

EDWARDS AQUIFER AUTHORITY

FINAL

**REGULATORY IMPACT ASSESSMENT
FOR PROPOSED RULES
CHAPTER 711, SUBCHAPTERS E (GROUNDWATER WITHDRAWAL PERMITS), G
(GROUNDWATER AVAILABLE FOR PERMITTING; PROPORTIONAL
ADJUSTMENT; EQUAL PERCENTAGE REDUCTION) AND K (ADDITIONAL
GROUNDWATER SUPPLIES)**

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EXECUTIVE SUMMARY

Under its Legislative mandate, the Edwards Aquifer Authority (“Authority”) has the responsibility “... to manage, conserve, preserve, and protect the Aquifer and to increase the recharge of, and prevent the waste or pollution of water in the Aquifer” (S.B.1477, 73rd Legislature of the State of Texas, 1993). The Authority’s Board of Directors has determined that to effectively implement the Act it is necessary to enact rules. In certain cases involving Proposed Rules having potentially widespread and substantial effects on the public, the Board’s policy is to direct the General Manager, through the Authority’s General Counsel, to conduct an assessment of the potential impacts of the Proposed Rules – both adverse and beneficial. This document assesses the impact of the Proposed Rules creating "interruptible withdrawal rights" ("Interruptible Rights") in lieu of compensation when Initial Regular Permits ("IRPs") are proportionally adjusted below the statutory minimums under the Phase-2 Proportional Adjustment. The Proposed Rules are found within Chapter 711, Subchapters E (Groundwater Withdrawal Permits), G (Groundwater Available for Permitting; Proportional Adjustment; Equal Percentage Reduction) and K (Additional Groundwater Supplies), §§711.98 (Initial Regular Permits), 711.164 (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits), 711.176 (Groundwater Amounts for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts), and 711.304 (Allocation of Additional Groundwater Supplies).

In essence, if these Proposed Rules are adopted as Final Rules, qualifying IRPs will be issued with two groundwater withdrawal amounts: (1) an "Interruptible Right"; and (2) an "Uninterruptible Right". The Interruptible Right is subject to interruption when the San Antonio Pool Index Well J-17 is less than or equal to 665 feet above mean sea level (msl), and the Uvalde Pool Index Well J-27 is less than or equal to 865 feet msl. The Uninterruptible Right is subject to interruption when the San Antonio Pool Index Well J-17 is less than or equal to 650 and the Uvalde Pool Index Well J-27 is less than or equal to 845 feet msl. (Note: in this regard the Uninterruptible Right is misleadingly named. That is to say the Uninterruptible Right is, in fact, also interruptible, but under lower Aquifer levels than apply to Interruptible Rights. Because this is the terminology employed by the Act in §1.14(f), for this reason the Authority adopts this terminology.) Additionally, withdrawals of the Interruptible Right are not accounted for with respect to the §1.14(b) 450,000 acre-feet annual withdrawal "cap". Uninterruptible Rights do apply with respect to the cap.

Impacts on the Authority include additional monitoring and enforcement responsibilities to oversee accounting for Interruptible and Uninterruptible Rights to ensure that Interruptible Rights are withdrawn only when the applicable index well levels exceed the

specified trigger levels. As the effects of the Proposed Rules become apparent it may become necessary to provide more regulatory and administrative definition for purposes of monitoring compliance. Subsequent rule making for this purpose may create the need for additional staff. Even if additional staff is not indicated for the period between the effective date of the Proposed Rules and December 2007, in the event the Proposed Rules are adopted as Final Rules, it would be prudent to update the Strategic Plan to reflect these changes.

Users would avoid the substantial costs of contributing through Aquifer management fees to compensation for certain proportional adjustments required under the current rules. Municipal and industrial users would benefit most, as under the current provisions of the Act and Authority rules, they would bear a disproportionate burden of these costs. If reducing withdrawals to 450,000 acre-feet per year is to be financed with Aquifer management fees over a short period of time (as allowed under Section 1.29 (b) "...and programs authorized under this article,") then the \$2 limit for irrigation users (Section 1.29 (c)) would effectively shift much of the cost of reducing withdrawals to 450,000 acre-feet per year to M&I users because of Section 1.29 (e), as interpreted by the Authority. The Proposed Rules would eliminate the potential relative advantage to irrigation users arising from the Aquifer management fee rate cap of \$2 per acre-foot for the withdrawal reduction program to 450,000 acre-feet per year.

Impacts on the regulated community would include deletion of compensation and the creation of Interruptible Rights for some IRP holders in each of the user groups (municipal, industrial, and agricultural) as a result of Phase-2 Proportional Adjustment. For 2004, IRPs would be Phase-2 proportionally adjusted by a projected 10.45 percent and for those where the adjustment resulted in an IRP amount below the statutory minimums, their IRPs would be granted both an Interruptible and Uninterruptible Right. Additional Phase-2 Proportional Adjustments (and possible Phase-1 Proportional Adjustments) would take place between 2005 and 2007 as interim authorization status permits become effective on January 1st of each of those years. Under the Proposed Rules, there would be no compensation for an adjustment in an IRP due to Phase-2 Proportional Adjustment. According to this analysis, Interruptible Rights (particularly in the San Antonio Pool) would have limited market value (leases may be more feasible than sales) but would be useful under certain management strategies for the Edwards Aquifer Authority.

Impacts on the Aquifer include potential withdrawals of both Uninterruptible and Interruptible Rights when index well levels allow for Interruptible Rights to be withdrawn (during "high" Aquifer conditions). Although both Interruptible and Uninterruptible Rights could potentially be completely withdrawn by the end of the year, in these situations water levels

and springflows would be at high levels, meaning that excess pumpage would not result in adverse effects at Comal and San Marcos springs. Extremely low springflows at Comal Springs occur when water levels at J-17 are well below 665 feet msl which precludes the use of Interruptible Rights. By creating Uninterruptible Rights, the Authority can limit pumping to the amount required by the Act when water levels are within certain limits (while honoring historical average and irrigator minimums), thereby preserving minimum springflows under most conditions.

There is little evidence that creation of an Interruptible Right by the Proposed Rules would directly increase Aquifer demand during wet periods, except for the planned implementation of Aquifer storage and recovery (ASR). The ASR project would have positive effects on springflow by reducing demand for Aquifer pumping during dryer periods because stored surplus water could be utilized.

During non-drought conditions, effects of the Proposed Rules may result in decreased Aquifer levels and associated decreased springflow. However, estimates of springflow and biological impacts suggest that the Proposed Rules would have negligible impacts to the Aquifer and its biological resources. Any adverse impacts would be substantially mitigated by the ability to transfer water from the Aquifer during wet periods using Interruptible Rights when the Aquifer level is above 665 msl at J-17 for future ASR projects to reduce pumping demand and protect springflow when droughts occur. Additional mitigation would likely be provided through implementation of biological and Aquifer management measures identified in the Authority's proposed Draft Habitat Conservation Plan currently under development.

The key change in these Proposed Rules is the introduction of Interruptible Rights, instead of monetary compensation, in exchange for Phase-2 Proportional Adjustments below the statutory minimums. In so doing, both the "cap" and the "minimums" as set out in §§1.14(b) and 1.16(e), respectively, can be satisfied. The following sections of this rules assessment investigate various aspects of the issues introduced above.

1.0 INTRODUCTION

1.1 EDWARDS AQUIFER AUTHORITY RULES ASSESSMENT PROCESS

In 2001, the Legislature of the State of Texas determined that the rule-making function of the Edwards Aquifer Authority would no longer be subject to the requirements of the Administrative Procedures Act, found at Chapter 2001 of the Texas Government Code, to perform evaluations of a Proposed Rules' impacts on, among others, small businesses, local employment, and other interests (S.B. 2, 77th Legislature, 2001). Nonetheless, the Authority and its Board of Directors have determined that the assessment of potential impacts of certain Proposed Rules would benefit the Authority, the regulated community, and the public. Accordingly, upon the recommendation of the General Manager, the Board of Directors may direct the General Counsel to prepare a rules assessment to assist the Board in the process of evaluating and giving final approval to a set of Proposed Rules.

Under a rules assessment protocol approved by the General Manager, the rules assessment analysis would generally consist of four principal elements:

Impacts on the Authority. How would implementation of the Proposed Rules affect the Authority with respect to staffing requirements, costs, record keeping and reporting, enforcement responsibilities, and other administrative and risk management issues?

Impacts on the regulated community. What is the nature and extent of effects that would be directly experienced by persons or groups whose property or activities are addressed by the Proposed Rules?

Impacts on the Aquifer and Aquifer-related elements of the natural environment. To what extent are the Proposed Rules' effects on the regulated community balanced by the aggregate impacts of the rules' implementation on the quantity or quality of water in the Aquifer, springs, riparian habitats, and other Aquifer-dependent natural resources?

Longer term or indirect social and economic effects. What secondary or cumulative effects may accrue to the regional economy, population, or institutions from implementation of the Proposed Rules?

The Authority's Board of Directors and General Manager have directed that a rules assessment generally following the above protocol be completed for the Proposed Rules: Chapter 711, Subchapters E (Groundwater Withdrawal Permits), G (Groundwater Available for

Permitting; Proportional Adjustment; Equal Percentage Reduction) and K (Additional Groundwater Supplies), §§711.98 (Initial Regular Permits), 711.164 (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits), 711.176 (Groundwater Amounts for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts), and 711.304 (Allocation of Additional Groundwater Supplies). This rules assessment is generally based on the application of available data and previous research and studies performed by the Authority. See **Appendix A** for a full copy of the Proposed Rules.

1.2 BACKGROUND OF THE PROPOSED RULES

The Authority interprets the Act to generally establish a “cap” on certain annual withdrawals pursuant to regular permits, limiting permitted withdrawals from the Aquifer for the period ending December 31, 2007, to 450,000 acre-feet for each calendar year. (Act § 1.14(b) and (c)). The Act also cites specific Aquifer levels below which the Authority must interrupt withdrawals under regular permits. Specifically, § 1.14(f) of the Act states that when the level of the Aquifer at Index Well J-17 is equal to or greater than 650 feet above mean sea level, or equal to or greater than 845 feet above mean sea level at Index Well J-27, the Authority may authorize withdrawals from the San Antonio and Uvalde Pools, respectively, on an Uninterruptible basis. On the other hand, under § 1.14(f) the Authority may determine that an appropriate water management strategy is to not allow uninterrupted withdrawals, but instead interrupt all or part of authorized withdrawals at index well levels higher than those set out in § 1.14(f).

The Act also establishes the amount of groundwater withdrawals to be authorized by initial regular permits (IRPs) based on historical groundwater use minimums. Section 1.16(e) provides in relevant part, that “. . . An existing irrigation user shall receive a permit for not less than two acre-feet a year for each acre of land the user actually irrigated in any one calendar year during the historical period. An existing user who has operated a well for three or more years during the historical period shall receive a permit for at least the average amount of water withdrawn annually during the historical period.”

A major administrative challenge for the Authority has been reconciling the 450,000 acre-feet per year cap and the statutory minimums under §1.16(e). When IRPs are issued, they remain in "interim authorization status" until January 1 of the following year when they become effective (§711.66). All past IRPs have totaled less than 450,000 acre-feet per year. However, after 2003 IRPs that have been in Interim Authorization Status become effective on January 1, 2004, the total withdrawals authorized by effective IRPs will exceed 450,000 acre-feet per year for the first time. Therefore, IRPs must be reduced to total 450,000 acre-feet through the "proportional adjustment" process also specified by §1.16(e) of the Act.

In an effort to honor both of the statutory minimums and the 450,000 acre-feet cap, the Authority proposes to revise Chapter 711 Subchapters E (§711.98), G (§711.164 and §711.176) and K (§711.304). The current rules provide for the Authority to initiate proportional adjustment of IRPs (previously authorized under §1.16(e) of the Act and §711.172 of the rules) according to established formulas that account for irrigator minimums and historical average minimums. Currently, the rules (§711.176(b)(6)) state that if a permit holder qualifies for an irrigator minimum or historical average use minimum and proportional adjustment (PA-2) results in an adjusted permit amount below that minimum, the difference would be compensated at fair market value. A multi-step proportional adjustment process set out in §711.172(g) would take place after which, under the Proposed Rules, most permit holders would be granted Interruptible Rights in lieu of compensation. The first adjustment is called proportional adjustment 1 (PA-1) and the second is proportional adjustment 2 (PA-2). As an estimated provisional PA-1 was proposed by the General Manager in 2000, this assessment discusses the PA-2 process. (Note: IRPs have been issued with estimated PA-1 calculations set out in the IRPs based on the General Manager's 2000 proposal. In reality, the PA-1 is provisional and subject to revision over time as more information is acquired. The "final" PA-1 and PA-2 will be calculated when the last IRP becomes final at some indeterminate date in the future.) The primary substantive change to the existing rules is that, instead of issuing IRPs with aggregate "Uninterruptible Rights" of 450,000 acre-feet per year and compensating IRP holders for PA-2 amounts under the statutory minimums, "Interruptible Rights" would be granted.

The Proposed Rules creation of a conditional Interruptible Right in lieu of compensation for the difference between the PA-2 amount and the applicable minimum would allow the Authority to honor the required minimums in § 1.16 (e) of the Act while meeting the 450,000 acre-feet withdrawal limit required by § 1.14 (b). This regulatory assessment addresses the ramifications of the Proposed Rules and potential challenges that may arise.

1.3 DESCRIPTION AND REGULATORY SCHEME OF PROPOSED RULES

The regulated community for the Proposed Rules includes all owners of IRPs including municipal, industrial, and irrigation water users. The regulatory scheme was largely laid out in §711.172 Proportional Adjustment of Initial Regular Permits. This section defines historical average minimums (approximately the average for users with at least three years of beneficial use in the historical period) and irrigator minimums (approximately two acre-feet per acre for acreage actually irrigated in the historical period). Non-irrigators with withdrawals from the Aquifer during at least three years in the historical period are entitled to a "historical average minimum." All other existing users do not qualify for a minimum. The maximum historical use

is determined as provided for in §711.172(b)(3): "(A) an applicant's irrigator minimum; (B) for an applicant who has beneficial use without waste during the historical period for a full calendar year, the applicant's actual maximum beneficial use of groundwater from the Aquifer without waste during any one full calendar year of the historical period; or (C) for an applicant who has beneficial use without waste during the historical period, but, due to the applicant's activities not having been commenced and in operation for a full calendar year, the applicant does not have beneficial use for a full calendar year, the applicant's extrapolated maximum beneficial use calculated as follows: the amount of groundwater that would normally have been placed to beneficial use without waste by the applicant for a full calendar year during the historical period for the applied-for purpose had the applicant's activities been commenced and in operation for a full calendar year during the historical period". The proportional adjustment procedure to reduce aggregate IRPs to 450,000 acre-feet per year is a multiple step process described in §711.172 (g).

The Proposed Rules vary from the original rules in one key way. The original rules stated that "...the difference between the applicant's PA-2 amount and the applicable minimum may not be withdrawn by the applicant, but instead, the Authority shall provide to the applicant compensation for this amount at the fair market value as that term is defined in §11.0275, Texas Water Code (Fair Market Value)." The Proposed Rules amend that provision by deleting compensation for this amount and granting an Interruptible Right defined as the difference between the applicant's PA-2 amount and the applicable minimum. For wells in the San Antonio Pool, this water amount can only be withdrawn when Index Well J-17 exceeds 665 feet above mean sea level and for wells in the Uvalde Pool when Index Well J-27 exceeds 865 feet above mean sea level. These levels are derived by analogy from §1.19(b) and (c) of the Act relating to term permits, the withdrawals from which are not interpreted as applying against the cap under the Act. The balance of the groundwater withdrawal amount of an IRP left after application of the PA-2 remains the "Uninterruptible" Right but also remains subject to interruption under the provisions of the DM/CPM rules when Index Well J-17 falls below 650 feet above mean sea level (msl) for wells in the San Antonio Pool and when Index Well J-27 falls below 845 feet above msl in the Uvalde Pool (see §711.164).

Chapter 3 of this assessment describes withdrawal scenarios for Uninterruptible Rights and Interruptible Rights.

Subchapter K, §711.304 (Allocation of Additional Groundwater Supplies) states that if the cap is raised under §1.14(d) of the Act and its implementing rules in subchapter K of Chapter 711, then that water will be allocated to the extent available on a *pro rata* basis to restore the Uninterruptible Rights to the extent possible. Interruptible Rights would be converted

to Uninterruptible Rights first, followed by Proportionally Adjusted amounts, followed by retired initial regular permits. This section of the Proposed Rules will not be further discussed in this assessment.

1.4 METHODS AND ORGANIZATION

1.4.1 Report Organization

This report provides a characterization of the potential impacts of the Proposed Rules. Pursuant to the rules assessment protocol described in **Section 1.1**, this assessment analyzes the expected impacts of the Proposed Rules on the Authority, the regulated community, and the Aquifer and Aquifer-related resources. **Section 2.0** addresses potential impacts on the Authority. **Section 3.0** describes impacts to the regulated community with regard to the elimination of compensation and the establishment of Interruptible and Uninterruptible Rights. **Section 4.0** discusses impacts on the Edwards Aquifer and Aquifer-related elements of the natural environment. **Section 5.0** provides a section-by-section analysis of the Proposed Rules. **Section 6.0** presents a summary of findings.

1.4.2 Methods and Assumptions

Authority data on proportionally adjusted permits were reviewed to determine how permit holders from the various user groups (municipal, industrial, agricultural) are affected by the Proposed Rules. Groundwater modeling (GWSIM) undertaken in the Draft Programmatic Assessment of Proposed Rules (Research and Planning Consultants, 2000) was reviewed and implications to municipal, industrial and agricultural/irrigation users drawn in that assessment were summarized and, where needed, updated. Index Well (J-17) data were reviewed for the period from 1980 to 2002 to determine how frequently J-17 exceeded 665 feet above mean sea level. This review helped to determine the approximate frequency with which Interruptible water rights might be available for withdrawal during the applicable period of the rules (2004 to 2007) under various demand scenarios. In addition, a qualitative analysis of the value of Interruptible Rights versus compensation was prepared to supplement the analysis reported in the Draft Programmatic Assessment. Impacts to the Authority were discussed with respect to budget and staffing requirements for administering the Proposed Rules. The report is not a quantitative assessment that relies heavily on modeling results; rather it considers potential impacts on the regulated community by reviewing published study results and historic data and anticipating various possible scenarios that could take place between 2004 and 2007 under the Proposed Rules.

