TCEQ REGULATORY GUIDANCE

Water Quality
RG-433
October 2005

Guidelines for Identifying and Protecting Aquifer Recharge Features

Texas Commission on Environmental Quality • PO Box 13087 • Austin, Texas • 78711-3087

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Guidelines for Identifying and Protecting Aquifer Recharge Features

THIS IS A GUIDANCE DOCUMENT AND SHOULD NOT BE INTERPRETED AS A REPLACEMENT TO THE RULES.
The rules regarding recharge feature identification and protection may be found in 30 Texas Administrative Code (TAC) Sections (§§) 321.34(f)(3) and (4).

Prepared by:
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Recharge Feature Guidance Document
TCEQ publication RG-433 ■ October 2005

Contents

Introduction

Purpose of This Booklet

The purpose of this document is to provide guidance on identifying and certifying the presence of recharge features and to discuss best management practices that protect aquifers from concentrated animal feeding operations (CAFOs). Specifically, this document gives guidance on satisfying the recharge feature regulations in Title 30 of the Texas Administrative Code (TAC), Chapter 321, Subchapter B (sections 321.34(f)(3) and (4)) and on provisions in the CAFO General Permit TXG920000 (Part III, Section A, 3).

This document includes the relevant portions of the regulations (Appendix A) and the general permit (Appendix B) for your convenience. It also includes a copy of the recharge feature identification reporting form and instructions for filling it out (Appendix C).

Who Should Read This Booklet

This document is intended to assist the following individuals in understanding and complying with the recharge feature regulations:

- Anyone preparing an application for an individual or general permit to apply waste from a concentrated animal feeding operation (CAFO)
- Anyone who will prepare and certify a recharge feature document or plan
- The owner or operator of a permitted CAFO

Recharge Features

A **recharge feature** is a natural or artificial feature either on or beneath the ground surface that provides or creates a significant hydrologic connection (or pathway) between the ground surface and the underlying groundwater within an aquifer.

A **significant pathway** between the land surface and the subsurface has the ability to transmit waste, wastewater, or precipitation mixed with waste to groundwater. The wastewater may impact the groundwater quality within an aquifer or migrate laterally to discharge as seeps that may impact surface water quality. Recharge features with significant pathways include geomorphologic, geologic, soil, and artificial features. Agricultural practices may also enhance existing recharge features.

An **aquifer**, as defined in 30 TAC §321.32, is a saturated permeable geologic unit that can transmit, store, and yield to a well, the quality and quantities of groundwater sufficient to provide for a beneficial use. An aquifer can be composed of unconsolidated sands and gravels, permeable sedimentary rocks such as sandstones and limestones, and/or heavily fractured volcanic and crystalline rocks. Groundwater within an aquifer can be confined, unconfined, or perched.

The following sections provide specific examples of the different types of natural and artificial recharge features as well as information on agricultural practices that may enhance these features.

Natural Features

Natural features are divided into two main types: geomorphologic/geologic features and soil features.

Geomorphologic and Geologic Features

Geomorphologic and geologic features are discussed in greater detail in Appendix C (see the section entitled “Geomorphologic and Geologic Features” on page 16). The following geomorphologic or geologic features may act as pathways between the land surface and the subsurface:

- watercourses or drainage ways bisecting or transecting stratigraphic units or sediments constituting an aquifer
- springs
- excessive slopes
- depressions
- playa lakes, playa depressions, or playa basins

- large-scale conduits that connect sediments and soils at the surface to the subsurface, such as:
  - faults
  - fractured sediments
  - caves
  - sinkholes
  - solution cavities or vugs
  - concentrated or extensive animal burrowing
- locations of major or minor aquifers, listed in Texas Water Development Board (TWDB) Report 345 "Aquifers of Texas"—see Table 1 (major aquifers) and Table 2 (minor aquifers) for lists of these aquifers.

These land surface features may be located or described using resources such as:

- USDA Soil Survey publications
- Bureau of Economic Geology maps (Geologic Atlas of Texas)
- other Bureau of Economic Geology publications
- Texas Water Development Board (TWDB) publications
- Railroad Commission of Texas (RRC) records and maps
- groundwater district records and maps
- field reconnaissance

Table 1. Major Aquifers Identified by the TWDB

Ogallala	Carrizo-Wilcox	Seymour
Gulf Coast	Trinity	Hueco-Mesilla Bolson
Edwards (Balcones Fault Zone)	Edwards-Trinity (Plateau)	Cenozoic Pecos Alluvium

Table 2. Minor Aquifers Identified by the TWDB

Bone Springs-Victorio Peak	Edwards-Trinity (High Plains)	Ellenburger-San Saba
Dockum	Blaine	Blossom
Brazos River Alluvium	Sparta	Marble Falls
Hickory	Nacatoch	Rustler
West Texas Bolsons	Lipan	Capitan Reef Complex
Queen City	Igneous	Marathon
Woodbine	Rita Blanca	Yegua[1]

