TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

June 1, 2001

Mr. Charles D. Patterson
Summerlin Properties, Inc.
P.O. Box 1629
Wimberley, Texas 78676

Re: Edwards Aquifer, Comal County
NAME OF PROJECT: River Chase Unit-4; Project is located approximately 2.5 miles south of Purgatory Road on F.M. 306; New Braunfels, Texas
TYPE OF PLAN: Request for Approval of a Water Pollution Abatement Plan (WPAP); 30 Texas Administrative Code (TAC) Chapter 213 Edwards Aquifer
Edwards Aquifer Protection Program File No. 1,661.00

Dear Mr. Patterson:

The Texas Natural Resource Conservation Commission (TNRCC) has completed its review of the WPAP application for the referenced project submitted to the San Antonio Regional Office by Kelly Kilber, P.E., of Pro-Tech Engineering Group, Inc. on behalf of Summerlin Properties, Inc. on March 21, 2001. Final review of the application was conducted after additional materials were received on May 18, 2001, May 22, 2001, and May 31, 2001. As presented to the TNRCC, the Temporary Best Management Practices (BMPs) and construction plans were prepared by a Texas Licensed Professional Engineer to be in general compliance with the requirements of 30 TAC Chapter 213. These planning materials were sealed, signed, and dated by a Texas Licensed Professional Engineer. Therefore, based on the engineer's concurrence of compliance, the planning materials for construction of the proposed project and pollution abatement measures are hereby approved subject to applicable state rules and the conditions in this letter. The applicant or a person affected may file with the chief clerk a motion for reconsideration of the executive director's final action on this Edwards Aquifer protection plan. A motion for reconsideration must be filed no later than 20 days after the date of this approval letter. *This approval expires two (2) years from the date of this letter unless, prior to the expiration date, more than 10 percent of the construction has commenced on the project or an extension of time has been requested.*

PROJECT DESCRIPTION

The proposed residential project will have an area of approximately 289.95 acres. It will include the construction of 170 single family residential lots and associated driveways and residential streets. The impervious cover will be 30.04 acres (10%). According to a letter dated, March 8, 2001, signed by Thomas H. Hornseth, P.E., with Comal County, the site in the development is acceptable for the use of on-site sewage facilities.

PERMANENT POLLUTION ABATEMENT MEASURES

Since this single-family residential project will not have more than 20 percent impervious cover, an exemption from permanent BMPs is approved.

GEOLOGY

According to the geologic assessment included with the application, approximately fifteen possibly sensitive and sensitive features were identified on the proposed development. The San Antonio Regional Office did not conduct a site inspection of the proposed project site.

SPECIAL CONDITIONS

I. Features S-75 and S-79 will be sealed by road construction and a sealing certificate, signed by a professional engineer, provided to the TNRCC Region 13 office within 30 days of feature closure. Separation distances for OSSF installation for features S-75 and S-79 shall not be required.

II. Water well plugging reports shall be submitted to the San Antonio Regional Office of the TNRCC and the Office of the Comal County Engineer within 30 days of well closure.

III. If the impervious cover ever increases above 20 percent or the land use changes, the exemption for the whole site may no longer apply and the property owner must notify the San Antonio Regional Office of these changes.

IV. The proposed on-site sewage facility (OSSF) must be permitted by a local or the state permitting authority prior to commencement of construction.

V. All planning and design materials for the proposed OSSF shall be submitted by a professional engineer or a sanitarian registered in Texas.

VI. The following minimum separation distances in feet must be provided between OSSF units and recharge features or possible recharge features:

Sewage Treatment Tanks or Holding Tanks	50
Soil Absorption Systems, & Unlined Evapo-transpiration Beds	150
Lined Evapotranspiration Beds	50
Sewer Pipe with Watertight Joints	50
Surface Irrigation Fields	150
Drip Irrigation Fields	100 when $R_a \leq 0.1$ 150 when $R_a > 0.1$

STANDARD CONDITIONS

1. Pursuant to §26.136 of the Texas Water Code, any violations of the requirements in 30 TAC Chapter 213 may result in administrative penalties.

Prior to Commencement of Construction:

2. Within 60 days of receiving written approval of an Edwards Aquifer protection plan, the applicant must submit to the San Antonio Regional Office, proof of recordation of notice in the county deed records, with the volume and page number(s) of the county deed records of the county in which the property is located. A description of the property boundaries shall be included in the deed recordation in the county deed records. A suggested form (Deed Recordation Affidavit, TNRCC-0625) that you may use to deed record the approved WPAP is enclosed.

3. All contractors conducting regulated activities at the referenced project location shall be provided a copy of this notice of approval. At least one complete copy of the approved WPAP and this notice of approval shall be maintained at the project location until all regulated activities are completed.

4. Modification to the activities described in the referenced WPAP application following the date of approval may require the submittal of a plan to modify this approval, including the payment of appropriate fees and all information necessary for its review and approval prior to initiating construction of the modifications.

5. The applicant must provide written notification of intent to commence construction, replacement, or rehabilitation of the referenced project. Notification must be submitted to the San Antonio Regional Office no later than 48 hours prior to commencement of the

regulated activity. Written notification must include the date on which the regulated activity will commence, the name of the approved plan and file number for the regulated activity, and the name of the prime contractor with the name and telephone number of the contact person. The executive director will use the notification to determine if the approved plan is eligible for an extension.

6. Temporary erosion and sedimentation (E&S) controls, i.e., silt fences, rock berms, stabilized construction entrances, or other controls described in the approved WPAP, must be installed prior to construction and maintained during construction. Temporary E&S controls may be removed when vegetation is established and the construction area is stabilized. If a water quality pond is proposed, it shall be used as a sedimentation basin during construction. The TNRCC may monitor stormwater discharges from the site to evaluate the adequacy of temporary E&S control measures. Additional controls may be necessary if excessive solids are being discharged from the site.

7. All borings with depths greater than or equal to 20 feet must be plugged with non-shrink grout from the bottom of the hole to within three (3) feet of the surface. The remainder of the hole must be backfilled with cuttings from the boring. All borings less than 20 feet must be backfilled with cuttings from the boring. All borings must be backfilled or plugged within four (4) days of completion of the drilling operation. Voids may be filled with gravel.

<u>During Construction:</u>

8. During the course of regulated activities related to this project, the applicant or agent shall comply with all applicable provisions of 30 TAC Chapter 213, Edwards Aquifer. The applicant shall remain responsible for the provisions and conditions of this approval until such responsibility is legally transferred to another person or entity.

9. If any sensitive feature (caves, solution cavities, sink holes, etc.) is discovered during construction, all regulated activities near the feature must be suspended immediately. The applicant or his agent must immediately notify the San Antonio Regional Office of the discovery of the feature. Regulated activities near the feature may not proceed until the executive director has reviewed and approved the methods proposed to protect the feature and the aquifer from potentially adverse impacts to water quality. The plan must be sealed, signed, and dated by a Texas Licensed Professional Engineer.

10. A single well exist on the site. All water wells, including injection, dewatering, and monitoring wells must be in compliance with the requirements of the Texas Department of Licensing and Regulation under Title 16 TAC Chapter 76 (relating to Water Well Drillers and Pump Installers) and all other locally applicable rules, as appropriate.

11. If sediment escapes the construction site, the sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain). Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50 percent. Litter, construction debris, and construction chemicals shall be prevented from becoming stormwater discharge pollutants.

12. The following records shall be maintained and made available to the executive director upon request: the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.

13. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, and construction activities will not resume within 21 days. When the initiation of stabilization measures by the 14th day is precluded by weather conditions, stabilization measures shall be initiated as soon as practicable.

<u>After Completion of Construction:</u>

14. A Texas Licensed Professional Engineer must certify in writing that the permanent BMPs or measures were constructed as designed. The certification letter must be submitted to the San Antonio Regional Office within 30 days of site completion.

15. The applicant shall be responsible for maintaining the permanent BMPs after construction until such time as the maintenance obligation is either assumed in writing by another entity having ownership or control of the property (such as without limitation, an owner's association, a new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity. The regulated entity shall then be responsible for maintenance until another entity assumes such obligations in writing or ownership is transferred. A copy of the transfer of responsibility must be filed with the executive director through the San Antonio Regional Office within 30 days of the transfer. A copy of the transfer form (TNRCC-10263) is enclosed.

16. Upon legal transfer of this property, the new owner(s) is required to comply with all terms of the approved Edwards Aquifer protection plan. If the new owner intends to commence any new regulated activity on the site, a new Edwards Aquifer protection plan that specifically addresses the new activity must be submitted to the executive director. Approval of the plan for the new regulated activity by the executive director is required prior to commencement of the new regulated activity.

17. An Edwards Aquifer protection plan approval or extension will expire and no extension will be granted if more than 50 percent of the total construction has not been completed within ten years from the initial approval of a plan. A new Edwards Aquifer protection plan must be submitted to the San Antonio Regional Office with the appropriate fees for review and approval by the executive director prior to commencing any additional regulated activities.

18. At project locations where construction is initiated and abandoned, or not completed, the site shall be returned to a condition such that the aquifer is protected from potential contamination.

If you have any questions or require additional information, please contact Tom Gutierrez of the Edwards Aquifer Protection Program of the San Antonio Regional Office at 210-403-4025.

Sincerely,

Bobby D. Caldwell

for Jeffrey A. Saitas, P.E.
Executive Director
Texas Natural Resource Conservation Commission

JAS/tg

Enclosure: Deed Recordation Affidavit, Form TNRCC-0625
Change in Responsibility for Maintenance on Permanent BMPs-Form TNRCC-10263

cc: Mr. Kelly Kilber, Pro-Tech Engineering Group, Inc.
Mr. Greg Ellis, Edwards Aquifer Authority
Mr. John Bohuslav, TXDOT San Antonio District
Mr. Harry Bennett, City of New Braunfels
Mr. Tom Hornseth, Comal County
TNRCC Field Operations, Austin

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Sincerely,

Bobby D. Caldwell

for Jeffrey A. Saitas, P.E.
Executive Director
Texas Natural Resource Conservation Commission

JAS/tg

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cc: Mr. Kelly Kilber, Pro-Tech Engineering Group, Inc.
Mr. Greg Ellis, Edwards Aquifer Authority
Mr. John Bohuslav, TXDOT San Antonio District
Mr. Harry Bennett, City of New Braunfels
Mr. Tom Hornseth, Comal County
TNRCC Field Operations, Austin

COPY

Comal County

OFFICE OF COMAL COUNTY ENGINEER

April 26, 2001

Mr. Tom Gutierrez
Texas Natural Resource Conservation Commission
14250 Judson Rd.
San Antonio, TX 78233-4480

Re: Water Pollution Abatement Plan (WPAP) for proposed subdivision, River Chase, Unit Four, within Comal County, Texas

Dear Mr. Gutierrez:

We appreciate the opportunity to submit our comments regarding the WPAP for the referenced.

We would suggest that the WPAP requirements include the plugging of all abandoned wells, in accordance with the State regulations, and request that copies of the plugging reports would be forwarded to our office.

Should you have any questions, please feel free to contact us.

Sincerely,

Thomas H. Hornseth, P.E.
Comal County Engineer

195 David Jonas Drive • New Braunfels, Texas 78132-3760 • (830) 608-2090 FAX: (830) 608-2009

4-26-01

Were to send WSAP responses to

TNRCC
Tom Gutierrez
14250 Judson Rd.
S.A., TX 78233-4480

(210)
@490-3096

OFFICE OF COMAL COUNTY ENGINEER

195 David Jonas Drive
New Braunfels, Texas 78132-3760
(830) 608-2090 Fax (830) 608-2009

Facsimile transmittal

To:	Tom Gutierrez	**Fax:**	210-545-4329
From:	Thomas Hornseth	**Date:**	4-26-01
Re:	WPAP/River Chase, Unit Four	**Pages:**	2
Cc:		**Pages:**	

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☑ **Originals to follow via mail**

Comments follow.

GENERAL INFORMATION FORM
FOR REGULATED ACTIVITIES ON THE
EDWARDS AQUIFER RECHARGE AND TRANSITION ZONES
AND RELATING TO 30 TAC §213.4(b) & §213.5(b)(2)(A), (B)
EFFECTIVE JUNE 1, 1999

RECEIVED-TNRCC
2001 MAR 21 PM 1:49
SAN ANTONIO REGION

PROJECT NAME: RIVER CHASE UNIT FOUR
COUNTY: COMAL STREAM BASIN: ALLIGATOR CREEK

RECEIVED
APR 3 2001
COUNTY ENGINEER

EDWARDS AQUIFER: X RECHARGE ZONE
__ TRANSITION ZONE

PLAN TYPE: X WPAP __ AST __ EXCEPTION
__ SCS __ UST __ MODIFICATION

Tom Gutierrez

Aerobics
ex. wells.

APPLICANT INFORMATION

1. Applicant:

Contact Person: CHARLES D. PATTERSON
Entity: SUMMERLIN PROPERTIES, INC.
Mailing Address: P. O. BOX 1629
City, State: WIMBERLEY, TX Zip: 78676
Telephone: (512) 847-5263 FAX: (512) 847-3690

2. Agent/Representative (If any):

Contact Person: KELLY KILBER
Entity: PRO-TECH ENGINEERING GROUP, INC.
Mailing Address: 100 E. SAN ANTONIO ST., SUITE 100
City, State: SAN MARCOS, TX Zip: 78676
Telephone: (512) 353-3335 FAX: (512) 396-0224

PROJECT LOCATION

3. Site Address: RIVER CHASE
Street: 6205 FM 306
City: NEW BRAUNFELS, TX Zip: 78132

4. __ This project is inside the city limits of _____.
__ This project is outside the city limits but inside the ETJ (extra-territorial jurisdiction) of _____.
X This project is not located within any city's limits or ETJ.

5. The location of the project site is described below. The description provides sufficient detail and clarity so that the TNRCC's Regional staff can easily locate the project and site boundaries for a field investigation.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

December 29, 1999

Brenda J. Ritzen, Environmental Health Coordinator
Office of Comal County Engineer
195 David Jonas Drive
New Braunfels, Texas 78132-3760

Re: Authorized Agent (AA) Responsibilities Regarding Pollution Abatement Plans

Dear Ms. Ritzen:

We have completed our review of the following issue as requested: Can an AA deny an application for a standard system if the pollution abatement requires aerobic treatment units?

If the pollution abatement plan requires aerobic treatment units, you do have the authority to enforce the provisions of the pollution abatement plan and can therefore turn down the standard system since it is prohibited by the pollution abatement plan. However, if the site evaluation indicates that a standard disposal system is acceptable according 30 Texas Administrative Code §285, then we have no objections to your office permitting standard disposal systems even though this may conflict with the pollution abatement plan.

If you have any questions concerning this matter, please contact me at 512/239-4799.

Sincerely,

Warren D. Samuelson

Warren D. Samuelson, P.E.
Team Leader
On-Site Sewage Facilities Program, MC-178

WDS/amm

cc: Bobby Caldwell, Water Program Manager, TNRCC Region 13

00-001

2.5 MILES SOUTH OF PURGATORY ROAD ON FM 306

6. X **ATTACHMENT A - ROAD MAP.** A road map showing directions to and the location of the project site is attached at the end of this form.

7. X **ATTACHMENT B - USGS / EDWARDS RECHARGE ZONE MAP.** A copy of the official 7 ½ minute USGS Quadrangle Map (Scale: 1" = 2000') of the Edwards Recharge Zone is attached behind this sheet. The map(s) should clearly show:

   X Project site.
   X USGS Quadrangle Name(s).
   X Boundaries of the Recharge Zone (and Transition Zone, if applicable).
   X Drainage path from the project to the boundary of the Recharge Zone.

8. X Sufficient survey staking is provided on the project to allow TNRCC regional staff to locate the boundaries and alignment of the regulated activities and the geologic or manmade features noted in the Geologic Assessment. **The TNRCC must be able to inspect the project site or the application will be returned.**

9. X **ATTACHMENT C - PROJECT DESCRIPTION.** Attached at the end of this form is a detailed narrative description of the proposed project.

10. Existing project site conditions are noted below:
   __ Existing commercial site
   __ Existing industrial site
   __ Existing residential site
   __ Existing paved and/or unpaved roads
   __ Undeveloped (Cleared)
   X Undeveloped (Undisturbed/Uncleared)
   __ Other: _____

PROHIBITED ACTIVITIES

11. X I am aware that the following activities are prohibited on the **Recharge Zone** and are not proposed for this project:

   (1) waste disposal wells regulated under 30 TAC Chapter 331 of this title (relating to Underground Injection Control);
   (2) new feedlot/concentrated animal feeding operations, as defined in 30 TAC §213.3;
   (3) land disposal of Class I wastes, as defined in 30 TAC §335.1;
   (4) the use of sewage holding tanks as parts of organized collection systems; and
   (5) new municipal solid waste landfill facilities required to meet and comply with Type I standards which are defined in §330.41(b), (c), and (d) of this title (relating to Types of Municipal Solid Waste Facilities).

12. X I am aware that the following activities are prohibited on the **Transition Zone** and are not proposed for this project:

(1) waste disposal wells regulated under 30 TAC Chapter 331 (relating to Underground Injection Control);
(2) land disposal of Class I wastes, as defined in 30 TAC §335.1; and
(3) new municipal solid waste landfill facilities required to meet and comply with Type I standards which are defined in §330.41 (b), (c), and (d) of this title.

ADMINISTRATIVE INFORMATION

13. The fee for the plan(s) is based on:

X For a Water Pollution Abatement Plan and Modifications, the total acreage of the site where regulated activities will occur.
__ For an Organized Sewage Collection System Plans and Modifications, the total linear footage of all collection system lines.
__ For a UST Facility Plan or an AST Facility Plan, the total number of tanks or piping systems.
__ A Contributing Zone Plan.
__ A request for an exception to any substantive portion of the regulations related to the protection of water quality.
__ A request for an extension to a previously approved plan.

14. Application fees are due and payable at the time the application is filed. If the correct fee is not submitted, the TNRCC is not required to consider the application until the correct fee is submitted. Both the fee and the Edwards Aquifer Fee Form have been sent to the Commission's:

__ TNRCC cashier
X Austin Regional Office (for projects in Hays, Travis, and Williamson Counties)
__ San Antonio Regional Office (for projects in Bexar, Comal, Kinney, Medina, and Uvalde Counties)

15. X Submit one (1) original and three (3) copies of the completed application to the appropriate regional office for distribution by the TNRCC to the local municipality or county, groundwater conservation districts, and the TNRCC's Central Office.

