EDWARDS UNDERGROUND
WATER DISTRICT

Report 93-09

STAFF REPORT TO
BOARD OF DIRECTORS
OF THE
EDWARDS UNDERGROUND WATER DISTRICT

URBAN DEVELOPMENT
ON THE EDWARDS AQUIFER RECHARGE ZONE

August, 1993

Staff Report to
Board of Directors
of the
Edwards Underground Water District

Urban Development
on the Edwards Aquifer Recharge Zone

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Urban Development on the Edwards Recharge Zone

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I. Purpose

Increased development activities on the Edwards Recharge Zone (ERZ) has heightened concerns by District staff that the current mechanisms in place to protect the Edwards aquifer from degradation associated with urbanization are not adequate. This report was written by staff to apprise the District Board of Directors of these concerns and to initiate policy discussions.

II. Introduction

Over the past year, a substantial increase in development activities over the Edwards Recharge Zone (ERZ) has been observed, particularly in Bexar County. With increased development comes a greater threat of contamination to the Edwards aquifer resulting from the deleterious consequences of urbanization.

Contamination associated with urban development is derived from both point and non-point sources. Point source pollution originates at a specific, readily identified location, such as a leaking gasoline tank or an industrial waste-water outfall. Non-point source pollution is defined as contamination whose source cannot be precisely identified, such as contaminated stormwater runoff. Nationwide, non-point source pollution is recognized as the largest source of pollution affecting water resources. Concern about the impact of non-point source pollution has been demonstrated by recent federal regulations designed to address water quality problems throughout the country (see Appendix 1, Section B).

In Texas, responding to a mandate of the 72nd Legislature, the Texas Water Commission (TWC) initiated a comprehensive assessment of water quality in each river basin in Texas. Commonly referred to as the Texas Clean Rivers Act, its goal is to identify significant pollution sources, both point and non-point, affecting water quality in each watershed.

Water quality degradation can result from virtually all modern human activity. Contamination associated with urban development may occur both during construction and after completion of construction. During construction, common sources of contamination include leakage of gasoline, grease, and oil from construction equipment as well as construction debris such as paint, solvents, and adhesives. Furthermore, indiscriminate dumping of construction waste increases as construction activities increase. Non-point source pollution includes stormwater which has run across and through these wastes, and increased stream sedimentation from excessive erosion caused by excavation

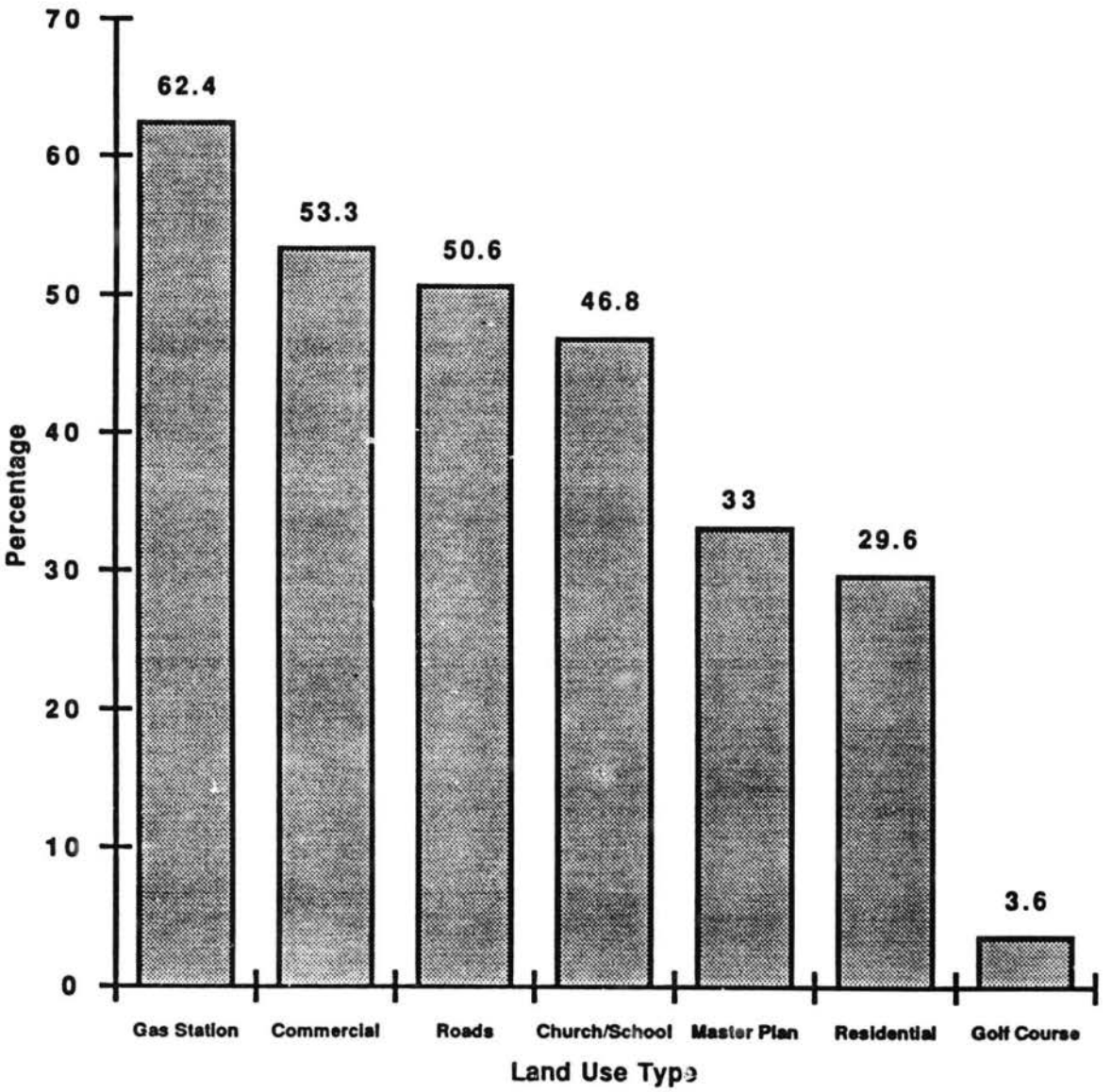
associated with construction activities. Also, contamination of stormwater may result from fresh applications of asphaltic materials used for road paving and roofing.

After construction, contamination sources vary widely depending upon the nature of the development. Leaking sewer lines may occur within any development connected with a municipal wastewater treatment facility. Underground hydrocarbon and hazardous materials storage tanks also pose a threat to the Edwards aquifer due to the nature of their contents and their subsurface location. Two known cases of leaking underground gasoline storage tanks resulted in localized contamination of the Edwards aquifer and necessitated the closure of private domestic wells. Also, a fire destroyed an industrial dry cleaning facility, causing the leakage of solvents into the Edwards aquifer. Interestingly, these three cases occurred on the Edwards Transition Zone (ETZ) which is considered less sensitive than the ERZ (see Section IV). As the number of storage tank facilities over the Edwards aquifer increases, so too does the risk of leaks, spills, and overfills.

The increase in the amount of impervious cover (paved or built areas) within a development reduces the ability of contaminated stormwater runoff to be attenuated through natural filtration and adsorption. Retail and commercial facilities as well as medical facilities, schools, and churches generally require a high percentage of impervious cover relative to the total size of the land used (see Figure 1). Of particular concern are parking lots, which accumulate gasoline, oil, and grease. New or expanded roads and highways encourage an increase in vehicular traffic with a resultant leakage of hydrocarbons, radiator fluids, and metal dust from brake linings. An increase in highway traffic also results in an increased risk of accidental, catastrophic spills resulting from collisions involving hazardous materials haulers.

Recent construction activities on the ERZ consist primarily of residential subdivisions. While it is commonly believed that residential subdivisions are an environmentally friendly land use, this is not necessarily so. The profligate use of pesticides and fertilizers for lawn care in typical urban settings (estimated at five to eight times agricultural use) and the increase in the use of commercial lawn care companies are likely to contribute to contaminated stormwater runoff. Excessive amounts of fertilizers and pesticides combined with over-application of irrigation water force the chemicals beyond the root zone and eventually to the water table. Also, the length of sewer lines used in typical residential subdivisions is substantially greater than that used in comparably sized commercial subdivisions, with an associated higher risk of line leakage or breakage.

Figure 1:
Percent Impervious Cover by Land Use Type*



* Based on Water Pollution Abatement Plan submittals, May 1992 through April 1993.

A proliferation of supporting commercial activities associated with residential subdivisions is certain to follow, each with some level of risk of contaminating the Edwards aquifer. These activities, examples of which are already in place on the ERZ, include gas stations, golf courses, retail and commercial facilities, medical facilities, schools, churches, roads, and highways.

The cumulative impact on the Edwards aquifer of all activities on the ERZ is far greater than the sum of their parts, although more difficult to measure. No mechanism presently is in place by which a regulatory entity might restrict development activities based on a cumulative evaluation procedure. In other words, projects are not assessed with consideration of a background of existing conditions. Many applicants for developments on the ERZ state that dilution will mitigate the effects of contaminants associated with each development. Dilution, however, will cease to be a mitigating factor at some point in the future as increasing development activities each contribute "diluted" contaminants to stormwater runoff which recharges the aquifer. Unless development activities are evaluated collectively and regulated accordingly, this cumulative effect cannot be and will not be prevented.

Furthermore, as developed areas expand and the amount of impervious cover across the ERZ increases, the amount of infiltration of rainfall into the soil is reduced, causing an increase in runoff and a loss of groundwater recharge. In addition, many recharge features (caves, sinkholes, and solution cavities) are sealed, ostensibly to prevent contaminants from entering the aquifer, but also reducing recharge. Loss of recharge over time could contribute to a lowered water table, exacerbating both water quantity and water quality problems. As less water is available to dilute pollutants entering the aquifer, the potential for groundwater contamination will magnify. Presently, no regulations exist to protect and maintain the recharge capacity of the land being developed. This is unquestionably one of the most serious oversights in ERZ protection.

A spectrum of regulatory agencies (see Appendix 1) exercise some control on development activities over the ERZ, for a variety of purposes. It is questionable, however, whether any of the regulations provide adequate protection against potential water quality degradation associated with development activities over the ERZ.

III. Enabling Legislation and Resolutions of the Edwards Underground Water District Relative to Water Quality Protection

The District currently has responsibility, due to its enabling legislation and to specific Resolutions and Orders

passed by the District's Board of Directors, to protect the Edwards aquifer from contamination associated with development activities over the ERZ. The District's enabling legislation states that the District is created for the "purpose of conserving, protecting, and recharging the underground water-bearing formations within the District, and for the prevention of waste and pollution of such underground water...."

The following Resolutions have been adopted by the District's Board regarding development on the ERZ.

- On December 14, 1971, a resolution was passed that stated the Board's opinion that urban development on the Edwards ERZ "...will cause or contribute to the pollution of the Edwards Underground Reservoir..." It also declared that the policy of the District is that urban development within the ERZ is discouraged.

- A resolution passed on March 14, 1972 resolved to intervene in the suit opposing a large development ("San Antonio Ranch"), unless adequate studies of its environmental impact to the aquifer were conducted, due to its location primarily on the ERZ.

- Resolution No. 09-86-070, passed on September 9, 1986, opposed the granting of domestic waste discharges on the ERZ which cannot meet discharge permit requirements. It stated that continued development on the ERZ may lead to a proliferation of domestic wastewater discharges.

- A non-degradation policy, Resolution No. 09-86-071, was passed on September 9, 1986. It declared that certain activities such as high density residential and/or commercial developments constructed throughout a significant portion of the ERZ may lead to groundwater quality degradation. It further stated that the goal of the District shall be to maintain the current high level of water quality in the Edwards aquifer; the policy of the District shall be to prevent water quality degradation of the Edwards; and sensitive areas such as sinkholes and caves should be protected from contamination and maintained as local recharge points.

These Resolutions clearly indicate the Board's continued conviction that urban development on the ERZ may cause contamination of the Edwards aquifer and should therefore be discouraged and controlled.

The responsibility of the District to protect the Edwards aquifer from contamination will be transferred to the newly created Edwards Aquifer Authority (the "Authority") on

September 1, 1993. Senate Bill No. 1477, which created the Authority and describes its powers, states that the Authority, "...in order to prevent pollution and enforce water quality standards in the counties included within the authority's boundaries and within a buffer zone... shall apply pollution control regulations equally and uniformly throughout the area within the counties and the buffer zone."

Currently, there is a lack of adequate performance standards or regulatory controls to protect the aquifer against water quality degradation associated with development activities on the ERZ. This fact, coupled with the rapid pace of development over the ERZ at this time, should send an alarming signal that degradation of water in the Edwards aquifer is eminent, unless swift actions are taken to implement more accurate impact assessment procedures and more stringent standards and controls on development activities. Given the District's responsibilities and past pledges and the Authority's legislative powers to protect the Edwards aquifer, staff believes that the District or Authority Board should actively promote such efforts.

IV. Growth Trends and Development Characteristics

Data from various sources indicates trends in development activities within Bexar County, within the City of San Antonio (CSA), and particularly within the ERZ boundaries in Bexar County and the CSA. The data generally indicates that the growth rate in these areas was fairly rapid from the early to mid 1980's, decreased from the mid 1980's to early 1990's, and is now increasing again at a relatively rapid pace.

Data from the Bexar Appraisal District indicates that, as of 1991, approximately 36% of land on the ERZ in Bexar County is developed for residential, commercial, or industrial uses. The remaining acreage on the ERZ in Bexar County is used as ranch land, farm land, or military operations.

In June 1991, the CSA Planning Commission and Department of Planning published a report entitled, "San Antonio Report on Development and Planning Activities 1980-1990" (the "Report"). The Report was developed as a historical and statistical inventory of development in the 1980's, and a guide describing the setting within which to forecast growth and change into the 1990's. The Report characterized 1980 through 1985 by a steady increase in development activity, peaking in 1985. From 1986 through 1988, a major decline in activity was recorded, and increases were recorded for 1989 and 1990.

The Report also reviewed population and housing by census tract as an indicator of population shifts and growth in San Antonio and Bexar County. Between 1980 and 1990, the fastest growing areas in Bexar County were northwest, north central, and northeast Bexar County. By 1990, the northwest and northeast quadrants of Bexar County had increased their total share of both population and housing units to 40% and 30%, respectively, of the total population and housing in Bexar County. The Report also determined that the geographic zone between north Loop 410 and north Loop 1604 showed the largest population and housing growth in the 1980's, and in 1990 comprised approximately 40% of the population and housing units for Bexar County.

The Land Development Policy Study (the "Study") was recently conducted - with a report currently being finalized - by the CSA and the Bexar County Metropolitan Planning Organization to propose alternatives to manage the physical growth of this community. An analysis of past, present, and future growth trends was conducted to meet the objectives of the Study.

A study group reviewed growth trends on land tracts over the ERZ and Drainage Zone in northern Bexar County. The County was divided into the following sectors: near northwest, near north central, near northeast, far northwest, far north central, and far northeast ("near" designating the area inside loop 1604 and "far" designating the area outside loop 1604). The study reports that since 1970, much of the growth within Bexar County has been within these sectors. Between 1980 and 1990, housing increased as follows:

near northwest:	143.0%
near north central:	164.6%
near northeast:	151.5%
far northwest:	55.4%
far north central:	197.4%
far northeast:	309.5%

The CSA's Planning Department also compiles platting data for development activities within the CSA's jurisdiction (including both the CSA's corporate limits and its extra territorial jurisdiction). Table 1 displays all subdivision platting activity over the ERZ between 1980 and 1992, indicating: the number of plats and lots; acreage; average number of lots per acre; percentage of plats approved on the ERZ compared to total number of plats approved within the CSA's jurisdiction; and percentage of acreage of ERZ plats compared to total plat acreage.