[1] Added after the publication of Report 345

Soil Features

Soil features are discussed in greater detail in Appendix C (see the section entitled "Soil Features" on page 19). The following soil features may act as pathways between the land surface and the subsurface:

- soils possessing excessive shrink/swell characteristics and surface cracks extending into the subsurface
- extensive vertical soil cracking in a closed depression not identified as a playa
- soils identified by the USDA Soil Survey as developing in playa basins
- shallow soil development overlying geologic units constituting aquifer sediments
- soils developing a seasonal apparent or perched groundwater table
- rapidly permeable soils
- eroding soils on excessive slopes

Artificial Features

Artificial features are discussed in greater detail in Appendix C (see the section entitled "Artificial Features" on page 21). The following artificial features may provide a pathway between the land surface and the subsurface:

- water wells
- adits, mine shafts, or air shafts
- excavation pits
- material pits (for example, sand, gravel, or caliche pits)
- silage pit areas
- surface penetrations or test holes

Agricultural Practices That May Enhance Recharge Features

Existing geomorphologic, geologic, and soil recharge features may be enhanced through the following agricultural practices:

- fallow ground or extended periods between crop harvesting and planting
- wide row spacing
- crop or grass cover experiencing periods of dormancy
- flood irrigation
- barren ground resulting from any of the following:
  - absence of viable soil to establish and maintain plant growth
  - soil chemistry causing chronic to toxic conditions limiting plant growth
  - animal denudation

The Recharge Feature Document

The following sections explain the purpose and objectives of the recharge feature document, who can certify such a document, and the steps needed to complete the document.

Purpose and Objectives of the Recharge Feature Document

The purpose of the recharge feature document is to satisfy the requirements found in 30 TAC §§321.34(f)(3) and (4) (see Appendix A) or the provisions in the CAFO General Permit TXG920000, Part III, Section A, 3. (See Appendix B).

The recharge feature document has three primary objectives:

- Identify surface recharge features that
  - have the ability to transmit surface water to the subsurface and replenish groundwater resources or
  - allow water to migrate laterally, discharge as seeps, and impact surface water quality.
- Provide a plan that proposes best management practices (BMPs) that protect recharge features from waste application.
- Certify that the proposed BMP for land application of waste will prevent degradation of groundwater and surface water quality.

Who May Certify a Recharge Feature Document

According to 30 TAC §§321.34(f)(3) and (4), the recharge feature document must be signed, dated, and sealed by either a Texas licensed professional engineer (P.E.) or a Texas licensed professional geoscientist (P.G.), as appropriate, and in conformance with the Texas Engineering Practices Act or the Texas Geoscience Practice Act and the licensing and registration boards under these acts.

The certifying individual should have an understanding of geological processes and expertise in the field identification of recharge features. The individual may also be requested to represent his or her findings in a public meeting or during a contested case hearing.

Steps to Complete the Recharge Feature Document

A recharge feature identification form and detailed instructions for completing it are included as Appendix C of this document. The following steps provide a general overview of the process:

1. Document the sources and methods used to identify the presence or absence of artificial or natural recharge features on any tracts of land owned, operated, or controlled by the applicant that are to be used as a part of a CAFO.

2. At a **minimum**, gather information about recharge features as follows:
   a. review the sources, records, and maps found at the Railroad Commission of Texas (RRC), the groundwater district (if applicable), the Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), and the Natural Resources Conservation Service (NRCS)
   b. review any information held by the previous owner of site (if available)
   c. perform an on-site inspection.

3. Propose BMPs that will protect recharge features from receiving waste.

4. Sign and date the recharge feature document and affix the seal of either a Texas licensed professional engineer (P.E.) or a Texas licensed professional geoscientist (P.G.).

5. Submit the certified form to the TCEQ.

Protecting Identified Recharge Features

The following sections discuss what you need to do if recharge features are certified to be present and offer examples of some best management practices that you can use to protect these features.

What to do if Recharge Features are Present

According to 30 TAC §321.34(f)(4), when recharge features are certified to exist on permitted tracts of land, the applicant must submit a plan for protecting the aquifer from impacts that could occur via the recharge features. This plan must be signed, dated, and sealed by a Texas licensed professional engineer or a Texas licensed professional geoscientist, as appropriate, and in conformance with the Texas Engineering Practices Act or the Texas Geoscience Practice Act and the licensing and registration boards under these acts. The plan must include at least one of the following items:

- provisions for installing the necessary and appropriate protective measures for each located recharge feature, including, but not limited to, impervious cover, berms, buffer zones, or other equivalent protective measures, on the facility area and land management units;
- submission of a detailed groundwater monitoring plan covering all affected facilities and land application areas, except as specified in 30 TAC §321.41 (Special Requirements for Discharges to a Playa) or TXG920000 Part III, Section A, 7 (b) (Special Considerations for Existing Retention Control Structure, Playas). At a minimum, the groundwater monitoring plan shall specify procedures to
  - annually collect a groundwater sample from representative wells
  - have each sample analyzed for chlorides, nitrates, and total dissolved solids, and
  - compare those values with background values for each well.
- provisions for any other similar method or approach demonstrated by the applicant to be protective of any associated recharge feature and approved by the commission.

