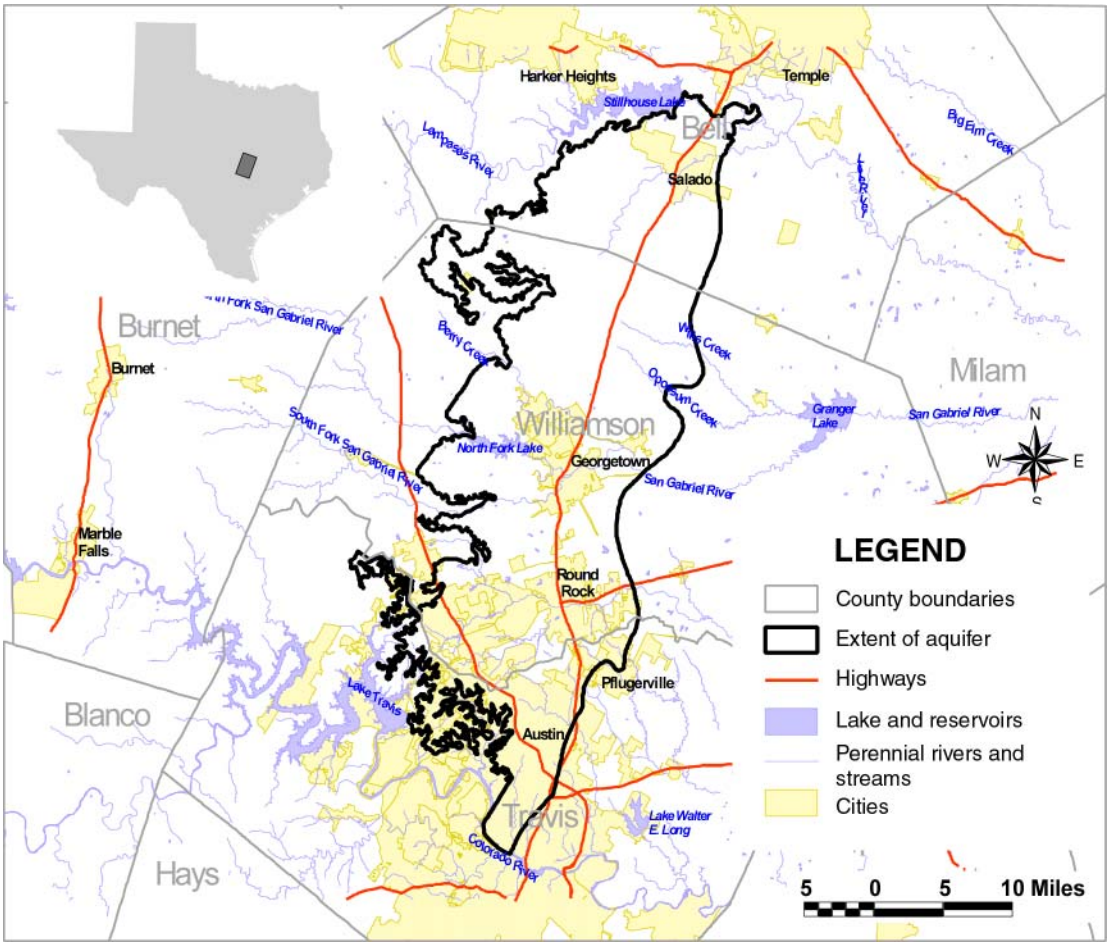

Figure 3-1. Location of the study area.

3.0 Study Area

The northern segment of the Edwards aquifer is located in central Texas (fig. 3-1). It is the northernmost of the three segments that make up the Edwards (Balcones Fault Zone) aquifer (fig. 2-1). The study area underlies parts of Bell, Travis, and Williamson counties and extends over parts of two regional water planning areas, the Lower Colorado (K) and Brazos (G) Regional Water Planning Areas (fig. 3-2). The northern part of the study area also lies within the Clearwater Underground Water Conservation District (fig. 3-3). The northern segment of the Edwards aquifer extends from the Colorado River in Travis County to the Lampasas River in southern Bell County. This segment of the Edwards aquifer is bounded by the Colorado River to the south, the western margin of the Edwards and associated limestones outcrop to the west and north, and to the east by the easternmost extent of fresh groundwater, referred to as the bad water line.

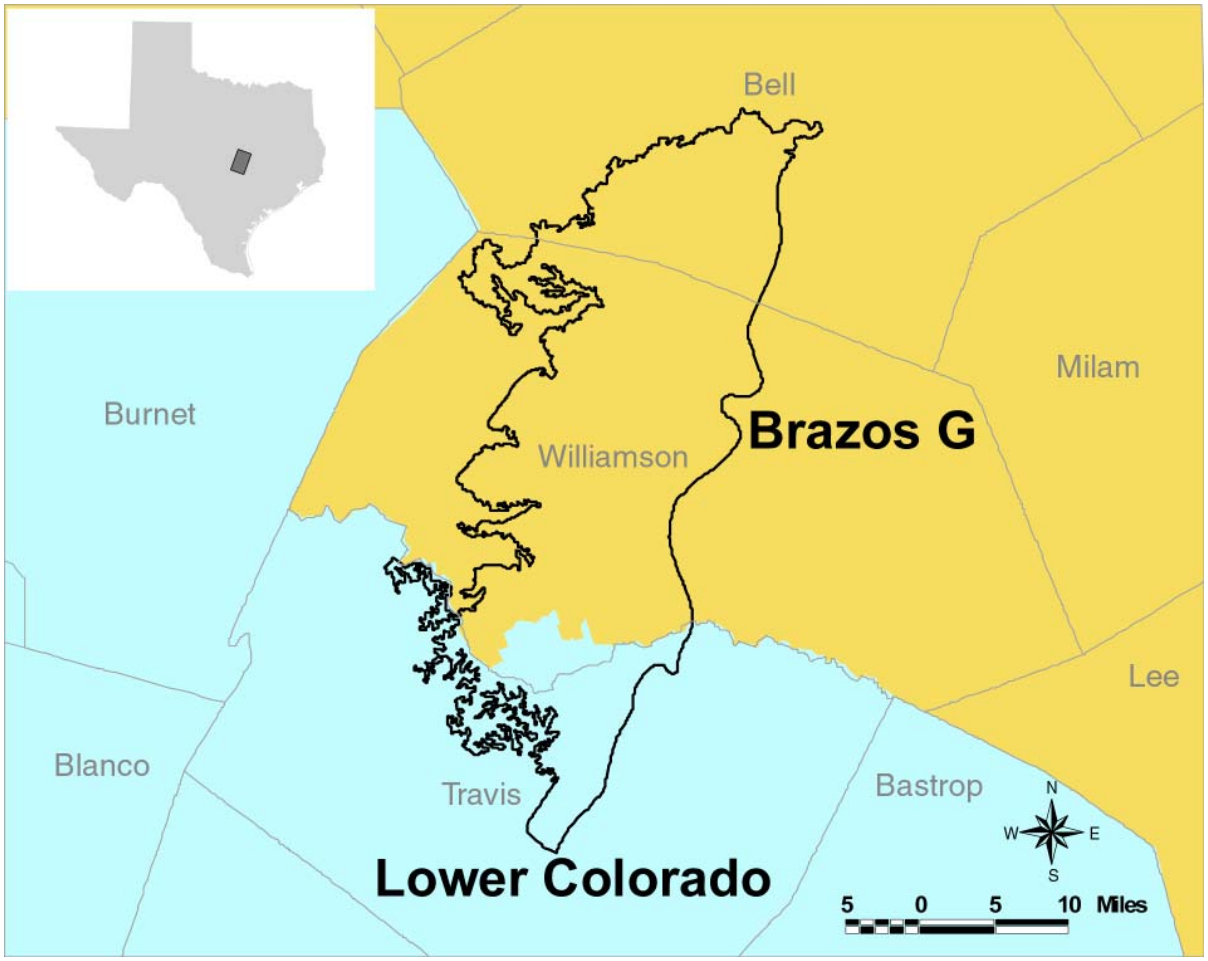

Figure 3-2. Location of regional water planning group boundaries in the study area.

3.1 Physiography and Climate

The topography of central Texas is relatively flat, with an elevation range of 500 to 1,000 feet above sea level (fig. 3-4). There are three physiographic provinces in the study area, the Edwards Plateau, Rolling Prairie, and Blackland Prairie (fig. 3-5). The occurrence of these three physiographic provinces is related to the underlying geology that will be discussed in more detail later in this section.

In the study area, the Edwards Plateau is composed of the Hill Country, Jollyville Plateau, and Lampasas Cutplains. The Jollyville Plateau has been separated from the Hill Country by erosion that resulted in the formation of the Colorado River valley. The Hill Country and Jollyville Plateau are characterized by highly dissected canyonland, while the Lampasas Cutplains is characterized by gently rolling terrain. The Rolling Prairie developed in the Balcones Fault Zone and coincides with the outcrop of limestone rocks that overlie the aquifer. The Blackland Prairie occurs where the limestones are overlain by younger alluvial units that occur along the margin of the Gulf Coastal Plain (Senger and others, 1990). The most prominent topographic feature is the Balcones Escarpment, a product of normal faulting in this region. This escarpment forms the

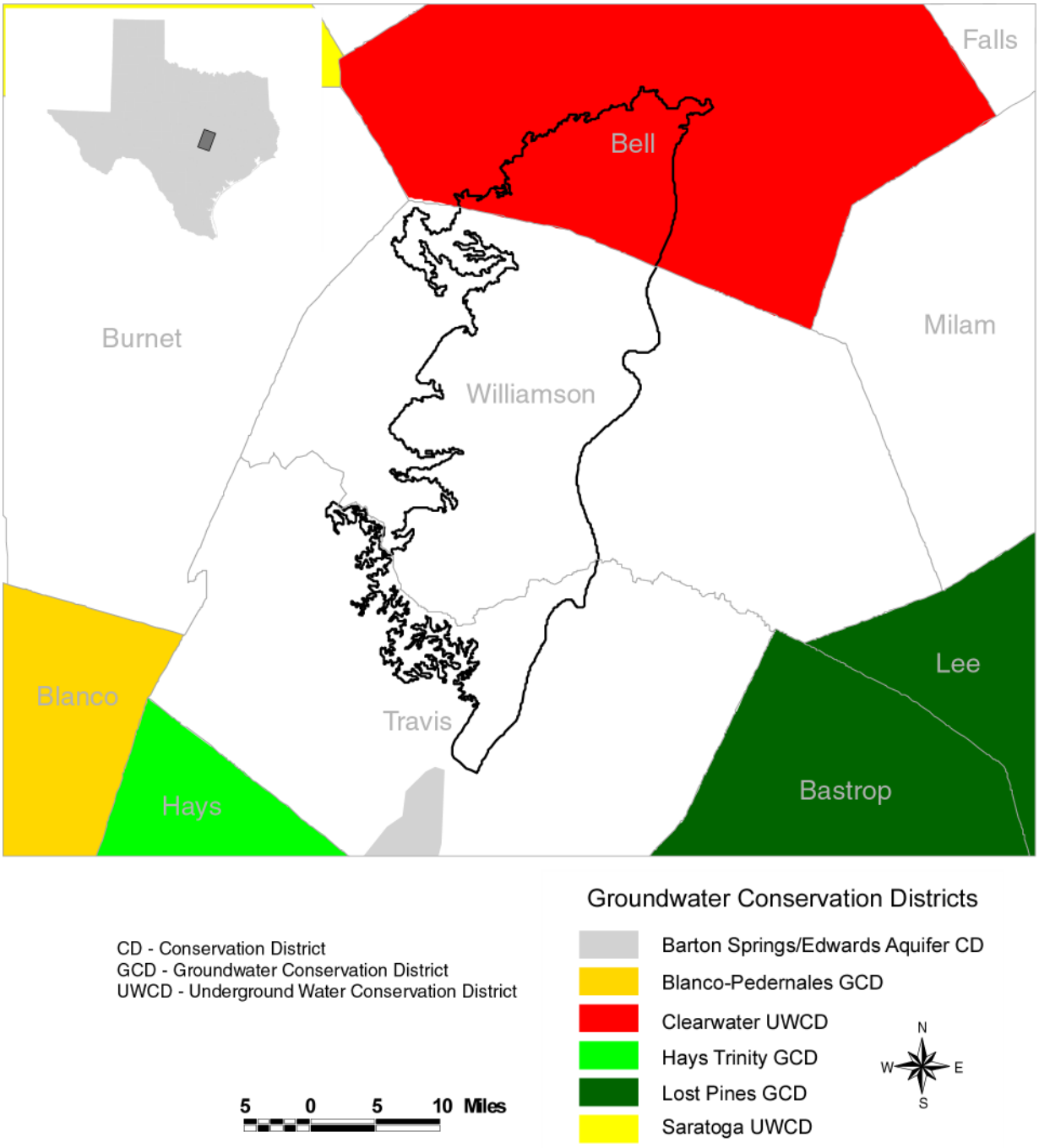

Figure 3-3. Location of groundwater conservation districts in the study area.

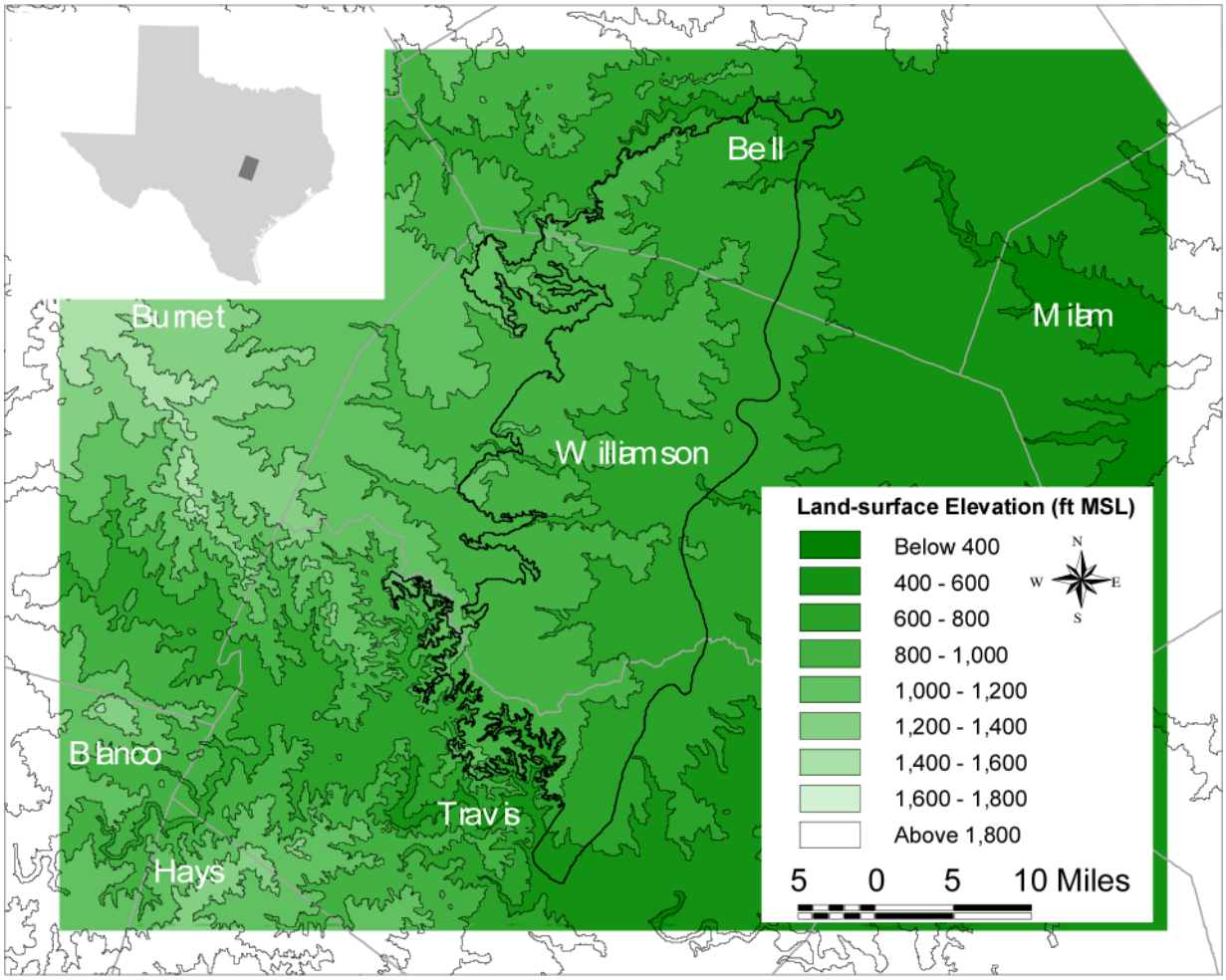

Figure 3-4. Land-surface elevation in the study area.

boundary between the Jollyville Plateau and Hill Country parts of the Edwards Plateau and the Rolling Prairie (Trippet and Garner, 1976). This boundary becomes more subdued to the north in the Lampasas Cutplains.

Central Texas has a sub-humid climate. At weather stations located within the study area, median annual precipitation ranges from 20 to 30 inches (fig. 3-6). Approximately 60 percent of annual precipitation falls in April through June and September through October (fig. 3-7). Some of this precipitation takes the form of severe thunderstorms. These thunderstorms frequently produce major flash floods that have the potential to generate recharge to the underlying aquifer (Senger and others, 1990). Monthly precipitation is typically lowest during July and August. Precipitation data display a wide range of annual precipitation in the study area. Data for the period 1930 through 1997 indicate annual precipitation ranging from 10 to 55 inches (fig. 3-8). Lowest annual precipitation occurred during 1954 through 1956 at some stations. This coincides with the drought of the 1950s, which affected the entire state.

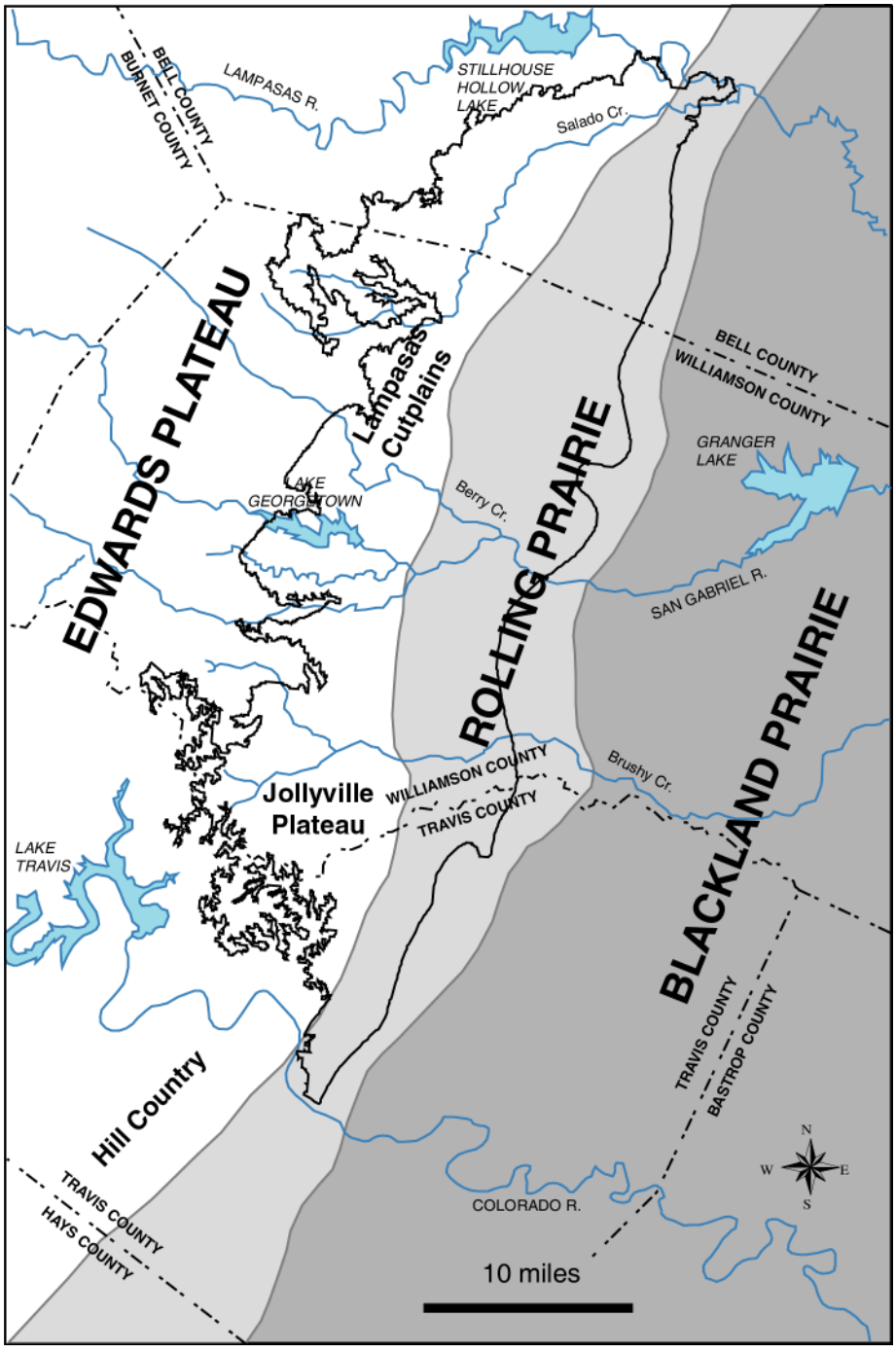

Figure 3-5. Physiographic provinces in the study area (modified from Senger and others, 1990).

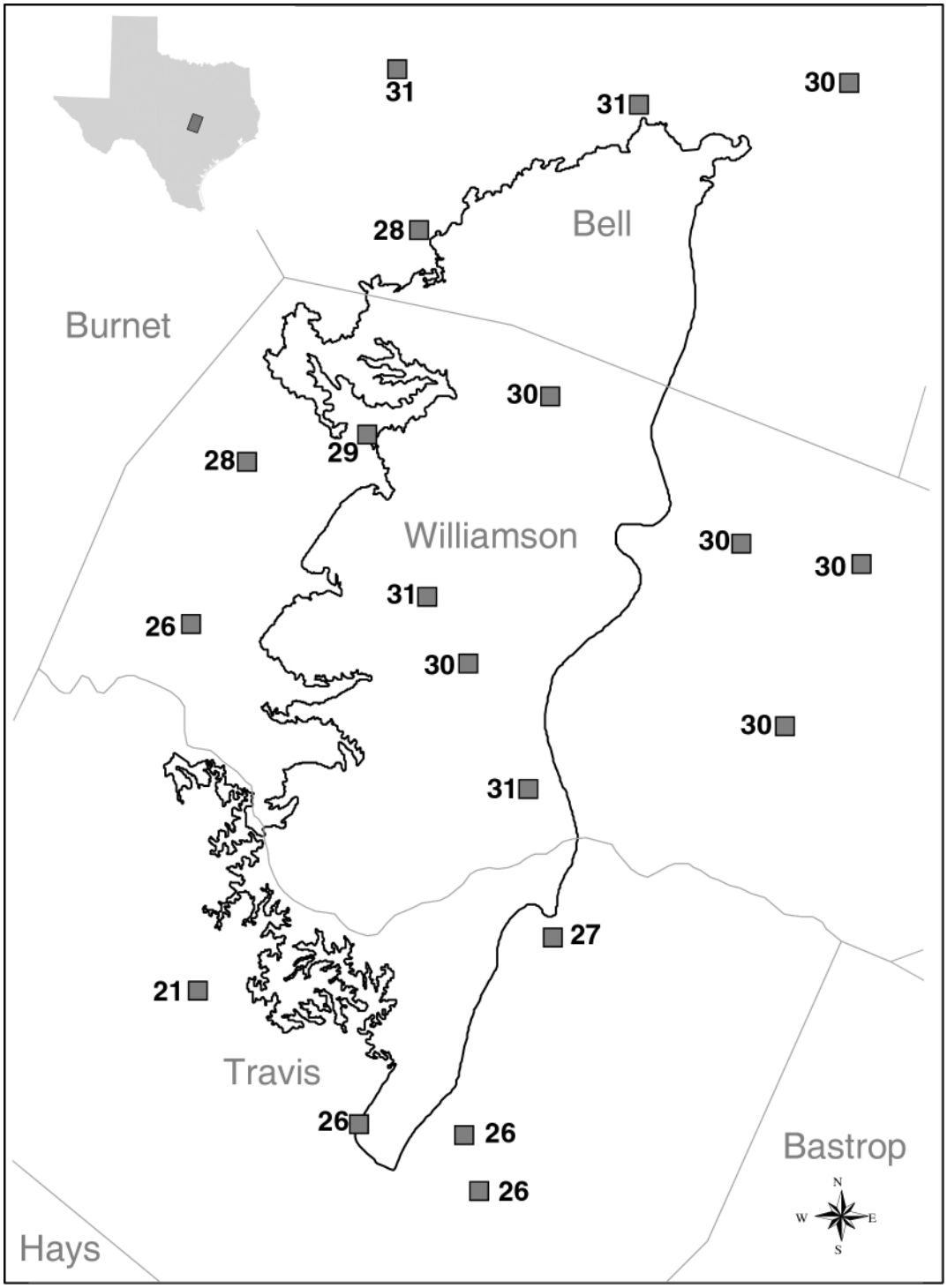

Figure 3-6. Mean annual precipitation (inches) in the study area, from National Climate Data Center.

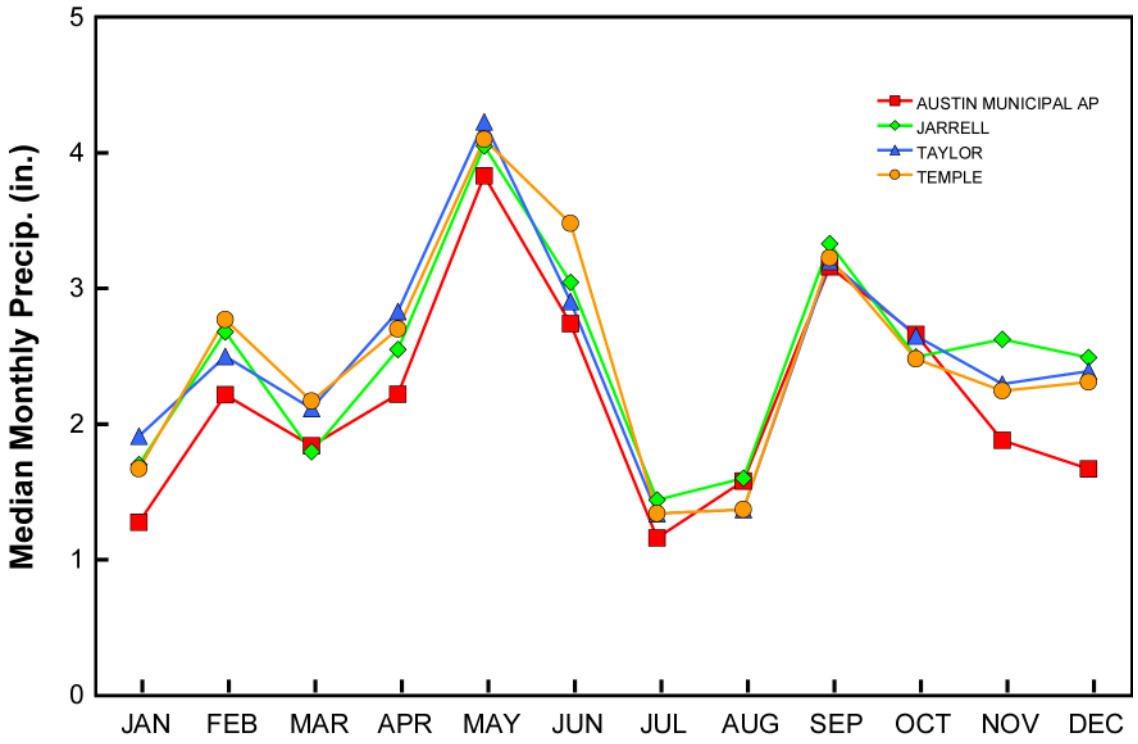

Figure 3-7. Mean monthly precipitation at selected stations in the study area, from National Climate Data Center.

Average monthly lake-surface evaporation in this region ranges between 2 and 8 inches (fig. 3-9). Lake-surface evaporation is typically highest during summer months (June through August) and lowest during winter months (December through February), when precipitation exceeds evaporation. The average annual temperature in this region is 68 °F, with mean maximum and minimum temperatures of 95 °F and 41 °F, respectively (Brune and Duffin, 1983).

3.2 Geology

Stratigraphic units underlying the study area range in age from the Paleozoic Ellenburger Group to Recent alluvium (Brune and Duffin, 1983). Only Cretaceous and younger rocks are exposed at the surface (fig. 3-10). Most of these stratigraphic units crop out along the Balcones Fault Zone, a zone of normal faulting that trends northeast-southwest through the study area (Trippet and Garner, 1976). Total displacement of the Balcones Fault Zone is up to 1,200 feet. Stratigraphic units in the study area are composed mainly of limestone and shale or clay. The oldest rock units, the Ordovician Ellenburger Group and the Pennsylvanian Bend and Strawn groups, occur at great depth and are not known to yield usable water in the study area (Brune and Duffin, 1983). The most important aquifer units in the study area occur in the Cretaceous Trinity, Fredericksburg, and Washita Groups (fig. 3-11). These Cretaceous units are approximately 2,000 feet thick and dip gently toward the southeast (Trippet and Garner, 1976).

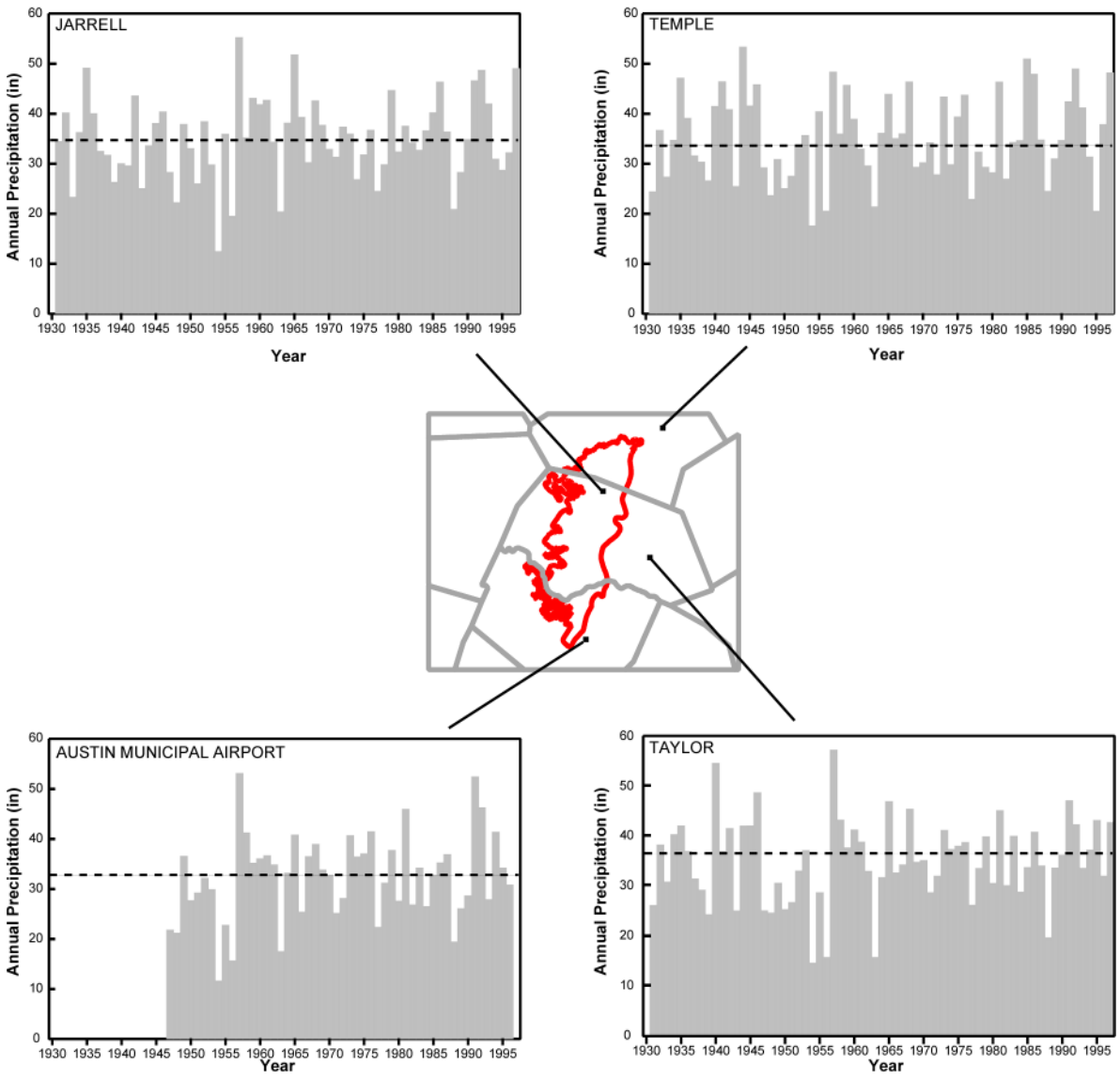

Figure 3-8. Historical annual precipitation at selected stations in the study area, from National Climate Data Center. The dashed lines represents the mean average precipitation for each station.

The Trinity Group is divided into the Travis Peak, Glen Rose, and Paluxy Formations (Brune and Duffin, 1983). The Travis Peak Formation consists primarily of limestone, sand, and shale. The Glen Rose Formation is predominantly composed of alternating layers of limestone and dolomite at the top and massive layers of limestone and dolomite at the base. The Paluxy Formation is composed of fine quartz sand cemented by calcium carbonate. In the study area, this formation is relatively thin, up to 10 feet thick.

The Fredericksburg Group is divided into the Walnut Formation, Comanche Peak Limestone, and Edwards Limestone (Brune and Duffin, 1983). The Walnut and Comanche Peak Formations

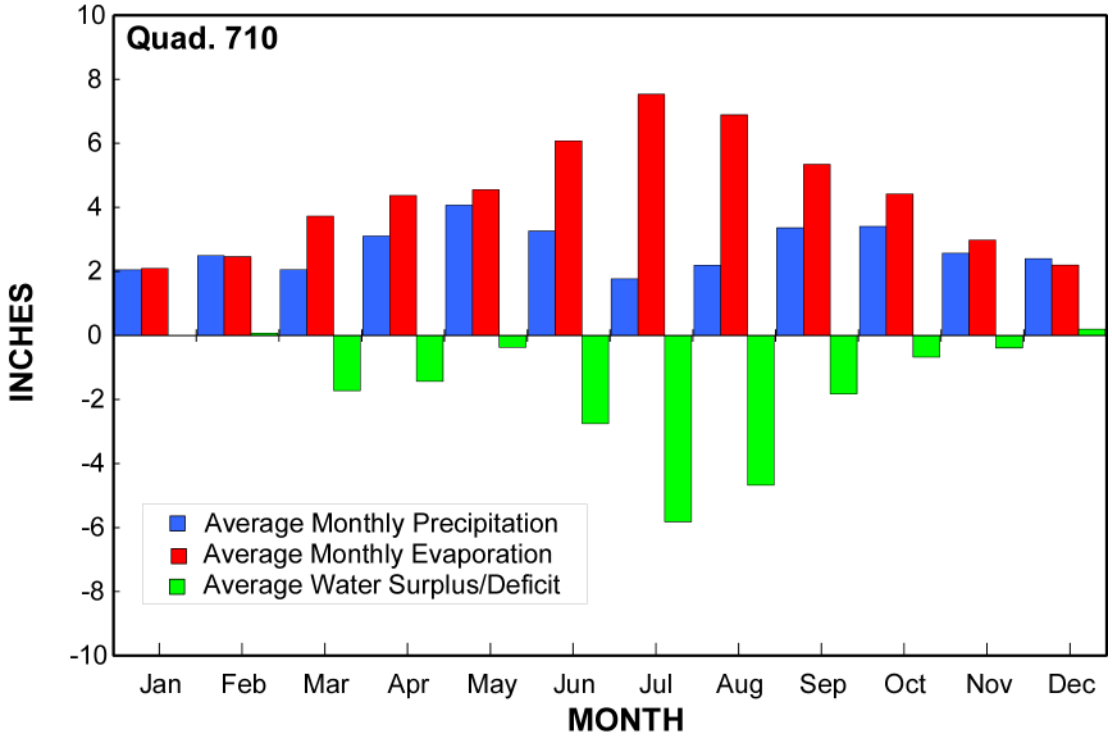

Figure 3-9. Mean monthly precipitation and pan evaporation from TWDB database.

are composed of fine-grained limestone and shale. The Walnut and Comanche Peak Formations occur primarily in the subsurface in the northern part of the study area. The Edwards Limestone is composed of massive vuggy limestone with fine-grained marl at the top of the formation. This marl is very thin in the study area and tends to become thicker toward the north.

The Washita Group is divided into the Georgetown Formation, Del Rio Clay, and Buda Limestone (Brune and Duffin, 1983). The Georgetown Formation thins southward and is composed of fine-grained limestone that in places is hydraulically connected to the Edwards Limestone. The Del Rio Clay and Buda Limestone are composed of shale and fine-grained limestone, respectively (Brune and Duffin, 1983).

The stratigraphic nomenclature of units that compose the Edwards aquifer differs north and south of the Colorado River. South of the river, the “Edwards” is treated as a group composed of two formations, the Kainer and Person Formations (Rose, 1972). The Kainer Formation is equivalent to the Walnut Formation, Comanche Peak Limestone, and lower parts of the Edwards Limestone. Equivalents of the Person Formation are largely absent north of the Colorado River. North of the Colorado River, the uppermost parts of the Edwards Limestone are equivalent to the basal members of the Person Formation.

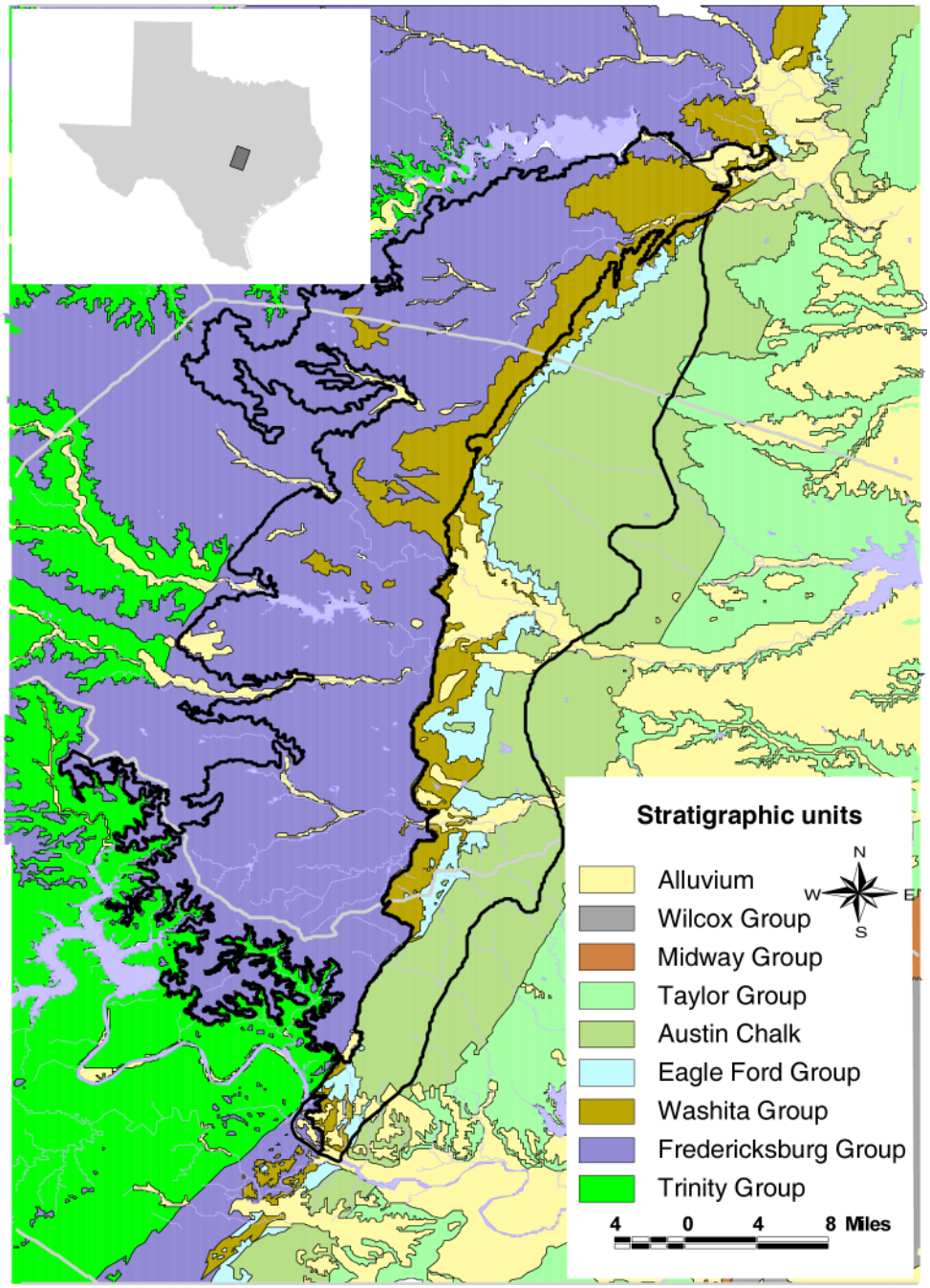

Figure 3-10. Surface geology in the study area.

Series	Group	Stratigraphic Unit		Hydrologic Unit	Maximum Thickness (feet)
Gulf	Navarro			Navarro and Taylor Group	850
	Taylor				
	Austin			Austin Chalk	450
Comanche	Eagle Ford				50
	Washita	Buda Limestone			50
		Del Rio Clay			60
		Georgetown Formation		Edwards aquifer	100
	Fredericksburg	Edwards Limestone			200
		Comanche Peak Limestone			50
		Walnut Formation			150
	Trinity	Paluxy Formation		Upper Trinity	10
		Glen Rose	Upper Member		450
			Lower Member	Middle Trinity	450
		Travis Peak	Hensell Sand Member		100
			Cow Cr. Limestone Member		100
			Hammett Shale Member		50
			Sligo Member	Lower Trinity	150
			Hosston Member		850

Figure 3-11. Stratigraphic and hydrostratigraphic units in the study area.

4.0 Previous Work

Many geologic and hydrogeologic reports include the northern segment of the Edwards aquifer. Studies of the stratigraphy and structure of the area include Tucker (1962), Proctor and others (1974), Collins (1987), and Kreitler and others (1987). Woodruff and others (1985) and Yelderman and others (1987) are compendia that provide information on different aspects of the hydrogeology of the northern segment, such as water supply development, transmissivity distribution, and pump-test analysis. More detailed hydrogeologic studies include Klemt and others (1975), Brune and Duffin (1983), Senger and Kreitler (1984), Baker and others (1986), Kreitler and others (1987), Flores (1990), Duffin and Musick (1991), and Ridgeway and Petrini (1999). Senger and others (1990) discussed both the groundwater geochemistry and hydrology of the northern segment. The review of groundwater flow models conducted in Texas by Mace (2001b) indicates that there are no published models for the northern segment of Edwards aquifer.

Several regional and sub-regional models have simulated groundwater flow in the San Antonio and Barton Springs segments of the Edwards aquifer (Campana, 1975; Knowles and Klemt, 1978; Mahin, 1978; Klemt and others, 1979; Mahin and Campana, 1983; Slade and others, 1985; Maclay and Land, 1988; Kuniansky, 1993; Kuniansky and Holligan, 1994; Barrett, 1996; Uliana

and Sharp, 1996; Scanlon and others, 2001). However, none of these models extended north of the Colorado River.