In 1980, 25 plats on the ERZ were approved by the CSA, representing only 4.8% of the total number of plats approved by the CSA. That year, 432 acres were platted on

Table 1:

Annual Total Platting Activity on the Recharge Zone:

Bexar County - 1980 through 1992

	Plats	Pct. of Total*	Acreage	Pct. of Total*
1980	25	4.8	432.2	12.0
1981	19	4.0	302.2	8.4
1982	37	8.4	364.0	12.7
1983	34	6.5	296.7	5.7
1984	50	7.4	919.6	16.8
1985	58	8.3	1,106.7	19.0
1986	52	9.8	759.5	18.5
1987	13	3.8	115.3	5.7
1988	7	3.0	60.0	5.9
1989	8	4.1	102.3	8.9
1990	5	2.1	233.1	14.8
1991	16	7.5	113.3	5.7
1992	25	7.0	261.0	11.1
Total	349	-	5,065.7	-

* The percentage of plats and acreage platted on the Recharge Zone relative to total number of plats and acreage platted in all of Bexar County.

the ERZ, representing 12% of the total acres of approved plats. In 1992, again, 25 plats were approved on the ERZ, but now representing 7% of all plats approved that year. That year, 261 acres were platted on the ERZ. Although the acreage was less than that platted in 1980, it represents about the same percentage of the total acres platted, 11.1%.

Table 2 displays platting of single-family residential (SFR) subdivisions on the ERZ between 1980 and 1992, indicating: the number of SFR plats and lots; SFR acreage; average number of SFR lots per acre; percentage of SFR plats approved on the ERZ compared to total number of SFR plats approved within the CSA's jurisdiction; and percentage of SFR acreage of ERZ plats compared to total SFR plat acreage.

In 1980, 15 SFR plats were approved on the ERZ, representing 9.32% of all SFR plats approved by the CSA. That year, 268 acres were platted as SFR subdivisions, representing 12.7% of total acres of approved SFR plats in 1980. In 1992, 19 SFR plats were approved, representing 13.1% of all SFR plats approved that year. Total acreage was 229, representing 17.9% of total acres platted for SFR subdivisions in 1992. In 1993, new home sales are skyrocketing and Bexar County is poised for another building boom.

Another indication of development activity on the ERZ is the submittal and TWC approval of Water Pollution Abatement Plans (WPAPs) (see Appendix 1, Section E). Table 3 indicates the number of WPAPs for various types of projects received and reviewed by the District since May 1992 (the time at which the Division of Planning and Environmental Management took responsibility for WPAP review). The data illustrates the increase in development activities over the ERZ.

WPAPs, sewer plans, and hydrocarbon storage facility plans which were approved by the TWC between 1975 and 1992 are indicated in Figures 2-5. The numbers of approvals do not reflect the numbers of new development projects since they include approvals for minor modifications to existing plans as well as new plans. The changes over time, however, clearly illustrate ERZ development trends in Bexar, Comal, and Hays Counties.

Approvals of WPAPs and sewer plans rose rapidly in the early to mid 1980's and declined in 1987. Another rapid increase began in 1990 and continues to this date. Approvals of hydrocarbon storage facilities generally follows the same pattern as WPAP and sewer plan approvals, but lag several years behind, reflecting a conventional development pattern.

Table 2:

Annual Residential Platting Activity on the Recharge Zone:

Bexar County - 1980 through 1992

	Plats	Pct. of Total*	Acreage	Pct. of Total*
1980	15	9.3	268.2	12.7
1981	10	8.2	172.6	9.0
1982	13	1[illegible].7	164.9	16.0
1983	13	8.3	177.6	5.8
1984	22	12.9	558.1	17.6
1985	23	12.7	836.5	24.8
1986	23	14.9	603.2	23.9
1987	4	4.7	39.1	4.7
1988	2	4.0	13.6	5.5
1989	3	4.7	94.5	17.1
1990	2	3.5	19.7	4.7
1991	8	16.3	74.4	7.7
1992	19	13.1	228.6	17.9
Total	157	-	3,250.9	-

* The percentage of residential plats and acreage platted on the Recharge Zone relative to total number of residential plats and acreage platted in all of Bexar County.

Table 3:

Water Pollution Abatement Plan Submittals:

Bexar, Comal, and Hays Counties - May, 1992 through April, 1993

By Project Type

	Residential	Commercial	Church/School	Roads	Golf Course	Gas Station	Master Plan	Total
May '92		1		1				2
June	1						1	2
July	1	1	1					3
August	3		1	1				5
September	3		1					4
October	3	1						4
November	2			1				3
December	2	1				1		4
January '93	1				2			3
February	4	1						5
March	4							4
April	2	1		1		2		6
Total	26	6	3	4	2	3	1	45

Note: Does not include Water Pollution Abatement Plans (WPAPs) for temporary construction activities (e.g., reclamation fill site work) or amendments to previously approved WPAPs.

Figure 2:
State Approvals for Development on the Recharge Zone in Bexar, Comal, and Hays Counties: 1980 - 1992

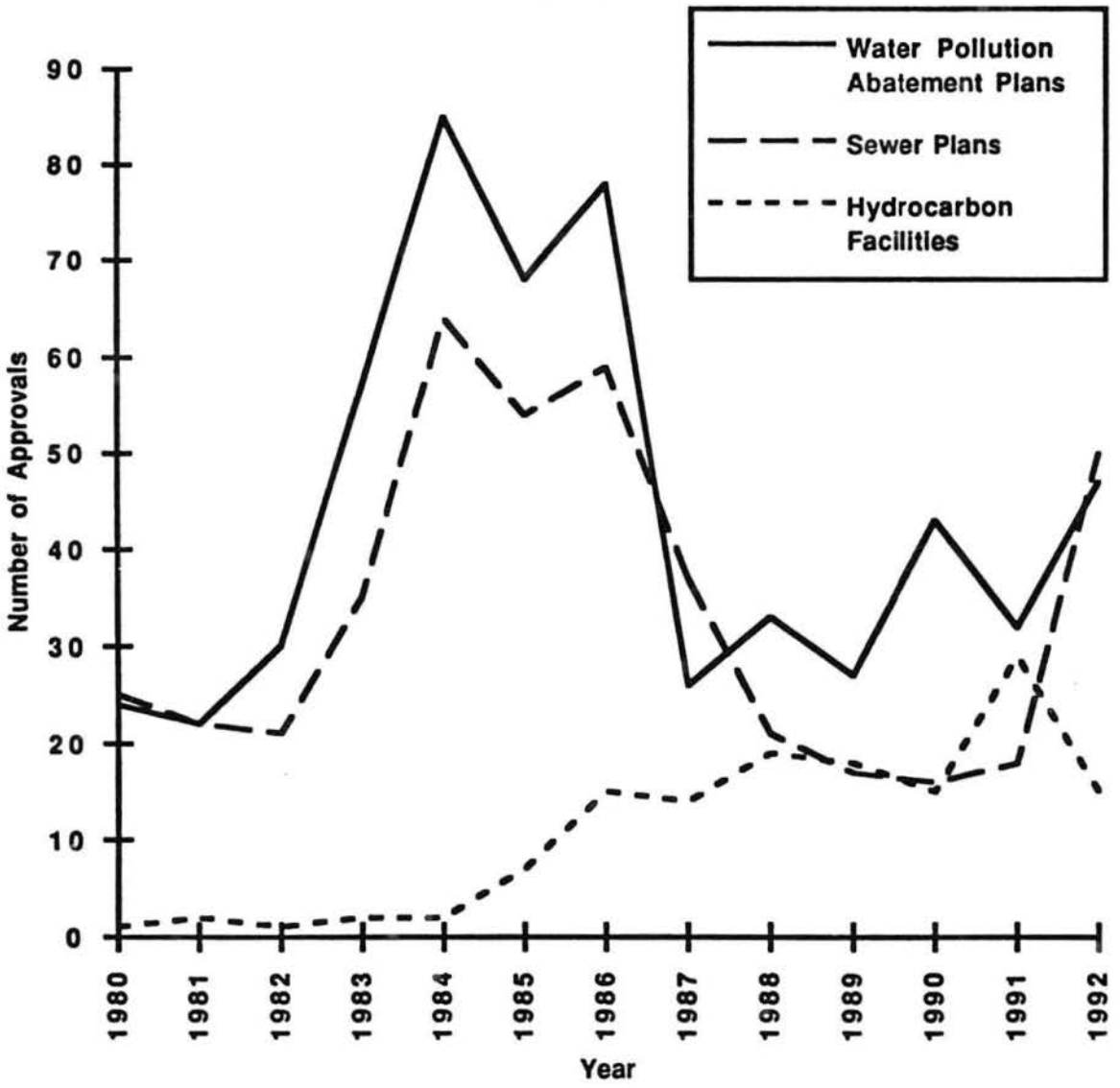


Figure 3:
State Approvals for Development on the Recharge Zone in Bexar Co.: 1980 - 1992

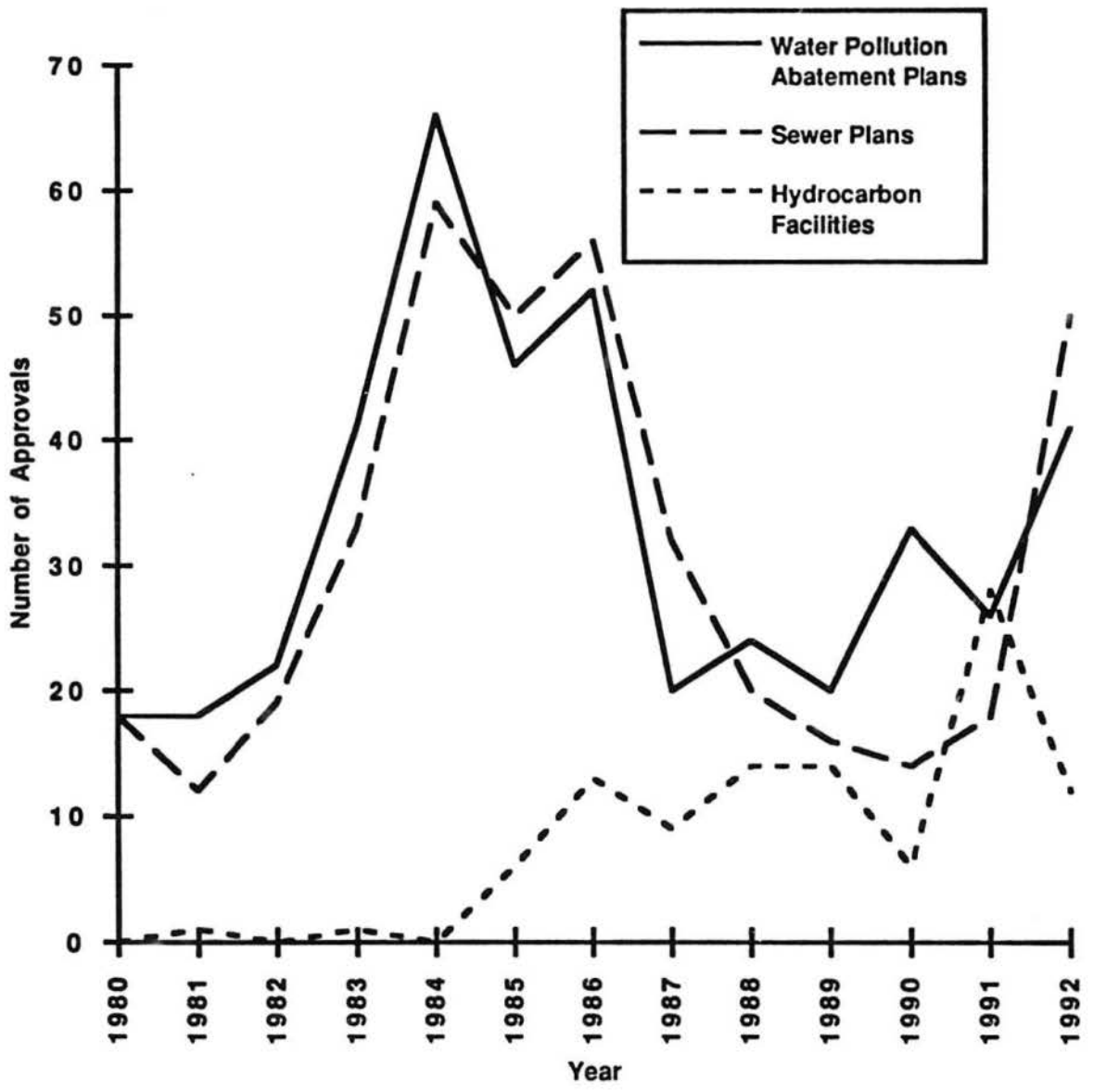


Figure 4:
State Approvals for Development on the Recharge Zone in Comal Co.: 1980 - 1992