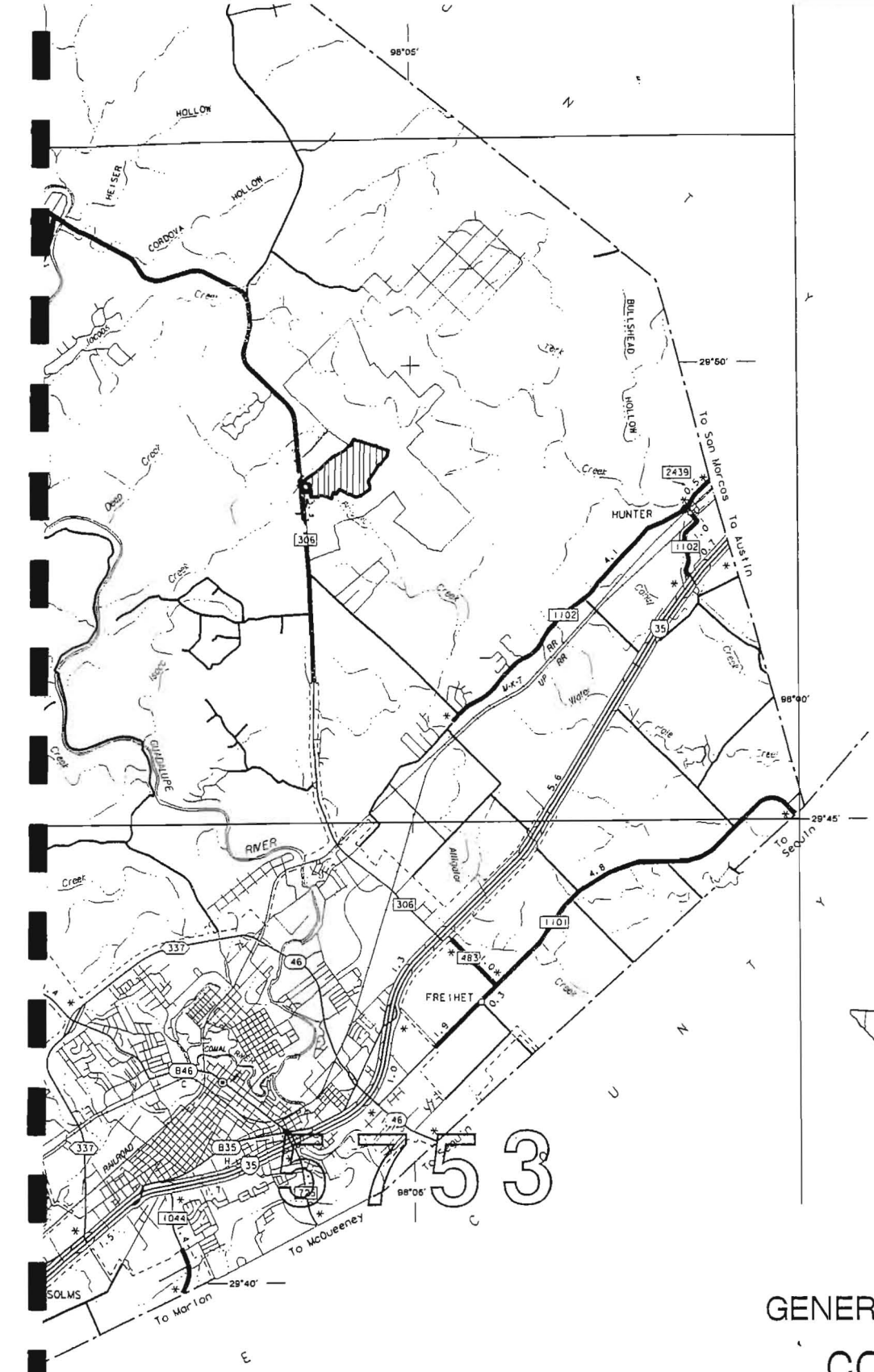
16. X No person shall commence any regulated activity until the Edwards Aquifer Protection Plan(s) for the activity has been filed with and approved by the executive director.
__ No person shall commence any regulated activity until the Contributing Zone Plan for the activity has been filed with the executive director.

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. This **GENERAL INFORMATION FORM** is hereby submitted for TNRCC review. The application was prepared by:

KELLY KILBER
Print Name of ~~Applicant~~/Agent

Signature of ~~Applicant/Owner~~/Agent

3/19/01
Date



GENERAL HIGHWAY MAP

COMAL COUNTY

TEXAS

PREPARED BY THE

TEXAS DEPARTMENT OF TRANSPORTATION

TRANSPORTATION PLANNING AND PROGRAMMING DIVISION

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

SCALE IN MILES

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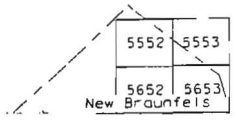
MAP

1988



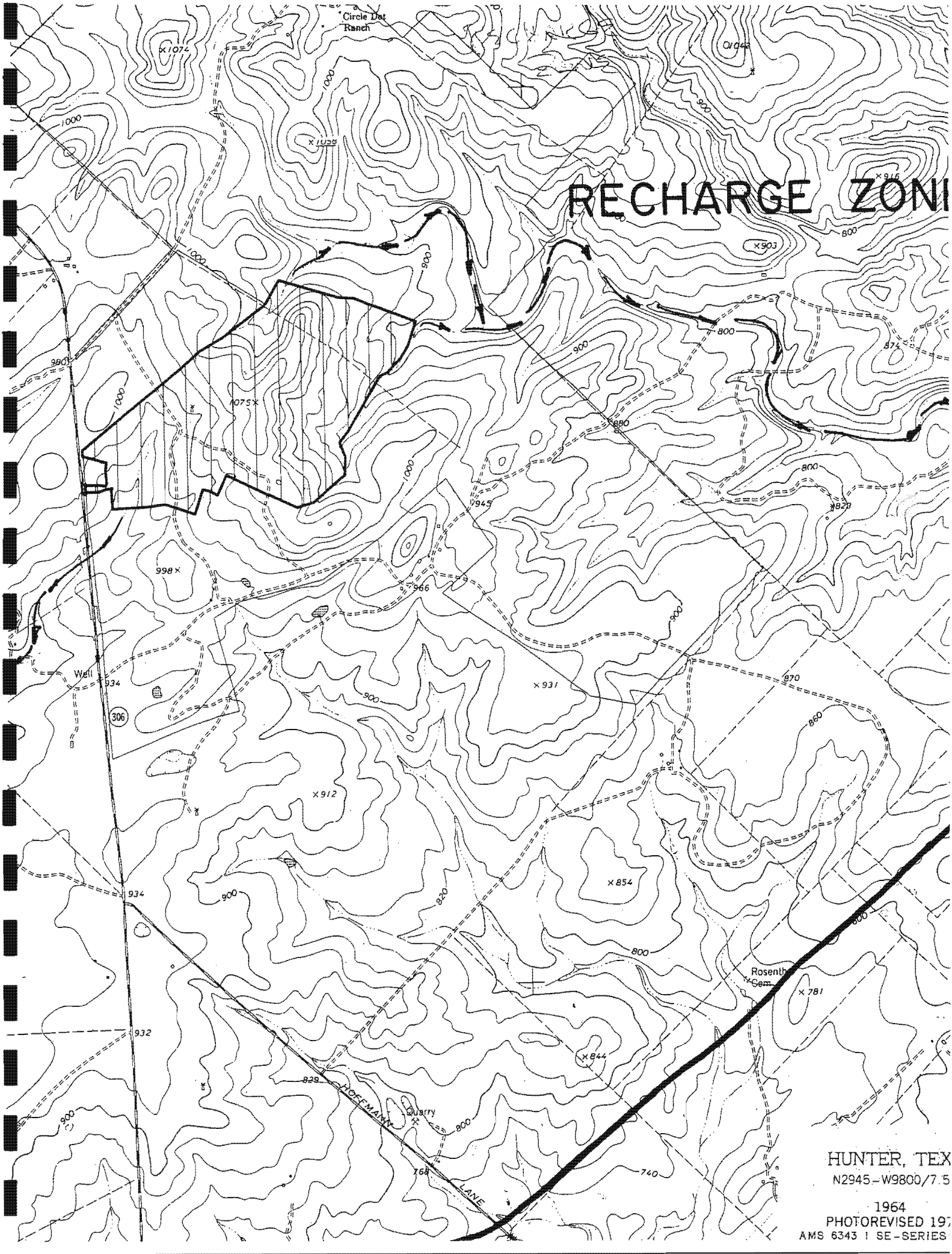
NOTICE

This map has been prepared for internal use within the Texas Department of Transportation.

Accuracy is limited to the validity of available data as of dates shown.

TRAVEL INFORMATION

Dial 1-800-452-9292 for travel assistance from a professional Texas travel counselor, including routing in Texas, emergency road condition information, and other travel services, or to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PROJECT DESCRIPTION:

River Chase Unit Four is a 162 Lot single family residential subdivision located approximately 7 miles north of the city of New Braunfels off of FM 306. The project consists of 291.84 acres of land located in the Wesley Hughes Survey No. 30, Comal County, Texas and is not located within any Extra Territorial Jurisdiction of any local city.

River Chase Unit Four is located on the eastern edge of the Edwards Plateau. York Creek runs through the northeastern side of this property. The development is located within the Edwards Aquifer Zone as determined by the TNRCC. This property is currently open/unused land, past uses have been for ranching and grazing purposes.

The development will consist of approximately 162 single-family residential lots, , with a minimum lot size of one 1.01 acre. 16,943 feet of asphalt roadway will be constructed. New Braunfels Utility will supply water for the development. Water distribution lines will be constructed in accordance with New Braunfels Utility specifications. Wastewater will be treated and disposed of by private septic systems constructed in accordance with the TNRCC and Comal County Health Department's rules and regulations. All septic systems to be a Class I Aerobic system. Sheet flow and open ditches to York Creek will transport Stormwater runoff.

Horizon

Corporate
Headquarters:
Austin, TX

Offices:
Beaumont, TX
Houston, TX
Karnes City, TX
Pittsburg, TX
San Antonio, TX
Shreveport, LA
Ann Arbor, MI

GEOLOGIC ASSESSMENT
FOR 1855-ACRE PFUEFFER RANCH
AT FM 306
COMAL COUNTY, TEXAS
HJN 010083 GA

PREPARED FOR:

SOUTHERLAND PROPERTIES
WIMBERLY, TEXAS

PREPARED BY:

HORIZON ENVIRONMENTAL SERVICES, INC.

MARCH 2000

HORIZON ENVIRONMENTAL SERVICES, INC.
P.O. Box 162017 • Austin, Texas 78716 • 2600 Dellana Lane, Suite 200 • Austin, Texas 78746
(512) 328-2430 • FAX (512) 328-1804 • http://www.horizon-esi.com

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TNRCC GEOLOGIC ASSESSMENT FORM

FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE/TRANSITION ZONES
AND RELATING TO 30 TAC §213.5(b)(3), EFFECTIVE JUNE 1, 1999

PROJECT NAME: 1855-ACRE PROPERTY, PFEUFFER RANCH AT FM 306, COMAL COUNTY, TEXAS.

TYPE OF PROJECT: X WPAP __ AST __ SCS __ UST

LOCATION OF PROJECT: X Recharge Zone __ Transition Zone __ Contributing Zone

PROJECT INFORMATION

1. X Geologic or manmade features are described and evaluated using the attached **GEOLOGIC ASSESSMENT TABLE (Appendix A)**.

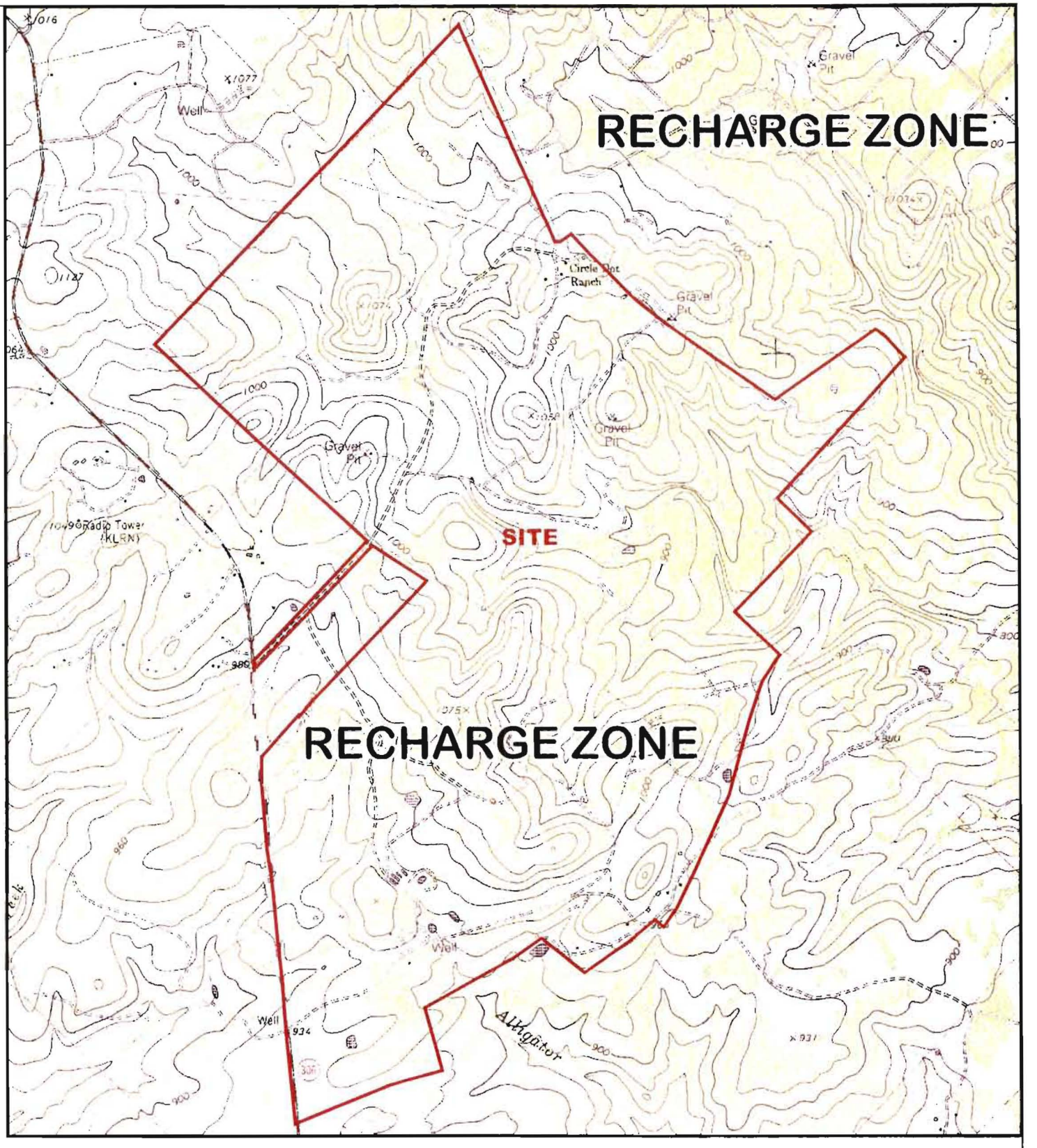
2. Soil cover on the project site is up to 6.7 feet thick. In general, the soil present appears to have the ability to:

   __ transmit fluid flow to the subsurface.
   X impede fluid flow to the subsurface.

3. X **SOILS ATTACHMENT**. A narrative description of soil units and a soil profile, including thickness and hydrologic characteristics are provided in Section 5.0 of the Additional Comments section at the end of this form.

4. X A **STRATIGRAPHIC COLUMN** is attached at the end of this form that shows formations, members, and thicknesses. The outcropping unit should be at the top of the stratigraphic column (Appendix B).

5. X A **NARRATIVE DESCRIPTION OF SITE SPECIFIC GEOLOGY** is attached at the end of this form in the Additional Comments section. The description must include a discussion of the potential for fluid movement to the Edwards Aquifer, stratigraphy, structure, and karst characteristics of the site.



BASE MAP SOURCE: U.S. GEOLOGICAL SURVEY, 7.5' SERIES, HUNTER QUADRANGLE, 1994.

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SCALE IN FEET

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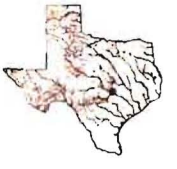

SITE LOCATION MAP

1855-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 000211 GA
November 2000

Horizon
ENVIRONMENTAL SERVICES, INC.

6. X Appropriate **SITE GEOLOGIC MAP(S)** are attached (Appendix C):

The Site Geologic Map must be the same scale as the applicant's Site Plan. The minimum scale is 1" : 400'

Applicant's Site Plan Scale	1" = 400'
Site Geologic Map Scale	1" = 400'

7. Method of collecting positional data:
   - X Global Positioning System (GPS) technology.
   - X Other method(s).

8. X The project site is shown and labeled on the Site Geologic Map.

9. X Surface geologic units are shown and labeled on the Site Geologic Map.

10. X Geologic or manmade features were discovered on the project site during the field investigation. They are shown and labeled on the Site Geologic Map and are described in the attached Geologic Assessment Table.
    - __ Geologic or manmade features were not discovered on the project site during the field investigation.

11. X The Recharge Zone boundary is shown and labeled, if appropriate.

12. All known wells (test holes, water, oil, unplugged, capped and/or abandoned, etc.):

    X There are 7(#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply.)
    - __ The wells are not in use and have been properly abandoned.
    - 1 The wells are not in use and will be properly abandoned.
    - 6 The wells are in use and comply with 16 TAC §76.

    __ There are no wells or test holes of any kind known to exist on the project site.

ADMINISTRATIVE INFORMATION

13. X One (1) original and three (3) copies of the completed assessment have been provided.

Date(s) Geologic Assessment was performed:

28, 29 June; 5, 7, 13, 14, 18, 20 July; 4, 11, 14, 23 August; and 7 September 2000
Date(s)

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. My signature certifies that I am qualified as a geologist as defined by 30 TAC 213.

Jason John
Print Name of Geologist

(512) 328-2430
Telephone

For Horizon Environmental Services, Inc.

(512) 328-1804
Fax

Signature of Geologist

16 March 2001
Date

Representing: Horizon Environmental Services, Inc., Austin, Texas

1855-ACRE
PFEUFFER RANCH
AT FM 306
COMAL COUNTY, TEXAS

ADDITIONAL COMMENTS
HJN 010083 GA

This report provides the results of a geologic assessment conducted by Horizon Environmental Services, Inc. (Horizon) on the above-referenced site. Horizon conducted the field reconnaissance on 28, 29 June; 5, 7, 13, 14, 18, 20 July; 4, 11, 14, 23 August; and 7 September 2000. Horizon spent a minimum of 260 hours in the field evaluating the site and surrounding area.

1.0 KARST INVESTIGATION METHODOLOGY

This geologic assessment includes a review of the site for potential aquifer recharge and documentation of general geologic characteristics for the subject site. Horizon conducted the necessary field and literature studies to meet or exceed Texas Natural Resource Conservation Commission (TNRCC) requirements. Horizon walked transects spaced 50 feet apart and mapped the location of features, if any, using a hand-held global positioning system (GPS), topographic maps, and aerial photographs. Horizon walked concentric circles (looking for karst features) around any areas showing evidence of internal drainage, including characteristics such as soil piping, solutionally enlarged voids or fractures, slumping, soil piping, extremely disturbed areas, or collapsed sinkholes. Section 4.0 provides a description of all features found during Horizon's survey.

2.0 ENVIRONMENTAL SETTING

2.1 LAND USE

The subject property consists of unimproved pasture and woodlands used for ranch and livestock activities. Several single-family residential houses are located on the subject site. Surrounding land use consists of undeveloped ranch land with sparse, single-family residential houses.

2.2 VEGETATION

Vegetation on the site consists of open grasslands and woodlands. Woodlands are dominated by plateau live oak (*Quercus fusiformis)*, Texas oak (*Quercus buckleyi*), Ashe juniper (*Juniperus ashei*), cedar elm (*Ulmus crassifolia*), with a few mesquite (*Prosopis glandulosa* var. *glandulosa*) interspersed. Ashe juniper removal has been practiced on the subject site, creating open grasslands.

2.3 TOPOGRAPHY AND SURFACE WATER

Topography on the subject property contains hills and valleys with surface elevations ranging from 920 to 1070 feet above mean sea level (MSL). Surface water drains via overland sheetflow and along natural drainages and York Creek. York Creek flows to the southeast through the center of the subject site. The portion of the subject site adjacent to York Creek is within the 100-year floodplain (FEMA, 1986).

2.4 RECHARGE ZONE BOUNDARY

The above-referenced site is within the Edwards Aquifer Recharge Zone as mapped by the TNRCC (TNRCC, 1996). The Recharge Zone is known as the area where the stratigraphic units constituting the Edwards Aquifer are exposed at the surface and where water may filter in the aquifer through permeable features such as cracks, fissures, caves and other openings in these layers (TNRCC, 1999). The Recharge Zone is identified as that area designated as such on official maps located in the appropriate regional office and groundwater conservation districts.

2.5 DESCRIPTION OF ON-SITE GEOLOGY

The subject site is found within the Edwards Aquifer Recharge Zone (TNRCC, 1996). According to published geologic maps of the region and Horizon's field investigation, the subject site is underlain by the Kainer and Person Formations of the Edwards Group limestones and the Georgetown, Del Rio, and Buda limestone formations. The site geologic map (Appendix C) was created from outcrop maps and areal photographs, allowing modification of published geologic maps (UT-BEG, 1982; Baumgardner and Collins, 1991; Hanson and Small, 1994). Following is a description of the site-specific geology, stratigraphy, potential for fluid movement, karstic characteristics, and geologic structures of the subject site.