5.0 Hydrogeology

The hydrogeologic setting of the northern segment of the Edwards aquifer is described by hydrostratigraphy, structure, water levels, recharge, discharge, surface-water features, and hydraulic properties. Each of these factors is described in more detail below.

5.1. Hydrostratigraphy

The northern segment of the Edwards aquifer generally consists of the Comanche Peak Limestone, Edwards Limestone, and Georgetown Formation (fig. 5-1). These stratigraphic units constitute the upper Fredericksburg and lower Washita Groups and are collectively referred to as the Edwards and associated limestones (Brune and Duffin, 1983). The aquifer overlies older Cretaceous rock of the Walnut and Glen Rose formations and is overlain by younger units that consist of the Del Rio Clay, Buda Limestone, Austin Chalk, Taylor Marl, and Navarro Group. The Walnut Formation and Del Rio Clay are recognized as confining units (Brune and Duffin, 1983; Baker and others, 1986). The base of the aquifer is defined as the base of rocks having greater water-yielding capabilities (Baker and others, 1986). In most areas, this excludes the Walnut Formation, although in other areas the Walnut Formation is composed of potentially permeable shell beds and may thus be included in the Edwards aquifer. Karstification in the form of honeycombing, sinkholes, and caves allows rapid infiltration and percolation of water through the aquifer.

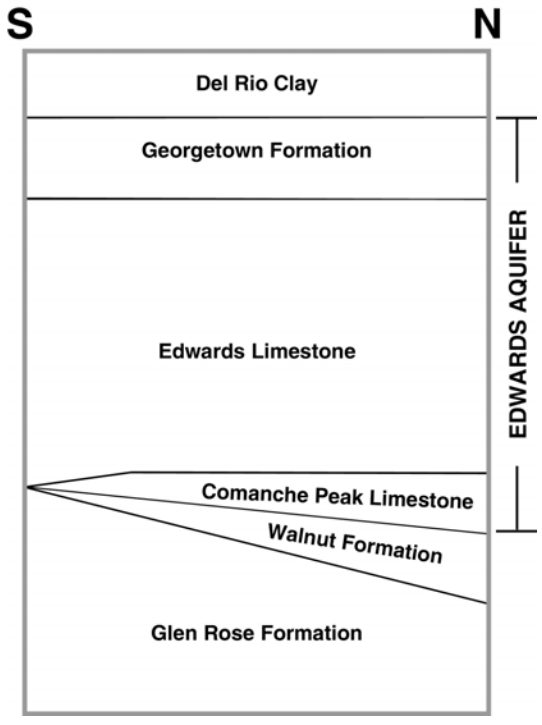

Figure 5-1. Schematic stratigraphic column of the study area.

The Comanche Peak Limestone is composed of nodular and fossiliferous marly limestone. This unit is characterized by considerable jointing (Brune and Duffin, 1983). The Edwards Limestone is composed of 200 to 350 feet of highly fractured and thickly bedded to massive limestone or dolomite, with minor shale, clay, and siliceous limestone. The Edwards Limestone consists of the Kainer, Person, Kiamichi, and Duck Creek formations. The Person and Kainer formations are composed of brittle, massive limestone that is sometimes dolomitic (Flores, 1990). The Edwards Limestone is vuggy in places because of the occurrence of solution-collapse zones (Brune and Duffin, 1983). These zones, parallel to bedding planes, are the result of dissolution of gypsum beds that formerly occurred in this stratigraphic unit. They are cavernous and iron stained and contain brecciated limestone, chert, crystalline calcite, and residual clay. They occur mainly 60 to 80 feet above the base of the Edwards Limestone, within the Person and Kainer formations, and are often referred to as the Kirschberg solution zone (Brune and Duffin, 1983; Flores, 1990). These solution-collapse zones, as much as 20 feet thick, are the main water-bearing horizons in the aquifer, with well yields greater than 300 gallons per minute (Brune and Duffin, 1983; Flores, 1990). The Kiamichi and Duck Creek formations constitute the Regional Dense Member near the top of the Edwards Limestone, especially in the northern part of the study area. The Regional Dense Member separates the Edwards aquifer into upper and lower units that may be circumvented by fault displacement (Flores, 1990). The Georgetown Formation is a massive nodular limestone that is often hydrologically connected to the underlying Edwards Limestone (Brune and Duffin, 1983).

In addition to solution-collapse zones, groundwater in the Edwards aquifer flows through a network of steeply dipping faults and joints (Brune and Duffin, 1983). Field measurements indicate that effective porosity is greatest in the Comanche Peak Limestone and decreases in the overlying Edwards Limestone and Georgetown Formation (Dahl, 1990; Flores, 1990). This trend has been attributed to limestone in the Comanche and Edwards being more brittle than that in the Georgetown Formation. Additionally, the lower units of the Edwards aquifer display greater effects of karstification (Dahl, 1990; Flores, 1990). Fracture porosity of the Edwards aquifer ranges from 0.4 to 2.5 percent away from major faults, to 1.5 to 4.25 percent adjacent to faults (Dahl, 1990). These porosity values are lower than porosities (4 to 42 percent) measured in the San Antonio segment of the Edwards aquifer (Hovorka and others, 1996).

5.2 Structure

The structural features that most influence groundwater flow in the study area are regional dip and the occurrence of the Balcones Fault Zone. Cretaceous rock overlies Paleozoic rock, forming an angular unconformity (Brune and Duffin, 1983), indicating that the Cretaceous rock was deposited on an erosional surface over steeply westward-dipping Paleozoic rock. The Cretaceous rock dips toward the southeast at 10 to 300 feet per mile, generally increasing with depth (Figure 4-2; Brune and Duffin, 1983). This dip angle excludes the effects of faulting.

The unconfined portion of the northern segment of the Edwards aquifer consists of the outcrop of the Edwards and associated limestones, which is wider in the north than in Travis County, near the Colorado River (fig. 3-10). This narrowing of the outcrop in the south occurs as a result of the combined effects of intense faulting and large topographic variations (fig. 5-2 and 5-3)

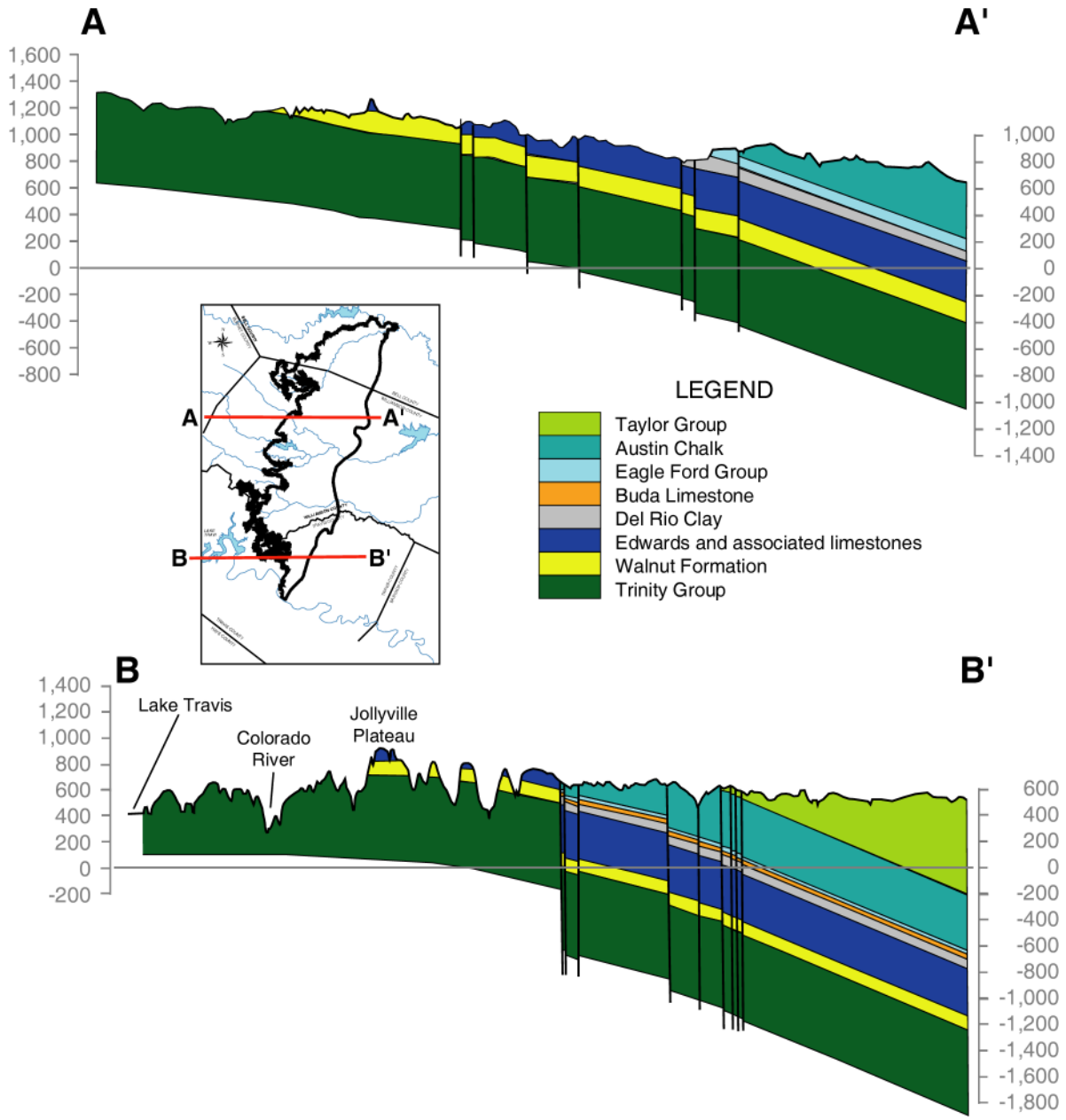

Figure 5-2. Geologic cross sections of the northern segment of the Edwards aquifer.

(Baker and others, 1986). Fracturing of the limestone also enhances the porosity of the limestone and plays a role in the development of karst features. Normal faulting, common in the southern portion of the study area, generally decreases toward the north (Baker and others, 1986). It is associated with the Balcones Fault Zone, a zone of faults about 6 to 8 miles wide that extends from Del Rio in south-central Texas to Dallas. This zone of normal faulting is characterized by major faults that strike north-south to northeast-southwest and dip 40 to 80° to the east, with a

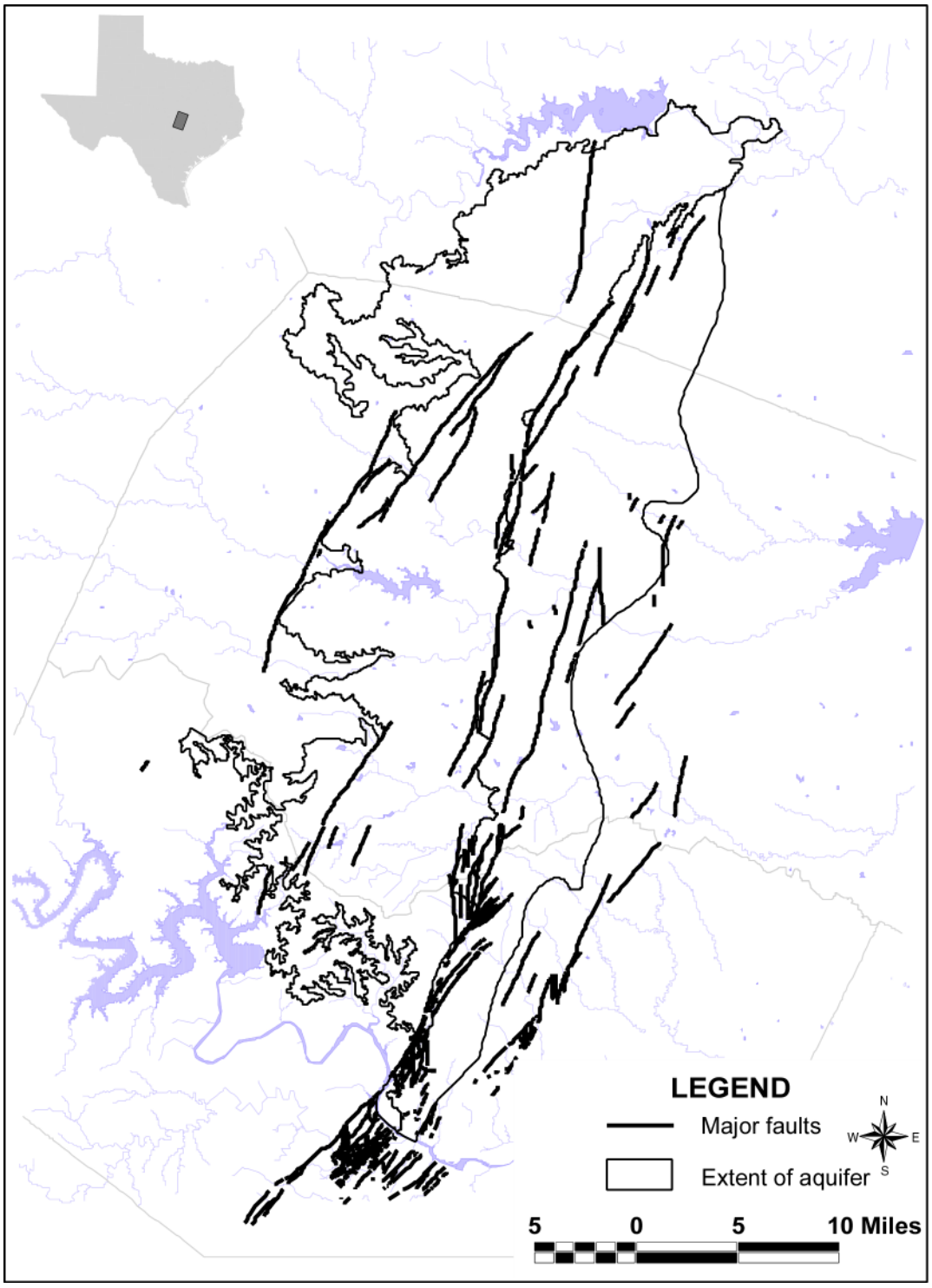

Figure 5-3. Major faults in the study area (adapted from Bureau of Economic Geology, 1981).

net displacement of 600 to 1,000 feet (Brune and Duffin, 1983; Collins, 1987). Cross faults, sub-perpendicular to major faults, are also common (Collins, 1987). In the Balcones Fault Zone, minor faults and joints occur mainly adjacent to the major faults and flexures. These minor faults, characterized by displacement of less than 6 feet, tend to form fracture zones up to 1 mile wide. Fracture densities in these zones lie in the range of 6 to 120 joints per 100 feet. Many of these minor faults are filled partly by calcite. However, the joints that occur in this area do not have mineral fillings, and abutting relationships suggest that these minor faults formed before the joints (Collins, 1987). Fracture apertures vary with stratigraphic units in the Edwards aquifer. Fracture apertures are generally less than 0.04 inches in Comanche Peak and Georgetown Formations and are up to several inches wide in the Edwards Limestone (Collins, 1987). These faults influence groundwater flow in two ways: faults provide preferential flow paths, and fault displacement in some cases produces barriers to groundwater flow (Brune and Duffin, 1983). Preferential groundwater flow along faults and joints in this aquifer often results in formation of solution cavities such as caves (Brune and Duffin, 1983).

Evaluation of fracture and lineament orientations in the northern part of the study area at different scales by Dahl (1990) shows different orientations of fractures varying in size from mapped major faults to field-observed fractures. The orientations of these fractures play a role in determining anisotropy in the aquifer. Dahl (1990) divided fractures into four groups: major mapped faults, high-altitude Landsat lineaments, field fractures, and topographic map lineaments. Major faults generally trend northeast-southwest. High-altitude Landsat lineaments are sparsely distributed and, together with the field fractures, are preferentially oriented northwest-southeast and northeast-southwest. The topographic map lineaments are generally randomly oriented, with only a slight northeast-southwest trend (Dahl, 1990). Adjacent to major faults, fractures are oriented generally northeast-southwest, approximately parallel to major faults of the Balcones Fault Zone. Away from major faults, fractures are oriented generally northwest-southeast. This trend of northwest-southeast- and northeast-southwest-oriented fractures is also observed in the more intensely faulted parts of the aquifer farther south (Kreitler and others, 1987).

The Edwards aquifer dips to the east at an average slope of 60 to 75 feet per mile (fig. 5-4 and 5-5). The slope varies generally because of faulting that produces a stair-step configuration downdip (Baker and others, 1986). The thickness of the northern segment of the Edwards aquifer increases generally toward the east, varying from less than 100 feet along the southern and western margins of the aquifer to more than 500 feet in the east (fig. 5-6).

5.3 Water Levels and Regional Groundwater Flow

In the northern segment of the Edwards aquifer, the potentiometric surface slopes generally toward the east and south adjacent to the Colorado River (fig. 5-7). Hydraulic gradients in the aquifer decrease east of the main faults of the Balcones Fault Zone (Senger and others, 1990). Intense fracturing in the Balcones Fault Zone suggests that the aquifer is anisotropic because of preferential flow through the generally northeast-southwest-oriented fractures (Baker and others, 1986; Duffin and Musick, 1991). Groundwater flow along fractures is responsible for the southward flow in the southern part of the study area, where fracturing is most intense. Senger and others (1990) suggested that some of the major faults, especially in the south, also act as

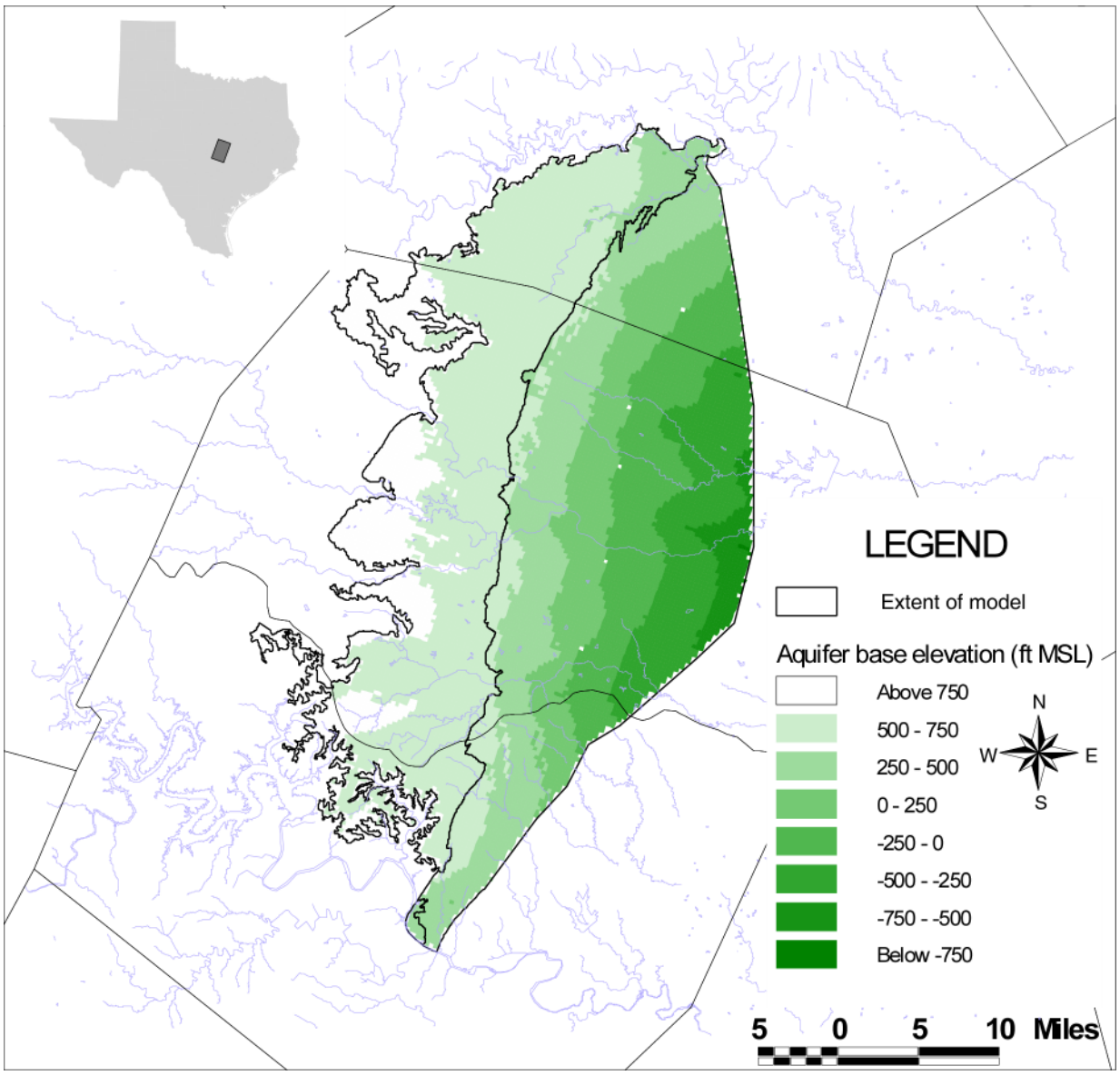

Figure 5-4. Elevation of the base of the Edwards aquifer (based on data from Collins and others, 2002).

hydraulic barriers, restricting west-to-east groundwater flow. In the central and northern parts of the aquifer, where faulting is less intense, the influence of fractures on regional groundwater flow is less apparent (Senger and others, 1990).

In the unconfined part of the aquifer, the water table occurs generally less than 100 feet below land surface and may approach land surface along incised streams (Senger and others, 1990). In the confined part of the aquifer, water levels approach or may in some cases exceed land surface, resulting in flowing wells. Water-level fluctuations observed in this aquifer are responses to changes in recharge and discharge rates associated with rapid recharge during wet periods (Baker and others, 1986). Adjacent to the Colorado River, water-level fluctuations are relatively small

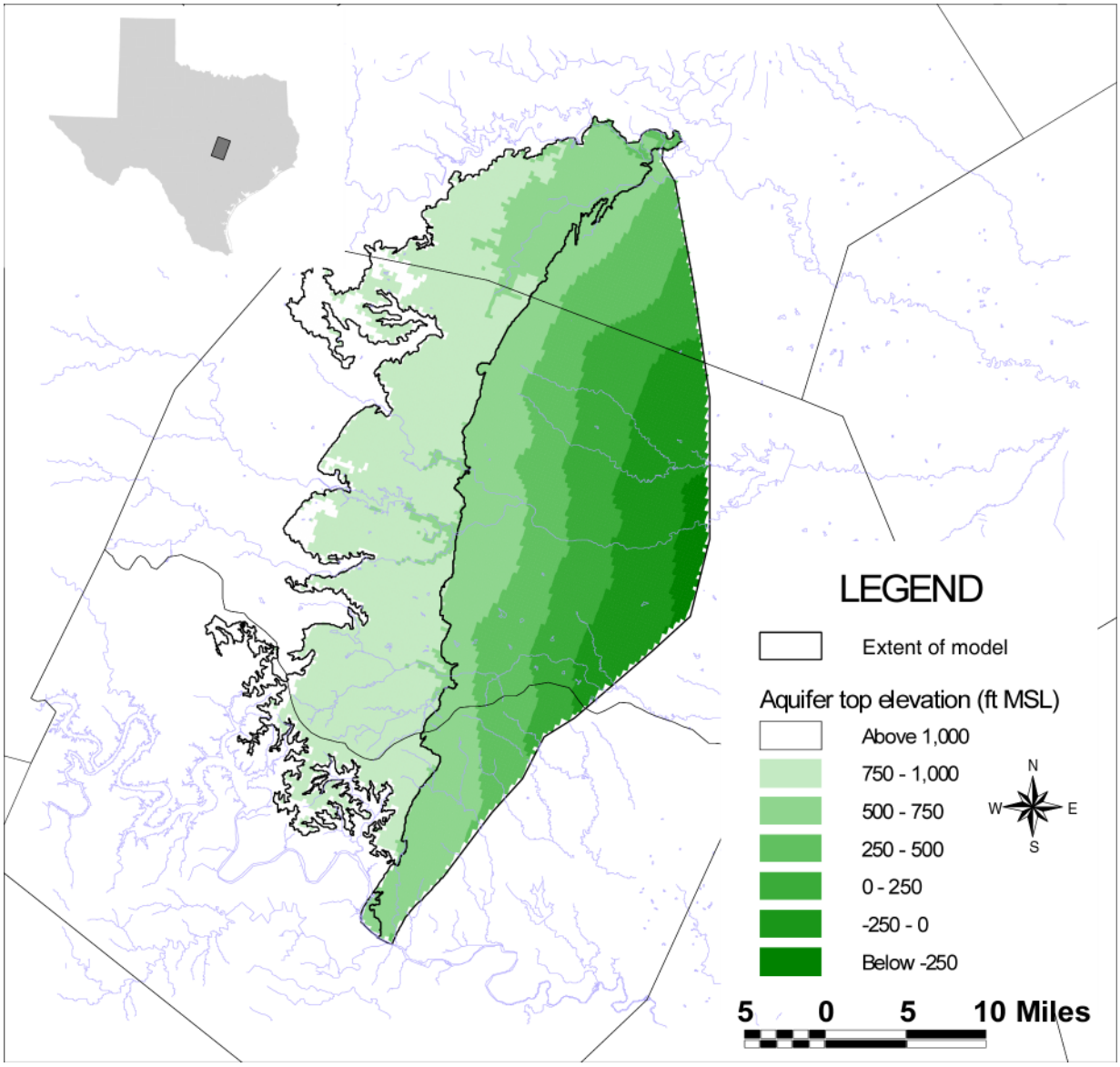

Figure 5-5. Elevation of the top of the Edwards aquifer (based on data from Collins and others, 2002).

because of the stabilizing effect of adjacent Lake Austin and Town Lake. Water-level declines have been observed during severe drought periods, such as the mid-1950s, 1983-84, and 1996 (Ridgeway and Petrini, 1999). A few available hydrographs indicate effects of pumping resulting in gradual long-term water-level decline. These hydrographs are from wells located mostly in the Pflugerville-Georgetown area. However, most hydrographs indicate a general balance between recharge and discharge in the aquifer (Baker and others, 1986; Dahl, 1990; Duffin and Musick, 1991; Ridgeway and Petrini, 1999).

Hydrographs in the unconfined part of the aquifer show generally synchronous water-level variations at many locations and a close correlation between precipitation and water-level

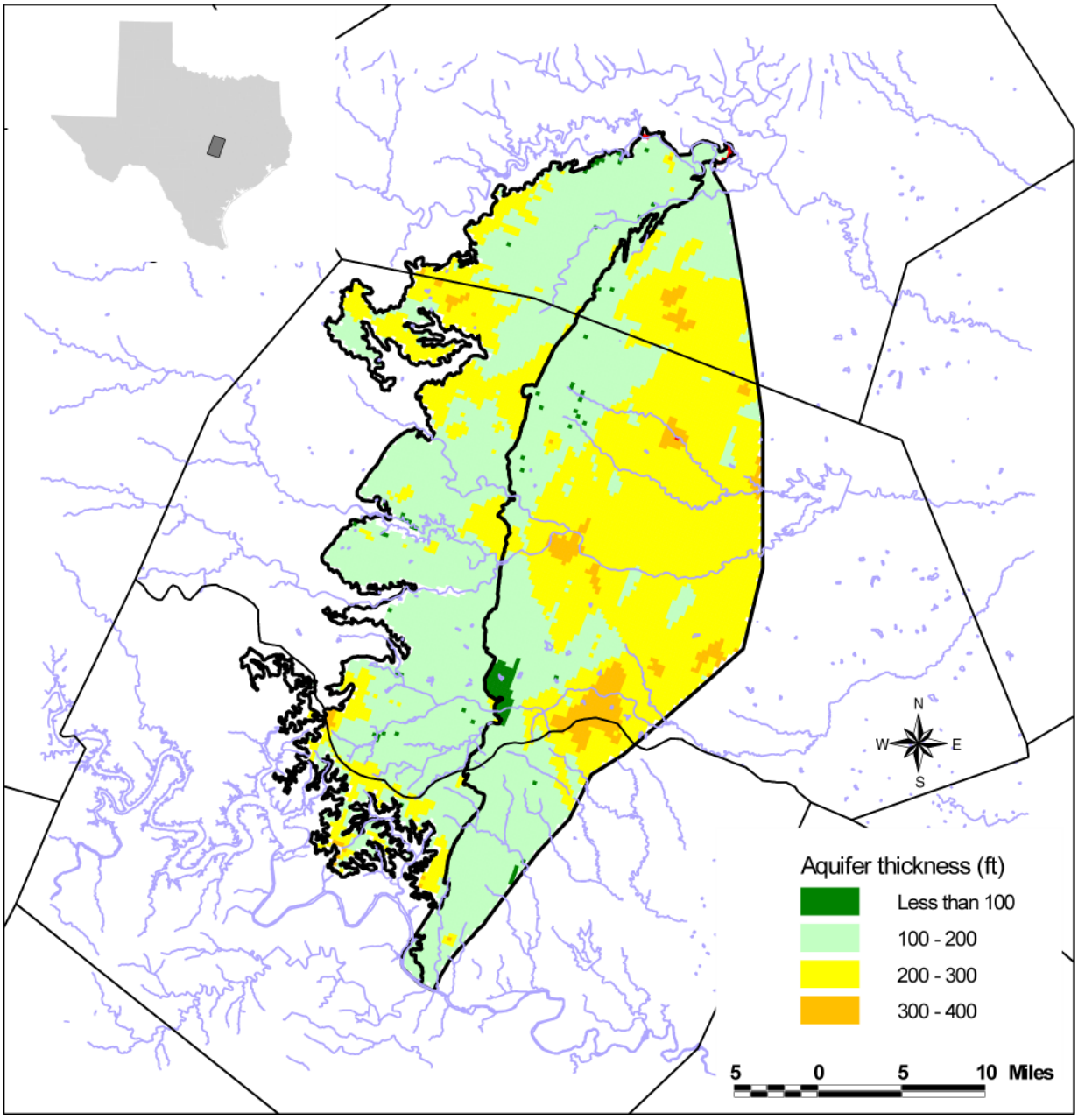

Figure 5-6. Thickness of the Edwards aquifer (based on data from Collins and others, 2002).

variation (Senger and others, 1990). Rapid water-level rises coincide with major rainfall events, especially during late spring and fall (fig. 5-8). The rate of water-level decline depends on the amount of recharge occurring during the recession period and the amount of nearby pumping (Senger and others, 1990). Continued rainfall tends to retard water-level declines, whereas pumping results in accelerated water-level declines. Hydrographs for wells in the confined part of the aquifer indicate a lag between major recharge events and water-level responses (Senger and others, 1990). In some parts of the aquifer, reversal of hydraulic gradients, partly related to increased pumping, has been observed during drought periods. This reversal suggests a potential

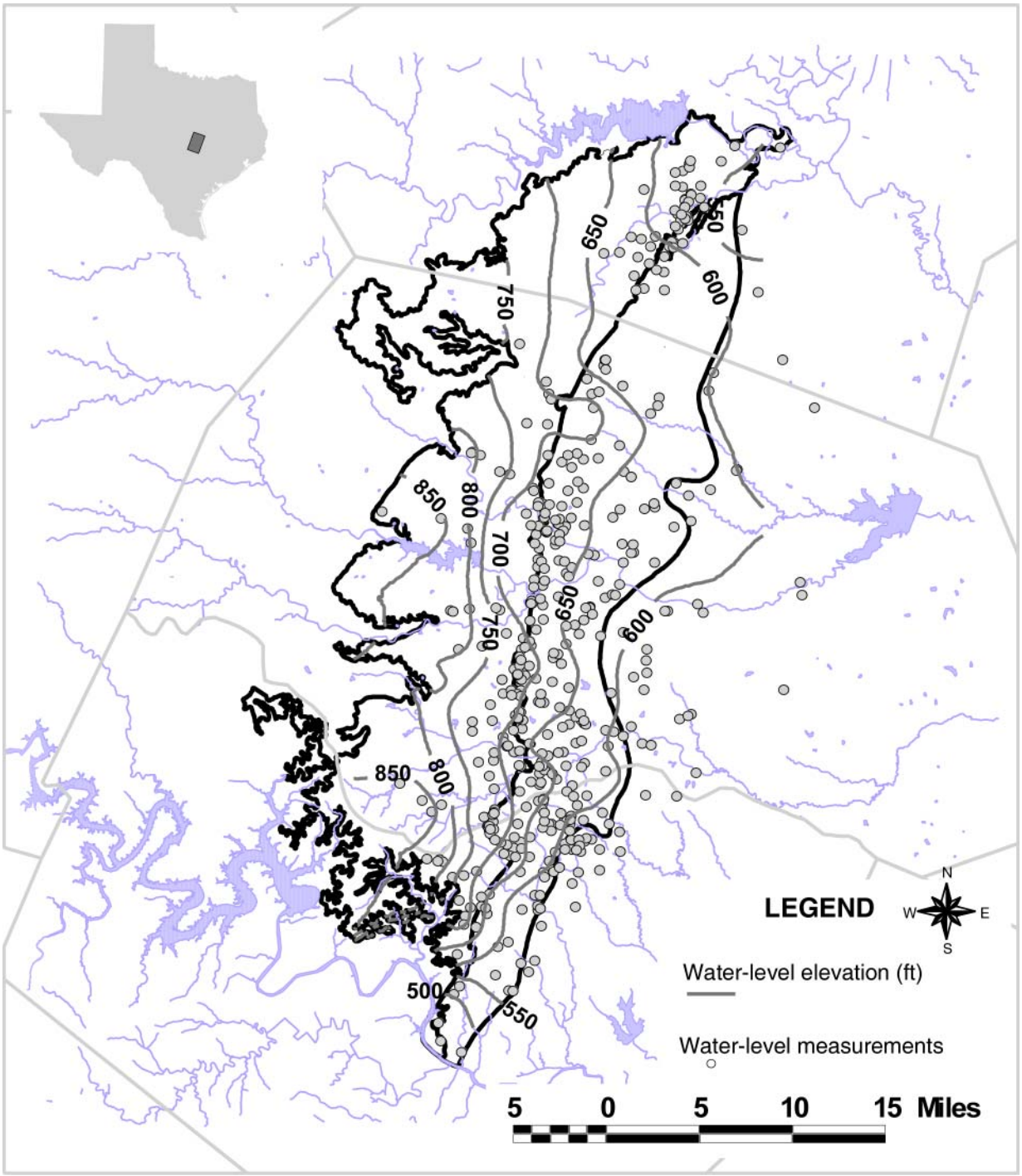

Figure 5-7. Water-level elevations in the northern segment of the Edwards aquifer.

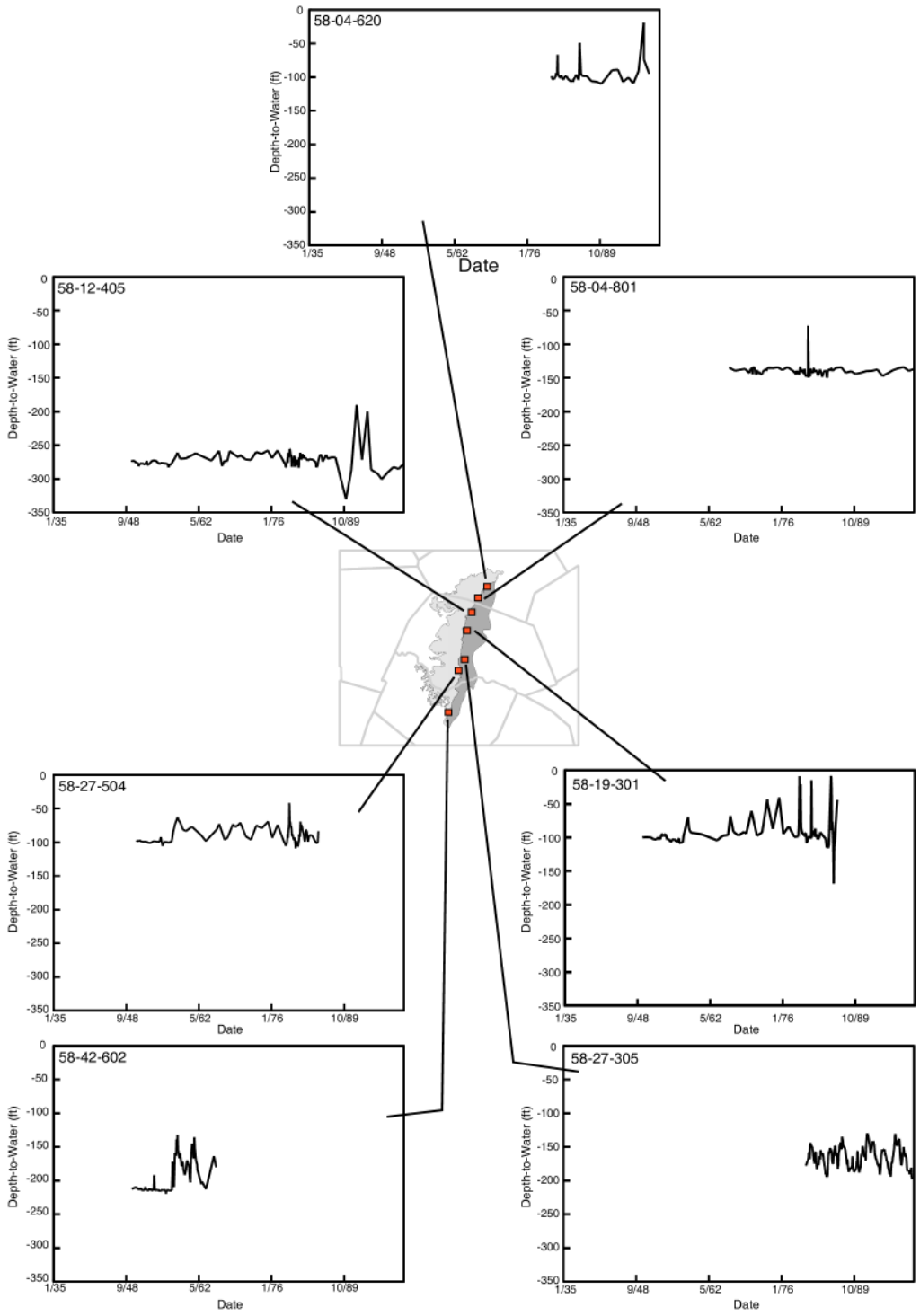

Figure 5-8. Groundwater hydrographs from selected wells in the study area.

for the influx of saline groundwater from depth. However, large, persistent cones of depression that could potentially produce this influx of saline groundwater have not been identified (Senger and others, 1990).

5.4 Recharge

Recharge to the Edwards aquifer takes the form of infiltration of precipitation that falls on the outcrop of the aquifer or infiltration of runoff derived from watershed areas upstream from the aquifer outcrop. The recharge zone in the northern part of the study area consists mainly of gently rolling terrain of the Lampasas Cutplains (fig. 3-5). In the south, the recharge zone is characterized by steeper, more highly dissected terrain of the Jollyville Plateau (Duffin and Musick, 1991). Both areas are characterized by the occurrence of numerous scattered karst features, such as dissolution-enhanced fractures, sinkholes, and caves, which are potential recharge sites. Sinkholes that occur in the Jollyville Plateau can transmit large amounts of water to the aquifer following heavy rainfall events (Kreitler and others, 1987). Recharge also takes the form of infiltration along faults and joints that intersect losing segments of perennial and intermittent streams that cross the study area. These fractures are often enlarged by karstification (Brune and Duffin, 1983). Infiltrating water tends to perch within the Georgetown Formation because of the occurrence of low-permeability shale members. Resultant lateral flow often discharges from small seeps and springs. Rapid recharge occurs when underlying Edwards and Comanche Peak limestones are encountered (Dahl, 1990).

Recharge processes are more complex in the north, where whether stream segments are gaining or losing depends on relative elevations of the water table and streambeds and thus may vary seasonally (Duffin and Musick, 1991). Streamflow studies by the United States Geological Survey (USGS) in 1978 and 1979 indicate that, in the north, streams generally act as points of groundwater discharge rather than recharge (fig. 5-9); (Senger and others, 1990; Duffin and Musick, 1991; Slade and others, 2002). Recharge in the north occurs primarily by intermittent streams and by infiltration of precipitation on the outcrop. Recharge also occurs in losing segments of the major rivers that occur along the western margin of the aquifer (Dahl, 1990; Slade and others, 2002). This recharge results in the formation of groundwater mounds along the upstream margin of the aquifer (fig. 5-7). Potential for recharge by cross-formational flow also exists from the underlying Trinity aquifer (Duffin and Musick, 1991).

Recharge estimates in the Salado Creek basin by Dahl (1990) indicate recharge of 15 percent of precipitation over the aquifer outcrop and 60 percent of storm runoff originating from upstream of the aquifer outcrop. These estimates of precipitation recharge were based on groundwater-level responses and an assumption of 2 percent porosity. The storm-runoff recharge was estimated based on stream discharge measurements above and below losing stream segments. Dahl (1990) indicated that recharge of precipitation in the Salado Creek basin contributes much larger volumes of water to the aquifer (about 29,000 acre-feet in 1985) than storm runoff (about 2,700 acre-feet).

Recharge due to cross-formational flow from the underlying Trinity aquifer is a possibility. However, it is unlikely that such cross-formational flow would contribute significantly to the Edwards aquifer because the two aquifers are separated by low-permeability units of the Glen Rose Formation hundreds of feet thick.

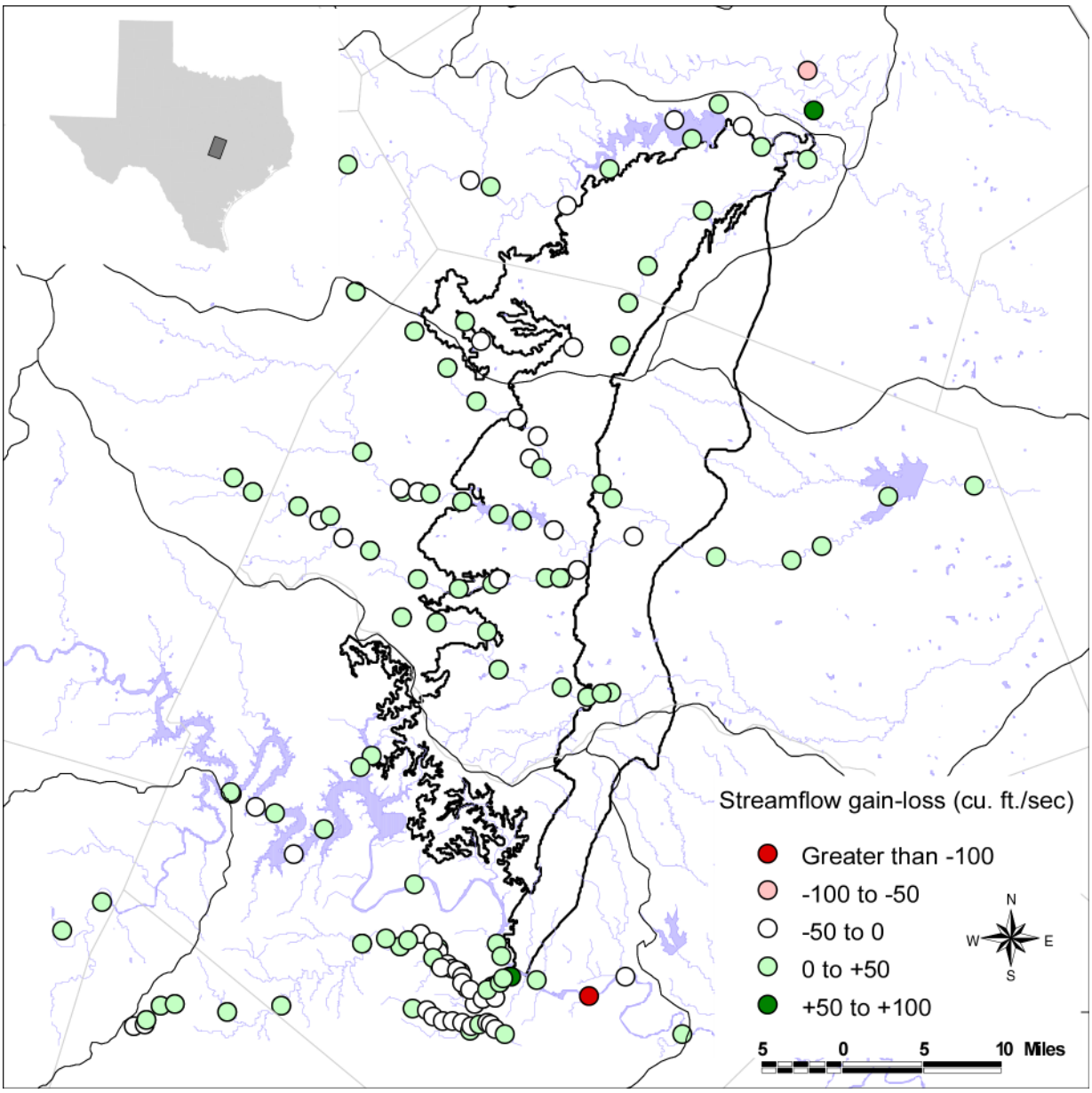

Figure 5-9. Streamflow gain-loss data from Slade and others (2002).