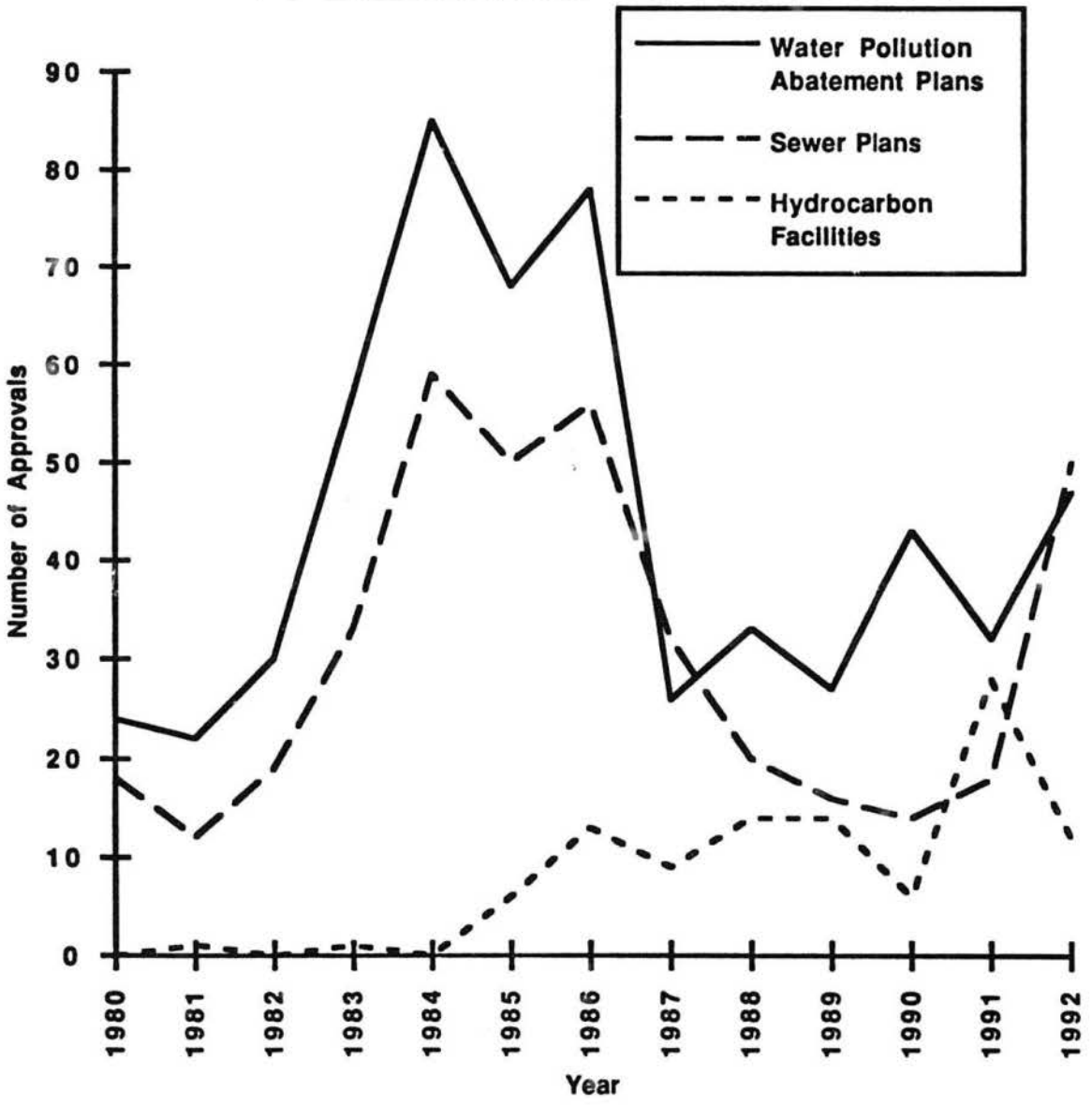
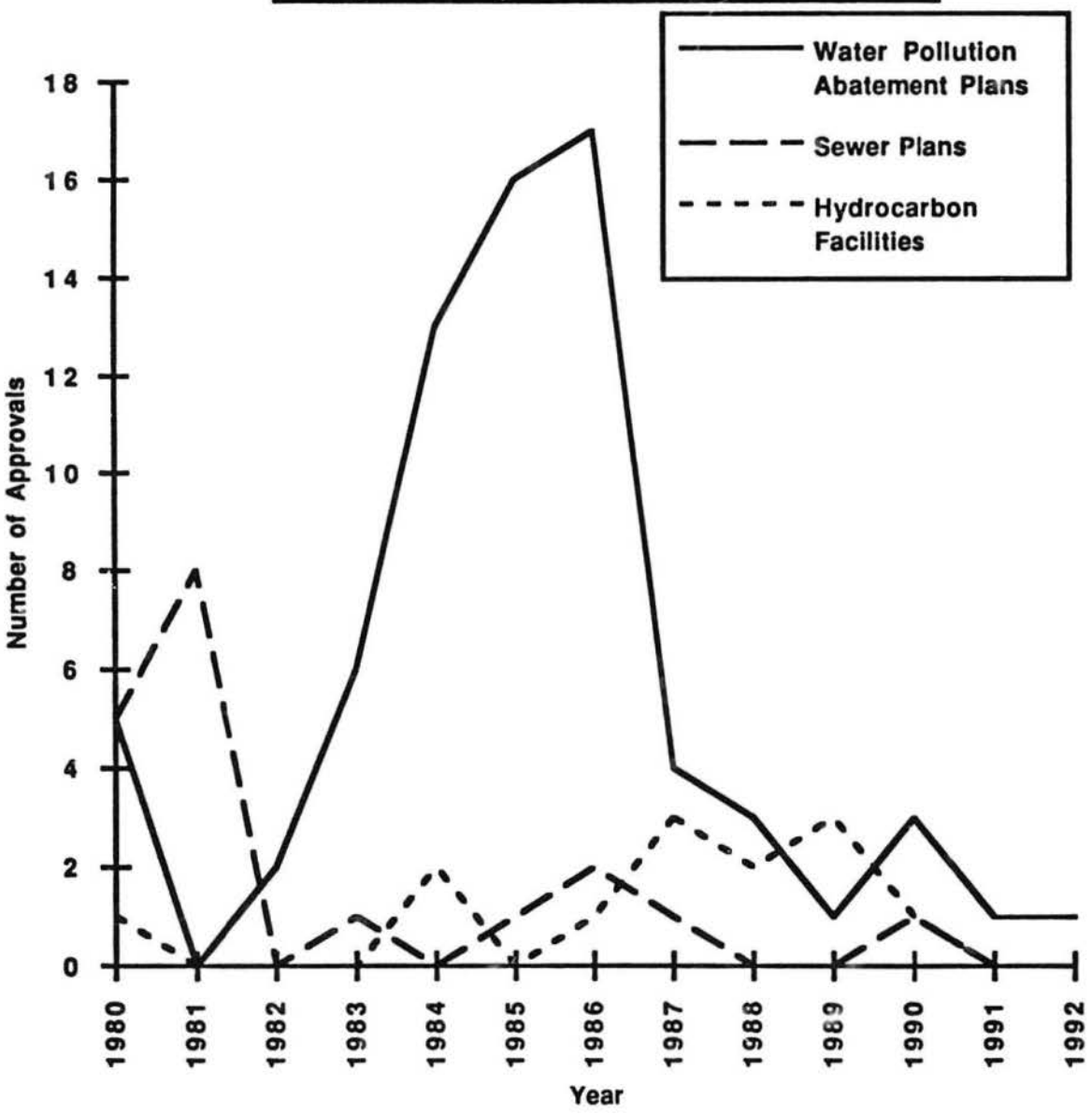


Figure 5:
State Approvals for Development on the Recharge Zone in Hays Co.: 1980 - 1992



The recent increase in development activity on the ERZ is even more pronounced when one considers actual construction activity. District staff estimates that less than 25% of the projects approved during the 1980's were ever constructed. (This can be attributed to economic rather than regulatory factors.) By contrast, an estimated 90% of the projects whose plans were approved since 1990 have been or will soon be constructed.

Table 4 illustrates the acreage and impervious cover associated with various types of land uses, based on WPAPs submitted to the District. (Impervious cover data is also illustrated in Figure 1.)

V. Current District Activities Relative to Edwards Recharge Zone Development

EDWARDS RULES MONITORING

The TWC is responsible for protecting water in the State of Texas. As such, it is responsible for promulgating and enforcing 31 Texas Administrative Code, Chapter 313, known as the Edwards Rules (the "Rules") (see Appendix 1, Section E). These rules are intended to protect the water quality of the Edwards aquifer from the effects of development on the ERZ.

The District is the agent charged by the State to assist in the administration of the Rules. District staff reviews and makes recommendations on WPAPs submitted to the TWC for approval under the Rules. A WPAP is required for all regulated activities on the ERZ and contains information about the nature of the project and the site geology.

District staff evaluates each WPAP application and submits a letter with comments and recommendations to the TWC staff for consideration prior to their issuance of the terms of approval for the project (see Appendix 2). Staff has attempted to make comments and recommendations which are consistent with the District's enabling act, the above referenced Board resolutions, and District statements submitted as testimony at TWC public hearings regarding the Rules. Many of these recommendations, however, refer to activities and processes which are not presently required by the Rules, and the TWC has rarely acted on District recommendations. District staff has repeatedly urged the TWC to review ERZ development activities in a cumulative manner.

One section of the Rules addresses hydrocarbon and hazardous substance storage in underground and aboveground storage tanks on the ERZ and the ETZ. The ETZ is an area generally south of the ERZ where the Edwards aquifer is not

Table 4:

Acreage and Impervious Cover by Project Type *

	Residential	Commercial	Church/School	Roads	Golf Course	Gas Station	Master Plan	Total
No. of WPAPs	26	6	3	4	2	3	1	45
Tot. Acres	1042.6	343.8	10.9	279.5	230.0	2.90	1,004.0	2,913.7
Avg. Acres	40.1	57.3	3.6	69.9	115.0	1.0	NA	NA
Tot. Imp. Cover**	308.9	183.2	5.1	141.4	8.3	1.81	331.0	979.7
Pct. Imp. Cover	29.6%	53.3%	46.8%	50.6%	3.6%	62.4%	33.0%	33.6%

* Based on Water Pollution Abatement Plan submittals, May, 1992 through April, 1993.

** Total acreage of impervious cover of all WPAPs submitted divided by total acreage of all WPAPs submitted.

Note: Percent impervious cover = Total impervious cover divided by total acreage.

exposed at the surface, but faults and fractures present a possible avenue for contamination to reach the aquifer. The ETZ was designated in the Rules for regulation of hydrocarbon and hazardous materials storage.

District staff reviews hydrocarbon storage facility plans submitted to the TWC and conducts compliance inspections of operational hydrocarbon storage facilities. Since January, 1991, District staff has found over 100 violations of the hydrocarbon storage section of the Edwards Rules and other state hydrocarbon storage regulations (Chapter 334 of the Texas Administrative Code) on the ERZ and ETZ in Bexar, Comal, and Hays Counties (see Table 5). Major violations are reported to the TWC for enforcement actions, and follow-up inspections are conducted as necessary. District staff's documentation on noncompliant facilities has been requested by TWC on an ongoing basis to prioritize TWC's compliance inspections of hydrocarbon storage facilities.

SUBMITTAL OF HEARING TESTIMONY - EDWARDS RULES

The District has consistently submitted testimony at the TWC hearings on the Edwards Rules exhorting the TWC to promulgate standards and regulations for ERZ and ETZ protection which are more stringent and more comprehensive than those currently in place. Over the years, some of the recommendations submitted by the District have been incorporated into the Rules, but many have not. At hearings in 1988, 1989, and 1992, District staff recommended that TWC staff collectively evaluate plans submitted for activities on the ERZ. The District's position is that each application for a proposed development should be reviewed with consideration of a background of existing conditions.

The last changes to the Edwards Rules were made in March, 1990. The last public hearing regarding the Rules was held in February, 1992 as a result of a formal request by the District. Changes to the Rules as a result of that hearing have not been published. The District's recommendations for the Rules included the following:

- The ETZ boundary should be reevaluated to include all areas fitting the geologic definition of the ETZ. The ETZ boundary should be extended to include portions of Uvalde County.

- The TWC should establish a "drainage zone" for regulation under the Rules. This zone would include the area wherein surface water runoff drains into creekbeds up to 10 miles upstream of the ERZ.

- Blasting requirements should be added to the Rules such that the blasting of rock within a regulated development is conducted according to an approved site-specific evaluation method.

Table 5:

Hydrocarbon Storage Facility Violations:
Bexar, Comal, and Hays Counties

County	Number of Facilities	Number of LPSTs	LPSTs as a Pct. of Total	Other Violations
Bexar	176	40	22.7%	60
Comal	43	6	14.0%	25
Hays	43	5	11.9%	23
Total	261	51	19.5%	108

Notes: LPSTs (Leaking Petroleum Storage Tank) are designated by the Texas Water Commission as hydrocarbon storage facilities where a release has occurred.

Other violations include failure to comply with any requirements under the Edwards Rules or other state hydrocarbon regulations.

- The TWC should collectively evaluate plans submitted for regulated activities within regulated developments, including residential subdivisions and hydrocarbon storage facilities.

- The Rules should require that WPAPs submitted for highway construction over the ERZ include plans for spill-containment features at stream crossings.

- The Rules should require that sewer pipe materials meet minimum standards at least as rigorous as those required by the CSA.

- The Rules should require that lift stations on the ERZ meet specified flowthrough storage capacity limits, and that geologic assessment be prepared.

- The Rules should require existing sewer collection systems on the ERZ to be tested every year rather than every five years; and if a defect is detected, measures to initiate repairs should be carried out within 30 days rather than within one year.

- The Rules should prohibit all landfills, not just hazardous waste landfills, on the ERZ, ETZ, and the proposed drainage zone of the Edwards aquifer.

- The Rules should prohibit commercial use of some fertilizers and pesticides on the ERZ and proposed drainage zone.

- The Rules should require vault systems for storage of hydrocarbon and hazardous substances.

- The Rules should require a minimum 150-foot separation between any Edwards aquifer well and an underground storage tank.

- The Rules should exempt aboveground storage facilities which have a cumulative storage capacity of less than 500 gallons rather than less than 1,000 gallons.

- The TWC should establish and follow a schedule for compliance inspections of operational underground and aboveground hydrocarbon storage facilities.

- The Rules should regulate rock quarrying activities in the ERZ and require routine groundwater sampling analyses from quarry sites and sites downgradient from quarries.

By letter to the Executive Director of the TWC on November 30, 1992, the District requested that the TWC hold another hearing. In response to the request, the Director indicated that he would be willing to meet with District staff to discuss the Edwards Rules.

Currently, the TWC is developing a Technical Guidance Manual (the "Manual") for the purpose of providing the regulated community with specific criteria for complying with the Rules (see Appendix 1, Section E). District staff as well as representatives from other water districts, municipalities, and the regulated community are participating in development of the Manual.

EDWARDS AQUIFER PRESERVATION PROGRAM

In May, 1991, the Board of Directors of the District approved Resolution & Order No. 03-91-138 establishing the Edwards Aquifer Preservation Program (EAPP). The purpose of the EAPP is to identify and protect hydrologically sensitive features and land areas in the Edwards aquifer region through acquisition of property or interest in property (i.e. easements) on the ERZ.

The goal of the EAPP is to employ conservation measures including land purchase and easement development to effect the protection and preservation of sensitive geologic features and geographic areas within the ERZ - such as caves, sinkholes, fault zones, and streambeds - for the enhancement of recharge to and the preservation of water quality in the Edwards aquifer.

Land acquisition alternatives may include:

- ownership "in fee" in which an estate is acquired outright with the greatest aggregate of rights;
- fee acquisition through donation, whereby to offset the cost of willfully transferring the fee gratis, the landowner may qualify for one or more tax benefits;
- conservation easements, whereby the landowner essentially gives up some property rights, allowing the property to remain privately held while furthering conservation interests;
- deed restrictions, whereby restrictive covenants, much like the terms contained in a conservation easement, may be placed in the deed when the title is transferred, but may not be permanent; and
- acquisition of full or partial land interests through methods other than conventional real estate transactions.

In August, 1993, the District in cooperation with Texas Parks and Wildlife Department (TPWD) and San Antonio Water System purchased a 5,150 acre tract of land, 4,100 acres of which is on the ERZ, known as "Government Canyon." TPWD owns the property and will operate it as a state park.

This purchase represents the first large tract acquired under the auspices of the EAPP. Additionally, the District has secured conservation easements covering 65 acres which include two large sinkholes. The sinkholes have been grated for the purpose of allowing recharge to the Edwards aquifer to occur while eliminating the risk of personal injury.

INTERLOCAL AGREEMENT

Since 1988, the District has entered into annual interlocal agreements with the CSA for the purpose of obtaining surface water quality data. The District has funded the installation of 18 water sampling stations, at the rate of three to four per year since the project began, located at several intermittent creek crossings in northern San Antonio. These facilities are equipped to automatically collect water samples after significant rainfall events and to notify CSA staff, by computer modem, when samples are collected. Staff then take the samples to a laboratory for analysis for chemical and biological parameters.

The purpose of the project is to assess and evaluate information regarding the effects of different land uses on the quality of surface water runoff. When enough data is collected from the various sampling sites, comparisons may be made between stations receiving runoff from various types and sizes of developments, and between the same stations over time in areas where land use has changed. Due to the gradual emplacement of the sampling stations, and to the scarcity of rainfall events significant enough for samples to be collected, statistical analyses of the data collected to date is inconclusive.

VI. Studies on Urban Development

Throughout the country, numerous studies recently conducted on the effects of urban development on water quality have indicated a direct relationship between stormwater pollution and impervious cover. The purpose and results of recent studies which have particular relevance to this region are summarized below.

CITY OF AUSTIN

The potential problem of non-point source pollution in the Austin area was first studied by the City of Austin (COA) in 1974 as part of a comprehensive planning effort entitled "Austin Tomorrow." This report identified non-point source pollution as a significant potential threat to the environment and to the economic well-being of the City.