Examples of BMPs That Will Protect Recharge Features

BMPs are generally one of two types: structural controls or nonstructural controls. Structural controls are physical barriers that prevent or restrict movement. Nonstructural controls are practices, plans, or methods.

Structural Controls

Some specific examples of structural controls include, but are not limited to, the following:

- dams, levees, berms, or dikes that contain or redirect storm water or overland sheet flow and prevent soil creep
- slurry walls to contain shallow lateral fluid movement
- terrace development and terrace contouring that prevent movement of waste down slope due to soil creep or erosion
- vegetative filter strips that filter, contain, and prevent the lateral movement of waste
- irrigation system or water wellhead backflow prevention devices added when wastewater or chemicals are introduced for the purpose of irrigation

Nonstructural Controls

Some specific examples of nonstructural controls include, but are not limited to, the following:

- comparing waste nutrient levels to the nutrient requirements of the cover vegetation and using that information to calculate the agronomic application rate for waste nutrients
- applying wastewater at a rate less than the permeability of the soil to prevent runoff
- applying wastewater at a rate that ensures that all wastewater will be used by the cover crops
- not applying waste to areas maintained around water wells as follows (see 30 TAC §321.38(b) or TXG920000, Part III, Section A, 4 (c)(1)):
  - public drinking water supply wells—500 feet
  - drinking water wells used for private water supply—150 feet
  - water wells used exclusively for agriculture irrigation—100 feet
- maintaining 100 feet of vegetative cover between waste or wastewater application areas and surface water and watercourses (see 30 TAC §321.40(h) or TXG920000 Part III, Section A, 11 (f)(1))

Contact Information

Who Can I Contact for More Help?

For additional assistance with the guidance provided in this booklet, please contact one of the following agencies:

USDA-Natural Resources Conservation Service
101 South Main
Temple, Texas 76501
Phone: 254-742-9800
FAX: 254-742-9819
http://www.nrcs.usda.gov

Texas Commission on Environmental Quality
12100 Park 35 Circle
P.O. Box 13087
Austin, Texas 78711-3087
Phone: 512-239-4671
Fax: 512-239-4430
http://www.tceq.state.tx.us

Texas State Soil & Water Conservation Board
311 North 5th St.
P.O. Box 658
Temple, Texas 76503
Phone: 254-773-2250
Fax: 254-773-3311
http://www.tsswcb.state.tx.us

Who Can I Contact for More Information?

The following institutions have maps, publications, and other information that will help you to perform the tasks discussed in this booklet.

Railroad Commission of Texas
1701 N. Congress Ave.
P.O. Box 12967
Austin, Texas 78711-2967
Phone: 512-463-7288
http://www.rrc.state.tx.us

Texas Water Development Board
Stephen F. Austin Bldg.
P.O. Box 13231
1700 N. Congress Avenue
Austin, Texas 78711-3231
Phone: 512-463-7847
Fax: 512-475-2053
http://www.twdb.state.tx.us

Texas Commission on Environmental Quality
12100 Park 35 Circle
P.O. Box 13087
Austin, Texas 78711-3087
Phone: 512-239-4671
Fax: 512-239-4430
http://www.tceq.state.tx.us

USDA-Natural Resources Conservation Service
101 South Main
Temple, Texas 76501
Phone: 254-742-9800
FAX: 254-742-9819
http://www.nrcs.usda.gov

USGS-United States Geological Survey
8027 Exchange Drive
Austin, Texas 78754-4733
Phone: 512-927-3500
Fax: 512-927-3590
http://www.usgs.gov

Bureau of Economic Geology
General Mail
University Station, Box X
Austin, Texas 78713-8924
Shipping
10100 Burnet Rd.
Bldg 130
Austin, Texas 78758-4445
Phone: 512-471-1534
Fax: 512-471-0140
http://www.beg.utexas.edu/mainweb/info01.htm

Groundwater District Map
http://www.twdb.state.tx.us/mapping/maps/pdf/gcd_only_8x11.pdf

Appendix A—CAFO Rules, 30 TAC §§321.34(f)(3) and (4)

(f) ...At a minimum, the executive director will require the following information to be submitted, as it is applicable to the facility...