2.0 IMPACTS ON THE EDWARDS AQUIFER AUTHORITY

2.1 STAFFING REQUIREMENTS (BASIS)

The Proposed Rule Chapter 711 (Groundwater Withdrawal Permits) Subchapter E (Groundwater Withdrawal Permits) is part of a broader set of initiatives to develop and refine a comprehensive groundwater withdrawal permit process. In addition to §711 (E), the Proposed Rules revise existing provisions for proportional adjustment and equal percentage reductions under Subchapter G, and Subchapter K (Additional Groundwater Supplies), respectively. The Proposed Rules are a major revision to the mechanism by which the Authority attempts to reconcile the requirements of reducing withdrawals from the Aquifer to 450,000 acre-feet per year, and the issuance of irrigator minimum permits and historical maximum average permits. As such, the Proposed Rules also represent a departure from the approach (for meeting the “cap”) described in Functional Area One of the Strategic Plan developed for the Authority.

Because of the way the proposed changes are embedded in the existing framework of Chapter 711, e.g. the responsibility of projecting and reporting estimated water usage is placed on the applicant, there is no significant change in work-scope indicated for the Authority. Consequently, the Authority does not anticipate an increase in staffing to manage the implementation of the program under the proposed amendment to the rule. However, the Authority will have to expend considerable effort in establishing an appropriate administrative process to accurately monitor withdrawal of Interruptible Rights.

As the effects of the proposed change in the rule take effect, however, it may become necessary to provide more regulatory definition for purposes of monitoring compliance. Subsequent rule making for this purpose may create the need for additional staff. Even if additional staff is not indicated for the period between the effective date of the Proposed Rules and December, 2007, it would be prudent to update the Strategic Plan to reflect these changes and those suggested by the reduction of the withdrawal cap to 400,000 acre feet per year in 2008.

2.2 FINANCIAL REQUIREMENTS

According to Section 1.3 of the Implementation Matrix for the Strategic Plan, the cost of the original approach to reducing pumpage to 450,000 acre-feet per year by December 31, 2004 (excluding the cost of purchasing water rights) is covered under the Authority’s Base Operating Cost (BOC).

Even without more systematic data from the existing Strategic Plan for the proposed plan to meet the 450,000 acre-feet per year cap without purchasing all or part of IRPs or IRP applications, however, it is not unreasonable to assume that the Authority's costs still would be covered under the BOC. The BOC is tied to budget cycles for the Authority and is adjusted to cover the cost of operations on an annual basis.

The cost of codifying and finalizing the Proposed Rules is bundled with ten other rule sets under Section 5.1.1 of the Implementation Matrix for the Strategic Plan. The total for the bundled rules is \$515,000.00. There is no breakout for the Proposed Rules in Section 5.1.1.

2.3 ENFORCEMENT RESPONSIBILITIES

Historically, enforcement of the Authority's rules has focused on the behavior of persons who have applied for and received permits for the withdrawal of water from the Aquifer. In that respect, enforcement resources at the Authority are probably adequate to meet the requirements of the Proposed Rules.

Compliance with Proposed Rules, however, can be anticipated according to three fundamental criteria: (1) the extent to which the regulated community perceives the rule as a reasonable means for achieving a legitimate policy objective, (2) the extent to which the methods of compliance are easily understood, and (3) the perceived probability that the rule will be enforced. The extent to which there are problems with the first two criteria determines the relative significance of the third.

In the context of the first criteria, the Proposed Rules convert a portion of water resources regulated by the Authority from a commodity which could not be used by permit holders but for which compensation could have been expected by IRP holders to one which can be used but for which access can be reduced or interrupted without compensation. Beyond that, the analysis described in this document indicates that there will be differential impacts between categories of users, e.g. municipal, industrial and agricultural.

In the context of the second criteria, IRP holders will be required to estimate water use while controlling for the uncertainty interjected by limitations associated with proportional adjustment to meet the Authority's need to stay below the withdrawal cap and, in addition, anticipate the possibility of further reductions that could be imposed by Demand Management/Critical Period management rules. In short, the Authority's permitting process is becoming increasingly complex.

Given these basic observations, the Authority may find it useful to revisit the potential for improving monitoring and enforcement capabilities.

2.4 INTERGOVERNMENTAL ISSUES

According to IRP data provided by the Authority (see Section 3.3.1 of this document) there will be 612 irrigation IRPs, 323 municipal IRPs and 188 industrial IRPs in effect on January 1, 2004. Irrigation IRPs will constitute 54.5 percent of the total. Municipal IRPs will account for 28.8 percent and industrial IRPs will account for the remaining 16.7 percent.

After proportional adjustments are made, the estimated Uninterruptible Rights withdrawals for 2004 will be distributed as follows:

- Irrigation IRPs: 174,863 acre-feet (38.9 percent)
- Municipal IRPs: 245,792 acre-feet (54.6 percent)
- Industrial IRPs: 29,345 acre-feet (6.5 percent)

The analysis in Section 3.0 of this document indicates that the Interruptible Rights available in 2004 will total 43,713 acre-feet. As an artifact of the Proposed Rules, irrigation water use is the primary beneficiary with regard to the availability of interruptible water supply: 94 percent of the *reduced* irrigation water (the difference between the original amount and the PA-2 amount) is available to irrigation IRP holders as Interruptible Rights. In contrast, the amount of interruptible water available to municipal IRP holders is relatively low: 9.6 percent of the reduced water is available to municipalities as Interruptible Rights, and 30.8 percent of the reduced industrial water is available under industrial IRPs as Interruptible Rights.

Under the Proposed Rules, all users would avoid the substantial costs of compensation for reduced rights required under the current rules. However, municipal and industrial users would benefit most, as under the current provisions of the Act and Authority rules, they would bear a disproportionate burden of these costs. Overall, however, the analysis described in this document indicates that Interruptible Rights have a relatively limited value to IRP holders in any category of use (with some difference between the San Antonio Pool and Uvalde Pool), in part because they are available only during wet years when they are not as likely to be needed.

It is in this context that permitted water users from all three sectors will want to fully understand the basis for the differentials inherent in the proposed framework. Municipal permit holders may very well want to spend time studying the impact of the Proposed Rules change.

The Authority may want to consider joint participation in other efforts to study the issues raised by adoption of the Proposed Rules.

3.0 IMPACTS ON THE REGULATED COMMUNITY

3.1 THE REGULATED COMMUNITY

Permitted groundwater users are divided into three categories: irrigation, municipal, and industrial water users. The irrigation category includes primarily farms, ranches, and cattle operations, as well as city permits. Many permit holders are small corporations or trusts. Among the groundwater users with industrial permits are the following: concrete and materials companies, fire departments, golf clubs, nurseries, quarries, educational facilities and school districts, medical centers, stockyards, cities, country clubs, and cultural centers (a zoo, museum, and water park), nurseries and feed yards. Municipal permit holders include cities of all sizes as well as other entities such as water supply corporations and a children's home. Under Proportional Adjustment, all permits will be adjusted and some will be granted Interruptible Rights under the Proposed Rules.

3.2 METHODS AND APPROACH

A review of permit data and proposed adjustment calculations for 2004 permits were conducted and summarized. The assessment of the potential impacts of the Proposed Rules on the regulated community draws heavily from the Authority's Draft Programmatic Assessment (RPC, 2000). That assessment included a GWSIM model simulation of the effects of Interruptible Rights (Scenario L) relative to a reference scenario with no such rights. The results of this simulation are summarized to provide background for the current evaluation of the Proposed Rules. In addition, Authority projections of water demand and alternative demand scenarios developed in this assessment are described. GWSIM-IV model simulation of the effects of Interruptible Rights over the 2004-2007 period is not attempted in this assessment.

3.3 QUANTIFICATION OF TOTAL PERMITTED RIGHTS

To assess the regional impacts of the Proposed Rules, it is necessary to review permit data for 2004 (IRPs and Interim Authorization Permits) and then to generally estimate the total quantity of IRPs that will likely be granted and the actual pumping that will occur through 2007 as a result of the IRPs. Only when all IRPs are final will the Authority know both the final values for the starting point on which the Proportional Adjustment will be based and the sum of the statutory minimums that will be recognized in the process. Once the final percentages are known, and not before, the final amount of Interruptible Rights will be known. Nonetheless, the following data analysis for 2004 gives an indication of how the process affects permitting.

3.3.1 Uninterruptible and Interruptible Rights (2004 Data)

The following discussion is a review of Proportionally Adjusted data for IRPs to be in effect as of January 1, 2004 (EAA, 2003b). Based on permit data obtained from the Authority in November 2003, a total of 612 irrigation IRPs (54.5 percent), 323 municipal IRPs (28.8 percent), and 188 industrial IRPs (including 14 industrial agricultural, or 16.7 percent) were approved for use as of January 1, 2004. Some of these permits have been leased to others. In some instances, multiple IRPs of varying types are held by a single groundwater user so these data are discussed in terms of IRPs. In November of 2000, the General Manager proposed that IRPs be issued with a PA-1 adjustment of approximately 28.7 percent. That adjustment reduced permits to 450,000 acre-feet per year from accepted permit applications totaling approximately 630,000 acre-feet per year. As of November 1, 2003, approved permits total approximately 502,517 acre-feet per year so a PA-2 factor was calculated to reduce permitted withdrawals to 450,000 acre-feet per year as required by the Act and the Authority's rules. The PA-2 factor will constitute a 10.45 percent reduction for 2004 IRPs. It is important to note that the IRPs scheduled to become effective on January 1, 2005 are anticipated to constitute roughly an additional 60,000 acre-feet per year, most likely requiring additional adjustments prior to January 1, 2005.

Authority staff has analyzed how the proportional adjustment would affect permit holders under the Proposed Rules. After the PA-2 adjustment of 10.45 percent, some permit holders would be eligible for Interruptible Rights because the PA-2 adjustment brought their permitted total to below their authorized minimum withdrawal amount as established in §711.172 of the rules. An authorized minimum is established for each IRP based on either a proven historical average minimum use or an irrigator minimum of two acre-feet per acre for irrigated acreage. Where the PA-2 adjustment was lower than that minimum amount, an Interruptible Right was calculated based on the difference between the PA-2 amount and the authorized minimum. Many permit holders, however, would not be eligible for an Interruptible Right primarily for one of two reasons: (1) the PA-2 adjustment resulted in a permitted withdrawal amount in excess of the statutory minimum so that the entire permitted withdrawal amount is considered uninterruptible; or (2) there was no established minimum permit amount (for example, if a non-irrigation water user did not make withdrawals from the Aquifer for three or more years of the historical period, he or she would not be guaranteed a historical average minimum).

After the 10.45 percent PA-2 adjustments, 595 of 612 irrigation IRPs (97.2 percent) would be eligible for Interruptible Rights to bring them up to their statutory minimums. Seventeen irrigation IRPs (2.8 percent) were not eligible for an Interruptible Right and, in all but

three of these cases, the PA-2 amount exceeded the statutory minimum amount. For municipal uses, a total of 323 IRPs were issued with 260 (80.5 percent) of those permits eligible to receive Interruptible Rights as the PA-2 adjustment was lower than the statutory minimum. Sixty-three IRPs (19.5 percent) were not eligible for Interruptible Rights either due to no statutory minimum or the PA-2 adjustment did not result in a permit amount that was lower than the statutory minimum. A total of 188 industrial IRPs were issued (including 174 industrial and 14 industrial agricultural) for 2004. Of these, 93 (49.5 percent) were not eligible for Interruptible Rights and 95 (50.5 percent) were eligible. Primarily, Interruptible Rights would not be available if the PA-2 amount was higher than the statutory minimum. These data pertain only to 2004 pumping IRPs. It is anticipated that an additional Proportional Adjustment may be required after all outstanding permits in Interim Authorization Status are finalized and the total amount permitted further exceeds 450,000 acre-feet per year.

Overall, these PA-2 adjustments result in Uninterruptible Rights equaling 450,000 acre-feet per year. After the adjustment, approximately 29,345 acre-feet of water were permitted for industrial use (6.5 percent of the adjusted total). Industrial IRPs were reduced by approximately 3,425 acre-feet, of which approximately 30.8 (1,053 acre-feet) percent would be available to certain permit holders as Interruptible Rights. Municipal IRPs totaled 245,792 acre-feet (54.6 percent) after the PA-2 adjustment. Municipal IRPs were reduced by 28,685 acre-feet and 9.6 percent of that reduced water (23,475 acre-feet) would be available as Interruptible Rights. Irrigation IRPs were granted for 174,863 acre-feet (or 38.9 percent). Irrigation water permitted was reduced by 20,407 acre-feet but 94 percent (19,184 acre-feet) of that reduction would be available as Interruptible Rights in contrast to the low percentage available for municipal. Interruptible Rights total 43,713 acre-feet which is less than the 52,517 acre-feet difference between the permitted withdrawals and the withdrawal cap.

Again, Interruptible Rights would be granted to those users for whom water rights fell below their statutory minimums as a result of the PA-2 adjustment. Interruptible Rights would be provided for that difference in lieu of compensation under the Proposed Rules. Where no authorized minimum existed, or where the PA-2 amount exceeded the minimum, no Interruptible Rights would be granted. Overall, the high irrigator minimums appear to largely safeguard irrigation IRPs from the effects of Proportional Adjustment. While most municipal IRPs and approximately half of industrial IRPs would be eligible for Interruptible Rights, those rights totaled a smaller portion of the water reduction for municipal and industrial compared to irrigation. Based on an analysis of 2004 data, it appears that irrigation users may have excess Interruptible Rights available for lease or sale to municipal and industrial users.

To use approximate amounts for ease of analysis, it is assumed that generally speaking, the division of water rights between municipal, industrial and agricultural is 200,000 acre-feet per year of irrigation rights and 250,000 acre-feet per year of municipal and industrial rights. A total allocation to irrigation users of 200,000 acre-feet per year or more will almost certainly exceed the amount of water that has been historically withdrawn for irrigation in recent years (see discussion in **Section 3.3.4** below). Conversely, the allocation of 250,000 acre-feet per year or less for municipal and industrial use will be lower than current demand. A reasonable expectation is that the municipal and industrial allocation will be fully used, but the irrigation allocation may not. If so, actual pumping of Uninterruptible Rights may initially be less than 450,000 acre-feet per year. This is consistent with Region L projections.

Over time, the development of a marketplace for water rights will shift rights from irrigation to the municipal and industrial sectors. This is already evidenced by metered reported withdrawals. However, since one half of irrigation IRPs must remain apurtenant to ownership of the land unless "converted", some irrigation allocations may remain unused well into the future. Actual withdrawals from Uninterruptible Rights are likely to average less than 450,000 acre-feet per year through 2007. Alternative pumping estimates based on several hydroclimatological scenarios are discussed in **Section 3.3.4.5** below.

3.3.2 Use of Interruptible Rights

The Proposed Rules would allow Interruptible Rights to be available for wells in the San Antonio Pool only when the Aquifer level, as measured at Index Well J-17, is greater than 665 feet above msl; or for wells in the Uvalde Pool, when the Aquifer level, as measured at Index Well J-27, is greater than 865 feet above msl. The following sections summarize relevant historical data as originally presented in the Draft Programmatic Assessment (RPC, 2000).

In Uvalde County, Interruptible Rights could be used when levels in well J-27 exceed 865 feet msl. Since 1940, J-27 has averaged greater than 865 feet in 73 percent of all months. In the 10 years of the 1990s, it averaged greater than 865 feet in 90 percent of all months. Interruptible Rights would have been unusable in 7 months in the dry year of 1996.

For all counties within the Authority's boundaries other than Uvalde, Interruptible Rights could be used when levels in Index Well J-17 exceed 665 feet msl. Since 1932, J-17 has averaged more than 665 feet in 51 percent of all months. In the 10 years of the 1990s, it averaged higher than 665 feet in 40 percent of all months. Based on historical data, Interruptible

Rights could not have been used at all in 1996 and only one-third of the time during the period 1994-1999.

The overall pattern is that Interruptible Rights would be most often available in wetter years or during the winter months. The long-term data set on index well water levels reflect a history of reported pumping by the U.S. Geological Survey (USGS) prior to 1998 that averaged much less than 450,000 acre-feet per year. The short-term data reflect a period of high recharge. On balance, the expectation is that if permitted pumping exceeds 450,000 acre-feet per year in the future (as it may with Interruptible Rights in place), water levels would be lower than in the past. Consequently, the percentages above represent the upper limit for estimating the frequency at which Interruptible Rights could be exercised. Based on GWSIM modeling reported in the Draft Programmatic Assessment, the actual frequency for use of Interruptible Rights would be on the order of 25 percent.

The quantity of Interruptible Rights used will depend on the usefulness of the rights to their owners. Use of Interruptible Rights by municipal and industrial users with access to non-Edwards water supplies is discussed below.

3.3.3 Authority Projection of Actual Pumping for the 2004-2007 Period

According to the Authority, the enabling Act provides that certain annual IRP withdrawals may not exceed 450,000 acre-feet annually for the period ending December 31, 2007. Although, §1.14(b) does not expressly provide for the Aquifer conditions to which the cap applies. However, the Act also provides minimum IRP withdrawal guarantees for certain users. As mentioned previously, an irrigation user shall receive an IRP for not less than two acre-feet per acre for each acre irrigated in one calendar year during the historical period. An existing user that operated a well for three or more years shall receive an IRP for at least the average amount of water withdrawn annually during the historical period. Authorized permit amounts effective for 2004 were discussed in **Section 3.3.1** and will total approximately 502,000 acre-feet. Ultimately staff estimates the total amount of permits that would qualify for an IRP (after IRPs convert from Interim Authorization Status to permits) will be approximately 560,000 acre-feet. The Proposed Rules would require the Board to issue Interruptible Rights through 2007 for any statutory minimums lost during the Proportional Adjustment process useable only at the specified Aquifer elevations. This policy was adopted to mitigate a complete loss of a portion of a water right that is guaranteed by the Act.

Authority staff considered the potential effects of Interruptible Rights in lieu of compensation on actual water withdrawn from the Aquifer on a yearly basis. The temporary creation of Interruptible Rights would not raise the potential amount of water permitted to be withdrawn above 450,000 acre-feet per year under Uninterruptible Rights. Interruptible Rights could result in additional withdrawals if Index Well levels remain above 665 msl (J-17, San Antonio Pool) and 865 msl (J-27, Uvalde Pool) for a substantial part of the year.

The following evaluation of a temporary increase of annual pumping limits due to Interruptible Rights is based on: (1) a review of historical water withdrawal trends; (2) regional population trends; (3) the area of irrigated land in the region; (4) the ability of the region to store significant volumes of water outside normal distribution systems; (5) Demand Management/Critical Period Management (DM/CPM) Regulations; (6) limitations on waste; (7) weather; and (8) conservation.

3.3.3.1 Background to Demand Projections

Based on the factors noted above, Authority staff has evaluated the potential effects of Interruptible Rights (in lieu of compensation) on the actual volume of water withdrawn from the Aquifer (EAA, 2003d).