Since that time, the COA has implemented three major stormwater quality monitoring programs to quantify the

effects of urban development on stormwater runoff quality and to improve control methods established to offset the effects.

1. The U.S. Geological Survey (USGS), under a USGS/COA Cooperative Program, began monitoring streamflow and water quality of large multi-land-use urban and suburban watersheds.

2. During 1980-1982, the COA participated in the Nationwide Urban Runoff Program (NURP) sponsored by the U.S. Environmental Protection Agency. This monitoring program was conducted for three test watersheds representing different degrees of residential development.

3. In 1984, the COA, in order to evaluate the effectiveness of control measures for stormwater quality management specified in the Land Development Code and the Environmental Criteria Manual, and to refine and expand the NURP, implemented its own Stormwater Monitoring Program. This program monitors flow and water quality of small single-land-use suburban watersheds and stormwater control structures.

A host of studies have been conducted - and reported - by the COA and others for the purpose of analyzing the hydrologic and water quality data obtained from these and other monitoring programs.

One COA paper presented statistical modeling studies for two of the COA's stormwater quality monitoring programs. The objectives were to document local stormwater runoff pollutant loading data and the effect of urban development on stormwater quality, and to evaluate the effectiveness of water quality control basins. This study confirmed previous findings that stormwater runoff pollutant loads linearly increase with watershed imperviousness. For some pollutants, concentrations were significantly higher in large multiple-land use watersheds than in small single-land use suburban watersheds of the same imperviousness, which is attributed to an increase of channel erosion, traffic volume, and population.

Another COA study updated previous COA reports. Study objectives were to determine the existing water quality conditions and trends of Austin area creeks, and the effects of urban development on water quality of the creeks. It found that storm runoff volume, pollutant load, and concentrations of chemical and biological pollutants significantly increased with increasing percent impervious cover. The water quality of Austin creeks depends largely on the quality and quantity of stormwater runoff, which in turn depends on percent impervious cover.

Two other COA studies analyzed data collected from two of the COA's monitoring programs and developed stormwater pollutant loading rate data for various types of land use in the Austin metropolitan area. They confirmed previous COA studies that stormwater runoff pollutant loads increase with watershed imperviousness and with population density. They also determined that pollutant loading rates of Austin creeks are significantly higher than loading rates for the small suburban sites, most likely due to additional non-point source pollution.

A USGS report presented data obtained from the USGS/COA Cooperative Program. This report compared stormflow and base flow water quality from drainage basins ranging from rural to urban, to determine the relation between the degree of urbanization and water quality in a drainage basin. Concentrations and densities of a number of chemical and biological contaminants were observed to increase with increased impervious cover. Also, sites with runoff from urban drainage basins had larger concentrations than the sites draining rural basins.

One study conducted by the COA evaluated the effects of the first flush of urban runoff pollutant loads and the efficiency of treatment devices. Data indicated that for larger runoff events, the pollutant load removed by the first half-inch of runoff does not constitute the majority of the total storm load.

TEXAS DEPARTMENT OF TRANSPORTATION

A multi-year study on surface water quality and quantity in the Austin area is currently being conducted. Concern over proposed construction of a highway extension in Austin over a portion of the ERZ resulted in litigation involving the Texas Department of Transportation (TxDOT) and the Federal Highway Administration. As a result of the litigation, a Consent Decree ordered a study of the water quality and quantity of highway runoff and the effects of highway construction and operation on the quality of receiving waters. The Center for Research in Water Resources with the University of Texas at Austin was chosen to conduct the study. Researchers will collect highway runoff during and after road construction and develop a predictive model based on the results. A review and evaluation of literature pertaining to the quantity and control of pollution from highway runoff and construction has been published, but data is not yet available. District staff will monitor the progress of this study.

SAN ANTONIO RIVER AUTHORITY

The San Antonio River Authority (SARA) is currently conducting a water quality assessment of the aquatic resources in the San Antonio River Basin, as mandated by

the TWC (see Appendix 1, Section L). The 1992 Regional Water Quality Assessment Report has been completed and incorporated into a statewide summary report. The SARA study indicated that the stream segments that are located above the San Antonio metropolitan area exhibit significantly better water quality than stream segments located within the metropolitan area, both historically and currently, although only limited data is available. In general, where water quality problems exist in the San Antonio River Basin they are usually manifest by high counts of fecal coliform bacteria, and although they have been substantially reduced in the last five years, they still often exceed stream standards. Chlorides and sulfates periodically exceed stream criteria in some segments. A preliminary review of available data indicates that there might be problems with priority pollutants in some segments within the basin.

Statewide, many river authorities considered non-point source pollution to be of concern. Several specific parameters they identified - such as elevated fecal coliform and nutrient levels, pesticides, toxic metals, and increased total dissolved and suspended solids - indicate contamination which may be attributable to non-point source pollution. They identified likely sources of non-point source pollution to include urban runoff and improperly managed construction sites.

Elevated fecal coliform levels were present in almost every river basin in the State. River authorities attributed elevated fecal coliform levels to septic tanks, potential illegal dumping of municipal garbage, and ineffective municipal wastewater treatment facilities. River authority assessments also identified several specific toxic materials problems. Herbicides appeared at disturbing levels at sampling sites, as did various pesticides and insecticides. Their presence was not entirely attributed to agricultural and silvicultural runoff: runoff from urban pesticide use was also considered to be a significant contributor to the potential problem.

The TWC has also requested that SARA conduct a pilot study to address non-point source pollution concerns in the San Antonio River basin; a work plan for the pilot study is currently being prepared.

VII. Land Use/Structural Alternatives

Several approaches may be used in protecting groundwater quality from additional pollutant loadings associated with urban development. Each approach has a number of alternatives which may tailored to the physical attributes of a given area or site. Similarly, the goals of water quality protection programs will direct which approaches

and alternatives are ultimately employed. For example, remedies will vary greatly if stated goals require no additional pollutant loadings in excess of background levels, as opposed to allowance of some acceptable level of pollutant loadings.

Thus, the following approaches are presented as a range of available techniques and strategies commonly employed to address water quality concerns. These approaches should not be considered necessarily mutually exclusive, nor as an exhaustive compendium of solutions, but instead as a sampling of available options.

Procedures for water quality protection commonly take the form of either land use or structural controls. The former usually require coordination of site planning techniques with the existing natural environment through maintenance or enhancement of open spaces. The latter rely on the design and installation of engineered facilities to mitigate the effects of urban runoff on-site. A brief overview of some techniques relevant to each approach is presented below.

LAND USE

As mentioned previously, land use regulations developed to protect water quality attempt to maintain the existing environment's hydrologic balance and quality.

1) Buffer Zones

Urban development within specified zones adjacent to land areas identified as sensitive may be severely restricted. Such zones may be either fixed or floating. Fixed buffers establish uniform parameters within the zone, such as limitations on development intensity or offsets from a sensitive feature for any development. Floating buffers take into account site factors such as slopes, soils, and geology, to determine zone boundaries and may further tailor the stringency and type of controls on a watershed by watershed basis.

The advantage of fixed buffers is that the consistency of application is easily understood by the regulated community, and easily administered by regulatory bodies. The disadvantage is that each developed site is not assessed individually, and thus cannot direct protection efforts where most needed ecologically.

As a case study, the City of Austin utilizes both techniques. Austin's land development code specifies fixed water quality buffers of 100 feet from centerline of waterways classified as "minor," 200 feet on "intermediate" streams, and 300 feet on "major" streams. Within these boundaries, with very limited exceptions, development is

prohibited. A form of floating buffer is established around critical environmental features, by factoring the catchment area for each feature to determine a range of minimum buffer sizes.

2) Cluster Development

An innovative site planning technique, cluster development, concerns configuring site layout to maximize and preserve open spaces without losing the number of developable units. In fact, clustering often allows for inclusion of more units than would be permitted under standard subdivision development.

Clustering can be included as part of a Planned Unit Development (PUD). PUD status is a zoning designation commonly granted to allow a mix of uses not allowed under conventional cumulative zoning. PUDs, however, do not necessarily, and most often in this area do not contain clustered housing with common open space.

The attraction of clustering is that it preserves open spaces, thereby reducing the degree of impervious cover for the overall project, regardless of the density of the total project. Such areas may also provide amenity value to the development while achieving ecological objectives. Clustering also reduces infrastructure costs by reducing the length of street and utility lines.

Cluster development does, however, require innovative design, and requires developers to sacrifice some measure of individual lot sizes for the sake of common open space. Furthermore, developers tend to be leery of creating common areas that may require maintenance by a neighborhood association.

Though there are no local examples of true cluster developments, the closest approximations are portions of the Oakwell Farms project and the Mission Trace PUD in Bexar County.

3) Density or Impervious Cover Limitations

Studies in Texas and throughout the nation suggest that with increased impervious cover comes increases in non-point source pollutant loadings (see Section V). Since it may be assumed that reduced percent imperviousness necessarily follows lower permitted densities, then density limits may be used as a water quality protection tool.

Ordinances can be developed to institute "estate" or "large-lot" zoning, which would set, for example, minimum lot sizes of one or five acres in sensitive areas. Others may be drafted to specify the maximum percentage of impervious cover allowed within a designated environmental quality zone.

The City of Austin, for instance, uses large-lot zoning to protect surface waters draining into Lake Austin, a source of the City's water supply. Impervious cover limits have also been featured in Austin's Comprehensive Watershed Ordinance (CWO). The CWO is part of the City's development code and extends beyond the Austin City limits into its extra-territorial jurisdiction.

This concept is hardly new for groundwater protection. Crystal Lake, Illinois, established in 1976 impervious coverage limitations in fragile recharge watersheds. Also in the mid-1970's, Southampton Township on Long Island, New York instituted an ordinance governing development intensity and bulk to protect natural recharge areas. The ordinance established 80,000 square foot (1.8 acre) minimum lot sizes and limitations (10% maximum) on lot coverage for main and accessory buildings.

One advantage of density or impervious cover limits lies in the simplicity of understanding and administration. Plan checking, review, administration, and compliance are far less costly, and resource protection may be more effective and permanent than structural controls requiring engineered designs and perpetual maintenance.

The development community generally opposes these type of pollution prevention initiatives as they limit the ability to design conventional quarter-acre lot subdivisions or higher density developments. The tendency toward larger lot sizes also raises questions of affordable housing in certain sectors.

Low density developments also make infrastructure connections more costly, prompting greater demand for on-site sewage (septic) systems. The trade-off between higher intensity development served by centralized sewer services versus lower densities and impervious coverages with septic systems certainly merits consideration. Again, cluster development can solve this trade-off dilemma.

4) Transfer of Development Rights

In some places, developers are permitted to transfer development rights they hold for lands which are deemed sensitive and encumbered with density limitations. These rights may be sold or otherwise transferred to apply to other areas where greater densities are allowed.

Transfers of development rights (TDRs) mitigate some of the economic hardships sustained by owners of land that is undeveloped but cannot be built upon or built as densely because of the imposition of land use controls.

Dade County, Florida included TDRs as one of the measures contained in a comprehensive plan developed in the 1970's to protect the critical East Everglades recharge area.

5) Performance Standards

Some entities eschew or are unable to impose land use controls and instead rely solely on a results-based approach to protect water resources. This technique sets specific, measurable water quality standards that must be met, and requires developers to demonstrate how proposed developments will meet these standards.

This approach is often used for natural resource protection in lieu of detailed specifications regarding construction techniques or site requirements. This is because detailed specifications may be unable to account for the highly localized conditions and function of natural resources. Furthermore, stipulating construction or land protection techniques stifles the possibility of innovative designs and technologies which achieve the desired results.

Performance standards guarantee governmental involvement and oversight in the significant alteration of sensitive lands. Particular land use and site development decisions, however, are left to the developer.

The weakness of this approach is the heavy reliance on ordinance administration, which can be costly for both the developer and public review entities. Developers may find the review process to be time consuming and to require substantial outside expertise. Public regulatory agencies must perform pre-development project reviews, on-going technical monitoring to ensure compliance, and enforcement if standards are not met, all of which add to the expense and time of administration.

Furthermore, public entities must have the ability to craft standards which genuinely protect the resource, while not unduly hampering development.

The Lower Colorado River Authority (LCRA) has established performance standards for the Lake Travis watershed, requiring the removal of the bulk (70-90%) of additional pollutant loads generated from a given development. The ordinance provides a menu of possible Best Management Practices (BMPs) as suggested pollution control techniques or technologies, but does not prescribe the use of any specific measures. The TWC has unofficially adopted these standards for WPAPs for commercial projects on the ERZ. The LCRA performance standards address removal of pollutant loads generated from individual developments, and therefore do not mitigate the cumulative effects of development.

6) Zoning Districts

By designating either special districts or creating overlay zoning districts, municipalities can establish a list of permitted uses, prohibited acts, and special or conditional

use procedures for development within the specified zones. Land within designated critical areas may also be "downzoned," thereby reducing development densities, and otherwise establishing other standards within the zone. The intent of such districts is to allow the land to be used and also allow land functions to continue regardless of the use.

The CSA has its own version of a zoning overlay district for that portion of the City over the ERZ (see Appendix 1, Section I).

Conclusion: The above approaches almost all require the use of the "police power." These are powers reserved to the states under the 10th Amendment to the U.S. Constitution, which include the power to regulate private activity in the interest of the public health, safety, or general welfare. In most states, Texas included, these powers, typically ordinance-making authority, are extended to municipalities with "home rule" authority. Other entities, such as the LCRA, may also have limited ordinance-making authority as granted by the state.

The above approaches to mitigating the effects of urbanization on recharge water quality are not, however, the ultimate arbiters of where and how development shall occur. These decisions are more a function of public infrastructure investments, such as roadway additions and expansions and sewer and water line extensions. These development basics have far greater impact on growth patterns than zoning designations and any regulations prescribed.

STRUCTURAL CONTROLS

Another approach to controlling point and non-point source pollutants involves the design, construction, and maintenance of structural controls. The approach relies on temporary or permanent engineered facilities, such as silt fences, berms, channels, and sedimentation/filtration ponds. Such controls are designed to keep sediment on site by controlling drainage and capturing stormwater runoff, then treating or otherwise removing certain pollutants which would otherwise enter receiving water bodies.

The structural controls employed at a given site depend largely upon whether the implementation strategy is aimed at mitigating pre-construction or post-construction activities. Other considerations include the type of land use proposed, the patterns of stormwater flow across the site (i.e. sheet flow versus concentrated flow), the extent of site disturbance, and the site's natural topographic and geologic characteristics.

The following is a brief description of some of the strategies employed as structural controls:

1) Detention Ponds

There are generally two types of stormwater treatment ponds which either allow suspended solids - sediments - to settle out (sedimentation ponds), or use permeable media such as sand and gravel or peat moss to filter out certain pollutants (filtration ponds). In either instance, stormwater is detained, allowing pollutants to be captured and later removed, while runoff is released to drain downgradient.

Typically, ponds are designed to treat the first half-inch of runoff, since 80% of pollutant loads (or volume of constituent pollutants) tend to be carried in this "first flush" of stormwater runoff. Note that while the term "ponds" is often used, as is "basin," to describe these permanent stormwater detention facilities, they may be designed as wet ponds or dry.

One of the biggest concerns with detention ponds is maintenance of the facilities. For them to function effectively, filtration ponds must be monitored closely and consistently, and the filtration media replaced regularly. Maintenance is crucial in pollutant removal. Detention ponds require long-term obligation, which may ultimately cost more than initial design and construction.