(3) a recharge feature certification, signed and sealed by a licensed Texas professional engineer, or a licensed Texas professional geoscientist, documenting the absence or presence of any natural or artificial recharge features identified on any tracts of land owned, operated, controlled, rented, or leased by the applicant and to be used as a part of a CAFO or land management unit. A certified water quality management plan prepared by the Texas State Soil and Water Conservation Board that is developed for a dry litter poultry facility that evaluates site-specific recharge characteristics and management practices of the operation will meet the recharge feature requirement of this paragraph.

(A) Documentation by the certifying party shall identify:

(i) the sources and methods used to identify the presence or absence of recharge features; and

(ii) the method or approach to be used to identify previously unidentified and undocumented recharge features that may be discovered during the time of construction;

(B) In preparing the recharge feature certification, the licensed Texas professional engineer or Texas professional geoscientist must conduct an on-site inspection and must review all pertinent records and maps maintained by the following entities or persons to locate any artificial recharge feature:

(i) Railroad Commission of Texas;

(ii) a Groundwater Conservation District, if applicable;

(iii) Texas Water Development Board;

(iv) the commission;

(v) Natural Resources Conservation Service (NRCS); and

(vi) previous owner of site, if available.

(4) where the applicant documents the presence of recharge features on the tracts for which an application is being filed, the applicant shall submit a plan. The plan must be signed and sealed by a licensed Texas professional engineer or licensed Texas professional geoscientist, as appropriate and in conformance with the Texas Engineering Practices Act and the Texas Geoscience Practice Act and the licensing and registration boards under these acts. The plan must prevent impacts to an aquifer from any recharge features present. The plan must include at least one of the following:

(A) provisions for the installation of the necessary and appropriate protective measures for each located recharge feature, including impervious cover, berms, buffer zones, or other equivalent protective measures, on the production area and land management units; or

(B) except as specified in §321.41 of this title (relating to Special Requirements for Discharges to a Playa), submission of a detailed groundwater monitoring plan covering all affected facilities and land application areas. At a minimum, the groundwater monitoring plan shall specify procedures to annually collect a groundwater sample from representative wells, have each sample analyzed for chlorides, nitrates, and total dissolved solids, and compare those values with background values for each well; or

(C) provisions for any other similar method or approach demonstrated by the applicant to be protective of any associated recharge feature and approved by the commission....

Appendix B—CAFO General Permit, TXG9200000, Part III, Section A, 3.

3. Recharge Feature Certification

Each PPP shall include a recharge feature certification, signed and sealed by a licensed Texas professional engineer, or a licensed Texas professional geoscientist, documenting the absence or presence of any natural or artificial recharge features identified on any tracts of land owned, operated, controlled, rented, or leased by the applicant and to be used as a part of a CAFO or land management unit. A certified water quality management plan prepared by the TSSWCB that is developed for a dry litter poultry facility that evaluates site specific recharge characteristics and management practices of the operation will meet the recharge feature requirement of this paragraph.

(A) Documentation by the certifying party shall identify:

(i) the sources and methods used to identify the presence or absence of recharge features; and

(ii) the method or approach to be used to identify previously unidentified and undocumented recharge features that may be discovered during the time of construction

(B) In preparing the recharge feature certification, the licensed Texas professional engineer or Texas professional geoscientist must conduct an on-site inspection and must review all pertinent records and maps maintained by the following entities or persons to locate any artificial recharge feature:

(i) Railroad Commission of Texas;

(ii) a Groundwater Conservation District, if applicable;

(iii) Texas Water Development Board;

(iv) the commission;

(v) Natural Resources Conservation Service (NRCS) and;

(vi) previous owner of site, if available.

(C) If documents show the presence of recharge features on the tracts for which an application is being filed, the applicant shall submit a plan, signed and sealed by a licensed Texas professional engineer, or licensed Texas professional geoscientist, as appropriate and in conformance with the Texas Engineering Practices Act and the

Texas Geoscience Practice Act and the licensing and registration boards under these acts. The plan must prevent impacts to an aquifer from any recharge features present. The plan must include at least one of the following:

(i) provisions for the installation of the necessary and appropriate protective measures for each located recharge feature, including impervious cover, berms, buffer zones, or other equivalent protective measures, on the production area and land management units; or

(ii) submit a detailed groundwater monitoring plan covering all affected facilities and land application areas. At a minimum, the groundwater monitoring plan shall specify procedures to annually collect a groundwater sample from representative wells, have each sample analyzed for chlorides, nitrates, and total dissolved solids, and compare those values with background values for each well; or

(iii) provisions for any other similar method or approach demonstrated by the applicant to be protective of any associated recharge feature and approved by the commission.