5.5 Rivers, Streams, Springs and Lakes

The northern segment of the Edwards aquifer is bisected by the hydrologic divide between the Colorado and Brazos River basins (fig. 5-10). This hydrologic divide coincides approximately with the boundary between Travis and Williamson counties. Consequently, surface water flows to the north and east toward the Brazos River in Bell and Williamson counties and toward the south to the Colorado River in Travis County. The Lampasas and Colorado rivers that form the northern and southern boundaries of the study area are the largest rivers in the area. Smaller rivers and creeks, such as Brushy Creek, Berry Creek, Salado Creek, and San Gabriel River,

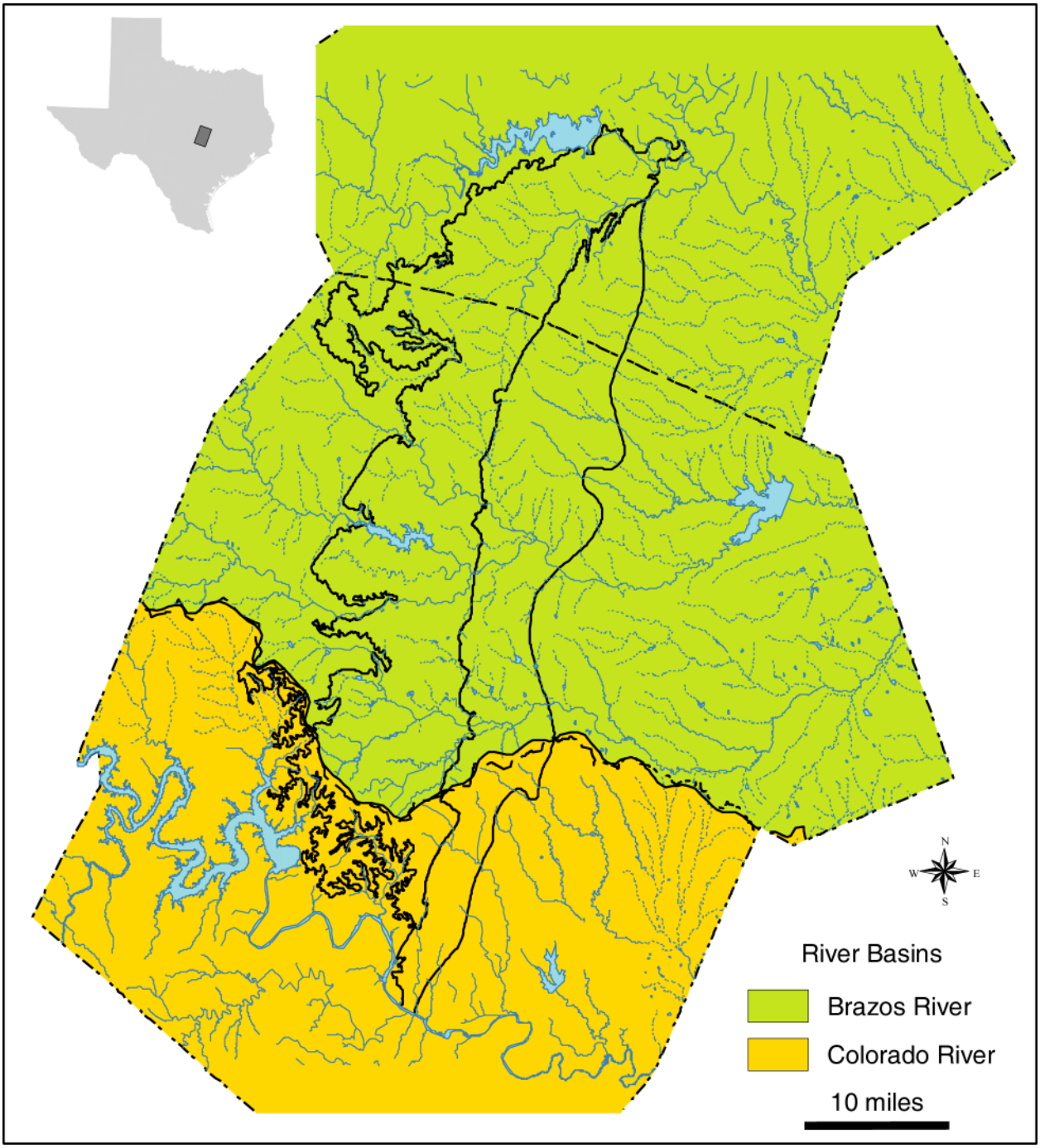

Figure 5-10. Location of river-basin boundaries in the study area.

cross the outcrop of the aquifer and are likely recipients of groundwater discharge, indicated by their perennial flow. Smaller tributaries of these rivers and creeks often flow intermittently as a result of storm-related runoff. Groundwater and surface-water systems are closely related in recharge and discharge zones, where interchange occurs as a result of recharge and discharge processes, respectively (Baker and others, 1986). Groundwater-surface-water interaction along gaining and losing stream segments of major rivers and creeks varies by location and hydrologic conditions because of significant hydrologic connections between streams and the underlying aquifer (Land and Dorsey, 1988).

In the study area, the relative impact on streamflow of storm-related runoff and groundwater discharge in the form of baseflow varies. Streams in which streamflow is dominated by baseflow are characterized by relatively small flow-rate fluctuations. Salado Creek, which is dominated by spring discharge, especially from Salado Springs, is an example of this type of stream (fig. 5-11). Streams dominated by storm runoff, such as Shoal Creek, are characterized by rapid recession after storms and low baseflow. Streamflow in Berry Creek is more representative of the streams in the study area, and streamflow fluctuations indicate inputs from both baseflow and storm-related runoff. Comparison of streamflow at pairs of stream gages can be used to indicate whether the stream is losing flow owing to recharge or receiving groundwater discharge (fig. 5-12). Decreased downstream flow commonly indicates a losing stream because of recharge to the underlying aquifer, whereas consistent increases in flow are quite often the result of groundwater discharge entering the stream. In the study area, decreased streamflow in downstream parts of Shoal Creek is consistent with recharge to the aquifer, whereas increased downstream flow in Berry Creek and the San Gabriel River can be attributed to groundwater discharge through numerous springs and seeps that occur in the area (fig. 5-12).

Spring and seeps in the western part of the aquifer discharge mostly from fractures or cavities in the Edwards Limestone or along the contact between the Edwards and Comanche Peak Limestones (Kreitler and others, 1987). In the east, major springs are associated with major faults, generally occurring some distance east of these faults.

5.6 Hydraulic Properties

As one would expect in a karst system, the hydraulic properties of Edwards aquifer rocks are highly variable. This variability can be attributed to many factors, such as (1) limestone primary porosity due to facies changes within or between individual stratigraphic units, (2) fracture densities, and (3) development of karst features. Hovorka and others (1996) showed that limestones deposited in subtidal environments exhibit lower porosities than carbonate sandstones or dolomite. On the basis of outcrop descriptions, Hovorka and others (1998) showed that fractures and karst features make up 1 to 3 percent of the outcrop area, and karst features develop preferentially adjacent to faults and in dolomitized limestone. Matrix permeability accounts for only about 1 percent of the flow through the aquifer, and the remainder is contributed by fractures and karst features.

Transmissivity estimates for the Edwards and associated limestones in the northern segment of the Edwards aquifer vary widely, lying in the range of 0.5 to 4×10^6 ft^2/day, seven orders of magnitude (fig. 5-13). These transmissivity estimates are calculated from specific-capacity data from the Texas Water Development Board (TWDB) well database using methods outlined in

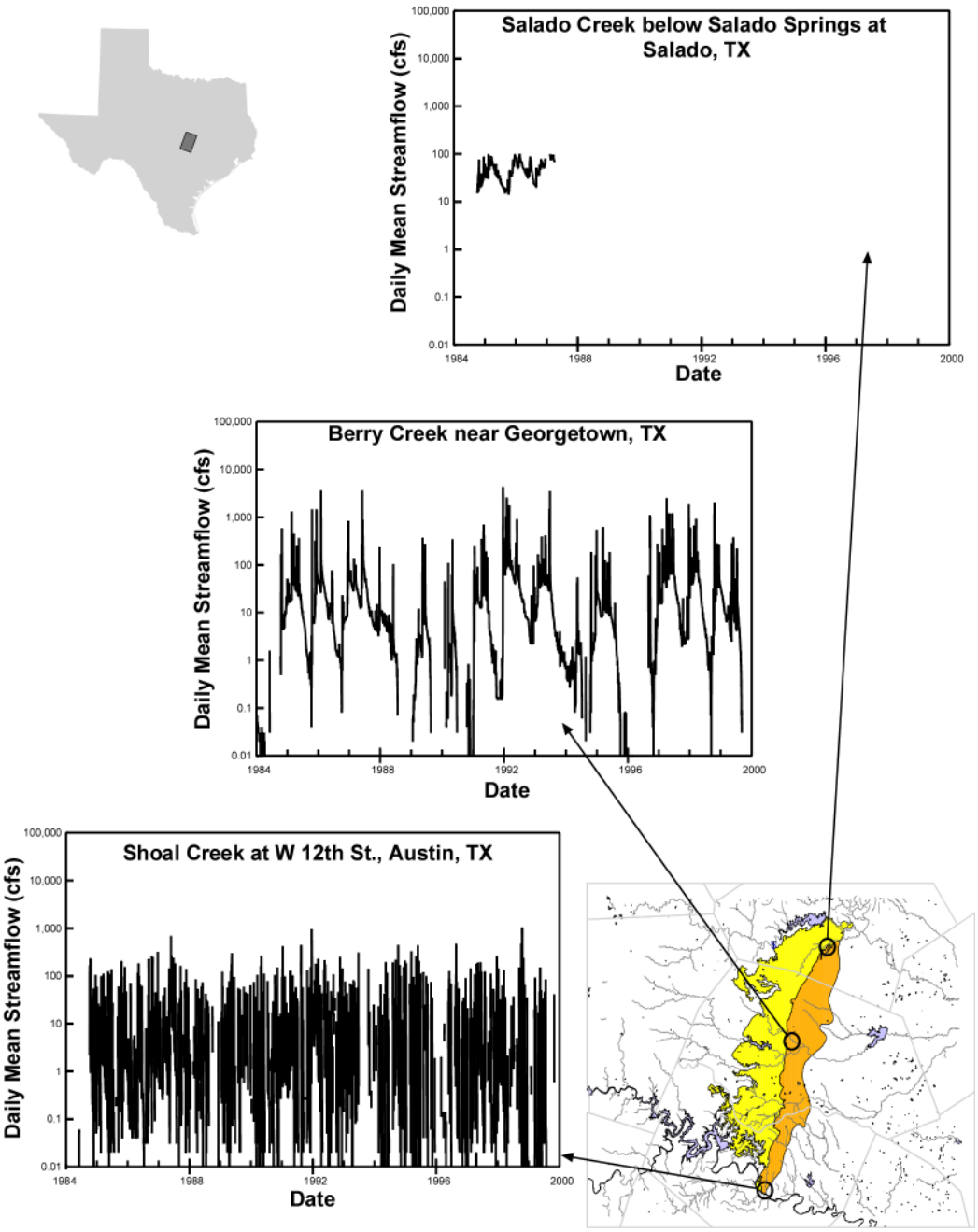

Figure 5-11. Historical mean daily streamflow at selected USGS gaging stations in the study area.

Mace (2001a). The highest transmissivities can be attributed to cave systems, whereas solution-enhanced fracture porosity and intergranular porosity produce intermediate and low transmissivities, respectively (Hovorka and others, 1998). In the aquifer, transmissivity in the central part of the unconfined aquifer is generally higher than along the eastern or western boundaries. This phenomenon is attributed to fracture densities that are associated with the major faults of the Balcones Fault Zone.

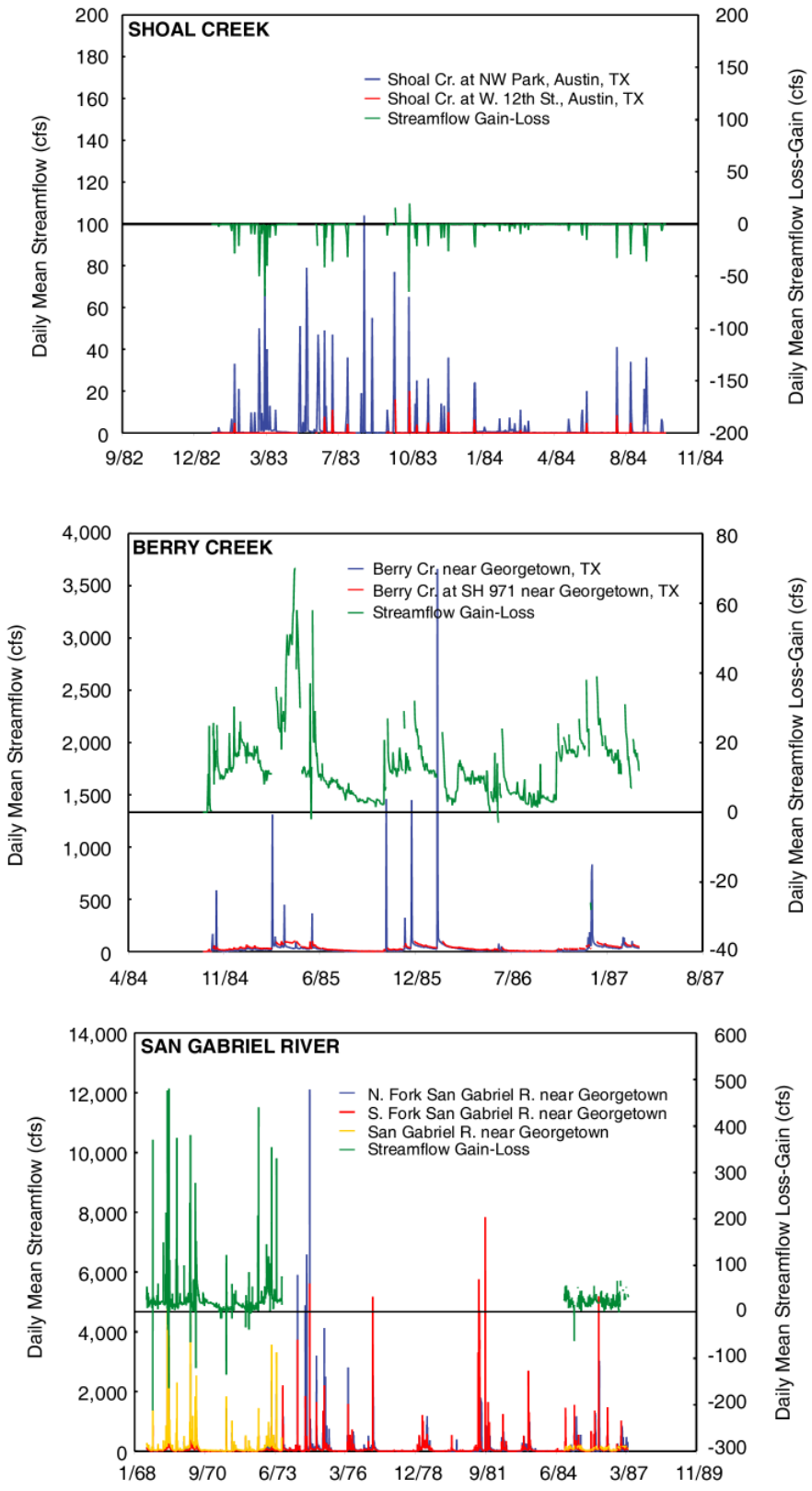

Figure 5-12. Mean daily streamflow and streamflow gain-loss at upstream-downstream

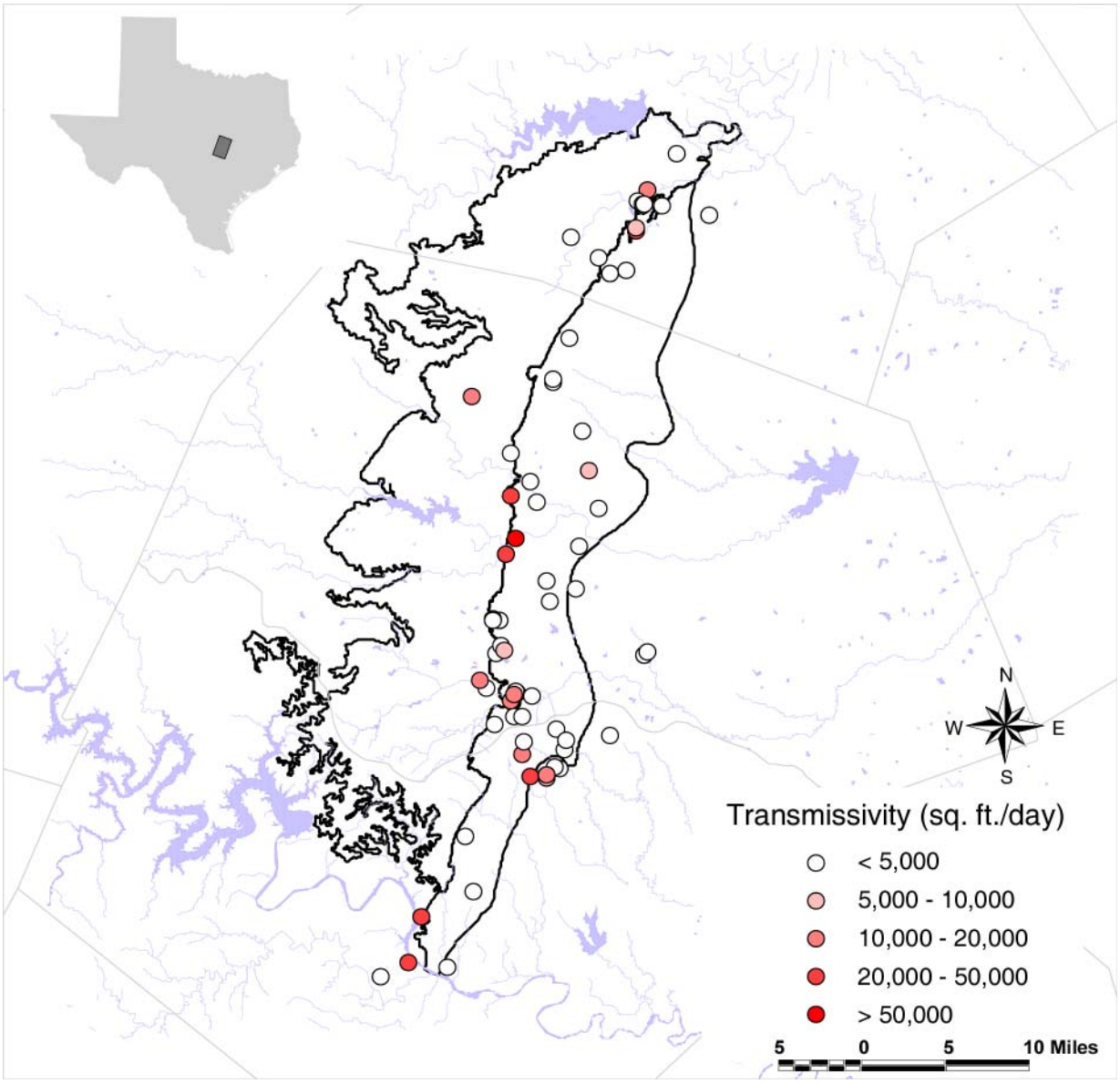

Figure 5-13. Transmissivity estimates based on specific capacity data.

There is little hydraulic conductivity data that are based on pumping tests for the northern segment of the Edwards aquifer. Transmissivity data from the available specific capacity test data were converted to hydraulic conductivity based on aquifer thickness (fig. 5-14). Resultant hydraulic conductivity values range between 0.01 and more than 30,000 ft/day, and median and geometric mean values are 9 ft/day. These values overlap with hydraulic conductivity data (2.7×10^{-5} to 13 ft/day) for the San Antonio segment of the Edwards aquifer (Hovorka and others, 1996). There is very little hydraulic conductivity data on the unconfined part of the aquifer. Spatial distribution of the data suggests no trends, with the highest hydraulic conductivity occurring within a few hundred feet of very low hydraulic conductivity values. Initially it was decided to distribute hydraulic conductivity in the model in three zones, the Jollyville Plateau

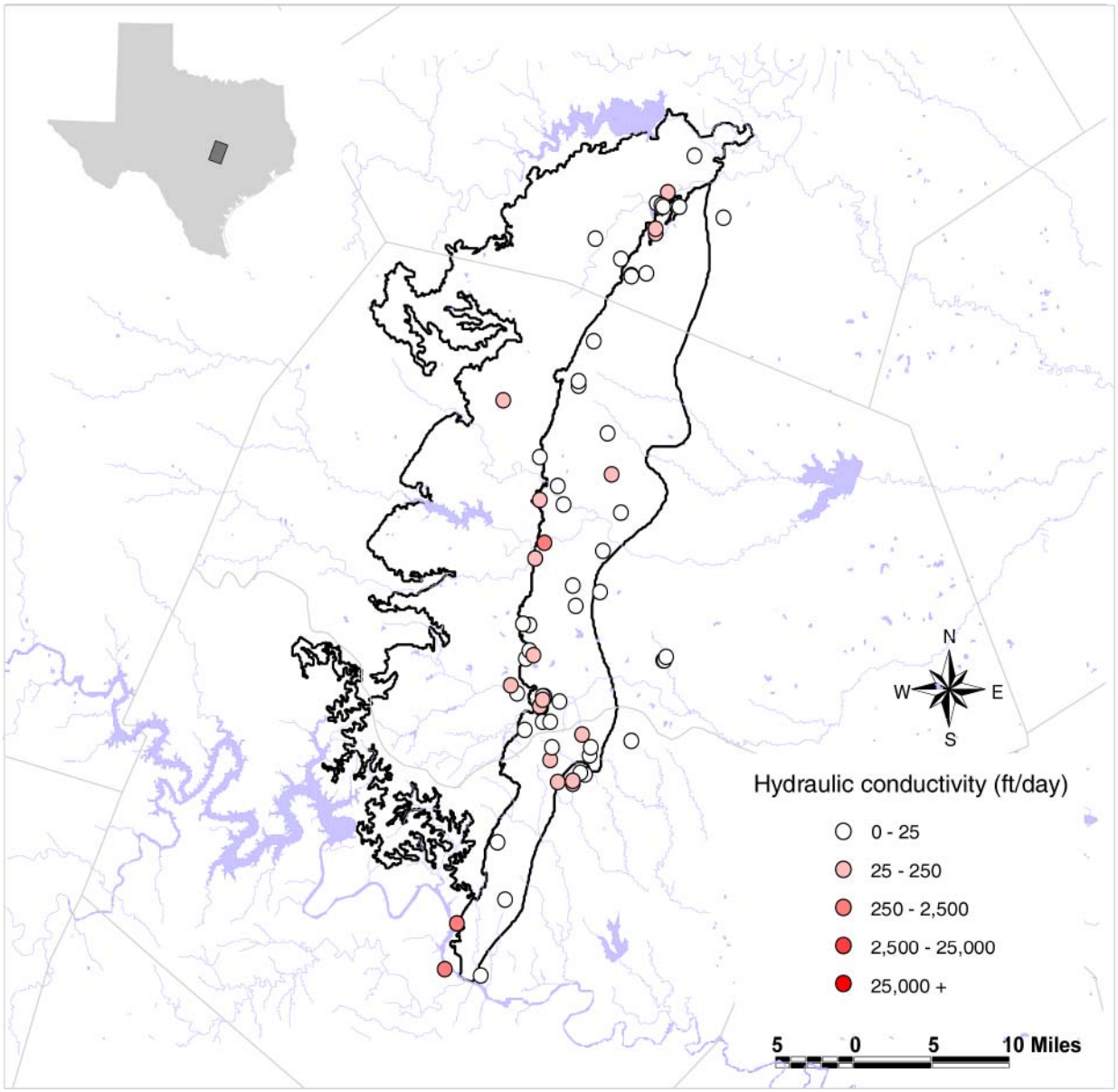

Figure 5-14. Hydraulic conductivity estimates based on specific capacity data.

outcrop, the remainder of the Edwards aquifer outcrop, and the confined part of the aquifer. The Jollyville Plateau zone coincided with the outcrop of relatively low permeability stratigraphic units, such as the Keys Valley Marl, Comanche Peak Limestone, and Cedar Park Limestone. The remainder of the aquifer outcrop is composed of the Edwards Limestone and Georgetown Formation, which have generally higher permeability than the Jollyville Plateau. The lower hydraulic gradients in the downdip part of the aquifer were initially thought to indicate higher permeability.

No published storativity data exist for the northern segment of the Edwards aquifer. Consequently, specific yield and specific storage values from the groundwater availability model

for the adjacent Barton Spring segment of the Edwards aquifer were used to represent storage in the northern segment of the Edwards aquifer (Scanlon and others, 2001).

5.7 Discharge

Groundwater discharge from aquifers can take the form of pumping, discharge to springs or seeps, or cross-formational flow to an adjacent aquifer.

The northern segment of the Edwards aquifer is only slightly to moderately developed. Consequently, natural discharge through springs and seeps is thought to be much larger than well pumping (Duffin and Musick, 1991). TWDB pumping estimates indicate total groundwater pumping of 30,000 acre-feet during 1999 (fig. 5-15). Municipal and rural domestic pumping together account for almost 90 percent of the groundwater withdrawn from the aquifer. Unlike in the San Antonio segment, irrigation pumping is insignificant in the northern segment of the Edwards aquifer. Municipalities that use northern Edwards groundwater are located mainly in the northern part of the aquifer segment and include Salado, Georgetown, Pflugerville, and Round Rock. During the 1980s and 1990s, rural domestic pumping fluctuated between 10,000 and 15,000 acre-feet per year (fig. 5-16). During the same period, irrigation pumping estimates rose rapidly from 1 to 3 acre-feet per year in the early 1980s to approximately 18 acre-feet per year in the early 1990s. Municipal pumping also fluctuated, ranging from 6,000 to 13,000 acre-feet per year. In both rural domestic and municipal pumping, pumping generally increased over the time period. Irrigation pumping in the study area apparently ceased in 1994. Manufacturing pumping increased gradually through the 1980s and 1990s, from 1,500 acre-feet per year to 2,500 acre-feet per year. Livestock pumping increased during the early 1980s, from less than 50 acre-feet per year to about 150 acre-feet per year, and has remained generally constant since then. Overall, total pumping from the northern segment of the Edwards aquifer increased rapidly during the early 1980s, from less than 20,000 acre-feet per year to about 25,000 acre-feet per year (fig. 5-15). In subsequent years, pumping from the northern Edwards aquifer has increased gradually.

The spatial distribution of pumping has been determined based on the spatial distribution of respective users: rural domestic, municipal, irrigation, manufacturing, and livestock (fig. 5-17). For example, rangeland used for rearing livestock is located primarily on the western side of the study area. Consequently, one would expect that pumping for livestock would be concentrated on the western, unconfined part of the aquifer. Pumping for rural domestic uses is a function of population density outside city limits. Consequently, the spatial distribution of rural domestic pumping varies with population density. Municipal and manufacturing wells extracting water from the northern segment of the Edwards aquifer are located primarily adjacent to the boundary between the confined and unconfined parts of the aquifer. These wells are located mostly in southern and central Williamson County and are associated with the municipalities that depend on Edwards aquifer groundwater, such as Georgetown, Round Rock, and Pflugerville. Irrigation pumping is relatively minor in the study area. Cultivated farmland and associated irrigation are located primarily in the eastern part of the aquifer. Seasonally, pumping peaks during the dry summer months and declines from fall through spring, when most rainfall occurs (Kreitler and others, 1987).

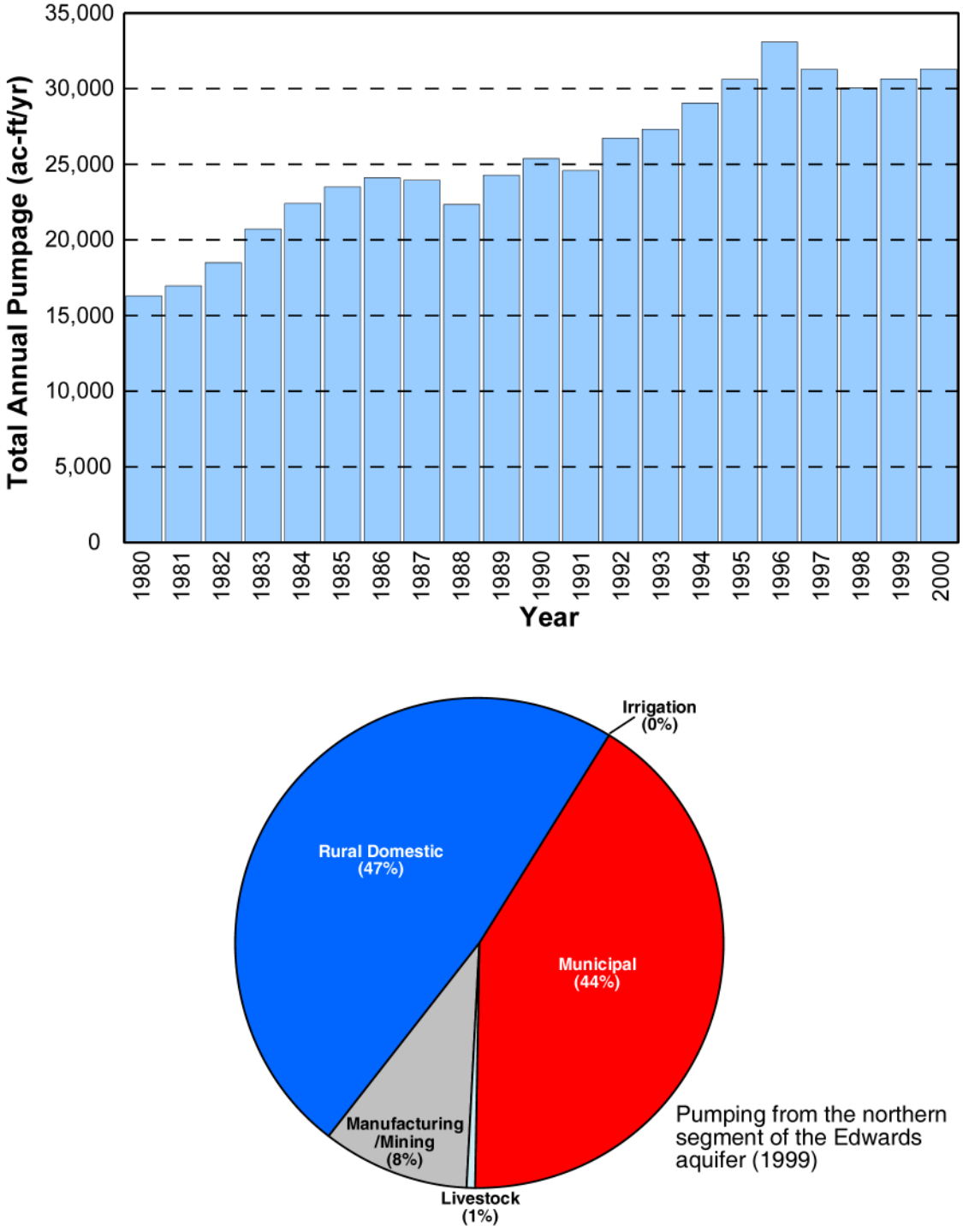

Figure 5-15. Total annual groundwater withdrawals from Edwards aquifer (1980-2000).

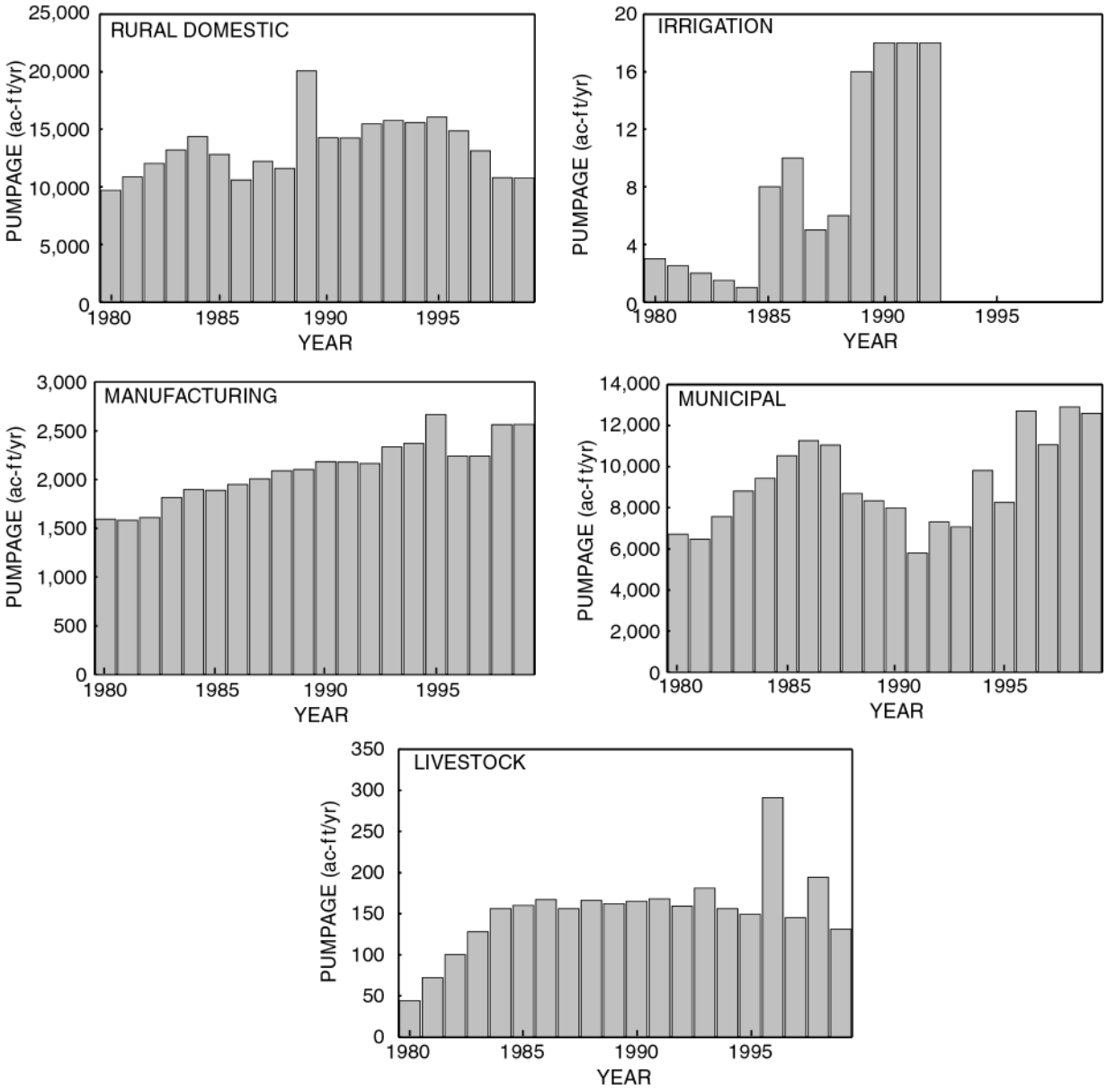

Figure 5-16. Annual groundwater withdrawals for rural domestic, irrigation, manufacturing, municipal, and livestock uses.

Precipitation over the recharge zone and the upstream contributing zone results in rapid increases in spring discharge. The lag time between precipitation events and spring response varies from almost immediate to more than 1 week (Brune and Duffin, 1983). Faulting frequently results in the juxtaposition of relatively impermeable Del Rio Clay and Buda Limestone and Edwards aquifer rock. This juxtaposition restricts groundwater flow across faults and often results in upward flow along the fault and discharge through springs (Brune and Duffin, 1983; Land and Dorsey, 1988; Senger and others, 1990). Hence the occurrence of several major springs—for example, Mount Bonnell, Salado, San Gabriel, and Berry springs, adjacent to the boundary between unconfined and confined parts of the aquifer (fig. 5-18). Other major springs occurring

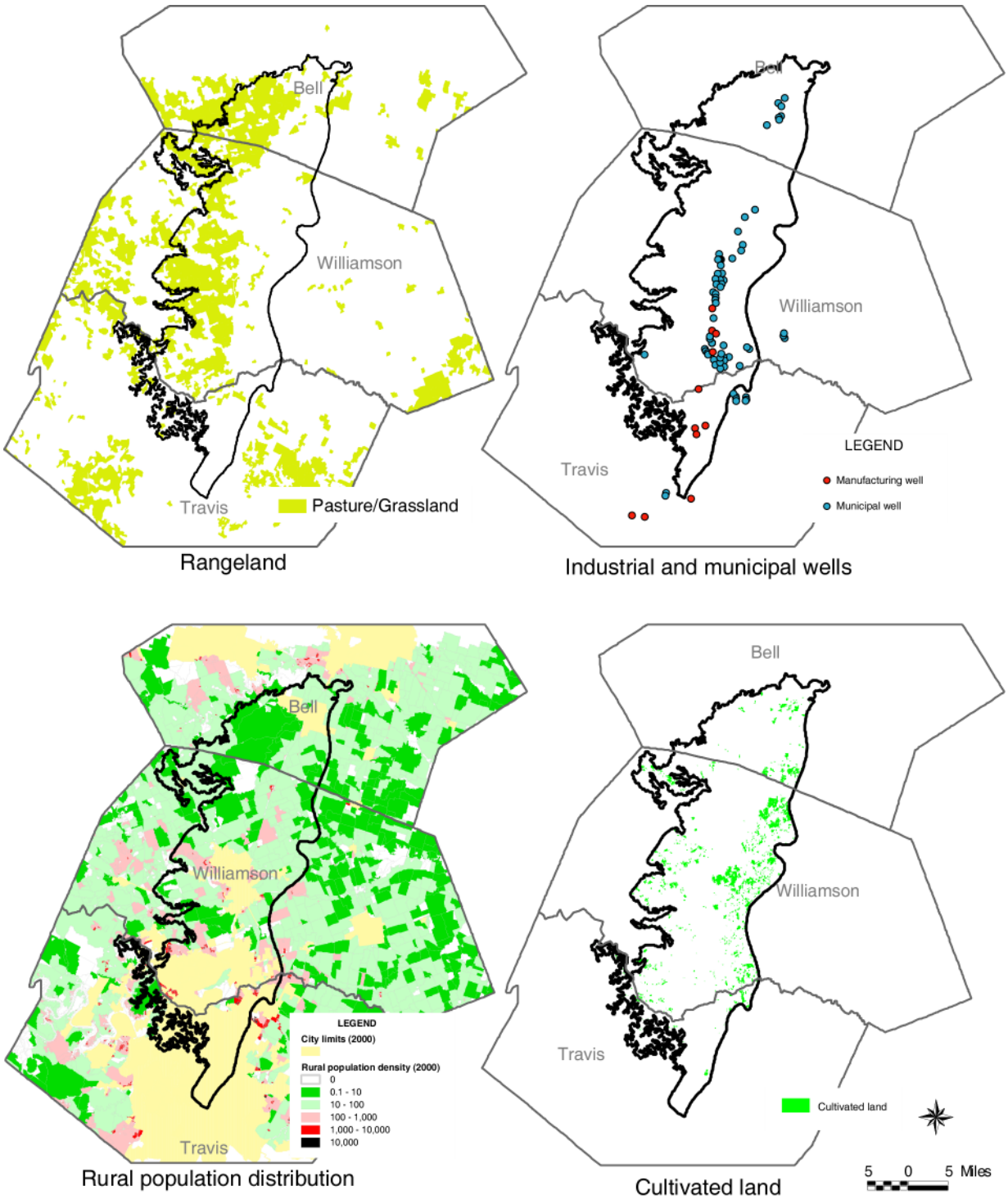

Figure 5-17. Spatial distribution of pumping for rural domestic, irrigation, manufacturing, municipal, and livestock uses.

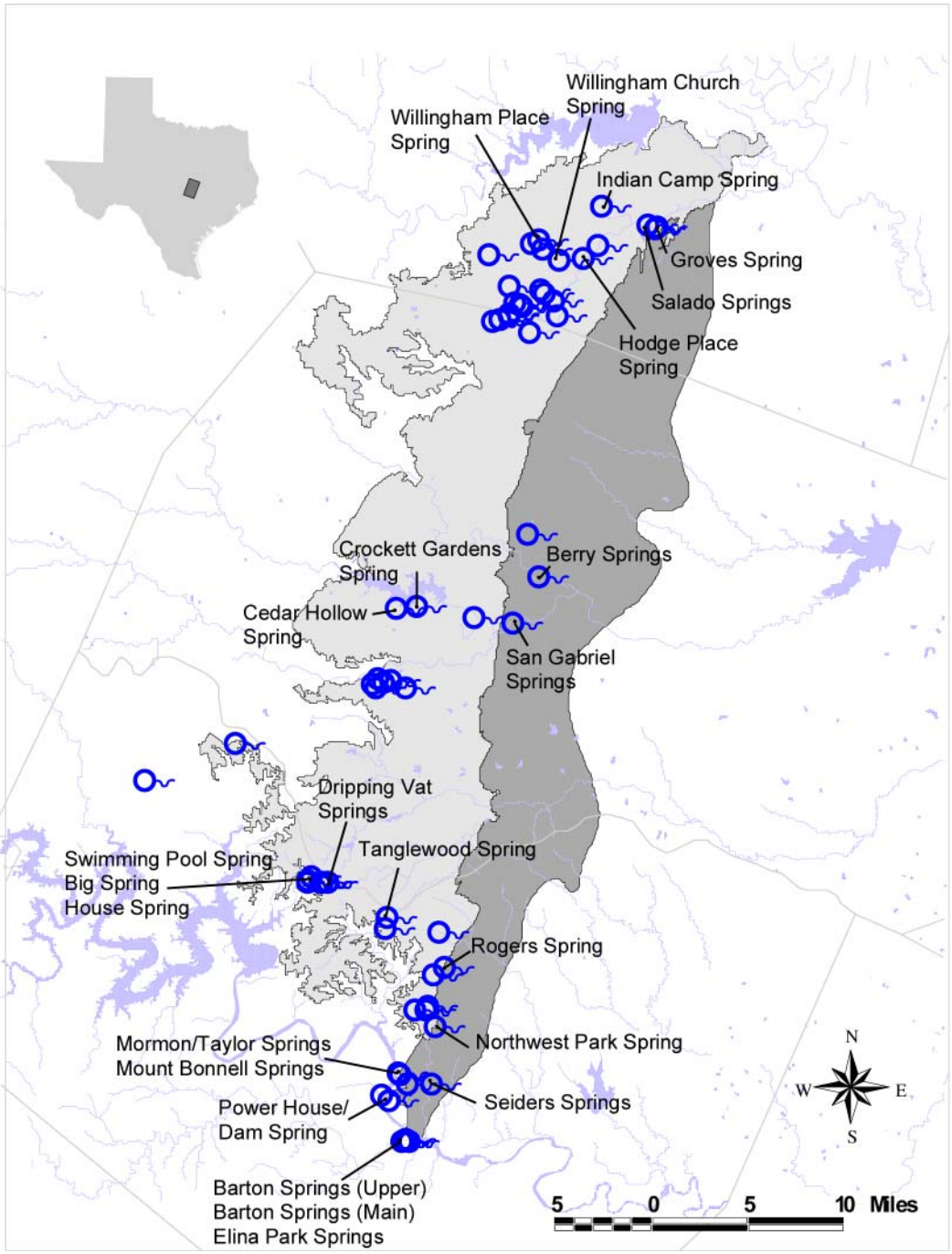

Figure 5-18. Location of major springs discharging from the Edwards aquifer in the study area.

in the study area include Childers Springs in Bell County; Deep Eddy, Mormon, Power House, and Seiders springs in Travis County; and Berry, Knight, San Gabriel, and Manske springs in Williamson County (Brune, 1975). Along the southern margin of the study area, discharge from

the aquifer often takes the form of numerous small springs or seeps located along the southern margin of the Jollyville Plateau (Senger and others, 1990).