In some cities, such as Austin, maintenance for detention ponds is performed by the developer in commercial and industrial settings, while the City maintains ponds constructed in residential areas. The CSA, however, does not presently perform this function, and one may not assume that it will have the resources to do so in the future.

Local examples of detention ponds are found in the Fiesta Texas theme park. The park has four sand filtration basins, the largest of which is roughly 1,000 feet long, 20 to 30 feet wide, and five to six feet deep. This basin is designed to treat the first flush of 85 acres of paved parking lots, which accommodate more than 6,500 vehicles. The basin has a concrete bottom with a perforated drainpipe system embedded in one inch of large-sized (3/4 inch) gravel and a geotextile filter fabric, with 18 inches of washed sand overlaying the filter fabric. Runoff subsequent to the first flush, and that treated after sedimentation and filtration, is diverted to an adjacent flood storage area prior to release into Leon Creek.

Compared to the San Antonio area, entities in the Austin area have a much longer track record of using a variety of different detention facilities, in a number of different settings, and with a host of filtration media. For

example, the Barton Springs/Edwards Aquifer Conservation District has been researching the efficacy of using peat as a filtration medium for a highly impervious commercial area. Peat had been used previously in the Washington, D.C. area for its efficiency in removing oil and grease from stormwater runoff.

2) Diversion Facilities

These control devices are strategically placed to intercept runoff and divert it to another location. They may be installed to either keep clean water from crossing and eroding a disturbed area or to move pollutant-laden runoff to another location where it can be more effectively treated.

A local example of such a structure is the diversion "aquaduct" constructed by the TxDOT as part of the State Highway 211 project. The facility was constructed because of concerns expressed by the District regarding the roadway's bridge crossing the San Geronimo Creek upstream of a District-owned recharge dam. Given the dam's location, the risk of pollution from highway runoff or a potential spill of transported hydrocarbons or hazardous materials inspired TxDOT to design the million-dollar diversion project.

The facility is designed to capture runoff or a spill from either side of the roadway near the bridge, and funnel it into a drain which carries it into the aquaduct. The aquaduct in turn carries flows and deposits them into the San Geronimo Creek downstream of the dam, below the ERZ, without treatment.

3) Temporary Controls

In the construction phase, there is a wide array of controls which may be employed, either singularly or (often) in combination, to temporarily combat erosion and sedimentation.

Contaminants are most easily transported as particulates attached to soils disturbed during the construction phase of development. It is estimated that erosion from construction sites can contribute 50 to 40,000 times the erosion of either undeveloped or developed land. Therefore, the use of controls to mitigate potential pollution effects from construction activities is essential.

Types of temporary controls include:

- silt fencing
- rock berms
- reinforced rock berms

- brush berms
- diversion berms
- hay bale or sand bag dikes
- temporary sedimentation basins
- interceptor swales
- stabilized construction entrances

These controls may also include BMPs such as project phasing to grade and disturb soils only when necessary, minimization of erosion and sedimentation by temporary revegetation, and the use of matting or gabions to stabilize soils. Use of BMPs may also be incorporated as part of the permanent plan to maintain a site from potential erosion or sedimentation after development. An example of post-construction BMPs is increased street sweeping to collect particulates.

These types of structural and temporary controls tend to be costly in terms of design times, construction and maintenance costs, the considerable time and expense involved in project plan reviews, and in preparation by construction teams.

However, the ultimate benefits of performing such controls enables development to proceed with much less impact on the indigenous environment and on natural systems than otherwise.

VIII. Recommendations

OVERVIEW

The risk to our drinking water brought about by the laissez-faire approach to developing the ERZ is simply too great for inaction. The conclusion of scientists and researchers from around the country is that non-point source pollution is the single largest remaining threat to our water supply. But even if it were not, the unpredictable effects of dense urban development on water quality and the certain diminution of recharge caused by imperviously covering the ERZ, should evoke rigorous controls, if not self-restraint. Neither strict controls nor self-restraint is employed in ERZ development.

Each residential subdivision built on the ERZ brings a host of negative environmental consequences. And following close behind are all of the modern day necessities (read conveniences) that urbanites and suburbanites have come to expect. Among them are gasoline stations, dry cleaners, auto repair shops, bountiful strip centers, and plenty of parking. We cannot reasonably expect this special land area to function in the same manner once it succumbs to the bulldozer and automobile. But with reasonable land use controls and pollution abatement measures combined with

aggressive education, some types and amounts of development can occur on the ERZ with minimal risk.

The intrinsic value of ERZ land and its function must be recognized even if that value cannot be quantified according to traditional economics.

POLICY CONSENSUS

If urban development on the ERZ is to be held in check and stormwater quality protected, policy makers at all levels of government must come to recognize the Edwards aquifer and its recharge zone as the truly unique resource that it is, and develop the prudent and necessary regulations for its protection.

Staff recommends a policy summit among members of the TWC, Edwards Underground Water District Board or Edwards Aquifer Authority Board, County Commissioners Courts, and City Councils within the Edwards region. The principle purposes of the summit would be: (1) to determine if staff concerns and sense of urgency is shared by regulators and policy makers, (2) to examine the role of each regulator in protecting the ERZ and identify gaps and weaknesses in existing regulations, and (3) seek consensus on the need for aggressive protection efforts.

To date, public meetings and well meaning efforts of public officials have had little effect on the style and density of ERZ development. Little more can be expected if policy and decision makers at the highest level are not committed to change.

LAND USE CONTROLS

Some may equate land use regulations with heresy and cleave to inviolate rights of private property ownership. But the fundamental rights of private property ownership are matched by the public's right to a healthful environment.

Land use controls have long been used in the United States for a wide variety of regulatory problems. Municipal zoning laws have been used extensively throughout the country, most frequently to prohibit noxious uses in residential neighborhoods. In fact almost all states authorize zoning by counties.

Land use regulations to protect resources are not without precedents in that they advance the legitimate governmental purpose to provide for the health, safety, and well-being of its citizens. Wetlands protection, dredge and fill regulations, and historic districts are all examples of resource protection laws having broad public support. Benefits conferred by resource protection laws are widely dispersed among the general public, but those same benefits

are realized by those on whom the laws are imposed. Can aquifer protection be less important than historic districts?

There is a variety of land use controls (see Section VI) effective in abating stormwater pollution and preserving recharge capacity. Staff recommends each and combinations of the following:

- Buffer zones - appropriate setbacks from creeks and sinkholes; restrictions on land "reclamation," "channelizing" creeks, and cut-and-fill operations.

- Building density limits - significantly lower than the four to five housing units per acre common in suburban San Antonio.

- Impervious cover limits - directly related to building density; percent limitations less than that for typical residential subdivisions.

- Cluster development zones - maximize open space without sacrificing developable units.

- Zoning districts - create a special district, identifying prohibited uses and establishing special conditions and limits such as those listed above.

STRUCTURAL CONTROLS

Another approach to pollution abatement is to design, build, and maintain, in perpetuity, permanent structures to capture and treat polluted stormwater, before it percolates underground. Examples include sedimentation or filtration ponds and oil/water separators. In lieu of low density, low impervious coverage developments (and thus, lower stormwater runoff), structural controls are becoming the abatement method of choice. However, structural controls have significant drawbacks.

Structures designed to capture stormwater cannot account for a large percentage of the rainfall that percolates directly underground, without running off, or for storm events of a lesser magnitude from which stormwater may travel but a short distance, never reaching the structure. And for developments at the downstream end of the ERZ, sedimentation or filtration ponds may intercept runoff just before it flows off of the ERZ, thus affording little protection to the aquifer.

Perpetual maintenance of these pollution control structures raises some troublesome questions. Who maintains these structures and who pays for it? Who samples and analyzes the sediments or filtration media, removes the contaminants and replaces the media? Who maintains valves, weirs,

grates, and channels? Who monitors, regulates, and penalizes? These questions, more so than the efficacy of the structures themselves, cast shadows over their widespread use.

However, if sensible land use controls are not employed, staff recommends permanent structural controls, built by the developer according to recognized standards, and maintained in perpetuity by the tenants of the residential or commercial development they serve.

Staff especially recommends stormwater detention facilities for large paved areas such as mall, grocery store, or department store parking lots.

PERFORMANCE STANDARDS

There is great reluctance in local government to impose land use or pollution control requirements such as those mentioned above. But if a new law provides a good amount of latitude and flexibility, then the bitter pill is easier to swallow. Establishing performance standards for pollution concentrations allows a developer to determine how to meet those standards.

This alternative provides specific limits on concentrations of certain pollutants in stormwater, then requires the land developer to design a development that produces stormwater meeting those limits, using whatever land use, structural, or other techniques so desired.

The weakness in this approach, like that of structural controls, is that direct percolation of pollution is not taken into account, nor is the diminution of recharge. Administration of such an approach would require extensive modelling, testing, and monitoring.

Staff recommends this alternative when land use and structural alternatives are untenable or impractical.

LAND ACQUISITION AND EASEMENTS

ERZ and drainage area land acquisition and easement development are viable and necessary methods of protecting both the quality and quantity of water in the Edwards aquifer from the deleterious effects of development. The Board of Directors of the Edwards Underground Water District or Edwards Aquifer Authority working with staff should therefore continue and strengthen efforts to identify and protect hydrologically sensitive features and land areas on the ERZ and drainage area through land purchase and easement development.

With sufficient resources devoted to this purpose, such efforts may be the swiftest and most reliable methods of

reducing the amount of ERZ property exposed to the threats associated with urban development.

EDUCATIONAL ACTIVITIES

The District can and should utilize a wide array of educational activities to compliment any efforts to mitigate or prevent the deleterious consequences of urbanization. Throughout the District's history, educational efforts have been paramount, and this experience can be drawn on to accomplish specific District goals regarding ERZ development. Staff recommends the following strategies for reaching different target audiences discussed below.

General Public

Within the last several years, District staff has greatly increased its efforts to provide information to the public regarding water quality concerns, and many of these activities address some of the issues raised above. A water quality brochure was recently developed and distributed, numerous District newsletter articles have addressed the ERZ and water quality, and Public Service Announcements now include water quality messages. Staff has made countless slide presentations on environmental concerns relative to the Edwards aquifer to school children, teachers, and various interest groups. Professional actors have even been used to bring water quality concerns to school children in the area. Hopefully, all of these efforts have helped promote an environmental ethic as well as a better understanding of regional water quality issues.

As development on the ERZ increases, more of the general public will live, work, shop, and drive on the ERZ. It is now more important than ever, therefore, that the District continue these educational efforts. In addition, specific information should be provided to those people who live on the ERZ and therefore have the greatest potential - collectively if not individually - to impact the ERZ.

The majority of new homes which are being built on the ERZ are in residential subdivisions. New homeowners can be targeted via homebuilders and realtors marketing properties on the ERZ. A spectrum of water information could be included with the information packet commonly provided by the homebuilders on warranties, homeowner associations, etc. In addition to the relative ease of targeting this group, the advantage of providing information to new homeowners is that they may be informed of recommended landscape practices prior to planting.

Homeowners in established subdivisions on the ERZ may be targeted through homeowner associations which exist for

many of the residential subdivisions on the ERZ. (Even in new subdivisions where the homebuilder may distribute

information, homeowner associations should also be contacted as a means to provide information to homeowners that replace the original owners.)

Printed materials should include general information on the Edwards aquifer and the nature and sensitivity of the ERZ. It should also include specific recommendations for environmentally sound lawn care practices which maximize the use of native xeriscape plants and techniques, and minimize the application of chemical pesticides and fertilizers. In the event that a residential subdivision has a permanent structural control for stormwater for which the homeowner association is responsible for maintaining, then the appropriate information should be provided to the association. (Even if another entity such as the municipality is given maintenance responsibility, the homeowners should be made aware - through the builder or the homeowner association - of the structure's purpose.)

In addition to the written materials, the homebuilders and representatives of homeowners associations should be provided the opportunity to meet with District staff - when the materials are provided and anytime thereafter - to discuss the materials and District concerns. A slide presentation addressing these concerns could also be available.

The Regulated Community and Agencies Involved in ERZ Protection

As growth on the ERZ increases, the number of professional engineers and geologists experienced in WPAP preparation expands. Nevertheless, much uncertainty still exists concerning the existing requirements pertaining to ERZ and ETZ development, standards of enforcement by the TWC and other regulatory agencies, and District concerns.

In efforts to develop its Technical Guidance Manual for the Edwards Rules (see Section IV and Appendix 1, Section E), TWC staff has solicited input from professional engineers, geologists, municipalities, and District staff and representatives from other water districts. Meetings have been productive.

A forum for continued discussion amongst the regulated community and the enforcement/recommending entities at the state and local level, wherein various concerns may be discussed, discrepancies resolved, and solutions worked out, would be beneficial. To the extent that problems associated with ERZ development can be mitigated through structural controls, the engineering community may be able to provide expertise in developing and evaluating

structural alternatives. Several engineers have already expressed an eagerness to participate in such an activity.

OTHER

District staff also recommends the following:

- The Board of Directors of the Edwards Underground Water District or Edwards Aquifer Authority, and other governing bodies should adopt resolutions stating specific goals to protect the Edwards aquifer from deleterious effects of urban development on the ERZ and ETZ.

- The Board of Directors of the Edwards Underground Water District or Edwards Aquifer Authority working with staff, should develop an Edwards Recharge Zone Protection Program, promulgating appropriate rules and regulations, to replace or enhance the TWC's Edwards Program. The program and regulations should emphasize comprehensive land use planning, requiring or encouraging the land use controls, structural controls, performance standards, and educational activities recommended above.

- The Board of Directors of the Edwards Underground Water District or Edwards Aquifer Authority and staff should work with and solicit input from the TWC, County Commissioners Courts, and City Councils within the Edwards region to develop an Edwards protection program.

- District staff should continue to assist the TWC with development of their Technical Guidance Manual (see Section IV), with recommendations for more stringent and effective controls.

- District staff should continue to request, on a regular basis, that the TWC hold hearings on the Edwards Rules (see Section IV). Staff should continue to submit hearing testimony to the TWC, with recommendations for Rules modifications.

- The District should urge the TWC to issue periodic reports on the number and types of violations of the Edwards Rules.

- District staff should continue to develop a water quality data base, monitor stormwater quality through interlocal agreements with CSA (see Section IV), and collect water quality data from TxDOT (see Section V) and other agencies.

- District staff should continue to develop a land use data base by entering WPAP and other land use data into the District's Geographical Information System.

IX. Conclusion

A recent increase in development activities on the ERZ has heightened concerns by District staff that the current mechanisms in place to protect the Edwards aquifer from degradation associated with urbanization are not adequate. Staff believes that the cumulative impact on the Edwards aquifer of the various types of development - and their associated risks - is not currently being addressed. The lack of adequate comprehensive standards and regulatory controls to protect the aquifer against water quality degradation, coupled with the rapid pace of development over the ERZ at this time, and presumably for some time to come, suggests that degradation of water in the Edwards aquifer is imminent. Swift actions to implement more accurate impact assessment procedures and more stringent standards and controls on development activities are crucial if the District is to uphold its enabling legislation and resolutions adopted for the purpose of protecting the quality of the Edwards aquifer.

Appendix 1

Overview of Current Regulatory Agencies, Controls, and Activities

A. Environmental Protection Agency: Sole Source Aquifer Program

Under the Sole Source Aquifer Amendment to the Safe Drinking Water Act of 1974, the U.S. Environmental Protection Agency (EPA) Administrator is authorized to determine that an aquifer is the sole source of drinking water for an area. The Edwards aquifer was the first in the nation to be designated a Sole Source Aquifer by the EPA. The amendment also provides for (but does not require) EPA to review planned federal financially-assisted projects to determine their potential for contaminating a sole source aquifer. Based on this review, no commitment of federal financial assistance may be made for projects which the EPA Administrator determines may contaminate an aquifer.