Appendix C—Recharge Feature Identification Reporting Form and Instructions

Use the recharge feature identification reporting form in this section to identify and certify the presence or absence of recharge features. The instructions that follow provide detailed explanations of what is needed on the form and why the information is important.

Please mail or fax the completed form to:

Texas Commission on Environmental Quality
Land Application Team (MC-148)
P.O. Box 13087
Austin, TX 78711-3087

Phone: 512-239-4671
Fax: 512-239-4430

Instructions

Facility and Contact Information

Fill out the permit number and name, facility location information, owner name and phone number, name and phone number of the person who is conducting the field investigation and reporting the data, and field observation and reporting dates.

The document must be sealed, dated, and signed by a licensed Texas professional engineer or a licensed professional geoscientist. Dating and signing the appropriate seal serves two purposes:

- The authority of the certifying individual attests to the identification of recharge features observed on the facility property. All “yes” answers to the listed features represent recharge features.
- The authority of the certifying individual attests that the proposed and implemented plan will prevent adverse impacts to recharge features from waste application and will be protective of water in the state.

Useful Definitions

The person certifying the form should review the following definitions as found in 30 TAC §321.32:

- **Aquifer**—A saturated permeable geologic unit that can transmit, store, and yield to a well, the quality and quantities of groundwater sufficient to provide for a beneficial use. An aquifer can be composed of unconsolidated sands and gravels, permeable sedimentary rocks such as sandstones and limestones, and/or heavily fractured volcanic and crystalline rocks. Groundwater within an aquifer can be confined, unconfined, or perched.
- **Best management practices (BMPs)**—The schedule of activities, prohibitions of practices, maintenance procedures, and other management and conservation practices to prevent or reduce the pollution of water in the state. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge, land application, or drainage from raw material storage.
- **Groundwater**—Subsurface water that occurs below the water table in saturated soils and geologic formations, and is other than underflow of a stream or an underground stream.
- **Playa**—A flat-floored, clayey bottom of an undrained basin that is located in an arid or semi-arid part of the state, that is naturally dry most of the year, and that collects runoff from rain, but is subject to rapid evaporation.
- **Recharge feature**—Those natural or artificial features either on or beneath the ground surface at the site under evaluation that provide or create a significant hydrologic connection between the ground surface and the underlying groundwater within an aquifer. Significant artificial features include, but are not limited to, wells and excavation or material pits. Significant natural hydrologic connections include, but are not limited to: faults, fractures, sinkholes, or other macro pores that allow direct surface infiltration; a permeable or shallow soil material that overlies an aquifer; exposed geologic formations that are identified as an aquifer; or a water course bisecting an aquifer.
- **Water in the state**—Groundwater, percolating or otherwise, lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, the Gulf of Mexico, inside the territorial limits of the state, and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or nonnavigable, and including the beds and banks of all watercourses and bodies of surface water, that are wholly or partially inside or bordering the state or inside the jurisdiction of the state.

Geomorphologic and Geologic Features

This section provides information about identifying natural surface features that have the ability to increase the introduction of surface water to the subsurface. These features may be land forms or physical characteristics that have developed in the sediments. The numbers correspond to the numbering on the Recharge Feature Identification Form that begins on page 23.

1–4. Watercourses, springs, seeps, and ponds are considered water in the state and should be protected from waste application.

2–5. During wet periods, intermittent streams, intermittent springs or seeps, and drainage ways may mobilize and transport waste off the permitted site, thus causing a discharge to occur that may adversely impact water in the state. During periods of inactive flow, these features, especially springs, may expose conduits connecting the surface with the subsurface.

6. Topographic slopes in excess of 8 percent have the ability to transport waste particles as soil creep and contribute to erosion at a much faster rate than smaller slopes. Slopes in excess of 8 percent also contribute to increased flow and focused head pressure of surface runoff.

7. Gullies are the result of continuous channeling erosion and are susceptible to increased runoff velocity and further erosion; see discussion for item 27 on page 21.

8–9. A topographic depression may be too small to be identified as a playa lake on the 1:250,000 scale maps in the Geologic Atlas of Texas. The 1:24,000 scale United States Geologic Survey (USGS) maps and the United States Department of Agriculture (USDA) soil survey maps make it possible to identify small depressions containing clay floors characteristic of playa lake deposits.

TCEQ policies with respect to playas are based on the Texas Water Code, Chapter 26.048, which prohibits the use of playa lakes for wastewater retention in new concentrated animal feeding operations (CAFOs). Existing CAFOs (authorized by permit before July 10, 1991) are "grandfathered" under the law and are required to monitor groundwater. This part of the water code and associated revisions to 30 TAC §307 (Texas Surface Water Quality Standards) have been applied to all new and amended permits for municipal and industrial facilities (permitted on or after July 10, 1991) that use playa lakes to retain wastewater.