Discharge through springs and seeps is most likely to occur within or adjacent to the unconfined part of the aquifer. Discharge in the confined part of the aquifer takes the form of cross-formational flow from the Edwards aquifer, through the Del Rio Clay, into overlying aquifer units such as the Austin Chalk.

5.8 Water Quality

Geochemical compositions of groundwater in the Edwards aquifer are used in defining the downdip margin of the aquifer. This boundary, referred to as the bad-water line, is defined as the easternmost extent of freshwater in the aquifer. Freshwater is defined as water with total dissolved solids (TDS) of less than 1,000 mg/l. Use of the bad-water line as the eastern boundary of the aquifer is justified because high-TDS groundwater is associated with restricted groundwater circulation (Ridgeway and Petrini, 1999), which has been confirmed by the occurrence of relatively low concentrations of tritium compared with those of updip parts of the aquifer.

Groundwater in the northern segment of the Edwards aquifer becomes progressively more mineralized from the outcrop recharge zone in the west to downdip parts of the aquifer in the east (Figure 4-19). Groundwater TDS varies from 200 to 400 mg/l in the recharge zone and increases to more than 3,000 mg/l downdip (Baker and others, 1986). Intense faulting in the south creates barriers to eastward groundwater flow and results in the occurrence of slightly to moderately saline groundwater within 1 to 2 miles of the recharge zone. This distance is much less than that of parts of the aquifer farther north, where faulting is less intense and saline groundwater occurs more than 10 miles from the recharge zone. In addition to variations of TDS across the aquifer, groundwater geochemical compositions also vary downdip from Ca-HCO_3- to Na-SO_4-type waters and Na-Cl-type water (fig 5-19); (Brune and Duffin, 1983). These hydrochemical patterns indicate hydrochemical evolution of groundwater along flow paths. In the south, where faults are more abundant, hydrochemical zones are much narrower than in the north. The large faults that disrupt groundwater flow may also provide pathways for an influx of deep saline groundwater, especially in the south (Senger and others, 1990).

The spatial distribution of groundwater having different geochemical compositions reflects the interaction of two main flow systems in the aquifer. These flow systems involve (1) rapid circulation of fresh groundwater from the recharge zone and (2) a slow influx of saline groundwater from downdip (Senger and others, 1990). The Ca-HCO_3-type water that occurs within or adjacent to the recharge zone is characterized by high tritium of 7 to 11 Tritium Units (TU). The slowly circulating groundwater is characterized by low tritium (< 1 TU) and mixed-cation-HCO_3-, Na-HCO_3-, and Na-mixed-anion-type groundwater (fig. 5-19). The contrasting low and high tritium in confined and unconfined parts of the aquifer, respectively, indicate that most groundwater circulation in the aquifer occurs in the unconfined part of the aquifer. The boundary between low- and high-tritium groundwater coincides with the bad-water line, indicating relatively little circulation of recently recharged groundwater in the saline parts of the aquifer. The bad-water line also follows the downdip boundary of the Na-HCO_3 zone in the north. In the south, where the Na-HCO_3 zone disappears, the bad-water line forms an irregular

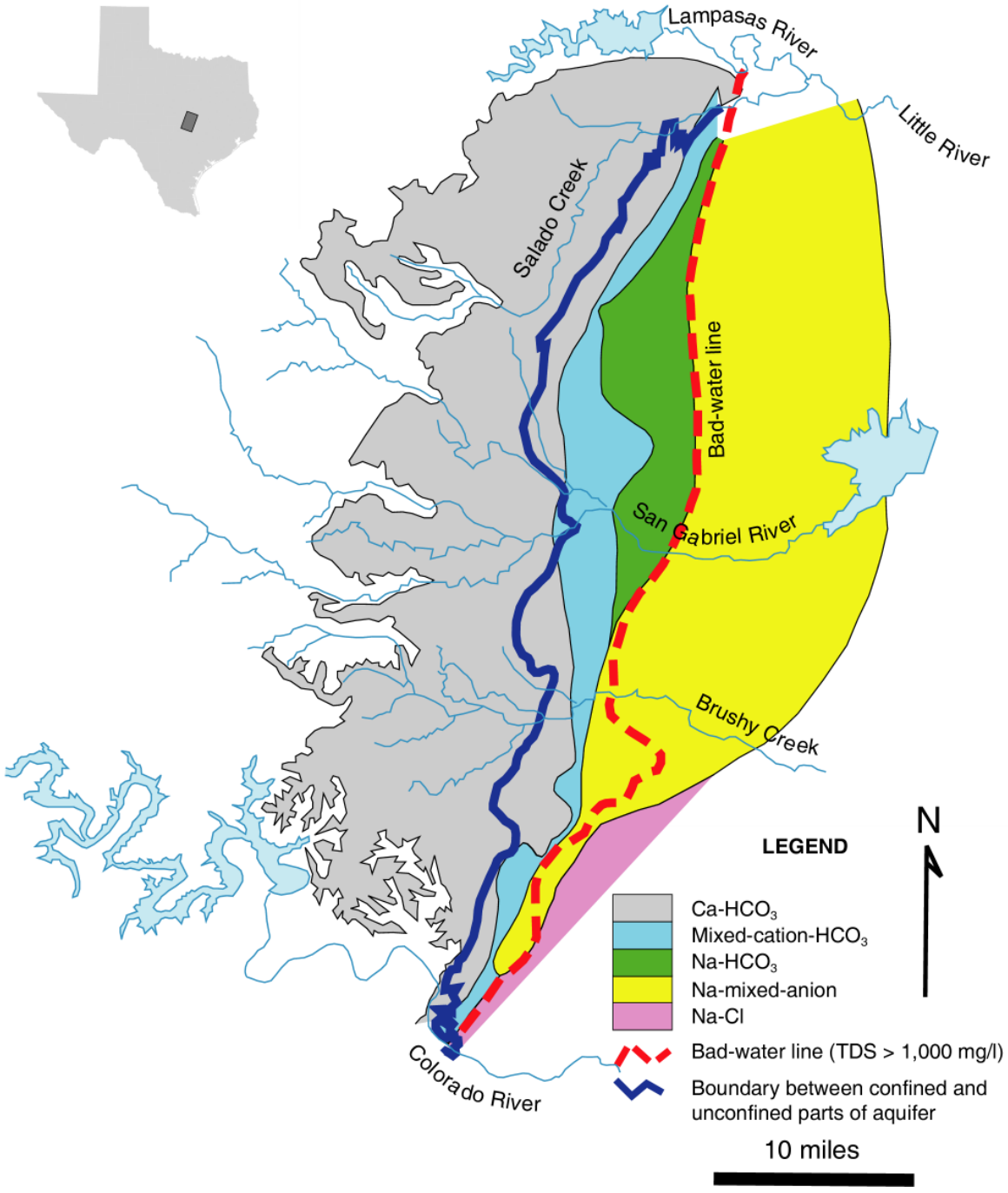

Figure 5-19. Variation of Edwards aquifer groundwater chemical compositions in the study area (modified from Senger and others, 1990).

pattern partly because of localized recharge along faults. At the Colorado River, the bad-water line coincides with the updip boundary of the Na-Cl zone. The north-south variation of groundwater geochemical zones can be explained by the relative influence of fresh and saline groundwater flow systems. In the south, where the influx of freshwater is restricted because of faulting, groundwater geochemical compositions are influenced largely by updip movement of Na-Cl brines from the Gulf Coast Basin. In the north, groundwater geochemical compositions are influenced by downdip hydrochemical evolution of fresh groundwater (Senger and others, 1990). Groundwater compositions do not apparently vary with fluctuating water levels (Baker and others, 1986). However, Flores (1990) suggested less fresh to slightly saline groundwater in the aquifer as compared with that indicated by a 1986 study. This difference suggests a slightly westward shift of the bad-water line over time (Flores, 1990).

6.0 Conceptual Model of Flow in the Aquifer

The conceptual model reflects our best understanding of the hydrology of the aquifer. The model describes predicted groundwater flow paths, as well as the processes, such as recharge and discharge, that constitute the water budget of the aquifer.

Precipitation that falls on the outcrop of the northern segment of the Edwards aquifer is the primary source of recharge water (fig. 6-1). This widespread recharge takes the form of direct infiltration through soil and rock and infiltration from numerous intermittent streams. Additional recharge results from infiltration of water from streams that cross the aquifer outcrop. Groundwater flows generally toward the east, except along the southern margin of the aquifer, where there is southward flow toward the Colorado River. Water quality parameters such as tritium indicate that there is very little groundwater flow beyond the bad-water line. The groundwater potentiometric surface indicates groundwater flow converging on Brushy and Salado Creeks, indicating discharge to these streams. This discharge is confirmed by the fact that both streams are perennially gaining streams. Other major discharge zones occur on the Colorado River along the southern margin of the aquifer, the San Gabriel River, and the Lampasas River along the northern margin of the aquifer. This discharge takes the form of springs and seeps that flow into the perennial rivers and streams that cross or are adjacent to the aquifer.

The northern segment of the Edwards aquifer is used primarily as a source of water for municipalities located mostly in the central and northern parts of the study area, such as the cities of Round Rock, Georgetown, Salado, and Pflugerville. Consequently, groundwater use is greater in Williamson and Bell counties than in Travis County. Despite annual increases in groundwater pumping averaging 5 percent per year over the past decade, total pumping in the northern segment of the Edwards aquifer is relatively small compared with that of the much larger San Antonio segment. Estimated pumping for 1999 was approximately 30,000 acre-feet in the northern segment of the Edwards aquifer, compared with pumping in excess of 400,000 acre-feet per year in the San Antonio segment. In addition to discharge to streams and pumping, groundwater discharge from the northern segment of the Edwards aquifer also occurs by cross-formational flow. Cross-formational flow occurs in the confined part of the aquifer, where groundwater discharges by upward flow from the Edwards aquifer to overlying units, such as the Austin Chalk.

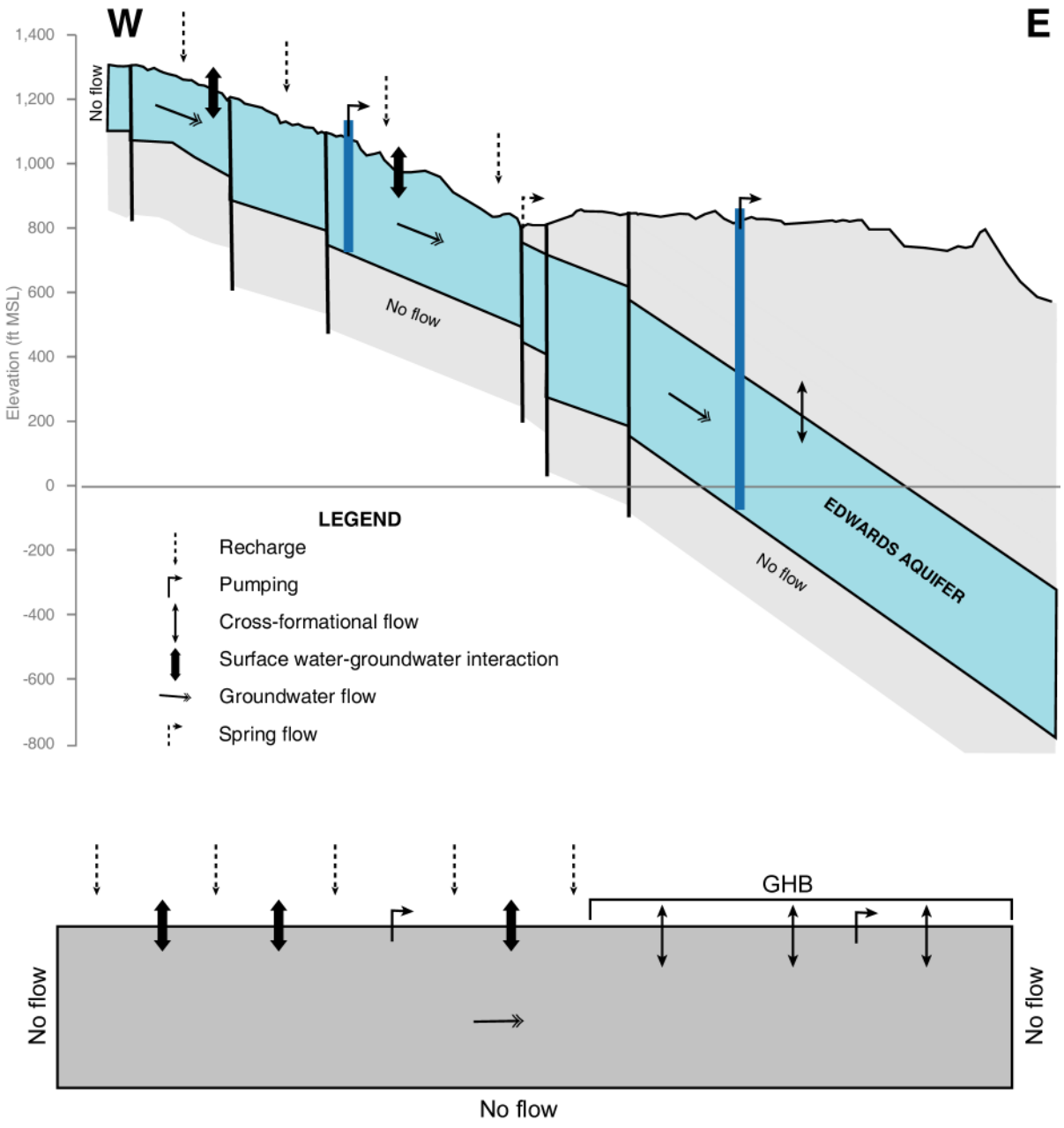

Figure 6-1. Conceptual model of groundwater flow in the study area.

7.0 Model Design

Model design includes (1) choice of code and processor, (2) discretization of the aquifer into layers and cells, and (3) assignment of model parameters. The model design must agree as much as possible with the conceptual model of groundwater flow in the aquifer.

7.1 Code and Processor

Groundwater flow through the northern segment of the Edwards aquifer was simulated using MODFLOW-96, a widely used modular finite-difference groundwater flow code written by USGS (Harbaugh and McDonald, 1996). This code was selected because of (1) its capabilities of simulating regional-scale groundwater processes in the Edwards aquifer, (2) its documentation and wide use (McDonald and Harbaugh, 1988; Anderson and Woessner, 1992), (3) the availability of a number of third-party pre- and post-processors for facilitating easy use of the modeling software, and (4) its easily available public domain software. Processing MODFLOW for Windows (PMWIN) version 5.3 aided in our loading data into the model and viewing model outputs (Chiang and Kinzelbach, 2001). Other pre- and post-processors should be able to read source files for MODFLOW-96. This model was developed and run on a Dell Optiplex GX150 with a 930 MHz Pentium III processor and 256 MB RAM running Microsoft Windows 2000 (v. 5).

7.2 Layers and Grid

The lateral extent of the model differs slightly from those of the previously defined aquifer boundaries. The eastern boundary of the model coincides with the easternmost occurrence of groundwater with TDS of less than 3,000 mg/l (fig. 7-1). These data differ from the TWDB definition of the northern segment of the Edwards aquifer, where the eastern boundary is the bad-water line, as defined by a TDS of 1,000 mg/l. As a precaution, the downdip boundary of the model was moved eastward to test whether groundwater flowed beyond the previously defined aquifer boundary. This model has one layer that is composed of the undifferentiated Edwards and associated limestones. The model grid has 160 columns and 250 rows, for a total of 40,000 cells. Of these cells, 15,076 are active. The model grid is oriented 20° east of north. The cells have uniform dimensions of 1,320 feet by 1,320 feet. This cell size was selected to reflect the density of input data while providing adequate output resolution. The uniform cell size facilitates the use of spreadsheets and grid-based contouring software for easy data manipulation.

7.3 Model Parameters

The model layer was assigned as a confined/unconfined layer type, allowing MODFLOW to calculate transmissivity and storativity from simulated saturated thickness and assigned hydraulic conductivity and specific storage values. The length and time units used in this model were feet and days, respectively. ArcView® was used to distribute model parameters spatially, such as aquifer base and top elevations, hydraulic conductivity, specific yield, and specific storage.

The top and base of the aquifer were based on structural data compiled by the Bureau of Economic Geology (fig. 5-4 and 5-5); (Collins and others, 2002). The top of the aquifer was defined as land surface in the unconfined part of the aquifer and the top of the Georgetown Formation in the confined part of the aquifer. The base of the aquifer was defined as the base of the Comanche Peak Limestone.Hydraulic conductivity was initially assigned to different zones in the model. These zones represented the Jollyville Plateau, aquifer outcrop, and downdip parts

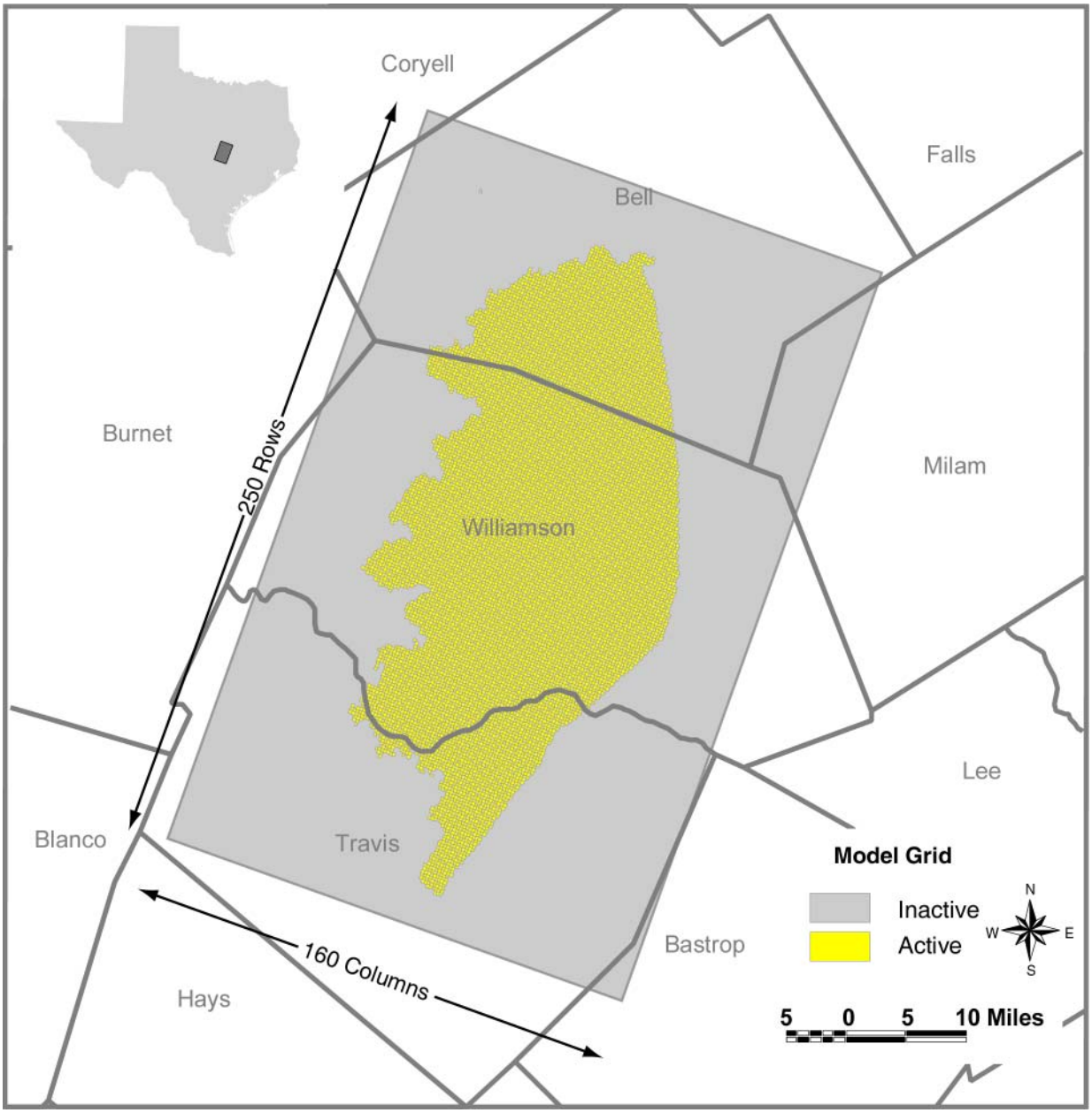

Figure 7-1. Model grid.

of the aquifer and were initially assigned hydraulic conductivity values to zones based on the geology.

Specific yield and specific storage were assigned uniformly throughout the model grid using values similar to those used in the groundwater availability model for the Barton Springs segment of the Edwards aquifer (Scanlon and others, 2001). The values for specific yield and specific storage used in this model were 0.005 and 5×10^{-6} per foot, respectively.

The Slice Successive Over-Relaxation (SSOR) package was used to solve the groundwater flow equation. The convergence criterion for iterations was set at 0.01 foot.

7.4 Model Boundaries

Model boundaries were assigned for (1) recharge, (2) pumping, (3) streams and springs, and (4) initial conditions. ArcView® was used to distribute model boundaries spatially, such as initial water-level elevations, drains, general-head boundaries (GHB), recharge, and pumping.

Initial water-level elevations were interpolated from average water levels for respective wells in the TWDB Well Database (fig. 4-7). These water-level elevations represent water-level measurements made during the month of January during the years 1990 through 1999. Average water levels were used because (1) the aquifer responds rapidly to precipitation, resulting in water-level fluctuations of up to 100 feet and (2) there is no apparent long-term regional-scale water-level decline in the northern segment of the Edward aquifer.

The Drain package in MODFLOW was used to simulate groundwater discharge to seeps, springs, and perennial streams (fig. 7-2). Discharge from the aquifer takes place only when simulated water levels in the drain cells exceed set elevations that represent streambed or spring orifice elevations. Discharge through drains is also a function of hydraulic conductance. In this model, initial drain hydraulic conductance was set at 1,000,000 ft^2/day— a value set high so that resistance to flow from the aquifer into the streams could be minimized. This action is justifiable because in the study area streambeds sediments are often composed of highly permeable gravel or fractured limestone. Drains were used to simulate discharge to perennial streams because in this segment of the Edwards aquifer, few losing segments are in the perennial streams (fig. 3-1).

The GHB Package was used to simulate cross-formational groundwater flow between the Edwards aquifer and overlying units. The GHB cells are located primarily in the downdip margin of the model and along major topographic lows formed by the major river valleys that cross the aquifer (fig. 7-3). These topographic lows have the greatest potential for groundwater discharge by cross-formational flow. Discharge through the GHB is head-dependent, as determined by the elevation of simulated hydraulic heads relative to GHB heads. The GHB heads were set to represent hydraulic heads in an overlying unit. In this model, GHB heads were set to an elevation 90 feet below land surface to simulate hydraulic heads in overlying stratigraphic units, such as the Eagle Ford Group and Buda Limestone. If simulated hydraulic heads exceeded GHB heads, groundwater flowed upward out of the aquifer. Otherwise, cross-formational flow entered the aquifer. In addition to relative heads, cross-formational flow discharge was also influenced by hydraulic conductance initially being set at 3,500 ft^2/day. The initial GHB conductance value was based on assumption of a very low confining-unit hydraulic conductivity factored over the area of each cell.

Recharge to the northern segment of the Edwards aquifer was spatially distributed based on assumptions that (1) recharge takes the form of widespread infiltration from numerous intermittent streams and through soils that overlie the aquifer outcrop and (2) recharge is a fraction of annual precipitation. Recharge in the model was set initially at 0.000343 ft/day, or 5 percent of average annual precipitation.

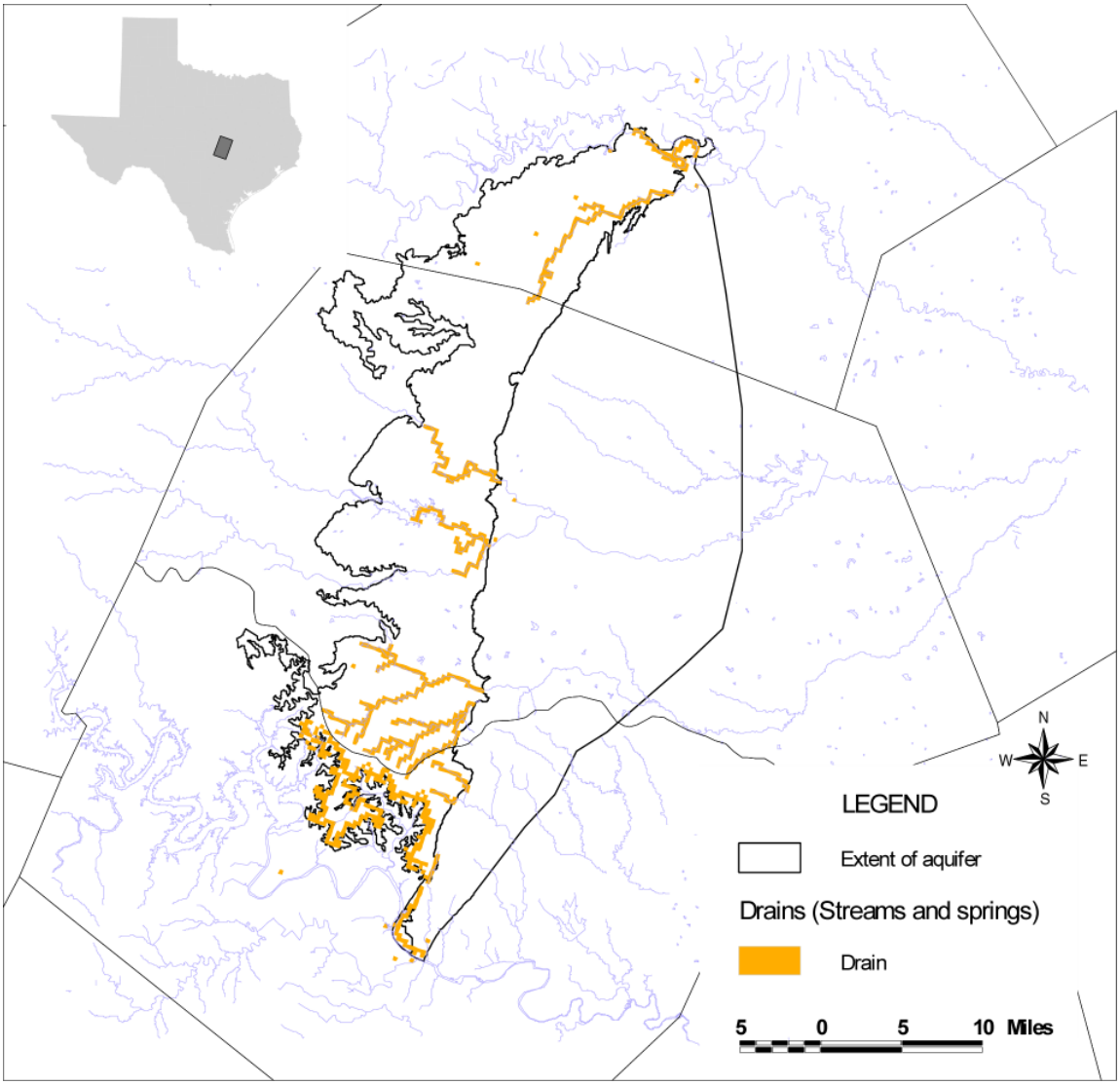

Figure 7-2. Distribution of drain cells in the model grid.

This model simulates the regional effects of pumping for rural domestic, municipal, irrigation, industrial, and livestock uses (table 7-1 and 7-2). Municipal and manufacturing pumping was distributed based on known well locations and pumping data from the TWDB Water Use Survey (fig.5-16 and 7-4). The other uses (domestic, irrigation, and livestock) were distributed throughout the model grid, reflecting the spatial distribution of associated land use. Rural domestic pumping was distributed based on the spatial distribution of population outside major urban areas that lie within the model grid. Pumping was distributed based on population data for the respective counties from 1990 and 2000 censuses such that pumping is proportional to the population within each active model cell. Irrigation pumping was distributed based on 1:250,000-scale Land Use and Land Cover data from USGS. Irrigation was assumed to occur on all land classified as orchards, row crops, or small grains. Livestock pumping was also distributed based on 1:250,000-scale Land Use and Land Cover data from USGS. Livestock pumping was assumed on all rangeland.

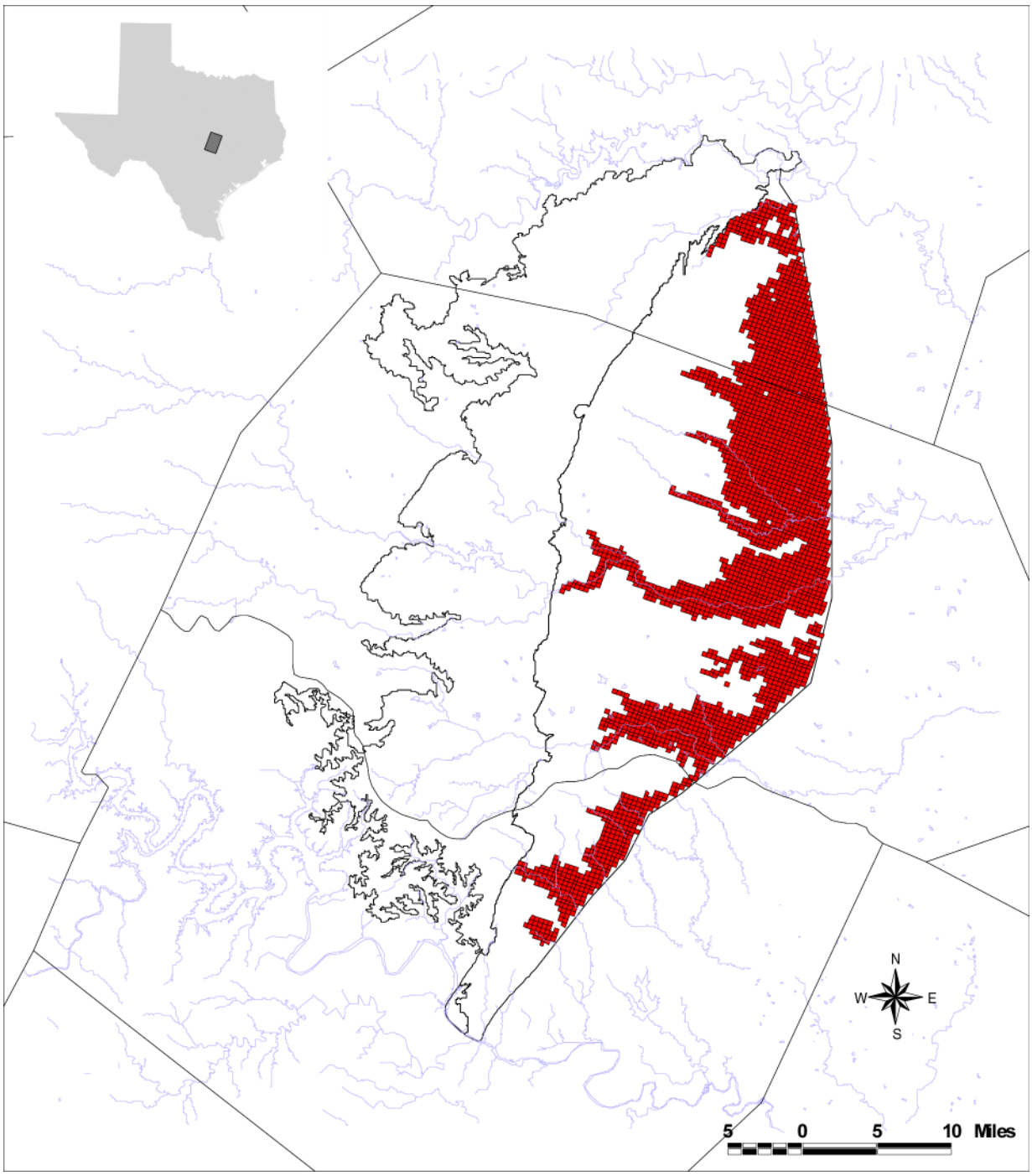

Figure 7-3. General-head boundary cells in the model.

Table 7-1. Rate of total groundwater withdrawal from the northern segment of the Edwards aquifer. Values expressed in acre-feet per year (data for 1980 through 2000 from TWDB water use surveys, 2001 through 2050 from regional water planning groups).

County	Bell	Travis	Williamson
Year			
1980	1,200	3,900	11,200
1981	1,100	4,500	11,400
1982	1,100	4,700	12,700
1983	1,100	5,200	14,400
1984	1,200	6,100	15,100
1985	1,100	6,200	16,200
1986	1,100	5,600	17,400
1987	1,100	5,700	17,200
1988	1,100	6,400	14,900
1989	1,700	7,000	15,500
1990	1,800	7,600	15,900
1991	1,800	8,000	14,800
1992	2,000	8,100	16,700
1993	2,100	8,800	16,400
1994	2,100	9,100	17,800
1995	2,100	9,700	18,800
1996	2,300	10,100	20,700
1997	2,100	9,000	20,100
1998	2,300	9,500	18,300
1999	2,400	9,700	18,600
2000	2,400	9,600	19,300
2010	470	2,600	2,900
2020	530	3,000	2,800
2030	590	4,400	2,900
2040	640	4,500	3,200
2050	690	4,700	3,100

Table 7-2. Rate of rural domestic, irrigation, livestock, manufacturing, and municipal groundwater withdrawal from the northern segment of the Edwards aquifer. Values expressed in acre-feet per year (data for 1980 through 2000 from TWDB water use surveys, 2001 through 2050 from regional water planning groups).

	Rural Domestic			Irrigation			Manufacturing/Mining			Municipal			Livestock		
County	Bell	Travis	Williamson	Bell	Travis	Williamson	Bell	Travis	Williamson	Bell	Travis	Williamson	Bell	Travis	Williamson
Year															
1980	1,000	3,400	3,600	3	0	0	0	240	1,300	140	260	6,300	20	10	20
1981	910	3,900	3,900	2	0	0	0	200	1,400	160	280	6,100	10	40	20
1982	920	4,100	4,200	1	0	0	0	150	1,500	180	360	7,000	10	70	20
1983	910	4,600	4,500	1	0	1	0	150	1,700	200	400	8,200	10	100	20
1984	920	5,200	4,900	0	0	1	0	230	1,700	260	570	8,500	10	130	20
1985	800	5,100	5,000	6	0	2	0	220	1,700	250	740	9,500	10	130	20
1986	800	4,400	6,600	7	0	2	0	280	1,700	250	860	10,100	10	140	20
1987	810	4,400	5,600	3	0	2	0	320	1,700	260	860	9,900	10	130	20
1988	810	4,800	5,900	5	0	1	0	400	1,700	300	1,100	7,300	10	140	20
1989	1,300	5,500	6,900	0	0	16	0	400	1,700	460	1,000	6,800	10	140	20
1990	1,400	6,000	7,500	0	0	18	0	480	1,700	450	970	6,700	10	140	20
1991	1,300	6,500	7,500	0	0	18	0	430	1,800	480	900	5,500	10	140	20
1992	1,400	6,400	7,400	0	0	18	0	460	1,700	580	1,100	7,500	10	140	10
1993	1,500	6,800	8,000	0	0	0	0	500	1,800	610	1,400	6,600	10	160	10
1994	1,400	6,900	8,500	0	0	0	0	580	1,800	640	1,600	7,500	10	130	20
1995	1,400	7,200	8,600	0	0	0	0	660	2,000	700	1,800	8,100	10	130	10
1996	1,500	7,200	9,300	0	0	0	0	480	1,700	820	2,200	9,700	10	260	20
1997	1,300	6,300	6,800	0	0	0	0	470	1,700	780	2,100	11,600	10	120	10
1998	1,400	6,300	6,800	0	0	0	0	570	2,000	890	2,400	9,500	10	140	10
1999	1,400	6,300	6,800	0	0	0	0	580	2,000	990	2,600	9,800	10	140	10
2000	1,400	6,300	6,800	0	0	0	0	580	2,000	990	2,600	10,500	10	140	10
2010	20	770	850	0	280	0	0	1,100	310	350	300	1,800	110	150	0
2020	20	1,100	1,000	0	250	0	0	1,100	260	410	370	1,500	110	150	0
2030	20	2,400	940	0	230	0	0	1,100	260	470	440	1,700	110	150	0
2040	20	2,500	1,000	0	210	0	0	1,200	260	520	490	2,000	110	150	0
2050	20	2,600	920	0	200	0	0	1,200	260	560	540	2,000	110	150	0

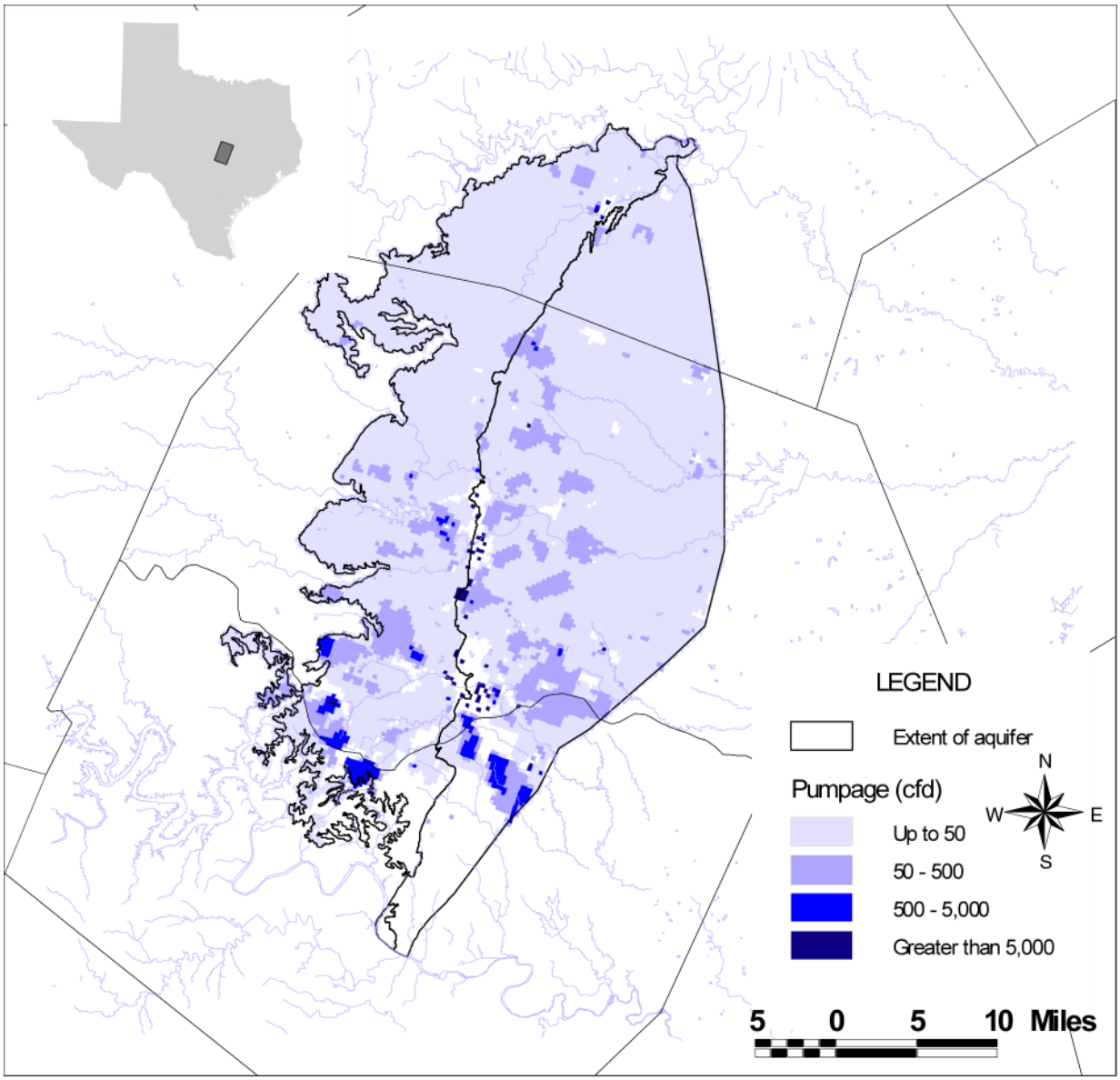

Figure 7-4. Distribution of total pumping in the model for 1980.

8.0 Modeling Approach

The process of modeling the northern segment of the Edwards aquifer included (1) steady-state model calibration, (2) historical transient model calibration, and (3) predictions of water-level variations over a 50-year planning period based on the transient model and pumping predictions developed by the Brazos G and Lower Colorado Regional Water Planning Groups. The steady-state model was developed first to facilitate easier calibration because some parameters, such as aquifer storage and water-level variations over time, do not need to be taken into consideration.

In the steady-state model, calibration requires consideration only of spatial variations in the aquifer.

The steady-state model was calibrated to reproduce water levels for early 1980. The steady-state model was used to investigate (1) recharge rates, (2) hydraulic properties, (3) boundary conditions, and (4) flow budget. Model calibration in the steady-state model involved matching simulated water levels and streamflow with available measurement data. Steady-state calibration was quantified using the root mean square error (RMSE) between measured and simulated water levels,

$$RMSE = \left[\frac{1}{n} \sum_{i=1}^{n} \left(h_m - h_s \right)_i^2 \right]^{0.5},$$

where n is the number of calibration points and h_m and h_s are measured and simulated water-level elevations, respectively, at point i. The calibration process for the steady-state model is designed to minimize the RMSE of the model with a target RMSE less than 10 percent of the range of measured water-level values.

Once steady-state calibration was achieved, the resultant model was the basis for the historical transient model. In the historical transient model, calibration involved matching water-level and streamflow fluctuations with available measurements. After the historical transient model was calibrated, it was used to predict how water levels may change over the next 50 years in response to predicted pumping and drought.

9.0 Steady-State Model

After input data were assembled and the model framework was constructed, the steady-state model was calibrated to fit measured parameters. Upon successful calibration, sensitivity of the model to selected input parameters was assessed.