2.5.1 Kainer Formation of the Edwards Group

The Kainer Formation is subdivided into informal members by Rose (1972). The Dolomitic, Kirschberg Evaporite, and Grainstone members are exposed on the subject site. The Kainer Formation ranges in thickness from about 260 to 310 feet and includes marine sediments consisting of fossiliferous mudstones (commonly rudistids) and wackestones that grade upward into dolomitic mudstones and evaporites, terminating in a *miliolid* grainstone (Hanson and Small, 1994). Though all members (hydrogeologic subdivisions) have some porosity and permeability, the Kirschberge Evaporite Member (Kek6) is reported to be the most porous and permeable of the Kainer Formation in Comal County (Hanson and Small, 1994).

2.5.1.1 Dolomitic Member (Kek_7)

The Dolomitic Member of the Kainer Formation (Hydrogeologic Subdivision VII of the Edwards Group) is poorly exposed along the northwestern portion of the subject site north of Bat Cave Fault (Hanson and Small,1994), and inferred due to thickness constraints along the southern portion of York Creek. The Dolomitic Member is regionally described as mostly dense crystalline limestone, with occasional zones of grainstone and layers of variably burrowed mudstone. Chert nodules and thin, discontinuous beds of chert are scattered throughout this member. Commonly rudist fossils, *Toucasia* sp., are found near the top of this member (Hanson and Small, 1994. Primary field characteristics of the Dolomitic Member on the subject site include abundant chert nodules and bivalve wackestone to packstones.

The Dolomitic Member is generally porous and relatively permeable. Evaporite beds are burrowed and dissolved to the extent of being honeycombed. Many beds contain isolated molds, casts, and burrows with large secondary porosity, but low permeability because voids are often unconnected. Caves are often associated with open bedding planes (Stein and Ozuna, 1995). The upper part of the Dolomitic Member may be cavernous and highly altered with abundant, red, clay-filled cavities (Rose, 1972).

2.5.1.2 Kirschberg Evaporite Member (Kek_6)

The Kirschberg Evaporite Member of the Kainer Formation (Hydrogeologic Subdivision VI of the Edwards Group) is regionally described as crystalline and chalky limestone, with lenses and nodules of chert about 50 feet thick. Primary field characteristics of the Kirschberg Evaporite Member on the subject site include thin to thick bedded buff to greyish-white color mudstones with fenestral porosity. Fenestral porosity (arranged in long rows parallel to bedding) suggests the remains of dissolved gypsum nodules (Rose, 1972). This member is described as the most porous and permeable member of the Kainer Formation and is host to extensive cave development in Comal County (Hanson and Small, 1994).

2.5.1.3 Grainstone Member (Kek_5)

The Grainstone Member of the Kainer Formation (Hydrologic Subdivision V of the Edwards Group) is exposed throughout the subject site. Primary field characteristics of the Grainstone Member on the subject site include white, cross-bedded, *Miliolid* and bivalve grainstones, with locally bivalved wakestones and mudstones. Regionally, the Grainstone Member is described as a dense, tightly cemented *Miliolid* grainstone, with some mudstone and wackestone.

The Grainstone Member is reported to be about 50 feet thick (Hason and Small, 1994). A *Toucasia* sp. (rudist fossil) bed is reported to be located at the top of the Grainstone Member (Rose, 1972). The Grainstone Member is highly recrystallized, thereby reducing its permeability and porosity. However, interparticle and intraparticle porosity and fracture (due to faulting) porosity and permeability are locally present.

Few caves are known to develop in this formation in Comal County; however, many caves in Bexar County have entrances in the lower part of this subdivision that provide access to the Kirschberg Evaporite Member below (Hanson and Small, 1994; Stein and Ozuna, 1995).

2.5.2 Person Formation of the Edwards Group

The Person Formation is subdivided into informal members by Rose (1972). The Regional Dense and Leached and Collapsed (Undivided) members are exposed on the subject site. The lithology of the Person Formation ranges from variably burrowed mudstone to grainstone to crystalline limestone (Hanson and Small, 1994). Though all members (hydrogeologic subdivisions) have some porosity and permeability, the Leached and Collapsed Member (Kek3) is reported to be the most porous and permeable of the Person Formation in Comal County (Hanson and Small, 1994).

2.5.2.1 Regional Dense Member (Kep_4)

The Regional Dense Member of the Person Formation (Hydrologic Subdivision IV of the Edwards Group) is regionally described as a dense, argillaceous mudstone (Rose, 1972; Hanson and Small, 1994). The Regional Dense Member is about 20 to 24 feet thick in Comal County (Hanson and Small, 1994). Primary field characteristics of the Regional Dense Member on the subject site include white, nodular, chalky, bivalve mudstones. Historically, the Regional Dense Member was quarried for road base throughout the subject site and was extremely useful as a stratigraphic marker during geologic mapping. The Regional Dense Member has little permeability or porosity overall and is known as the least porous or permeable subdivision (Hanson and Small, 1994). It does not typically produce large caves near the subject site. Hanson and Small (1994) describe this member as a possible confining unit locally within the Edwards Aquifer. However, caves, faults, and fractures may greatly reduce the confining effects of this member locally.

2.5.2.2 Leached and Collapsed Member (Kep_3)

The Leached and Collapsed Member of the Person Formation (Hydrologic Subdivision III of the Edwards Group) overlies the Regional Dense Member and is reported to be about 80 to 100 feet thick in Comal County. The Leached and Collapsed Member is regionally described as a variably burrowed mudstone to grainstone with intervals of crystalline limestone. Chert is commonly found within this member (Hanson and Small, 1994). The common collapsed zones within this member were the result of a collapse of the overlying limestone into the voids created by dissolved evaporite lenses and layers (Rose, 1972). Primary field identification characteristics of the Leached and Collapsed Member on the subject site include *Toucasia* sp. (rudist) fossils, bivalve wake- to packstones, and thick red soils with abundant chert cobbles. The Leached and Collapsed Member is one of the most porous and permeable formations (Stein and Ozuna, 1995). It is known to have vuggy and burrow porosity and permeability associated with evaporites, burrowed zones, breccia, and caves. Permeability and porosity are associated with collapsed zones, where evaporites have been dissolved and in areas where faulting or fractures occur.

2.5.3 Georgetown Formation (Kgt)

The Georgetown Limestone Formation (Hydrologic Subdivision I of the Edwards Group) is exposed in the southwestern portion of the subject site and overlies the Edwards Group (Person and Kainer Formations). The Georgetown limestone is reported to be less than 10 feet thick in Comal County (Small and Hanson, 1994). The Georgetown Formation is described as gray to light-tan, marly, fossiliferous limestone that usually contains brachiopods (*Waconella wacoensis*). The contact between the Edwards and Georgetown formations is pitted and bored and often contains iron-oxide staining with common *Toucasia* sp. fossils (Rose, 1972).

No karst features occur within this formation on the subject site and due to the thin, low porosity, and low permeability nature of the Georgetown Formation, it probably yields little water to wells in Comal County. However, where outcrop of the Georgetown Formation is extensively weathered the Georgetown Formation may be considered a part of the unsaturated zone of the Edwards Aquifer (Stein and Ozuna, 1995).

2.5.4 Del Rio Clay Formation (Kdr)

Contrary to the published map of Hanson and Small (1994), the Del Rio and Buda formations, not the Edwards Group limestones is found on the southern portion of the subject site. The Del Rio Formation underlies the lowlands in the southern portion of the subject site primarily used for cultivating hay. Del Rio Clay is about 40 to 50 feet thick in Comal County and is described as weathered, poorly compacted, friable, fossiliferous, blue-green to yellow-brown clay, with some thin lenticular, calcareous, siltstone beds (Rose, 1972; Hanson and Small, 1994). The primary marker fossil for the Del Rio Clay is the pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994).

The Del Rio Formation forms the primary upper confining unit of the Edwards Aquifer (Rose, 1972; Hanson and Small, 1994). The Del Rio Clay is described as having no porosity, low permeability, and no cavern development (Hanson and Small, 1994).

2.5.5 Buda Formation (Kbu)

The Buda Formation occupies the uplands of the southern portion of the subject site. The Buda Formation is reported to be about 40 to 50 feet thick in northeastern Comal County and consists of a buff, light gray, dense mudstone (Hanson and Small, 1994). Primary field identification includes small, calcite-filled veins, red-stained intraclasts, porcelaneous limestone character, and pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994). The Buda limestone is lithologically indistinguishable from the Georgetown limestone; however, the reported thickness of the Buda (up to 50 feet) compared to the relatively thin Georgetown Formation (less than 10 feet) and the stratigraphic position confirm that the Buda limestone is found on the subject site (Hanson and Small, 1994). The Buda Formation has low porosity and permeability with minor surface karst and no cavern development in the region (Hanson and Small, 1994).

2.5.6 Tertiary and Quaternary Gravel Deposits (T-Qgr)

This unit consists of unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits that locally cap topographically high areas on the subject site. These deposits are not associated with the present drainage systems and appear to be similar to gravel deposits equivalent to the late Tertiary or Quaternary Uvalde Gravel with thicknesses reportedly ranging from several feet to more than 10 feet (Baumgardner and Collins, 1991). This unit contains high porosity and permeability, but does not develop karst features associated with recharge of the Edwards Aquifer.

2.5.7 Quaternary Alluvium Deposits (Qal)

This unit consists of unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone deposits within creekbeds and drainages on the subject site. These deposits are associated with the modern drainage systems and occur as narrow, discontinuous deposits, with thicknesses from several feet to more than probably 10 feet locally. These deposits were generally not mapped due to their discontinuous, narrow, and relatively thin nature. These deposits contain very high porosity and permeability, but do not develop karst features associated with recharge of the Edwards Aquifer.

2.5.8 Geologic Structures

All faults were identified in the field by stratigraphic displacement (primarily the Regional Dense Member of the Person Formation), in addition to one or more of the following characteristics related to faulting: fault gouge and breccia, slickensides, steeply dipping beds due to fault-drag, fractured rock zones, and vegetation lineaments on areal photographs. All faults mapped are normal faults, and generally all contain vertical fault planes.

Some potential recharge features found on the subject site appear to be related to inferred and mapped faults on the subject site. Folding of limestone beds within fault-bound blocks and dipping limestone beds throughout the subject site accounts for greater apparent thicknesses on the geologic map.

2.6 SOILS

Soils on the subject site are characterized as follows (Batte, 1984):

SOIL NAME	SOIL TYPE	SOIL DEPTH (FEET)	UNDERLYING MATERIAL	PERMEABILITY	AVAILABLE WATER CAPACITY	SHRINK-SWELL CAPACITY
Comfort-rock outcrop complex (CrD), undulating	stony clay	1.1	indurated fractured limestone	slow	very low	low to moderate
Rumple-comfort association, undulating (RuD)	cherty clay loam to stony clay	2.3	indurated fractured limestone	moderately slow	very low	low to moderate
Perves clay, 1 to 5% slopes (PuC)	clay	1.6	indurated fractured limestone	moderately slow	very low	high
Medlin-Eckrant association, undulating (MEC)	clay to 3.2 feet and marl to 6.7 feet	6.7	fractured limestone	very slow	very low	high
Denton silty clay, 1 to 3% slopes (DeB)	clay	3.0	fractured, indurated limestone interbedded with calcareous clayey marl	slow	medium	high
Eckrant-rock outcrop complex, steep (ErG)	very stony clay	0.8	indurated fractured limestone	moderately slow	very low	moderate

2.7 WATER WELLS

A search was made for water wells on the subject site. A review of the records of the TNRCC and the Texas Water Development Board (TWDB) revealed 2 potential water wells on the subject site (TWDB, 2000). However, Horizon found 7 water wells (S21 through S24, S69, S91, and S99) on the subject site during field investigation. These wells are located on the site geologic map (Appendix C).

The results of this survey do not preclude the possibility of finding an additional abandoned test or water well during the clearing or construction phases of the proposed project. If a water well or casing is encountered during construction, construction should be halted until the TNRCC is contacted.

All abandoned wells must be capped or properly abandoned according to the Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code (TAC), Chapter 76, effective 3 January 1999. A plugging report must be submitted (by a licensed water well driller) to the Texas Department of Licensing and Regulation, Water Well Driller's Program, Austin, Texas. If a well is intended for use, it must comply with 16 TAC §76.

3.0 SPECIAL INSTRUCTIONS TO CONTRACTORS OR DEVELOPERS

The Edwards Aquifer Protection Plan (EAPP) and its associated documents address best management practices (BMPs) and describe recommended water pollution abatement strategies specifically for the subject site and surrounding area. Temporary and permanent BMPs should be used to control any runoff during and after the proposed activities and should be based on the TNRCC Guidelines for BMPs, which typically require that all runoff from areas of impervious cover be captured and filtered before leaving a site within the recharge zone (TNRCC, 1999).

4.0 GEOLOGIC ASSESSMENT TABLE COMMENTS (DETAILED FEATURE DESCRIPTIONS) AND ABATEMENT RECOMMENDATIONS

The following features are shown and labeled on the Geologic Assessment Table in Appendix A and on the Site Geologic Map in Appendix C. Below is a description for features found on the subject site.

S1 Stock pond. This manmade cattle pond is approximately 150 feet in diameter and 15 feet deep. The tank is filled with fine-grained sediment and holds water. No openings or internal drainages were found within this feature. No setback is recommended.

S2 Fracture Rock in drainage. A fractured rock outcrop measuring approximately 30 feet wide and 200 feet long. No solution features were noted during the field investigation. Fractures are spaced 1 every 1 foot, with apertures up to 2 inches, locally filled with black soil and trend 140° to 160°. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for Sewage Collection System (SCS) and/or Soil Adsorption System (SAS) may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S3 Solution cavity (sinkhole). This feature has a closed depression diameter of ~10 feet, extends vertically a minimum of 4 feet, and is filled with loose cobbles and organic debris. The feature appears to extend vertically into the subsurface an unknown distance. This feature is located 30 feet to the west of Feature S4. Horizon conducted a preliminary removal of loose rocks by hand around the natural opening and determined that it is connected to S4. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S4 Cave. This feature consists of a 2-foot diameter cavity in solid limestone that extends vertically 4 feet into a small room about 30 feet in diameter. Harvestman arachnids and cave crickets were observed within this feature. Horizon conducted a preliminary removal of loose rocks by hand around the natural opening and determined that this feature is a cave. Horizon recommends a more detailed mapping of this feature to determine its subaerial extent. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S5 Solution cavity. This feature is an enlarged bedding plane cavity within the margins of a creek bed. The entrance to this feature measures approximately 2 feet in diameter and extends 2 feet horizontally into the hillside. No airflow or cave fauna were observed for this feature. No setback is recommended.

S6 Fault and fracture zone within drainage. The fault exposed in the creek bed trends 15° and is associated with steeply dipping beds, fault gouge and breccia, and fractures. The exposed outcrop measures approximately 15 feet wide and 50 feet long within the drainage, and contains fractures spaced 1 every 2 to 3 inches, with apertures up to 2 inches and trends of 75° and 150°. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S7 Fractures in drainage. An outcrop of rock measuring approximately 15 feet wide and 40 feet long within a drainage. Fractures are spaced 1 every 1 foot, with apertures up to 0.5 inches and trend 85° and 125°. No solution features were found. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S8 Fractures in drainage. An outcrop of rock measuring approximately 30 feet wide and 40 feet long within a drainage. Fractures are spaced 1 every 2 to 3 inches, with apertures up to 1 inch locally filled with black soil and trend 120°. No solution features were found. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S9 Solution cavity. This feature measures approximately 1 foot in diameter and extends 1 foot horizontally, representing a solutionally enhanced bedding plane feature. This feature is located at the top of a hill with limited potential for recharge due to its location and infilling soil. No setback is recommended.

S10 Solution cavity. This feature is a solutionally enlarged fracture at the top of a hill. The feature measures approximately 4 feet long and 6 inches wide and extends 4 feet vertically. The base is infilled with soil. It is Horizon's opinion that this feature is a result of fracturing due to surficial weathering and the fracturing is limited in extent. No setback is recommended.

S11 Fractures within a drainage. An outcrop of fractured rock measuring approximately 15 feet wide and 30 feet long. Fractures are spaced 1 every 2 to 3 feet, with apertures up to 2 inches trending 110° and 030°. No solution features were found. This feature is coincident with the Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S12 Fractures in drainage. An outcrop of rock measuring within a drainage containing fractures spaced 1 every 1 foot with apertures up to 0.5 inches trending 60°. No solution features were found. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S13 **Sinkhole (potential cave).** This feature is approximately 3.5 feet in diameter, rimmed with limestone, and extends 3 feet to loose cobbles. This feature was observed to have air flow during hand excavation. This feature is coincident with the Bat Cave Fault zone (S18). Horizon recommends excavation of this feature to determine the recharge potential of this feature. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S14 Fractures in drainage. An outcrop of fractured rock measuring approximately 20 feet wide and 50 feet long. Fractures are spaced 1 every 2 to 3 feet, with apertures up to 1 inch, and trend 90°, 150°, and 120°. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S15 Fractures in drainage. An outcrop of rock measuring approximately 20 feet wide and 50 feet long. Fractures are spaced 1 every 3 inches to 1.5 feet, with apertures up to 1 inch, and trend 100°. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S16 Solution cavity. This feature is a solutionally enlarged bedding plane located on a hillside. The feature measures approximately 1 foot long, 6 inches wide, and extends 1 foot vertically to a horizontal bedding plane. No airflow or cave fauna were observed for this feature. It is Horizon's opinion that this feature has a limited areal extent and its recharge ability is limited. No setback is recommended.

S17 Solution cavity. This feature is a solutionally enlarged bedding plane located on the side of drainage. The feature measures approximately 1 foot long, 6 inches wide, and extends 1 foot vertically to a horizontal bedding plane. No airflow or cave fauna were observed for this feature. It is Horizon's opinion that this feature has a limited areal extent and recharge ability. No setback is recommended.

S18 Bat Cave Fault Zone. Horizon observed fault gouge, breccia, and fractures coincident with the fault zone mapped by Hanson and Small (1994). Additionally, Horizon field verified where the Bat Cave Fault intersects Country Road (CR) 306 and observed extensive fault breccia and gouge associated with this fault zone. This fault zone has fractured rock outcrops (S2, S11, S12, S14, S15) exposed within several drainages on the subject site. Setbacks for SCS and/or SAS may be appropriate for fractures within the drainages.

S19 Fault zone. Horizon observed fault gouge, fractures, and offset geologic members coincident with the fault zone mapped by Hanson and Small (1994). No solution cavities were observed along the fault. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate for fractures within the drainages. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S20 Fractures within a drainage. Fractures are spaced 1 every 1 foot, with cemented apertures and trends of 100°. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S21 Water well. This feature is located at the top of a hill and consists of an inactive windmill water well. If necessary, abatement measures are addressed in Section 2.7.

S22 Water well. This feature is an active water well. If necessary, abatement measures are addressed in Section 2.7.

S23 Water well. This feature is an active windmill water well. If necessary, abatement measures are addressed in Section 2.7.

S24 Water well. This feature is an active water well. If necessary, abatement measures are addressed in Section 2.7.

S25 Fractures in drainage. This rock outcrop measures approximately 50 feet in diameter and located between 2 converging drainages. Fractures are spaced 1 every 1 foot with apertures up to 2 inches and trends of 115°. Fractures on the hillsides were difficult to identify.

Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S26 Fault Zone. This fault zone is originally mapped by Baumgardner and Collins (1991) and is exposed in the CR 308 road cut. The fault is also exposed near the eastern boundary of the site. A vegetation lineament is coincident with this feature on the aerial photograph. No solution features are found within 200 feet of this fault, which is inferred over most of the property. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects and areas. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S27 Solution cavities. An outcrop of vuggy rock, measuring 8 feet in diameter, contains several solution cavities up to 2 feet in diameter and a 2-foot vertical depth. The cavities contain loose, fine-grained soil and leaf litter. No airflow or cave fauna were observed for this feature. One cavity contains mounded dirt apparently related to animal burrowing. Setbacks for SCS and/or SAS may be appropriate.