10–11. Faults and fractures can provide a planar pathway where mobilized waste may travel downward to saturated sediments bisected by the fault plane and adversely impact groundwater quality. Waste may also travel laterally along the fault strike and off the permitted site, possibly causing a discharge that may adversely impact water in the state.

12. Solution cavities in the exposed sediments or bedrock form from erosional and dissolution pathways created in the geologic past by surface water percolating to the subsurface. Solution cavities can transmit mobilized waste to saturated sediments and adversely impact groundwater quality or allow waste to travel off the permitted site, thus causing a discharge to occur that may adversely impact water in the state.

13. Sinkholes are enlarged solution cavities formed from surface water continuing to percolate to the subsurface.

14. Caves provide large openings connecting the surface with the subsurface.

15. Animal burrowing may penetrate below confining accumulative c-horizon soil layers or shallow clay-caliche layers and provide large openings that will introduce surface water to the subsurface at much faster rates than normal downward percolation. The most common examples of this phenomenon are crayfish and mammal burrowing.

16. The Texas Water Development Board (TWDB) has identified major and minor aquifers and included discussion on recharge and physical characteristics composing the aquifer sediments in the publication "Aquifers of Texas" (Report 345). Recognizing the producing aquifers underlying or exposed in the facility area will give the investigator physical characteristics of the aquifer that may cause the groundwater to be more susceptible to contamination. Also, according to the definition in 30 TAC §321.32, aquifers may consist of saturated permeable geologic units much smaller in area than the major or minor aquifers identified by the TWDB and should also be recognized.

    a. Major Aquifers are identified as the Ogallala, Gulf Coast, Edwards (Balcones Fault Zone), Carrizo-Wilcox, Trinity, Edwards-Trinity (Plateau), Seymour, Hueco-Mesilla Bolson, and Cenozoic Pecos Alluvium.

    b. Minor Aquifers are identified as the Bone Spring-Victorio Peak, Dockum, Brazos River Alluvium, Hickory, West Texas Bolsons, Queen City, Woodbine, Edwards-Trinity (High Plains), Blaine, Sparta, Nacatoch, Lipan, Igneous, Rita Blanca, Ellenburger-San

Saba, Blossom, Marble Falls, Rustler, Capitan Reef Complex, Marathon, and Yegua.

c. Aquifer sediments exposed on the surface of the land can accept water directly from precipitation or irrigated wastewater and percolate downward to the saturated portion of the aquifer where groundwater accumulates.
d. Fractured aquifer sediments can increase the rate of water movement downward to the saturated aquifer sediments.

e. Aquifer sediments that are rapidly permeable (6 inches/hour or greater, as defined by the USDA Soil Survey) can transmit precipitation or irrigated wastewater to the subsurface at rates that prevent attenuation or beneficial use of waste nutrients before they reach groundwater.

f. Sediments overlying aquifers, such as a shale or a sediment with a high percentage of clay particles, may have the ability to prevent percolation to the subsurface by possessing a slow rate of permeability;.

Soil Features

This section provides information about soil features that have the ability to increase the introduction of surface water to the subsurface. These soil features may be related to the formation of the soils or may result from terrestrial processes that have developed in the soils.

17. Soils developing surface cracks that extend into the subsurface exhibit higher permeability than the USDA soil survey reports and can transmit surface water to the subsurface at rates comparable to those for fractured sediments. Clay mottling (spotting) may occur where subsurface cracks terminate. Clay mottling results from changing water table levels and movement of water in the subsurface that oxidizes metals in clays.

18. The USDA Soil Survey identifies unique soils that develop exclusively in floors of playa or playa-like basins. The USDA soil survey maps are drawn at a scale of 1:24,000 and identify small depressions containing specific soils characteristic of playa lake deposits.

    TCEQ policies with respect to playas are based on the Texas Water Code, Chapter 26.048, which prohibits the use of playa lakes for wastewater retention in new concentrated animal feeding operations (CAFOs). Existing CAFOs (authorized by permit before July 10,

1991) are "grandfathered" under the law and are required to monitor groundwater. This part of the water code and associated revisions to 30 TAC §307 (Texas Surface Water Quality Standards) have been applied to all new and amended permits for municipal and industrial facilities (permitted on or after July 10, 1991) that use playa lakes to retain wastewater.

19. Soils developing in closed depressions not identified as playa lake deposits may have the ability to concentrate and accumulate waste material. These soils may develop dessication cracks during dry periods, and upon future precipitation they may serve as points of focused recharge or be more permeable than typical hydrated clay soils.

20. Soils overlying geological sediments composing an aquifer may be the only layer providing retention time for applied waste. Waste passing into aquifer sediments too quickly for cover vegetation to use the nutrients could adversely impact groundwater quality in the aquifer.