9.1 Steady-State Calibration

Recharge, hydraulic conductivity, and GHB conductance were adjusted to calibrate the steady-state model. Minor adjustments were also made to aquifer base elevations to reduce very large elevation changes between adjacent cells that otherwise resulted in unrealistic dry cells during model simulations.

Recharge was varied during the calibration process, resulting in a final uniform recharge rate of 0.0012 ft/day, or 20 percent of average annual precipitation in the model area. Effects of recharge were greatest in the recharge zone. Hydraulic conductivity of the model was adjusted by varying values in zones that make up the confined part of the aquifer, as well as different parts of the unconfined part of the aquifer. The model was relatively insensitive to hydraulic conductivity. Therefore, a uniform hydraulic conductivity of 25 ft/day was assigned to active cells in the calibrated model. This value is close to the median hydraulic conductivity (9 ft/day) but differs from initial zoned values that varied from 5 to 2,000 ft/day. The use of zones could not be justified because of (1) the insensitivity of the model, (2) the RMSE not changing whether

hydraulic conductivity was uniform or distributed in zones, and (3) the zones not being supported by available hydraulic conductivity data that were restricted mostly to the confined part of the aquifer. The GHB conductance in the calibrated model was reduced from the initial value of 3,500 ft^2/day to 20 ft^2/day. The effects of varying GHB conductance are greatest in the downdip parts of the aquifer. Recharge and GHB conductance have the combined effect of influencing the hydraulic gradient across the model.

Simulated water levels from the calibrated steady-state model are fairly close to measured water levels (fig. 9-1). The RMSE of the calibrated model is 32 feet, which is approximately 9 percent of the 343-foot range of measured water levels (fig. 9-2). This fact indicates that the average difference between measured and simulated water levels in the model is ±32 feet —acceptable because the result lies within the 10-percent target for model calibration.

In addition to the comparison of measured and simulated water levels, a comparison of measured streamflow and simulated drain discharge was used to indicate how well the model reproduces groundwater discharge to major streams and springs in the study area (fig. 9-3). There is general agreement between measured stream discharge of Shoal Creek, Lampasas River, Salado Creek, San Gabriel River, and Berry Creek, indicating that the steady-state model does a good job of reproducing baseflow to springs and streams.

The water budget of the steady-state model indicates that total groundwater flow through the model is approximately 80,000 acre-feet per year (table 9-1). Of this flow, 55 percent discharges to streams, 30 percent discharges through cross-formational flow, and 15 percent is pumped mostly for municipal and rural domestic uses. The water budget indicates that most natural discharge (~65 percent) and almost all recharge takes place in the unconfined part of the aquifer. This fact indicates that most groundwater circulation in the northern segment of the Edwards aquifer takes place in the unconfined part of the aquifer.

9.2 Steady-State Sensitivity Analysis

After calibration of the steady-state model was completed, the input parameters were analyzed to assess the sensitivity of model results to respective input parameters, that is, hydraulic conductivity, GHB conductance, pumping, and recharge. Sensitivity analysis is a method of quantifying uncertainty of the calibrated model related to uncertainty in the estimates of respective aquifer parameters, stresses, and boundary conditions (Anderson and Woessner, 1992). Determining the sensitivity of the model to specific parameters offers insights into the uniqueness of the calibrated model. Sensitivity analysis identifies which parameters have the greatest influence on water levels and groundwater discharge to springs and streams. A model is sensitive to a specified input parameter if relatively small changes in that parameter result in relatively large changes in simulated water levels. In other words, calibration is possible only over a narrow range of values and, consequently, model uncertainties are relatively low. A model is insensitive if relatively large changes of a specific input parameter produce relatively small water-level changes. Insensitivity results in higher uncertainties because the model will calibrate over a large range of input parameter values.

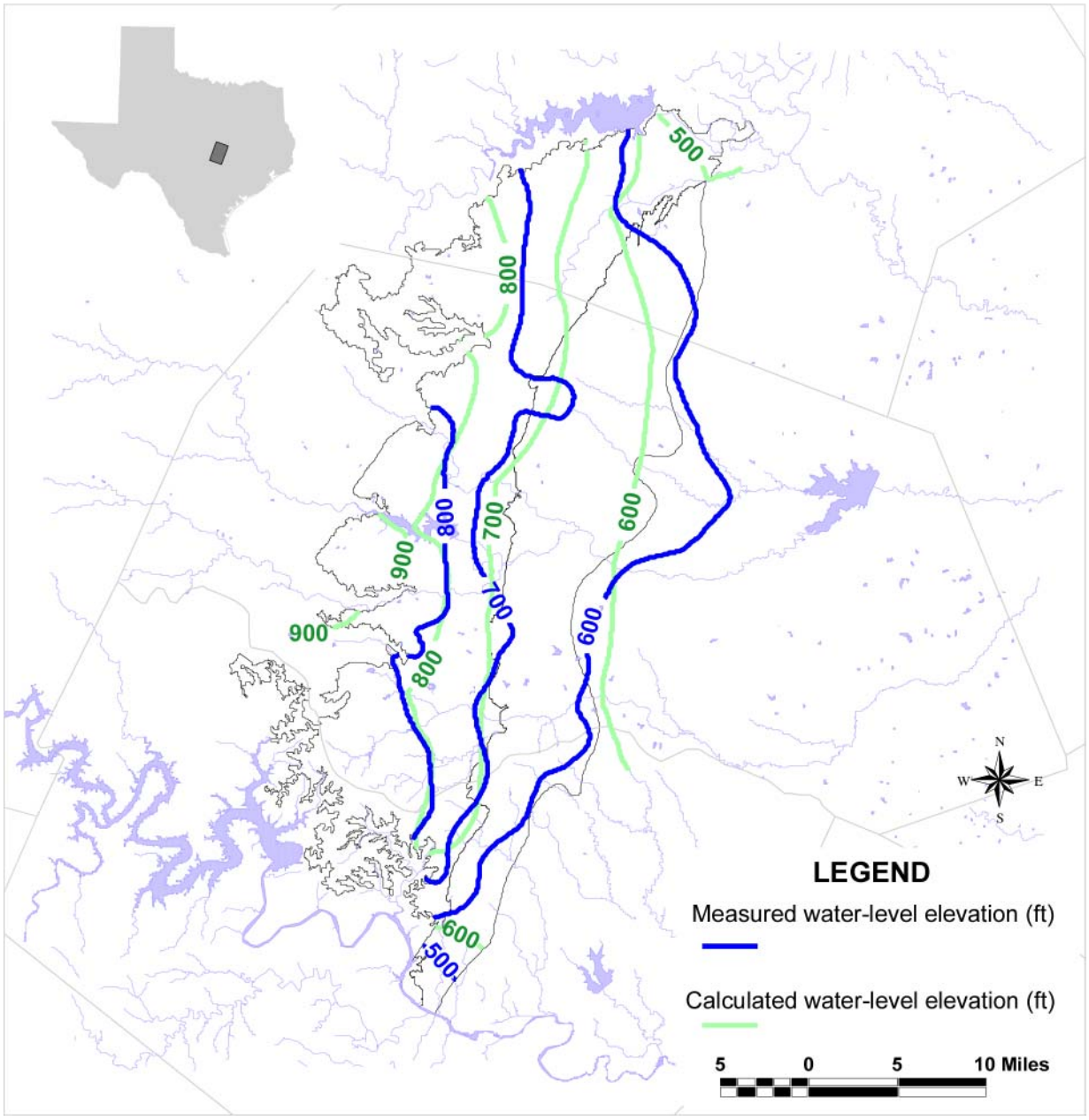

Figure 9-1. Distribution of measured and calculated water levels from the steady-state model.

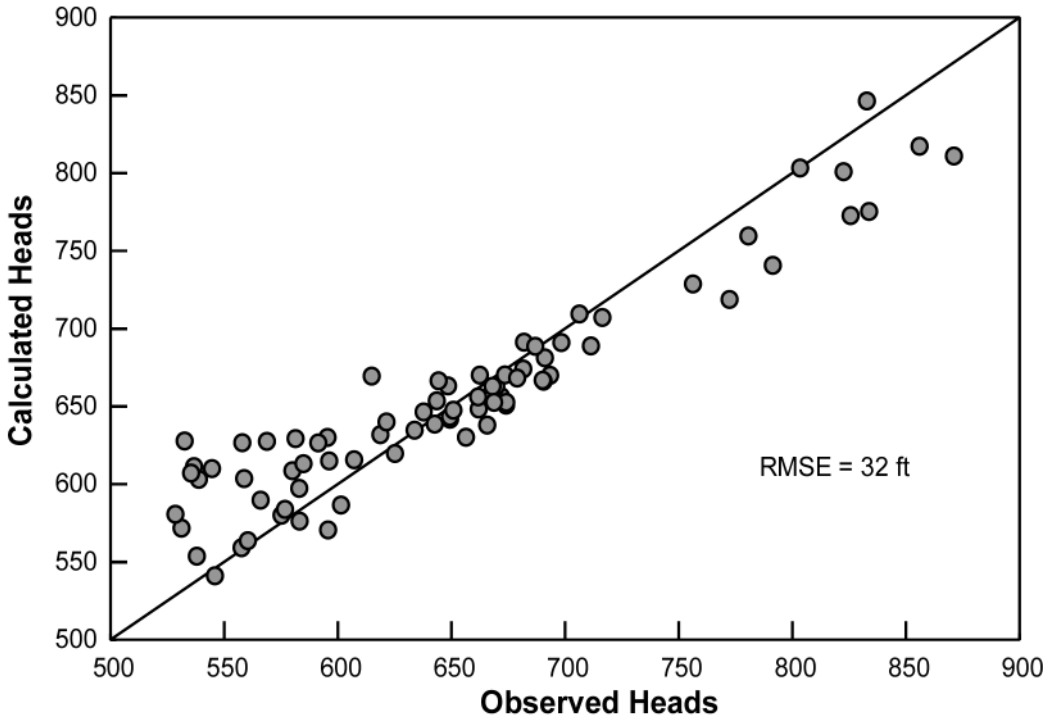

Figure 9-2. Measured and calculated water levels from the steady-state model.

Sensitivity is analyzed by systematically varying a parameter value and noting changes in water levels at the well locations used to calibrate the model. The water-level changes are quantified by calculating the Mean Difference as follows:

$$MD = \frac{1}{n}\sum_{i=1}^{n}\left(h_{sen} - h_{cal}\right)$$

where: n is the number of points, h_{sen} is the simulated water level for the sensitivity analysis, and h_{cal} is the calibrated water level. The Mean Difference is positive if water levels are higher than calibrated values and negative if they are lower than calibrated values.

Water levels in the model of the northern segment of the Edwards aquifer are most sensitive to recharge, and, to a lesser extent, to GHB conductance and pumping (fig. 9-4). The insensitivity of the model to hydraulic conductivity can be explained partly by the drain cells that simulate groundwater discharge to springs and streams in the unconfined part of the aquifer. Drain cells reduce the variation of water levels in the unconfined part of the aquifer. Discharge from the drains varies, counteracting the effects of hydraulic conductivity changes on water levels. Effects of recharge are greatest in the unconfined part of the aquifer because recharge is restricted to areas where aquifer rock is exposed at land surface. Effects of GHB conductance are greatest in the downdip parts of the aquifer, where GHB cells are located. General-Head Boundary conductance and recharge regulate the regional gradient of the aquifer. Varying recharge and GHB conductance raises and lowers water levels in up-gradient and down-gradient parts of the aquifer, respectively.

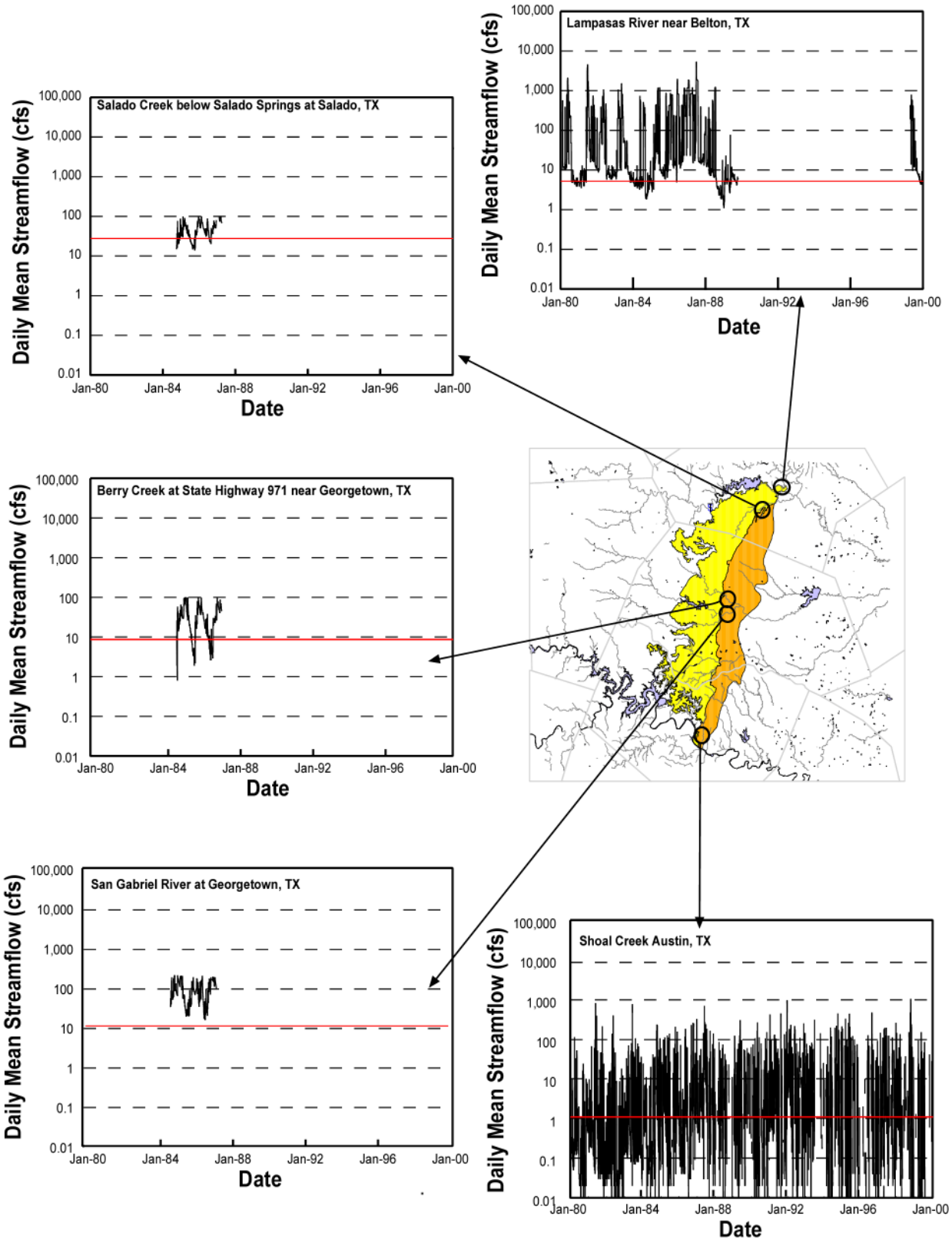

Figure 9-3. Measured (black) and calculated (red) streamflow from the steady-state model.

Table 9-1. Water budget for the calibrated steady-state model for 1980. Values expressed in acre-feet per year.

	In	Out	Net
Wells	-	13,000	-13,000
Drains	-	44,000	-44,000
Recharge	79,000	-	79,000
GHB	160	24,000	-24,000
% Difference			0.4%

County	Bell	Travis	Williamson
Recharge	23,000	53,000	4,000
Rivers	-24,000	-19,000	-1,400
GHB	-3,800	-18,000	-1,700
Wells	-400	-12,000	-600
Lateral Inflow	5,000	1,800	1,500
Lateral Outflow	-130	-6,600	-1,600
Total In	28,000	54,000	5,600
Total Out	-28,000	-55,000	-5,400
% Difference	-0.6%	-0.7%	3.3%

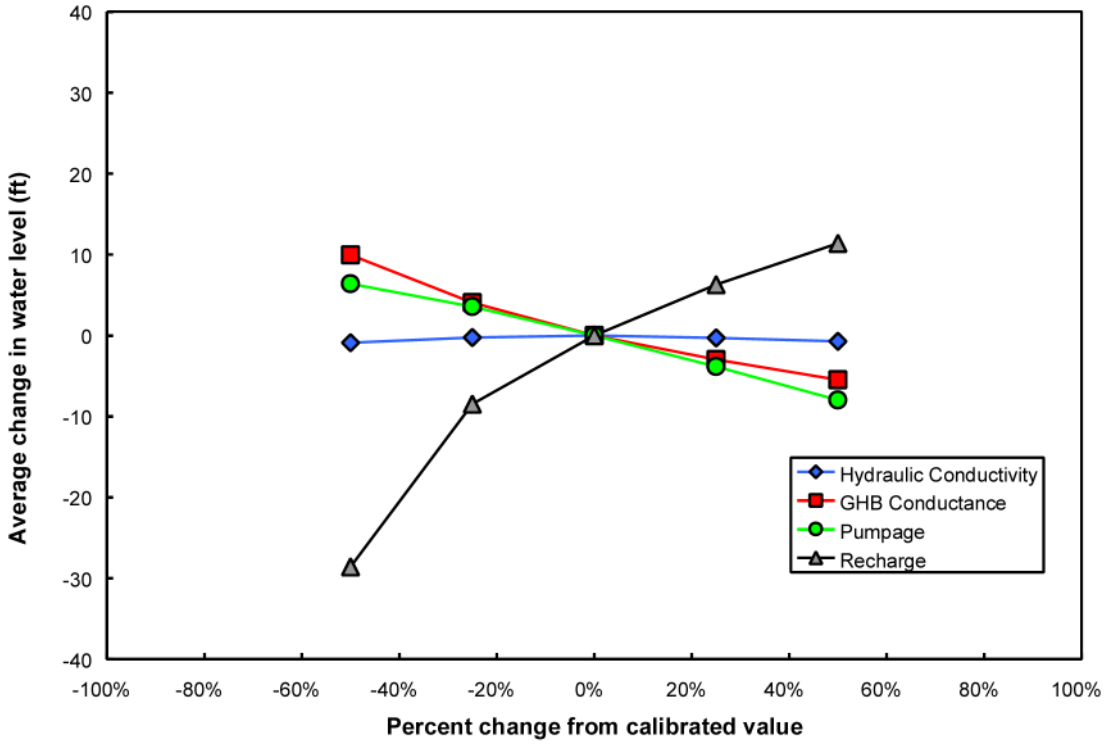

Figure 9-4. Sensitivity of numerically predicted water levels for 1980.

10.0 Transient Model

After calibration of the steady-state model to conditions in 1980, the model was then calibrated to simulate transient conditions during the period 1980 through 2000.

10.1 Transient Calibration

Water-level fluctuations during the period 1980 through 2000 were simulated using monthly stress periods. Calibration was achieved by adjusting storage parameter values, specific storage, and specific yield until the model responses approximated water-level fluctuations observed in wells in the model area. Specific yield is applicable to the unconfined part of the aquifer and is defined as the volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in the water level. Specific storage is applicable to the confined part of the aquifer and is defined as a measure of the volume of water per unit volume of aquifer rock that enters or leaves storage per unit change in water level. Specific storage and specific yield are important factors in transient calibration because they influence water-level responses to changes in recharge and discharge. Low specific storage or specific yield values result in water-level fluctuations that are larger and more rapid than those of higher specific storage or specific yield values. This difference occurs because less water is required to produce a given water-level change.

Best results were obtained using a specific storage of 5×10^{-6} per foot and a specific yield of 0.0005. In a small area in the western part of the model, characterized by very small water-level fluctuations over the transient period, a much higher specific yield of 0.05 was used (fig. 10-1). The specific storage value is the same as the value used in the groundwater availability model for the Barton Springs segment of the Edwards aquifer (Scanlon and others, 2001), which is not surprising because of the proximity of the two segments of the Edwards aquifer. The calibrated specific yield values (0.0005 to 0.05) in this model, although generally lower, overlap with the range of previous specific yield estimates in the region of 0.005 to 0.06 (Brune and Duffin, 1983; Slade and others, 1985; Scanlon and others, 2001). Overall, this model does a good job matching observed seasonal and interannual water-level and streamflow fluctuations (fig. 10-2 and 10-3). Differences between simulated and observed water-level fluctuations can be attributed to the influence of local-scale conditions that are not represented in this regional-scale model.

Over the calibration period, water-level fluctuations are generally greater in the unconfined part of the aquifer than in the confined part of the aquifer. This difference can be attributed to water-level responses to seasonal and interannual variation of recharge, coupled with the fact that most discharge from the aquifer also takes place in the unconfined part of the aquifer.

Comparison of model results and observations by Ridgeway and Petrini (1999) indicated general similarities. Despite rapid water-level fluctuations, the general trend over time indicates gradual water-level declines in the southern part of the model area, especially in the Pflugerville-Georgetown area (fig. 10-2). No long-term water-level declines occur in the less-populated, northern part of the model area.

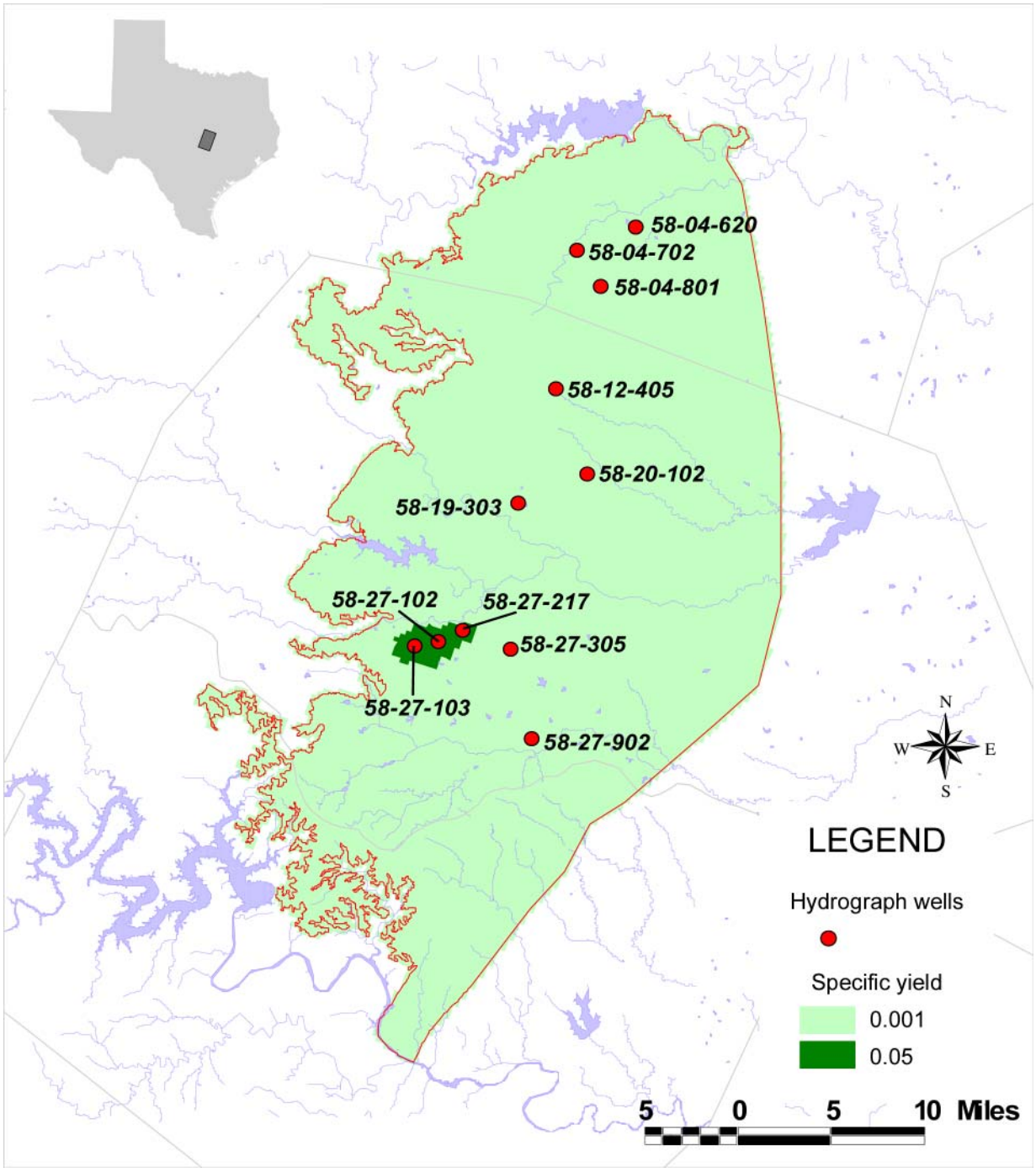

Figure 10-1. Distribution of specific yield in the model.

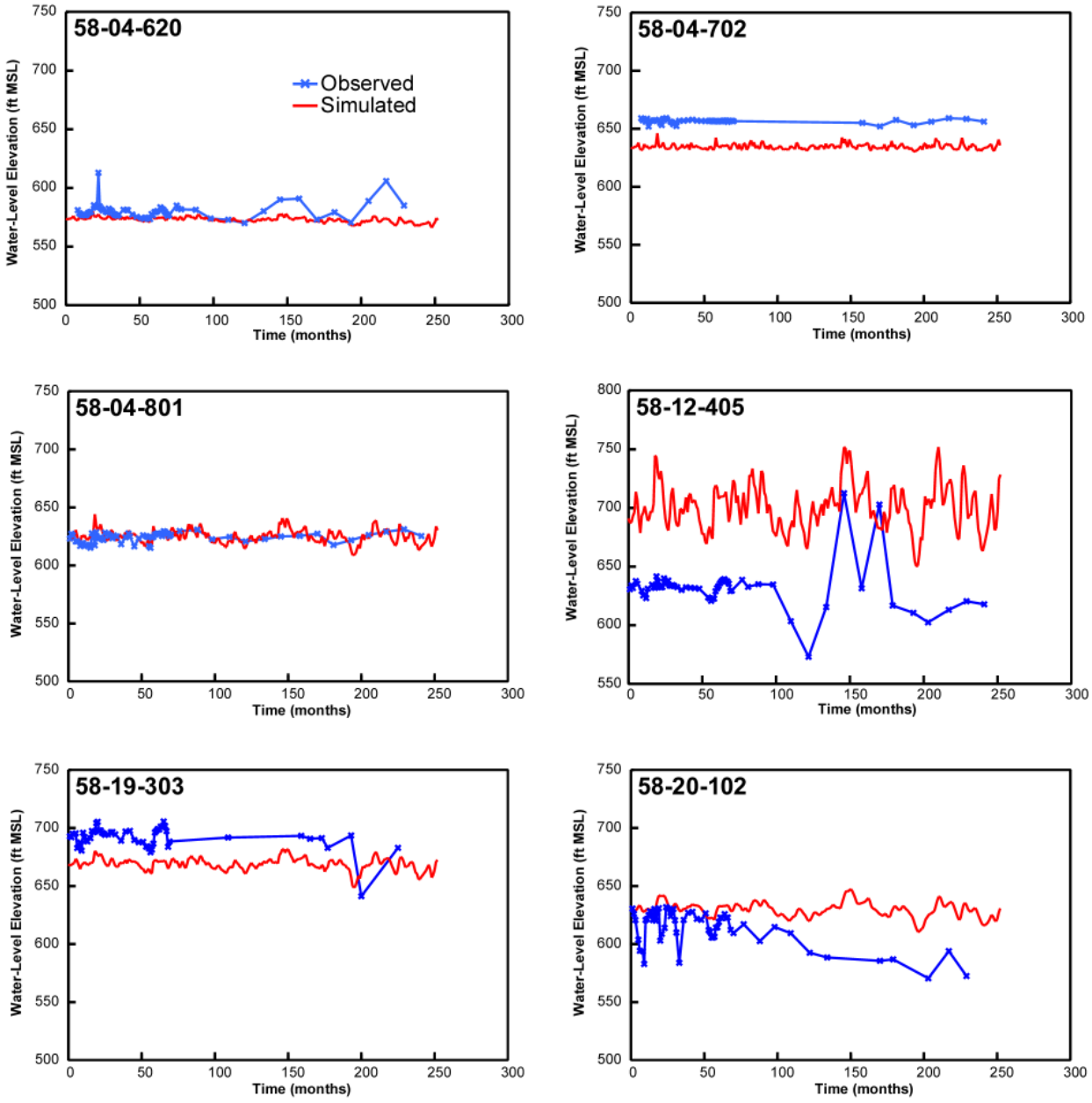

Figure 10-2. Measured and calculated water-level fluctuations for the period 1980 through 2000.

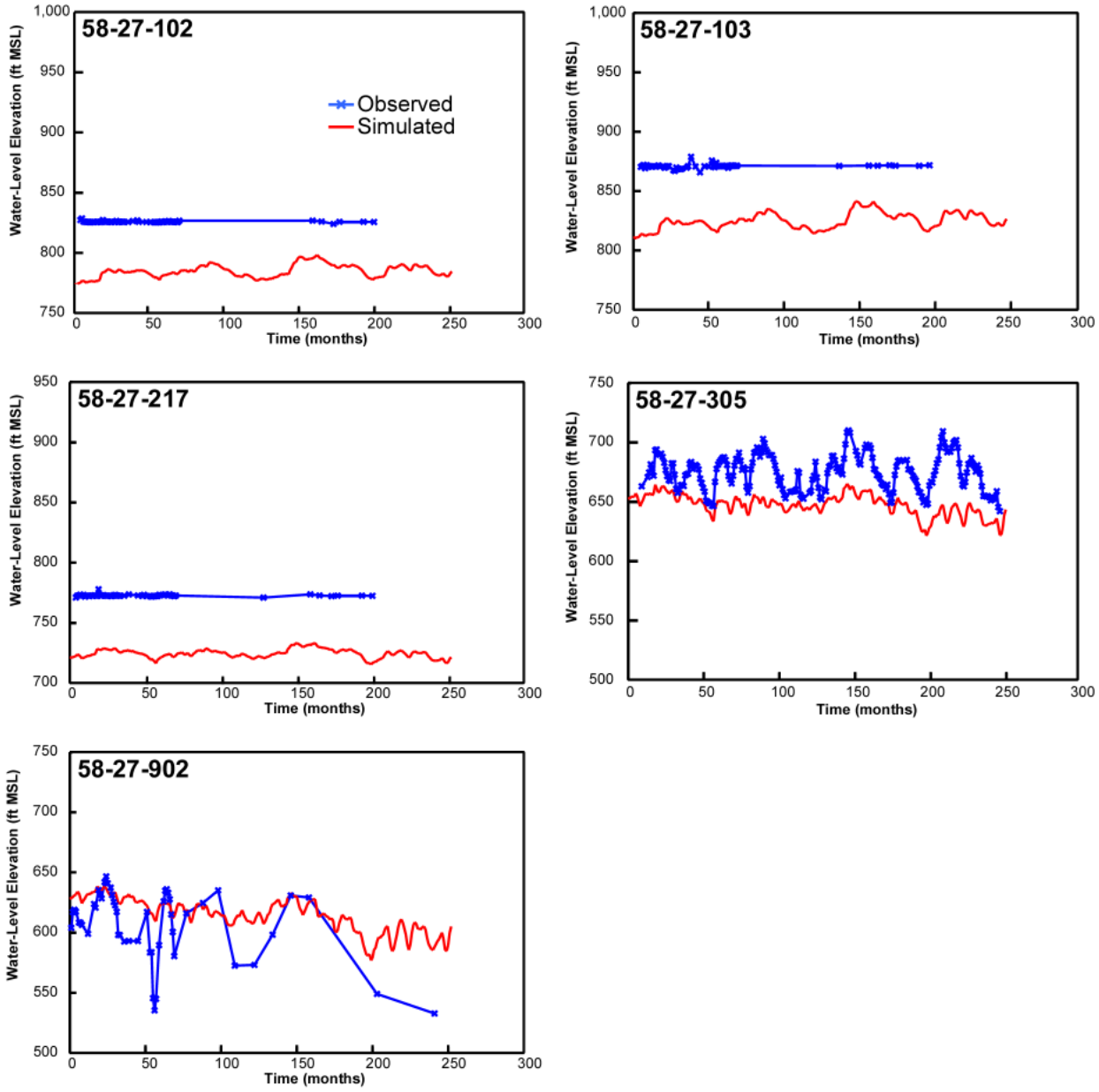

Figure 10-2. (cont.).

10.2 Transient Sensitivity Analysis

Upon completion of transient model calibration, the storage parameters were assessed to determine the sensitivity of the model to specific yield and specific storage. Sensitivity was analyzed by systematically varying specific yield and specific storage to determine associated changes in aquifer response over the transient model run.

Sensitivity analysis indicates that the overall model is more sensitive to variation of specific yield than specific storage. Variation of specific storage values ranging from 5×10^{-7} to 5×10^{-5}

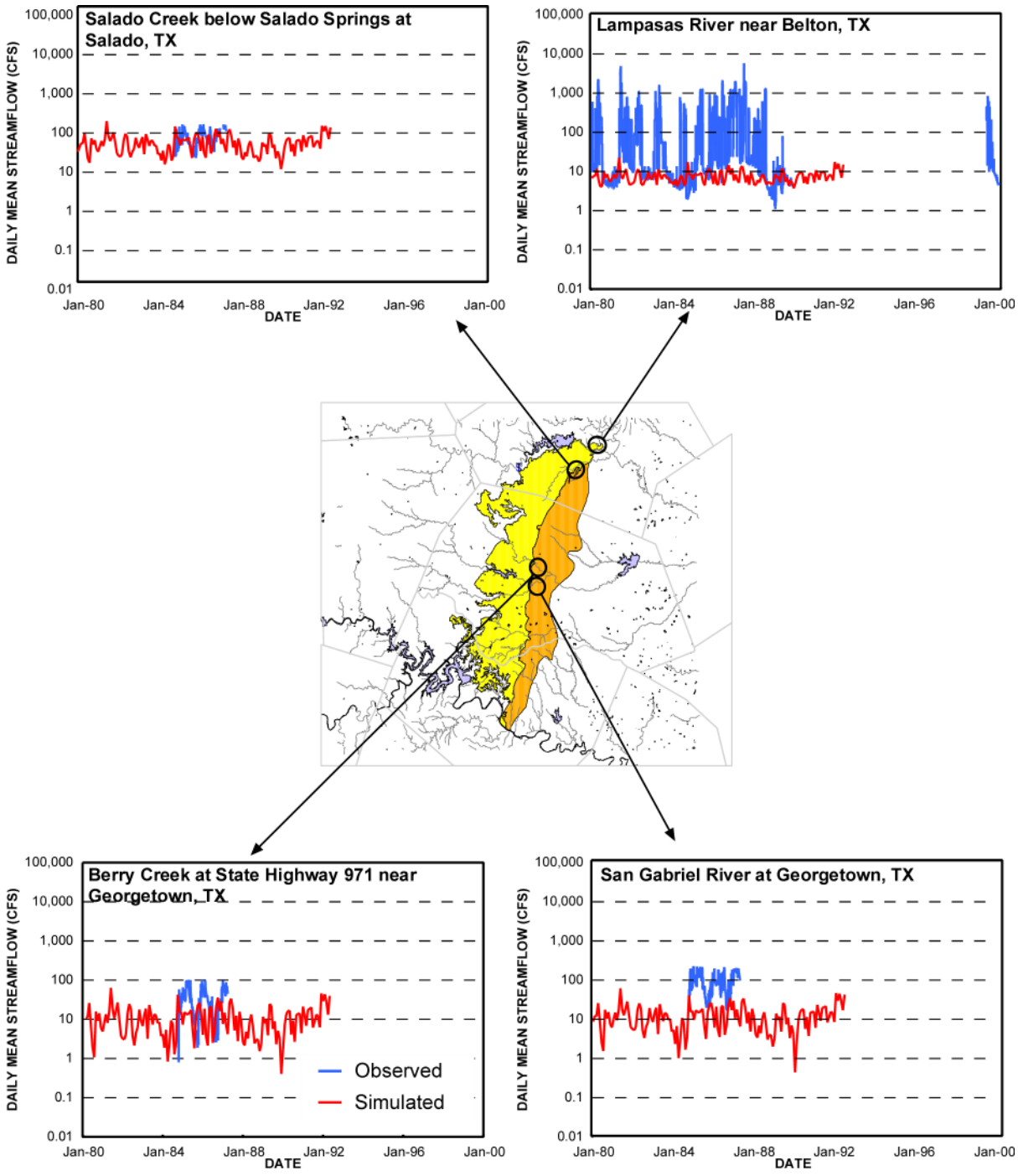

Figure 10-3. Measured and calculated streamflow fluctuations for the period 1980 through 2000.

per foot resulted in significant changes in simulated water-level responses only at calibration sites within the confined part of the aquifer (fig. 10-4). Variation of specific yield from 0.0005 to 0.05 produced significant variation of simulated water levels at calibration sites throughout the model area (fig. 10-5).

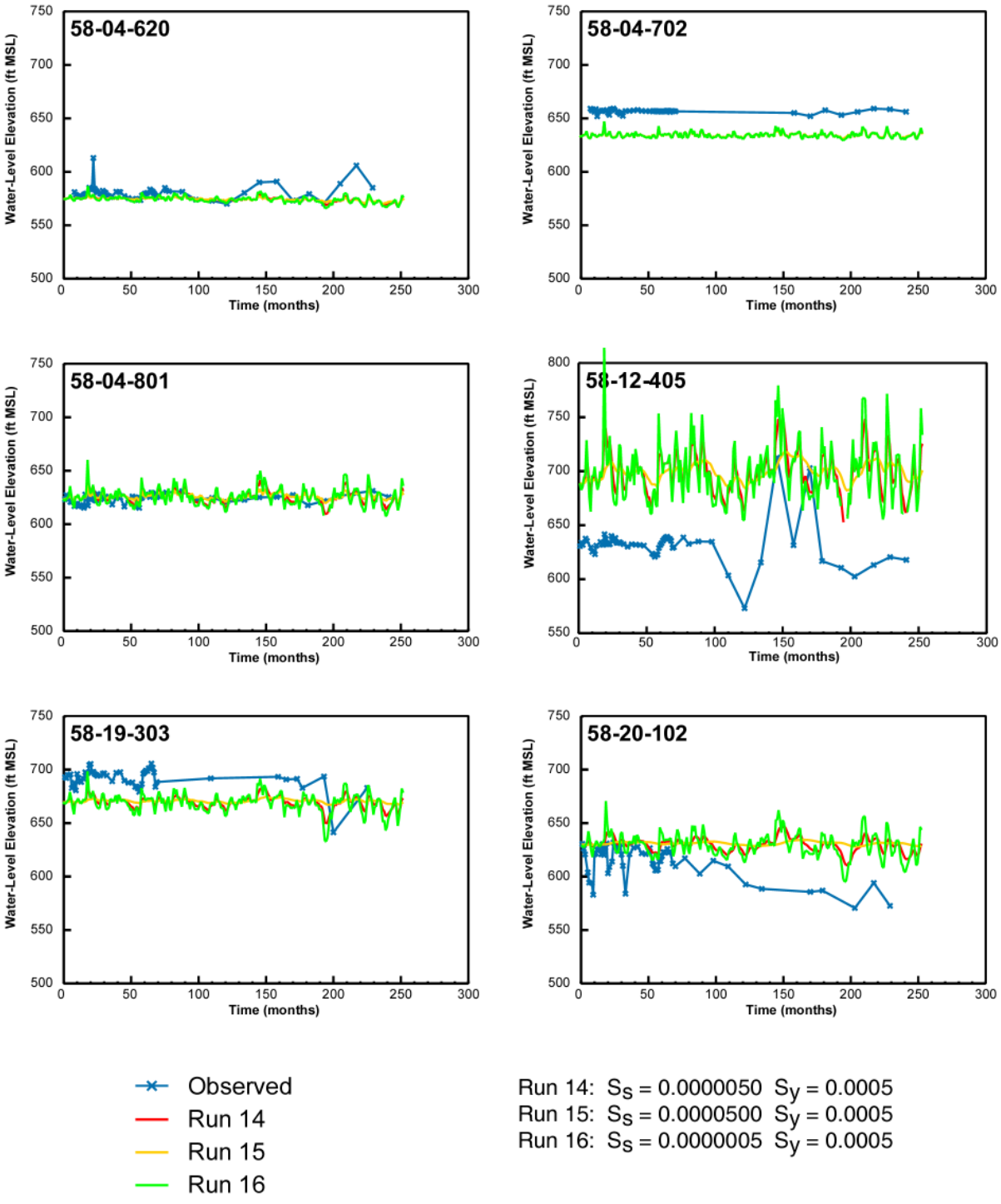

Figure 10-4. Sensitivity of model to specific storage.

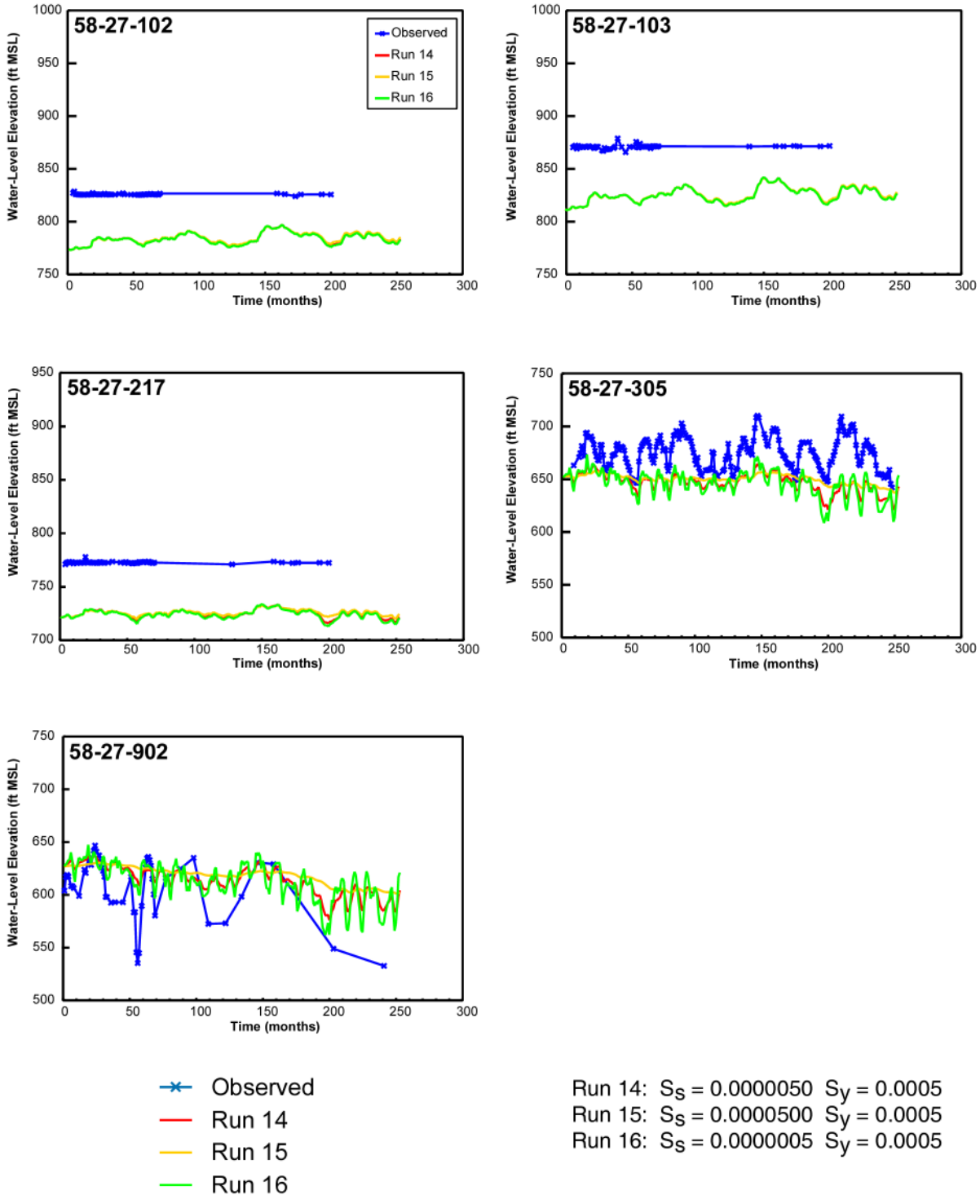

Figure 10-4. (cont.).