S28 Fractured rock zone. A rock outcrop measuring up to 20 feet wide and up to 1000 feet long is located within a creek bed. Fracture spacing is variable, with densities up to 1 every 0.25 feet, apertures up to 3 inches, and trends of 35°, 85° and 120°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Exposure of the outcrop is discontinuous, as it is partially covered with coarse alluvial deposits within the streambed. This feature is coincident with 2 fault zones (S29 and S30). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S29 Fault Zone. This fault zone is originally mapped by Hanson and Small (1994) and juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, fractures (S28 and S49), a linear exposure of red soils with rock breccia, and a vegetation lineament are coincident with this feature. No solution features are found within 200 feet of the fault on the property. Setbacks for SCS and/or SAS may be appropriate for portions of the drainages it intersects. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S30 Fault Zone. This fault zone juxtaposes the Kirschberg Evaporite and Grainstone members of the Kainer Formation within the same drainage as S-28. Additionally, fractures and a slight vegetation lineament on an aerial photograph are coincident with this feature.

Setbacks for SCS and/or SAS may be appropriate for portions of the drainages the fault intersects, as well as features S121 and S124 that are not within drainages, but coincide with the fault. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S31 Stock pond. This manmade cattle pond is approximately 200 feet in diameter and approximately 15 feet deep. No setbacks are recommended.

S32 Solution cavity. This feature is a solutionally enlarged fracture. It measures approximately 3 feet long, up to 3 inches wide, and extends 2.5 feet vertically to a horizontal bedding plane cavity. The feature trends to the northeast and no airflow or cave fauna were observed for this feature. Setbacks for SCS and/or SAS may be appropriate.

S33 Fault Zone. This fault zone is originally mapped by Hanson and Small (1994) and is exposed in the CR 308 road cut east of the site, where it juxtaposes the Leached and Collapsed Member and the Eagle Ford Formations. On the subject site, this fault zone juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, a vegetation lineament on an aerial photograph were coincident with this feature. No solution features are located within 200 feet of this inferred fault. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S34 Stock pond. This manmade cattle pond is approximately 75 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

S35 Stock pond. This manmade pond is approximately 200 feet long, 100 feet wide of unknown depth, and holds water. No openings or internal drainage were observed within this feature. No setback is recommended.

S36 Stock pond. This manmade cattle pond is approximately 50 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

S37 Stock pond. This manmade cattle pond is approximately 100 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

S38 Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

S39 Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

S40 Stock ponds. Four parallel stock ponds measuring up to 200 feet long and 20 feet wide. These ponds hold water and no openings or internal drainage were observed within this feature. No setbacks are recommended.

S41 Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

S42 Fault Zone. This fault zone was originally mapped by Hanson and Small (1994). This feature juxtaposes the Regional Dense and the Grainstone members of the Person and Kainer Formations. Additionally, a vegetation lineament on an aerial photograph was coincident with this feature. No solution features are located within 200 feet of this fault. Setbacks for SCS and/or SAS may be appropriate for only for portions of the drainages it intersects. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S43 Inferred fault zone. This fault zone is inferred based on exposed fractured bedrock. Setbacks for SCS and/or SAS may be appropriate since it is entirely within a drainage system.

S44 Fault Zone. This fault zone juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, fault gouge and a vegetation lineament on an aerial photograph were coincident with this feature. Setbacks for SCS and/or SAS may be appropriate for portions of the drainages it intersects and for features S-64, S-62, S-75, S-81, S-116, S-117, and S-118 that coincide with it.

S45 Man-made outhouse pit. A manmade closed depression approximately 8 feet in diameter and up to 3.5 feet deep. This feature is located near a house and was apparently used as an outhouse. No openings or internal drainage were observed within this feature. No setback is recommended.

S46 Solution cavity. This feature is located along the margins of a drainage, with an entrance measuring approximately 0.5 feet in diameter extending at an angle of 30° to a depth of 3 feet. It is infilled with soil. It is Horizon's opinion that this is an enlarged bedding plane with a low relative infiltration rate. No setback is recommended.

S47 Vuggy rock. An outcrop measuring up to 15 feet in diameter that contains unconnected and connected vugs. The vugs have a moderate density (1 per 2 to 4 inches) and apertures greater than 2 inches. It is Horizons opinion that the vugs are a result of surficial weathering. No setback is recommended.

S48 Fault and closed depression. A small fault zone, with gouge about 2 inches wide, striking 20° and dipping 79° to the east, is exposed in a quarry located within the Regional Dense Member. Additionally, dipping beds and fractures (trending 120° and 040°) within a nearby outcrop of the Grainstone Member, and a vegetation lineament on an aerial photograph are coincident with this feature. A small, closed depression, measuring about 30 feet in diameter and up to 2 feet deep, within the quarry contains mudcracks. The small fault has no associated solution cavities and the closed depression is man made. No setback is recommended for S-48.

S49 Fractured rock. A rock outcrop measuring up to 10 feet wide and 75 feet long is located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and a trend of 20°. Fractures are generally open; however, locally, apertures are cemented and filled with soil. This feature is coincident with a fault zone (S29). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainages. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S50 Vuggy rock. A outcrop of vuggy rock about 100 feet long and 50 feet wide, containing unconnected and locally connected vugs located slightly up drainage (approximately 200 feet) from S-29. This feature is within what appears to be the Kirschberg Evaporite Member and characteristically contains vugs due to dissolution of evaporite minerals. Vug densities are 1 every 0.5 feet, with apertures up to 3 inches. It is Horizon's opinion that the dissolution is due to surficial weathering. No setback is recommended.

S51 Solution cavity. The entrance of this feature is a solutionally enlarged entrance that measures approximately 1 foot in diameter extends 45° to the northwest to a depth of 1.5 feet where it is infilled with soil. It is located on a hillside and has a drainage area of less than 1 acre. It is Horizon's opinion that this feature has a low potential for recharge. No setback is recommended.

S52 Quarry and closed depression. This feature is a manmade quarry within the Regional Dense Member that contains a man-made closed depression measuring about 30 feet in diameter, up to 3 feet deep, and holding water. No openings or internal drainage were observed within this feature. No setback is recommended.

S53 Solution cavity. The entrance of this feature is a solutionally enlarged entrance that measures approximately 0.5 feet in diameter, and extends to a minimum depth of 2 feet. No airflow was observed for this feature. It is partially infilled with soil and has a moderate infiltration rate. It is located near the top of a hill with no defined catchment area. No setback is recommended.

S54 Fault Zone. This fault zone is exposed in a quarry and trends 135°, juxtaposing steeply dipping beds of the Grainstone Member with the chalky, nodular beds of the Regional Dense Member. Additionally, the fault zone contains fractures and fault gouge exposed within the quarry that was used for road base. The fault has no associated solution features and is located on a hillside. No setback is recommended.

S55 Stock pond. This dry stock pond is 50 feet in diameter, 7 feet deep, and is located within a drainage. No openings or internal drainage were observed within this feature. No setback is recommended.

S56 Stock ponds. Two stock ponds, approximately 50 feet in diameter and up to 5 feet deep, are located within a drainage and contain no water. No openings or internal drainage were observed within this feature. The ponds are located in adjacent and convergent drainages about 50 feet apart. No setback is recommended.

S57 Solution cavity. This feature is an enlarged bedding plane cavity with an entrance measuring 7 inches wide and 3 inches high, extending horizontally along the bedding plane 1.5 feet deep. It is located on a hillside with little or no recharge ability. No setback is recommended.

S58 Solution cavities. Two solutionally enlarged bedding planes on a shallow hillside with no defined catchment area. Each measures approximately 1 foot in diameter and extends to a depth of 2 feet to soil and leaf debris. This feature appears to extend horizontally along a bedding plane that pinches out with distance. The feature is interpreted to have limited recharge ability based on the location and infilling sediments. No setback is recommended.

S59 Solution cavity. This feature is a bedding plane solution cavity with an entrance measuring 8 inches wide, 5 inches high, and extends horizontally along the bedding plane 1.5 feet deep. It is located on a hillside with no defined catchment area. It is infilled with fine sediments. No setback is recommended.

S60 Solution cavities. Two entrances within a limestone outcrop appear solutionally enlarged, and measure approximately 0.5 feet in diameter, and extend to a depth of 1.5 feet to soil and leaf debris. This feature appears to also be partially modified by animal burrowing. No setback is recommended.

S61 Solution cavity. This feature is located on a hillside, measures 0.5 feet in diameter, and extends vertically a minimum of 3 feet. It is infilled with fine soil and loose leaf debris. No air or cave fauna was observed for this feature. It appears to have limited recharge ability based on location and infilling sediments. No setback is recommended.

S62 Collapsed sinkhole. This feature is a closed depression about 100 feet in diameter and 15 feet deep that does not appear to hold water, though no openings were observed within this feature. The feature is completely surrounded by limestone outcrop that locally contains caliche or possibly travertine along the exposed rock. The feature contains soil, chert, and limestone cobbles, and mature oak (up to 2 feet diameter) and persimmon trees. No evidence of manmade activities, such as spoil piles and dozer tracks/scrapes, was apparent surrounding the feature, although spoil piles (soil and Del Rio Clay) were dumped into 1 side of the sinkhole. This feature is coincident with S-44 (Fault). Setbacks for SCS and/or SAS is appropriate for this feature. Any untreated runoff should be diverted away from this feature.

S63 Solution cavity. This feature is an enlarged bedding with an entrance measuring 0.5 feet in diameter extending horizontally 2 feet deep. It is located on a hillside, infilled with fine sediments, and has a low relative infiltration rate. No setback is recommended.

S64 Fractures in drainage. A rock outcrop of steeply dipping fractures (20° to SE) measuring approximately 10 feet wide and 50 feet long located within a drainage. Fractures are spaced 1 every 1 foot with apertures up to 2 inches and trends of 55°. These fractures are coincident with S-44 (Fault). Setbacks for SCS and/or SAS may be appropriate for this drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S65 Stock pond. This stock pond is 30 feet in diameter, 5 feet deep, and located within a drainage. No openings or internal drainage were observed within this feature. No setback is recommended.

S66 Stock pond. This stock pond is 150 feet in diameter and 8 feet deep. This feature is located within a drainage and contains standing water and wetland vegetation. No openings or internal drainage were observed within this feature. No setback is recommended.

S67 Stock pond. This stock pond is 50 feet long, 30 feet wide, and 5 feet deep. This feature is located within a drainage and contains standing water and wetland vegetation. No openings or internal drainage were observed within this feature. No setback is recommended.

S68 Solution cavity. This feature is a solution cavity developed along a bedding plane with an entrance measuring 0.5 feet in diameter extending horizontally along the bedding plane 1 foot deep until it pinches out. It is partially infilled with soil. This feature is located near a hilltop with no defined catchment area. Its relative infiltration rate and ability to transmit fluids appear to be none to low. No setback is recommended.

S69 Water well. This feature is an active water well with a large water storage tank. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S70 Stock pond. This feature measures approximately 25 feet in diameter, up to 3 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S71 Stock pond. This feature measures approximately 60 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S72 Stock pond. This feature measures approximately 60 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S73 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S74 Solution cavity. This feature consists of a solutioned limestone hole measuring 1 feet in diameter, extending 2 feet deep to loose soil and leaf litter. No soil was piping into the feature and no air was observed to flow from the feature. This feature is located on a hillside with no defined catchment area. The infiltration rate is interpreted to be none to low. No setback is recommended.

S75 Solution cavity. This feature consists of a solutioned limestone hole measuring 0.3 feet in diameter and extends 5 feet to limestone cobbles. No soil was observed piping into the feature and no air was observed to flow from the feature. This feature appears to be developed along a fracture trending 20° that is coincident with an interpreted fault (S-44). Setbacks for SCS and/or SAS may be appropriate for this feature.

S76 Stock pond. This feature measures approximately 50 feet in diameter, up to 10 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S77 Stock pond. This feature measures approximately 50 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S78 Stock pond. This feature measures approximately 30 feet in diameter and up to 6 feet deep and apparently holds water but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S79 Solution cavity. This feature is a solution cavity developed along a bedding plane, with an entrance measuring approximately 1 foot in diameter extending subhorizontally 3 feet along the bedding plane. This feature is located on a hillside near a hilltop. Soil was observed piping into this feature. It has a 10-foot diameter defined catchment area. Based on the limited catchment area, size, and infilling sediments, no setback is recommended.

S80 Solution cavities (sinkholes). This feature consists of 2 solution cavities about 5 feet apart, within a single rock outcrop about 30 feet in diameter, located on the side of a hill. The entrances measure approximately 2.5 by 0.75 feet and 1.5 diameter, and both extend about 2.5 feet vertically to loose leaves and dirt that fall into the entrances off the hillside (< 10 acres). These features are developed along fractures that trend 0° to 10°. The fractures are interpreted to be a result of weathering of the side of the hill. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S81 Solution cavities. This feature contains 2 solution cavities developed along a bedding plane with entrances measuring approximately 1 foot in diameter extending subhorizontally along the bedding plane 3 feet deep. This feature is located within a drainage and nearly coincident with the fault zone (S44). Limestone beds within the drainage are observed to dip up to 12° to the north due to fault drag. Setbacks for SCS and/or SAS may be appropriate for this feature in the drainage.

S82 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S83 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S84 Stock pond. This feature measures approximately 30 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S85 Stock pond. This feature measures approximately 30 feet in diameter, up to 6 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S86 Fault zone. This fault zone was originally mapped by Hanson and Small (1994) and Baumgardner and Collins (1991). It is exposed in the CR 308 road cut. On the subject site, the fault juxtaposes the Buda-Del Rio Clay and the Kainer formations. A vegetation lineament on the aerial photograph is coincident with this feature where it is inferred. No solution features are associated with this fault and where it is inferred. Where the fault is seen at the CR 308 road cut it is on a hill top. The fault is inferred to exist northward beyond the hill by the road cut. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S87 Fault zone. This fault zone was mapped by Baumgardner and Collins (1991) and is exposed in the CR 308 road cut. On the subject site the fault juxtaposes the Buda-Del Rio Clay and the Kainer formations. A vegetation lineament on the aerial photograph is coincident with this feature. Solution cavity S-94 is the only solution feature associated with the fault that is inferred north of the road cut. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S88 Stock pond. This feature is located on a hillside and measures approximately 150 feet in diameter and up to 6 feet deep. The stock pond holds water, but was empty during field investigation. Its drainage area is less than 10 acres and infilled with fine sediments. No setback is recommended.

S89 Closed depression (quarry). This man-made depression is approximately 10 feet wide by 30 feet long and up to 3 feet deep, filled with household garbage. No setback is recommended.

S90 Closed depression (quarry). This feature is a road base quarry measuring 50 feet in diameter and up to 3 feet deep. The outcrop is very brecciaed with fractures trending 40°, most likely due to nearby faulting (S86 and S87). No setback is recommended for this feature.

S91 Active water well. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S92 Closed depression. This depression contains a buried 50-gallon drum, apparently used to incinerate household garbage. No openings or internal drainages were observed within this feature. This feature is man-made. No setback is recommended.

S93 Stock pond. This feature is located within a drainage and measures approximately 20 feet in diameter, up to 4 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S94 Solution cavity. This feature consists of a solution cavity about 1.5 feet in diameter and extends 2 feet vertically to compact soil and leaf litter. No airflow or fauna were associated with this feature during Horizon's field investigation. This feature is located adjacent to a drainage and fault S-87. Setbacks for SCS and/or SAS may be appropriate.

S95 Solution cavity. This feature consists of a solution cavity about 1.2 feet in diameter, extending 1.5 feet to compact soil and leaf litter. No airflow or fauna was associated with this feature during Horizon's field investigation. This feature is located on a hillside with no defined catchment area. It is Horizon's opinion that this feature has limited recharge ability. No setback is recommended.

S96 Stock pond. This feature measures approximately 50 feet long by 15 feet wide, up to 3 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S97 Stock pond. This feature measures approximately 50 feet in diameter, up to 8 feet deep, and apparently holds water, but was dry during field investigation. No setback is recommended.

S98 Closed depression (road-base quarry). This feature was apparently a quarry that measures approximately 100 feet long by 25 feet wide and up to 3 feet deep. Mud cracks within the depression indicate that it periodically holds water. No openings or internal drainages were observed within this man-made feature. No setback is recommended.

S99 Active water well. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S100 Solution cavity within a small, closed depression. The closed depression measures about 6 feet in diameter and contains a solution cavity developed along a bedding plane. The entrance to the solution cavity measures 1 foot in diameter extending 2 feet subhorizontally (~45°) along the bedding plane to loose leaf debris.

No air was around the entrance to this feature. This feature is located on a hillside with limited catchment area. Based on the location of the feature and infilling sediments, no setback is recommended.

S101 Solution cavity. This feature is an enlarged fracture located on a hillside. No airflow or cave fauna were observed for this feature. The opening is 2 feet long by 2 inches wide and extends to a depth of at least 2 feet. The feature is infilled with fine sediments at the bottom. It has a drainage area that is less than 1 acre and its ability to transmit fluids is moderate. The fractures are interpreted to be a result of weathering on a hillside and its recharge ability is interpreted to be low. No setback is recommended.

S102 Solution cavity. This feature is located on a hillside within thick vegetation. The solution cavity appears to be an enhanced fracture with a 6-inch diameter opening. The solution cavity extends down at least 2 feet and is in filled with fine sediments at the base. The feature's ability to transmit fluid is none to low with a drainage area less than 1 acre. No setback is recommended.

S103 Closed depression (road-base quarry). This quarry is within the Regional Dense Member and measures about 25 feet in diameter and up to 2.5 feet deep. Mud cracks, mesic grasses, and a shallow pool of water indicated the ability to hold water. No openings or internal drainage were observed within this man-made feature. No setback is recommended.

S104 Fault zone. Exposed within the S103 road base quarry is a fault plane, striking 45° and dipping 55° west, containing strongly expressed vertical slickensides indicating normal motion. The fault juxtaposes a white, chalky, and soft limestone bed with a greyish-white, dense, and crystalline limestone bed; the minimum displacement is about 10 feet. This fault comprises the northwestern side of a horst structure. This feature is located on a hilltop and associated with solution feature S105. No setback is recommended along the fault except for the area near S105.

S105 Solution cavity. This feature is located along a hillside, with an opening that measures approximately 2 feet by 6 inches and a depth of at least 1 foot. The feature appears to be an enlarged fracture that is infilled with fine sediments. It has a drainage area of less than 1 acre. The feature appears to be along a fault/fracture trend (S104). Setbacks for SCS and/or SAS may be appropriate.

S106 Closed depression (road-base quarry). This quarry is within the Regional Dense Member and measures about 25 feet by 100 feet and is up to 1.5 feet deep. Mud cracks and mesic grasses indicated the ability to hold water and no openings or internal drainage were observed within this feature. No setback is recommended.

S107 Fault zone. Exposed within the S106 road base quarry is a fault plane, striking 30° and dipping 70° east, containing weak, vertical slickensides indicating normal motion. The fault juxtaposes a white, chalky, and soft limestone bed with a grayish-white, dense, and crystalline limestone bed an unknown distance. This fault comprises the southeastern side of a horst structure. No solution features are associated with this feature. This feature is within 150 feet of fault S30. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects on the northern side. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S108 Fractured and vuggy rock. This feature consists of a rock outcrop on a hilltop measuring about 200 feet in diameter. Fracture density is 1 every 1 foot with apertures up to 2 inches and a trend of 55°. Fractures are generally open (locally solutioned); however, locally, apertures are cemented and filled with soil and loose organic debris. This feature also contains vuggy rock, with densities of 1 every 1 foot, locally connected, with apertures up to 2 inches. Setbacks for SCS and/or SAS may be appropriate for this feature.

S109 Fractured rock. This feature consists of a rock outcrop measuring up to 10 feet wide and 50 feet long located within a drainage. Fracture density varies from 1 every 0.1 feet to 1 every 3 feet, with apertures up to 1 inch, and a trend of 110° to 90°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Setbacks for SCS and/or SAS are appropriate for this feature within the bed of the drainage.

S110 Fractured and vuggy rock. This feature consists of a rock outcrop measuring about 200 feet by 50 feet within a streambed. Fracture density is 1 every 1 foot with apertures up to 0.5 inches and a trend of 50°. Fractures are generally open (locally solutioned); however, locally, apertures are filled with soil and loose organic debris. This feature also contains vuggy rock, with densities of 1 every 3 inches, and locally connected with apertures up to 3 inches. Setbacks for SCS and/or SAS are appropriate for this feature within the bed of the drainage.

S111 Vuggy rock. This feature consists of a vuggy rock outcrop about 300 feet long and up to 30 feet wide within York Creek. Vugs are generally unconnected with a density of 1 per 3 inches and up to 3-inch diameters. Setbacks for SCS and/or SAS are appropriate for this feature within the creek bed.