(1) Evaluation of Water Withdrawn from the Aquifer for the Previous 10-Year Period – As part of the Authority’s permit program, all permitted wells (municipal, industrial, and irrigation) are required to be metered and to report the amount of water withdrawn each year. By 2001, more than 99 percent of all permitted wells in the region had a working meter and were reporting withdrawal amounts. This allowed the Authority, for the first time, to have an accurate accounting of the amount of water being withdrawn for irrigation, industrial, and municipal purposes. Estimates for previous years had been based on limited measurements for various well types and estimates of the number of wells per user group (municipal, industrial, and irrigation) in the region supplied by the USGS.

The Authority publishes an annual Hydrogeologic Data Report (EAA, 2003a) that lists the amount of recharge and discharge by source from the Aquifer as well as results of the water quality testing program. For the period between 1993 and 2002 (last 10 years of available data), the mean volume of water withdrawn from the Aquifer was 414,800 acre-feet and the median was 411,100 acre-feet. The highest yearly demand during that period was estimated at 493,600 acre-feet in 1996 -- a year noted for above average temperatures and limited rainfall during the winter and spring months, a period when recharge is usually sufficient to increase

Aquifer levels and for which water usage (pumpage) was reported by the USGS. It appears that irrigation usage may have the least accuracy of all reported pumpage. In that year, the Authority had just undergone the transition from the Edwards Underground Water District and, therefore, did not have a DM/CPM program in place to limit withdrawals during droughts. Although withdrawal restrictions were imposed by some municipalities in 1996, the new Authority Board was unable to agree on the appropriate emergency DM/CPM regulations to implement. The lowest yearly demand during the last 10 years occurred in 1992 when only 327,200 acre-feet of water were used. The year 1992 was also the wettest year on record, with more than 2.48 million acre-feet of water recharged into the Aquifer.

During 2000, the region experienced a long, continuously dry period during the summer months. The region received below normal rainfall and recorded above average temperatures from April through early September. Over a 105-day period, from mid June to early September, the region did not receive a significant rainfall event (>0.5 inches)—the lowest since data has been collected on rainfall. On May 1, 2000 the Authority’s Board of Directors initiated “Emergency Drought Management Regulations” that limited the amount of water that could be withdrawn from the Aquifer. Average to above average rainfall occurred from mid-September through December 2000. Despite extreme drought conditions throughout the region for spring and summer of 2000, only 367,200 acre-feet of water were withdrawn from the Aquifer. The small amount of water withdrawn from the Aquifer in 2000, when compared to 1996 is the result of a number of factors including the Emergency Drought Management Regulations, implementation of conservation measures, and better water measurements through metering of wells, and very wet fall and winter quarters reducing demand.

(2) Population Trends in the San Antonio Region – A review of population trend analysis used for the Region L (South Central Texas Regional Water Planning Area) Water Planning Process, indicates that the regional population is expected to increase from 1.6 million people in 2000 to 1.9 million people in 2010, for an increase of approximately 19 percent or about 1.87 per cent per year (HDR Engineering, 2000). A proportional increase in water withdrawal from the 10-year mean withdrawal amount of 414,800 acre-feet per year over the 2004-2007 period would result in approximately 448,000 acre-feet of Edwards water used in 2007. A similarly proportional increase in the volume of water pumped during the drought year of 1996 would result in approximately 534,000 acre-feet of water used in 2007. However, these figures do not include the reductions that would occur through the implementation of the Authority’s DM/CPM rules and the advancement of conservation measures throughout the region. It is important to note that use of the mean masks any spikes in pumping that occurred during that timeframe.

(3) **Area of Irrigated Land** – The Authority collects data related to the estimated amount of water discharging the Aquifer by type (irrigation, municipal, domestic/stock, industrial/commercial, and springs) that is also reported in the Authority’s Hydrogeologic Data Report. For the period between 1993 and 2002 (last 10 years of available data), the mean volume of water withdrawn from the Aquifer for irrigation purposes was 105,400 acre-feet and the median value was 100,100 acre-feet. The highest yearly demand during that period was estimated by the USGS at 181,300 acre-feet in 1996—a year noted for above average temperatures and limited rainfall during the winter and spring months. The Authority did not have DM/CPM rules in place in 1996 to limit withdrawals during droughts. The lowest yearly demand during the last 10 years occurred in 1992, a very wet year, when only 27,100 acre-feet of irrigation groundwater was used.

A review of the Authority’s transfer records indicates that a majority of transferred water was moved from irrigation purposes to municipal and industrial purposes. The transfer of water from irrigation interests to municipal interests implies a significant volume of excess water available from the agricultural economy. Discussions with agricultural industry experts indicate that agricultural production in the region is shifting from row crops that consume large volumes of water to other crops that do not require as much water. The Region L Water Plan projects a 23 percent decrease in irrigation demand from 1990 – 2050 because of improved efficiency, decreased price supports from the federal government and other economic factors decreasing the profitability of farming. It seems unlikely that irrigated land in production will increase sufficiently over the next four years to cause total Aquifer withdrawals to reach the 560,000 acre-feet of water estimated as the upper limit for temporary and permitted withdrawals.

(4) **Regional Water Storage** – The Edwards Aquifer is one of the most prolific Aquifers in the world and historically, withdrawal of water from the Aquifer has been limited by demand, power costs and infrastructure constraints such as piping and pump capacity, rather than Aquifer properties. As a raw water source, the Aquifer had been treated as a large, almost unlimited groundwater reservoir until the formation of the Authority in 1996. With the exception of the San Antonio Water System’s (SAWS) Aquifer Storage and Recovery project (ASR), no known raw water storage facilities, such as surface reservoirs, have been built for the greater San Antonio area or for agricultural users in the western part of the region. The SAWS ASR project is expected to be complete in 2004 and will be available to store approximately 20,000 acre-feet of treated Edwards Aquifer water in the nearby Carrizo Aquifer. The Carrizo Aquifer, however, is currently at or near its capacity and a substantial amount of water will have to be withdrawn before Edwards water can be stored in it. The ASR project, when fully operational, will provide SAWS with the ability to withdraw Edwards water during wet periods

and store it in the Carrizo Aquifer. During dry periods, the stored water will be pumped into the San Antonio distribution system allowing SAWS to limit withdrawals from the Edwards Aquifer for a number of months during a drought, thereby helping to preserve Aquifer levels and springflows at Comal and San Marcos Springs during critical periods.

The lack of additional storage facilities available over the 2004-2007 period limits the amount of water that could be withdrawn from the Aquifer during high recharge periods for use in drier periods to about the 20,000 acre-feet SAWS will withdraw for their ASR project. This represents about 18 percent of the potential 110,000 acre-feet per year of withdrawals that would be hypothetically available as Interruptible Rights in wet years. Over eighty percent of the temporary withdrawals through Interruptible permits over the 2004-2007 period would, therefore, be used to meet current demands.

(5) **Demand Management/Critical Period Management Rules** – The Authority is required by its enabling statute (the Act) to limit the total withdrawals from the Edwards Aquifer through the issuance of withdrawal permits. Each municipal, industrial or irrigation well owner has “Interim Authorization” to continue to pump water from the Aquifer until the Authority takes final action on the well owner’s IRP application. Interim Authorization for a well ends on January 1 following the date on which the Authority enters a final order acting on the groundwater withdrawal permit application. As of November, 2003, the Authority had issued over 500,000 acre-feet per year of IRPs that will be effective in 2004 and expects to issue approximately 560,000 acre-feet per year of IRPs by the end of 2004.

The Authority's DM/CPM Rules (Chapter 715, Subchapters A and D) adopted at the November 2002 board meeting provide for the orderly reduction of water withdrawn from the Aquifer during droughts. The program is designed to limit the amount of water that can be withdrawn from the Aquifer depending upon the groundwater elevation at regional index wells and springflows at Comal and San Marcos springs. Currently, the regulations are designed to limit water withdrawals to a maximum of 350,000 acre-feet per year under extreme drought conditions. The reductions are based upon alternative maximum pumping limits of 400,000, 450,000, and 500,000 acre-feet per year. If a temporary withdrawal limit of 560,000 acre-feet of water a year is implemented, the Authority staff has recommended an interruption in pumping during critical periods to meet the desired goal of 350,000 acre-feet of withdrawals if the most restrictive stage of the DM/CPM rules is in effect for a calendar year.

(6) **Limitations on Waste** – Theoretically, water could be pumped from the Aquifer and discharged to the surface without being put to productive use. However, there are economic as well as regulatory limitations on this practice. Pumping water from the Aquifer requires

considerable power and associated costs. The wasting of water by agricultural and municipal and industrial permit holders is strongly discouraged and many public water supply systems have active water conservation programs. In addition, the Authority has proposed Groundwater Conservation and Reuse Rules (Chapter 715, Subchapters A, B, and C) that place a water delivery efficiency on irrigators, and a maximum unaccounted for water loss on municipal and industrial users. In addition to economic and regulatory constraints to the waste of water, the Act § 1.35 (c) states “A person may not waste water withdrawn from the Aquifer.”

(7) **Weather** – Water demand in the region is influenced by rainfall and temperature. Prolonged periods of below average rainfall and above average temperatures, especially in the spring and summer months, cause a significant increase in agricultural and municipal water demand. A recent report (Mauldin, 2003) evaluating drought conditions in south Texas, prepared for the Authority by Raymond Mauldin, Ph.D., indicates that long-term droughts, defined as droughts exceeding three years in duration, occurred only four times in the 279-year period of record. Three of these four occurred in the 1700s, and the fourth occurred in the early 1950s. The 1950s drought, covering a six-year stretch, was both the longest drought reflected in the available records as well as the most intensive of the four long-term droughts.

A long-term drought would be expected to create the greatest demand and have the most severe impacts on springflow. Considering that there have only been 4 long-term droughts in the 279-year period of record, there is a low probability that the region will enter into another long-term drought between the beginning of 2004 and end of 2007.

While extremely dry and hot weather can have an impact on water demand, actual pumping, as noted in (5) above, is limited by the DM/CPM rules that limit the amount of water that can be pumped during extreme droughts. Therefore, it is reasonable to conclude that: (1) it is unlikely that the region will enter a long-term drought during the temporary increase of permits through issuance of Interruptible permits and (2) even if a drought does occur, actual pumping will be limited by index well and springflow triggers in the DM/CPM Rules.

(8) **Conservation** – The potential effects of regional conservation programs currently underway have been estimated in the Authority’s regulatory assessment (Hicks & Company, 2003) of its proposed conservation rules (Chapter 715, Subchapter C). Estimated water savings of more than 130,000 acre-feet in 2012 would potentially reduce predicted Edwards Aquifer water use in that year to approximately 270,000 acre-feet. A substantial portion of the water savings could occur during the 2004-2007 period, supporting the Authority’s prediction of relatively slow growth of actual pumping.

3.3.3.2 Conclusions

Staff has considered the potential effects of Interruptible Rights in lieu of compensation on actual water withdrawn from the Edwards Aquifer on a yearly basis. Interruptible Rights should not have an appreciable effect on the volume of water withdrawn from the Aquifer in the near future, with the exception of the possible hydroclimatological scenarios described in the following section. The volume of water that can be withdrawn from the Aquifer each year is limited by demand, which is a function of population and weather, lack of significant storage into which Aquifer water could be placed when available through Interruptible Rights, and regulations such as the DM/CPM Rules of the Authority. Potential impacts to the endangered species habitat in Comal and San Marcos Springs, downstream water users or bays and estuaries are discussed in **Section 4.0**.

3.3.4 Alternative Demand Scenarios Over the 2004-2007 Period

3.3.4.1 Introduction

An analysis of historic San Antonio Index Well (J-17) water levels and pumpage estimates since 1980 (EAA, 2003a) reveals several important trends regarding the proposed introduction of Interruptible Rights. The manner in which these data are evaluated is important in determining the potential impact of Interruptible Rights on total pumpage, to be described below.

In evaluating the potential impacts of Interruptible Rights, the use of the Edwards Aquifer model (GWSIM-IV) was considered. However, it was decided that its use in this case would not be the most appropriate use of the model, and that valid conclusions could be reached by evaluating actual Aquifer data from the past 23 years (1980-2003). The reasons that the Edwards model was not considered appropriate in this application were:

- The model is better suited to evaluating and comparing multiple management strategies qualitatively, rather than assessing single strategies quantitatively. The use of the model in this evaluation would represent a quantitative use of the model, comparing one strategy over the period of record to actual water levels; and
- The available historic Aquifer data for the time period 1980-2003 were appropriate to inform our evaluation of the use of Interruptible permits. Actual

data are preferable to Edwards Aquifer model results to evaluate potential impacts over the 2004-2007 period.

3.3.4.2 Background

Table 3.3-1 shows the amount of irrigation, municipal and industrial pumpage withdrawn for the years 1980 to 2002. For the purposes of this discussion, "total pumpage" is the sum of irrigation, municipal and industrial pumpage, the only types of pumpage that the Authority regulates with IRPs, and are included in the 450,000 acre-feet/year total. Withdrawals under other permits are not included. Domestic and livestock pumpage is not included. The total pumpage has exceeded 450,000 acre-feet/year six times since 1980 (1984, 1985, 1988, 1989, 1990, and 1996). In most of these years, J-17 was lower than 665 feet msl for the entire year. Only in 1988 was J-17 above 665 feet msl for a significant portion of the year, from January to the end of April. However, this was not a result of weather conditions or water demand during the year, but rather a result of high J-17 water levels at the beginning of the year.

Table 3.3-1 January 1 J-17 Water Levels and Annual Pumpage Totals* for 1980-2002

Year	Jan 1 J-17 Level	Irr.	M&I	Total (Annual)	Year	Jan 1 J-17 Level	Irr.	M&I	Total (Annual)
1980	680.2	177.9	269.9	447.8	1992	680.7	27.1	265.5	292.6
1981	669.0	101.8	244.4	346.2	1993	691.8	69.3	288.1	357.4
1982	679.0	130	283.6	413.6	1994	677.5	104.5	286.3	390.8
1983	666.5	115.2	263.9	379.8	1995	676.3	95.6	292.3	387.9
1984	653.3	191.2	302.4	493.6	1996	664.9	181.3	300.1	481.4
1985	649.7	203.1	280.2	483.3	1997	650.7	77.4	287.4	364.8
1986	673.4	104.2	283.1	387.3	1998	671.9	131.9	308.2	440.1
1987	685.6	40.9	279.6	320.5	1999	686.3	113.6	315.7	429.3
1988	684.6	193.1	305	498.1	2000	663.5	106.3	295.1	401.4
1989	661.3	196.2	308.1	504.3	2001	676.7	79	275.3	354.3
1990	643.9	172.9	278.6	451.5	2002	694.8	94.6	259.1	353.7
1991	652.2	88.5	308	396.5	2003	694.8			

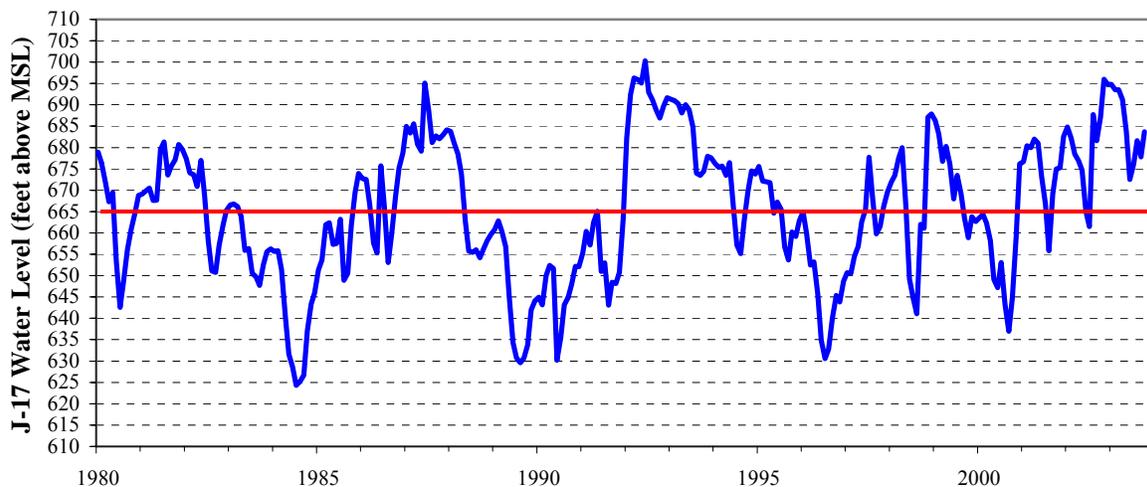
Source: EAA Hydrogeologic Report, 2003.

*Note: Total pumpage includes municipal, industrial, and irrigation only.

The ability to use Interruptible Rights under the Proposed Rules would not be a function of the demand in a particular year, but rather the Aquifer water levels during the year, especially at the beginning of the year. **Figure 3.3-1** shows J-17 water levels from 1980 to 2003, and **Table 3.3-1** shows the J-17 water level at the beginning of each year. These data show that J-17 water levels were high enough (at least 675 feet) in approximately half of the years since 1980 that Interruptible Rights could have been used for an appreciable length of time at the beginning of a particular year. The use of Interruptible Rights would not necessarily mean that a

higher amount of pumpage would occur. In fact, annual pumpage could be average, it would just be composed of Interruptible Rights and Uninterruptible Rights. If Interruptible Rights are used during the beginning of the year when they are available, Uninterruptible Rights could then be used during the remainder of the year. If J-17 water levels stayed above 665 feet for several months of the year, it is likely that all Interruptible Rights could be used during that particular year.

Figure 3.3-1 J-17 Water Levels for 1980-2003



Source: EAA Hydrogeologic Report, 2003.