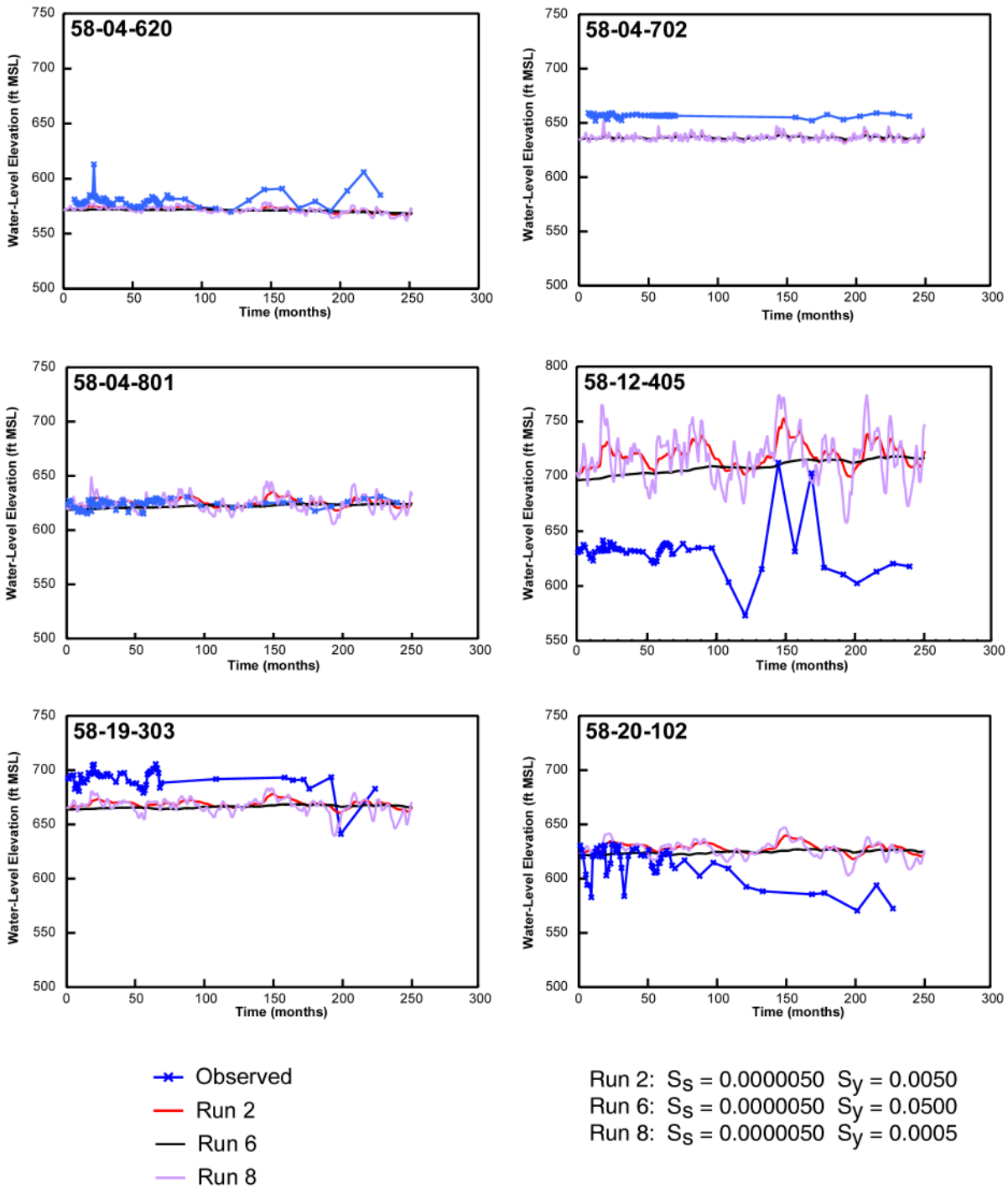

Figure 10-5. Sensitivity of model to specific yield.

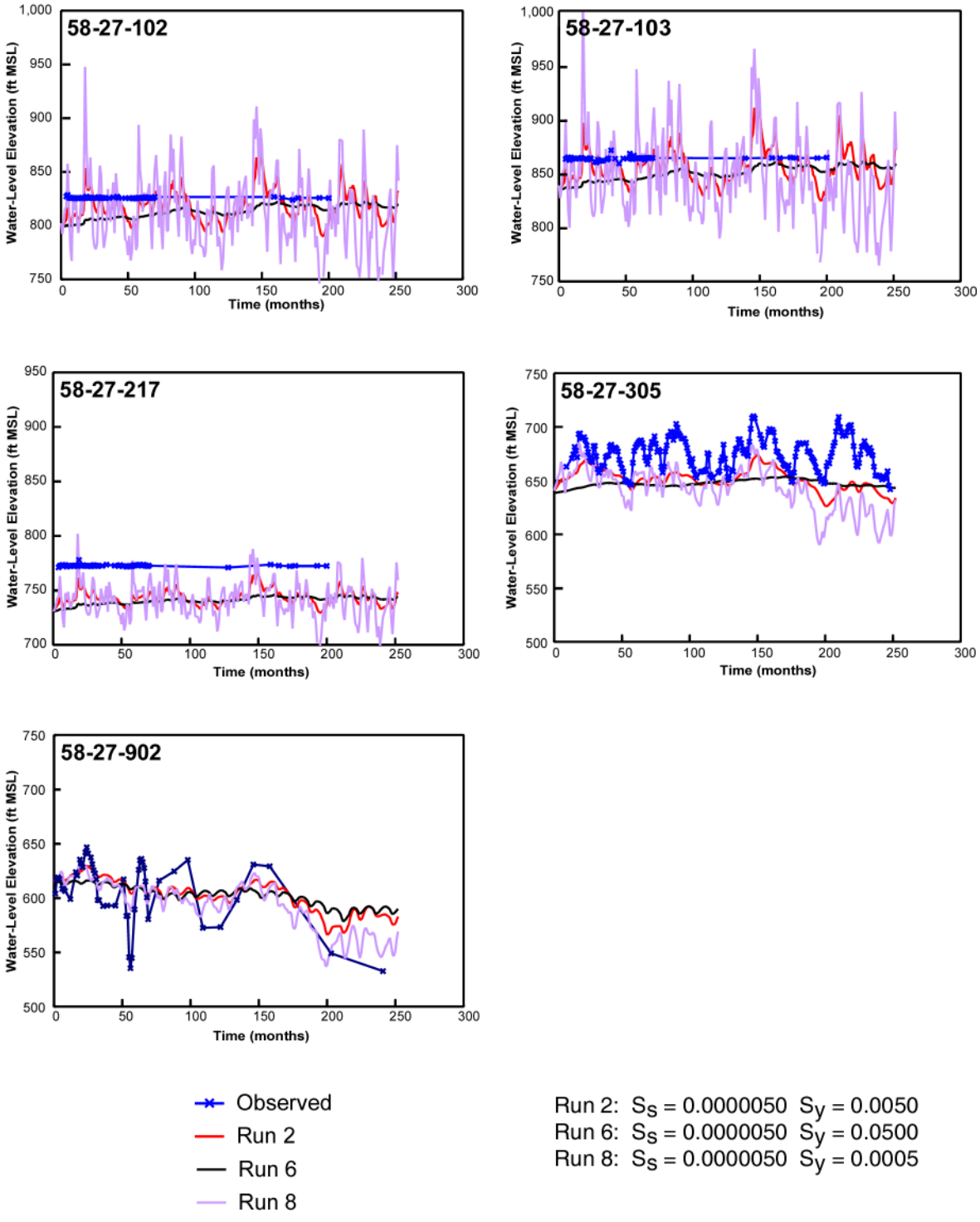

Figure 10-5. (cont.).

11.0 Predictions

As part of regional water planning, the regions assessed water demand and current supplies. If water demand exceeded current supplies, then there was a need for water. The regions then developed and recommended water management strategies to meet any water needs. In general, recommended water management strategies exceeded the needs for water. In these cases, the volume of water from current supplies plus recommended water management strategies exceeded projected demands. We decided that pumping assigned in the model needed to reflect projected demands more and not the full capacity of all recommended water management strategies. Therefore, in cases where demand exceeded current supplies and recommended water management strategies, we proportionally lowered the water needed from the different recommended water management strategies. We used a proportional approach because regions did not prioritize the different water management strategies and because a proportional approach does not favor one strategy over another.

To assess future availability of groundwater in the northern segment of the Edwards aquifer, the calibrated model was used to predict future water levels under average recharge and drought-of-record conditions. These simulations used projected groundwater pumping that took into account projected demand and water management strategies set by the regional planning groups in the study area. Water planning under drought conditions is a requirement of Senate Bill 1 water planning. The purpose of this water resources planning is to ensure that the state's future water needs are met, even during times of severe drought.

A drought can be defined as a period of deficient rainfall sufficient in length and severity to cause at least partial crop failure or to impair the ability to meet a normal water demand (Wilson and Moore, 1998). A drought of record is the most severe drought during the period of record in terms of duration and severity. For this model, the drought of record was determined by evaluating precipitation records for four stations in the model area. These stations are located at the Austin airport, Jarrell, Taylor, and Temple (fig. 3-8). The period of record for three of these stations began in the late 1920s and early 1930s, whereas records for the fourth station, Temple, extend back to 1900. Evaluation of these precipitation data indicates that the drought of record occurred during the period of 1954 through 1956. This drought coincides with the drought of record that affected most of Texas during the 1950s. At three of the four stations, 1954 is the driest year on record, although the drought of record in the study area was probably not as severe as in other parts of Texas. In the study area, the drought lasted only 3 years, and the precipitation during the second year of the drought (1955) approached, and in some cases exceeded, average annual precipitation.

In predictive model runs, the drought of record was simulated by recharge equivalent to 20 percent of the average of precipitation at the four stations during the years 1954, 1955, and 1956. These recharge rates are 0.0006, 0.0013, and 0.0008 ft/day, respectively. For non-drought years, average recharge (0.0012 ft/day) was used. To simulate future water levels in the aquifer over the period 2001 through 2050, six scenarios were run: (1) the 2010 Run, average recharge through 2007 and drought of record for the remaining 3 years; (2) the 2020 Run, average recharge through 2017 and drought of record for the remaining 3 years; (3) the 2030 Run, average recharge through 2027 and drought of record for the remaining 3 years; (4) the 2040 Run,

Table 11-1. Water budgets for the steady-state, transient, and predictive model runs expressed in acre-feet per year.

Year	Storage	Wells	Drains	Recharge	GHB
1980	-	-13,000	-44,000	79,000	-23,000
1990	-5,000	-18,000	-51,000	96,000	-21,000
2000	-9,500	-24,000	-68,000	120,000	-18,000
2010	3,300	-5,100	-29,000	53,000	-24,000
2020	3,400	-5,200	-29,000	53,000	-24,000
2030	3,400	-6,000	-28,000	53,000	-23,000
2040	3,400	-6,500	-28,000	53,000	-23,000
2050	3,400	-6,600	-28,000	53,000	-23,000
2050*	0	-6,600	-49,000	79,000	-25,000

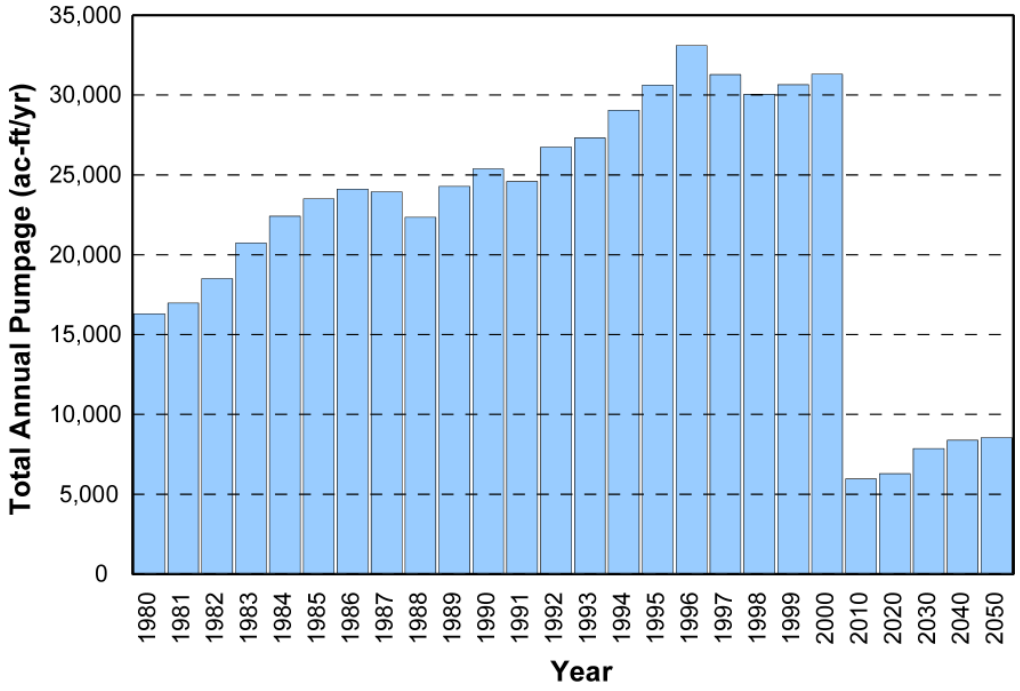

Figure 11-1. Historical and projected total pumping in the study area.

average recharge through 2037 and drought of record for the remaining 3 years; (5) the 2050 Drought Run, average recharge through 2047 and drought of record for the remaining 3 years; and (6) the 2050 Average Run, average recharge through 2050 (table 11-1). Predicted pumping data used in this model were obtained from the respective regional water planning groups. These data indicate projected pumping from the northern segment of the Edwards aquifer at much lower rates than at present (fig. 11-1). This difference is the result of conversion from the use of Edwards aquifer groundwater to surface water from reservoirs such as the Stillhouse Hollow Lake.

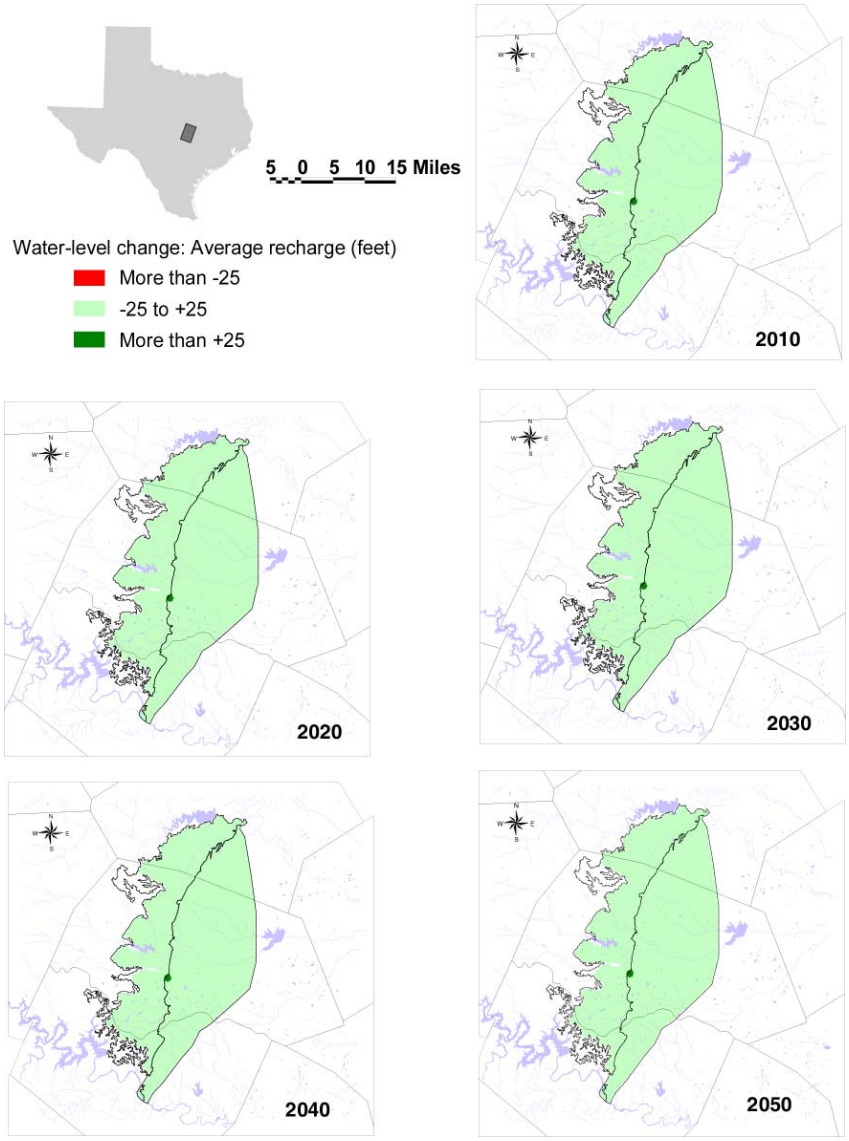

Figure 11-2. Simulated water-level changes 2010 through 2050, with average recharge.

Projected water-level changes for each decade were calculated by subtracting predicted water levels at the end of each decade from 1980 water levels, the beginning of transient calibration. Water levels from 1980 were selected as the baseline for determining predicted water-level change because they were characterized by average recharge. Consequently, differences in water levels between 1980 and future decades can not be attributed to differences in recharge rates except during drought years.

Under conditions of average recharge, predictive modeling indicates that future water levels in the northern segment of the Edwards aquifer will change less than 25 feet, compared with 1980 water levels (fig. 11-2). Under drought-of-record conditions, water-level declines occur primarily along the western margin of the aquifer (fig. 11-3).

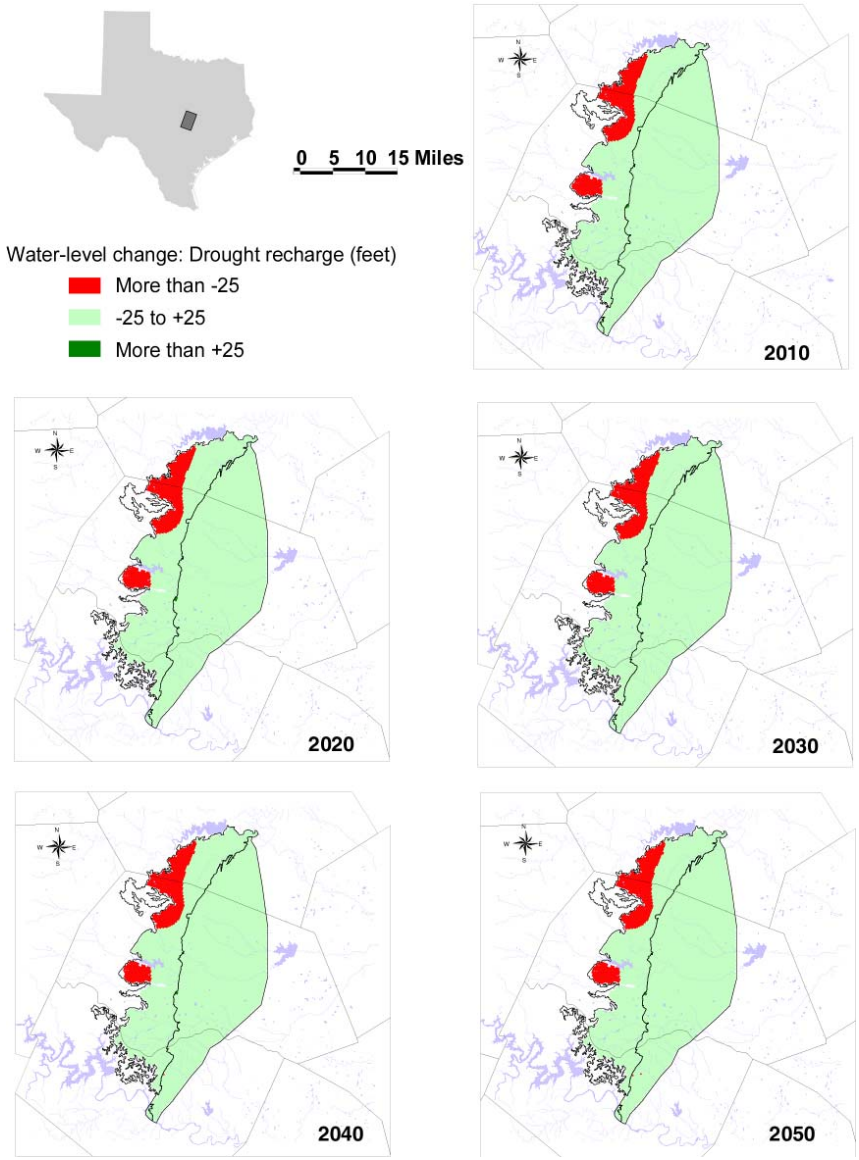

Figure 11-3. Simulated water-level changes 2010 through 2050, with drought-of-record recharge.

12.0 Limitations of the Model

All numerical groundwater flow models have limitations. These limitations are usually associated with (1) the extent of current understanding of the workings of the aquifer, (2) availability and accuracy of input data, and (3) assumptions and simplifications used in developing the conceptual and numerical models. The limitations determine the spatial and temporal variation of uncertainties in the model because calibration uncertainty decreases with increased availability of input data. Additionally, many of the assumptions, degree of simplification, and spatial resolution of groundwater flow models are influenced by availability of input data.

12.1 Input Data

Several input parameter data sets for the model are based on limited information. These include recharge, water-level and streamflow data, hydraulic conductivity, specific storage, and specific yield.

No information on the spatial or seasonal distribution of recharge to the northern segment of the Edwards aquifer has been published. Calibrated recharge rates of 20 percent of annual precipitation were obtained by trial-and-error. Application of this recharge rate to the transient model assumes that (1) a linear relationship exists between precipitation and recharge and (2) no threshold must be exceeded before recharge occurs. This assumption suggests the possibility of overestimating recharge during dry periods, when all precipitation may be taken up by evapotranspiration or absorbed by dry soils. A uniform spatial distribution of recharge to the aquifer was assumed for the model. This assumption follows the literature that suggests that recharge to the northern segment of the Edwards aquifer takes the form of generally diffuse recharge through soils, fractures, and intermittent streams in the aquifer outcrop (Duffin and Musick, 1991). The relatively good correlation between observed and simulated water levels and stream discharge suggests that, despite recharge uncertainties, the model water budget approximates the aquifer water budget.

Information on the spatial distribution of water levels in the northern segment of the Edwards aquifer is limited, especially along the updip and downdip margins of the aquifer. There is also model uncertainty associated with the number of wells with annual or more frequent water-level measurements. This uncertainty is especially apparent during the 1990s, when water-level measurements were made less frequently in the aquifer.

Uncertainty results from the paucity of streamflow data for the perennial streams that cross the aquifer outcrop. Available streamflow data for Berry Creek, Salado Creek, and the San Gabriel River are only for a few years during the mid- to late1980s. Streamflow data for the 1990s are absent for the Lampasas River. Uncertainty in stream discharge in the southern part of the model exists because (1) no streamflow data are available for Brushy Creek and (2) calibrating the model to stream discharge is difficult in perennial streams, such as Shoal and Walnut creeks, because they have low baseflow components.

Available transmissivity and hydraulic conductivity data for the northern segment of the Edwards aquifer is derived primarily from specific-capacity data obtained from wells located mostly in the central and southern parts of the model area. Most of these wells are located adjacent to the boundary between the confined and unconfined parts of the aquifer. No data exist from the unconfined part of the aquifer. These limited data are apparently random, suggesting local influences. Consequently, we decided to use a uniform hydraulic conductivity, based initially on the geometric mean of the available data, in this regional-scale model.

12.2 Assumptions

Several assumptions were made in the construction of this model. The most important assumptions were that (1) no groundwater flows between the northern segment of the Edwards

aquifer and the underlying Trinity aquifer; (2) recharge is restricted to the aquifer outcrop; (3) the Drain package of MODFLOW can be used to simulate discharge to streams flowing over the aquifer outcrop; (4) the GHB package of MODFLOW can be used to simulate cross-formational flow between the Edwards aquifer and overlying units, such as the Austin Chalk; and (5) negligible groundwater flow beyond the 3,000 mg/l isocon.

The northern segment of the Edwards aquifer is underlain by the Walnut Formation, which is reported to yield little or no water in the study area (Duffin and Musick, 1991). Consequently, it is unlikely that the Walnut Formation transmits significant amounts of groundwater between the Edwards and Trinity aquifers.

The Drain package of MODFLOW was used to simulate groundwater discharge to perennial streams in the study area. The Drain package allows water to move from the aquifer to rivers or streams, but not the reverse. Use of this package implies the assumption that the perennial streams are always gaining. This assumption is supported by streamflow gain-loss studies by Slade and others (2002). Additionally, steady-state and transient calibration results indicate overall agreement between measured and simulated discharge to perennial streams.

The GHB package was used to simulate cross-formational flow between the Edwards aquifer and overlying units. The spatial distribution of GHB cells in the model is based on the assumption that cross-formational flow takes place in downdip parts of the aquifer and along some valleys (Figure 6-3). It is also assumed that the hydraulic head on the boundary is equivalent to 90 feet below land surface and does not vary over time.

12.3 Scale of Application

The limitations described earlier and the nature of regional groundwater flow models affect the scale of application of the model. This model is most accurate in assessing regional-scale groundwater issues, such as predicting aquifer-wide water-level changes over the next 50 years that may result from different proposed water management strategies. Accuracy and applicability of the model decreases when moving from addressing regional- to local-scale issues because of limitations of the information used in model construction and the model cell size that determines spatial resolution of the model. Consequently, this model is not likely to accurately predict water-level declines associated with a single well because (1) these water-level declines depend on site-specific hydrologic properties not included in detail in regional-scale models and (2) the cell size used in the model is too large to resolve changes in water levels that occur over relatively short distances. Addressing local-scale issues requires a more detailed model, with local estimates of hydrologic properties, or an analytical model. This model is more useful in determining the impacts of groups of wells distributed over a few square miles. The model predicts changes in ambient water levels rather than actual water-level changes at a specific location, such as an individual well.

13.0 Future Improvements

The TWDB plans periodically to update, and thus improve, groundwater availability models. This model can be improved by incorporating greater complexity or hydrologic information that

was not available initially. Model uncertainty can be reduced with additional information on aquifer hydraulic properties, streamflow, water-level elevations, and recharge.

Additional streamflow data are required in order for us to better determine the seasonal and spatial distribution of stream discharge gain and loss. This ability will facilitate the use of the streamflow package of MODFLOW as a potentially superior alternative to the Drain package and to provide additional data for model calibration.

Additional hydraulic head measurements and aquifer-test data are required for the northern segment of the Edwards aquifer, especially the unconfined part of aquifer. This information can be used to improve calibration of the model by increasing the number and spatial distribution of sites for comparing measured and simulated water levels. Water-level data are needed for the stratigraphic units overlying the Edwards aquifer in order for the GHB to be better constrained. Aquifer tests will facilitate determination of whether improving the model by spatially distributing hydraulic conductivity, specific storage, and specific yield can be justified.

This model can also be improved by an investigation of the spatial and temporal distribution of recharge. Determination of the hydrologic conditions required for the occurrence of recharge to the northern segment of the Edwards aquifer will facilitate better constraints on the seasonal distribution of recharge to the aquifer.

14.0 Conclusions

A numerical groundwater flow model was constructed to simulate groundwater flow through the northern segment of the Edwards aquifer. It is to be used as a tool to evaluate groundwater resource management strategies by predicting water-level changes in response to pumping and drought. Model construction was based on available hydrologic and geologic data for the northern Edwards aquifer. The model is composed of one layer with 40,000 cells, 12,877 of which are active. The modeling approach included construction and calibration of steady-state (1980) and historical transient (1980 through 2000) models and using the resultant calibrated transient model to predict aquifer responses through 2050 under average recharge and drought-of-record conditions. The predictive model runs used projected pumping developed by the Brazos G and Lower Colorado Regional Water Planning Groups.

The calibrated model does a good job of matching water-level distribution and fluctuations in the aquifer and stream discharge. The RMSE for the steady-state model is 32 feet, about 9 percent of the hydraulic-head drop across the study area. Calibration of the steady-state and transient models resulted in (1) an average recharge rate of 20 percent of mean annual precipitation, (2) hydraulic conductivity of 25 ft/day, (3) specific yields of 0.05 to 0.0005, and (4) specific storage of 5×10^{-6} per foot. The model is most sensitive to changes in specific yield, recharge, and GHB conductance. This model indicates that approximately 50 to 70 percent of groundwater flow occurs within the unconfined part of the aquifer, resulting in discharge to perennial streams. Pumping, mostly for municipal, rural domestic, and industrial uses, accounts for less than 20 percent of groundwater discharge from the aquifer; the remaining 10 to 30 percent is discharge by cross-formational flow in the confined parts of the aquifer. The much larger water-level fluctuations in the unconfined compared with the confined part of the aquifer can be attributed to

a more active groundwater flow system, with almost all of the recharge and most of the groundwater discharge occurring from the unconfined part of the aquifer. Calibration of the transient model indicates that the model is able to reproduce historical water-level fluctuations that indicate gradual water-level declines in the Georgetown-Pflugerville area.

Predictive model runs indicate that under average recharge conditions, water levels will rise slightly relative to 1980 water levels throughout most of the study area over the 50-year planning period as a result of reduced pumping starting in 2001. Under drought-of-record conditions, water levels in the northern segment of the Edwards aquifer will decline, especially along the updip margin of the aquifer. In the predictive scenarios run, higher water levels occur in the central part of the study area. These higher water levels are the result of projected municipal and industrial pumping rates in the Round Rock-Georgetown area that are much lower than historical pumping rates. Pumping rates are expected to rise over the 2001 through 2050 period but will still be much lower than pre-2000 pumping rates. These lower pumping rates will result from conversion from the use of Edwards aquifer groundwater to surface water to meet water demands. Effects of these rising pumping rates are most apparent in the southern part of the study area.

15.0 Acknowledgements

In this modeling effort, many people should be acknowledged for their assistance. First and foremost, I would like to thank the Clearwater Underground Water Conservation District for its support and interest during the model development. A number of TWDB staff members have also been helpful in providing assistance and advice, including Roberto Anaya, Ali Chowdhury, Cindy Ridgeway, Richard Smith, and Shirley Wade. The support of TWDB management, including Robert Mace, William Mullican, and Kevin Ward, has been helpful in ensuring the successful completion of this project.

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Appendix C
Austin Sheet – Geologic Atlas of Texas

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
W. L. FISHER, DIRECTOR

EXPLANATION

Recent
- Qal — Alluvium
- Qt (Qa | Qhg) — Fluviatile terrace deposits
- Ql — Lissie Formation undivided

Pleistocene
- Qw (Qwl | Qwc) — Willis Formation

Miocene
- Mf — Fleming Formation
- Mo — Oakville Sandstone
- Mc — Catahoula Formation

Eocene or Oligocene
- Ewb — Wellborn Formation
- Ecs — Caddell Formation
- Ey — Yegua Formation
- Ecm — Cook Mountain Formation
- Es — Sparta Sand
- Ew — Weches Formation
- Eqc — Queen City Sand
- Er — Reklaw Formation
- Ec — Carrizo Sand

Eocene
- Ecb (Ewc | Esb | Ewn | Eh) — Wilcox Group

Upper Cretaceous
- Emi — Midway Group
- Ki — Cretaceous igneous rocks
- Knm (Kpg | Kns | Kpg | Ko) — Navarro Group and Marlbrook Marl ("upper Taylor marl"), Pecan Gap Chalk, and Ozan Formation ("lower Taylor marl")
- Kau — Austin Chalk
- Keb (Kef | Kbu) — Eagle Ford Group and Buda Limestone
- Kdg (Kdr | Kgt) — Del Rio Clay ("Grayson Marl") and Georgetown Formation
- Kfr (Ked | Kc | Kkc | Kcp | Kwd | Kbc) — Fredericksburg Group
- Kpa — Paluxy Sand

Lower Cretaceous
- Kgr(u) (Kgr(l)) — Glen Rose Formation
- Kh — Hensell Sand

Fault — U / D

U, upthrown side; D, downthrown side; dashed where inferred

QUATERNARY
TERTIARY
CRETACEOUS

Prepared by the Army Map Service (AJSX), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1954 by photogrammetric methods. Horizontal and vertical control by USGS and USC&GS. Aerial photography 1952-53. Photography field annotated 1954. Limited revision by U. S. Geological Survey 1963.

100,000-foot grids based on Texas coordinate system, central and south central zones.

10,000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue.

Partially funded by Texas Department of Water Resources

VIRGIL E. BARNES, PROJECT DIRECTOR

Geologic mapping by Shell Oil Company, Humble Oil & Refining Company, Mobil Oil Company, Shell Development Company, C. V. Proctor, Jr., T. E. Brown, J. H. McGowen, N. B. Waechter, and sources shown on the Index of Geologic Mapping. C. V. Proctor, Jr., T. E. Brown, J. H. McGowen, and N. B. Waechter compiled the geologic mapping on high altitude aerial photographs, compiled unmapped areas photogeologically, and field checked all mapping. Geologic mapping reviewed by Austin Geological Society, Geologic Atlas Committee, D. H. Eargle, Chairman, and E. T. Baker, Jr. (U. S. Geological Survey) and R. C. Peckham and R. L. Bluntzer (Texas Water Development Board). Geology scribed by J. W. Macon.

LOCATION MAP

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 Nautical Miles

CONTOUR INTERVAL 50 FEET

TRANSVERSE MERCATOR PROJECTION

1960 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 9°30' EASTERLY FOR THE CENTER OF THE WEST EDGE TO 8°30' EASTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 0°05' WESTERLY.

GEOLOGIC ATLAS OF TEXAS, AUSTIN SHEET

FRANCIS LUTHER WHITNEY MEMORIAL EDITION

REPRINTED 1981

INDEX OF GEOLOGIC MAPPING

Numbers in outlined areas refer to items in bibliography in "Index to Areal Geologic Maps in Texas, 1891-1961," by T. E. Brown (1963), Bureau of Economic Geology, The University of Texas at Austin. For area A, see G. L. Dawe, L. E. Garner, and P. U. Rodda (MS.) Geology of the Mansfield Dam quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area B, see M. A. C. Rogers, G. L. Dawe, and P. U. Rodda (MS.) Geology of the Jollyville quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area C, see K. P. Young (MS.) Geology of the Pflugerville West quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area D, see G. L. Dawe, L. E. Garner, and P. U. Rodda (MS.) Geology of the Bee Cave quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area E, see P. U. Rodda, L. E. Garner, and G. L. Dawe (1970) Geology of the Austin West quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map No. 38; for area F, see K. P. Young and L. E. Garner (MS.) Geology of the Austin East quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area G, see K. P. Young and L. E. Garner (MS.) Geology of the Manor quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area H, see K. P. Young and L. E. Garner (MS.) Geology of the Montopolis quadrangle, Travis County, Texas, Univ. Texas Austin, Bur. Econ. Geology Geol. Quad. Map; for area I, see L. E. Garner and K. P. Young (MS.) Geology of the Oak Hill quadrangle, Travis County, Texas, Univ. Texas, Austin, Bur. Econ. Geology Geol. Quad. Map; and area J from E. T. Baker, Jr., and J. A. Watson (MS map by Baker) Quantity of low flow in Barton Creek, Texas, July 6-8 and October 1-3, 1970. Prepared by the U. S. Geological Survey in cooperation with the Texas Water Development Board.

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LEGEND

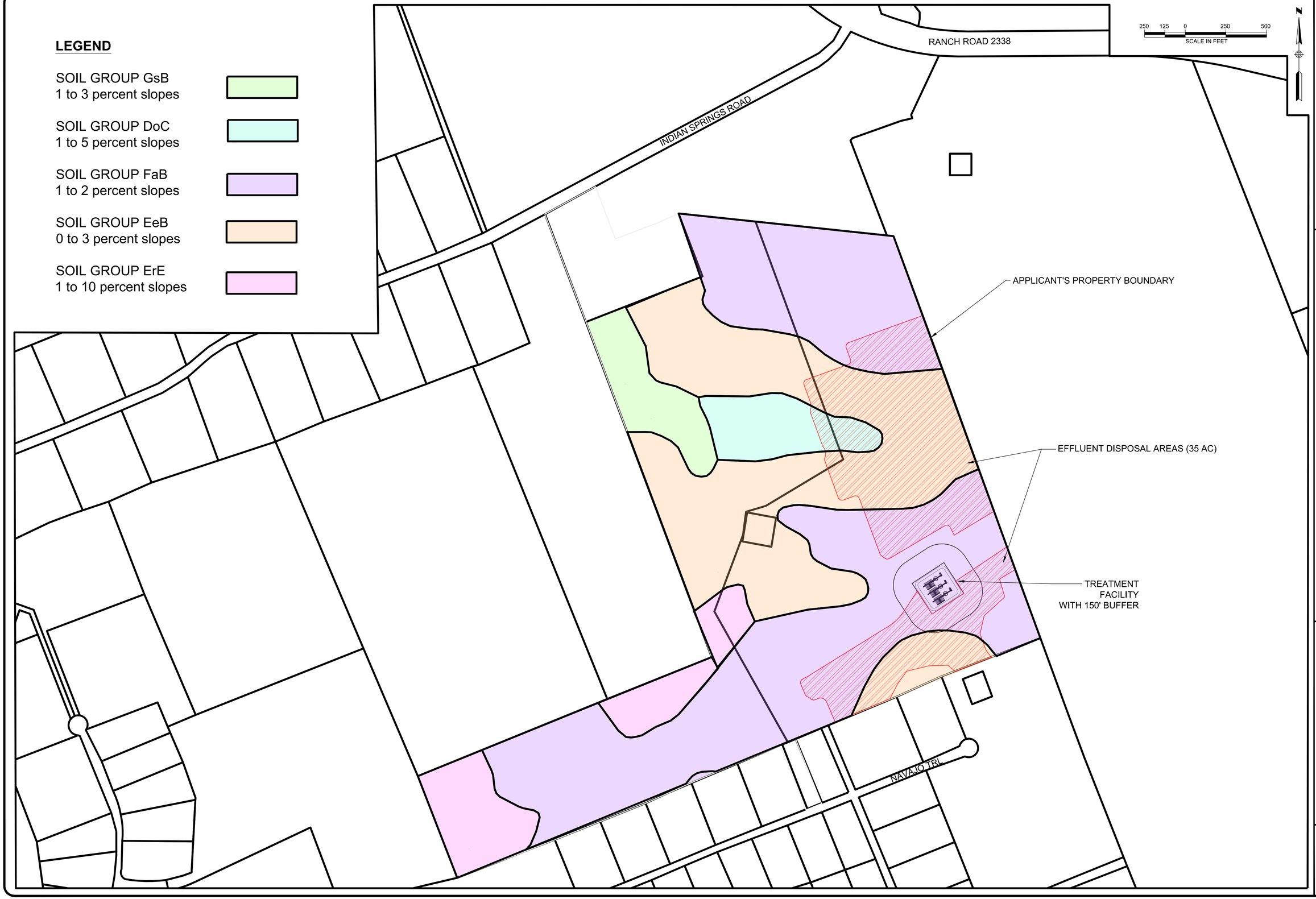
SOIL GROUP GsB
1 to 3 percent slopes

SOIL GROUP DoC
1 to 5 percent slopes

SOIL GROUP FaB
1 to 2 percent slopes

SOIL GROUP EeB
0 to 3 percent slopes

SOIL GROUP ErE
1 to 10 percent slopes



SOILS MAP

REAGOR TRACT WWTP

WILLIAMSON COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735

Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

1 OF 1

I:\a444 Hanover\TLAP\Exhibits\Soil Map.dwg

TEXAS A&M AGRILIFE EXTENSION

Soil Analysis Report

Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478

Visit our website: http://soiltesting.tamu.edu

Report generated for:
Wastewater Solutions
Reagor Ranch
9217 Hwy 290 West - Ste 100
AUSTIN, TX 78736

Sample received on: 1/31/2025
Printed on: 2/11/2025
Area Represented: not provided

Ellis County
Laboratory Number: 676255
Customer Sample ID: 12-18
Crop Grown: IMPROVED AND HYBRID BERMUDA GRASS (3 HAY CUTTINGS-2 TONS/A AVG.)

Analysis	Results	CL*	Units	ExLow	VLow	Low	Mod	High	VHigh	Excess.	Fertilizer Recommended
pH	**8.1**	(5.8)	-	**Mod. Alkaline**							
Conductivity	**136**	(-)	umho/cm	**None**				CL*			
Nitrate-N	**2**	(-)	ppm**								**95** lbs N/acre
Phosphorus	**1**	(50)	ppm								**120** lbs P2O5/acre
Potassium	**76**	(150)	ppm								**120** lbs K20/acre
Calcium	**49,754**	(180)	ppm								**0** lbs Ca/acre
Magnesium	**207**	(50)	ppm								**0** lbs Mg/acre
Sulfur	**259**	(13)	ppm								**0** lbs S/acre
Sodium	**14**	(-)	ppm								
Iron											
Zinc											
Manganese											
Copper											
Boron											
Limestone Requirement											**0.00** tons 100ECCE/acre

			Detailed Salinity Test (Saturated Paste Extract)			
			pH	**7.2**		
			Conductivity	**0.40**	mmhos/cm	
			Sodium	**11**	ppm	**0.479** meq/L
			Potassium	**1**	ppm	**0.033** meq/L
			Calcium	**69**	ppm	**3.463** meq/L
TKN	**583**	ppm	**Magnesium**	**2**	ppm	**0.160** meq/L
TN	**807**	ppm	**SAR**	**0.36**		
Ammonium-N	**3.7**	ppm	**SSP**	**11.58**		

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Nitrogen: Apply an additional 100 lbs/A of nitrogen for each subsequent hay cuttings.

Potassium: Split apply potassium fertilizer if recommendation is for more than 75 lbs K2O per acre.

Online fertilizer calculators to determine appropriate fertilizers and application rates.
http://soiltesting.tamu.edu

Methods: pH and conductivity/ 2:1; nitrate-N/Cd-red.; P, K, Ca, Mg, Na, and S/Mehlich 3 by ICP; Fe, Zn, Mn, and Cu/DTPA by ICP; and B/hot water by ICP.

Soil Analysis Report

Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478

Visit our website: http://soiltesting.tamu.edu

Report generated for:
Wastewater Solutions
Reagor Ranch
9217 Hwy 290 West - Ste 100
AUSTIN, TX 78736

Sample received on: 1/31/2025
Printed on: 2/11/2025
Area Represented: not provided

Ellis County
Laboratory Number: 676256
Customer Sample ID: 18-30
Crop Grown: IMPROVED AND HYBRID BERMUDA GRASS (3 HAY CUTTINGS-2 TONS/A AVG.)