S112 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 1 to 1.5 feet high, extending horizontally along the bedding plane up to 5 feet deep pinching out to soil and organic debris.

This feature does not appear to hold water. No flowing air or fauna were observed for this feature. The feature is interpreted to be the result of weathering with little to no potential for recharge. No setback is recommended.

S113 Fractured rock and possible collapsed sinkhole. This feature consists of a rock outcrop measuring up to 100 feet in diameter containing fractures and limestone beds that dip toward one another. The dipping beds may be the result of minor folding, undocumented faulting, or perhaps solutioning and collapse. Alluvial deposits within the drainage partially cover this feature, obscuring a more definitive interpretation. Fenestral porosity within nearby limestone outcrops indicates that this feature is most likely developed within the Kirschberg Evaporite Member of the Kainer Formation. Collapsed features can occur associated with the dissolution of evaporite minerals. Fracture density within the exposed outcrop varies from 1 every 0.1 feet to 1 every 3 feet, with apertures up to 2 inches, and a trend of 60° to 90°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature. Horizon recommends excavation to determine if additional abatement measures are warranted.

S114 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 3 feet high, extending horizontally along the bedding plane up to 12 feet deep pinching out to black soil and organic debris. This feature does not appear to hold water. No flowing air or fauna was observed for this feature. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S115 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 3 feet high extending horizontally along the bedding plane up to 8 feet deep and pinching out to black soil and organic debris. This feature does not appear to hold water. No flowing air or fauna was observed for this feature. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S116 Solution cavity. This feature consists of a cavity about 1 foot in diameter, extending up to 1 foot to compact soil and leaf litter. Soil appeared to be piping into the feature, though no airflow or fauna was associated with this feature during Horizon's field investigation. This feature is coincident with a fault zone (S44). Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S117 Solution cavity. This feature consists of a cavity about 1 foot in diameter, extending up to 1 foot to compact soil and leaf litter. Soil and cobble-sized rocks appeared to be piping into the feature, though no air flow or fauna was associated with this feature during Horizon's field investigation. This feature is coincident with a fault zone (S44) and located about 100 feet to the north of S116. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S118 Sinkhole (potential cave). This feature consists of sinkhole within a closed depression about 20 feet in diameter and surrounded by Texas Persimmon trees. The sinkhole measures about 6 feet by 3.5 feet and extends a minimum of 3 feet to loose cobble- to boulder-sized rocks. A weak current of cool air was observed to flow from the sinkhole, and soil and rocks pipe into this feature. This feature is coincident with a fault zone (S44). Fire ants were observed within the entrance to the sinkhole. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S119 Solution cavity. This feature consists of a bedding plane cavity about 1 foot in diameter extending horizontally up to 2 feet to compact soil. The entrance is located about 4 feet from the bottom of a drainage. No airflow was associated with this feature during Horizon's field investigation. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S120 Solution cavity. This feature consists of a bedding plane cavity about 1.5 feet long by 0.5 feet high, extending horizontally up to 3 feet to compact soil. The entrance to the bedding plane cavity is located along the margin of a closed depression measuring about 5 feet in diameter that pipes soil into the cavity. The closed depression contains a hole (about 0.25 feet in diameter) that appears to pipe soil and extends vertically 1 feet. No airflow was associated any of these features during Horizon's field investigation. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S121 Solution cavity. This feature consists of a solutioned fracture trending about 170° (parallel to the hillside) that is about 3 feet long by up to 0.5 wide extending vertically up to 2.5 feet to cobbles, soil and leaf debris. No airflow or fauna was associated with this feature during Horizon's field investigation. This feature is associated with an interpreted fault (S30). Setbacks for SCS and/or SAS may be appropriate for this feature.

S122 Fractured rock. This feature consists of a rock outcrop measuring up to 10 feet wide and 50 feet long located within a drainage. Fracture density varies from 1 every 1 foot, with apertures up to 2 inches and a trend of 120°, 90° and 35°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. This feature is coincident with a fault zone (S30). Setbacks for SCS and/or SAS may be appropriate for this feature where it intersects a creek bed or drainage. No setbacks are recommended on uplands where fault is buried and inferred.

S123 Fractured rock. This feature consists of a rock outcrop measuring up to 25 feet wide and 100 feet long located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 35° and locally 135°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. This feature is coincident with a fault zone (S30). Setbacks for SCS and/or SAS may be appropriate for this feature within a creek bed or drainage. No setbacks are recommended on uplands where fault is buried.

S124 Solution cavities. This feature consists of 3 solution cavities with dimensions of 1 by 0.5 feet. The outcrop that contains the cavities is about 20 feet in diameter and located on a hillside. The cavities each extend approximately 1 foot deep to compact soil. No airflow or fauna was associated any of these features during Horizon's field investigation. This feature is associated with an interpreted fault (S30). Setbacks for SCS and/or SAS may be appropriate for this feature.

S125 Fractured rock. This feature consists of a rock outcrop measuring up to 30 feet wide and 200 feet long located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 52° and 155°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. Setbacks for SCS and/or SAS may be appropriate for this feature where it is exposed in the bed of the drainage.

S126 Stock pond. This feature is located on a hilltop and measures approximately 25 feet long by 10 feet wide and up to 2 feet deep. This feature most likely holds water, but not very much, and was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S127 Rock quarry. This small rock quarry is located adjacent to a dirt road and measures approximately 20 feet long by 10 feet wide by 3 feet deep. The feature has a drainage area that is less than 1 acre and no openings or internal drainages were observed within this feature. No setback is recommended.

S128 Solution cavity. This feature is located on a hillside, with a drainage area of less than 1 acre. The opening measures 6 inches long by 8 inches wide and has a depth of at least 1 foot. After a depth of 1 foot, a limestone floor is reached and the opening continues along a bedding plane. It is in filled with fine sediments and its ability to transmit fluids appears to be none to low. No setback is recommended.

S129 Rock quarry. This feature is located along a hillside adjacent to a road and the property fence line. The quarry measures approximately 20 feet in diameter, with a depth of about 1 foot. It has a drainage area of less than 1 acre and no openings or internal drainages were observed within this feature. No setback is recommended.

S130 Rock quarry. This closed depression created by excavation for road base. The feature measures about 50 feet in diameter and up to 1 foot deep within a hillside. No openings or internal drainage were observed within this feature. No setback is recommended.

S131 Solution cavity. This feature consists of a solution cavity within a closed depression about 8 feet in diameter and up to 2.5 feet deep. The solution cavity is about 0.5 feet in diameter and extends up to 1 foot deep to loose leaf and soil debris that appear to pipe into the cavity. This feature was previously labeled S134 in a draft report and S137 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature.

S132 Stock pond. This pond measures about 150 feet in diameter and is up to 8 feet deep. This feature was observed to hold water and contain no exit portals. The ability to hold water for this feature indicates the low permeability. This feature was previously labeled S135 in a draft report and S138 in the field. No setback is recommended.

S133 Fractures and solution cavity. This feature consists of a rock outcrop measuring up to 50 feet in diameter. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 055°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. A solution cavity, measuring about 6 feet in diameter and up to 3 feet deep, is exposed in the outcrop. This feature was previously labeled S136 in a draft report and S139 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature

S134 Solution cavities. This feature consists of 3 solution cavities. One cavity is a solution fractures up to 4 feet long, 0.5 feet wide and 2.5 feet deep, trending 75°. The second cavity is about 1 foot in diameter and up to 2 feet deep on the same trend as the fracture. A third feature is a cavity about 1.5 by 0.5 feet and extends subhorizontally about 3 feet. This feature was previously labeled S137 in a draft report and S140 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature

S135 Closed depression zone. This feature consists of a zone with up to 3 natural closed depressions measuring about 50 feet in diameter and up to 1.5 feet deep, filled with black soil and scattered chert cobbles. No openings or internal drainages were observed within the feature. This feature was previously labeled S138 in a draft report and S141 in the field. Any untreated runoff should be diverted away from this feature. No additional setbacks are warranted.

S136 Sinkhole (potential cave). This feature consists of a sinkhole measuring about 10 feet in diameter and about 5 feet deep, with exposed limestone around the perimeter of the feature. Two cavities extend into the subsurface to the east and west an unknown distance and appear to pipe soil and leaf debris. The sinkhole is filled with loose cobbles and organic debris. Fractures trend 235° coincident with 1 side of the sinkhole. This feature was previously labeled S139 in a draft report and S142 in the field. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature.

A1 Stock tank. This stock tank is located approximately 100 feet northwest of the subject site and exposes red soils and an outcrop of angular breccia composed of limestone and chert fragments within a fine-grained matrix interpreted to be fault gouge. This tank is approximately 25 feet in diameter and up to 5 feet deep and did not appear to hold water. However, due to its large catchment basin, exposed breccia, and its position on a fault zone, it may provide relatively minor recharge. This feature is coincident with the fault zone S29. Any untreated runoff should be diverted away from this feature.

A2 Fault zone. This feature consists of a minor fault zone exposed within a quarry of the Regional Dense Member. The fault plane strikes 20°, dips 50°E, and has a vertical displacement (vertical slickensides) of a crystalline limestone bed of about 1.5 feet. Beds dip 13°W within the quarry due to fault drag, indicating that a fault with larger displacement is likely nearby. Fractures within the quarry trend 70° and 45°. This feature is located off-site and within a drainage. No setback is recommended.

A3 Fault zone. This feature consists of a minor fault zone exposed within a quarry of the Regional Dense Member. The fault plane contains a 1-inch thick zone of fault gouge and strikes 115°. A crystalline limestone bed is apparently displaced about 0.5 feet. Beds dip 8°S within the quarry due to fault drag. Fractures within the quarry trend 035° and 050°. This feature is located on the side of a hill and off-site. No setback is recommended.

A4 Fault zone. This feature consists of a fault zone located south of the subject site. A strong vegetation lineament is coincident with this feature. It does not cross any drainages that are within 300 feet of the subject site. No setback is recommended.

A5 Stock tank. This feature was mapped by Baumgardner and Collins (1991) as a karst sinkhole. This feature holds water along the eastern portion. This feature is coincident with fault zone A-4. Any untreated runoff from the subject site should be diverted away from this feature. Setbacks for SCS and/or SAS are appropriate for this feature.

5.0 PARTICIPATING PERSONNEL

Horizon's participating personnel for this Geologic Assessment are listed below. Resumes for participants are provided in Appendix F.

PERSON	PARTICIPATION
Kristin Miller, Senior Staff Geologist	Field Investigation
Jason John, Geologic Field Technician	Field Investigation
Greg Sherrod	Field Investigation, Records Search
Joe Waring	Field Investigation, Records Search

6.0 REFERENCES

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(TNRCC) Texas Natural Resource Conservation Commission. *Complying with the Edwards Aquifer Rules: Administrative Guidance.* Revised August 1999.

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(TWDB) Texas Water Development Board. Water Well Drillers' Records. July 2000.

(UT-BEG) University of Texas - Bureau of Economic Geology. *Geologic Atlas of San Antionio Sheet.* The University of Texas at Austin. Revised 1983.

APPENDIX A

GEOLOGIC ASSESSMENT TABLE

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-acre Pfeuffer Ranch

FEATURE ID			FEATURE CHARACTERISTICS																								PHYSICAL SETTING																	
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 -20	HIGH >20	YES
S1	CD	10	Kek	150	150	15														5			0			15	15			0						10			10	10			YES
S2	FR	0	Kek							200/30	140-160	10			10		5			5			0			30		30					15				20	35			35	YES
S3	SC	10	Kep	10	10	4															10				30	50		50		0						10			10	10			YES
S4	C	35	Kep				30	6	30													15			30	80			80	0						10			10	10			YES
S5	SC	10	Kek				2	2	1											5			0			15	15			0						10			10	10			YES
S6	FZ	15	Kek							50/15	15	10			10		5			5				10		55		55					15				20	35			35	YES
S7	FR	0	Kek							40/15	85-125				10		5			5				10		30		30			5				10			15		15		YES
S8	FR	0	Kek							40/30	120				10		5			5				10		30		30					15				20	35			35	YES
S9	SC	10	Kep				1	1	1											5			0			15	15			0					5				5	5			YES
S10	SC	10	Kep				0.5	4	4											5			0			15	15			0					5				5	5			YES
S11	FR	0	Kep							30/15	30-110	10		5			5			5				10		35		35				10				20	30			30	YES
S12	FR	0	Kek								60	10			10		5			5				10		40		40				10				20	30			30	YES
S13	SH	20	Kek	3.5	3.5	3					45	10									10			10		50		50			5				10			15		15		YES
S14	FR	0	Kek							50/20	90-120-150	10		5			5			5				10		35		35				10				20	30			30	YES
S15	FR	0	Kek							50/20	100	10			10		5			5				10		40		40				10				20	30			30	YES
S16	SC	10	Kep				1	6	1											5			0			15	15			0						10			10	10			YES
S17	SC	10	Kek				1	1	1											5			0			15	15			0						10			10	10			YES
S18	FZ	15	Kek								45	10								5				10		40		40					15				20	35			35	YES
S19	FZ	15	Kek								30	10								5				10		40		40					15				20	35			35	YES
S20	FR	0	Kek							20/20	100			5					0					10		15	15					10				20	30			30	YES
S21	MM	35	KeP																						30	65			65	0						10			10	10			YES
S22	MM	35	KeP																						30	65			65	0						10			10	10			YES
S23	MM	35	KeP																						30	65			65	0						10			10	10			YES
S24	MM	35	Kbu																						30	65			65	0						10			10	10			YES
S25	FR	0	KeK							50/50	115			5			5			5				10		25		25		0						10			10	10			YES
S26	FZ	15	KeK/KeP								~60	10								5				10		40		40					15				20	35			35	YES

SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

I have read, understood, and followed the Texas Natural Resource Conservation Commission's Instructions to Geologists. The information presented here complies with that document and is a true representation of the conditions observed in the field.

Geologist signature

19 March 2001
Date

Sheet 1 of 6

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-ACRE PFEUFFER RANCH

FEATURE ID			FEATURE CHARACTERISTICS																									PHYSICAL SETTING																							
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 -20	HIGH >20	YES
S27	SC	10	Kep				2	2	2											5				10		25		25		0					5				5	5			YES
S28	FR	0	Kek							1000/20	~~35-85-~~ 120	10			10			10			10			10		50		50					15				20	35			35	YES
S29	FZ	15	Kek/Kep								45	10								5				10		40		40					15				20	35			35	YES
S30	FZ	15	Kek/Kep								45	10								5				10		40		40					15				20	35			35	YES
S31	CD	10	Kek	200	200	15														5			0			15	15					10			10			20		20		YES
S32	SC	10	Kep	3	0.3	2.5					~45	10								5				10		35		35		0					5				5	5			YES
S33	FZ	15	Kek/Kep								50	10								5				10		40		40					15				20	35			35	YES
S34	CD	10	Kbu	75	75	10														5			0			15	15				5					10			15		15		YES
S35	CD	10	Kbu	200	100	10														5			0			15	15				5					10			15		15		YES
S36	CD	10	Kep	50	50	10														5			0			15	15				5					10			15		15		YES
S37	CD	10	Kek	100	100	10														5			0			15	15				5					10			5	5			YES
S38	CD	10	Kep	20	20	5														5			0			15	15				5					10			15		15		YES
S39	CD	10	Kdr	20	20	5														5			0			15	15				5					10			15		15		YES
S40	CD	10	KeK	# #	20	5														5			0			15	15				5					10			15		15		YES
S41	CD	10	Kbu	50	50	10																	0			15	15				5					1	10			15		15		YES
S42	FZ	15	KeK/KeP								~45	10												10		40		40					15				20	35			35	YES
S43	FZ	15	KeK/KeP								~135	10												10		40		40				10					10	20		20		YES
S44	FZ	15	KeK/KeP								~45	10								5				10		40		40					15				20	35			35	YES
S45	CD	10	KeP	8	8	4														5			0			15	15			0								5	5			YES
S46	SC	10	KeK	1	1	3														5				10		25		25		0						10			10	10			YES
S47	VR	0	KeP							15/15				5			5			5				10		5	5			0						10			10	10			YES
S48	FZ	15	KeK/KeP								~20	10								5				10		40		40				10					10	20		20		YES
S49	FR	0	KeK							75/10	20	10			10		5			5				10		40		40				10				20	30			30	YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

I have read, understood, and followed the Texas Natural Resource Conservation Commission's Instructions to Geologists. The information presented here complies with that document and is a true representation of the conditions observed in the field.

Geologist signature — Date: 19 March 2001

GEOLOGIC ASSESSMENT TABLE																									PROJECT NAME:													1855-acre Pfeuffer Ranch					
FEATURE ID			FEATURE CHARACTERISTICS																												PHYSICAL SETTING												
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25-60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15-20	HIGH >20	YES
S50	VR	0	Kek							100/50					10			10		5			0			25		25			5					10			15		15		YES
S51	SC	10	Kek	1	1	2														5				10		25		25		0						10			10	10			YES
S52	CD	10	Kep	30	30	3														5						15	15												0				YES
S53	SC	10	Kep	1	1	2														5						15	15												0				YES
S54	FZ	15	Kek/Kep								315	10								5						30		30											0				YES
S55	CD	10	Kep	50	50	7														5						15	15					10				10			20		20		YES
S56	CD	10	Kep	50	50	5														5						15	15					10				10			20		20		YES
S57	SC	10	Kep	0.5	3	1.5														5						15	15			0					5				5	5			YES
S58	SC	10	Kep	1	1	2														5						15	15			0					5				5	5			YES
S59	SC	10	Kep	0.8	0.5	1.5														5						15	15			0					5				5	5			YES
S60	SC	10	Kep	0.5	0.5	1.5														5						15	15			0					5				5	5			YES
S61	SC	10	Kep	0.5	0.5	3														5				10		25		25		0						10			10	10			YES
S62	SH	20	Kep	100	100	15					~45	10								5				10		45		45				10				10			20		20		YES
S63	SC	10	Kep	0.5	0.5	2														5				10		25		25		0						10			10	10			YES
S64	FR	0	Kep							50/10	55	10		5			5			5				10		35		35					15					20	35			35	YES
S65	CD	10	Kep	30	30	5														5			0			15	15					10				10			20		20		YES
S66	CD	10	Kdr	150	150	8														5			0			15	15					10						20	30			30	YES
S67	CD	10	Kep	50	30	5														5			0			15	15					10						20	30			30	YES
S68	SC	10	Kep	0.5	0.5	1														5				10		25		25		0						10			10	10			YES
S69	MM	35	Kbu																	5					30	70			70	0					5				5	5			YES
S70	CD	10	Kep	25	25	3														5			0			15	15			0						10			10	10			YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

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[signature] 19 March 2001

Geologist signature Date

Sheet 3 of 6

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-acre Pfeuffer Ranch

FEATURE ID			FEATURE CHARACTERISTICS																						PHYSICAL SETTING														
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25-60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15-20	HIGH >20	YES
S71	CD	10	Kek	60	60	5														5			0			35		35			5					10			15		15		YES
S72	CD	10	Kep	60	60	5														5			0			15	15				5					10			15		15		YES
S73	CD	10	Kep	30	30	7														5			0			15	15				5					10			15		15		YES
S74	SC	10	Kep	1	1	2														5				10		25		25		0						10			10	10			YES
S75	SC	10	Kep	1	1	5					20									5				10		25		25		0						10			10	10			YES
S76	CD	10	Kep	50	50	10														5			0			15	15					10				10			20		20		YES
S77	CD	10	Kep	50	50	7														5			0			15	15					10				10			20		20		YES
S78	CD	10	Kep	30	30	6														5			0			15	15					10				10			20		20		YES
S79	SC	10	Kep	1	1	3														5				10		25		25		0					5				5	5			YES
S80	SC	10	Kep	2.5	0.8	2.5																15			30	55		55				10				10			20		20		YES
S81	SC	10	Kep				1	3	1											5				10		25		25			5					10			35			35	YES
S82	CD	10	Kep	30	30	7														5			0			15	15				5					10			15		15		YES
S83	CD	10	Kep	30	30	7														5			0			15	15				5					10			15		15		YES
S84	CD	10	Kep	30	30	5														5			0			15	15				5					10			15		15		YES
S85	CD	10	Kep	30	30	6														5			0			15	15				5					10			15		15		YES
S86	FZ	15	Kek/Kep								-45	10								5				10		40		40					15				20	35			35	YES
S87	FZ	15	Kek/Kep								-45	10								5				10		40		40					15				20	35			35	YES
S88	CD	10	Kek	150	150	6														5			0			15	15					10				10	20		20		YES
S89	CD	10	Kbu	10	30	3														5			0			15	15			0				5				5	5			YES
S90	CD	10	Kbu	50	50	3														5			0			15	15			0				5				5	5			YES
S91	MM	35	Kbu																	5					30	70			70	0					10			10	10			YES
S92	CD	10	Kbu	2	2	3														5			0			15	15					10					20	30			30	YES
S93	CD	10	Kek	20	20	4														5			0			15	15					10					20	30			30	YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
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Geologist signature — Date: 19-March-2001