21. Shallow soils (6 inches or less) overlying aquifer sediments may not retain applied waste in the root zone long enough for cover vegetation to use the nutrients. Waste passing into aquifer sediments too quickly could adversely impact the water quality in the aquifer. It could also travel off the permitted site, thus causing a discharge that may adversely impact water in the state.

22. Perched groundwater results from percolating surface water collecting on a shallow confining layer, usually clay or limestone, and accumulating as shallow groundwater analogous to a dish holding water. The confining layer is not necessarily of large lateral extent. The shallow groundwater could have the ability to transport dissolvable waste nutrients off the permitted site. This transportation of dissolvable waste by shallow groundwater would constitute a discharge that could adversely impact water in the state.

23. Soils developing a high water table have the ability to transmit precipitation to an existing water table and raise the water level to very near the surface. The shallow groundwater could have the ability to come in contact with waste applied at the surface. Shallow groundwater could also transport dissolvable waste nutrients off the permitted site. This transportation of dissolvable waste by shallow groundwater would constitute a discharge that could adversely impact water in the state.

24. Mottled (spotted) clays and clay-rich sediments that exhibit a mottled color and/or texture may indicate poor aeration and lack of drainage

and indicate developing seasonal shallow groundwater that oxidizes the iron minerals contained in the sediments.

25. The USDA Soil Survey defines a rapidly permeable soil as one with a 6 inches/hour or greater permeability rate. Waste applied on soils percolating at 6 inches/hour or greater may move too rapidly for vegetation to use nutrients before reaching a water table or migrating off the permitted site and adversely impacting water in the state.
26. Topographic slopes in excess of 8 percent have the ability to transport waste particles as soil creep and contribute to erosion at a much faster rate than smaller slopes. Applying wastes to slopes in excess of 8 percent can contribute to excessive runoff that could impact surface water quality, increase velocity and holding capacity of the runoff, and enhance erosion.

27. Eroding soils could expose sediments that compose an aquifer or that have the ability to store water in the shallow subsurface. Shallow to nonexistent soil cover means that applied waste nutrients will percolate more quickly to the subsurface and could travel off the permitted site, thus causing a discharge that may adversely impact water in the state.

28. Vegetation uptake is the primary beneficial use of the waste nutrients nitrogen and phosphorous. Cover vegetation, such as grass, crops, or native plants, takes up waste nutrients and converts them to plant mass before the nutrients have the opportunity to percolate past the rooting zone and adversely impact groundwater quality.

    Barren ground or absence of vegetation decreases the effectiveness of plant removal of nutrients from applied waste. Barren ground or absence of vegetation, whether as a result of an agricultural practice or due to imbalances in soil chemistry, is more likely to allow waste nutrients to pass unused through the root zone, infiltrate downward, and impact groundwater quality.

Artificial Features

Artificial features, or surface penetrations, have the ability to rapidly introduce waste-derived nutrients that are applied at the surface to the subsurface or directly into a source of groundwater.

Oil and gas wells have protective measures in place required by the Railroad Commission of Texas (RRC) and the TCEQ Surface Casing Team. The oil and gas operator must cement the outer casing that will protect of fresh water above the hydrocarbon production interval. You do not need to identify oil

and gas wells on the form because the RRC and the TCEQ Surface Casing Team have approved the cement casing operation as protective of groundwater.

Water wells drilled before June 1, 1983 were not required to meet water well drilling standards required by 16 TAC §76 (Water Well Drillers rules). Identifying water well locations, completion standards, and the condition of the wellhead can provide information for the potential of an on-site water well to communicate waste nutrients or irrigated wastewater to groundwater resources.

29. Water wells should be located by on-site investigation because they are artificial penetrations capable of rapidly transmitting waste applied at the surface to the subsurface.

30. Identify the number of water wells, including windmills, on the facility property. Fill out the individual water well identification form for each well.

31–2. Material pits and excavation pits have the ability to collect irrigated wastewater or waste combined with storm water and may not have an agency-approved liner or bottom to prevent excessive leakage to groundwater resources.

33. Adits, mine entrances, and air shafts are large openings connecting the surface with the subsurface that have the ability to quickly transmit waste applied at the surface to groundwater resources.

Individual Water Well Identification

All water wells on the facility property should have a completed individual well information form. All well information questions were cross-referenced from 16 TAC §76 (Water Well Drillers rules), specifically 16 TAC §76.1000, as to the standards of completion of water wells. The standards are considered protective of groundwater quality. The distances from the wellhead to areas receiving waste storage or application or from animal pen areas are cited from 30 TAC §321.38(b) or TXG920000, Part III, Section A, 4 (c)(1).

Texas Commission on Environmental Quality
Recharge Feature Identification Reporting Form

This form is to be used to identify recharge features for the purpose of recommending best management practices that will prevent applied waste from impacting surface and/or groundwater quality.