Analysis	Results	CL*	Units	ExLow	VLow	Low	Mod	High	VHigh	Excess.	Fertilizer Recommended
pH	8.0	(5.8)	-	Mod. Alkaline							
Conductivity	351	(-)	umho/cm	None							
Nitrate-N	0	(-)	ppm**								95 lbs N/acre
Phosphorus	2	(50)	ppm	III							120 lbs P2O5/acre
Potassium	201	(150)	ppm								0 lbs K20/acre
Calcium	42,663	(180)	ppm								0 lbs Ca/acre
Magnesium	398	(50)	ppm								0 lbs Mg/acre
Sulfur	256	(13)	ppm								0 lbs S/acre
Sodium	38	(-)	ppm								
Iron											
Zinc											
Manganese											
Copper											
Boron											
Limestone Requirement											0.00 tons 100ECCE/acre

			Detailed Salinity Test (Saturated Paste Extract)			
			pH	7.1		
			Conductivity	0.42	mmhos/cm	
			Sodium	9	ppm	0.376 meq/L
			Potassium	2	ppm	0.044 meq/L
			Calcium	82	ppm	4.067 meq/L
TKN	768	ppm	Magnesium	1	ppm	0.122 meq/L
TN	1066	ppm	SAR	0.26		
Ammonium-N	3.7	ppm	SSP	8.15		

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Nitrogen: Apply an additional 100 lbs/A of nitrogen for each subsequent hay cuttings.

Online fertilizer calculators to determine appropriate fertilizers and application rates.
http://soiltesting.tamu.edu

Methods: pH and conductivity/ 2:1; nitrate-N/Cd-red.; P, K, Ca, Mg, Na, and S/Mehlich 3 by ICP; Fe, Zn, Mn, and Cu/DTPA by ICP; and B/hot water by ICP.

Soil Analysis Report

Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
2478 TAMU
College Station, TX 77843-2478

Visit our website: http://soiltesting.tamu.edu

Report generated for:
Wastewater Solutions
Reagor Ranch
9217 Hwy 290 West - Ste 100
AUSTIN, TX 78736

Sample received on: 1/31/2025
Printed on: 2/11/2025
Area Represented: not provided

Ellis County
Laboratory Number: 676254
Customer Sample ID: 0-6
Crop Grown: IMPROVED AND HYBRID BERMUDA GRASS (3 HAY CUTTINGS-2 TONS/A AVG.)

Analysis	Results	CL*	Units	ExLow VLow Low Mod High VHigh Excess.	Fertilizer Recommended
pH	**7.8**	(5.8)	-	**Mod. Alkaline**	
Conductivity	**206**	(-)	umho/cm	**None**	
Nitrate-N	**4**	(-)	ppm**		**90** lbs N/acre
Phosphorus	**12**	(50)	ppm		**90** lbs P2O5/acre
Potassium	**230**	(150)	ppm		**0** lbs K20/acre
Calcium	**33,062**	(180)	ppm		**0** lbs Ca/acre
Magnesium	**154**	(50)	ppm		**0** lbs Mg/acre
Sulfur	**206**	(13)	ppm		**0** lbs S/acre
Sodium	**7**	(-)	ppm		
Iron					
Zinc					
Manganese					
Copper					
Boron					
Limestone Requirement					**0.00** tons 100ECCE/acre

			Detailed Salinity Test (Saturated Paste Extract)		
			pH	**7.1**	
			Conductivity	**0.69** mmhos/cm	
			Sodium	**3** ppm	**0.134** meq/L
			Potassium	**13** ppm	**0.335** meq/L
			Calcium	**146** ppm	**7.285** meq/L
TKN	**2685**	ppm	**Magnesium**	**3** ppm	**0.260** meq/L
TN	**3541**	ppm	**SAR**	**0.07**	
Ammonium-N	**9.5**	ppm	**SSP**	**1.68**	

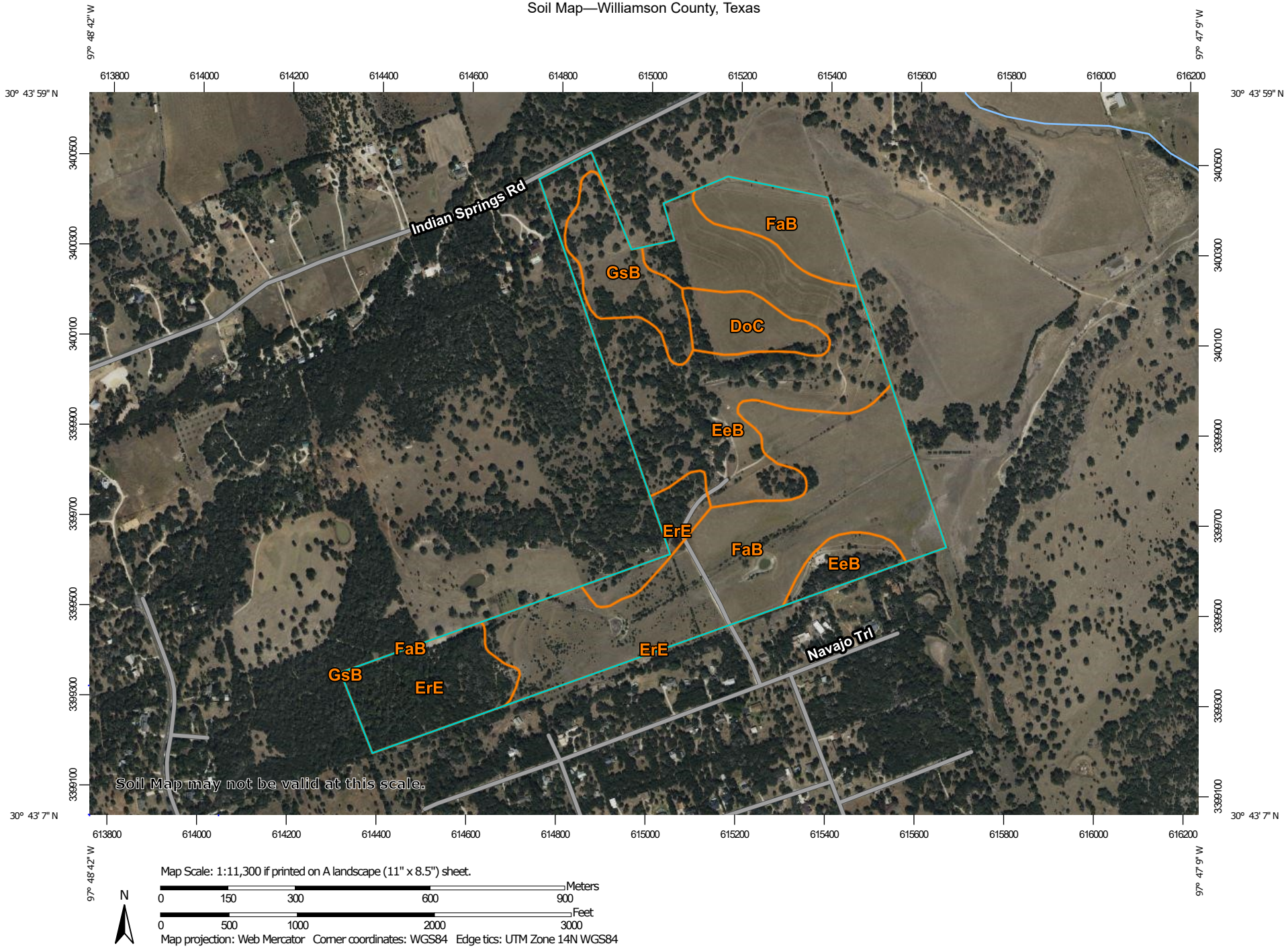
*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg

Nitrogen: Apply an additional 100 lbs/A of nitrogen for each subsequent hay cuttings.

Online fertilizer calculators to determine appropriate fertilizers and application rates.
http://soiltesting.tamu.edu

Methods: pH and conductivity/ 2:1; nitrate-N/Cd-red.; P, K, Ca, Mg, Na, and S/Mehlich 3 by ICP; Fe, Zn, Mn, and Cu/DTPA by ICP; and B/hot water by ICP.

Soil Map—Williamson County, Texas



Map Scale: 1:11,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Texas
Survey Area Data: Version 25, Aug 30, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DoC	Doss silty clay, moist, 1 to 5 percent slopes	8.4	4.8%
EeB	Eckrant stony clay, 0 to 3 percent slopes, stony	61.6	35.4%
ErE	Eckrant-Rock outcrop association, 1 to 10 percent slopes	22.1	12.7%
FaB	Fairlie clay, 1 to 2 percent slopes	69.2	39.7%
GsB	Georgetown stony clay loam, 1 to 3 percent slopes	12.8	7.4%
Totals for Area of Interest		**174.1**	**100.0%**

PERMIT NO. WQ0016685001

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P.O. Box 13087
Austin, Texas 78711-3087

PERMIT TO DISCHARGE WASTES
under provisions of Chapter 26
of the Texas Water Code

George Reagor and Laura Reagor

whose mailing address is

906 East Sandstone Street, Llano, Texas 78643 and
14943 Sandalfoot Street, Houston Texas 77095

Nature of Business Producing Waste: Domestic wastewater treatment operation, SIC Code 4952.

General Description and Location of Waste Disposal System:

Description: The Reagor Tract Wastewater Treatment Facility consists of an activated sludge process plant using the extended aeration mode. Treatment units in the Interim I phase include a bar screen, an aeration basin, a final clarifier, a digester, and a chlorine contact chamber. Treatment units in the Interim II phase include a bar screen, two aeration basins, two final clarifiers, two digesters, and two chlorine contact chambers. Treatment units in the Final phase include a bar screen, three aeration basins, three final clarifiers, three digesters, and three chlorine contact chambers. The permittee is authorized to dispose of treated domestic wastewater effluent at a daily average flow not to exceed 0.05 MGD via non-public access subsurface area drip dispersal system with a minimum area of 11.7 acres in the Interim I phase, 0.10 MGD via 23.3 acres in the Interim II phase, and 0.15 MGD via 35 acres in the Final phase. The permittee is required to provide at least three days of temporary storage for times when the facility is out of service due to an emergency or for scheduled maintenance. Application rates shall not exceed 0.1 gallons per square foot per day. The permittee will maintain the Bermuda grass overseeded with Winter Rye grass on the disposal site.

Location: The wastewater treatment facility and disposal site are located approximately 0.59 miles south of the intersection of Indian Springs Road and Ranch-to-Market Road 2338, in Williamson County, Texas 78633. See Attachment A.

Drainage Area: The wastewater treatment facility and disposal site are located in the drainage basin of Berry Creek in Segment No. 1248A of the Brazos River Basin. No discharge of pollutants into water in the State is authorized by this permit.

This permit and the authorization contained herein shall expire at midnight, **five years from the date of issuance**.

ISSUED DATE:

_____
For the Commission

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Conditions of the Permit: No discharge of pollutants into water in the State is authorized.

A. Effluent Limitations

Character: Treated Domestic Sewage Effluent

Volume: Daily Average Flow – 0.05 MGD from the treatment system in the Interim I phase

Daily Average Flow – 0.10 MGD from the treatment system in the Interim II phase

Daily Average Flow – 0.15 MGD from the treatment system in the Final phase

Quality: The following effluent limitations shall be required:

	Effluent Concentrations (Not to Exceed)			
Parameter	Daily Average mg/l	7-Day Average mg/l	Daily Maximum mg/	Single Grab mg/l
Biochemical Oxygen Demand (5-day)	10	15	25	35
Total Suspended Solids	15	25	40	60
E. coli, CFU or MPN/ 100 ml	N/A	N/A	N/A	126

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units.

The effluent shall be chlorinated in a chlorine contact chamber to a residual of 1.0 mg/l with a minimum detention time of 20 minutes.

B. Monitoring Requirements:

Parameter	Monitoring Frequency	Sample Type
Flow	Continuous	Totalizing Meter
Biochemical Oxygen Demand (5-day)	One/week	Grab
Total Suspended Solids	One/week	Grab
pH	One/month	Grab
Total Chlorine Residual	Five/week	Grab
E. coli	One/quarter (Interim I) One/month (Interim II and Final phases)	Grab

The monitoring shall be done after the final treatment unit and prior to storage of the treated effluent. If the effluent is land applied directly from the treatment system, monitoring shall be done after the final treatment unit and prior to land application. These records shall be maintained on a monthly basis and be available at the plant site for inspection by authorized representatives of the Commission for at least three years.

STANDARD PERMIT CONDITIONS

This permit is granted in accordance with the Texas Water Code and the rules and other Orders of the Commission and the laws of the State of Texas.

DEFINITIONS

All definitions in Section 26.001 of the Texas Water Code and 30 TAC Chapter 305 shall apply to this permit and are incorporated by reference. Some specific definitions of words or phrases used in this permit are as follows:

1. Flow Measurements

    a. Daily average flow - the arithmetic average of all determinations of the daily flow within a period of one calendar month. The daily average flow determination shall consist of determinations made on at least four separate days. If instantaneous measurements are used to determine the daily flow, the determination shall be the arithmetic average of all instantaneous measurements taken during that month. Daily average flow determination for intermittent discharges shall consist of a minimum of three flow determinations on days of discharge.

    b. Annual average flow - the arithmetic average of all daily flow determinations taken within the preceding 12 consecutive calendar months. The annual average flow determination shall consist of daily flow volume determinations made by a totalizing meter, charted on a chart recorder and limited to major domestic wastewater discharge facilities with a 1 million gallons per day or greater permitted flow.

    c. Instantaneous flow - the measured flow during the minimum time required to interpret the flow measuring device.

2. Concentration Measurements

    a. Daily average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit, within a period of one calendar month, consisting of at least four separate representative measurements.

        i. For domestic wastewater treatment plants - When four samples are not available in a calendar month, the arithmetic average (weighted by flow) of all values in the previous four consecutive month period consisting of at least four measurements shall be utilized as the daily average concentration.

        ii. For all other wastewater treatment plants - When four samples are not available in a calendar month, the arithmetic average (weighted by flow) of all values taken during the month shall be utilized as the daily average concentration.

    b. 7-day average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit, within a period of one calendar week, Sunday through Saturday.

    c. Daily maximum concentration - the maximum concentration measured on a single day, by the sample type specified in the permit, within a period of one calendar month.

3. Sample Type

   a. Composite sample - For domestic wastewater, a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow, and collected at the intervals required by 30 TAC § 319.9 (a). For industrial wastewater, a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow, and collected at the intervals required by 30 TAC § 319.9 (b).

   b. Grab sample - an individual sample collected in less than 15 minutes.

4. Treatment Facility (facility) - wastewater facilities used in the conveyance, storage, treatment, recycling, reclamation and/or disposal of domestic sewage, industrial wastes, agricultural wastes, recreational wastes, or other wastes including sludge handling or disposal facilities under the jurisdiction of the Commission.

5. The term “sewage sludge” is defined as solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in 30 TAC Chapter 312. This includes the solids which have not been classified as hazardous waste separated from wastewater by unit processes.

6. The term “biosolids” is defined as sewage sludge that has been tested or processed to meet Class A, Class AB, or Class B pathogen standards in 30 TAC Chapter 312 for beneficial use.

7. Bypass - the intentional diversion of a waste stream from any portion of a treatment facility.

MONITORING REQUIREMENTS

1. Monitoring Requirements

   Monitoring results shall be collected at the intervals specified in the permit. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall conduct effluent sampling in accordance with 30 TAC §§ 319.4 - 319.12.

   As provided by state law, the permittee is subject to administrative, civil and criminal penalties, as applicable, for negligently or knowingly violating the Texas Water Code, Chapters 26, 27, and 28, and Texas Health and Safety Code, Chapter 361, including but not limited to knowingly making any false statement, representation, or certification on any report, record or other document submitted or required to be maintained under this permit, including monitoring reports, records or reports of compliance or noncompliance, or falsifying, tampering with or knowingly rendering inaccurate any monitoring device or method required by this permit or violating any other requirement imposed by state or federal regulations.

2. Test Procedures

   a. Unless otherwise specified in this permit, test procedures for the analysis of pollutants shall comply with procedures specified in 30 TAC §§ 319.11 - 319.12. Measurements, tests and calculations shall be accurately accomplished in a representative manner.

b. All laboratory tests submitted to demonstrate compliance with this permit must meet the requirements of 30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.

3. Records of Results

a. Monitoring samples and measurements shall be taken at times and in a manner so as to be representative of the monitored activity.

b. Except for records of monitoring information required by this permit related to the permittee's sewage sludge or biosolids use and disposal activities, which shall be retained for a period of at least five years, monitoring and reporting records, including strip charts and records of calibration and maintenance, copies of all records required by this permit, and records of all data used to complete the application for this permit shall be retained at the facility site, or shall be readily available for review by a TCEQ representative for a period of three years from the date of the record or sample, measurement, report, or application. This period shall be extended at the request of the Executive Director.

c. Records of monitoring activities shall include the following:

i. date, time and place of sample or measurement;
ii. identity of individual who collected the sample or made the measurement.
iii. date and time of analysis;
iv. identity of the individual and laboratory who performed the analysis;
v. the technique or method of analysis; and
vi. the results of the analysis or measurement and quality assurance/quality control records.

The period during which records are required to be kept shall be automatically extended to the date of the final disposition of any administrative or judicial enforcement action that may be instituted against the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit using approved analytical methods as specified above, all results of such monitoring shall be included in determining compliance with permit requirements.

5. Calibration of Instruments

All automatic flow measuring or recording devices and all totalizing meters for measuring flows shall be accurately calibrated by a trained person at plant start-up and as often thereafter as necessary to ensure accuracy, but not less often than annually unless authorized by the Executive Director for a longer period. Such person shall verify in writing that the device is operating properly and giving accurate results. Copies of the verification shall be retained at the facility site and/or shall be readily available for review by a TCEQ representative for a period of three years.

6. Compliance Schedule Reports

   Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later than 14 days following each schedule date to the Regional Office and the Enforcement Division (MC 224).

7. Noncompliance Notification

   a. In accordance with 30 TAC § 305.125(9), any noncompliance which may endanger human health or safety, or the environment shall be reported by the permittee to the TCEQ. Except as allowed by 30 TAC § 305.132, report of such information shall be provided orally or by facsimile transmission (FAX) to the Regional Office within 24 hours of becoming aware of the noncompliance. A written submission of such information shall also be provided by the permittee to the Regional Office and the Enforcement Division (MC 224) within five working days of becoming aware of the noncompliance. The written submission shall contain a description of the noncompliance and its cause; the potential danger to human health or safety, or the environment; the period of noncompliance, including exact dates and times; if the noncompliance has not been corrected, the time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance, and to mitigate its adverse effects.

   b. The following violations shall be reported under Monitoring and Reporting Requirement 7.a.:

      i. Unauthorized discharges as defined in Permit Condition 2(g).

      ii. Any unanticipated bypass which exceeds any effluent limitation in the permit.

   c. In addition to the above, any effluent violation which deviates from the permitted effluent limitation by more than 40% shall be reported by the permittee in writing to the Regional Office and the Enforcement Division (MC 224) within 5 working days of becoming aware of the noncompliance.

   d. Any noncompliance other than that specified in this section, or any required information not submitted or submitted incorrectly, shall be reported to the Enforcement Division (MC 224) as promptly as possible.

8. In accordance with the procedures described in 30 TAC §§ 35.301 - 35.303 (relating to Water Quality Emergency and Temporary Orders) if the permittee knows in advance of the need for a bypass, it shall submit prior notice by applying for such authorization.

9. Changes in Discharges of Toxic Substances

   All existing manufacturing, commercial, mining, and silvicultural permittees shall notify the Regional Office, orally or by facsimile transmission within 24 hours, and both the Regional Office and the Enforcement Division (MC 224) in writing within five (5) working days, after becoming aware of or having reason to believe:

   a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant listed at 40 CFR Part 122, Appendix D,

Tables II and III (excluding Total Phenols) which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i. One hundred micrograms per liter (100 µg/L);
ii. Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
iii. Five (5) times the maximum concentration value reported for that pollutant in the permit application; or
iv. The level established by the TCEQ.

b. That any activity has occurred or will occur which would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i. Five hundred micrograms per liter (500 µg/L);
ii. One milligram per liter (1 mg/L) for antimony;
iii. Ten (10) times the maximum concentration value reported for that pollutant in the permit application; or
iv. The level established by the TCEQ.

10. Signatories to Reports

All reports and other information requested by the Executive Director shall be signed by the person and in the manner required by 30 TAC § 305.128 (relating to Signatories to Reports).

PERMIT CONDITIONS

1. General

a. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in an application or in any report to the Executive Director, it shall promptly submit such facts or information.

b. This permit is granted on the basis of the information supplied and representations made by the permittee during action on an application, and relying upon the accuracy and completeness of that information and those representations. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked, in whole or in part, in accordance with 30 TAC Chapter 305, Subchapter D, during its term for good cause including, but not limited to, the following:

i. Violation of any terms or conditions of this permit;
ii. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or
iii. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

c. The permittee shall furnish to the Executive Director, upon request and within a reasonable time, any information to determine whether cause exists for amending, revoking, suspending or terminating the permit. The permittee shall also furnish to the Executive Director, upon request, copies of records required to be kept by the permit.

2. Compliance

   a. Acceptance of the permit by the person to whom it is issued constitutes acknowledgment and agreement that such person will comply with all the terms and conditions embodied in the permit, and the rules and other orders of the Commission.

   b. The permittee has a duty to comply with all conditions of the permit. Failure to comply with any permit condition constitutes a violation of the permit and the Texas Water Code or the Texas Health and Safety Code, and is grounds for enforcement action, for permit amendment, revocation or suspension, or for denial of a permit renewal application or an application for a permit for another facility.

   c. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

   d. The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal or other permit violation which has a reasonable likelihood of adversely affecting human health or the environment.

   e. Authorization from the Commission is required before beginning any change in the permitted facility or activity that may result in noncompliance with any permit requirements.

   f. A permit may be amended, suspended and reissued, or revoked for cause in accordance with 30 TAC §§ 305.62 and 305.66 and Texas Water Code Section 7.302. The filing of a request by the permittee for a permit amendment, suspension and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

   g. There shall be no unauthorized discharge of wastewater or any other waste. For the purpose of this permit, an unauthorized discharge is considered to be any discharge of wastewater into or adjacent to water in the state at any location not permitted as an outfall or otherwise defined in the Special Provisions section of this permit.

   h. The permittee is subject to administrative, civil, and criminal penalties, as applicable, under Texas Water Code §§ 7.051 - 7.075 (relating to Administrative Penalties), 7.101 - 7.111 (relating to Civil Penalties), and 7.141 - 7.202 (relating to Criminal Offenses and Penalties).

3. Inspections and Entry

   a. Inspection and entry shall be allowed as prescribed in the Texas Water Code Chapters 26, 27, and 28, and Texas Health and Safety Code Chapter 361.

   b. The members of the Commission and employees and agents of the Commission are entitled to enter any public or private property at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the state or the compliance with any rule, regulation, permit or other order of the Commission. Members, employees, or agents of the Commission and Commission contractors are entitled to enter public or private property at any reasonable time to investigate or monitor or, if the

responsible party is not responsive or there is an immediate danger to public health or the environment, to remove or remediate a condition related to the quality of water in the state. Members, employees, Commission contractors, or agents acting under this authority who enter private property shall observe the establishment's rules and regulations concerning safety, internal security, and fire protection, and if the property has management in residence, shall notify management or the person then in charge of his presence and shall exhibit proper credentials. If any member, employee, Commission contractor, or agent is refused the right to enter in or on public or private property under this authority, the Executive Director may invoke the remedies authorized in Texas Water Code Section 7.002. The statement above, that Commission entry shall occur in accordance with an establishment's rules and regulations concerning safety, internal security, and fire protection, is not grounds for denial or restriction of entry to any part of the facility, but merely describes the Commission's duty to observe appropriate rules and regulations during an inspection.

4. Permit Amendment and/or Renewal

   a. The permittee shall give notice to the Executive Director as soon as possible of any planned physical alterations or additions to the permitted facility if such alterations or additions would require a permit amendment or result in a violation of permit requirements. Notice shall also be required under this paragraph when:

      i. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements in Monitoring and Reporting Requirements No. 9;

      ii. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

   b. Prior to any facility modifications, additions, or expansions that will increase the plant capacity beyond the permitted flow, the permittee must apply for and obtain proper authorization from the Commission before commencing construction.

   c. The permittee must apply for an amendment or renewal at least 180 days prior to expiration of the existing permit in order to continue a permitted activity after the expiration date of the permit. If an application is submitted prior to the expiration date of the permit, the existing permit shall remain in effect until the application is approved, denied, or returned. If the application is returned or denied, authorization to continue such activity shall terminate upon the effective date of the action. If an application is not submitted prior to the expiration date of the permit, the permit shall expire and authorization to continue such activity shall terminate.

   d. Prior to accepting or generating wastes which are not described in the permit application or which would result in a significant change in the quantity or quality of the existing discharge, the permittee must report the proposed changes to the Commission. The permittee must apply for a permit amendment reflecting any necessary changes in permit conditions, including effluent limitations for pollutants not identified and limited by this

permit.

e. In accordance with the Texas Water Code § 26.029(b), after a public hearing, notice of which shall be given to the permittee, the Commission may require the permittee, from time to time, for good cause, in accordance with applicable laws, to conform to new or additional conditions.

5. Permit Transfer

a. Prior to any transfer of this permit, Commission approval must be obtained. The Commission shall be notified in writing of any change in control or ownership of facilities authorized by this permit. Such notification should be sent to the Applications Review and Processing Team (MC 148) of the Water Quality Division.

b. A permit may be transferred only according to the provisions of 30 TAC § 305.64 (relating to Transfer of Permits) and 30 TAC § 50.133 (relating to Executive Director Action on Application or WQMP update).

6. Relationship to Hazardous Waste Activities

This permit does not authorize any activity of hazardous waste storage, processing, or disposal which requires a permit or other authorization pursuant to the Texas Health and Safety Code.

7. Property Rights

A permit does not convey any property rights of any sort, or any exclusive privilege.

8. Permit Enforceability

The conditions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

9. Relationship to Permit Application

The application pursuant to which the permit has been issued is incorporated herein; provided, however, that in the event of a conflict between the provisions of this permit and the application, the provisions of the permit shall control.

10. Notice of Bankruptcy.

a. Each permittee shall notify the Executive Director, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of Title 11 (Bankruptcy) of the United States Code (11 USC) by or against:

i. the permittee;
ii. an entity (as that term is defined in 11 USC, § 101(14)) controlling the permittee or listing the permit or permittee as property of the estate; or
iii. an affiliate (as that term is defined in 11 USC, § 101(2)) of the permittee.

b. This notification must indicate:

i. the name of the permittee;
ii. the permit number(s);
iii. the bankruptcy court in which the petition for bankruptcy was filed; and
iv. the date of filing of the petition.

OPERATIONAL REQUIREMENTS

1. The permittee shall at all times ensure that the facility and all of its systems of collection, treatment, and disposal are properly operated and maintained. This includes, but is not limited to, the regular, periodic examination of wastewater solids within the treatment plant by the operator in order to maintain an appropriate quantity and quality of solids inventory as described in the various operator training manuals and according to accepted industry standards for process control. Process control, maintenance, and operations records shall be retained at the facility site, or shall be readily available for review by a TCEQ representative, for a period of three years.

2. Upon request by the Executive Director, the permittee shall take appropriate samples and provide proper analysis in order to demonstrate compliance with Commission rules. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall comply with all applicable provisions of 30 TAC Chapter 312 concerning sewage sludge or biosolids use and disposal and 30 TAC §§ 319.21 - 319.29 concerning the discharge of certain hazardous metals.

3. Domestic wastewater treatment facilities shall comply with the following provisions:

a. The permittee shall notify the Municipal Permits Team, Wastewater Permitting Section (MC 148) of the Water Quality Division, in writing, of any facility expansion at least 90 days prior to conducting such activity.

b. The permittee shall submit a closure plan for review and approval to the Municipal Permits Team, Wastewater Permitting Section (MC 148) of the Water Quality Division, for any closure activity at least 90 days prior to conducting such activity. Closure is the act of permanently taking a waste management unit or treatment facility out of service and includes the permanent removal from service of any pit, tank, pond, lagoon, surface impoundment and/or other treatment unit regulated by this permit.

4. The permittee is responsible for installing prior to plant start-up, and subsequently maintaining, adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures by means of alternate power sources, standby generators, and/or retention of inadequately treated wastewater.

5. Unless otherwise specified, the permittee shall provide a readily accessible sampling point and, where applicable, an effluent flow measuring device or other acceptable means by which effluent flow may be determined.

6. The permittee shall remit an annual water quality fee to the Commission as required by 30 TAC Chapter 21. Failure to pay the fee may result in revocation of this permit under Texas Water Code § 7.302(b)(6).

7. Documentation

For all written notifications to the Commission required of the permittee by this permit, the permittee shall keep and make available a copy of each such notification under the same conditions as self-monitoring data are required to be kept and made available. Except for information specified as not confidential in 30 TAC § 1.5(d), any information submitted pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted in the manner prescribed in the application form or by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, information may be made available to the public without further notice. If the Commission or Executive Director agrees with the designation of confidentiality, the TCEQ will not provide the information for public inspection unless required by the Texas Attorney General or a court pursuant to an open records request. If the Executive Director does not agree with the designation of confidentiality, the person submitting the information will be notified.

8. Facilities which generate domestic wastewater shall comply with the following provisions; domestic wastewater treatment facilities at permitted industrial sites are excluded.

   a. Whenever flow measurements for any domestic sewage treatment facility reach 75 percent of the permitted daily average or annual average flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the domestic wastewater treatment and/or collection facilities. Whenever the flow reaches 90 percent of the permitted daily average or annual average flow for three consecutive months, the permittee shall obtain necessary authorization from the Commission to commence construction of the necessary additional treatment and/or collection facilities. In the case of a domestic wastewater treatment facility which reaches 75 percent of the permitted daily average or annual average flow for three consecutive months, and the planned population to be served or the quantity of waste produced is not expected to exceed the design limitations of the treatment facility, the permittee shall submit an engineering report supporting this claim to the Executive Director of the Commission.

      If in the judgement of the Executive Director the population to be served will not cause permit noncompliance, then the requirement of this section may be waived. To be effective, any waiver must be in writing and signed by the Director of the Enforcement Division (MC 219) of the Commission, and such waiver of these requirements will be reviewed upon expiration of the existing permit; however, any such waiver shall not be interpreted as condoning or excusing any violation of any permit parameter.

   b. The plans and specifications for domestic sewage collection and treatment works associated with any domestic permit must be approved by the Commission and failure to secure approval before commencing construction of such works or making a discharge is a violation of this permit and each day is an additional violation until approval has been secured.

   c. Permits for domestic wastewater treatment plants are granted subject to the policy of the Commission to encourage the development of area-wide waste collection, treatment and disposal systems. The Commission reserves the right to amend any domestic wastewater permit in accordance with applicable procedural requirements to require the system covered by this permit to be integrated into an area-wide system, should such be developed; to require the delivery of the wastes authorized to be collected in, treated by or discharged from said system, to such area-wide system; or to amend this permit in any

other particular to effectuate the Commission's policy. Such amendments may be made when the changes required are advisable for water quality control purposes and are feasible on the basis of waste treatment technology, engineering, financial, and related considerations existing at the time the changes are required, exclusive of the loss of investment in or revenues from any then existing or proposed waste collection, treatment or disposal system.

9. Domestic wastewater treatment plants shall be operated and maintained by sewage plant operators holding a valid certificate of competency at the required level as defined in 30 TAC Chapter 30.

10. Facilities which generate industrial solid waste as defined in 30 TAC § 335.1 shall comply with these provisions:

    a. Any solid waste, as defined in 30 TAC § 335.1 (including but not limited to such wastes as garbage, refuse, sludge from a waste treatment, water supply treatment plant or air pollution control facility, discarded materials, discarded materials to be recycled, whether the waste is solid, liquid, or semisolid), generated by the permittee during the management and treatment of wastewater, must be managed in accordance with all applicable provisions of 30 TAC Chapter 335, relating to Industrial Solid Waste Management.

    b. Industrial wastewater that is being collected, accumulated, stored, or processed before discharge through any final discharge outfall, specified by this permit, is considered to be industrial solid waste until the wastewater passes through the actual point source discharge and must be managed in accordance with all applicable provisions of 30 TAC Chapter 335.

    c. The permittee shall provide written notification, pursuant to the requirements of 30 TAC § 335.8(b)(1), to the Corrective Action Section (MC 127) of the Remediation Division informing the Commission of any closure activity involving an Industrial Solid Waste Management Unit, at least 90 days prior to conducting such an activity.

    d. Construction of any industrial solid waste management unit requires the prior written notification of the proposed activity to the Registration and Reporting Section (MC 129) of the Permitting and Remediation Support Division. No person shall dispose of industrial solid waste, including sludge or other solids from wastewater treatment processes, prior to fulfilling the deed recordation requirements of 30 TAC § 335.5.

    e. The term "industrial solid waste management unit" means a landfill, surface impoundment, waste-pile, industrial furnace, incinerator, cement kiln, injection well, container, drum, salt dome waste containment cavern, or any other structure vessel, appurtenance, or other improvement on land used to manage industrial solid waste.

    f. The permittee shall keep management records for all sludge (or other waste) removed from any wastewater treatment process. These records shall fulfill all applicable requirements of 30 TAC Chapter 335 and must include the following, as it pertains to wastewater treatment and discharge:

        i. Volume of waste and date(s) generated from treatment process;
        ii. Volume of waste disposed of on-site or shipped off-site;
        iii. Date(s) of disposal;

iv. Identity of hauler or transporter;
v. Location of disposal site; and
vi. Method of final disposal.

The above records shall be maintained on a monthly basis. The records shall be retained at the facility site, or shall be readily available for review by authorized representatives of the TCEQ for at least five years.

11. For industrial facilities to which the requirements of 30 TAC Chapter 335 do not apply, sludge and solid wastes, including tank cleaning and contaminated solids for disposal, shall be disposed of in accordance with Chapter 361 of the Texas Health and Safety Code.

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SLUDGE PROVISIONS

The permittee is authorized to dispose of sludge or biosolids only at a Texas Commission on Environmental Quality (TCEQ) authorized land application site, co-disposal landfill, wastewater treatment facility, or facility that further processes sludge. **The disposal of sludge or biosolids by land application on property owned, leased or under the direct control of the permittee is a violation of the permit unless the site is authorized with the TCEQ. This provision does not authorize Distribution and Marketing of Class A or Class AB Biosolids. This provision does not authorize the permittee to land apply biosolids on property owned, leased or under the direct control of the permittee.**

SECTION I. REQUIREMENTS APPLYING TO ALL SEWAGE SLUDGE OR BIOSOLIDS LAND APPLICATION

A. General Requirements

1. The permittee shall handle and dispose of sewage sludge or biosolids in accordance with 30 TAC § 312 and all other applicable state and federal regulations in a manner that protects public health and the environment from any reasonably anticipated adverse effects due to any toxic pollutants that may be present in the sludge or biosolids.

2. In all cases, if the person (permit holder) who prepares the sewage sludge or biosolids supplies the sewage sludge or biosolids to another person for land application use or to the owner or lease holder of the land, the permit holder shall provide necessary information to the parties who receive the sludge or biosolids to assure compliance with these regulations.

3. The land application of processed or unprocessed chemical toilet waste, grease trap waste, grit trap waste, milk solids, or similar non-hazardous municipal or industrial solid wastes, or any of the wastes listed in this provision combined with biosolids, WTP residuals or domestic septage is prohibited unless the grease trap waste is added at a fats, oil and grease (FOG) receiving facility as part of an anaerobic digestion process.

B. Testing Requirements

1. Sewage sludge or biosolids shall be tested once during the term of this permit in accordance with the method specified in both 40 CFR Part 261, Appendix II and 40 CFR Part 268, Appendix I [Toxicity Characteristic Leaching Procedure (TCLP)] or other method that receives the prior approval of the TCEQ for the contaminants listed in 40 CFR Part 261.24, Table 1. Sewage sludge or biosolids failing this test shall be managed according to RCRA standards for generators of hazardous waste, and the waste's disposition must be in accordance with all applicable requirements for hazardous waste processing, storage, or disposal. Following failure of any TCLP test, the management or disposal of sewage sludge or biosolids at a facility other than an authorized hazardous waste processing, storage, or disposal facility shall be prohibited until such time as the permittee can demonstrate the sewage sludge or biosolids no longer exhibits the hazardous waste toxicity characteristics (as demonstrated by the results of the TCLP tests). A written report shall be provided to both the TCEQ Registration and Reporting Section (MC 129) of the Permitting and Registration Support Division and the Regional Director (MC Region 11) within seven (7) days after failing the TCLP Test.

The report shall contain test results, certification that unauthorized waste management has stopped, and a summary of alternative disposal plans that comply with RCRA standards for the management of hazardous waste. The report shall be addressed to: Director, Permitting and Registration Support Division (MC 129), Texas Commission on Environmental Quality, P.O. Box 13087, Austin, Texas 78711-3087. In addition, the permittee shall prepare an annual report on the results of all sludge toxicity testing. The permittee shall submit the following information in an annual report to the TCEQ by September 30th of each year. The permittee must submit this annual report using the online electronic reporting system available through TCEQ's website. If the permittee requests and obtains an electronic reporting waiver, the annual report can be submitted in hard copy to the TCEQ Regional Office (MC Region 11) and the Enforcement Division (MC 224).

2. Biosolids shall not be applied to the land if the concentration of the pollutants exceeds the pollutant concentration criteria in Table 1. The frequency of testing for pollutants in Table 1 is found in Section I.C. of this permit.

TABLE 1

Pollutant	Ceiling Concentration (Milligrams per kilogram)*
Arsenic	75
Cadmium	85
Chromium	3000
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
PCBs	49
Selenium	100
Zinc	7500

* Dry weight basis

3. Pathogen Control

All sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site must be treated by one of the following methods to ensure that the sludge meets either the Class A, Class AB or Class B biosolids pathogen requirements.

a. For sewage sludge to be classified as Class A biosolids with respect to pathogens, the density of fecal coliform in the sewage sludge must be less than 1,000 most probable number (MPN) per gram of total solids (dry weight basis), or the density of Salmonella sp. bacteria in the sewage sludge must be less than three MPN per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed. In addition, one of the alternatives listed below must be met:

Alternative 1 - The temperature of the sewage sludge that is used or disposed shall be maintained at or above a specific value for a period of time. See 30 TAC § 312.82(a)(3)(A) for specific information;

Alternative 5 (PFRP) - Sewage sludge that is used or disposed of must be treated in one of the Processes to Further Reduce Pathogens (PFRP) described in 40 CFR Part 503, Appendix B. PFRP include composting, heat drying, heat treatment, and thermophilic aerobic digestion; or

Alternative 6 (PFRP Equivalent) - Sewage sludge that is used or disposed of must be treated in a process that has been approved by the U. S. Environmental Protection Agency as being equivalent to those in Alternative 5.

b. For sewage sludge to be classified as Class AB biosolids with respect to pathogens, the density of fecal coliform in the sewage sludge must be less than 1,000 MPN per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge be less than three MPN per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed. In addition, one of the alternatives listed below must be met:

   Alternative 2 - The pH of the sewage sludge that is used or disposed shall be raised to above 12 std. units and shall remain above 12 std. units for 72 hours.

   The temperature of the sewage sludge shall be above 52° Celsius for 12 hours or longer during the period that the pH of the sewage sludge is above 12 std. units.

   At the end of the 72-hour period during which the pH of the sewage sludge is above 12 std. units, the sewage sludge shall be air dried to achieve a percent solids in the sewage sludge greater than 50%; or

   Alternative 3 - The sewage sludge shall be analyzed for enteric viruses prior to pathogen treatment. The limit for enteric viruses is less than one Plaque-forming Unit per four grams of total solids (dry weight basis) either before or following pathogen treatment. See 30 TAC § 312.82(a)(2)(C)(i-iii) for specific information. The sewage sludge shall be analyzed for viable helminth ova prior to pathogen treatment. The limit for viable helminth ova is less than one per four grams of total solids (dry weight basis) either before or following pathogen treatment. See 30 TAC § 312.82(a)(2)(C)(iv-vi) for specific information; or

   Alternative 4 - The density of enteric viruses in the sewage sludge shall be less than one Plaque-forming Unit per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed. The density of viable helminth ova in the sewage sludge shall be less than one per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed.

c. Sewage sludge that meets the requirements of Class AB biosolids may be classified a Class A biosolids if a variance request is submitted in writing that is supported by substantial documentation demonstrating equivalent methods for reducing odors and written approval is granted by the executive director. The executive director may deny the variance request or revoke that approved variance if it is determined that the variance may potentially endanger human health or the environment, or create nuisance odor conditions.

d. Three alternatives are available to demonstrate compliance with Class B biosolids

criteria.
Alternative 1

i. A minimum of seven random samples of the sewage sludge shall be collected within 48 hours of the time the sewage sludge is used or disposed of during each monitoring episode for the sewage sludge.

ii. The geometric mean of the density of fecal coliform in the samples collected shall be less than either 2,000,000 MPN per gram of total solids (dry weight basis) or 2,000,000 Colony Forming Units per gram of total solids (dry weight basis).

Alternative 2 - Sewage sludge that is used or disposed of shall be treated in one of the Processes to Significantly Reduce Pathogens (PSRP) described in 40 CFR Part 503, Appendix B, so long as all of the following requirements are met by the generator of the sewage sludge.

i. Prior to use or disposal, all the sewage sludge must have been generated from a single location, except as provided in paragraph v. below;

ii. An independent Texas Licensed Professional Engineer must make a certification to the generator of a sewage sludge that the wastewater treatment facility generating the sewage sludge is designed to achieve one of the PSRP at the permitted design loading of the facility. The certification need only be repeated if the design loading of the facility is increased. The certification shall include a statement indicating the design meets all the applicable standards specified in Appendix B of 40 CFR Part 503;

iii. Prior to any off-site transportation or on-site use or disposal of any sewage sludge generated at a wastewater treatment facility, the chief certified operator of the wastewater treatment facility or other responsible official who manages the processes to significantly reduce pathogens at the wastewater treatment facility for the permittee, shall certify that the sewage sludge underwent at least the minimum operational requirements necessary in order to meet one of the PSRP. The acceptable processes and the minimum operational and record keeping requirements shall be in accordance with established U.S. Environmental Protection Agency final guidance;

iv. All certification records and operational records describing how the requirements of this paragraph were met shall be kept by the generator for a minimum of three years and be available for inspection by commission staff for review; and

v. If the sewage sludge is generated from a mixture of sources, resulting from a person who prepares sewage sludge from more than one wastewater treatment facility, the resulting derived product shall meet one of the PSRP, and shall meet the certification, operation, and record keeping requirements of this paragraph.

Alternative 3 - Sewage sludge shall be treated in an equivalent process that has been approved by the U.S. Environmental Protection Agency, so long as all of the following requirements are met by the generator of the sewage sludge.

i. Prior to use or disposal, all the sewage sludge must have been generated from a single location, except as provided in paragraph v. below;

ii. Prior to any off-site transportation or on-site use or disposal of any sewage sludge generated at a wastewater treatment facility, the chief certified operator of the wastewater treatment facility or other responsible official who manages the processes to significantly reduce pathogens at the wastewater treatment facility for the permittee, shall certify that the sewage sludge underwent at least the minimum operational requirements necessary in order to meet one of the PSRP. The acceptable processes and the minimum operational and record keeping requirements shall be in accordance with established U.S. Environmental Protection Agency final guidance;

iii. All certification records and operational records describing how the requirements of this paragraph were met shall be kept by the generator for a minimum of three years and be available for inspection by commission staff for review;

iv. The Executive Director will accept from the U.S. Environmental Protection Agency a finding of equivalency to the defined PSRP; and

v. If the sewage sludge is generated from a mixture of sources resulting from a person who prepares sewage sludge from more than one wastewater treatment facility, the resulting derived product shall meet one of the Processes to Significantly Reduce Pathogens, and shall meet the certification, operation, and record keeping requirements of this paragraph.