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-acre Pfeuffer Ranch

FEATURE ID			FEATURE CHARACTERISTICS																						PHYSICAL SETTING																
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z																			0	5	10	15	0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15-20	HIGH >20	YES
S94	SC	10	Kek	0.3	0.3	2														5				10		25		25		0						10			10	10			YES
S95	SC	10	Kek	1.3	1.3	1.5														5				10		25		25		0						10			10	10			YES
S96	CD	10	Kek	50	15	3														5			0			60		60			5					10			15		15		YES
S97	CD	10	Kek	50	50	8														5			0		.	15	15				5					10			15		15		YES
S98	CD	10	Kep	100	25	3														5			0			15	15			0						10			10	10			YES
S99	MM	35	Kdr																						30	65			65										0				YES
S100	SC	10	Kek	1	1	2														5						15	15												0				YES
S101	SC	10	Kek	2	0.1	2														5				10		25		25		0						10			10	10			YES
S102	SC	10	Kek	0.5	0.5	2														5				10		25		25		0						10			10	10			YES
S103	CD	10	Kep	25	25	2.5														5			0	10		25		25		0						10			10	10			YES
S104	FZ	15	Kek/Kep								45	10								5				10		40		40			5					10			15		15		YES
S105	SC	10	Kep	2	0.5	1					45	10								5				10		35		35		0						10			10	10			YES
S106	CD	10	Kep	25	100	1.5														5			0	10		25		25		0						10			10	10			YES
S107	FZ	15	Kek/Kep								30	10								5				10		40		40			5					10			15		15		YES
S108	FR	0	Kek							200/200	55	10		5			5			5				10		35		35		0						10			10	10			YES
S109	FR	0	Kek							50/10	90-110	10		5			5			5				10		35		35				10						20	30			30	YES
S110	FR	0	Kek							200/50	55	10		5			5			5				10		35		35					15				15		30			30	YES
S111	VR	0	Kek							300/30				5			5			5				10		25		25					15				20	35			35	YES
S112	SC	10	Kek				1.5	5	1.5											5			0	10		25		25					15				20	35			35	YES
S113	FRSH Z	35	Kek							50/50				5			5			5				10		60		60					15				20	35			35	YES
S114	SC	10	Kek				3	12	3											5			0	10		25	15	25					15				20	35			35	YES
S115	SC	10	Kek				3	8	3											5			0	10		25		25					15				20	35			35	YES
S116	SC	10	Kek	1	1	1					~45	10									10			10		40		40			5					10			15		15		YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

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Geologist signature

19 March 2001
Date

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-acre Pfeuffer Ranch

FEATURE ID			FEATURE CHARACTERISTICS																								PHYSICAL SETTING																							
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z																																							
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 -20	HIGH >20	YES
S117	SC	10	Kek	1	1	1					~45	10									10			10		40		40			5				10			15		15		YES
S118	SH	20	Kek	3.5	6	3					~45	10									10				30	35		35				10			10			10	10			YES
S119	SC	10	Kek				1	2	1											5			0	10		25		25			5			10			15		15		YES
S120	SC	10	Kek				1.5	3	0.5											5				10		25		25			5			10			15		15		YES
S128	SC	10	Kek	0.5	0.5	1														5				10		25		25		0				10			10	10			YES
S129	CD	10	Kek	20	20	1														5			0			15	15			0				10			10	10			YES
S130	CD	10	Kek	50	50	1														5			0			15	15			0				10			10	10			YES
S131	SC	10	Kep	8	8	2.5														5				10		25		25		0				10			10	10			YES
S132	CD	10	Kep									10								5			0			25		25			5			10			15		15		YES
S133	FRSC Z	35	Kep	10	10	5					50/50	10		5			5			5				10		70			70		5			10			15		15		YES
S134	SCZ	35	Kep	4	0.5	2.5				60/60	75	10								5				10		60		60			5			10			15		15		YES
S135	CD	10	Kep	50	50	1					~60	10								5			0			25		25		0				10			10	10			YES
S136	SH	20	Kep	10	10	5					235	10									10				30	70			70		5			10			15		15		YES
A-1	CD	10	Kek	25	25	5						10								5				10		35		35			5			10			15		15		YES
A-2	FZ	15	Kek								~020	10								5				10		40		40			5						5	5			YES
A-3	FZ	15	Kek								~115	10								5				10		40		40			5						5	5			YES
A-4	FZ	15	Kek/Kep								~50	10								5				10		40		40				15				20	35			35	YES
A-5	CD	10	Kek	300	400	15					~45	10								5			0			25		25				10		10			20		20		YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
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TNRCC-0585-Table (Rev. 6/1/99)

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19 March 2001

Geologist signature — Date

APPENDIX B

GEOLOGIC STRATIGRAPHIC COLUMN

GEOLOGIC STRATIGRAPHIC COLUMN

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
Quaternary		Quarternary Alluvium		~10	Qal	Unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits within creekbeds. These deposits have high porosity and permeability. No karst features are associated with these deposits.
Late Tertiary to Quaternary		equivalent of the Uvalde Gravel deposits		~10	Q-Tgr	Unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits that locally cap topographically high areas on the subject site. These deposits have high porosity and permeability. No karst features are associated with these deposits.
Upper Cretaceous	Upper confining unit	Buda Limestone		40 to 50	Kbu	Hard limestone, gray to tan, dense, nodular, abundant fossil mollusks. Low porosity and permeability. Minor surface karst development.
		Del Rio Clay		40 to 50	Kdr	Dark gray to olive brown clay, pyritic, gypsiferous, calcareous with abundant *lymatogyra arietina, Waconella wacoensis*. No porosity or permeability. No cave development. Primary upper confining unit of Edwards Aquifer.
Lower Cretaceous	I	Georgetown Formation		less than 10	Kgt	Gray to light tan marly limestone containing abundant fossil shells *Waconella wacoensis*. Low porosity and permeability. No cave development.
	II	Person Formation of the Edwards Group	Cyclic & Marine members, undivided	80 to 100	Kep2	Light tan, massive mudstone to packstone and *Miliolid* grainstone with boxwork vugs and chert. One of the most permeable members. Many subsurface caves.

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
	III	Person Formation of the Edwards Group	Leached and Collapsed members, undivided	80 to 100	Kep3	Light gray, bioturbated iron-stained beds separated by thick limestone composed of crystalline limestone, mudstone to wackestone and *Miliolid* grainstone; chert; collapsed breccia. One of the most porous and permeable. Many developed caves.
	IV	Person Formation of the Edwards Group	Regional Dense	20 to 24	Kep4	Light tan, wispy, dense, argillaceous mudstone. Low permeability and acts as a vertical barrier. No cave development.
	V	Kainer Formation of the Edwards Group	Grainstone	50 to 60	Kek5	Light gray to white, Miliolid, crossbedded grainstone; mudstone to wackestone; chert. Reduced permeability due to recrystallization. Few developed caves.
	VI	Kainer Formation of the Edwards Group	Kirschberg evaporite	50 to 60	Kek6	Light gray, highly altered crystalline limestone; chalky mudstone; chert; contains boxwork voids with neospar and travertine frame. One of the most porous and permeable subdivisions. Probably extensive cave development.
	VII	Kainer Formation of the Edwards Group	Dolomitic	110 to 130	Kek7	Thick-bedded, light gray mudstone to grainstone; crystalline limestone; chert. Massively bedded, light gray, with abundant *Toucasia*. Locally permeable and water-yielding. Caves related to structure or bedding planes.
	VIII	Kainer Formation of the Edwards Group	Basal Nodular	50 to 60	Kek8	Massive shaly, fossiliferous, nodular and mottled limestone; mudstone; miliolid grainstone. Usually low permeability and few caves.

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
	Lower Confining Unit	Upper Glen Rose		350 to 500	Kgr	Alternating strata of marl, dolomite, and limestone. Lower confining unit of the Edwards Aquifer. Relatively impermeable with some surface cave development.

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Senger, R. K., and C. W. Kreitler. Hydrogeology of the Northern Segment of the Edwards Aquifer, Austin Region. *Report of Investigations 192.* The University of Texas at Austin, Bureau of Economic Geology, 1990.

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_____. *Geologic Map of the Austin Area.* The University of Texas at Austin. Reprinted 1992.

APPENDIX C

SITE GEOLOGIC MAP

APPENDIX D

RESUMES OF PARTICIPANTS

RESUMES OF KEY PERSONNEL

Corporate Experience

Horizon Environmental Services, Inc. (Horizon) has performed hundreds of Geologic Assessments to complete Water Pollution Abatement Plans within the Edwards Aquifer Recharge Zone. The geographic extent of Horizon's Geologic Assessments includes Bexar, Comal, Hays, Travis, and Williamson Counties of Texas, in support of Edwards Aquifer protection.

Horizon is particularly well-qualified to provide both the technical and administrative support required for project planning and permitting efforts related to various federal and state permits or approvals. Overall corporate services provided by Horizon focus primarily upon environmental services other than those related to hazardous substances. However, we have personnel who are ASTM-trained and who have several years of applied experience in performing Phase I Environmental Site Assessments (ESAs) and due diligence reviews for property (real estate) transfers. Horizon's capabilities and experience are very broad in compliance with the National Environmental Policy Act (NEPA), particularly as related to multidisciplinary Environmental Assessments and Environmental Impact Statements (EISs), jurisdictional wetlands, endangered species, cultural resource issues, geologic assessments, cave management, and expert testimony.

Horizon is an Austin-based Texas Corporation with additional offices in Beaumont and Houston, Texas, and Shreveport, Louisiana. Founded in 1987, Horizon is a small-business enterprise as defined by Section 3 of the Small Business Act and the standards established by the Small Business Administration Regulation under CAR 121.

Services which Horizon provides for various clients include jurisdictional wetland determinations; endangered species habitat assessments and surveys; archeological surveys and mitigation (prehistoric and historic); ecological risk and damage assessments; Phase I environmental site assessments; wildlife habitat and wetlands restoration or creation; baseline aquatic and terrestrial investigations (inland and coastal); HEP analyses; IFIM analyses; environmental constraints analyses for alternative project sites, routes, and land development scenarios ("fatal flaw" analyses); post-project land use planning and mitigation; multidisciplinary Environmental Assessments in support of federal and state Environmental Impact Statements; and permit management including preparation, agency coordination, and expert testimony.

Kristin Miller, RPG

Kristin Miller is a graduate of the University of Texas at Austin with 2 bachelor degrees in Geological Sciences and Geography (Environmental Resource Management). Ms Miller is currently working on a master's program at UT-Austin in Geomorphology with a specialization in karst sediment transport. She is Registered Professional Geologist (Mississippi Registration #0523), Environmental Specialist, Senior Staff Project Manager, and Senior Staff Geologist with Horizon. Ms. Miller has more than 9 years experience in environmental consulting and 7 years experience at the Texas Natural Resource Conservation Commission (formerly Texas Water Commission) and Texas Water Development Board.

Ms. Miller is an ASTM-trained Environmental Site Assessment (ESA) Professional and has hundreds of Phase I ESAs in the State of Texas. Ms. Miller provides due diligence investigations regarding the potential for hazardous substance liabilities. Ms. Miller prepares Phase I ESAs that meet or exceed nationally accepted standards set by the ASTM Practice E-1527-97. Ms. Miller has been caving since 1982, where she began as a tour guide and part-time volunteer, surveying Inner Space Caverns in Georgetown, Texas. Ms. Miller has performed hundreds of geologic assessments within the Edwards Aquifer Recharge Zone in Central Texas. She is a member of the Geological Society of America, Austin Geological Society, and National Speleological Society.

Ms. Miller's resume includes geologic assessments; cave studies; karst investigations; cave closure and management plans; NOI and FERC documentation; biological sampling; integrated pest management; endangered species habitat assessments; population surveys; territory mapping; wetland determinations and planting, project management; and state, local, and federal environmental permitting assistance. She is authorized to conduct biological sampling and is listed on Horizon's Scientific Collection Permits. Ms. Miller has conducted hundreds of endangered species habitat assessments for the federally protected golden-cheeked warbler, black capped-vireo, and cave-invertebrate species. She provides technical, biological, and geological support and on-site investigations for Environmental Impact Statements throughout Texas and Louisiana.

Jason John

Jason John graduated from the Colorado School of Mines in 1995 with a Bachelor of Science degree in Geophysical Engineering and a minor in Geology. He is currently a geologic field technician at Horizon and is studying Stratigraphy in the graduate program at UT. While in undergraduate and graduate school, Mr. John worked as a geoscience intern in Texas, Louisiana, and Alaska where he produced isopach structural porosity, permeability, water saturation, and net sand maps for key reservoir horizons of an undeveloped reservoir and conducted research on stratigraphic, structural, exploration histories. Mr. John researched and compiled regional cross-sections of the Gulf of Mexico and synthesized several of them to gain a regional understanding of the subsurface structure, stratigraphic units, and facies changes of the onshore area. He also

worked for the Department of Water Resources in Arizona as an Engineering Aide where he conducted snow and rain surveys and prepared geologic maps for digitization. Mr. John's computer skills include ARCview, GEOLOG, Geoquest, AutoCAD, and technical software programs.

Joe Waring

Joe Waring is an EMS-trained field technician at Horizon who provides administrative and technical support for field mapping, karst surveys, cave mapping and exploration, water well inventories, endangered species record searches, background research, and wetland restoration/design.

WATER POLLUTION ABATEMENT PLAN APPLICATION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b), EFFECTIVE JUNE 1, 1999

PROJECT NAME: RIVER CHASE UNIT FOUR

PROJECT INFORMATION

1. The type of project is:
   170 Residential: # of Lots: ___
   ___ Residential: # of Living Unit Equivalents: ___
   ___ Commercial
   ___ Industrial
   ___ Other: _____

2. Total site acreage (size of property): 289.95

3. Projected population: 476

4. The amount and type of impervious cover expected after construction are shown below:

Impervious Cover of Proposed Project	Sq. Ft.	Sq. Ft./Acre	Acres
Structures/Rooftops	595,000	÷ 43,560 =	13.66
Parking	340,000	÷ 43,560 =	7.80
Other paved surfaces	373,400	÷ 43,560 =	8.58
Total Impervious Cover	1,308,400	÷ 43,560 =	30.04
Total Impervious Cover ÷ Total Acreage x 100 =			10%

5. X **ATTACHMENT A - Factors Affecting Water Quality.** A description of any factors that could affect surface water and groundwater quality is provided at the end of this form.

6. X Only inert materials as defined by 30 TAC 330.2 will be used as fill material.

FOR ROAD PROJECTS ONLY
Complete questions 7-12 if this application is exclusively for a road project.

7. Type of project:
   ___ TXDOT road project.
   ___ County road or roads built to county specifications.
   ___ City thoroughfare or roads to be dedicated to a municipality.
   ___ Street or road providing access to private driveways.

8. Type of pavement or road surface to be used:

__ Concrete
__ Asphaltic concrete pavement
__ Other: _____

9. Length of Right of Way (R.O.W.): _____ feet.
Width of R.O.W.: _____ feet.
L x W = _____ Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.

10. Length of pavement area: _____ feet.
Width of pavement area: _____ feet.
L x W = _____ Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.
Pavement area _____ acres ÷ R.O.W. area _____ acres x 100 = ____% impervious cover.

11. __ A rest stop will be included in this project.
__ A rest stop will **not** be included in this project.

12. __ Maintenance and repair of existing roadways that do not require approval from the TNRCC Executive Director. Modifications to existing roadways such as widening roads/adding shoulders totaling more than one-half (1/2) the width of one (1) existing lane require prior approval from the TNRCC.

STORMWATER TO BE GENERATED BY THE PROPOSED PROJECT

13. **ATTACHMENT B - Volume and Character of Stormwater.** A description of the volume and character (quality) of the stormwater runoff which is expected to occur from the proposed project is provided at the end of this form. The estimates of stormwater runoff quality and quantity should be based on area and type of impervious cover. Include the runoff coefficient of the site for both pre-construction and post-construction conditions.

WASTEWATER TO BE GENERATED BY THE PROPOSED PROJECT

14. The character and volume of wastewater is shown below:

100 % Domestic	59,500 gallons/day
__ % Industrial	_____ gallons/day
__ % Commingled	_____ gallons/day
TOTAL	59,500 gallons/day

15. Wastewater will be disposed of by:
X **On-Site** Sewage Facility (OSSF/Septic Tank):
ATTACHMENT C - Suitability Letter from Authorized Agent. An on-site sewage facility will be used to treat and dispose of the wastewater. The appropriate licensing authority's (authorized agent) written approval is provided at the end of this form. It states that the land is suitable for the use of an on-site sewage facility or identifies areas that are not suitable.
X Each lot in this project/development is at least one (1) acre (43,560 square feet) in size. The system will be designed by a licensed professional engineer or registered sanitarian and installed by a licensed installer in compliance with 30 TAC §285.
__ Sewage Collection System (Sewer Lines):
__ Private service laterals from the wastewater generating facilities will be connected

to an existing SCS.

__ Private service laterals from the wastewater generating facilities will be connected to a proposed SCS.

__ The SCS was previously submitted on _____.

__ The SCS was submitted with this application.

__ The SCS will be submitted at a later date. The owner is aware that the SCS may not be installed prior to executive director approval.

The sewage collection system will convey the wastewater to the _____ (name) Treatment Plant. The treatment facility is :

__ existing.

__ proposed.

16. X All private service laterals will be inspected as required in 30 TAC 213.5.

SITE PLAN REQUIREMENTS

Items 17 through 27 must be included on the Site Plan.

17. The Site Plan must have a minimum scale of 1" = 400'.
Site Plan Scale: 1" = 200 '.

18. 100-year floodplain boundaries

__ Some part(s) of the project site is located within the 100-year floodplain. The floodplain is shown and labeled.

X No part of the project site is located within the 100-year floodplain.

The 100-year floodplain boundaries are based on the following specific (including date of material) sources(s):

FEDERAL EMERGENCY MANAGEMENT FLOOD INSURANCE RATE MAP
COMAL COUNTY MAP NO. 485463 0110C, SEPTEMBER 29, 1986

19. __ The layout of the development is shown with existing and finished contours at appropriate, but not greater than ten-foot contour intervals. Show lots, recreation centers, buildings, roads, etc.

X The layout of the development is shown with existing contours. Finished topographic contours will not differ from the existing topographic configuration and are not shown.

20. All known wells (oil, water, unplugged, capped and/or abandoned, test holes, etc.):

X There are 1 (#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply)

__ The wells are not in use and have been properly abandoned.

X The wells are not in use and will be properly abandoned.

__ The wells are in use and comply with 30 TAC §238.

X There are no wells or test holes of any kind known to exist on the project site.

21. Geologic or manmade features which are on the site:

X All **sensitive and possibly sensitive** geologic or manmade features identified in the Geologic Assessment are shown and labeled.

__ No **sensitive and possibly sensitive** geologic or manmade features were identified in the Geologic Assessment.

__ **ATTACHMENT D - Exception to the Required Geologic Assessment.** An exception to

the Geologic Assessment requirement is requested and explained in ATTACHMENT D provided at the end of this form. Geologic or manmade features were found and are shown and labeled.

__ **ATTACHMENT D - Exception to the Required Geologic Assessment.** An exception to the Geologic Assessment requirement is requested and explained in ATTACHMENT D provided at the end of this form. No geologic or manmade features were found.