The Sole Source Aquifer Program, Office of Ground Water, EPA Region VI is responsible for reviewing planned financially-assisted projects which may impact the Edwards aquifer. District staff's efforts to involve representatives of this office in the review of qualifying projects have been unsuccessful. The program appears to have virtually no effect on development activities on the Edwards Recharge Zone (ERZ).

District staff recently attended an EPA Regional Ground Water Protection Programs Technical Meeting concerning Sole Source Aquifer Programs. Discussions at the meeting revealed that administration of the Sole Source Program - throughout the country as well as in Region VI - is largely underfunded and given a low priority.

B. Environmental Protection Agency: National Pollutant Discharge Elimination System

The EPA recently published final rules concerning National Pollutant Discharge Elimination System (NPDES) permit application regulations for stormwater discharges. These regulations were designed to address the problems associated with stormwater runoff, including erosion, flooding, and water quality. One goal of the NPDES regulations is to improve the water quality of surface waters which are considered receiving waters from non-point stormwater runoff.

The NPDES regulations apply to municipalities, industry, and construction activities. All cities of 100,000 or greater population must be in compliance as a municipality, and are also required to obtain industrial permits.

Land developers proposing any construction activities on areas of five acres or more must file stormwater discharge permit applications prior to construction. The application must contain an effective plan to keep sediments and toxic materials in runoff from leaving the site. A stormwater detention pond or other sediment trapping mechanism is required unless the applicant can show that the use of such a mechanism is inappropriate or poses an undue hardship on the developer. Locally, the primary manifestation of NPDES so far has been the use of silt fences to control sedimentation in stormwater runoff leaving construction sites (both on and off the ERZ). These measures also are generally required by the Texas Water Commission (TWC) for ERZ construction projects (see Section E, below).

The NPDES permit program for cities the size of San Antonio has been in effect since November of 1992, but its full impact to this region has not yet been realized. Many of the mechanisms for regulation and enforcement are still being worked out on the federal, state, and local level. EPA has the authority to enforce the terms of its NPDES regulations but does not have sufficient resources to do so. Currently, the only mechanism by which a noncompliant industry or municipality may be forced to comply with NPDES is through the process of a third-party lawsuit. Cities are required, however, to submit to EPA by November, 1993, comprehensive stormwater management plans which are at least as stringent as EPA's regulations. After EPA approval of the CSA's plan, the City will be able to enforce the regulations within the corporate city limits.

C. Federal Emergency Management Agency

The Federal Emergency Management Agency (FEMA) was created to assist state and local governments by funding emergency programs to protect public safety and property. In 1968, FEMA created the National Flood Insurance Act. The Act established the National Flood Insurance Program, to provide insurance for communities who adopt flood plain management programs to mitigate future flood losses. The Act requires the identification of all flood plain areas and flood risk zones within the Extra Territorial Jurisdiction (ETJ) areas in which a community has land use jurisdiction.

D. U.S. Fish and Wildlife Service: Endangered Species Act of 1973

The Endangered Species Act of 1973 (ESA) prohibits the taking or harming of any species that has been

designated as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS). Although the purpose of the ESA is not ERZ protection, its mandate for protecting endangered species has far-reaching implications for planning and development in this area. The recent ruling against the USFWS for failure to protect the endangered species in Comal and San Marcos Springs is an example of the extensive influence of the ESA on water quantity management issues for Edwards users.

Although the ESA to date has had only minimal influence on water quality management issues in the Edwards area, it has the potential to impact ERZ development.

If a property is generally located where habitat for an endangered species occurs (or is otherwise believed to provide such habitat), USFWS may require that a biological survey be conducted. Confirmation of the species might result in USFWS requiring a buffer zone or other mitigation measure, or even prohibiting development, unless the developer can get USFWS concurrence that the intended land use will not impact the species.

Two USFWS-designated endangered species occur in Bexar, Comal, and Hays Counties: the Golden-cheeked warbler and Black-capped vireo. Areas of the ERZ coincide with habitat for these species, including known nesting sites of both species. In addition, several invertebrates known to inhabit caves in Bexar County have been petitioned for designation with USFWS as endangered or threatened. If a cave species is so designated, any activity which could impact its environment - such as construction near a cave entrance which alters the quantity or quality of runoff into the cave - could be restricted by USFWS.

District staff is aware of only one ERZ project which has been directly impacted by the ESA. A residential subdivision known to be Golden-cheeked warbler habitat is currently being developed. The USFWS required the project include a buffer zone of 50 to 150 feet wide. Some of this area was required to be dedicated as a wildlife reserve. An additional buffer within individual lots along the border of the reserve restricts the lot owner from constructing in this area. The TWC conditions of approval state that any development within the area designated as a wildlife reserve shall require a project specific WPAP prior to construction, and that buyers of affected lots shall be notified before purchase that no construction shall be allowed within the buffer zone.

E. Texas Water Commission

The TWC is responsible for protecting water in the State of Texas. As such, it is responsible for promulgating and enforcing 31 Texas Administrative Code, Chapter 313, known as the Edwards Rules (the "Rules"). The stated purpose of these Rules is to "regulate activities having the potential for causing pollution of the Edwards aquifer."

Regulated activities under these rules include any construction activities "which alter or disturb the topographic, geologic, or existing recharge characteristics of a site; or any other activities which may pose a potential for contaminating the Edwards aquifer." Prior to commencement of regulated construction activities on the ERZ, an applicant must obtain approval from the TWC for a Water Pollution Abatement Plan (WPAP). The contents must include information relative to preventing pollution of stormwaters on-site, downgradient of the site, and from entering recharge features. A geologic assessment of the site (and the adjacent area within the 100-year floodplain for a distance of one mile downstream of the development) is also required.

Sewer line construction on the ERZ is also regulated in the Rules and requires approval of a Sewage Collection System (SCS) Plan. The SCS application must comply with TWC standards for materials and construction methods. The TWC holds pre-construction meetings with representatives from San Antonio Water System (SAWS), the applicant, and engineers and contractors for the applicant for the purpose of coordinating sewer line and other infrastructure construction activities.

Underground and aboveground hydrocarbon and hazardous materials storage facilities on the ERZ as well as the ETZ are also regulated under the Edwards Rules. The Rules require double-walled containment and continuous monitoring systems for underground storage tanks. Aboveground tanks are required to be contained within an impervious berm sized to capture 150% of the tank volume. Plans for construction of hydrocarbon storage facilities must be submitted to the TWC for review and approval prior to commencement of construction.

District staff's opinion is that the Edwards Rules are inadequate to protect the Edwards aquifer from contamination associated with urban development. TWC staff does not have a review system in place by which to evaluate development activity in a cumulative manner.

Numerous WPAP applications which have received TWC approval under the Rules do not, in District staff's judgement, adequately address the prevention of pollution.

District staff maintains that the TWC's "Edwards Program," the program for administering the Edwards Rules, is understaffed. Despite the ever-increasing number of ERZ development applications being received by the District 8 (local) office of the TWC for review, the staff responsible for the program consists of only two persons. Final approval for projects under Edwards Rules review was recently transferred from the TWC central (Austin) office to the TWC local office, putting even more pressure on the local office to expedite its reviews. Furthermore, on several occasions staff was informed that developers had succeeded in placing pressure on TWC local office staff to expedite reviews by contacting high officials at TWC to ask that particular projects be prioritized. (When this occurs, District staff must likewise expedite the District's review or risk TWC final approval of projects prior to District submittal of comments and recommendations to the TWC.)

Crucial to the effectiveness of the Edwards Rules is enforcement monitoring. Structural devices such as silt fences are generally required by the TWC to control sedimentation during construction activities. Frequently, however, they are not maintained correctly by construction contractors, and therefore do not function effectively, if at all. The TWC Edwards Program staff, due to its small size, is unable to monitor this problem. Likewise, TWC staff does not routinely monitor operational hydrocarbon storage tank facilities for compliance with the provisions of their approval letter unless notified (usually by District staff) of a major violation.

Section 26.046 of the Texas Water Code states that the TWC shall annually hold a public hearing to receive testimony from the public on actions the TWC should take to protect the Edwards aquifer from pollution. These hearings have been held sporadically since 1979, some pursuant to public distribution of draft Rules, providing the opportunity for suggestions to be incorporated into the final Rules. The last changes to the Edwards Rules were made in March, 1990. The last public hearing regarding the Rules was held in February, 1992 as a result of a formal request by the District. Changes to the Rules as a result of that hearing have not been published.

Currently, the TWC is developing a Technical Guidance Manual (the "Manual") for the purpose of providing the regulated community with specific criteria for complying with the Edwards Rules. The Manual will outline minimum standards and design specifications for temporary erosion and sedimentation control structures, permanent stormwater pollution control measures, hydrocarbon storage tank installations, and sewage collection systems. A draft Manual is expected to be available to the regulated community by September 1993, and will be expanded and revised as necessary. District staff as well as representatives from other water districts, municipalities, and the regulated community have been participating in development of the Manual.

Although the Rules cannot be expanded or modified without a public hearing, wording within the Rules allows the TWC to exercise some discretionary powers regarding the protection of water quality. Thus, it is possible for the TWC to require more stringent measures of water quality protection than are specifically described in the Rules themselves or presently required by the TWC. The proposed Manual will be a means of standardizing such measures. The Manual may require that land use restrictions, structural devices, and education efforts (such as pesticide management programs for homeowner associations) be employed in varying combinations, appropriate to site-specific environmental and land use factors, as acceptable methods of permanent stormwater pollution control.

District staff is hopeful that implementation of the provisions of the proposed Manual will provide greater protection to the ERZ and ETZ than presently exists.

The TWC is also responsible for on-site sewerage (septic) system regulations on the ERZ. Chapter 285 of the Texas Administrative Code pertains to septic systems, with one section (285.18) titled "On-site Sewerage Facilities on Recharge Zones of the Edwards Aquifer." Bexar, Comal, and Hays Counties act as authorized agents to the state in enforcing these regulations (see Sections F, G, and H, below). The most significant requirements for septic systems on ERZ sites include:

- minimum lot sizes of at least one acre per living unit (compared to minimum lot sizes of 1/2 acre if there is an organized water line and one acre only if there is a private water well for sites not on the ERZ); and

- o minimum of four percolation performance tests on the proposed absorption field site (compared to two tests for non-ERZ sites).

TWC staff anticipates that these regulations will be modified in the future and may be more stringent than they are now.

F. Bexar County

Bexar County's involvement in ERZ regulation is limited to permitting of and enforcement of septic systems and landfills within its jurisdiction. The County acts as the authorized agent to the state by enforcing TWC regulations pertaining to septic systems (see Section E, above).

There are no zoning districts within Bexar County.

G. Comal County

Comal County's involvement in ERZ regulation is limited to permitting of and enforcement of on-site sewerage facilities within its jurisdiction. The County acts as the authorized agent to the state by enforcing TWC regulations pertaining to septic systems (see Section E, above).

H. Hays County

Hays County's involvement in ERZ regulation is limited to permitting of and enforcement of on-site sewerage facilities within its jurisdiction. The County acts as the authorized agent to the state by enforcing TWC regulations pertaining to septic systems (see Section E, above).

I. Municipality: City of San Antonio

State law gives the CSA authority for planning within its corporate limits. Within the CSA's ETJ, which generally extends five miles beyond the city limits, state law gives the City authority to regulate the subdivision of land and platting. The master set of rules for zoning and subdivision development within the CSA and its ETJ is Chapter 35 of the City Code known as the Unified Development Code (UDC).

ZONING

Zoning is one method by which land uses within the corporate limits of the CSA is controlled. Specific zoning restrictions apply to the ERZ within this boundary, which comprises about 15% of the ERZ in Bexar

County. Article III of the UDC describes the Edwards Recharge Zone District (ERZD), designated as an overlay to the regular zoning districts. Property located within this overlay district must also be designated within one of the regular zoning districts, such as residential or business, and authorized uses must be permitted in both the regular zoning district and the overlay district.

Certain land uses, such as chemical manufacturing, are prohibited over the ERZ. Other land uses, such as gas stations, are permitted only with approval from the CSA City Council.

All properties within the ERZD are classified as temporary R-1 (single family residence districts) prior to development. In order for a property within the ERZD to be re-zoned to a higher use category, the Zoning Commission's and City Council's approval must first be obtained. Approvals for higher use zoning on the ERZD are given with the condition that a TWC-approved WPAP will be submitted.

In addition, staff with the SAWS Aquifer Studies Division, Department of Water Resources submits recommendations to the Zoning Commission and City Council for proposed ERZD zoning cases. For each case, SAWS staff submits a report which includes a discussion of the intended land use for the development, geologic factors, environmental concerns, and environmental recommendations. These recommendations may be made part of the Zoning Commission and City Council approval, and City Council has occasionally denied a zoning application on the ERZD based on Edwards aquifer considerations. The SAWS recommendation is not based on an evaluation of the cumulative effect of development on the ERZ.

The CSA will not issue a building permit or certificate of occupancy for any development activity which is regulated under the Edwards Rules until a WPAP approval letter is issued by the TWC.

SUBDIVISION REGULATIONS

Virtually all of the ERZ in Bexar County which is not within the City's corporate limits falls within its ETJ (approximately eighty five percent of the ERZ in Bexar County). The City's Subdivision Regulations are contained in Article IV of the UDC, known as the Subdivision Code. It describes the City's regulations governing plats and subdivisions of land within its corporate limits and the ETJ to promote public health, safety and general welfare, and healthful development of

the City. No special requirements in the Subdivision Code pertain to development over the ERZ, with the following exceptions: the City requires a TWC-approved WPAP for subdivisions and a TWC letter of acceptance for sewer lines prior to development (but not prior to plat approval). Also, within the ERZ outside the City limits, a licensed master plumber must obtain a permit from the City's Planning Department for all private service lateral connections to the City's sewer system.

Staff with SAWS Aquifer Studies Division, Department of Water Resources submits a report to the CSA Planning Commission regarding plats on the ERZ within the ETJ of the City. Since there are no ERZ-specific requirements in the Subdivision Code, the Planning Commission does not base their decision upon this report.

A "Land suitability" section of the Subdivision Code states that the Planning Commission may disapprove a plat if the Commission finds the land to be unsuitable for development due to natural/environmental conditions which may pose a danger to health, safety, or property. Examples of conditions which may render land unsuitable are listed in this section and do not include the ERZ.

District staff suggests that the ERZ itself may render some areas unsuitable for development: if the aquifer becomes polluted as a result of that development, a long term danger to the health of Edwards aquifer users may indeed result.

OTHER

The CSA regulates all wastewater collection (sewer) systems which are connected to a City wastewater treatment plant. The City regulations for sewer systems are generally more restrictive than those of the Edwards Rules.

On-site disposal systems within the City limits must be permitted by the City Health Department, which enforces state regulations within its jurisdiction.

The CSA also requires licensing by the City Fire Department for anyone using explosives in the course of infrastructure development. The Fire Department also inspects hydrocarbon tank installations throughout the City.

The CSA is currently developing a city-specific code for stormwater regulations for incorporation into the UDC. The City's regulations are proposed to be more specific than the EPA's broad guidelines under NPDES, and will

include storm-water runoff restrictions pertaining to development over the ERZ. These regulations will focus on industrial sites.

J. Municipality: City of New Braunfels

The City of New Braunfels has no regulations pertaining to the protection of the Edwards aquifer from the effects of development over the ERZ.