In addition to the Alternatives 1 – 3, the following site restrictions must be met if Class B biosolids are land applied:

i. Food crops with harvested parts that touch the biosolids/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of biosolids.

ii. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of biosolids when the biosolids remain on the land surface for 4 months or longer prior to incorporation into the soil.

iii. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of biosolids when the biosolids remain on the land surface for less than 4 months prior to incorporation into the soil.

iv. Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of biosolids.

v. Domestic livestock shall not be allowed to graze on the land for 30 days after application of biosolids.

vi. Turf grown on land where biosolids are applied shall not be harvested for 1 year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn.

vii. Public access to land with a high potential for public exposure shall be restricted for 1 year after application of biosolids.

viii. Public access to land with a low potential for public exposure shall be restricted for 30 days after application of biosolids.

ix. Land application of biosolids shall be in accordance with the buffer zone requirements found in 30 TAC § 312.44.

4. Vector Attraction Reduction Requirements

All bulk sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site shall be treated by one of the following Alternatives 1 through 10 for vector attraction reduction.

Alternative 1 - The mass of volatile solids in the sewage sludge shall be reduced by a minimum of 38%.

Alternative 2 - If Alternative 1 cannot be met for an anaerobically digested sludge, demonstration can be made by digesting a portion of the previously digested sludge anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30° and 37° Celsius. Volatile solids must be reduced by less than 17% to demonstrate compliance.

Alternative 3 - If Alternative 1 cannot be met for an aerobically digested sludge, demonstration can be made by digesting a portion of the previously digested sludge with percent solids of two percent or less aerobically in the laboratory in a bench-scale unit for 30 additional days at 20° Celsius. Volatile solids must be reduced by less than 15% to demonstrate compliance.

Alternative 4 - The specific oxygen uptake rate (SOUR) for sewage sludge treated in an aerobic process shall be equal to or less than 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20° Celsius.

Alternative 5 - Sewage sludge shall be treated in an aerobic process for 14 days or longer. During that time, the temperature of the sewage sludge shall be higher than 40° Celsius and the average temperature of the sewage sludge shall be higher than 45° Celsius.

Alternative 6 - The pH of sewage sludge shall be raised to 12 or higher by alkali addition and, without the addition of more alkali shall remain at 12 or higher for two hours and then remain at a pH of 11.5 or higher for an additional 22 hours at the time the sewage sludge is prepared for sale or given away in a bag or other container.

Alternative 7 - The percent solids of sewage sludge that does not contain unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 75% based on the moisture content and total solids prior to mixing with other materials. Unstabilized solids are defined as organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Alternative 8 - The percent solids of sewage sludge that contains unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 90% based on the moisture content and total solids prior to mixing with other materials at the time the sludge is used. Unstabilized solids are defined as organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Alternative 9 -

i. Biosolids shall be injected below the surface of the land.

ii. No significant amount of the biosolids shall be present on the land surface within one hour after biosolids are injected.

iii. When sewage sludge that is injected below the surface of the land is Class A or Class AB with respect to pathogens, the biosolids shall be injected below the land surface within eight hours after being discharged from the pathogen treatment process.

Alternative 10-

i. Biosolids applied to the land surface or placed on a surface disposal site shall be incorporated into the soil within six hours after application to or placement on the land.

ii. When biosolids that are incorporated into the soil is Class A or Class AB with respect to pathogens, the biosolids shall be applied to or placed on the land within eight hours after being discharged from the pathogen treatment process.

C. Monitoring Requirements

Toxicity Characteristic Leaching Procedure (TCLP) Test	- once during the term of this permit
PCBs	- once during the term of this permit

All metal constituents and fecal coliform or *Salmonella* sp. bacteria shall be monitored at the appropriate frequency shown below, pursuant to 30 TAC § 312.46(a)(1):

Amount of biosolids (*) metric tons per 365-day period	Monitoring Frequency
0 to less than 290	Once/Year
290 to less than 1,500	Once/Quarter
1,500 to less than 15,000	Once/Two Months
15,000 or greater	Once/Month

(*) *The amount of bulk biosolids applied to the land (dry wt. basis).*

Representative samples of sewage sludge shall be collected and analyzed in accordance with the methods referenced in 30 TAC § 312.7

Identify each of the analytic methods used by the facility to analyze enteric viruses, fecal coliforms, helminth ova, *Salmonella* sp., and other regulated parameters.

Identify in the following categories (as applicable) the sewage sludge or biosolids treatment process or processes at the facility: preliminary operations (e.g., sludge or biosolids grinding and degritting), thickening (concentration), stabilization, anaerobic digestion, aerobic digestion, composting, conditioning, disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization), dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons), heat drying, thermal reduction, and methane or biogas capture and recovery.

Identify the nature of material generated by the facility (such as a biosolid for beneficial use or land-farming, or sewage sludge or biosolids for disposal at a monofill) and whether the material is ultimately conveyed off-site in bulk or in bags.

SECTION II. REQUIREMENTS SPECIFIC TO BULK SEWAGE SLUDGE FOR APPLICATION TO THE LAND MEETING CLASS A, CLASS AB or B BIOSOLIDS PATHOGEN REDUCTION AND THE CUMULATIVE LOADING RATES IN TABLE 2, OR CLASS B PATHOGEN REDUCTION AND THE POLLUTANT CONCENTRATIONS IN TABLE 3

For those permittees meeting Class A, Class AB or B pathogen reduction requirements and that meet the cumulative loading rates in Table 2 below, or the Class B pathogen reduction requirements and contain concentrations of pollutants below listed in Table 3, the following conditions apply:

A. Pollutant Limits

Table 2

Pollutant	Cumulative Pollutant Loading Rate (pounds per acre)*
Arsenic	36
Cadmium	35
Chromium	2677
Copper	1339
Lead	268
Mercury	15
Molybdenum	Report Only
Nickel	375
Selenium	89
Zinc	2500

Table 3

Pollutant	Monthly Average Concentration (milligrams per kilogram)*
Arsenic	41
Cadmium	39
Chromium	1200
Copper	1500
Lead	300
Mercury	17
Molybdenum	Report Only
Nickel	420
Selenium	36
Zinc	2800

*Dry weight basis

B. Pathogen Control

All bulk sewage sludge that is applied to agricultural land, forest, a public contact site, a reclamation site, shall be treated by either Class A, Class AB or Class B biosolids pathogen reduction requirements as defined above in Section I.B.3.

C. Management Practices

1. Bulk biosolids shall not be applied to agricultural land, forest, a public contact site, or a reclamation site that is flooded, frozen, or snow-covered so that the bulk sewage sludge enters a wetland or other waters in the State.

2. Bulk sewage sludge not meeting Class A biosolids requirements shall be land applied in a manner which complies with Applicability in accordance with 30 TAC §312.41 and the Management Requirements in accordance with 30 TAC § 312.44.

3. Bulk biosolids shall be applied at or below the agronomic rate of the cover crop.

4. An information sheet shall be provided to the person who receives bulk Class A or AB biosolids sold or given away. The information sheet shall contain the following information:

    a. The name and address of the person who prepared the Class A or AB biosolids that are sold or given away in a bag or other container for application to the land.

    b. A statement that application of the Class A or AB biosolids to the land is prohibited except in accordance with the instruction on the label or information sheet.

    c. The annual whole sludge application rate for the biosolids application rate for the biosolids that does not cause any of the cumulative pollutant loading rates in Table 2 above to be exceeded, unless the pollutant concentrations in Table 3 found in Section II above are met.

D. Notification Requirements

1. If bulk biosolids are applied to land in a State other than Texas, written notice shall be provided prior to the initial land application to the permitting authority for the State in which the bulk biosolids are proposed to be applied. The notice shall include:

    a. The location, by street address, and specific latitude and longitude, of each land application site.

    b. The approximate time period bulk biosolids will be applied to the site.

    c. The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who will apply the bulk biosolids.

2. The permittee shall give 180 days prior notice to the Executive Director in care of the Wastewater Permitting Section (MC 148) of the Water Quality Division of any change planned in the biosolids disposal practice.

E. Record Keeping Requirements

The documents will be retained at the facility site and/or shall be readily available for review by a TCEQ representative. The person who prepares bulk sewage sludge or a biosolids material shall develop the following information and shall retain the information at the facility site and/or shall be readily available for review by a TCEQ representative for a period

of five years. If the permittee supplies the sludge to another person who land applies the sludge, the permittee shall notify the land applier of the requirements for record keeping found in 30 TAC § 312.47 for persons who land apply.

1. The concentration (mg/kg) in the sludge of each pollutant listed in Table 3 above and the applicable pollutant concentration criteria (mg/kg), or the applicable cumulative pollutant loading rate and the applicable cumulative pollutant loading rate limit (lbs/ac) listed in Table 2 above.

2. A description of how the pathogen reduction requirements are met (including site restrictions for Class AB and Class B biosolids, if applicable).

3. A description of how the vector attraction reduction requirements are met.

4. A description of how the management practices listed above in Section II.C are being met.

5. The following certification statement:

   "I certify, under penalty of law, that the applicable pathogen requirements in 30 TAC § 312.82(a) or (b) and the vector attraction reduction requirements in 30 TAC § 312.83(b) have been met for each site on which bulk biosolids are applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

6. The recommended agronomic loading rate from the references listed in Section II.C.3. above, as well as the actual agronomic loading rate shall be retained. The person who applies bulk biosolids shall develop the following information and shall retain the information at the facility site and/or shall be readily available for review by a TCEQ representative indefinitely. If the permittee supplies the sludge to another person who land applies the sludge, the permittee shall notify the land applier of the requirements for record keeping found in 30 TAC § 312.47 for persons who land apply:

   a. A certification statement that all applicable requirements (specifically listed) have been met, and that the permittee understands that there are significant penalties for false certification including fine and imprisonment. See 30 TAC § 312.47(a)(4)(A)(ii) or 30 TAC § 312.47(a)(5)(A)(ii), as applicable, and to the permittee's specific sludge treatment activities.

   b. The location, by street address, and specific latitude and longitude, of each site on which sludge is applied.

   c. The number of acres in each site on which bulk sludge is applied.

   d. The date and time sludge is applied to each site.

e. The cumulative amount of each pollutant in pounds/acre listed in Table 2 applied to each site.

f. The total amount of sludge applied to each site in dry tons.

The above records shall be maintained on-site on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

F. Reporting Requirements

The permittee shall submit the following information in an annual report to the TCEQ by September 30th of each year. The permittee must submit this annual report using the online electronic reporting system available through TCEQ's website. If the permittee requests and obtains an electronic reporting waiver, the annual report can be submitted in hard copy to the TCEQ Regional Office (MC Region 11) and the Enforcement Division (MC 224).

1. Identify in the following categories (as applicable) the sewage sludge or biosolids treatment process or processes at the facility: preliminary operations (e.g., sludge or biosolids grinding and degritting), thickening (concentration), stabilization, anaerobic digestion, aerobic digestion, composting, conditioning, disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization), dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons), heat drying, thermal reduction, and methane or biogas capture and recovery.

2. Identify the nature of material generated by the facility (such as a biosolid for beneficial use or land-farming, or sewage sludge for disposal at a monofill) and whether the material is ultimately conveyed off-site in bulk or in bags.

3. Results of tests performed for pollutants found in either Table 2 or 3 as appropriate for the permittee's land application practices.

4. The frequency of monitoring listed in Section I.C. that applies to the permittee.

5. Toxicity Characteristic Leaching Procedure (TCLP) results.

6. PCB concentration in sludge or biosolids in mg/kg.

7. Identity of hauler(s) and TCEQ transporter number.

8. Date(s) of transport.

9. Texas Commission on Environmental Quality registration number, if applicable.

10. Amount of sludge or biosolids disposal dry weight (lbs/acre) at each disposal site.

11. The concentration (mg/kg) in the sludge or biosolids of each pollutant listed in Table 1 (defined as a monthly average) as well as the applicable pollutant concentration criteria (mg/kg) listed in Table 3 above, or the applicable pollutant loading rate limit (lbs/acre) listed in Table 2 above if it exceeds 90% of the limit.

12. Level of pathogen reduction achieved (Class A, Class AB or Class B).

13. Alternative used as listed in Section I.B.3.(a. or b.). Alternatives describe how the pathogen reduction requirements are met. If Class B biosolids, include information on how site restrictions were met.

14. Identify each of the analytic methods used by the facility to analyze enteric viruses, fecal coliforms, helminth ova, *Salmonella* sp., and other regulated parameters.

15. Vector attraction reduction alternative used as listed in Section I.B.4.

16. Amount of sludge or biosolids transported in dry tons/year.

17. The certification statement listed in either 30 TAC § 312.47(a)(4)(A)(ii) or 30 TAC § 312.47(a)(5)(A)(ii) as applicable to the permittee's sludge or biosolids treatment activities, shall be attached to the annual reporting form.

18. When the amount of any pollutant applied to the land exceeds 90% of the cumulative pollutant loading rate for that pollutant, as described in Table 2, the permittee shall report the following information as an attachment to the annual reporting form.

    a. The location, by street address, and specific latitude and longitude.

    b. The number of acres in each site on which bulk biosolids are applied.

    c. The date and time bulk biosolids are applied to each site.

    d. The cumulative amount of each pollutant (i.e., pounds/acre) listed in Table 2 in the bulk biosolids applied to each site.

    e. The amount of biosolids (i.e., dry tons) applied to each site.

    The above records shall be maintained on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

SECTION III. REQUIREMENTS APPLYING TO ALL SEWAGE SLUDGE OR BIOSOLIDS DISPOSED IN A MUNICIPAL SOLID WASTE LANDFILL

A. The permittee shall handle and dispose of sewage sludge or biosolids in accordance with 30 TAC § 330 and all other applicable state and federal regulations to protect public health and the environment from any reasonably anticipated adverse effects due to any toxic pollutants that may be present. The permittee shall ensure that the sewage sludge or biosolids meets the requirements in 30 TAC § 330 concerning the quality of the sludge disposed in a municipal solid waste landfill.

B. If the permittee generates sewage sludge or biosolids and supplies that sewage sludge or biosolids to the owner or operator of a municipal solid waste landfill (MSWLF) for disposal, the permittee shall provide to the owner or operator of the MSWLF appropriate information needed to be in compliance with the provisions of this permit.

C. The permittee shall give 180 days prior notice to the Executive Director in care of the Wastewater Permitting Section (MC 148) of the Water Quality Division of any change planned in the sewage sludge or biosolids disposal practice.

D. Sewage sludge s or biosolids hall be tested once during the term of this permit in accordance with the method specified in both 40 CFR Part 261, Appendix II and 40 CFR Part 268, Appendix I (Toxicity Characteristic Leaching Procedure) or other method, which receives the prior approval of the TCEQ for contaminants listed in Table 1 of 40 CFR § 261.24. Sewage sludge or biosolids failing this test shall be managed according to RCRA standards for generators of hazardous waste, and the waste's disposition must be in accordance with all applicable requirements for hazardous waste processing, storage, or disposal.

   Following failure of any TCLP test, the management or disposal of sewage sludge or biosolids at a facility other than an authorized hazardous waste processing, storage, or disposal facility shall be prohibited until such time as the permittee can demonstrate the sewage sludge or biosolids no longer exhibits the hazardous waste toxicity characteristics (as demonstrated by the results of the TCLP tests). A written report shall be provided to both the TCEQ Registration and Reporting Section (MC 129) of the Permitting and Registration Support Division and the Regional Director (MC Region 11) of the appropriate TCEQ field office within 7 days after failing the TCLP Test.

   The report shall contain test results, certification that unauthorized waste management has stopped, and a summary of alternative disposal plans that comply with RCRA standards for the management of hazardous waste. The report shall be addressed to: Director, Permitting and Registration Support Division (MC 129), Texas Commission on Environmental Quality, P. O. Box 13087, Austin, Texas 78711-3087. In addition, the permittee shall prepare an annual report on the results of all sludge toxicity testing. This annual report shall be submitted to the TCEQ Regional Office (MC Region 11) and the Enforcement Division (MC 224), by September 30_{th} of each year.

E. Sewage sludge or biosolids shall be tested as needed, in accordance with the requirements of 30 TAC Chapter 330.

F. Record Keeping Requirements

   The permittee shall develop the following information and shall retain the information for five years.

1. The description (including procedures followed and the results) of all liquid Paint Filter Tests performed.

2. The description (including procedures followed and results) of all TCLP tests performed.

The above records shall be maintained on-site on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

G. Reporting Requirements

The permittee shall submit the following information in an annual report to the TCEQ by September 30th of each year. The permittee must submit this annual report using the online electronic reporting system available through TCEQ's website. If the permittee requests and obtains an electronic reporting waiver, the annual report can be submitted in hard copy to the TCEQ Regional Office (MC Region 11) and the Enforcement Division (MC 224).

1. Identify in the following categories (as applicable) the sewage sludge or biosolids treatment process or processes at the facility: preliminary operations (e.g., sludge or biosolids grinding and degritting), thickening (concentration), stabilization, anaerobic digestion, aerobic digestion, composting, conditioning, disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization), dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons), heat drying, thermal reduction, and methane or biogas capture and recovery.

2. Toxicity Characteristic Leaching Procedure (TCLP) results.

3. Annual sludge production in dry tons/year.

4. Amount of sludge or biosolids disposed in a municipal solid waste landfill in dry tons/year.

5. Amount of sludge or biosolids transported interstate in dry tons/year.

6. A certification that the sewage sludge or biosolids meets the requirements of 30 TAC § 330 concerning the quality of the sludge disposed in a municipal solid waste landfill.

7. Identity of hauler(s) and transporter registration number.

8. Owner of disposal site(s).

9. Location of disposal site(s).

10. Date(s) of disposal.

The above records shall be maintained on-site on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

SECTION IV. REQUIREMENTS APPLYING TO SLUDGE OR BIOSOLIDS TRANSPORTED TO ANOTHER FACILITY FOR FURTHER PROCESSING

These provisions apply to sludge or biosolids that is transported to another wastewater treatment facility or facility that further processes sludge or biosolids. These provisions are intended to allow transport of sludge or biosolids to facilities that have been authorized to accept sludge or biosolids. These provisions do not limit the ability of the receiving facility to determine whether to accept the sludge or biosolids, nor do they limit the ability of the receiving facility to request additional testing or documentation.

A. General Requirements

1. The permittee shall handle and dispose of sewage sludge or biosolids in accordance with 30 TAC Chapter 312 and all other applicable state and federal regulations in a manner that protects public health and the environment from any reasonably anticipated adverse effects due to any toxic pollutants that may be present in the sludge.

2. Sludge or biosolids may only be transported using a registered transporter or using an approved pipeline.

B. Record Keeping Requirements

1. For sludge transported by an approved pipeline, the permittee must maintain records of the following:

   a. the amount of sludge or biosolids transported;

   b. the date of transport;

   c. the name and TCEQ permit number of the receiving facility or facilities;

   d. the location of the receiving facility or facilities;

   e. the name and TCEQ permit number of the facility that generated the waste; and

   f. copy of the written agreement between the permittee and the receiving facility to accept sludge or biosolids.

2. For sludge or biosolids transported by a registered transporter, the permittee must maintain records of the completed trip tickets in accordance with 30 TAC § 312.145(a)(1)-(7) and amount of sludge or biosolids transported.

3. The above records shall be maintained on-site on a monthly basis and shall be made available to the TCEQ upon request. These records shall be retained for at least five years.

C. Reporting Requirements

The permittee shall submit the following information in an annual report to the TCEQ by September 30th of each year. The permittee must submit this annual report using the online electronic reporting system available through TCEQ's website. If the permittee requests and obtains an electronic reporting waiver, the annual report can be submitted in hard copy to the TCEQ Regional Office (MC Region 11) and the Enforcement Division (MC 224).

1. Identify in the following categories (as applicable) the sewage sludge or biosolids treatment process or processes at the facility: preliminary operations (e.g., sludge or biosolids grinding and degritting), thickening (concentration), stabilization, anaerobic digestion, aerobic digestion, composting, conditioning, disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization), dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons), heat drying, thermal reduction, and methane or biogas capture and recovery.

2. the annual sludge or biosolids production;

3. the amount of sludge or biosolids transported;

4. the owner of each receiving facility;

5. the location of each receiving facility; and

6. the date(s) of disposal at each receiving facility.

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SPECIAL PROVISIONS:

1. This permit is granted subject to the policy of the Commission to encourage the development of areawide waste collection, treatment and disposal systems. The Commission reserves the right to amend this permit in accordance with applicable procedural requirements to require the system covered by this permit to be integrated into an areawide system, should such be developed; to require the delivery of the wastes authorized to be collected in, treated by or discharged from said system, to such areawide system; or to amend this permit in any other particular to effectuate the Commission's policy. Such amendments may be made when the changes required are advisable for water quality control purposes and are feasible on the basis of waste treatment technology, engineering, financial, and related considerations existing at the time the changes are required, exclusive of the loss of investment in or revenues from any then existing or proposed waste collection, treatment or disposal system.

2. The permittee shall employ or contract with one or more licensed wastewater treatment facility operators or wastewater system operations companies holding a valid license or registration according to the requirements of 30 TAC Chapter 30, Occupational Licenses and Registrations, and in particular 30 TAC Chapter 30, Subchapter J, Wastewater Operators and Operations Companies.

   This Category C facility must be operated by a chief operator or an operator holding a Class C license or higher. The facility must be operated a minimum of five days per week by the licensed chief operator or an operator holding the required level of license or higher. The licensed chief operator or operator holding the required level of license or higher must be available by telephone or pager seven days per week. Where shift operation of the wastewater treatment facility is necessary, each shift which does not have the on-site supervision of the licensed chief operator must be supervised by an operator in charge who is licensed not less than one level below the category for the facility.

3. The permittee shall maintain and operate the treatment facility in order to achieve optimum efficiency of treatment capability. This shall include required monitoring of effluent flow and quality as well as appropriate grounds and building maintenance.

4. Prior to construction of the wastewater treatment facilities, the permittee shall submit to the TCEQ Wastewater Permitting Section (MC 148) of the Water Quality Division, a summary transmittal letter according to the requirements in 30 TAC § 217.6(d). If requested by the Wastewater Permitting Section, the permittee shall submit plans, specifications and a final engineering design report which comply with the requirements of 30 TAC Chapter 217, Design Criteria for Wastewater Treatment Systems. The permittee shall clearly show how the treatment system will meet the permitted effluent limitations required on Page 2 of the permit. A copy of the summary transmittal letter shall be available at the plant site for inspection by authorized representatives of the TCEQ.

5. Prior to construction of the subsurface area drip dispersal system, the permittee shall submit, to the TCEQ Wastewater Permitting Section (MC148) of the Water Quality Division, an engineering report, including plans and specifications, that meets the requirements in 30 TAC Chapter 222, Subsurface Drip Dispersal Systems, Subchapter D: Design Criteria.

6. Reporting requirements according to 30 TAC §§ 319.1-319.11 and any additional effluent reporting requirements contained in this permit are suspended from the effective date of the permit until plant startup or discharge, whichever occurs first, from the facility described by

this permit. The permittee shall provide written notice to the TCEQ Regional Office (MC Region 11) and the Applications Review and Processing Team (MC 148) of the Water Quality Division at least forty-five (45) days prior to plant startup or anticipated discharge, whichever occurs first, and prior to completion of each additional phase, on Notification of Completion Form 20007.

7. The permittee shall comply with the requirements of 30 TAC § 309.13 (a) through (d). In addition, by ownership of the required buffer zone area, the permittee shall comply with the requirements of 30 TAC § 309.13(e).

8. According to the requirements of 30 TAC § 222.81(a), the permittee shall locate the subsurface area drip dispersal system a minimum horizontal distance of 100 feet from surface waters in the state. The permittee shall locate the subsurface area drip dispersal system a minimum horizontal distance of 500 feet from public water wells, springs, or other similar sources of public drinking water and 150 feet from private water wells as described in 30 TAC § 309.13(c)(1). The permittee shall not locate a subsurface area drip dispersal system within a floodway according to the requirements of 30 TAC § 222.81(d).

9. The proposed facility is on the Edwards Aquifer Contributing Zone, so 30 TAC 213 Subchapter B rules apply.

10. South irrigation area: The permittee shall survey the two drainages identified by the Regional inspection to determine their exact location and extent so that the SADDS fields can be properly buffered by a minimum horizontal distance of 100 feet from surface water in the state.

11. North irrigation area: The permittee shall conduct a survey to identify the location of a water well suspected by the Regional inspection to be in the vicinity of piping, a hose bib, and a trough. If a well is found, it shall be plugged per 16 TAC §76.100 or a minimum 150-foot buffer shall be maintained between the well and irrigation fields.

12. The permittee shall develop a Springs/Seeps Monitoring Plan and submit the plan to the TCEQ Water Quality Assessment Team (MC-150) for review, possible modification, and approval within 30 days of permit issuance. At a minimum, the plan shall include:

    a) A procedure to conduct quarterly field checks at the drip irrigation fields and down-gradient of the fields to identify emerging springs or seeps.
    b) A procedure to sample springs or seeps in the event that springs/seeps develop after drip irrigation of effluent commences.
    c) Quarterly field checks and sampling (if applicable) of the springs/seeps shall occur after a minimum rainfall event of 0.5-inch, if possible.
    d) Analysis of springs/seeps water for nutrients, including, but not limited to, a complete nitrogen series [(Nitrate (as N), Nitrite (as N), Total Kjeldahl Nitrogen, ammonia as N], total phosphorus, ortho-phosphate, chlorides, fecal coliform, and specific conductivity.
    e) A record of the quarterly checks and sampling of the springs and seeps shall be maintained in a field log and kept onsite for TCEQ inspection.
    f) Monitoring of emerging and existing springs/seeps shall continue for the life of the system.

g) The permittee shall submit the data, including laboratory reports, and a map showing the locations of any seeps/springs that were sampled per the Seeps/Springs Monitoring Plan to the Water Quality Assessment Team (MC-150) of the Water Quality Division, the TCEQ Region 11 (Austin) Office, and the Enforcement Division (MC-224) during the month of September of each year for review. If no seeps/springs were identified during a particular quarter, that information shall be included in the annual report.

h) A procedure for the implementation of corrective measures to remedy the discharge if laboratory analysis indicates that wastewater is emerging as a seep or spring.

i) The permittee shall implement the plan upon approval by the Water Quality Assessment Team. The executive director may request modification of the approved plan if future information indicates that it would be necessary for the protection of the environment.

14. Any recharge features uncovered by construction of and operation of the SADDS fields and wastewater treatment facilities shall be addressed in an updated and certified Recharge Feature Plan. The Recharge Feature Plan will include the best management practices implemented that will prevent impact to recharge features from wastewater application and prevent groundwater contamination. The updated and certified Recharge Feature Plan shall be submitted to the TCEQ Water Quality Assessment Team (MC-150) and the TCEQ Region 11 (Austin) Office within 30 days of discovery of the feature. The Recharge Feature Plan must be certified by a Texas-licensed Professional Geoscientist or a Texas-licensed Professional Engineer.

15. The permittee shall comply with buffer zone requirements of 30 TAC Section §309.13(c). A wastewater treatment plant unit, defined by 30 TAC Section §309.11(9), must be located a minimum horizontal distance of 250 feet from a private well and a minimum horizontal distance of 500 feet from a public water well site, spring, or other similar sources of public drinking water, as provided by §290.41(c)(1) of this title.

16. The permittee shall comply with the buffer zone requirements of 30 TAC §309.13(c), specifically regarding water wells and waters in the state. The permittee must locate the wastewater irrigation fields a minimum horizontal distance of 500 feet from public water wells, springs, or other similar sources of public drinking water; 150 feet from private water wells; and 100 feet from surface waters in the state.

17. The permittee shall construct berms or swales that will prevent, or divert, stormwater from entering all subsurface wastewater application areas.

18. Application rates shall not exceed 0.1 gallons per square foot per day. The permittee is responsible for providing equipment to determine the application rate and for maintaining accurate records of the volume of effluent applied. According to the requirements of 30 TAC § 222.161(d), the permittee shall maintain records documenting all activities associated with maintaining the vegetative cover (the crops), like planting, over-seeding, mowing height, fertilizing, and harvesting. These records shall be maintained for a minimum of five years and be made available to TCEQ staff upon request.

19. The permittee shall use cultural practices to promote and maintain the health and propagation of the Bermuda grass and ryegrass crops and avoid plant lodging. The permittee shall harvest the crops (cut and remove it from the field) at least once during the year. Harvesting and mowing dates shall be recorded in a log book kept on site to be made available to TCEQ personnel upon request.

20. The physical condition of the land application fields shall be monitored on a weekly basis. Any area with problems such as surface runoff, surficial erosion, or stressed or damaged vegetation, etc., shall be recorded in a field log kept onsite. Corrective measures will be implemented within 24 hours of discovery.

21. Subsurface irrigation practices shall be designed and managed so as to prevent ponding and surfacing of effluent, contamination of ground and surface water, and the occurrence of nuisance conditions in the area. To promote effluent and nutrient uptake by the crop, and to prevent pathways for effluent surfacing, Bermuda grass and ryegrass shall be established and well maintained in the irrigation area throughout the year.

22. For any area where treated effluent is stored or where there exist hose bibs or faucets, the permittee shall erect adequate signs stating that the irrigation water is from a non-potable water supply. Signs shall consist of a red slash superimposed over the international symbol for drinking water accompanied by the message "DO NOT DRINK THE WATER" in both English and Spanish. All piping transporting the effluent shall be clearly marked with these same signs.

23. Based on the requirements of 30 TAC § 222.151, the subsurface area drip dispersal system shall be designed and managed so as to prevent seepage or percolation out of the root zone, other than leaching in the amount required to maintain the health of the vegetative cover. Surfacing and ponding is prohibited. Creating a condition at the treatment facility or the drip dispersal zones that contributes to vector attraction or odor is prohibited.

24. Effluent shall not be applied for irrigation during rainfall events or when the ground is frozen or saturated.

25. The permittee shall remove large (greater than 12-inch) stones and flagstones from the irrigation area. Any large stones brought to the surface during any trenching for the drip lines, construction, maintenance activities, and/or any disturbing of the soil shall be removed.

26. Drip irrigation lines shall be installed on the contour and lateral slopes of the tubing shall not exceed 1 percent. The permittee can apply for a variance to this provision by providing justification in the detailed design criteria per Chapter 222 indicating how uneven application of effluent due to back draining will be avoided.

27. Irrigation to treated effluent on land with a slope of 10% or greater is prohibited. Irrigation of treated shall be limited to those tracts designated on Attachment A of this permit only after proper grading has been accomplished.

28. Emitters shall be installed a minimum of six (6) inches below the soil surface. A minimum of 12 inches of soil shall exist below the plane of the driplines.

29. A minimum of 18 inches of soil shall exist throughout the application area (note that ground-up limestone rock is not soil). If imported soils are used, the permittee shall submit, no later than 90 days prior to construction, to the TCEQ Water Quality Assessment Team (MC 150) and the Wastewater Permitting Section (MC 148) of the Water Quality Division, a plan for review and possible revision and approval describing how the imported soils will be incorporated into the native soils and how soil erosion will be prevented in the affected areas

30. Each zone shall have at least one soil moisture sensing devices placed at 12 inches below the depth of the drip lines that will automatically shut off irrigation to that zone when the soil becomes saturated. The devices shall be located on the downgradient side of each zone. The soil moisture monitoring devices, including a map of the monitoring device locations, shall be included with the dispersal zone design and submitted with the engineering report required by 222 TAC Subchapter D.

31. The permittee shall obtain representative soil samples from the root zones of the land application area receiving wastewater. Composite sampling techniques shall be used. Each composite sample shall represent no more than 35.15 acres with no less than one (1) cores per dosing bed (zone) representing each composite sample. Subsamples shall be composited by like sampling depth, type of crop and soil type for analysis and reporting. Soil types are soils that have like topsoil or plow layer textures. These soils shall be sampled individually from 0 to 12 inches and 12 to 24 inches below ground level. The permittee shall sample soils in December to February of each year. Soil samples shall be analyzed within 30 days of sample collection.

    The permittee shall provide annual soil sample analyses of the land application area according to the following table:

Parameter	**Method**	**Minimum Analytical Level (MAL)**	**Reporting units**
pH	2:1 (v/v) water to soil mixture		Reported to 0.1 pH units after calibration of pH meter
Electrical Conductivity	Obtained from the SAR water saturated paste extract	0.01	dS/m (same as mmho/cm)
Nitrate-nitrogen	From a 1 N KCl soil extract	1	mg/kg (dry weight basis)
Total Kjeldahl Nitrogen (TKN)	For determination of Organic plus Ammonium Nitrogen. Procedures that use Mercury (Hg) are not acceptable.	20	mg/kg (dry weight basis)
Total Nitrogen	= TKN plus Nitrate-nitrogen		mg/kg (dry weight basis)
Plant-available: Phosphorus	Mehlich III with inductively coupled plasma	1 (P)	mg/kg (dry weight basis)
Plant-available:	May be determined	5 (K)	mg/kg (dry weight basis)

Potassium (K) Calcium (Ca) Magnesium (Mg) Sodium (Na) Sulfur (S)	in the same Mehlich III extract with inductively coupled plasma	10 (Ca) 5 (Mg) 10 (Na) 1 (S)	
Water-soluble: Sodium (Na) Calcium (Ca) Magnesium (Mg)	Obtained from the SAR water saturated paste extract	1 (Na) 1 (Ca) 1 (Mg)	Water soluble constituents are reported in mg/L
Sodium Adsorption Ratio (SAR)	$SAR = \frac{Na}{\sqrt{\frac{(Ca + Mg)}{2}}}$		Express concentrations of Na, Ca and Mg in the water saturated paste extract in milliequivalents/liter (meq/L) to calculate the SAR. The SAR value is unit less. If the SAR is greater than 10, amendments (e.g., gypsum) shall be added to the soil to adjust the SAR to less than 10.
Amendment addition, e.g., gypsum			Report in short tons/acre in the year effected

A copy of this soil testing plan shall be provided to the analytical laboratory prior to sample analysis. The permittee shall submit the results of the annual soil sample analyses with copies of the laboratory reports and a map depicting the areas that have received wastewater within the permanent land application fields to the TCEQ Regional Office (MC Region 11) and the Enforcement Division (MC 224), no later than September 1st of each sampling year. If wastewater is not applied in a particular year, the permittee shall notify the same TCEQ offices and indicate that wastewater has not been applied on the approved land irrigation site(s) during that year.

32. The permittee shall design and install temporary storage that equals at least three days of the design flow of the facility for times when the subsurface area drip dispersal system is out of service due to an emergency or scheduled maintenance. In addition, the permittee shall pump and haul wastewater from the facility to prevent the discharge of treated or untreated wastewater if complete shutdown of the wastewater treatment facility becomes necessary or if the storage capacity is exceeded.

33. Permanent transmission lines shall be installed from the treatment system to each drip irrigation zone of the subsurface drip irrigation system. According to 30 TAC § 222.153, the permittee shall flush the subsurface area drip dispersal system from the dispersal zone and

return the flush water to a point preceding the treatment system at least once every two months.

34. According to 30 TAC § 222.163, Closure Requirements, the permittee shall close the system under the standards set forth in this section.

35. According to the requirements of 30 TAC § 222.43, the permittee shall notify the TCEQ Regional Office (MC Region 11) for each of the following activities:

    a. At least 30 days prior to the date the field layout and/or construction startup is scheduled to begin for the proposed subsurface drip irrigation system.

    b. At least 30 days prior to the date that construction is projected to be complete.

    c. Within 30 days after operation of the proposed subsurface drip irrigation system.

    d. If soils are imported, at least 30 days prior to completion of the soil importing project.

36. According to the requirements of 30 TAC § 222.45, the permittee shall submit a copy of the issued permit to the health department with jurisdiction in the area where the system is located before commencing operation of the proposed subsurface drip irrigation system. The permittee shall retain proof of delivery for the duration of the permit.

37. In accordance with 30 TAC § 319.9, a permittee that has at least twelve months of uninterrupted compliance with its bacteria limit may notify the commission in writing of its compliance and request a less frequent measurement schedule. To request a less frequent schedule, the permittee shall submit a written request to the TCEQ Wastewater Permitting Section (MC 148) for each phase that includes a different monitoring frequency. The request must contain all of the reported bacteria values (Daily Avg. and Daily Max/Single Grab) for the twelve consecutive months immediately prior to the request. If the Executive Director finds that a less frequent measurement schedule is protective of human health and the environment, the permittee may be given a less frequent measurement schedule. For this permit, one/quarter may be reduced to one/month (Interim I) and one/month may be reduced to 2/month (Interim II and Final phases). **A violation of any bacteria limit by a facility that has been granted a less frequent measurement schedule will require the permittee to return to the standard frequency schedule and submit written notice to the TCEQ Wastewater Permitting Section (MC 148).** The permittee may not apply for another reduction in measurement frequency for at least 24 months from the date of the last violation. The Executive Director may establish a more frequent measurement schedule if necessary to protect human health or the environment.

TECHNICAL SUMMARY AND
EXECUTIVE DIRECTOR'S PRELIMINARY DECISION

DESCRIPTION OF APPLICATION

Applicant:	George Reagor and Laura Reagor TCEQ Permit No. WQ0016685001
Regulated Activity:	Domestic Wastewater Permit
Type of Application:	New Permit
Request:	New Permit
Authority:	Texas Water Code (TWC) § 26.027; 30 Texas Administrative Code (TAC) Chapters 222, 305, 309, 312, 319, and 30; and Commission policies.

EXECUTIVE DIRECTOR RECOMMENDATION

The Executive Director has made a preliminary decision that this permit, if issued, meets all statutory and regulatory requirements. The draft permit includes an expiration date of **five years from the date of issuance,** according to 30 TAC § 305.127(1)(C)(ii)(III), Conditions to be Determined for Individual Permits.

REASON FOR PROJECT PROPOSED

George Reagor and Laura Reagor has applied to the Texas Commission on Environmental Quality (TCEQ) for a new permit, Permit No. WQ0016685001 to authorize the disposal of treated domestic wastewater at a daily average flow not to exceed 0.05 MGD via non-public access subsurface area drip dispersal system with a minimum area of 11.7 acres in the Interim I phase, 0.10 MGD via 23.3 acres in the Interim II phase, and 0.15 MGD via 35 acres in the Final phase. The proposed wastewater treatment facility will serve the Reagor Tract subdivision in Williamson County.

PROJECT DESCRIPTION AND LOCATION

The Reagor Tract Wastewater Treatment Facility consists of an activated sludge process plant using the extended aeration mode. Treatment units in the Interim I phase will include a bar screen, an aeration basin, a final clarifier, a digester, and a chlorine contact chamber. Treatment units in the Interim II phase will include a bar screen, two aeration basins, two final clarifiers, two digesters, and two chlorine contact chambers. Treatment units in the Final phase will include a bar screen, three aeration basins, three final clarifiers, three digesters, and three chlorine contact chambers. The facility has not been constructed.

The draft permit authorizes the disposal of sludge at a TCEQ-authorized land application site, co-disposal landfill, wastewater treatment facility, or facility that further processes sludge.

The wastewater treatment facility and disposal site will be located approximately 0.59 miles south of the intersection of Indian Springs Road and Ranch-to-Market Road 2338 in Williamson County, Texas 78633.

The wastewater treatment facility and disposal site will be located in the drainage basin of San Gabriel/North Fork San Gabriel River in Segment No. 1248 of the Brazos River Basin. No discharge of pollutants into water in the State is authorized by this permit.

SUMMARY OF EFFLUENT DATA

There is no effluent data since the facility has not been constructed.

DRAFT PERMIT CONDITIONS

The draft permit authorizes the disposal of treated domestic wastewater effluent at a daily average flow not to exceed 0.05 MGD via non-public access subsurface area drip dispersal system with a minimum area of 11.7 acres in the Interim I phase, 0.10 MGD via 23.3 acres in the Interim II phase, and 0.15 MGD via 35 acres in the Final phase. The permittee is required to provide at least three days of temporary storage for times when the facility is out of service due to an emergency or for scheduled maintenance. Application rates shall not exceed 0.1 gallons per square foot per day. The permittee will maintain the Bermuda grass overseeded with Winter Rye grass on the disposal site.

The effluent limitations in the draft permit, based on a daily average, are 10 mg/l biochemical oxygen demand (BOD_5), and 15 mg/l total suspended solids (TSS). The effluent limitation in the draft permit, based on a single grab, 126 colony forming units (CFU) or most probable number (MPN) of *E. coli* per 100 ml. The effluent shall contain a total chlorine residual of at least 1.0 mg/l after a detention time of at least 20 minutes based on peak flow.

The permittee shall comply with the requirements of 30 TAC § 309.13 (a) through (d). In addition, by ownership of the required buffer zone area, the permittee shall comply with the requirements of 30 TAC § 309.13(e).

The draft permit includes Sludge Provisions according to the requirements of 30 TAC Chapter 312, Sludge Use, Disposal and Transportation. The draft permit authorizes the disposal of sludge at a TCEQ-authorized land application site, co-disposal landfill, wastewater treatment facility, or facility that further processes sludge.

SUMMARY OF CHANGES FROM APPLICATION

None.

BASIS FOR DRAFT PERMIT

The following items were considered in developing the draft permit:

1. Application submitted with letter dated December 11, 2024 and additional information submitted with letter dated January 6, 2025.

2. Interoffice Memorandum from the Water Quality Assessment Team, Water Quality Assessment & Standards Section, Water Quality Division.

PROCEDURES FOR FINAL DECISION

When an application is declared administratively complete, the Chief Clerk sends a letter to the applicant advising the applicant to publish the Notice of Receipt of Application and Intent to Obtain Permit in the newspaper. In addition, the Chief Clerk instructs the applicant to place a copy of the application in a public place for review and copying in the county where the facility is

or will be located. This application will be in a public place throughout the comment period. The Chief Clerk also mails this notice to any interested persons and, if required, to landowners identified in the permit application. This notice informs the public about the application, and provides that an interested person may file comments on the application or request a contested case hearing or a public meeting.

Once a draft permit is completed, it is sent, along with the Executive Director's preliminary decision, as contained in the technical summary or fact sheet, to the Chief Clerk. At that time, Notice of Application and Preliminary Decision will be mailed to the same people and published in the same newspaper as the prior notice. This notice sets a deadline for making public comments. The applicant must place a copy of the Executive Director's preliminary decision and draft permit in the public place with the application.

Any interested person may request a public meeting on the application until the deadline for filing public comments. A public meeting is intended for the taking of public comment, and is not a contested case proceeding.

After the public comment deadline, the Executive Director prepares a response to all significant public comments on the application or the draft permit raised during the public comment period. The Chief Clerk then mails the Executive Director's Response to Comments and Final Decision to people who have filed comments, requested a contested case hearing, or requested to be on the mailing list. This notice provides that if a person is not satisfied with the Executive Director's response and decision, they can request a contested case hearing or file a request to reconsider the Executive Director's decision within 30 days after the notice is mailed.

The Executive Director will issue the permit unless a written hearing request or request for reconsideration is filed within 30 days after the Executive Director's Response to Comments and Final Decision is mailed. If a hearing request or request for reconsideration is filed, the Executive Director will not issue the permit and will forward the application and request to the TCEQ Commissioners for their consideration at a scheduled Commission meeting. If a contested case hearing is held, it will be a legal proceeding similar to a civil trial in state district court.

If the Executive Director calls a public meeting or the Commission grants a contested case hearing as described above, the Commission will give notice of the date, time, and place of the meeting or hearing. If a hearing request or request for reconsideration is made, the Commission will consider all public comments in making its decision and shall either adopt the Executive Director's response to public comments or prepare its own response.

For additional information about this application, contact Kimberly Kendall, P.E. at (512) 239-4540.

Kimberly Kendall

Kimberly Kendall, P.E.
Municipal Permits Team
Wastewater Permitting Section (MC 148)

May 21, 2025
Date