22. X The drainage patterns and approximate slopes anticipated after major grading activities.

23. X Areas of soil disturbance and areas which will not be disturbed.

24. X Locations of major structural and nonstructural controls. These are the temporary and permanent best management practices.

25. X Locations where soil stabilization practices are expected to occur.

26. X Surface waters (including wetlands).

27. __ Locations where stormwater discharges to surface water or sensitive features.
X There will be no discharges to surface water or sensitive features.

ADMINISTRATIVE INFORMATION

28. X One (1) original and three (3) copies of the completed application have been provided.

29. X Any modification of this WPAP will require TNRCC executive director approval, prior to construction, and may require submission of a revised application, with appropriate fees.

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. This **WATER POLLUTION ABATEMENT PLAN APPLICATION FORM** is hereby submitted for TNRCC review and executive director approval. The form was prepared by:

KELLY KILBER
Print Name of ~~Applicant~~/Agent

Signature of ~~Applicant/Owner~~/Agent

3/19/01
Date

ATTACHMENT A

The major factors that affects surface water and groundwater quality will be construction equipment on the site with the potential for leakage from maintenance and refueling.

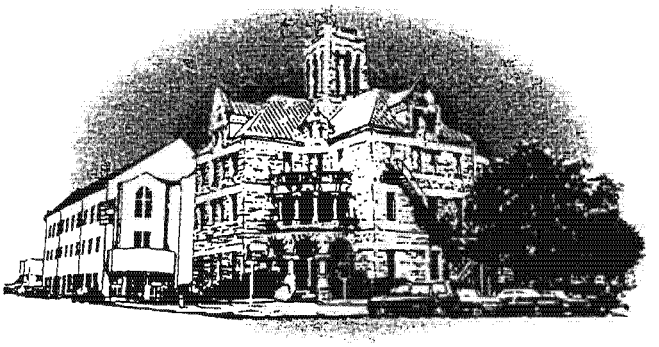
ATTACHMENT B

Volume And Character Of Stormwater

This site is divided into two distinct drainage basins. The approximate stormwater runoff for twenty five (25) year storm is 1000 cfs. The character of the water will be similar to other low density single family residential developments.

Runoff coefficient for the project is 0.45 for both pre-construction and post construction due to the low impervious cover.

All septic systems for this subdivision to be a Class I Aerobic System.



Comal County

OFFICE OF COMAL COUNTY ENGINEER

March 8, 2001

Mr. Charles D. Patterson
Summerlin Properties, Inc.
P.O. Box 1629
Wimberley, TX 78676

Re: Proposed subdivision, RIVER CHASE, UNIT 4, within Comal County, Texas

Dear Property Owner(s):

We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the property to be approved with the conditions that individual septic systems permits shall be required for the lots within this subdivision.

Please be advised that these individual permits will be required to meet 30 TAC 285.40, subchapter E (copy attached). Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

Should you have any questions, please feel free to contact us.

Sincerely,

Thomas H. Hornseth, P.E.
Comal County Engineer

cc: Pro-Tech Engineering Group

195 David Jonas Drive • New Braunfels, Texas 78132-3760 • (830) 608-2090 FAX: (830) 608-2009

TEMPORARY STORMWATER SECTION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4)(A), (B), (D)(i) and (G); EFFECTIVE JUNE 1, 1999

PROJECT NAME: RIVER CHASE UNIT FOUR

POTENTIAL SOURCES OF CONTAMINATION

Examples: Fuel storage and use, chemical storage and use, use of asphaltic products, construction vehicles tracking onto public roads, and existing solid waste.

1. Fuels for construction equipment and hazardous substances which will be used during construction:

   ___ Aboveground storage tanks with a cumulative storage capacity of less that 250 gallons will be stored on the site for less than one (1) year.

   X Aboveground storage tanks with a cumulative storage capacity between 250 gallons and 499 gallons will be stored on the site for less than one (1) year.

   ___ Aboveground storage tanks with a cumulative storage capacity of 500 gallons or more will be stored on the site. An **Aboveground Storage Tank Facility Plan** application must be submitted to the appropriate regional office of the TNRCC prior to moving the tanks onto the project.

   ___ Fuels and hazardous substances will not be stored on-site.

2. X **ATTACHMENT A - Spill Response Actions**. A description of the measures to be taken to contain any spill of hydrocarbons or hazardous substances is provided at the end of this form.

3. X Temporary aboveground storage tank systems of 250 gallons or more cumulative storage capacity must be located a minimum horizontal distance of 150 feet from any domestic, industrial, irrigation, or public water supply well, or other sensitive feature.

4. X **ATTACHMENT B - Potential Sources of Contamination.** Describe in an attachment at the end of this form any other activities or processes which may be a potential source of contamination.

   ___ The are no other potential sources of contamination.

SEQUENCE OF CONSTRUCTION

5. X **ATTACHMENT C - Sequence of Major Activities.** A description of the sequence of major activities which will disturb soils for major portions of the site (grubbing, excavation, grading, utilities, and infrastructure installation) is provided at the end of this form. For each activity described, an estimate of the total area of the site to be disturbed by each activity is given.

6. X Name the receiving water(s) at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project: YORK CREEK

TEMPORARY BEST MANAGEMENT PRACTICES (TBMPs)

Erosion control examples: tree protection, interceptor swales, level spreaders, outlet stabilization, blankets or matting, mulch, and sod. Sediment control examples: stabilized construction exit, silt fence, filter dikes, rock berms, buffer strips, sediment traps, and sediment basins. Please refer to the Technical Guidance Manual for guidelines and specifications. **All structural BMPs must be shown on the site plan.**

7. X **ATTACHMENT D - Temporary Best Management Practices and Measures.** A description of the TBMPs and measures that will be used during and after construction are provided at the end of this form. For each activity listed in the sequence of construction, include appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented.

__ TBMPs and measures will prevent pollution of surface water, groundwater, and stormwater. The construction-phase BMPs for erosion and sediment controls have been designed to retain sediment on site to the extent practicable. The following information has been provided in the attachment at the end of this form

a. A description of how BMPs and measures will prevent pollution of surface water, groundwater or stormwater that originates upgradient from the site and flows across the site.

b. A description of how BMPs and measures will prevent pollution of surface water or groundwater that originates on-site or flows off site, including pollution caused by contaminated stormwater runoff from the site.

c. A description of how BMPs and measures will prevent pollutants from entering surface streams, sensitive features, or the aquifer.

d. A description of how, to the maximum extent practicable, BMPs and measures will maintain flow to naturally-occurring sensitive features identified in either the geologic assessment, TNRCC inspections, or during excavation, blasting, or construction.

8. The temporary sealing of a naturally-occurring sensitive feature which accepts recharge to the Edwards Aquifer as a temporary pollution abatement measure during active construction should be avoided.

__ **ATTACHMENT E - Request to Temporarily Seal a Feature.** A request to temporarily seal a feature is provided at the end of this form. The request includes justification as to why no reasonable and practicable alternative exists for each feature.

X There will be no temporary sealing of naturally-occurring sensitive features on the site.

9. X **ATTACHMENT F - Structural Practices.** Describe the structural practices that will be used to divert flows away from exposed soils, to store flows, or to otherwise limit runoff discharge of pollutants from exposed areas of the site. Placement of structural practices in floodplains has been avoided.

10. X **ATTACHMENT G - Drainage Area Map**. A drainage area map is provided at the end of this form to support the following requirements.

__ For areas that will have more than 10 acres within a common drainage area

disturbed at one time, a sediment basin will be provided.

__ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a smaller sediment basin and/or sediment trap(s) will be used.

__ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a sediment basin or other equivalent controls are not attainable, but other TBMPs and measures will be used in combination to protect down slope and side slope boundaries of the construction area.

X There are no areas greater than 10 acres within a common drainage area that will be disturbed at one time. A smaller sediment basin and/or sediment trap(s) will be used in combination with other erosion and sediment controls within each disturbed drainage area.

11. NA **ATTACHMENT H - Temporary Sediment Pond(s) Plans and Calculations.** Temporary sediment pond or basin construction plans and design calculations for a proposed temporary BMP or measure has been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information must be signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed temporary BMPs and measures are provided as at the end of this form.

12. X **ATTACHMENT I - Inspection and Maintenance for BMPs.** A plan for the inspection of temporary BMPs and measures and for their timely maintenance, repair, and, if necessary, retrofit is provided at the end of this form. A description of documentation procedures and recordkeeping practices is included in the plan.

13. X All control measures must be properly selected, installed, and maintained in accordance with the manufacturers specifications and good engineering practices. If periodic inspections by the applicant or the executive director, or other information indicates a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations.

14. X If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain).

15. X Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50%. A permanent stake will be provided that can indicate when the sediment occupies 50% of the basin volume.

16. X Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, picked up daily).

SOIL STABILIZATION PRACTICES

Examples: establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, or preservation of mature vegetation.

17. X **ATTACHMENT J - Schedule of Interim and Permanent Soil Stabilization Practices.** A schedule of the interim and permanent soil stabilization practices for the site is attached at the end of this form.

18. X Records must be kept at the site of the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.

19. X Stabilization practices must be initiated as soon as practicable where construction activities have temporarily or permanently ceased.

ADMINISTRATIVE INFORMATION

20. X All structural controls will be inspected and maintained according to the submitted and approved operation and maintenance plan for the project.

21. X If any geologic or manmade features, such as caves, faults, sinkholes, etc., are discovered, all regulated activities near the feature will be immediately suspended. The appropriate TNRCC Regional Office shall be immediately notified. Regulated activities must cease and not continue until the TNRCC has reviewed and approved the methods proposed to protect the aquifer from any adverse impacts.

22. X Silt fences, diversion berms, and other temporary erosion and sediment controls will be constructed and maintained as appropriate to prevent pollutants from entering sensitive features discovered during construction.

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. This **TEMPORARY STORMWATER SECTION** is hereby submitted for TNRCC review and executive director approval. The application was prepared by:

KELLY KILBER
Print Name of Agent

Signature of Agent

3/19/01
Date

ATTACHMENT A
Spill Response Actions

An earthern berm will be built immediately downgradient of any spill. Then all material will be removed from the site and disposed of in an approved manner.

ATTACHMENT B

The major factors that affects surface water and groundwater quality will be construction equipment on the site with the potential for leakage from maintenance and refueling.

ATTACHMENT C

CONSTRUCTION CONTROLS:

The major construction activities to take place at the project site consist of the construction of approximately 16,943 linear feet of asphalt road and the installation of water distribution lines. FM 306 will be used as the construction entrance. Rock Berms and silt fences for sediment traps will be constructed where shown on Drainage Map. All disturbed areas not covered with impervious material will be renegotiated with Rye-Bermuda grass mix immediately after completion of the grading. These areas will be prepared, seeded and watered by approved methods. Drainage Map shows guidelines for the restoration of grassed areas.

The following is an approximate chronological listing of the construction Activities and the Temporary Erosion Controls to be utilized during each activity.

CONSTRUCTION ACTIVITY	TEMPORARY EROSION CONTROL
Clearing and grubbing street right-of-way, rough grading of roads	Install rock berms, and silt fences and stabilized construction entrances.
Installation of water distribution system	No additional erosion controls necessary
Installation of drainage structures	No additional erosion controls necessary
Installation of base material	No additional erosion controls necessary
Installation of asphalt pavement	Seed disturbed areas immediately upon completion
Completion of construction	Remove sediment traps only after seed has established permanent growth.

All these construction activities will take place in the road row, approximately 23.10 acres.

ATTACHMENT H

There are no temporary sediment ponds planned for this project.

ATTACHMENT I

INSPECTIONS AND MAINTENANCE FOR BMPS

a. Each Contractor will designate a qualified person or persons to perform the following inspections:

   1. Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.

   2. Erosion and sediment control measures identified in the plan will be observed to ensure that they are operating correctly.

   3. Where discharge locations or points are accessible, they will be inspected to ascertain when the erosion control measures are effective in preventing significant impacts to receiving waters.

   4. Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking. The inspection will be conducted by the responsible person at least once every seven calendar days and within 24 hours after the end of a storm of 0.5 inch or greater.

      After a portion of the site is finally stabilized, inspection will be conducted at least once every month until construction activities have been completed.

b. Based on the results of the inspection, the site description and control measures will be revised by the Engineer as appropriate, but in no case later than seven calendar days following the inspection. Any modifications shall be implemented within seven days of the inspection.

c. A report prepared by the contractor summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the erosion controls, and actions taken in accordance with item" b" above will be made. The report will be signed and a copy of the report must be submitted to the Engineer within 2 days after the inspection.

Copies of the forms and certifications to be used for the Inspection and Maintenance report are included.

INSPECTION AND MAINTENANCE GUILDELINES FOR SILT FENCES

1. Inspect all fencing weekly, and after any rainfall.

2. Remove sediment when buildup reaches 6 inches, or install a second line of fencing parallel to the old fence.

3. Replace any torn fabric or install a second line of fencing parallel to the torn section.

4. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but will not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points.

INSPECTION AND MAINTENANCE GUIDELINES FOR ROCK BERMS

1. Inspection should be made weekly and after each rainfall by the responsible party. For installations in streambeds, additional daily inspections should be made.

2. Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt of in an approved manner.

3. Repair any loose wire sheathing.

4. The berm should be reshaped as needed during inspection.

5. The berm should be replaced when the structure ceases to function as intended due to silt accumulation among the rocks, washout, construction traffic damage, etc.

6. The rock berm should be left in place until all upstream areas are stabilized and accumulated silt removed.

INSPECTION REPORT

PROJECT NAME: **RIVER CHASE, UNIT FOUR**

REPORT NO._____ _ DATE:_____ PROJECT FILE NO:_____

INSPECTOR:_____ TITLE_____

REASON FOR INSPECTION (CHECK ONE) Weekly_____ or ½" Rain_____

DATE OF LAST RAINFALL_____AMOUNT_____

SITE CONDITIONS:

EROSION AND SEDIMENTATION CONTROLS	IN CONFORMANCE	EFFECTIVE
Construction Entrance	YES/NO/NA	YES/NO
Sediment Traps	YES/NO/NA	YES/NO
Inlet Protection	YES/NO/NA	YES/NO
Stabilization	YES/NO/NA	YES/NO
Silt Fence	YES/NO/NA	YES/NO
Straw/Hay Bales	YES/NO/NA	YES/NO
Vegetative Buffer Strips	YES/NO/NA	YES/NO
Rock Berms	YES/NO/NA	YES/NO

VIOLATIONS NOTED:

_____

_____

RECOMMENDED REMEDIAL ACTIONS:

_____

_____

COMMENTS:

_____

_____

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision with a system designed to assure that qualified personnel property gathered and evaluated 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 that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

INSPECTOR:_____ **DATE:**_____

COPY_____

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all areas disturbed during construction.

OTHER CONTROLS:

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed of at a legal disposal area away from the site. All collection and disposal methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize the tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains FM 306 adjacent to the site, will be used as the main delivery route. This paved roadway can be easily cleaned by a front end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the road. The pavement surface should be cleaned as necessary but not less than once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at the entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

PERMANENT STORMWATER SECTION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4)(C), (D)(ii), (E), and (5), EFFECTIVE JUNE 1, 1999

PROJECT NAME: RIVER CHASE UNIT FOUR

Permanent best management practices (BMPs) and measures that will be used during and after construction is completed.

1. X Permanent BMPs and measures must be implemented to control the discharge of pollution from regulated activities after the completion of construction.

2. X These practices and measures have been designed, and will be constructed, operated, and maintained to insure that 80% of the incremental increase in the annual mass loading of total suspended solids (TSS) from the site caused by the regulated activity is removed. These quantities have been calculated in accordance with technical guidance prepared or accepted by the executive director.

   __ The TNRCC Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.

   __ A technical guidance other than the TNRCC TGM was used to design permanent BMPs and measures for this site. The complete citation for the technical guidance that was used is provided below

   _____

   _____

   _____

   _____

3. NA Owners must insure that permanent BMPs and measures are constructed and function as designed. A Texas Licensed Professional Engineer must certify in writing that the permanent BMPs or measures were constructed as designed. The certification letter must be submitted to the appropriate regional office within 30 days of site completion.

4. X Where a site is used for low density single-family residential development and has 20 % or less impervious cover, other permanent BMPs are not required. This exemption from permanent BMPs must be recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

   X This site will be used for low density single-family residential development and has 20% or less impervious cover.

   __ This site will be used for low density single-family residential development but has more than 20% impervious cover.

   __ This site will not be used for low density single-family residential development.

5. X The executive director may waive the requirement for other permanent BMPs for multi-family residential developments, schools, or small business sites where 20% or less impervious cover is used at the site. This exemption from permanent BMPs must be

recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

_X_ **ATTACHMENT A - 20% or Less Impervious Cover Waiver.** This site will be used for multi-family residential developments, schools, or small business sites and has 20% or less impervious cover. A request to waive the requirements for other permanent BMPs and measures is found at the end of this form.

__ This site will be used for multi-family residential developments, schools, or small business sites but has more than 20% impervious cover.

_X_ This site will not be used for multi-family residential developments, schools, or small business sites.

6. **ATTACHMENT B - BMPs for Upgradient Stormwater.**

__ A description of the BMPs and measures that will be used to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site is identified as **ATTACHMENT B** at the end of this form.

_X_ If no surface water, groundwater or stormwater originates upgradient from the site and flows across the site, an explanation is provided as **ATTACHMENT B** at the end of this form.

__ If permanent BMPs or measures are not required to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site, an explanation is provided as **ATTACHMENT B** at the end of this form .

7. **ATTACHMENT C - BMPs for On-site Stormwater.**

__ A description of the BMPs and measures that will be used to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff from the site is identified as **ATTACHMENT C** at the end of this form.

_X_ If permanent BMPs or measures are not required to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff, an explanation is provided as **ATTACHMENT C** at the end of this form.

8. _X_ **ATTACHMENT D - BMPs for Surface Streams.** A description of the BMPs and measures that prevent pollutants from entering surface streams, sensitive features, or the aquifer is provided at the end of this form. Each feature identified in the Geologic Assessment as "sensitive" or "possibly sensitive" has been addressed.

9. _X_ The applicant understands that to the extent practicable, BMPs and measures must maintain flow to naturally occurring sensitive features identified in either the geologic assessment, executive director review, or during excavation, blasting, or construction.

__ The permanent sealing of or diversion of flow from a naturally-occurring "sensitive" or "possibly sensitive" feature that accepts recharge to the Edwards Aquifer as a permanent pollution abatement measure has not been proposed for any naturally-

occurring "sensitive" or "possibly sensitive" features on this site.

X **ATTACHMENT E - Request to Seal Features.** A request to seal a naturally-occurring "sensitive" or "possibly sensitive" feature, that includes a justification as to why no reasonable and practicable alternative exists, is found at the end of this form. A request and justification has been provided for each feature.

10. NA **ATTACHMENT F - Construction Plans.** Construction plans and design calculations for the proposed permanent BMPs and measures have been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information have been signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed permanent BMPs and measures are provided at the end of this form. Design Calculations, TNRCC Construction Notes, all man-made or naturally occurring geologic features, all proposed structural measures, and appropriate details must be shown on the construction plans.

11. NA **ATTACHMENT G - Inspection, Maintenance, Repair and Retrofit Plan.** A plan for the inspection, maintenance, repair, and, if necessary, retrofit of the permanent BMPs and measures is provided at the end of this form. The plan has been prepared and certified by the engineer designing the permanent BMPs and measures. The plan has been signed by the owner or responsible party. The plan includes procedures for documenting inspections, maintenance, repairs, and, if necessary, retrofits as well as a discussion of record keeping procedures.

12. — The TNRCC Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.

— Pilot-scale field testing (including water quality monitoring) may be required for BMPs that are not contained in technical guidance recognized by or prepared by the executive director.

— **ATTACHMENT H - Pilot-Scale Field Testing Plan.** A plan for pilot-scale field testing is provided at the end of this form.

13. X **ATTACHMENT I -Measures for Minimizing Surface Stream Contamination.** A description of the measures that will be used to avoid or minimize surface stream contamination and changes in the way in which water enters a stream as a result of the construction and development is provided at the end of this form. The measures address increased stream flashing, the creation of stronger flows and in-stream velocities, and other in-stream effects caused by the regulated activity which increase erosion that results in water quality degradation.