K. Municipality: City of San Marcos

The City of San Marcos has no regulations pertaining to the protection of the Edwards aquifer from the effects of development over the ERZ. The City's Master Plan, however, includes recommendations developed in a study which designated a priority area within the City. This area, which includes parts of the ERZ, requires protection of its natural resources. Decisions on zoning/rezoning cases in the priority area may be based on protection of these natural resources, resulting in a lower intensity land use.

L. Other Agencies

As a result of the passage of Senate Bill 818 by the 72nd Legislature, 1991, the TWC has adopted sections of the Texas Water Code which require a program for water quality assessment by watershed. The San Antonio River Authority (SARA) has been named as the regional agency responsible for the planning, coordination, and implementation of the water quality assessment program for the San Antonio River basin. SARA is conducting a water quality assessment of the aquatic resources in the San Antonio River Basin. During the first year of the program, it has concentrated on organizing a Steering Committee, collecting and interpreting available water quality data from area agencies (including the District), and identifying citizen monitoring and public awareness opportunities.

Appendix 2

Representative Letters From District Staff to Texas Water Commission Regarding Water Pollution Abatement Plans

EDWARDS UNDERGROUND
WATER DISTRICT

FILE COPY

6.10-1.3-1

June 28, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road, Suite 360
San Antonio, Texas 78232-5042

Re: La Cantera West Office Building Water Pollution Abatement Plan (WPAP)

Dear Mr. Mauser:

District staff has completed its review of the application submitted for the above referenced WPAP, received on June 22, 1993. Staff inspected the site on June 23, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

Staff has particular concerns regarding commercial/retail projects on the Recharge Zone, due primarily to the anticipated high number of vehicles and the relatively high amount of impervious cover associated with such projects. Staff does note, however, that the percentage of impervious cover projected for this project is very low (17%) compared to other existing and proposed commercial/retail developments on the Edwards Recharge Zone.

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210-222-2204
FAX 222-9869

Staff believes that the measures described in this WPAP to prevent on-site and downgradient pollution by contaminated stormwater runoff from the site, during and after completion of construction, may provide protection to the Edwards Aquifer. Permanent measures include using existing vegetated areas as filter strips, using landscaping which will minimize the required amount of fertilizer and water needed for maintenance, and plans to sweep the parking areas monthly.

However, District staff reiterate the need for cumulative evaluations of Recharge Zone developments. We believe that performance standards based on these evaluations are necessary for setting effective removal efficiencies for abatement measures such as those being proposed.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc: Mr. Hank B. Smith, P.E., TWC
Mr. Tom Dreiss, La Cantera Development Company
Mr. Gene Dawson, Jr., P.E., Pape-Dawson Engineers
Mr. Scott Halty, SAWS

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EDWARDS UNDERGROUND
WATER DISTRICT

FILE COPY

6.10-1.3-1

June 1, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road, Suite 360
San Antonio, Texas 78232-5042

Re: Shavano Park, Unit 15D Water Pollution Abatement Plan (WPAP)

Dear Mr. Mauser:

District staff has completed its review of the application submitted for the above referenced WPAP, received on May 18, 1993. Staff inspected the site with Mr. Duane Moy with M.W. Cude & Associates and yourself on May 6, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

Stormwater runoff which is typical of residential subdivisions may be a source of pollution. The profligate use of pesticides and fertilizers in typical urban settings, accompanied by the increase in the use of commercial lawn care companies, is likely to contribute to contaminated stormwater runoff. Contamination from lawn care chemicals may be detected if residential subdivisions are evaluated collectively. This exemplifies the District's contention that Recharge Zone activities should be reviewed in a cumulative manner.

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Staff does note, however, that the percentage of impervious cover projected for this project is low (16%) compared to other existing and proposed residential subdivisions on the Edwards Recharge Zone. Concerns relative to the cumulative review process and use of lawn care chemicals notwithstanding, staff prefers low density, low impervious cover projects to other development projects on the Edwards Recharge Zone.

Furthermore, staff believes that the measures described in this WPAP to prevent on-site and downgradient pollution by contaminated stormwater runoff from the site, including a grass-lined channel, may provide protection to the Edwards Aquifer. However, we reiterate the need for cumulative evaluations of Recharge Zone developments. We believe that performance standards based on these evaluations are necessary for setting effective removal efficiencies for abatement measures such as those being proposed.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc: Mr. Hank Smith, TWC
Mr. Daniel D. Kossl, Denton Development Co.
Mr. Michael Cude, P.E., M.W. Cude & Associates, Inc.
Mr. Scott Halty, SAWS

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EDWARDS UNDERGROUND
WATER DISTRICT

FILE COPY

6.10-1.3-1
6.10-2.2-1

May 27, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer, Suite 360
San Antonio, Texas 78232-5042

Re: Diamond Shamrock No. 1038 at Loop 1604 and Bulverde

Mr. Mauser:

District staff has completed its review of the Underground Hydrocarbon and Hazardous Substance Storage application (HHSSA) and the Water Pollution Abatement Plan (WPAP) for the above referenced project, received on April 19, 1993 and April 27, 1993, respectively. Staff inspected the site on May 6, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission, (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

The need for this cumulative review process for hydrocarbon storage facilities is supported by data assessed by the Petroleum Storage Tank Division of the Commission, which indicates that releases attributed to underground storage tank systems are a widespread problem and can pose a significant threat of hydrocarbon contamination to the Edwards Aquifer.

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District staff notes several inaccuracies regarding the submitted equipment specifications. The Red Jacket interstitial vapor probe listed in the application has been discontinued since August 1, 1992. The Marley Pump Company currently offers liquid interstitial sensors as suitable replacements. Other discrepancies include incorrect model numbers for the liquid sump probe and the overfill prevention valve. The application also indicates that the overfill valve provides shutoff at both 90 and 95 percent of the tank's capacity. Additionally, the Red Jacket PPM 3000 is proposed as an overfill alarm although this function will be provided by the Red Jacket PPM 9000 system.

Staff discussed these inconsistencies with Mr. Kress, project engineer, to provide him an opportunity to rectify any errors prior to the Commission's official response. Mr. Kress responded by furnishing District staff with an appropriate serial number for overfill equipment which satisfies current federal and state flow restriction requirements. Mr. Kress stated that corrections would be made to the interstitial and sump probe portions of the application. He further explained that the proposal for a Red Jacket PPM 3000 system was submitted in error and should be omitted. District staff recommends that all revisions to the original application should be incorporated into the final HHSSA application submitted to the TWC for review.

Given the sensitivity of the Recharge Zone, which is characterized by the downstream recharge features identified in the assessment, the potential for water quality degradation resulting from point and non-point source contamination cannot be disregarded. Therefore, the District does not recommend approval for this type of land use within the Recharge Zone.

In the event the Commission grants approval of this facility, the District suggests the following:

1. An inspection of the final tankhold excavation should be conducted prior to installation of the underground storage tank system to verify the presence or absence of potential recharge features. The presence of any feature in the tankhold which would facilitate subsurface migration would necessitate relocating the underground storage tank system.

2. A release contingency plan and training program should be established for onsite personnel, in addition to the proposed released detection equipment training seminars.

3. Stormwater influent and effluent should be analyzed to establish the effectiveness of the sedimentation/ filtration basin to remove contaminants.

4. The Maintenance Plan and Schedule for Sedimentation and Filtration Basins should be revised such that the level of accumulated silt will be checked monthly, and the silt removed if it exceeds six inches. In addition, the level of accumulated silt in the filtration basins should also be checked monthly, and if the depth of the silt/pollutants exceed one half inch, it should be removed.

5. A definitive schedule for steam cleaning the parking lot pavement should be established and implemented.

District staff appreciates the opportunity to provide you with these comments and welcomes any questions you may have.

Sincerely,

Melissa M. Lopez
Environmental Protection Technician

MML/bmc
cc: Mr. Scott Halty, SAWS
Mr. Ed Kress, Diamond Shamrock

044mml

EDWARDS UNDERGROUND
WATER DISTRICT

FILE COPY

6.10-1.3-1

May 18, 1993

Mr. Hank Smith, P.E.
Texas Water Commission
P.O. Box 13087
1700 North Congress Avenue
Austin, Texas 78711-3087

Re: Proposed State Highway Improvements - Loop 1604 -
CSJ 2452 02 023 Water Pollution Abatement Plan (WPAP)

Dear Hank:

District staff has completed its review of the application submitted for the above referenced WPAP, received on April 20, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

District staff recognizes that highways by their nature provide some open space. We also recognize, however, that highway expansion encourages an increase in vehicular traffic with a resultant leakage of hydrocarbons, radiator fluids, and metal dust from brake linings. An increase in highway traffic also results in an increase in the risk of accidental spills of hazardous materials caused by collisions. In addition, an increase in commercial development activities - including gas stations and parking lots for retail facilities - with their associated contribution of contaminants to stormwater runoff, may be expected to result from the easier access afforded by highway expansion.

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District staff believes that the above-referenced application demonstrates a willingness to mitigate the effects of stormwater runoff, both during and after construction, and staff applauds this effort. Beyond the measures proposed, staff can offer no other techniques for effectively protecting the Edwards aquifer against the effects of highway expansion. If the Recharge Zone becomes densely developed, staff hopes that the use of permanent stormwater pollution control measures, such as the Hazardous Materials Traps and vegetative channels proposed for this project, becomes commonplace.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc: Mr. John Mauser, TWC, District 8
Ms. Julia M. Brown, P.E., TxDOT
Mr. G. Michael Kyrish, P.E., Raba-Kistner Consultants
Mr. Scott Halty, SAWS

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EDWARDS UNDERGROUND
WATER DISTRICT

FILE COPY

6.10-1.3-1

May 13, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road
San Antonio, Texas 78232-5028

Re: Fiesta Trails Subdivision Units 1, 2, and 3 Water Pollution Abatement Plan (WPAP)

Dear Mr. Mauser:

District staff has completed its review of the application submitted for the above referenced WPAP, received on April 20, 1993. Staff inspected the site with Mr. Keith Pyron with Vickrey & Associates, Mr. Kirk Nixon with San Antonio Water System, and yourself on April 14, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

Staff has particular concerns regarding commercial/retail projects on the Recharge Zone, due primarily to the anticipated high number of vehicles and the relatively high amount of impervious cover (94.36% for this project) associated with such projects. These concerns will not be fully alleviated until the implementation of more comprehensive evaluation procedures such as a cumulative review. Staff believes that the measures described in this WPAP to prevent on-site and downgradient pollution by contaminated stormwater runoff from the site, including sedimentation/sand filtration basins with oil absorbent booms, flow across undeveloped acreage, and flow across a vegetated swale may provide protection to the Edwards Aquifer.

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However, we reiterate the need for cumulative evaluations of Recharge Zone developments. We believe that performance standards based on these evaluations are necessary for setting effective removal efficiencies for abatement measures such as those being proposed.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc.: Mr. Hank Smith, TWC
Mr. Mike Birnbaum, Cencor Realty Services
Mr. Larry Heimer, P.E., Vickrey & Associates, Inc.
Mr. Scott Halty, SAWS

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EDWARDS UNDERGROUND
WATER DISTRICT

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6.10-1.3-1

May 12, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road
San Antonio, Texas 78232-5028

Re: De Zavala Ten Water Pollution Abatement Plan (WPAP)

Dear Mr. Mauser:

District staff has completed its review of the application submitted for the above referenced WPAP, received on April 20, 1993. Staff inspected the site with Mr. Joe Nix and Mr. Kerry Koehler with W.F. Castella & Associates, Inc., and Mr. Thomas Gutierrez with the Texas Water Commission (Commission) on May 11, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Commission that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

Furthermore, in light of growing concerns with the environmental impact of stormwater runoff, as evidenced by the new National Pollution Discharge Elimination System (NPDES) requirements, the District urges the Commission to consider requiring <u>permanent</u> stormwater controls for subdivisions and other developments which may contribute to stormwater pollution after construction activities cease.

The profligate use of pesticides and fertilizers in typical urban settings, accompanied by the increase in the use of commercial lawn care companies, is likely to contribute to contaminated stormwater runoff. Contamination from lawn care chemicals may be detected if residential subdivisions are evaluated collectively.

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Under the "Temporary and Permanent Stormwater Pollution Abatement" section, "After Completion of Construction" subsection of the WPAP, requiring the applicant to identify any potential sources of contamination, the response is that "the low density residential development should result in any hydrocarbon leaks being diluted to harmless concentrations before leaving the development. District staff contends that this statement is not substantiated with data. Furthermore, even if dilution is considered a mitigating factor for this development, it may cease to be a mitigating factor at some point in the future if other surrounding development activities also contribute "diluted" hydrocarbons or other associated contaminants to stormwater runoff. This exemplifies the District's contention that Recharge Zone activities should be reviewed in a cumulative manner.

In response to the requirement to describe measures to prevent upgradient or on-site pollutants from flowing across or from the site or entering any recharge features, the applicant states that "... there would be no appreciable potential for stormwater pollution originating from upgradient or on-site." District staff contends that this statement is not substantiated with data.

The applicant states in the WPAP that, "the utility infrastructure construction may require pre-blasting of the trenches and backfilling of the trenches until the utility line is to be installed." The District does not condone approval of blasting prior to the Commission's approval of the Sewer Collection System (SCS) for the project. Such pre-approval presupposes that the project's SCS will be approved, and specifically that the sewer line placement will be approved in the location indicated. A thorough Commission review of the SCS application should be prerequisite to the approval of any sewage collection system activity, including excavation.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc: Mr. Hank Smith, TWC
Mr. Herb Quiroga, RAYCO, Ltd.
Mr. Steven E. Hanan, P.E., W.F. Castella & Associates
Mr. Scott Halty, SAWS

010gkk

EDWARDS UNDERGROUND
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6.10-1.3-1

April 15, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road
San Antonio, Texas 78232-5028

Re: Inwood Hollow Development Water Pollution Abatement Plan (WPAP)

Dear Mr. Mauser:

District staff has completed its review of the application submitted for the above referenced WPAP, received on March 31, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

Furthermore, in light of growing concerns with the environmental impact of stormwater runoff, as evidenced by the new National Pollution Discharge Elimination System (NPDES) requirements, the District urges the Commission to consider requiring permanent stormwater controls for subdivisions and other developments which may contribute to stormwater pollution after construction activities cease.

In the section of the WPAP which requires the applicant to identify potential sources of contamination, the response is that, "there does not appear to be any particular source of pollution from this development. Stormwater runoff is expected to be typical of residential subdivisions.

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Approximately 60% of the development will be well maintained yards and grassed drainage easement." District staff contends that stormwater runoff which is typical of residential subdivisions - particularly from "well maintained yards" - may indeed be a source of pollution. The profligate use of pesticides and fertilizers in typical urban settings, accompanied by the increase in the use of commercial lawn care companies, is likely to contribute to contaminated stormwater runoff. Contamination from lawn care chemicals may be detected if residential subdivisions are evaluated collectively. This exemplifies the District's contention that Recharge Zone activities should be reviewed in a cumulative manner.

The geologic assessment for the project identifies a cave in the flood plain of Salado Creek downgradient from the site. Described as a vertical shaft within the Edwards Limestone, this feature reportedly drains an area of greater than 2000 acres including a portion of the proposed site. The feature is assessed as highly sensitive with respect to recharge of the Edwards Aquifer. The cave opening is only a few feet above the flowline of Salado Creek. It is about 600 linear feet south of the northernmost end of the project, and about 75 feet west of the westernmost end of the project.