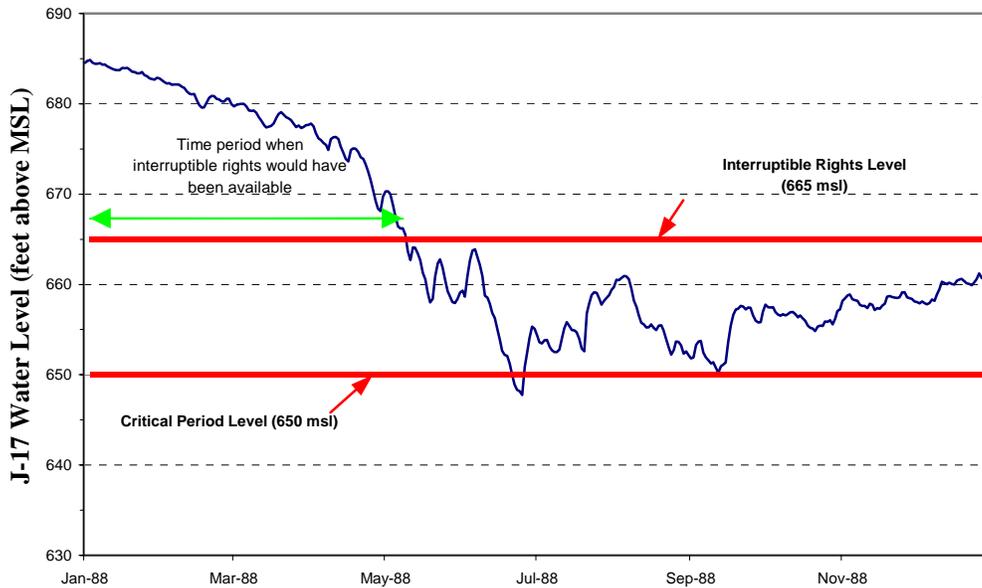
3.3.4.3 Impact of DM/CPM Rules

Demand Management/Critical Period Management (DM/CPM) rules reductions should not be counted upon to reduce overall pumpage during a particular year except in certain circumstances. DM/CPM rules are not a drought management strategy, but rather a low water level/springflow management strategy. Although over longer periods of time this is synonymous to a drought management strategy, over the short term, including one-year time periods that are being evaluated for annual withdrawal totals, this is not the case. Because DM/CPM reductions only begin when J-17 water levels drop below 650 feet, whether they occur during a particular year is heavily dependent upon the J-17 water level at the beginning of that year. If J-17 is at a very high level on January 1, the likelihood that the level will drop to 650 feet is low, even if hot and dry (drought) conditions exist and pumpage is very high during that year.

A good example of this is the year 1988, which was a very hot and dry year with the second highest pumpage of record, with withdrawals of nearly 500,000 acre-feet. **Figure 3.3-2**

shows Index Well J-17 levels for 1988, which began the year at about 685 feet, a similar water level to the J-17 level expected for the start of 2004. Even though 1988 was a very dry year and pumpage was very high, J-17 only dropped below 650 feet for five days, and Comal Springs discharge never dropped below 200 cubic feet per second (cfs). DM/CPM interruptions would have had very little, if any, impact on pumpage during 1988 because water levels started out at such a high level.

Figure 3.3-2 - J-17 Water Level For 1988



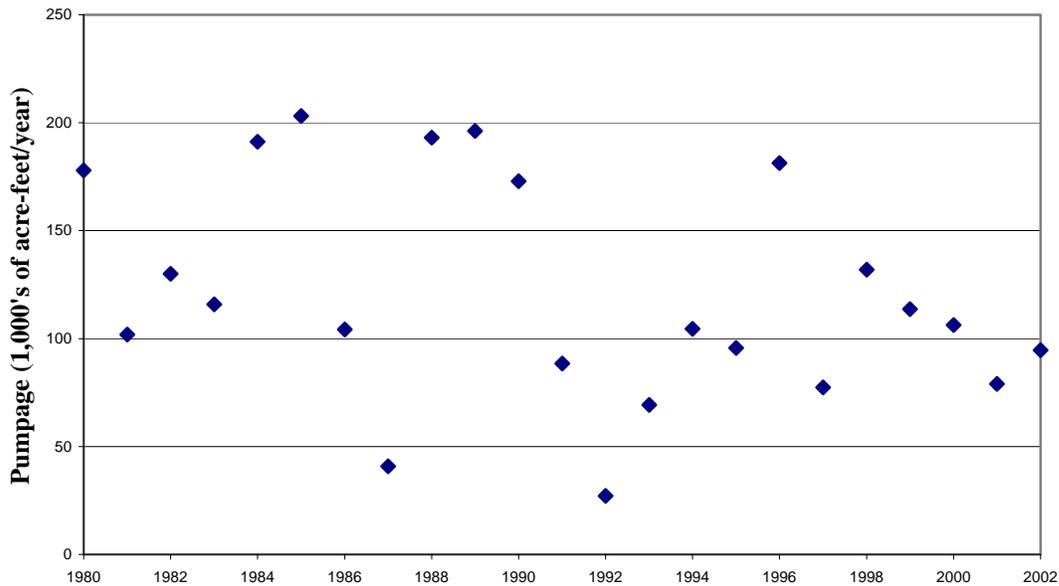
Source: EAA Hydrogeologic Report, 2003.

3.3.4.4 Historic Pumpage Trends

Figures 3.3-3 through **3.3-5** show the annual irrigation, municipal and industrial, and total pumpage for 1980 to 2002. These figures indicate several important trends, described below.

As can be observed in **Figure 3.3-3**, irrigation pumpage is highly variable between 1980 and 2002, as would be expected due to varying weather conditions. **Figure 3.3-4** shows municipal and industrial pumpage to be relatively stable. All of the high pumpage demand years shown in **Figure 3.3-5** were those with irrigation demand of greater than 150,000 acre-feet. Therefore, it can be plausibly assumed that over the next four years (2004 - 2007), those years with a higher demand will likely be due to high irrigation demand.

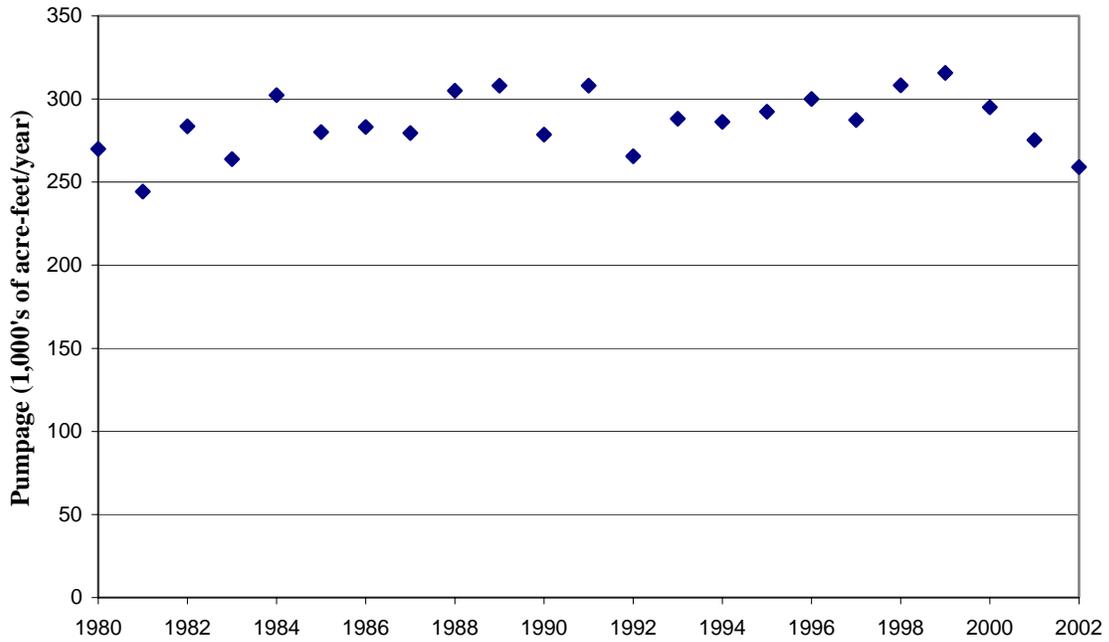
Figure 3.3- 3 - Total Irrigation Well Pumpage



Source: EAA Hydrogeologic Report, 2003.

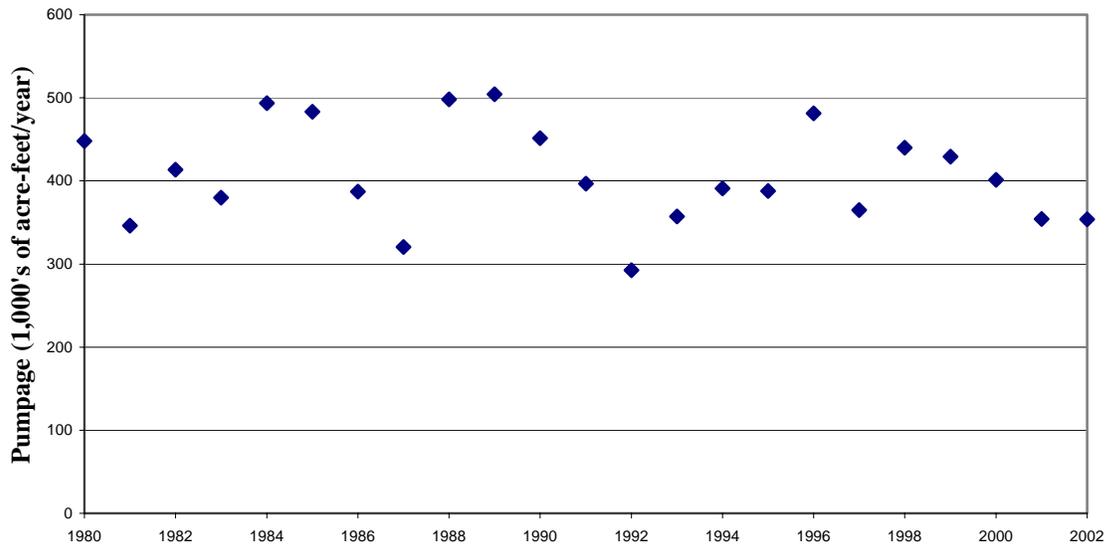
Municipal and industrial pumpage is relatively stable over this time period, showing a slight increasing trend since 1980. However, this long-term trend is lost in the variability of the data over short time periods, and so we can assume that over the next four years municipal and industrial pumpage will not vary significantly from the trend shown in **Figure 3.3-4**. It is unlikely that municipal and industrial pumpage would be reduced enough by DM/CPM reductions to drop certain total pumpage under IRPs below 450,000 acre-feet during a very hot and dry year such as 1984, 1988, or 1996, where irrigation demands would be very high.

Figure 3.3-4 - Total Municipal and Industrial Well Pumpage



Source: EAA Hydrogeologic Report, 2003.

**Figure 3.3-5 - Total Well Pumpage
(Irrigation + Municipal and Industrial)**



Source: EAA Hydrogeologic Report, 2003.

There are a few important issues relating to irrigation pumpage. First, irrigation pumpage is not subject to Stage I or II DM/CPM reductions, and therefore unless water levels are very low (J-17 less than 630 feet), irrigation pumpage is not affected by these rules. Second, irrigation pumpage peaks earlier in the year than municipal and industrial pumpage, and J-17 water levels are usually at the lowest point in the year during the summer municipal and industrial demand peak. Because irrigation pumpage peaks before J-17 is at its lowest level, this lessens the chance that irrigation pumpage will be subject to DM/CPM reductions. In addition, if irrigators were able to use their Interruptible Rights early in the year when they are often available, they could then lease or transfer the more valuable uninterruptible portion of their unused rights later in the year, increasing total withdrawals. However, this would only occur when water levels and springflows would be at high levels.

An evaluation of **Figures 3.3-3** through **3.3-5** does not indicate a clear reduction in any type of pumpage since 1980 that would compensate for the increase in irrigation pumpage that typically occurs in a very hot and dry year. The year 1996 had one of the highest irrigation pumpage levels in the entire period of record, a level that, although unlikely, could be repeated in the next four years. A similar year of high irrigation pumpage coupled with the use of Interruptible Rights could potentially allow increased total pumpage at some time during the four-year period (2004 - 2007). But, as noted above, this would only occur when water levels and springflows would be at high levels.

3.3.4.5 Future High Demand Scenarios

If a future year is hot and dry (drought conditions), one of the following scenarios will determine what pumpage during that year might be:

1) *Dry Year Following a Dry Year* - In the case of a hot and dry year that follows a hot and dry year, the demand for groundwater is likely to be very high. However, in this case, Interruptible Rights would likely not be available during the year. DM/CPM interruptions would also likely play a significant role in reducing the withdrawals from the Aquifer because if the dry year is preceded by a dry year, water levels at the start of the year would be low, and DM/CPM rules would have a significant impact on pumpage.

2) *Dry Year Following a Wet Year* - In the case of a hot and dry year that follows a wet year, the demand for groundwater is also likely to be high. However, in this case, Interruptible Rights would likely be available at the beginning of the year due to high Aquifer water levels, and DM/CPM reductions might not come into effect because water levels at the

beginning of the dry year would be at a high enough level that J-17 would remain above the 650 foot DM/CPM trigger regardless of the pumpage demand during the dry year.

3) *Dry Year Following a Moderate Year* - In the case of a hot and dry year that follows a moderate year, either of the above scenarios may take place, depending on what level J-17 is at the beginning of the dry year.

The year 1988 provides a good example of how the use of Interruptible Rights might occur. During that year, when the total pumpage was 500,000 acre-feet, Interruptible Rights would have been able to be used during the first four months of the year, as shown in **Figure 3.3-2**. If all of the pumpage during this time period were applied to Interruptible Rights, then the remaining 450,000 acre-feet per year of Uninterruptible Rights would have been available for withdrawal during the last eight months of the year. Because DM/CPM reductions would not have impacted pumpage during the year, 500,000 acre-feet of groundwater (the amount actually pumped in 1988) could have been produced during 1988 through the combined use of Interruptible and Uninterruptible Rights under the Proposed Rules. Even under this high pumpage scenario (potentially allowed in the future through use of Interruptible Rights), water levels at J-17 only dropped below 650 feet msl (Stage I Critical Period) for five days.

3.3.4.6 The Impact of Aquifer Storage and Recovery (ASR)

The production and storage of groundwater by a permit holder from the Aquifer, such as could occur with the ASR project being constructed by San Antonio Water System (SAWS), could also impact the potential for use of Interruptible Rights. Prior to the completion of the ASR project in 2004, there will be no capacity to store water in the San Antonio region. However, the ASR project, when completed, will allow up to 22,000 acre-feet of water to be stored for later use. This project would allow the withdrawal of additional groundwater beyond that which is needed to meet current demand. During periods when J-17 is above 665 feet, Interruptible Rights could be used to withdraw groundwater for storage in the ASR system. In the event of a dry year where Interruptible Rights were not available at the beginning of the year, if J-17 water levels rose above 665 feet at the end of the year, Interruptible Rights could then be used to refill the ASR system. The ASR project would, of course, allow reduced Aquifer withdrawals in drought periods as stored water would be withdrawn instead of Aquifer water.

3.3.4.7 Conclusions

The use of Interruptible and Uninterruptible Rights could, under certain circumstances, result in higher pumping of groundwater from the Edwards Aquifer in the next

four years (2004-2007). The use of Interruptible Rights would not require an excessively high water demand. When water levels are high enough, Interruptible Rights could be used to meet average or even below average demands. If water levels allow the use of Interruptible Rights at the beginning of a year, there may be some demand to which these rights can be applied. An estimated twenty percent of the municipal and industrial demand occurs in the first quarter of the year, and if it is especially hot and dry, irrigators may also be pre-irrigating in preparation for planting in the spring. The use of these rights would then allow the uninterrupted portion of the permit to be applied over a shorter period of time. This higher pumpage would not necessarily have a detrimental effect on springflows because Interruptible Rights could only be pumped when Index Well/Aquifer levels and springflows are high.

If Aquifer water levels are very high at the beginning of the year, and the weather during that year is hot and dry, then pumpage would be high but DM/CPM rules would not reduce pumpage significantly. When examined on a year-to-year basis as is required for the current evaluation, DM/CPM reductions are not so much a function of weather and pumpage conditions during a particular year as they are a function of water levels in the Aquifer at the beginning of the year. Even if DM/CPM rules had been in effect during the last 20 years, some record pumpage years may not have been impacted since triggers would not have been reached. Still, DM/CPM rules would protect springflows.

Water levels will be very high at the beginning of 2004; and based on an evaluation of January 1 water levels since 1980, it is likely that at least one additional year between 2005 and 2007 will also start out with high J-17 water levels. If water levels at the beginning of a year are high, then all first quarter withdrawals could be applied to Interruptible Rights. During these years, once the J-17 water level reaches 665 feet, the full amount of Uninterruptible Rights would then be available until the Aquifer fell below DM/CPM trigger levels. The potential impacts of higher pumpage on the Aquifer and Aquifer-related resources is discussed in **Section 4.0** below.

3.4 IMPACTS ON MUNICIPAL AND INDUSTRIAL USERS

Anticipating the withdrawal limits required under the Act, large municipal and industrial water users such as the San Antonio Water System (SAWS) and Bexar Metropolitan Water District (Bexar Met) are already well advanced in their plans to obtain future water supplies from sources other than withdrawals from the Edwards Aquifer. Many smaller utilities also will use non-Edwards water, either because they can associate with one of the larger utilities, or because they are located near other water sources. Non-Edwards supplies may

include surface water, ground water from other Aquifers, or recycled wastewater (including effluent that originated from an Edwards supply). These supplies are identified in the South Central Texas Regional Water Plan (HDR Engineering, 2000) as alternative water management strategies needed to meet the expected supply deficit for the region over the next 50 years.

Most alternatives require substantial capital investments in facilities to buy water rights or to divert, convey, and treat water. These are largely fixed costs and will remain constant during the amortization period of the project. Operating costs for pumping and treatment may also be substantial.

Utilities with access to non-Edwards water would probably be able to use their Interruptible Rights in conjunction with their non-Edwards supplies, and it is reasonable to assume they would do so. The reasons why Interruptible Rights would be of value to these users are outlined in **Table 3.4-1**, below:

Table 3.4-1 Factors Bearing on the Exercise of Interruptible Rights for Municipal and Industrial Users with Access to Non-Edwards Water Supplies	
1	The M&I users already have Edwards wells and infrastructure to use Edwards water.
2	Edwards water costs very little to pump, treat, and distribute. An alternative water source, especially a surface water source, is likely to cost much more to acquire, divert, convey and treat — usually much more. Therefore, at times when Interruptible Rights are available, a water utility probably would save money by using Edwards water and saving the variable operations costs of the alternative. (Put another way, Interruptible Edwards water rights probably have the lowest marginal cost of any water supply.)
3	There often are benefits in conserving water in the alternative source when the Edwards is high so that more water will be available when the Edwards is low.
4	Large M&I users such as SAWS will develop cost-effective projects (Aquifer Storage and Recovery) to store Interruptible Edwards water during wet periods and recover it in dry periods.

Source: RPC, 2000.

The yield from Interruptible Rights would be less dependable than that of most alternative supplies. A prudent utility would not view Interruptible Rights as acceptable substitutes for Uninterruptible Rights. Therefore, Interruptible Rights do not lessen the need for municipalities to acquire and invest in uninterruptible supplies. However, because using Interruptible Rights can save operating costs for a water utility that also uses non-Edwards water, the rights are likely to be used and useful to these M&I users. Because of this value, and the lack of value to other users (described in **Section 3.4.1.3**), it is reasonable to assume that municipal suppliers who have access to non-Edwards water will enter the marketplace and acquire (probably through short-term leases) Interruptible Rights if their own Interruptible Rights are not sufficient to fill storage facilities. However, the storage of Interruptible Rights would require

projects that will take several years to develop. Only the SAWS ASR project could potentially be available to store Interruptible Rights during the period 2004-2007. Therefore, until other projects are developed to increase storage capacity beyond 20,000 acre-feet, and because of fees and costs associated with acquiring Interruptible Rights, it is questionable whether there will be an active market for the Interruptible Rights in the 2004-2007 period.