Responsibility for maintenance of permanent BMPs and measures after construction is complete.

14. X The applicant is responsible for maintaining the permanent BMPs after construction until such time as the maintenance obligation is either assumed in writing by another entity having ownership or control of the property (such as without limitation, an owner's association, a new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity. Such entity shall then be responsible for maintenance until another entity assumes such obligations in writing or ownership is transferred.

15. X A copy of the transfer of responsibility must be filed with the executive director at the

appropriate regional office within 30 days of the transfer if the site is for use as a multiple single-family residential development, a multi-family residential development, or a non-residential development such as commercial, industrial, institutional, schools, and other sites where regulated activities occur.

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. This **PERMANENT STORMWATER SECTION** is hereby submitted for TNRCC review and executive director approval. The application was prepared by:

Kelly Kilber
Print Name of Agent

Signature of Agent

3/19/01
Date

ATTACHMENT B

No upgradient stormwater flows across the site

ATTACHMENT C

This site has less than 20% impervious cover and no permanent BMPs will be constructed. All drainage courses will be left in there natural state. No diversion of Stormwater runoff or new channelization will take place.

ATTACHMENT D

S-23 Water well to be plugged in accordance with TNRCC standards.
S-61 50' Radius OSSF Setback Easement
S-62 150' Radius OSSF Setback Easement
S-64 50' Radius OSSF Setback Easement
S-75 Feature to be covered by road construction
S-79 Feature to be covered by road construction
S-80 100' Radius OSSF Setback Easement
S-116 50' Radius OSSF Setback Easement
S-117 50' Radius OSSF Setback Easement
S-118 100' Radius OSSF Setback Easement

S-30, S-33, S-35, S-42, S-44, these features to have OSSF Setback Easements in drainage intersects.

ATTACHMENT E

Features S-75 and S-74 will be sealed by road construction. Alternative road alignment was not practical.

AGENT AUTHORIZATION FORM
FOR REQUIRED SIGNATURE
EDWARDS AQUIFER PROTECTION PROGRAM
RELATING TO 30 TAC CHAPTER 213
EFFECTIVE JUNE 1, 1999

I CHARLES D. PATTERSON,
Print Name

PRESIDENT
Title - Owner/President/Other

of SUMMERLIN PROPERTIES, INC.
Corporation/Partnership/Entity Name

have authorized Kelly Kilber , P. E.
Print Name of Agent/Engineer

of Pro-Tech Engineering Group Inc.
Print Name of Firm

to represent and act on the behalf of the above named Corporation, Partnership, or Entity for the purpose of preparing and submitting this plan application to the Texas Natural Resource Conservation Commission (TNRCC) for the review and approval consideration of regulated activities.

I also understand that:

1. The applicant is responsible for compliance with 30 Texas Administrative Code Chapter 213 and any condition of the TNRCC's approval letter. The TNRCC is authorized to assess administrative penalties of up to $10,000 per day per violation.

2. A notarized copy of the Agent Authorization Form must be provided for the person preparing the application, and the forms must accompany the completed application.

3. Application fees are due and payable at the time the application is submitted. The application fee must be sent to the TNRCC cashier or to the appropriate regional office. The application will not be considered until the correct fee is received by the commission.

4. For applicants who are not the property owner, but who have the right to control and possess and control the property, additional authorization is required from the owner.

Applicant's Signature

2/26/01
Date

THE STATE OF Texas §

County of Hays §

BEFORE ME, the undersigned authority, on this day personally appeared CHARLES D. PATTERSON known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed same for the purpose and consideration therein expressed.

GIVEN under my hand and seal of office on this 26 day of February, 2001.

NOTARY PUBLIC

RICHARD McDANIEL
MY COMMISSION EXPIRES
August 17, 2001

Typed or Printed Name of Notary

MY COMMISSION EXPIRES: _____

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
EDWARDS AQUIFER PROTECTION PLAN
APPLICATION FEE FORM

NAME OF PROPOSED PROJECT: River Chase Unit Four
PROJECT LOCATION: Comal County, Texas
NAME OF APPLICANT: Summerlin Properties, Inc.
APPLICANT'S ADDRESS: P. O. Box 1629
CONTACT PERSON: Charles D. Patterson PHONE: (512) 847-5263
Please Print

AUSTIN REGIONAL OFFICE (3373)
☒ Hays
☐ Travis
☐ Williamson

SAN ANTONIO REGIONAL OFFICE (3362)
☐ Bexar
☐ Comal
☐ Kinney
☐ Medina
☐ Uvalde

APPLICATION FEES MUST BE PAID BY CHECK, CERTIFIED CHECK, OR MONEY ORDER, PAYABLE TO THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION. YOUR CANCELED CHECK WILL SERVE AS YOUR RECEIPT. **THIS FORM MUST BE SUBMITTED WITH YOUR FEE PAYMENT**. THIS PAYMENT IS BEING SUBMITTED TO (CHECK ONE):

☐ **SAN ANTONIO REGIONAL OFFICE**
☐ **Mailed to TNRCC**:
TNRCC - Cashier
Revenues Section
Mail Code 214
P.O. Box 13088
Austin, TX 78711-3088

☒ **AUSTIN REGIONAL OFFICE**
☐ **Overnight Delivery to TNRCC**:
TNRCC - Cashier
12100 Park 35 Circle
Building A, 3rd Floor
Austin, TX 78753
512/239-0347

Type of Plan	Size	Fee Due
Water Pollution Abatement, One Single Family Residential Dwelling	Acres	$
Water Pollution Abatement, Multiple Single Family Residential and Parks	289.95 Acres	$ 5,000.00
Water Pollution Abatement, Non-residential	Acres	$
Sewage Collection System	L.F.	$
Lift Stations without sewer lines	Acres	$
Underground or Aboveground Storage Tank Facility	Tanks	$
Piping System(s)(only)	Each	$
Exception	Each	$
Extension of Time	Each	$

Signature

3-21-01
Date

River Chase

UNIT FOUR

COMAL COUNTY, TEXAS

WPAP

NOTE:

1. UPON COMPLETION OF EARTHMOVING ACTIVITY, ALL DISTURBED AREAS WILL BE IMMEDIATELY SEEDED WITH BERMUDA GRASS OR OTHER APPROPRIATE SEED. THIS ACTIVITY WILL BE DONE PRIOR TO PAVING OR SUBGRADE TREATMENT.

2. ALL SILT FENCES ARE TO BE INSPECTED AT THE START OF EACH DAY AND NECESSARY REPAIRS ARE TO BE MADE.

The contractor shall hydromulch or sod all exposed cuts and fills upon completion of grading and installation of all utilities. The seeding or erosion control shall be applied at the specified rate over areas disturbed by construction as follows:

From September 15 to March 1, seeding shall be with a combination of (1) one pound per (1000) thousand square feet of unhulled bermuda and (3) three pounds per (1000) thousand square feet of winter rye with a purity of 95% with 85% germination.

From March 1 to September 15, seeding shall be with hulled bermuda grass (Cynodon Dactolyn) at a rate of (1) one pound per (1000) thousand square feet with a purity of 95% with 85% germination.

Fertilizer shall have an analysis of 15-10-5 and shall be applied at the rate of 600 pounds per acre. Mulch type to be Cornell, applied at a rate of 2100 pounds per acre. Restoration shall be acceptable when the grass has reached a height of at least 1-1/2" (95%) coverage and no bare spots larger than 16 square feet exist.

The seeded or planted area is to be irrigated or sprinkled in a manner which will not erode the topsoil but will sufficiently soak the soil to a depth of 6 inches. The irrigation shall occur at seven day intervals for the first two months. Rainfall occurrences of at least 1 inch shall postpone the watering operation for one week.

LEGEND

- S-1 ✱ KARST or MAN-MADE FEATURE
- A-1 ✱ OFF-SITE KARST or MAN-MADE FEATURE
- S-69 WATER WELL (in use)
- S-21 WATER WELL (abandoned)
- S-9 STOCK POND, CLOSED DEPRESSION (CD) or QUARRY (non-sensitive features)
- FAULTS: (dashed where inferred) U/D = KNOWN DOWNTHROWN
- ANTICLINE & SYNCLINE
- LITHOLOGIC CONTACT (dashed were inferred)

GEOLOGIC FORMATIONS:

- Qal QUATERNARY ALLUVIUM
- Qal/Tgr QUATERNARY - TERTIARY GRAVELS
- Kbu/Kgr BUDA FORMATION
- Kbu DEL RIO
- Kgr GRORGETOWN FORMATION
- Kep2 PERSON FORMATION II (Cyclic & Marine Members, Undivided)
- Kep3 PERSON FORMATION III (Leached and Collapsed Members, Undivided)
- Kep4 PERSON FORMATION IV (Regional Dense Member)
- Kek5 KAINER FORMATION V (Dolomitic Member)
- Kek6 KAINER FORMATION VI (Kirschberg Evaporite Members)
- Kek7 KAINER FORMATION VII (Dolomitic Members)

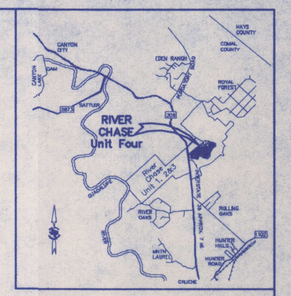
DRAINAGE STRUCTURE

STABILIZED CONSTRUCTION ENTRANCE

ROCK BERM ******

SILT FENCE — SF —

SCALE: 1" =200'



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
WATER POLLUTION ABATEMENT PLAN
GENERAL CONSTRUCTION NOTES

1. Written construction notification must be given to the appropriate TNRCC regional office no later than 48 hours prior to commencement of the regulated activity. Information must include the date on which the regulated activity will commence, the name of the approved plan for the regulated activity, and the name of the prime contractor and the name and telephone number of the contact person.

2. All contractors conducting regulated activities associated with this project must be provided with complete copies of the approved Water Pollution Abatement Plan and the TNRCC letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractors are required to keep on-site copies of the approved plan and approval letter.

3. If any sensitive feature is discovered during construction, all regulated activities near the sensitive feature must be suspended immediately. The appropriate TNRCC regional office must be immediately notified of any sensitive features encountered during construction. The regulated activities near the sensitive feature may not proceed until the TNRCC has reviewed and approved the methods proposed to protect the sensitive feature and the Edwards Aquifer from any potentially adverse impacts to water quality.

4. No temporary aboveground hydrocarbon and hazardous substance storage tank system is installed within 150 feet of a domestic, industrial, irrigation, or public water supply well, or other sensitive feature.

5. All temporary erosion and sedimentation (E&S) control measures must be properly selected, installed, and maintained in accordance with the manufacturers specifications and good engineering practices. Controls specified in the temporary storm water section of the approved Edwards Aquifer Protection Plan are required during construction. If inspections indicate a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations. The controls must remain in place until disturbed areas are revegetated and the areas have become permanently stabilized.

6. If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain).

7. Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50 %at can indicate when the sediment occupies 50

8. Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, picked up daily).

9. All spoils (excavated material) generated from the project site must be stored on-site with proper E&S controls. For storage or disposal of spoils at another site on the Edwards Aquifer Recharge Zone, the owner of the site must receive approval of a water pollution abatement plan for the placement of fill material or mass grading prior to the placement of spoils at the other site.

10. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently ceases is precluded by weather conditions, stabilization measures shall be initiated as soon as practicable. Where construction activity on a portion of the site is temporarily ceased, and earth disturbing activities will be resumed within 21 days, temporary stabilization measures do not have to be initiated on that portion of site. In areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable.

11. The following records shall be maintained and made available to the TNRCC upon request: the dates when major grading activities occur; the dates when construction activities temporarily or permanently cease on a portion of the site; and the dates when stabilization measures are initiated.

12. The holder of any approved Edward Aquifer protection plan must notify the appropriate regional office in writing and obtain approval from the executive director prior to initiating any of the following:

A. any physical or operational modification of any water pollution abatement structure(s), including but not limited to ponds, dams, berms, sewage treatment plants, and diversionary structures;

B. any change in the nature or character of the regulated activity from that which was originally approved or a change which would significantly impact the ability of the plan to prevent pollution of the Edwards Aquifer;

C. any development of land previously identified as undeveloped in the original water pollution abatement plan.

Austin Regional Office
1921 Cedar Bend, Suite 150
Austin, Texas 78758-5336
Phone (512) 339-2929
Fax (512) 339-3795

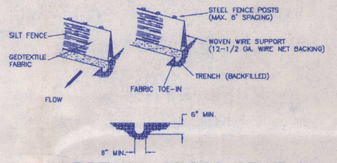
San Antonio Regional Office
140 Heimer, Suite 360
San Antonio, Texas 78232-5042
Phone (210) 490-3096
Fax (210) 545-4329

OWNER/DEVELOPER:
SUMMERLIN PROPERTIES, INC.
P.O. BOX 1629
WIMBERLEY, TEXAS 78676
(512) 847-5263

PRO·TECH ENGINEERING GROUP
INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

EO 14677
..\14677\prelim\prelim-unit4.dwg
02/13/01 RPB

PREPARED: MARCH 5, 201



TRENCH CROSS-SECTION

GENERAL NOTES:

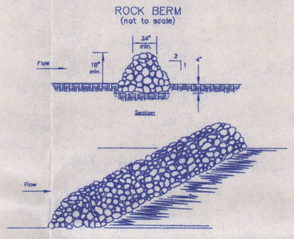
1. STEEL POSTS WHICH SUPPORT THE SILT FENCE SHALL BE INSTALLED ON A SLIGHT ANGLE TOWARD THE ANTICIPATED RUNOFF SOURCE. POST MUST BE EMBEDDED A MINIMUM OF ONE FOOT.
2. THE TOE OF THE SILT FENCE SHALL BE TRENCHED IN WITH A SPADE OR MECHANICAL TRENCHER, SO THAT THE DOWNSLOPE FACE OF THE TRENCH IS FLAT AND PERPENDICULAR TO THE LINE OF FLOW. WHERE FENCE CANNOT BE TREATED IN (E.G. PAVEMENT) WEIGHT FABRIC FLAP WITH WASHED GRAVEL ON UPHILL SIDE TO PREVENT FLOW UNDER FENCE.
3. THE TRENCH MUST BE A MINIMUM OF 6 INCHES DEEP AND 8 INCHES WIDE TO ALLOW FOR THE SILT FENCE FABRIC TO BE LAID IN THE GROUND AND BACKFILLED WITH COMPACTED MATERIAL.
4. SILT FENCE SHOULD BE SECURELY FASTENED TO EACH STEEL SUPPORT POST OR TO WOVEN WIRE, WHICH IS IN TURN ATTACHED TO THE STEEL FENCE POST.
5. INSPECTION SHALL BE MADE WEEKLY OR AFTER EACH RAINFALL EVENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. SILT FENCE SHALL BE REMOVED WHEN THE SITE IS COMPLETELY STABILIZED SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
7. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6 INCHES. THE SILT SHALL BE DISPOSED OF IN AN APPROVED SITE AND IN SUCH A MANNER AS TO NOT CONTRIBUTE TO ADDITIONAL SILTATION.

STANDARD SYMBOL SF

SILT FENCE

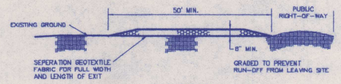
N.T.S.

ROCK BERM
(not to scale)

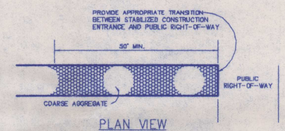


GENERAL NOTES

1. Use only open-graded rock, with most of the fines removed.
2. Stone shall be crushed and, unless otherwise specified, shall be at least 3 inches in diameter and less than 1 cubic foot in volume.
3. The rock berm shall be embedded into the soil a minimum of 4 inches.
4. The rock berm shall be inspected after each rain, and the stone shall be replaced when the structure ceases to function as intended, due to silt accumulation among the rocks, washout, construction traffic damage, etc.
5. When silt reaches a depth equal to one-third the height of the berm or one foot, whichever is less, the silt will be removed and disposed of in an approved site and in such a manner as to not create a siltation problem.
6. When the site is completely stabilized, the berm will be removed and disposed of in an approved manner.



PROFILE



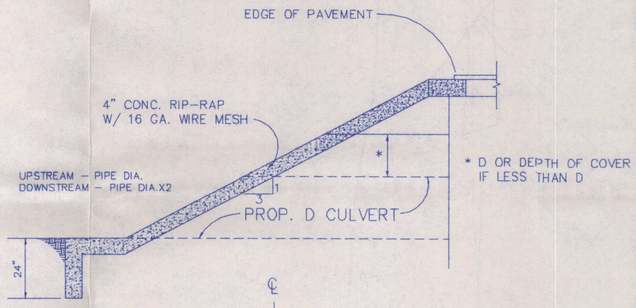
PLAN VIEW

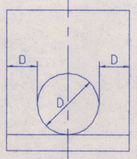
GENERAL NOTES:

1. Stone size unless otherwise specified, aggregate shall conform to Grade 1 for coarse aggregates under Specification No. 403 "Concrete for Structures."
2. Length as effective, but not less than fifty (50) feet.
3. Thickness not less than eight (8) inches.
4. Width not less than full width of all points of ingress or egress.
5. Washing when necessary, wheels will be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through use of sand bags, gravel, boards or other approved method
6. Maintenance the entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public right-of-way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public right-of-way must be removed immediately.

STABILIZED CONSTRUCTION ENTRANCE

N.T.S.





NOTE:
D = PIPE DIAMETER, BUT
NOT LESS THAN 24"

TYPICAL CONCRETE RIP-RAP DETAIL

N.T.S.

RIVER CHASE
UNIT FOUR

EROSION CONTROL DETAILS

COMAL COUNTY, TEXAS

PRO-TECH
ENGINEERING
GROUP
INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

DATE MARCH 5, 2001

E.D. 14677 | SCALE NTS | SHEET 2 OF 2

000211GA\000211s1ga.dwg\KAM111-8-00

LEGEND

S-1 ✱	KARST or MAN-MADE FEATURE
A-1 ✱	OFF-SITE KARST or MAN-MADE FEATURE
S-69 -O-	WATER WELL (in use)
S-21 ⌽	WATER WELL (abandoned)
S-9 ●	STOCK POND, CLOSED DEPRESTION (CD) or QUARRY
U / D	FAULTS: (dashed where inferred) UPTHROWN DOWNTHROWN
◊ / ╳	ANTICLINE & SYNCLINE
- - - - -	LITHOLOGIC CONTACT (dashed were inferred)

GEOLOGIC FORMATIONS:

Qal	QUATERNARY ALLUVIUM
Q-Tgr	QUATERNARY - TERTIARY GRAVELS
Kbu	BUDA FORMATION
Kdr	DEL RIO
Kgt	GEORGETOWN FORMATION
Kep2	PERSON FORMATION II (Cyclic & Marine Members, Undivided)
Kep3	PERSON FORMATION III (Leached and Collapsed Members, Undivided)
Kep4	PERSON FORMATION IV (Regional Dense Member)
Kek5	KAINER FORMATION V (Grainstone Member)
Kek6	KAINER FORMATION VI (Kirschberg Evaporite Members)
Kek7	KAINER FORMATION VII (Dolomitic Members)

BASE MAP SOURCE:
PRO-TECH ENGINEERING GROUP, INC.

GEOLOGY MODIFIED FROM:
SMALL, TED A. AND JOHN A. HANSON. GEOLOGIC FRAMEWORK AND HYDROGEOLOGIC CHARACTERISTICS OF THE EDWARDS AQUIFER OUTCROP, COMAL COUNTY, TEXAS. *U.S. GEOLOGICAL SURVEY (USGS) WATER-RESOURCES INVESTIGATIONS REPORT* 94-4117. 1994.

BAUMGARDNER AND COLLINS, GEOLOGIC MAP OF HUNTER QUAD., BUREAU OF ECONOMIC GEOLOGY OPEN FILE MAP. 1991.

(UT-BEG) UNIVERSITY OF TEXAS - BUREAU OF ECONOMIC GEOLOGY. REPRINTED 1992. SAN ANTONIO SHEET

0 200 400
SCALE IN FEET

N

SITE GEOLOGIC MAP

1855-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 010083 GA
March 2001

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APR 3 2001
COUNTY ENGINEER

Horizon
ENVIRONMENTAL SERVICES, INC.