Please mail and/or fax the completed form to:

Texas Commission on Environmental Quality
Land Application Team (MC-148)
P.O. Box 13087
Austin, Texas 78711-3087

Phone: 512-239-4671
Fax: 512-239-4430

Permit #:_____ Permit name: _____

County: _____ Address: _____

City / Town / Village: _____ Zip Code: _____

Owner Name: _____ Owner Phone: _____

Reporter Name (Last, First): _____ Phone: _____

Field Observation Date: _____ Reporting Date: _____

I certify that the facility (has) or (does not have) recharge features on the property owned or leased by the applicant.

I certify that the proposed plan and implemented and maintained best management practices will prevent any adverse impacts from waste application to recharge features, surface water and groundwater qualities.

(dated & signed appropriate seal below)

_____
name:

(printed full name as appears on seal)

Geomorphologic and Geology Features on the Facility Property	YES	NO
1. Do any watercourses bisect the facility property?		
2. Do any intermittent streams bisect the facility property?		
3. Are there any active or intermittent springs?		
4. Are there any ponds other than wastewater ponds?		
5. Do any drainage ways carry storm water off the facility property?		
6. Are topographic slopes in excess of an 8 percent grade?		
7. Are there any gullies?		
8. Are there any topographic depressions?		
9. Are there any playa lake deposits as identified by the Geologic Atlas of Texas?		
10. Are there any faults?		
11. Are there any fractured sediments?		
12. Are solution cavities forming in the exposed sediments or bedrock?		
13. Are there any sinkholes?		
14. Are there any caves?		
15. Are there signs of animal burrowing?		
16. Aquifer features—groundwater in the area is produced from these major or minor aquifers as identified by the Texas Water Development Board (TWDB):	—	—
16a. Major Aquifer(s):	—	—
16b. Minor Aquifer(s)	—	—
16c. Are aquifer sediments exposed on the surface of the land?		
16d. Are aquifer sediments fractured?		
16e. Are aquifer sediments rapidly permeable (6 inches/hour or greater)?		
16f. Do the overlying sediments or geologic formations have the ability to quickly convey surface water to the underlying aquifer?		
Comments:	—	—

Soil Features on the Facility Property	YES	NO
17. Are soils developing surface cracks that extend into the subsurface?		
18. Are any soils, as identified by the USDA Soil Survey, developed in playa basins?		
19. Are soils developing in closed depressions not identified as playa lake deposits?		
20. Are soils overlying aquifer sediments?		
21. Are shallow soils overlying aquifer sediments (6 inches or less)?		
22. Are any of the soils developing a seasonal perched groundwater table?		
23. Are any soils developing a seasonal high apparent groundwater table?		
24. Are any clays in the soil profile mottled in color?		
25. Are any soils rapidly permeable (6 inches/hour or greater)?		
26. Are there soils on excessive slopes (greater than an 8 percent slope)?		
27. Are there areas of eroding soils?		
28. Are the soils exposed with an absence of vegetation?		
Comments:	—	—

Artificial Features on the Facility Property	**YES**	**NO**
29. Are there any water wells?		
30. How many water wells, including windmills, are there? _____ **For each well, fill out the individual water well information form.**	—	—
31. Are there any active or abandoned pits; that is, material pits (sand, gravel, caliche, etc.), disposal pits, or burn pits?		
32. Are there any active or abandoned excavation pits?		
33. Are there any active or abandoned adits, mine entrances, or air shafts?		
Comments:	—	—

Individual Water Well Information Form

Water Well Identification Number: _____

WELL INFORMATION	YES	NO
Is the well active and producing?		
Is the well shut in?		
Is the wellhead capped?		
Is the well abandoned?		
Is the well plugged and abandoned?		
Is the well located at the surface?		
If the well is not identifiable at the surface, has a metal detector survey been performed?		
If the well is not identifiable at the surface, has a metal detector survey located the metal casing, or a signature of the abandoned well?		
Are there plans to properly plug and abandon the wellhead?		
Can a water well driller, water conservation district, or the land owner produce a document confirming the plugging and abandoning procedure?		
Has a surface concrete slab or sealing block been placed around the well at ground level?		
Does the ground slope away from the well bore?		
Does the slab surface slope away from the well bore?		
Is the annular space between the surface and the well casing filled with either concrete or bentonite slurry?		
Is there a watertight sanitary seal between the casing and the pipe column?		
Is there a berm around the wellhead?		
Is there a structure (well house) enclosing the wellhead?		
Are there backflow prevention valves at the wellhead?		
Are there backflow prevention valves in the irrigation system?		
Is the buffer distance from waste application or pen areas at least 100 feet?		
Is the buffer distance from waste application or pen areas at least 150 feet?		
Is the buffer distance from waste application or pen areas at least 500 feet?		