For municipal and industrial users totally dependent on the Edwards, the logic would be simpler, but would have the same result. These users would almost certainly seek to acquire enough reliable Uninterruptible Rights to meet their needs. Interruptible Rights would be useless in droughts and therefore of little or no value. These users would hold the rights in case there was some future opportunity to store and recover the water.

3.4.1 Economic Impacts of Proposed Rule on Municipal and Industrial Users of Edwards Water

3.4.1.1 Overview of Effects

Interruptible Rights would be created under the Proposed Rules in two stages: (1) The Authority calculated a Proportional Adjustment of 10.45 percent in November 2003, that only reduced a portion of permits below their statutory minimums. For those permits, an Interruptible Right would be created in lieu of compensation. Under this first adjustment, 80.5 percent of municipal permits and 50.5 percent of industrial permits would receive Interruptible Rights (but total acre-feet of water available as Interruptible Rights is limited to a certain portion of the total reduction; 9.6 percent of reduced municipal water and 30.8 percent of reduced industrial water would be available); and (2) A second proportional adjustment will be calculated in 2004, reducing permits an estimated 20 percent and creating more Interruptible Rights.

In order to make reasonable economic decisions (purchasing, selling, leasing, or forgoing) about Interruptible Rights, municipal and industrial users must assess the uncertainty associated with these rights. The Proposed Rules would create temporary rights, some in the near future and more in 2004 with the final proportional adjustment. Under the proposed rule, these rights would exist only through 2007. Realistically, Interruptible Rights could be affected in the shorter term by litigation, legislation or by a change in the Authority's rules. In general terms, markets respond to uncertainty (risk) by reducing terms of commitment and discounting future values. Attitudes to risk vary, depending on the psychology of the risk-taker and the probable outcomes. Allowing for exceptions, most individuals are held to be risk averters. Such investors would expect higher returns as compensation for higher risks. Municipal and industrial permit holders, many of whom are public agencies, would likely find the determination of an

appropriate level of risk and return for the proposed Interruptible Rights to be a challenge over the short term proposed for the rule (2004-2007). As a result, it is unlikely that a robust market for these rights will develop within the four-year time frame of the proposed rule, making the determination of value and economic impact very hypothetical.

Compensation for the reduced Uninterruptible Rights as required under the current rules would disproportionately affect M&I users. Section 1.29 (e) of the Act limits Aquifer management fees for financing compensation for the withdrawal reduction program to meet the 450,000 acre-feet per year cap to be assessed on irrigation users to \$2 per acre-foot of water withdrawn. No limitation of the Aquifer management fee (based on permitted water rights) is provided for M&I users. The Proposed Rules, by temporarily eliminating compensation, would shield M&I users from the impact of financing a substantial part of the compensation at least through 2007.

3.4.1.2 Loss of Potential Compensation for Uninterruptible Rights for the Period 2004-2007

The Proposed Rules would eliminate the possibility of compensation for Uninterruptible Rights reduced by PA-2 through the year 2007, providing instead a temporary Interruptible Right. The existing rule requires compensation for the amount of water that may not be withdrawn (as a result of PA-2) based on fair market value as that term is defined in Section 11.0275 of the Texas Water Code:

“§ 11.0275. Fair Market Value

Whenever the law requires the payment of fair market value for a water right, fair market value shall be determined by the amount of money that a willing buyer would pay a willing seller, neither of which is under any compulsion to buy or sell, for the water in an arms-length transaction and shall not be limited to the amount of money that the owner of the water right has paid or is paying for the water.

Added by Acts 1997, 75th Leg., ch. 1010, § 2.04, eff. Sept. 1, 1997.”

For Uninterruptible Rights, there exists a limited history of such exchanges by willing buyers and willing sellers of Edwards Aquifer water. This market history would form the basis for the determination of fair market value for compensation under the existing rule.

The Draft Programmatic Assessment (RPC, 2000), as noted in Section 3.6.2, has addressed the issue of quantifying the market value of Uninterruptible Rights. A marketplace in Edwards Aquifer water rights has already begun to develop. Factors motivating the market place are noted below, but the essential concept is that market economics will stimulate most

municipal and industrial users, and some irrigators, to buy rights while simultaneously encouraging many irrigators and some industrial users to sell rights.

The nature of the Proposed Rules pose difficulties in predicting how Uninterruptible rights will trade. The most important issue is that the Act requires that 50 percent of an irrigation IRP, referred to as the “base right,” remain appurtenant to the land. However, the rules allow transfers and conversions of the base right under certain circumstances. For purposes of our basic assessment, we have assumed that a quantity of 1 acre-foot per acre is not available for transfer. A second issue is that, as written, the rules probably allow separate transfers of Interruptible and Uninterruptible Rights. In the assessment it was assumed that the 1 acre-foot that remains with the land is part of the Uninterruptible Right.

A few quantitative attributes of the anticipated marketplace in Uninterruptible Rights are presented in **Table 3.4-2** as background. The principle conclusion reached in the Draft Programmatic Assessment was that a large market exists for transfer of irrigation water rights to municipal and industrial purposes. The only two limits to this market would seem to be: 1) how many rights irrigators are willing to sell (or, what the price needs to be to accomplish the sale); and 2) the presumption that the base acre-foot cannot transfer.

Table 3.4-2 Quantitative Attributes of the Anticipated Marketplace in Uninterruptible Rights*	
1.	Buyers will be seeking water for several purposes: a) to replace Edwards pumping that is cut by the permitting process, including water lost due to the proportional reduction and water lost due to findings by the Authority that certain withdrawals were not beneficially used; b) to firm up the supply that is permitted as Interruptible Rights; and c) to provide water for growing demands.
2.	Replacement water needs can be approximated by comparing recent municipal and industrial pumping, to the assumed allocation of Uninterruptible Rights. 1998 municipal and industrial pumping totaled about 308,000 acre-feet. The assumed allocation of Edwards rights to the municipal and industrial sectors calculated previously is about 243,000 acre-feet per year. If we assume that most buyers will, as a minimum, seek to acquire Edwards rights to replace the Edwards pumping they lose through regulation, there is a market for 65,000 acre-feet per year.
3.	The market to meet growing future needs depends on buyer policies. Based on demand forecasts, the potential market is several hundred thousand acre-feet per year. However, the region’s largest water utility, the San Antonio Water System, has a stated policy to meet growth demands from non-Edwards sources; and the second largest utility, the Bexar Metropolitan Water District, also is concentrating its supply efforts on non-Edwards sources. If this policy holds, then the ultimate demand for Edwards water by municipal and industrial users may not exceed 100,000 acre-feet per year.
4.	The number of industrial users that may enter the marketplace is not known, but presumably demand from these users would total several thousand acre-feet per year. This is because several of the owners of larger industrial permits are now out of business or have a recent history of using less water than their Edwards claim would entitle them to. Industrial sales, therefore, could reduce the market for irrigation rights.

**Table 3.4-2 Quantitative Attributes of the Anticipated Marketplace
in Uninterruptible Rights***

- Continued -

5.	In 1998, a dry year, irrigation pumping reported to the Authority was just over 131,000 acre-feet per year. This represents a bit more than 1.5 acre-feet per acre from active acres. Therefore, some transfer of irrigation rights can occur from active acres without curtailing irrigation activity. This will range from zero on some acres to the full marketable right on others. The total should be several tens of thousands of acre-feet.
6	The Authority will need to acquire and retire 50,000 acre-feet per year of rights by 2008 in order to satisfy the Act's requirement that withdrawals be cut to 400,000 acre-feet per year by that time. The Authority is therefore a customer (and perhaps the only customer) for the assumed base acre-foot right on 115,000 acres.
7.	If the Authority limits its acquisition of base rights to 50,000 acre-feet per year and obtains it all from the irrigation sector, then 65,000 acre-feet per year of irrigation rights could be locked into irrigation use. This is roughly half the actual 1998 use.

Source: RPC, 2000.

*All the quantifications are approximate and intended to inform readers of the overall magnitude of what may occur.

Economic assessment of the impact on M&I users of the loss of compensation under the Proposed Rules must make assumptions about the price that would have been paid for the reduced Uninterruptible Rights. At this time, the Edwards marketplace has not matured to the point that prices are firm. It is probably, therefore, unwarranted to make explicit estimates of prices that could be realized if compensation occurred under the existing rule. As an approximation of the economic impact of the Proposed Rules on M&I users, however, we can rely on actual transfers of Uninterruptible Rights, some of which have occurred at a capital cost of \$700 per acre-foot of water right (that can be withdrawn in perpetuity). That price, when amortized over 30 years at 6 percent interest, equates to an annual cost of about \$50 per acre-foot of rights, comparable to recent 5-year leases of \$77 per acre-foot (San Antonio Express-News, 2003).

Costs to reduce Aquifer withdrawals from 532,000 acre-feet (total uninterruptible withdrawals from initial permits proposed in 2000) to 450,000 acre-feet per year through acquisition of irrigation rights have been estimated in the Authority's Draft HCP/EIS (Hicks & Company, 2003) to range between 49 million and 205 million dollars, based on an assumed market value of water rights ranging from \$600 to \$2,500 per acre-foot.

The Authority has since developed a revised estimate of potential compensation costs based on recent experience with water rights transactions. In late 2001, during development of a five-year Strategic Plan (2002 – 2006), it became apparent that the actual amount of uninterruptible IRPs was indeed going to be at least 82,000 acre-feet greater than the 450,000 acre-feet cap specified in the Act. As a result, the Authority incorporated into the plan an estimated cost to compensate reduced water rights, based on information developed during the

rules assessment process. The most economical water rights for the Authority to acquire are the base irrigation water rights that are appurtenant with the land. Although the agricultural value of the base water rights was estimated in the 2000 Draft Programmatic Assessment at \$500 per acre-foot, to avoid the appearance of underestimating the value of the base water rights, the Authority used \$600 per acre-foot to estimate costs with the following results:

- The total cost for the initial purchase of 82,000 acre-feet was estimated at \$50,000,000 in 2001 dollars.
- The total cost based on a thirty-year re-payment was \$97,195,000 (based on 2001 dollars).
- The annual re-payment cost was \$3,240,000 (in 2001 dollars).
- The annual increase in Aquifer management fees to finance the payment was estimated to be \$10 per acre-foot.

The cost to the Authority to reduce certain IRP withdrawals to 400,000 acre-feet by 2008 was estimated at a similar amount (\$50,000,000), even though the amount of water to be retired was less (50,000 acre-feet), and the expenses to pay for the retirement would be shared with downstream water rights users on the Guadalupe River. The expected cost of water rights was higher because unrestricted irrigation groundwater must be purchased, and they are significantly more expensive than base irrigation water rights. The total estimated cost to the Authority to achieve all permit reduction requirements was estimated to cost nearly \$200,000,000. In addition, these added expenses did not provide any additional water to meet the large water demand deficit calculated for the region, of particular concern to the Authority.

As a result, the board created an Ad Hoc Committee on Withdrawal Reduction Compliance (the Committee) to consider the buydown or an appropriate alternative. The term “buydown” refers only to the Authority’s water right purchase program reducing uninterruptible IRPs to 450,000 acre-feet. The permit retirement program includes reducing uninterruptible IRPs to 400,000 acre-feet. The Committee met for five months in 2002, and while they discussed several options or alternatives, it was unable to make a recommendation to the board on how to achieve the buydown. Complicating reduction compliance plans further, the Authority had made significant progress on contested cases by mid-2002 and realized that the total amount of water rights that qualified for uninterruptible IRPs was nearly 560,000 acre-feet.

In October 2002, the Authority offered all irrigation applicants or permittees (532 in total) \$600 per acre-foot for any water rights they wanted to sell or retire, asking interested

parties to contact the Authority. As of December 2002, only one party had contacted the Authority with an offer to sell 54 acre-feet. It is apparent the current cost of water rights (to achieve a buydown to 450,000 acre-feet) is considerably higher than the Authority expected in the fall of 2001. Therefore, the cost estimate to achieve the permit limits of 450,000 and then 400,000 acre-feet per year is even greater than reported in the Strategic Plan in the fall of 2001. As of January 2003, the latest range of estimated expenses (in 2003 dollars) were predicted to be much higher:

- The cost for the initial purchase of 107,000 acre-feet (to reduce permitted withdrawals to 450,000 acre-feet) would range from \$128,400,000 (at \$1,200 per acre-foot) to \$214,000,000 (at \$2,000 per acre-foot).
- The cost (to reduce permitted withdrawals to 450,000 acre-feet) based on a thirty-year payment would be \$250,590,000 (at \$1,200 per acre-foot) to \$417,600,000 (at \$2,000 per acre-foot).
- The annual cost (to reduce permitted withdrawal to 450,000 acre-feet) would be \$8,400,000 to \$13,900,000, depending on the price of the water.
- The annual increase in Aquifer management fees to finance the payment (to reduce permitted withdrawals to 450,000 acre-feet) would be \$26 to \$43 per acre-foot, depending on the price of the water.

While the compensation would produce direct income to irrigators throughout the region, the costs of Aquifer management fees assessed by the Authority to fund the acquisition of water rights to reduce uninterrupted IRPs to 450,000 acre-feet per year would ultimately be paid primarily by municipal and industrial water users through increased water rates. The Authority's Proposed Habitat Conservation Plan requires that pumping under IRPs will not exceed 450,000 acre-feet per year through 2007. These costs would be reflected as economic benefits to sellers of irrigation rights, and additional economic costs to municipal and industrial users.

The magnitude of these estimates makes it clear that the anticipated process of achieving the statutorily required reductions by means of compensation for and retirement of groundwater withdrawal rights will have a very substantial and far-reaching impact on the regional economy, both as a transfer of wealth from urban to rural economies and as a net economic burden on the municipal and industrial water using sectors.

Under the existing rules, the potential for compensation for the reduced rights is clouded by the lack of explicit authorization in the Act for the Authority to issue revenue bonds to finance the purchase of reduced rights. Although Section 1.29 provides that the authority shall assess a fee to finance the retirement of rights, Section 1.28 (b) of the Act only provides explicit authority for revenue bonds to be issued to, "...finance the purchase of land or the purchase, construction, or installation of facilities or equipment."

If reducing withdrawals to 450,000 acre-feet per year is to be financed with Aquifer management fees over a short period of time (as allowed under Section 1.29 (b) "...and programs authorized under this article,") then the \$2 limit for irrigation users (Section 1.29 (c)) would effectively shift much of the cost of reducing withdrawals to 450,000 acre-feet per year to M&I users because of Section 1.29 (e), as interpreted by the Authority. Although it is difficult to determine a quantitative estimate of the impact of the Proposed Rules on M&I users, it is clear that under the Proposed Rules, M&I users would avoid, over the 2004-2007 period, the payment of very large fees necessary to finance, at fair market value, the compensation for proportionately reduced rights to reach 450,000 acre-feet per year, as required by the current rules.

3.4.1.3 Value of Temporary Interruptible Rights

An analysis of historic San Antonio Index Well (J-17) water levels and pumpage estimates since 1980 reveal several important trends regarding the proposed introduction of Interruptible rights. **Table 3.3-1** above shows the amount of irrigation, municipal and industrial, and total pumpage for the years 1980 to 2002. For the purposes of this discussion, "total pumpage" is the sum of irrigation, municipal and industrial pumpage, the only types of uninterruptible pumpage that the Authority regulates with IRPs, and the types of pumpage included in the 450,000 acre-feet/year total. Domestic and livestock pumpage is not included in the total pumpage.

The total pumpage has exceeded 450,000 acre-feet per year six times since 1980 (1984, 1985, 1988, 1989, 1990, and 1996). In most of these years J-17 was lower than 665 feet (above mean sea level) for the entire year. Only in 1988 was J-17 above 665 feet for a significant portion of the year, from January to the end of April. However, this was not a result of weather conditions or water demand during the year, rather it was due to high J-17 water levels at the beginning of the year.

The ability to use Interruptible Rights is not a function of the demand in a particular year, but rather the Aquifer water levels during the year, especially at the beginning of the year. **Figure 3.3-1** shows J-17 water levels from 1980 to 2003, and **Table 3.3-1** shows the J-17 water

level at the beginning of each year. These data show that J-17 water levels were high enough (at least 675 feet) in approximately half (50 %) of the years since 1980 to have permitted withdrawal of Interruptible Rights for an appreciable length of time in the early portion of a particular year. The use of Interruptible Rights would not necessarily mean that a higher amount of total pumpage would occur. In fact pumpage could be average, it would just be composed of Interruptible Rights and Uninterruptible Rights. If Interruptible Rights are used during the beginning of the year when they are available, Uninterruptible Rights could then be used during the remainder of the year. If J-17 water levels stayed above 665 feet msl for several months of the year, it is likely that all Interruptible water Rights could be used during a particular year. This assumes the Interruptible Rights and Uninterruptible Rights would be separated.

Several of the factors bearing on the value of Interruptible Rights as discussed in **Table 3.3-1**, suggest that irrigators would not use them very often and that many farmers would want to sell their Interruptible Rights to municipal and industrial users. Because of the limited and unpredictable usefulness of the rights, the market price would probably be much less than for Uninterruptible Rights, and a market for them will be some time in developing, possibly not within the four year period 2004-2007 for the proposed rule. Since agricultural users pay no Aquifer-management fees for holding unused Rights, one might expect very little liquidity in these rights for some time. Almost all the Interruptible Rights would eventually transfer, albeit at a significant discount. Those who have been expecting higher prices for their entire withdrawal rights might be disappointed.

For Interruptible Rights, the probable price would likely be less than the value added for municipal and industrial buyers. For a typical municipal or industrial user, annual operating costs for a non-Edwards supply (for water, diversion, conveyance, storage, and treatment) may range over \$180 per acre-foot per year versus an annual operating cost of \$20 per acre foot of water derived from the Edwards. Thus, in a year when M&I Interruptible Rights could be used, withdrawing Interruptible water could save M&I operators more than \$160 per acre-foot in annual operating costs. If the rights would be available 50 percent of the time, the savings would be \$80 per year per acre-foot of rights. This savings would be reduced by the amount of the EAA fee, assumed here to be \$25 per acre-foot per year, leaving a net value of \$55 to the potential buyer.