The WPAP states that during construction, this feature would be protected by the placement of a silt fence along the downgradient side of the construction area which could drain toward the cave. Due to the proximity of the cave to the project site and to its sensitive nature, District staff recommends that the Commission require additional silt fencing be placed around the feature during all construction activities, including the construction of individual homes on the lots immediately upgradient of the feature. This additional fencing should be maintained in the manner described in the WPAP for the silt fencing proposed. All fencing should be rigorously monitored for conformance with the maintenance plan and schedule.

The WPAP proposes that after completion of construction, a permanent drainage channel with a silt trap will discharge to the creek near the cave. District staff recommends that more effective measures be required to prevent pollutants from entering the cave after completion of construction.

- A drainage channel is proposed for the northwestern end of the project to discharge runoff from lots and street in that area. The discharge point will be about 600 feet upgradient of the cave. In order to prevent

hydrocarbons from street runoff and lawn care chemicals from lot runoff from reaching the feature, staff urges the Commission to require the plan be modified such that runoff is not discharged into the creek upgradient from the cave. Mr. Robert Leisman, project engineer, indicated to District staff that it might be feasible to divert runoff from this area via the streets to the southern end of the property, for discharge into the creek downgradient of the cave. Another, less preferable alternative, also discussed with Mr. Leisman, is the substitution of the proposed concrete channel with a natural vegetation channel. Mr. Leisman has expressed a willingness to incorporate these suggestions into a plan modification, if so directed by the Commission.

- The cave should be protected from runoff from the lots on the westernmost end of the project which will drain as sheet flow into the creek just upgradient of or adjacent to the cave opening. The opening is only about 75 feet west of the closest lot. District staff urges the Commission to require a vegetative buffer strip between the lots and the creek. This area should not be included in the individual homeowners' lots; it should be maintained by San Antonio Water System (the entity indicated in the WPAP for responsibility for maintaining any permanent sedimentation/filtration structures); and the application of lawn care chemicals within this area should be prohibited. In addition, or alternatively, an interceptor drain should be required which would divert most of the sheet flow runoff from the lots in this area to a discharge point which is downgradient of the cave. Mr. Leisman has indicated the feasibility of incorporating these suggestions into a plan modification, if so directed by the Commission.

Contamination associated with typical urban settings presents a problem which is not resolved by diversion around one major recharging feature in a recharging creek. District staff is concerned that lawn care chemicals and hydrocarbons may reach the Edwards Aquifer through the many downgradient recharging features within Salado Creek.

The cave in Salado Creek provides strong evidence that the rock under the site and within the downgradient flow paths is karstic in nature, and that opportunities may exist for rapid infiltration of surface water, and contaminants associated with surface water, from the development. This clearly exemplifies the dilemma of attempting to protect the Edwards Aquifer while developing the Recharge Zone.

Diverting runoff around the cave and providing a vegetative buffer in the area immediately upgradient may provide nominal protection to the aquifer, but at the expense of lost recharge. Beyond these suggestions however, District staff can offer no other technique for effectively protecting the Edwards Aquifer.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Michael J Ulock

For Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc: Mr. Dan Kossl, Lee - 1604 No. One, Ltd.
Mr. Robert Liesman, Macina, Bose, Copeland & Assoc.
Mr. Scott Halty, SAWS

014gkk

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WATER DISTRICT

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6.10-1.3-1

February 3, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road
San Antonio, Texas 78232-5028

Re: La Cantera West Golf Course Water Pollution Abatement Plan (WPAP)

Dear ~~Mr. Mauser~~ John:

District staff has completed its review of the application submitted for the above referenced WPAP, received on January 4, 1993. Staff inspected the site with Mr. Ruben Cervantes with Pape-Dawson Engineers; Mr. Mark Dobson with Raba-Kistner Consultants, Inc.; Mr. Scott Halty and Mr. Kirk Nixon with San Antonio Water System; and yourself on January 21, 1993, January 22, 1993, and January 26, 1993.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

Furthermore, in light of growing concerns with the environmental impact of stormwater runoff, as evidenced by the new National Pollution Discharge Elimination System (NPDES) requirements, the District urges the Commission to consider requiring <u>permanent</u> stormwater controls for subdivisions and other developments which may contribute to stormwater pollution after construction activities cease.

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Measures are described in the "Temporary & Permanent Stormwater Pollution Abatement" Section of the WPAP for: preventing pollution of stormwaters originating upgradient of the site; originating on-site; preventing downgradient pollution by contaminated stormwater runoff from the site; and preventing pollutants from entering any recharge features identified in the geologic assessment, both during and after completion of construction. These measures include various temporary and permanent measures to capture the first half inch of runoff, provide for reuse of captured storm waters as irrigation water for the golf course, and provide an isolated system for keeping the storm waters trapped in the basins on site. These measures consist of the use of hay bales, silt fences, diversion/ filtration berms, diversion channels, an underground bypass storm drain system, vegetated filter strips, grass bunkers/basins, sediment/detention basins, and interceptor berms/channels. District staff believes these measures will prevent or substantially mitigate downgradient pollution by contaminated stormwater runoff originating upgradient and on the site.

District staff does have concerns regarding on-site contamination resulting from direct infiltration of fertilizers and pesticides associated with golf course maintenance.

One hundred fourteen on-site potential recharge features were identified in the geologic assessment. Most of these features are vuggy or fractured rock outcrops. Based on the professional judgement of the geologists conducting the assessment, one feature was assessed as a low level of concern, and the other 113 were not considered sensitive features. (Based on the San Antonio City Council's Committee on the Aquifer flow chart, 31 features were assessed as a moderate level of concern, 12 as a low level of concern, and 71 were not considered sensitive features.)

According to Mr. Dobson, one of the consultant geologists, a significant factor in some of these potential features being assessed as not sensitive or of low concern, rather than a higher level of concern, is the relatively steep gradient where they occur which would allow little if any opportunity for runoff to enter these features. District staff notes, however, that the runoff factor will change substantially in all areas where grasses are established. Activities which might impact these features should therefore be evaluated accordingly.

Further concern by District staff stems from the belief that, on the Edwards Aquifer Recharge Zone, direct infiltration of surface water runoff into the subsurface is not limited to areas identified as recharge features, but may occur in other areas as well.

The potential of an applied fertilizer or pesticide to migrate downward through identified recharge features or other recharge areas into the aquifer largely depends upon the extent to which the chemicals are adsorbed onto the soil particles or taken up by the grass thatch or grasses. The potential for this adsorption or uptake is dependent upon a variety of factors, including the chemicals used, soil type, soil moisture content, and grass type. District staff is aware that many of these factors cannot be determined until the golf course nears completion. Responsibility for the application of chemicals will rest with the golf course superintendent, a position which is not yet filled.

District staff contends that despite the lack of currently available detailed information on chemical application practices associated with this project, such information is nevertheless critical to an evaluation of the project's impact to the Edwards Aquifer. Staff therefore urges the Commission to require the applicant to submit, at such time as is known, documentation describing the program for application of fertilizers and pesticides associated with golf course maintenance. The documentation should include a list of chemicals anticipated for use, a description of application methods, and an application schedule. As the program is adjusted, new reports should be submitted for review. In addition, the superintendent should be required to maintain on-site records of all chemical application activities.

At the District's request, Mr. Cervantes submitted by letter of January 25, 1993, and copied to the Commission, a description of some golf course maintenance practices proposed, and a list of fertilizers and pesticides commonly used in south central Texas. He has indicated that the list includes products likely to be used for the project, but may contain products which will not be used. Selection of the fertilizer and pesticide products for this project has not yet been made and will depend on a number of factors.

District staff does, however, submit comments and recommendations regarding maintenance practices described and chemicals listed in Mr. Cervantes' letter.

District staff favors the computer controlled "watered-in" golf course irrigation system described. Staff recommends that moisture content in the soils be monitored for evidence of cracking, which might allow for rapid downward migration of chemicals. Although overwatering should be avoided, enough water should be applied to the areas receiving chemicals to prevent soils from cracking.

Staff agrees that the underdrain system for the greens and tees will provide some protection against downward migration of chemicals into the aquifer. Staff also strongly supports the use of Integrated Pest Management techniques to reduce the need for pesticides.

One of the fertilizer products listed, Milorganite, is derived from sewage sludge. District staff advises that this or any other sludge derived fertilizer be used only if the heavy metal content can be shown not to exceed that of other commercial fertilizer products.

District staff recommends that future documentation describing the golf course maintenance program include a list of pests to be targeted by each insecticide, since insecticide use - and its impact on the environment - may vary according to the pest it is intended to control. (For example, in order for the insecticide product DURSBAN to effectively control fire ants, it must be applied frequently, applied through subsurface injection, or applied by drenching the mounds, while control of other pests involves less intensive application techniques.) Staff further recommends that the hormonal insect growth regulator product, Award (previously called LOGIC), or a similar product be used for fire ant control, rather than a traditional chemical insecticide.

The herbicides and fungicides on the list are rapidly metabolized, adhere to clay soils, and have relatively short half lives. Of those listed, the herbicide product Prowl is, staff believes, the least preferable due to a longer half life (3-4 months) than those of the other products listed.

District staff also urges the Commission to require the applicant to install and use subsurface sampling devices, such as pan lysimeters, to monitor any effects of chemicals applied to the golf course turf on the quality of runoff and leachate. Routine analyses of samples should be conducted and records maintained on site. Groundwater monitor wells might also be required for sampling.

Thank you for your attention to our concerns, and if you have any questions please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK/bmc
cc: Mr. Gary Newman, USAA Real Estate Company
Mr. Ruben Cervantes, P.E., Pape-Dawson Engineers
Mr. Scott Halty, SAWS

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6.10-2.2-1
6.10-1.3-1

January 19, 1993

Mr. John K. Mauser
Texas Water Commission, District 8
140 Heimer Road
San Antonio, Texas 78232-5028

Re: Andy's Convenience Store II

Dear ~~Mr. Mauser~~:

District staff has completed its review of the Water Pollution Abatement Plan (WPAP) and the Underground Hydrocarbon and Hazardous Substance (UHHS) Application for the above referenced project, received on December 9, 1992 and December 16, 1992, respectively. Staff inspected the site on December 16, 1992.

At public hearings on the Edwards Rules in 1988, 1989, and 1992, District staff recommended to the Texas Water Commission (Commission) that Commission staff collectively evaluate plans submitted for activities on the Edwards Recharge Zone. Each application for a proposed development should be reviewed with consideration of a background of existing conditions. The District's concerns regarding development over the Edwards Recharge Zone will not be alleviated until such time as Commission staff considers such controls for Recharge Zone developments and follows procedures by which to evaluate plans in a cumulative manner.

The need for this cumulative review process for hydrocarbon storage facilities is supported by data assessed by the Petroleum Storage Tank Division of the Commission, which indicates that releases attributed to underground storage tank systems are a widespread problem and can pose a significant threat of hydrocarbon contamination to the Edwards Aquifer.

Furthermore, in light of growing concerns with the environmental impact of stormwater runoff, as evidenced by the new National Pollution Discharge Elimination System

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(NPDES) requirements, the District urges the Commission to consider requiring permanent stormwater controls for subdivisions and other developments which may contribute to stormwater pollution after construction activities cease.

District staff has specific concerns that some aspects of UHHS application for the above referenced project are not adequate to protect the Edwards Aquifer. Several discrepancies and omissions in the application were also noted. These concerns and recommendations were relayed to Mr. Mark Brown with Brown Engineering Company to provide the applicant the opportunity to correct these problems prior to the Commission's final consideration of the project. Mr. Brown's responses (attachment #1) were submitted by letter of January 12, 1993 to District staff.

District staff has reviewed the letter and determined that some of the responses adequately resolve the problems in question; staff recommends that these items be incorporated into a revised UHHS application. Staff has found that other responses, however, do not adequately address our concerns, and recommends that the Commission require these items to be treated as discussed below and then be incorporated into the revised UHHS application. The response numbers below refer to the responses in Mr. Brown's letter.

Response 1

The revised model number for the dispenser end flexible connector is incorrect according to Titeflex (the manufacturer for the connectors) and the Commission PST Technical Services Division and should be corrected. The revised model number for the pump end flex connector is correct and should replace the incorrect model number in the application. Also, the appropriate updated equipment brochures should be provided to the Commission as soon as they are available, as indicated in the response.

Responses 2, and 3

The model numbers for the monitor well probe and interstitial tank probe are correct and should replace the incorrect model numbers in the application.

Response 4

This information should be incorporated into the application.

Response 5

District staff is concerned that faults and voids may be present within the proposed tank location which could provide an avenue for rapid infiltration in the event of a release. Mr. Brown submitted logs for two borings taken at the previously proposed tank location site and a map indicating the locations. He stated that borings have not been taken at the currently proposed tank site and that the contractor will determine the presence of voids prior to major excavation. District staff believes that this cannot be determined without bore samples, and urges the Commission to require that borings be taken at the newly proposed tank location prior to excavation.

Response 6

District staff expressed an uncertainty about the ability of the proposed system to detect a release given the extensive length of piping. Mr. Brown addressed this concern by proposing to relocate two of the four monitor wells to the outside of the tank pit liner, to locations as yet unspecified. District staff maintains that two detection points within the tank pit are insufficient, and recommends the following placement of six monitor wells: two wells within the tank pit liner, two wells outside of the liner but within the immediate tank pit, and one well each at the two areas where the piping is angled at 90 degrees (indicated on attachment #2).

Also, District staff recommends weekly manual inspections of unmonitored wells for the presence of hydrocarbons, with documentation maintained on site.

Response 7

This information should be incorporated into the application.

Response 8

District staff recommends that the revised schedule for the vegetative filters, as well as a provision for maintaining a written record of inspections and any necessary maintenance be incorporated into both the UHHS application and WPAP as a condition of approval.

Of great concern to District staff is an off-site subsurface geologic feature. Appendices of both the WPAP and UHHS applications contain supplemental information on this feature, stating that site investigations performed for the project revealed an "open vertical shaft" located about 70 feet north of the north property line of the site. This feature was not evaluated in the geologic assessment since it was determined to be upgradient of the site.

At the District's request, Mr. Brown attempted to obtain permission from the landowner of the property on which the feature is located for cavers to conduct a subsurface investigation, but permission was not granted. Mr. Brown did submit a general description of the feature to the District (attachment #3), based on measurements he made from the entrance to the feature. He indicated there are no horizontal shafts and no evidence of flows.

During a field inspection of the feature conducted by District staff on December 16, 1992, some moisture was observed on the sides of the feature indicating that the feature had received some recharge. A drainage pathway to the feature from the south indicates that, contrary to the geologic assessment, the feature may be downgradient from the site. The moisture and drainage pathway were both documented in photographs.

District staff maintains that due to the proximity of the feature to the site, the nature of the proposed project, and the possibility that the feature may be downgradient from the site, it should be evaluated in a revised geologic assessment. Furthermore, given the size of the visible portion of the feature, a thorough subsurface investigation is necessary to determine the extent and recharge capacity of the feature. Otherwise it should be assumed to be a potentially significant recharging feature.

The District therefore urges the Commission to require a more thorough investigation of the feature prior to final consideration of the project by the Commission and the District. Continued efforts should be made to obtain permission from the landowner to allow a caver to conduct a subsurface assessment. Without more information, and given the risks associated with underground hydrocarbon storage facilities, the District recommends the Commission not grant approval for construction of this project.

Thank you for your attention to our concerns, and if you would like copies of the above-referenced photographs of the recharge feature, or have any questions, please let us know.

Cordially,

Gayle K. Kipp
Environmental Coordinator

GKK:MML/bmc
cc: Mr. Rudy Rosas
Mr. Mark S. Brown, Brown Engineering Company
Mr. Scott Halty, SAWS