The actual selling price of Interruptible Rights would be probably substantially less because of the risk that the right could remain unavailable for several years, and because the main value of the right would not manifest for many years in the future, when the high operating cost non-Edwards projects are developed. Because of the cost of holding such rights, municipal

operators are not likely to want to acquire them in advance of need. On a present value basis, the benefits of any future savings would be largely consumed if Aquifer management fees were paid over a holding period of eight or more years.

Because of their limited and unpredictable usefulness, the market lease price for Interruptible Rights should be much less than for Uninterruptible Rights, perhaps as low as \$35-\$40 per acre-foot for a 5-year lease term. The uncertain availability of the Interruptible right would inhibit a higher price.

The term of commitment for Interruptible leases may be very short. The Groundwater Trust is a program offered by the Authority to facilitate the marketing of Edwards Aquifer water rights through maintenance of a trust fund. See EAA Rules Chapter 711, Subchapter N. Information for those interested in selling or leasing interim authorization or groundwater rights has been posted on the Authority's web page. This information reveals that the majority of those interested in making their Uninterruptible Rights available prefer to lease their rights for a 1-5 year term rather than sell.

3.4.1.4 Summary of Economic Impacts

Our expectations for the economic impacts of the Proposed Rules issuing Interruptible Rights on M&I users are summarized below:

- All users would avoid the substantial costs of compensation for reduced rights required under the current rules. M&I users would benefit most as, under the current provisions of the Act and Authority rules, they would bear a disproportionate burden of these costs.
- Interruptible Rights are too uncertain to be relied on to meet current demand. Their value is probably restricted to those users who can take advantage of an uncertain supply, therefore, a user with available storage.
- Interruptible Rights will be of greatest value to municipal and industrial users who develop costly non-Edwards water supplies. For these users, using existing Edwards wells when Interruptible Rights are available is likely to cost less than the non-Edwards supply.
- Because of their unreliability, Interruptible Rights are likely to be of reduced value to other users, including most municipal, and industrial users who continue to use the Edwards as their sole source of supply.

3.5 IMPACTS ON IRRIGATORS

Irrigators may be affected in one of two general ways. They may attempt to utilize Interruptible Rights as part of their annual irrigation water budget, possibly to the detrimental effect of their business prospects. Alternatively, they could plan to utilize all Interruptible supplies when well levels indicate a wet start of the year. Both possible scenarios are described below.

Irrigators will probably find very limited use for the Interruptible Rights established by the Proposed Rules (RPC, 2000). If the total quantity of water needed by irrigators can be met by Uninterruptible Rights, the Interruptible supply is not needed. For irrigating farmers who need more water than Uninterruptible Rights permit to maintain full production, the use of Interruptible Rights would involve additional risks. The prospective availability of Interruptible Rights would have to be projected before the planting season without knowing actual rainfall and the resulting J-17 well level. In Medina and Uvalde Counties, there would be some years when the Aquifer is so high that one could confidently forecast that the Interruptible Right would be usable for the entire irrigation season. In drier years, one could predict that the water level would probably drop to below the index well trigger levels and the Interruptible Right would be lost. A wet year would reduce crop irrigation demand, reducing the need for Interruptible Rights.

Each farmer would have to predict how long into the growing season the Interruptible Rights would be available, and whether the remaining Uninterruptible Rights would be enough to finish the crop. In such a scenario, the average annual income would be less and more farm failures would be expected over the long run. Interruptible Rights would be most available during wet periods and November through March, when they are least needed, and least secure during dry periods, when they are most needed.

Buyers of farm products would be cautious about signing contracts that commit them to crops that have an insecure water supply. Given that some dry years are inevitable and that reliance on Interruptible Rights would ensure some crop failures, the buyers could turn to producers from outside the Authority area to ensure a reliable supply of products. The net result would be that some crops currently grown under relatively low-risk contracting arrangements with processors would be grown speculatively for the fresh produce market. For farmers affected by this factor, another element of risk would be introduced into their business profile. Bankers in turn would be reluctant to lend money on the basis of that part of farmers' projected income that depends on the use of an insecure water supply and an uncertain selling price. Lacking buyers and financing, in at least some years farmers would base their planting only on the

uninterruptible portion of their water right only. The Interruptible Right would be unused in those years.

Based on this assessment, many farmers would likely lease or sell their Interruptible Rights to municipal or industrial users. Because of their limited and unpredictable usefulness, the market lease price for Interruptible Rights should be much less than for Uninterruptible Rights. Recent transactions by the San Antonio Water System (San Antonio Express-News, 2003) indicate that for Uninterruptible Rights the current market lease price for a 5-year lease is \$77 per acre-foot. The uncertain availability of the Interruptible Right would suggest a substantially lower price.

An alternative reaction by irrigators to the issue of Interruptible Rights might be to adjust cropping strategies to optimize the use of the right. If an Interruptible Right can be used with fair certainty for the first three or four months of the calendar year, then some farmers might alter their business to favor crops that harvest early in the calendar year when they can be assured of using their Interruptible Rights. If there is no other way to use the right, they will have relatively little regard for the tradeoffs between water efficiency and income. Some quick-producing crops may use more water than their historical plantings would indicate. Interruptible Rights then becomes assets that must be used early in the year if at all.

Under the original rule, compensation would be required for a reduction in rights to achieve 450,000 acre-feet per year potentially financed by permit holders through Aquifer management fees. Irrigator's Aquifer management fees are capped at \$2 per acre-foot. As noted above, the Proposed Rules would, through 2007, delete the compensation requirement for the buydown of the difference between the applicant's PA-2 amount and the applicable minimum, substituting the establishment of Interruptible Rights that may be withdrawn at high Aquifer levels. The Proposed Rules, therefore, would eliminate the potential relative advantage to irrigation users arising from the Aquifer management fee rate cap of \$2 per acre-foot for the withdrawal reduction program to 450,000 acre-feet per year.

4.0 IMPACTS ON THE AQUIFER AND AQUIFER-RELATED RESOURCES

Impacts of withdrawals via Interruptible Rights on Aquifer resources have been examined in the Draft Programmatic Assessment (RPC, 2000) and those results will be summarized as background to the current assessment. Additional information on the Aquifer water budget is included in this section, along with a discussion of biological resources and springflows. The limitation on pumping of Interruptible Rights to high Aquifer levels provides a key measure of protection for springflows and dependent species.

4.1 DRAFT PROGRAMMATIC ASSESSMENT EXAMINATION OF INTERRUPTIBLE RIGHTS

4.1.1 Introduction

The Draft Programmatic Assessment developed a set of hypothetical scenarios including one for Interruptible Rights withdrawals. The following scenario was input to the GWSIM model to estimate the hydrologic effects of Interruptible withdrawals. This is Scenario L in the Draft Programmatic Assessment's Appendix GWSIM. The assessment of impacts to the Aquifer of the Proposed Rules in the current study, **Section 4.2**, does not use the GWSIM-IV model because the model is most appropriately used to simulate and compare various strategies over longer periods of time and is less appropriate for quantitative evaluation of individual strategies such as the short-term withdrawal of Interruptible Rights over the next four years (2004-2007).

4.1.2 Scenario L Assumptions

- From other scenarios, an available data set for input to the GWSIM model was used that assumed pumping for municipal and industrial use at 297,940 acre-feet per year (representing a 20 percent increase over assumed permitted levels; see Scenario C, Appendix GWSIM). Also available was a data set that assumed permitted irrigation pumping at 219,541 acre-feet per year (Scenario B).
- It was assumed that the aggregate pumping including irrigation—517,481 acre-feet per year—would occur when Interruptible Rights were available. Thus, it was effectively assumed that when Interruptible Rights were available, withdrawals would increase by 67,481 acre-feet per year. That value is intermediate between the estimates of Interruptible Rights —50,000 to 80,000 acre-feet per year.
- IRP withdrawals were assumed to be 450,000 acre-feet per year at other times.

- The scenario assigned all the extra pumping to municipal and industrial users in direct proportion to their assumed permitted rights. Therefore, most of the interruptible pumping was in Bexar County.
- A Comal Springs springflow of >200 cfs was used as a surrogate for water levels that are high enough to allow use of Interruptible Rights.¹

4.1.3 GWSIM Modeling

The model results indicate that with a withdrawal cap of 450,000 acre-feet per year uninterruptible IRPs in place and no Interruptible pumping, the >200 cfs Comal Springs trigger would be reached 34 percent of the time. Historic water levels would have allowed use of Interruptible Rights at least 40 percent of the time, but these data may overstate long-term future conditions. The model results are considered to be in reasonable agreement with the historic data.

The use of Interruptible Rights would lower Aquifer levels, so that the well-specific water levels used to turn Interruptible Rights off would be reached more often. Therefore, Interruptible Rights would be useful much less than 34 percent of the time. The simulation results predict that Interruptible Rights would actually be useable approximately 25 percent of the time.

Historical data suggest this prediction may be overestimated. Over the 48-year period of record 1955-2002, total Aquifer pumping exceeded the assumed model pumpage of 517,481 acre-feet per year in only four years (EAA 2003a). In each of these years, irrigation pumping was substantially below the assumed model pumpage of 219,481 acre-feet/year. Highest estimated withdrawal for irrigation peaked in 1985 at 203,100 acre-feet.

4.1.3.1 Effects on Water Levels

The GWSIM predictions of Aquifer water levels do not provide accurate absolute values, but alternative pumping rates can be compared in relative terms. At J-17, the effect of the Interruptible Rights would lower water levels by an average of 2.9 feet. The difference is 3.2 feet at the Hondo well and 2.6 feet at the Uvalde well. Using a rule of thumb that it costs 15

¹ Water levels at the index wells were not used, because GWSIM does not accurately simulate the absolute values of such levels. A higher trigger level for Comal Springs, 250 cfs, also was simulated (Scenario M in Appendix GWSIM). The more restrictive trigger made the Interruptible rights much less usable. To ensure a conservative analysis, the results of the 200 cfs trigger are reported here.

cents to lift an acre-foot of water an extra foot, the total regional increase in pumping costs resulting from the Interruptible Rights concept would be on the order of \$200,000 per year.

4.1.3.2 Effects on Springflows

The effects of Interruptible Rights are represented by Scenario L in the Draft Programmatic Assessment's Appendix GWSIM. The effects of 450,000 acre-feet per year of pumping are represented by Scenario B. The model outputs are unreliable in absolute terms, and tend to under-predict springflow effects, but the *relative* values are reasonably useful for comparison purposes.

Table 4.1-1 summarizes some of the basic results of the GWSIM simulations that are reported in the Appendix. The first simulation is for irrigation, municipal and industrial withdrawals of about 485,000 acre-feet per year, which in the model represents existing conditions in 2000 (Scenario H in the Appendix to the Draft Programmatic Assessment). Next is simulation of a proportional reduction of these withdrawals to 450,000 acre-feet per year. The third scenario includes withdrawals by Interruptible Rights (Scenario L); the method for calculating withdrawals is described in Section 6.2.3 of the Draft Programmatic Assessment. The fourth shows an unconstrained future, with withdrawals exceeding 600,000 acre-feet per year (Scenario D). Additional results of the model simulations are cited in the impact analysis in Chapter 6 of the Draft Programmatic Assessment.

Table 4.1-1, can be interpreted as follows:

- Most of the impact from Interruptible Rights occurs at high springflows. This is because Interruptible Rights can only be used when the Aquifer water levels are high, which is also a time of high springflows.
- The effects of the Interruptible withdrawals quickly dissipate once the Interruptible Rights are shut down. This is because of the unusual water-balance features of the Edwards Aquifer, in which reductions in pumping are substantially offset by corresponding changes in springflow.
- For a repeat of historical recharge conditions, the effect of Interruptible pumping compared to a steady 450,000 acre-feet per year of pumping is to reduce discharge from Comal Springs.. As a result, available downstream water supplies in the Comal and Guadalupe Rivers would be reduced.

The effect at San Marcos Spring is simulated to be negligible.

Table 4.1-1 Draft Programmatic Assessment of GWSIM Scenario Modeling

Summary of Results from GWSIM				
(Water levels are given relative to Scenario H; values rounded to nearest foot)				
Scenario	H	B	L	D
Variable	Existing 485,000 AFY	Cap 450,000 AFY	Interruptible Rights	Unconstrained 608,845 AFY
Average Water level, Bexar County	Reference	8 feet higher than reference	4 feet higher than reference	48 feet lower than reference
Average Water level, Medina County	Reference	9 feet higher than reference	4 feet higher than reference	43 feet lower than reference
Average Water level, Uvalde County	Reference	12 feet higher than reference	9 feet higher than reference	39 feet lower than reference
Average flow, Comal Springs	116 cfs	148 cfs	131 cfs	29 cfs
Months Comal flows < 200 cfs*	579	516	585	727
Months Comal dry*	150	80	86	527
Average flow, San Marcos Springs cfs	127 cfs	131 cfs	129 cfs	95 cfs
Lowest monthly flow, San Marcos Springs, cfs	46 cfs	56 cfs	55 cfs	0 cfs

*Out of a 780 month period, assuming repeat of recharge conditions 1934-98

Source: Draft Programmatic Assessment, 2000.

NOTE: This table does not include the effects of existing DM/CPM rules.

4.1.3.3 Effects on Frequency of Demand Management/Critical Period Reductions

Because exercise of Interruptible Rights would potentially lower water levels in the Aquifer, the thresholds for implementing critical period reductions would be reached more frequently. GWSIM outputs do not reliably predict actual water levels, and therefore the model water-level outputs cannot be used to predict this effect.

Using Comal springflows as an indicator, and assuming a threshold of 200 cfs, the critical period reductions would be in place nine percent more often under the Interruptible Rights concept than under scenario B. The 60 cfs discharge at Comal Springs, which is the lowest target flow identified by USFWS, would be reached about one percent more often [Note: This was based on early assumptions about critical period reductions that have been superceded by higher reductions imposed by the Authority's DM/CPM Final Rules].

The model indicates that at the start of a critical period, water levels would be dropping faster if there had been Interruptible pumping in the past than if there had not been such pumping. While this effect dissipates quickly, it is possible that this effect could require an amendment to the DM/CPM rules to require greater pumping curtailments during the early

stages of a drought. If this is the case, any benefits obtained from use of Interruptible Rights might be substantially offset by greater pumping restrictions during droughts.

4.2 IMPACTS OF PROPOSED INTERRUPTIBLE RIGHTS ON THE AQUIFER THROUGH 2007

4.2.1 Aquifer Demand

In this assessment, total water demand on the Aquifer for human needs is computed as the sum of municipal, manufacturing, irrigation, steam electric power generation, mining, and livestock water demands. Although water demand on the Edwards Aquifer for these purposes is expected to increase substantially over the 2000 to 2060 period (Texas Water Development Board, 2003), demand growth over the next four years (2004-2007) as noted in Section 3.3.5, is not expected to exceed 448,000 acre-feet per year except in the alternative demand scenario described in Section 3.3.5.5. Water demand for sustaining spring ecosystems at San Marcos and Comal Springs, although not projected by the TWDB, is expected to remain constant. The Act establishes as a major function and goal the protection of the Aquifer-dependent species that are designated as threatened or endangered under state or federal law. The supporting of springflows through water conservation is an essential aspect of preserving the habitats of seven endangered and one threatened species living in the region's spring ecosystems.

For a given level of regional population, employment and irrigation, regional water demand on the Edwards Aquifer would be determined by future water use efficiencies, in terms of water used per capita, per employee (or per unit of output), and per acre of irrigated cropland. There is little evidence that creation of an Interruptible Right by the Proposed Rules would directly increase Aquifer demand during wet periods, except for the planned implementation of Aquifer storage and recovery (ASR). Under this Aquifer management strategy, during higher Aquifer levels (above 665 msl), water could be pumped from the Aquifer using Interruptible Rights and stored for future use during dryer periods. The ASR project would have positive effects on springflow by reducing demand for Aquifer pumping during dryer periods because stored surplus water could be utilized.

4.2.2 Water Demand for Spring Ecosystems and Species

As noted in the Authority's Draft Programmatic Assessment, the immediate, direct regional impacts of the Proposed Rules would include potentially reduced springflows during wet periods. However, withdrawals using Interruptible Rights would only occur during those periods when springflows are relatively high and above critical levels, thus limiting the likelihood of impacts on endangered species.

Eight species are listed as threatened or endangered that depend on water in or discharged from the southern portion of the Edwards Aquifer system, thereby invoking protection by the federal Endangered Species Act (ESA). The seven endangered species of the Edwards Aquifer system are the Texas blind salamander (*Eurycea rathbuni*), fountain darter (*Etheostoma fonticola*), San Marcos gambusia (*Gambusia georgei*), Texas wild-rice (*Zizania texana*), Comal Springs riffle beetle (*Heterelmis comalensis*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), and Peck's cave amphipod (*Stygobromus pecki*). The threatened species is the San Marcos salamander (*Eurycea nana*).

All species are aquatic and inhabit ecosystems dependent on the Edwards Aquifer. The Texas blind salamander is a subterranean species, occurring in the Aquifer around San Marcos Springs. The Comal Springs dryopid beetle and Peck's cave amphipod are known to occur in the Aquifer around Comal Springs. The fountain darter and Comal Springs riffle beetle occur in the spring-fed systems of both Comal and San Marcos Springs, while the San Marcos salamander and Texas wild-rice only occur in the spring-fed ecosystem of San Marcos Springs. The San Marcos gambusia is endemic to the San Marcos Springs ecosystem. It has not been observed since 1983 and may be extinct. Cagle's map turtle (*Graptemys caglei*), a candidate for listing, is endemic to the Guadalupe River system of South Texas and is dependent on streamflow of the Guadalupe River. Flows of the Guadalupe River downstream of the confluence with the San Marcos River are partially dependent on the Edwards Aquifer, Comal Springs, and San Marcos Springs. A study completed by Dr. Killebrew of West Texas A&M indicated springflow did not appear to be the only important factor in their existence (Killebrew et al, 2002).

One of the primary threats to the listed species is the intermittent loss of habitat from reduced or no springflows resulting from reduced Aquifer recharge and regional pumping. The southern portion of the Edwards Aquifer serves more than 1.7 million people as their primary source of water, and current water use has increased to the extent that variable precipitation and associated recharge, coupled with regional pumping contributes to loss of springflow and habitat.

The Authority is preparing an application for an Incidental Take Permit and regional Habitat Conservation Plan under §10(a)(1)(B) of the Endangered Species Act. This take would be incidental to otherwise lawful activities that would occur as a result of water withdrawals within the jurisdiction of the Authority. In order to minimize and mitigate incidental take, the Authority is identifying a level of Aquifer withdrawal that would not reduce springflow below critical levels except during conditions of severe drought. This level of Aquifer withdrawal would be implemented incrementally, and then would not be exceeded during the proposed 50-year permit period. The withdrawal of water under proposed Interruptible Rights is not expected

to detrimentally affect springflows during drought periods because withdrawal of such rights would be prohibited when the Aquifer level falls below the index well trigger levels of 665 feet above msl at J-17 and 865 above msl at J-27.

This section will describe the potential impacts of implementation of the Proposed Rules on the Edwards Aquifer (in terms of Aquifer levels and springflows) and related biological resources, including the endangered and threatened species. The following sub-sections provide summary descriptions of Aquifer dynamics, historical Aquifer and springflow levels, and a discussion of the potential impact of conservation measures.

4.2.3 The Edwards Aquifer Water Budget

The dynamics of Edwards Aquifer water levels and associated flows of Comal Springs and San Marcos Springs are affected by the rate of water entering the Aquifer (recharge) and the rate of water exiting the Aquifer (discharge). Recharge, as discussed, occurs from water entering the recharge zone from streams, natural catchments, recharge structures and localized runoff from precipitation events. Seasonal rainfall over the region ultimately controls the rate of recharge. Discharge occurs from withdrawal of water from wells and from natural springs and seeps. Discharge is greatly affected by water demand and rate of pumping. If recharge is high, the Aquifer can sustain higher levels of pumping, while maintaining higher levels of springflows. However, if there is low seasonal rainfall and recharge combined with high rates of pumping, then Aquifer levels decrease with resulting decreased spring discharge until the point that DM/CPM rules are triggered and pumping is reduced. Historic recharge and discharge of the Edwards Aquifer and effects to springflows are discussed below.

4.2.3.1 Groundwater Recharge

Estimates of the average annual recharge of the Edwards Aquifer vary. Maclay (1995) cites an average annual recharge of 635,000 acre-feet. However, Klemt et al. (1979) indicates an average annual recharge of approximately 651,000 acre-feet. Data from the Authority (2003) indicate an average annual recharge of approximately 699,000 acre-feet for the period of record 1934-2002, and an even higher annual average of 920,000 acre-feet during the period 1991-2000. Contributions of the major river basins to the average annual recharge of the Edwards Aquifer during the period of record 1934-2000 are listed in **Table 4.2-1**.

Table 4.2-1 Contributions of Major River Basins to Average Annual Recharge of the Edwards Aquifer, 1934-2002

Basin	Average Annual Recharge (acre-feet)
Frio River–Dry Frio River Basin	135,200
Nueces River–West Nueces River Basin	120,700
Area between Sabinal River and Medina River Basins	110,700
Cibolo Creek–Dry Comal Creek Basin	111,300
Area between Medina River and Cibolo Creek–Dry Comal Creek Basins	71,500
Medina River Basin	62,400
Blanco River Basin	44,600
Sabinal River Basin	42,600
TOTAL	698,900

Source: Edwards Aquifer Authority 2003.

Recharge to the Aquifer varied greatly during the years 1934-2002. Variability was correlated with annual precipitation and corresponding runoff into the major river and creek basins. Lowest annual recharge (44,000 acre-feet) occurred during 1956 at the peak of the drought of record. Highest recharge (2,486,000 acre-feet) occurred in 1992.

Most recharge is contributed by streams crossing the Aquifer recharge zone (85 percent). A much smaller portion is contributed by direct precipitation and localized runoff within the recharge zone (15 percent). Rates of infiltration of water carried by the streams across the recharge zone have been estimated by the Corps of Engineers (1965) to range from 500 to greater than 1,000 cfs.

4.2.3.2 Groundwater Discharge

Water escapes the Edwards Aquifer from wells and from natural springs and seeps occurring near geological faults along the Edwards formation and Balcones Escarpment. Wells are the principal source of water for agricultural, municipal, and industrial uses in the region. Depths of wells range from less than 500 feet in the unconfined Aquifer to more than 3,000 feet in the confined Aquifer in the western region (Maclay, 1995). Wells in the area can be very large, with casing diameters ranging from 10 to 30 inches and capable of pumping in excess of 35,000 gallons per minute. The contribution of groundwater pumping to total Aquifer discharge in 2002 was approximately 38 percent (367,200 acre-feet), while springflow contributed about 62 percent (609,900 acre-feet) (EAA, 2003a). However, over the years 1934 to 2002, the proportion of total discharge contributed by pumping and springflow varied greatly.

Well discharge has generally increased over the period of record to a point beginning in 1968 and running through 1989 where annual discharge consistently exceeded the average annual recharge (Maclay, 1995). Pumping peaked in 1989 at an estimated level of 542,000 acre-feet. Since 1980, as a result of increased pumping, there has been greater fluctuation of springflow with increased time required for recovery, even during a period that recorded the two highest levels of Aquifer recharge (1992 and 1987).

Texas originally had 281 known major non-saline springs, and of these only four were defined as large, having an average flow of over 100 cfs. Of the four largest Texas springs, only two remain, San Marcos and Comal Springs (Brune, 1975). Both of these springs are supported by the Edwards Aquifer.

Other spring outlets of the Aquifer are Leona Springs, San Antonio, San Pedro and Hueco Springs. Total flow from all the springs has averaged over 350,000 acre-feet per year and approximately 90 to 95 percent of that total is attributed to Comal and San Marcos Springs. For the year 2002, spring discharge is presented in **Table 4.2-2**.

Table 4.2-2 Estimated Annual Discharge of Major Springs of the Edwards Aquifer in 2002*

Comal Springs	San Marcos Springs	Hueco Springs	San Antonio Springs	San Pedro Springs	Leona Springs and Leona River Underflow	Total Discharge All Springs
274,800	195,900	58,400	58,600	10,000	12,200	609,900
45%	32%	9%	10%	2%	2%	100%

Source: Edwards Aquifer Authority 2003a.

*Measured in Acre-Feet and Percent of Total Discharge

4.2.3.3 Comal Springs

Comal Springs, located in the City of New Braunfels in Comal County, is the largest natural springs group in the state and is the source of the Comal River. At 623 feet above sea level, Comal Springs is one of the lowest elevation springs fed by the Edwards Aquifer. The springs discharge from four major orifices and flow into Landa Lake (Abbott and Woodruff, 1986). In recorded history, Comal Springs has only gone dry once, in 1956, for 144 days during the drought of record (Longley, 1995).

4.2.3.4 San Marcos Springs

San Marcos Springs, located in the city of San Marcos in Hays County, and very near the base of the Balcones Escarpment, is the second largest spring group in the state and is the source of the San Marcos River. San Marcos Springs, at 574 feet above mean sea level, exhibits the lowest elevation of the major springs in the southern portion of the Edwards Aquifer. Water issues from six major and several minor orifices at the bottom of Spring Lake. The water in San Marcos Springs averages approximately 72° F with slight seasonal variations. Because San Marcos Springs is lower in elevation than Comal Springs and is further down the pathway of the flow of water within the confined artesian Aquifer zone, discharge at Comal Springs appears to dampen effects at San Marcos Springs.

Although Comal Springs went dry for approximately 144 days from June through November in 1956, such an event has never occurred at San Marcos Springs. San Marcos Springs did reach a recorded low discharge of 91 acre-feet per day (46 cfs) in 1956. The record high daily flow for San Marcos Springs was 627 acre-feet in 1975. The average monthly flow during the period 1996 through 2001 was 187 cfs.

Local stream recharge from the Blanco and Guadalupe Rivers and Sink, Purgatory, York, Dry Comal and Alligator Creeks contributes to San Marcos Springs as it crosses the recharge zone (Brune, 1981). San Marcos Springs is also supplied by “regional underflow past the Comal Springs area” (Guyton, 1979).

4.2.3.5 Other Springs

Hueco, San Antonio, San Pedro, and Leona Springs are lesser spring outlets for the Edwards Aquifer. These springs generally have declining or erratic flow due to their high elevation, seasonal fluctuations during dry years, and increased pumping from the Aquifer.

Hueco Springs, in Comal County, is located three miles north of New Braunfels and 300 feet west of the Guadalupe River. The springs consist of two orifices at a high elevation (approximately 658 feet above sea level), and therefore have variable flow and often go dry or have long periods of low flow during drought (Abbott and Woodruff 1986). The maximum discharge for Hueco Springs was 260 acre-feet per day (131 cfs) in 1968 (Brune, 1975) and has averaged about 70 acre-feet per day. Hueco Springs water comes from recharge in the nearby Dry Comal Creek and Guadalupe River basins.

San Antonio Springs are located in Brackenridge Park within the City of San Antonio. These springs are 668 feet above mean sea level and the largest spring is called Head

of the River, implying that it is the head of the San Antonio River. San Antonio Springs number over 100, all of which can flow during a wet year, such as in 1973.

San Pedro Springs, in Bexar County, are located in San Pedro Park in San Antonio at 661 feet above mean sea level. Both San Antonio and San Pedro Springs are supplied by waters that recharge over 62 miles to the west where the Frio, Sabinal, and Medina Rivers and Hondo and Leon Creeks cross the Balcones Fault Zone. Water from these springs is discharged from faults in the Austin Chalk formation. These springs now have erratic or no flow (Brune, 1975).

Leona Springs are found in four groupings along or beneath the surface of the Leona River in Uvalde County. Leona Springs, which are 860 feet above sea level, are recharged by the Nueces River and other streams to the northwest (Brune, 1981).

4.2.4 Impact of Interruptible Rights on the Aquifer

As noted in **Section 3.3.5** above, the use of Interruptible and Uninterruptible Rights would not require an excessively high water demand. When water levels are high enough, Interruptible Rights could be used to meet average or even below average demands. If water levels allow the use of Interruptible Rights at the beginning of a year, there will always be some demand to which these rights can be applied. An estimated twenty percent of the municipal and industrial demand occurs in the first quarter of the year, and if it is especially hot and dry, irrigators may also be pre-irrigating in preparation for planting in the spring. The use of these rights would then allow the Uninterruptible portion of the permit to be applied over a shorter period of time.

If Aquifer water levels are very high at the beginning of the year, and the weather during that year is hot and dry, then pumpage would be high but DM/CPM rules would not reduce pumpage significantly. When examined on a year-to-year basis as is required for the current evaluation, DM/CPM reductions are not so much a function of weather and pumpage conditions during a particular year as they are a function of water levels in the Aquifer at the beginning of the year. If DM/CPM rules had been in effect during the last 20 years, some record pumpage years may not have been impacted at all by these rules.

Water levels will be very high at the beginning of 2004; and based on an evaluation of January 1 water levels since 1980, it is likely that at least one additional year between 2005 and 2007 will also start out with high J-17 water levels. If water levels at the beginning of a year are high, then all first quarter withdrawals could be applied to Interruptible Rights. During these

years, once the J-17 water level reaches 665 feet, the full amount of Uninterruptible Rights would then be available until the Aquifer fell below DM/CPM trigger levels.

4.3 POTENTIAL IMPACTS OF REDUCED SPRINGFLOWS RESULTING FROM WITHDRAWAL OF INTERRUPTIBLE RIGHTS ON THE AQUIFER'S BIOLOGICAL RESOURCES

4.3.1 Springflows and the Ecosystems

The Edwards Aquifer, including its two largest spring ecosystems, Comal and San Marcos Springs, maintains a diversity of species, many of which are endemic. While the Aquifer and its spring systems are closely associated with respect to water quality, water quantity, and thermal conditions, the Edwards Aquifer supports a highly adapted biological assemblage that differs considerably from those species found in the spring ecosystems. The individual species within the subterranean biological assemblage have adapted to seasonal and weather-related variations in groundwater levels. The focus of this part of the rules assessment will be on the potential impact of the withdrawal of Interruptible Rights under the Proposed Rules on flows from Comal and San Marcos Springs and the subsequent impact to the respective aquatic ecosystems.

A host of environmental attributes shapes the partitioning of habitat and control distributions of the various species in the Comal and San Marcos Springs ecosystems. These attributes include flow (depth and velocity), temperature, substrate size and distribution, oxygen content, turbidity, and other physical and chemical conditions that combine with biotic influences to control population dynamics of individual species (U.S Fish and Wildlife Service, 1996). Regarding species-specific biological requirements, the factor most-frequently discussed with concern to all species is the quantity of springflow.

With the exception of the San Marcos gambusia, *Gambusia georgei*, each of these species is currently present in its respective spring ecosystem, which indicates persistence through the drought of record (though likely extinct now, the San Marcos gambusia was sampled subsequent to the drought of record). One could expect that these species would continue to survive if environmental conditions resemble the period of record. While there is no clear evidence that the drying of Comal Springs was the sole cause for the disappearance of the fountain darter in that system in the 1950s, any period of zero flow would introduce the potential for reduced survival of some species. Maintaining a hydrograph similar to that of recorded history, while providing a measure of safety against periods of zero flow, would provide the best

means of protecting the aquatic communities as a whole and meeting the goal of threatened and endangered species survival in the wild.

Existing ecosystem function and native aquatic biodiversity can be preserved by maintaining springflows at levels similar to those previously recorded. Achieving this objective would help ensure the survival of threatened and endangered species in the Comal and San Marcos Springs, and maintain the integrity of the entire aquatic ecosystem.

Impacts to the flora and fauna within the Comal and San Marcos Springs ecosystems are directly related to the amount and quality of usable habitat that remains available to each species. The dynamic nature of stream ecosystems dictates that the amount of available habitat to each species will fluctuate in response to a number of variables, one of the most significant of which is streamflow. Instream flow must be sufficient to meet the necessary requirements of the species dependant on the stream system.

Periods of severe drought pose risks to several species of concern in both the San Marcos and Comal Springs systems because of the resulting periods of low-flow and potential loss of suitable habitat. Although water quantity is a major factor to suitable habitat for these species, other requirements for suitable habitat include adequate water quality, preferred vegetation composition, low incidence of competitive, non-native species, and other more species-specific conditions.

4.3.2 Potential Impacts to Biological and Hydrological Risk Resulting from the Hypothetical Withdrawal of Interruptible Rights through 2007

Biological impacts and risks to the biological resources of the Comal, San Marcos, and other springs systems arising as a result of the Proposed Rules are assessed here within the context of the risk analysis undertaken for the Authority's draft HCP/EIS.

The risk assessment for the HCP/EIS addressed the risks to the ecosystems associated with several alternative annual Aquifer pumping limit levels and related springflow levels. Depending on the amount of hydrologic alteration indicated in the analysis, biological risk (low, moderate, high, and severe) was assessed based upon suitable habitat for the species and the relative amount of time that low-flow conditions would be expected. These two components, hydrologic alteration and biological risk, were combined to assess total risks to the species. Based on an analysis of springflow variability over the period of record for Comal and San Marcos Springs, that assessment concluded that the spring ecosystems have evolved within an environment of considerable variation in flow and that the continued vitality of the ecosystems

would *best be maintained* in the future within a regime of *continued flow variation*. The analysis does note, however, that *extremely low or high flows pose increased risks* to the species inhabiting the ecosystems. A range of flow variation was identified that would provide sufficient habitat necessary to minimize biological and hydrological risks.

Extremely low springflows at Comal Springs occur when water levels at J-17 are well below 665 feet msl which would preclude the withdrawal of Interruptible Rights. Above 665 feet msl, water levels and springflows would be at high levels. In such conditions, pumping of Interruptible Rights would not have adverse effects to the spring ecosystems.

Results of biological modeling to evaluate pumping alternatives for the HCP indicate that at very low flows and/or low recharge ecosystems are adversely impacted by hydrologic alteration. The extent of these impacts would depend on the duration and intensity of low springflow events that might resulting from the increased pumping allowed by the Interruptible withdrawals. Such impacts cannot be quantitatively estimated for this evaluation. Declining Aquifer levels and resulting impacts to the spring ecosystems would be managed through two principal controlling mechanisms: 1) curtailment of Interruptible pumping when the Index Wells decline below 665 and 865 msl, and 2) additional DM/CPM reductions required by DM/CPM rules if Aquifer levels continue to decline below 650 feet msl.

Although the proposed Interruptible Rights could allow increased pumping during conditions when Aquifer levels exceed 665 feet msl, this withdrawal of water under proposed Interruptible Rights is not expected to detrimentally affect springflows at Comal or San Marcos Springs during drought periods because withdrawal of such rights would be prohibited when the Aquifer level falls below the index well trigger levels of 665 feet above msl at J-17 and 865 msl at J-27.

Estimates of springflow and biological impacts suggest that the Proposed Rules would have, at the very most, negligible to minimal impact to the Aquifer and its biological resources. Potential adverse impacts would be substantially mitigated by the ability to transfer water from the Aquifer during wet periods using Interruptible Rights when the Aquifer level is above 665 msl at J-17 for future storage and recovery to reduce pumping demand and protect springflow when droughts occur. Additional mitigation would also be provided through implementation of biological and Aquifer management measures identified in the Authority's proposed Habitat Conservation Plan currently under development.

4.3.3 Potential Downstream Impacts of Withdrawal of Interruptible Rights

If lower springflows result from the withdrawal of Interruptible Rights, flows of the San Marcos, Comal, Nueces, San Antonio, and Guadalupe Rivers downstream of the springs could be affected. Although this assessment has not used the Guadalupe River Water Availability Model to estimate the quantitative impact of potential lower springflows to the receiving rivers at various gauge points downstream, it can reasonably be concluded that over relatively short reaches downstream of the springs, lower springflows would lead to lower river flows. Lower river flows would have several negative impacts on the local area's water-related recreational economy and reduce water available to surface rights holders in the Guadalupe River Basin, as discussed below. The following examination of downstream impacts draws upon material developed in the Authority's Draft Programmatic Assessment (RPC, 2000), its Draft Habitat Conservation Plan/Environmental Impact Statement and the 1998 Assessment Report of the South Central Texas Water Advisory Committee (SCTWAC).

4.3.3.1 Springflow-Dependent River Recreation and Commercial Enterprises

As noted in the EAA's Draft Programmatic Assessment (RPC, 2000), tourist attractions benefit from pumping restrictions and higher springflows. Water recreation businesses along the San Marcos and Comal Rivers would directly benefit from higher flows, since faster river flow affords more exciting tubing, canoeing, and rafting. Water recreation below Canyon Dam benefits indirectly from higher Comal springflow since more water could be stored behind Canyon Dam for later release, significantly extending the period of desirable river recreation conditions.

Comal Springs and San Marcos Springs play important roles in the health of the tourist industry in Comal and Hays counties, respectively. These springs, the Comal and San Marcos Rivers, Canyon Lake, and the middle Guadalupe River, collectively support a large, water-based sector of the regional economy.

Tourism spending for overnight visitors in Comal County was estimated to be \$161,660,000 in the year 2000, generating \$3,340,000 in local sales tax receipts (city and county) and \$11,320,000 in state sales tax receipts (Texas Department of Economic Development and Dean Runyon Associates 2001). Day visitors were estimated to generate the same economic impact as overnight guests in Comal County (Meek 2002). As a result, total tourism spending in Comal County was estimated to be approximately \$323,000,000 in the year 2000, generating approximately \$6,680,000 in local sales tax receipts or approximately 55.3 percent of the total City of New Braunfels and Comal County sales tax receipts of \$12,080,000.

Water-based recreation was estimated to account for 70 percent of annual tourism revenue in Comal County, generating approximately \$4,700,000 in local sales tax revenues in the year 2000 (Meek 2002).

Employment in the leisure and hospitality industry ranged from 11 percent to 15 percent of total Comal County employment during the year 2001. Reflecting the importance of water-based recreation in Comal County, employment in the leisure and hospitality industry rose during the water season from May through September and fell during the rest of the year. For example, leisure and hospitality employment in Comal County averaged 4,625 jobs during the third quarter of 2001 and fell to 3,292 jobs during the fourth quarter, a decrease of 28.8 percent (Texas Workforce Commission 2002).

Tourism spending for overnight visitors in Hays County was estimated to be \$111,970,000 in the year 2000, generating \$1,770,000 in local sales tax receipts (city and county) and \$8,210,000 in State sales tax receipts (Texas Department of Economic Development and Dean Runyon Associates 2001). Information on the economic impacts of day visitors and water-based recreation in Hays County is not available.

Unlike Comal County, employment in the leisure and hospitality industry remained relatively stable throughout the year in Hays County, ranging from 10.8 percent to 11.8 percent of total employment during the year 2001. For example, leisure and hospitality employment in Hays County averaged 4,205 jobs during the third quarter of 2001 and fell to 3,995 jobs during the fourth quarter, a decrease of only 5.0 percent (Texas Workforce Commission 2002). The stability of tourism employment throughout the year indicates that water-based recreation plays a smaller role in Hays County than in Comal County.

The possible reduction of Comal and San Marcos springflows under the assumption of implementation of the Proposed Rules on Interruptible Rights during periods of extreme hydroclimatology could reduce downstream river flows but these reductions would largely occur during relatively wet periods when streamflows would be above average. These reductions would be unlikely to have substantial negative impacts to the businesses along the Comal and Guadalupe Rivers and to those seeking to enjoy the rivers. This assessment does not, however, include estimates of the quantitative economic effects associated with Interruptible Rights.

4.3.3.2 Surface Water Rights in the Guadalupe River Basin

The Guadalupe River Basin originates in southwestern Kerr County and drains southeasterly to Guadalupe Bay in the San Antonio Bay System. Drainage area for the Guadalupe River Basin is 6,070 square miles, and the main tributaries to the Guadalupe River are the Blanco and San Marcos Rivers.

The base flow of the Guadalupe River is affected by flows of the Comal and San Marcos Rivers, each river originating from Comal Springs and San Marcos Springs, respectively. The Comal River, the shortest river in Texas and the United States, runs approximately 3.1 miles before emptying into the Guadalupe River. The San Marcos River also empties into the Guadalupe River near Gonzales in Gonzales County after its confluence with the Blanco River.

Appendix *Surface* in the Draft Programmatic Assessment (RPC, 2000) summarizes findings presented in the Assessment Report of the South Central Texas Water Advisory Committee (1998). The SCTWAC Report discussed in limited ways the impacts to the Nueces and San Antonio Basins. Results of the GSA-4 model were used to estimate the downstream effects of alternative withdrawal limits imposed by the Authority.

The SCTWAC report concluded that a withdrawal limit of 450,000 acre-feet per year is not fully protective of downstream water rights, especially during a repeat of a drought similar to the drought of the 1950s. Water rights in the Comal River would be affected the most, with no water available for diversion for a period of more than two years. For purposes of their assessment, the key comparison was to a hypothetical future condition in which Edwards pumping is not constrained. While this scenario was not simulated by SCTWAC, their report does contain information indicating that a change in withdrawal rates of several hundred thousand acre-feet per year would have significant impacts. Increased shortages would be felt throughout the system, but especially in the upper reaches including Canyon Reservoir.

The report further concluded that a more detailed assessment of downstream impacts would be appropriate for the 400,000 acre-feet per year cap to be implemented in 2008, because downstream users are required to pay for part of the cost of meeting that reduction. The SCTWAC report indicates that a 450,000 acre-feet per year withdrawal limit is a beneficial start in protecting downstream interests but is not sufficient. The report's simulations also indicate that changes in springflow resulting from a 450,000 acre-feet per year cap would be small compared to the overall water budget of the river system as it discharges into Guadalupe Bay.

Thus, withdrawal limits imposed by the Edwards Aquifer Authority would yield relatively small benefits to the fish harvest or the bay and estuary ecosystems.

The Draft Programmatic Assessment's examination of downstream effects was based on GWSIM modeling of the period of record, including the drought of record. Downstream interests are particularly concerned about Aquifer withdrawals during severe drought conditions.

The withdrawal of Interruptible Rights under the Proposed Rules would likely increase the rate of decline in springflow during drought conditions (especially in a wet year-dry year scenario), providing relatively less water for these rivers. But as these relative decreases in springflows resulting from Interruptible Rights withdrawals have not been modeled with the Guadalupe River Water Availability Model (TCEQ, 2003), the quantitative impact on surface water availability to downstream rights holders and environmental interests cannot be explicitly estimated. Slightly negative impacts could be expected to occur, however, especially in the river reaches immediately below the springs.

4.3.3.3 San Antonio Bay and Guadalupe Estuary

Since a portion of the flow of the Guadalupe River is derived from flows of the Comal and San Marcos Rivers, contributions of Edwards Aquifer discharge to the Guadalupe River via Comal and San Marcos springs can be significant under certain conditions. Local runoff to the estuary is contributed from parts of the San Antonio-Nueces and Lavaca-Guadalupe coastal basins. Both the quantity and quality of flow of the Guadalupe River subsequently affect biological productivity of the Guadalupe Estuary System including Mission Lake, Guadalupe, Ayres, San Antonio, Mesquite, and Espiritu Santo Bays. The Resource Protection Division of the Texas Parks and Wildlife Department has recommended a "...lowest target value..." freshwater inflow to the Guadalupe Estuary System of 1,150,000 acre-feet per year to fulfill the biological needs of the system on a seasonal basis. Occasional higher inflows above the target level are recommended to maintain the biological productivity and ecological health of the estuary (TPWD 1998). The contribution of various sources of freshwater to the Guadalupe Estuary System is provided in **Table 4.3-1**.

Table 4.3-1 Average Annual Freshwater Inflow to Guadalupe Estuary System

Source	Inflow (acre-feet/year)	% of Total Inflow
Guadalupe River	1,304,000	42.8
San Antonio River	485,400	15.9
Precipitation	440,000	14.4
Local runoff	460,000	15.1
Edwards Aquifer	360,000	11.8
TOTAL	3,049,400	100.0

SOURCE: CH2M Hill 1986.

The average annual contribution of the Edwards Aquifer according to the above table is about 12 percent. The proportion contributed by the Edwards Aquifer to freshwater inflow into the bay system is higher in drought years. Using data provided by Espey, Huston & Associates (1986), McKinney and Watkins (1993) concluded that contributions of the Edwards Aquifer during the drought of record that occurred in 1956 were about 30 percent of the total inflow to San Antonio Bay. In comparison, unpublished information from the Guadalupe-Blanco River Authority (GBRA) compiled from data obtained from the U.S. Geological Survey and Texas Water Development Board and Water Availability Modeling from the Texas Commission on Environmental Quality (TCEQ), indicates that contributions of Comal and San Marcos Springs to bay and estuary inflows during the peak summer months of the 1956 drought ranged between 30 and 55 percent (Votteler, 2002). Based on unpublished information obtained from TPWD (2000), the contribution of the Edwards Aquifer springflow to San Antonio Bay and Guadalupe Estuary System during the drought year of 1996 was about 33 percent of the total inflow. Estimates by the GBRA for springflow contribution to the estuary during 1996 were similar, with the highest contribution exceeding 35 percent during the month of July (Votteler, 2002). The contribution of spring discharges to the Guadalupe River flow at Victoria, Texas during the 1996 drought was estimated by Votteler to be 78 percent.

Water availability modeling of the impact of increased springflows on the contributions of freshwater inflows to the San Antonio Bay and Guadalupe Estuary System has not been undertaken for this assessment of the Proposed Rules. However, based on the relationship between springflows and contributions to the bay and estuary, as cited above, it would not be unreasonable to conclude that the withdrawal of Interruptible Rights under the Proposed Rules could have slightly negative, if unquantifiable, impacts on these resources if these withdrawals led to an annual withdrawal of substantially more than 450,000 acre-feet per year. These impacts would potentially be most severe during drought conditions. The withdrawal of Interruptible Rights would, however, take place mostly during periods of high precipitation and recharge. A hypothetical scenario can be considered whereby drought conditions existed in the Guadalupe Basin and above average precipitation and recharge occurred

in the recharge zone portion of the Nueces and San Antonio Basins leading to high Aquifer levels. Under this improbable set of circumstances, the withdrawal of Interruptible Rights and possible impacts to springflow and subsequent downstream flows could occur.

5.0 RULE ANALYSIS BY SECTION

5.1 CHAPTER 711 (GROUNDWATER WITHDRAWAL PERMITS) SUBCHAPTER E (GROUNDWATER WITHDRAWAL PERMITS)

5.1.1 Chapter 711 Subchapter E (Groundwater Withdrawal Permits)

Chapter 711 Subchapter E (Groundwater Withdrawal Permits) is amended as follows:

“CHAPTER 711. GROUNDWATER WITHDRAWALS

Subchapter E. Groundwater Withdrawal Permits

§ 711.98 Initial Regular Permits

...

- (m) The board shall issue withdrawal amounts to an applicant for an initial regular permit pursuant to § 711.176 of this chapter (Groundwater Withdrawal Amount for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts) or as modified by § 711.180 of this chapter (Voluntary Waiver of Applications for Initial Regular Permits).”

5.1.2 Subchapter E (Groundwater Withdrawal Permits), Section 711.98(m)

Section 711.98(m) links the requirements for issuing IRPs to §711.176 (Groundwater Withdrawal Amount for Initial Regular Permits; Compensation for Phase-2 Proportional Amounts) or as modified by § 711.180 (Voluntary Waiver of Applications for Initial Regular Permits). The proposed amendment to § 711.98(m) exchanges the concept of compensation for Phase-2 proportional amounts to Interruptible withdrawals under the IRP structure.

The proportional adjustment of IRPs is set forth in Section 711.172. In this section baselines are defined for the purpose of calculating adjustments to permitted withdrawals. Essentially, historical average minimums (which consist of at least three years of beneficial use in the historical period) and irrigator minimums (which are two acre-feet per year per each acre that was actually irrigated in the historical period) are used along with the concept of maximum historical use (which is the greater of the two minimums or in some cases the extrapolated maximum beneficial use) and, in turn, are applied on a permit by permit basis to reduce aggregate uninterruptible withdrawals to 450,000 acre-feet per year.

5.2 THE PROPOSED AMENDMENTS TO SUBCHAPTER G (GROUNDWATER AVAILABLE FOR PERMITTING; PROPORTIONAL ADJUSTMENTS; EQUAL PERCENTAGE REDUCTION)

The proposed amendments to Subchapter G (Groundwater Available for Permitting; Proportional Adjustments; Equal Percentage Reduction) are as follows:

Subchapter G. Groundwater Available for Permitting; Proportional Adjustment; Equal Percentage Reduction

Section

...

§ 711.164 Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits

...

§ 711.176 Groundwater Withdrawal Amount for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts

§ 711.164 Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits

(a) Except as provided by subsection (c), unless increased pursuant to § 1.14(d) of the Act and Subchapter K of this chapter (Additional Groundwater Supplies), the amount of groundwater from the Aquifer that the board may permit to be withdrawn on an uninterruptible basis pursuant to initial regular permits, and additional regular permits for the period from the effective date of these rules through December 31, 2007, shall not exceed 450,000 acre-feet for each calendar year under the following Aquifer conditions:

(1) for wells in the San Antonio pool, whenever the water level of the Aquifer as measured at well J-17 is greater than 650 feet above mean sea level;

(2) for wells in the Uvalde pool, whenever the water level of the Aquifer as measured at well J-27 is greater than 845 feet above mean sea level.

...

§ 711.176 Groundwater Withdrawal Amounts for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts

...

(b) If the aggregate maximum historical use of all applicants to be issued initial regular permits exceeds the amount of groundwater available for permitting in § 711.164(a) of this chapter (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits), then an applicant shall receive an initial regular permit authorizing the withdrawal of groundwater from the Aquifer in the following amount:

...

(6) if the applicant qualifies for an irrigator or historical average minimum, a PA-2 amount is calculated pursuant to § 711.172(g)(7) and (8) of this chapter (Proportional Adjustment of Initial Regular Permits), and the applicant's irrigator or historical average minimum (or where an irrigator applicant qualifies for both minimums, the greater of the two) is greater than the applicant's PA-2 amount, then in an amount equal to the applicant's PA-2 amount. In such a case, the difference, in acre-feet, between the applicant's PA-2 amount and the applicable minimum may, through December 31, 2007, be withdrawn on an Interruptible basis by the applicant only under the following Aquifer conditions:

(A) for wells in the San Antonio Pool, whenever the water level of the Aquifer as measured at well J-17 is greater than 665 feet above mean sea level; or

(B) for wells in the Uvalde Pool, whenever the water level of the Aquifer as measured at well J-27 is greater than 865 feet above mean sea level.

5.2.1 Section 711.176 Amendments

Section 711.176 is amended to exchange the concept of compensation for Interruptible withdrawals of Phase-2 proportional amounts calculated pursuant to Section 711.172(g)(7) and (8). Interruptible water rights are essentially defined as the difference between PA-2 and the applicable minimum.

5.2.2 Subchapter G, Section 711.164 (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits)

Section 711.164 (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits) is amended to include withdrawals on an Interruptible basis pursuant to IRPs, and additional regular permits for the period from the effective date of these rules through December 31, 2007. Withdrawals under these parameters shall not exceed 450,000 acre-feet for each calendar year under two specific conditions which are added to §711.164 (a):

(1) Interruptible withdrawals will be allowed for wells in the San Antonio pool whenever the water level at Index Well J-17 exceeds 665 feet above mean sea level.

(2) For wells in the Uvalde pool, Interruptible withdrawals under PA-2 conditions will be allowed when Index Well J-27 exceeds 865 feet above mean sea level.

5.2.3 Subchapter G, Section 711.176 (Groundwater Withdrawal Amounts for Initial Regular Permits and Phase-2 Proportional Amounts)

Section 711.176 (Groundwater Withdrawal Amounts for Initial Regular Permits and Phase-2 Proportional Amounts) is amended to replace the concept of compensation for

Interruptible withdrawals. Section 711.176 (b)(6) is amended to include the definition of the applicable time frame (from the effective date of the Proposed Rules through December 31, 2007) and specifically replaces compensation with potential use of water rights on an Interruptible basis by the applicant. It also stipulates use of water on an Interruptible basis as long as J-17 is greater than 665 feet above mean sea level in the San Antonio pool or as long as J-27 is greater than 865 feet above mean sea level in the Uvalde pool for wells in the respective pools.

5.3 AMENDMENTS TO SUBCHAPTER K (CONDITIONAL GROUNDWATER SUPPLIES)

Amendments to Subchapter K (Conditional Groundwater Supplies) are as follows:

Subchapter K. Additional Groundwater Supplies

Section

...

§ 711.304 Allocation of Additional Groundwater Supplies

§ 711.304 Allocation of Additional Groundwater Supplies

If the board issues an order under § 711.302 of this chapter (Board Order Increasing the Permitted Withdrawal Cap), the additional groundwater shall be allocated as follows:

...

(2) if the additional groundwater supplies are attributable to a water management strategy identified in § 711.294 of this chapter (Water Management Strategies) and the water management strategy is paid for or implemented by the Authority, then the additional groundwater will be allocated, to the extent water is available, to restore on a *pro rata* basis any reductions from initial regular permittees' maximum historical use in the following order of priority:

(A) conversion of the Interruptible PA-2 amount into an uninterruptible withdrawal amount under § 711.164(a) (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits) of this subchapter;

(B) retirements of initial regular permits made pursuant to § 1.21(c) of the Act and subchapter H (Withdrawal Reductions and Regular Permit Retirement Rules) of chapter 715 (Comprehensive Water Management Plan Implementation); and

(C) any proportionally adjusted amounts under § 711.172(h) of this chapter (Proportional Adjustment of Initial Regular Permits).

5.3.1 Subchapter K, Section 711.304 (Allocation of Additional Groundwater Supplies)

The relevant provisions of Subchapter K are in Section 711.304 (Allocation of Additional Groundwater Supplies). Essentially §711.304 (2) is amended to provide that additional groundwater will be allocated to the extent that water is available to restore on a pro rata basis any reductions from IRPs' maximum historical use according to three basic priorities. The essential amendment is the addition of a new priority that takes precedence over two existing priorities. The new priority provides for the conversion of the Interruptible PA-2 amount into an uninterruptible withdrawal amount under §711.164 (a) (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits).

5.4 CUMULATIVE EFFECTS

The cumulative effects of the proposed amendments stem primarily from the need to convert water rights which could not be withdrawn but for which applicants could be compensated into water rights that could be withdrawn on an Interruptible basis. The framework for calculating the proportional amounts already exists in §711.172. The transformation from compensated but unusable water rights to uncompensated but conditionally usable water rights balances the two competing statutory requirements of limiting certain withdrawals to 450,000 acre-feet per year through December 31, 2007 and the requirement to issue minimum permits for irrigators and historical maximum average permits for other permit holders. More specifically, the approach allows the authority to honor the required minimums in §1.16 (e) of the Act while attempting to meet the cap required by §1.14 (b).

As indicated in Section 3.0 of this document, the Proposed Rules will lead to withdrawals reduced by approximately 10.45 percent on a provisional basis (for 2004) followed by additional Proportional Adjustments between 2005 and 2007. Moreover, within the three basic categories for water use it appears that regulatory artifacts like high irrigator minimums will safeguard irrigation permits from the potential effects of proportional adjustments. However, for most of the municipal permits and for approximately half of the industrial permits that were granted Interruptible Rights, those rights resulted in smaller portions when compared to irrigation permits.

Ironically, an equalizing factor for all three categories of water withdrawals is embedded in the fact that the use of Interruptible water rights is tied to minimum index well levels, which are in turn tied to precipitation levels, which ultimately means that, for the most part, they will be available only during wet years when they are not as likely to be needed.

6.0 SUMMARY OF FINDINGS

The Proposed Rules would require the Board to issue Interruptible Rights for groundwater withdrawals through 2007 for any statutory minimums reduced during the Proportional Adjustment process. These Interruptible Rights would be useable only at the specified Aquifer elevations. As the Authority is currently unable to finance the compensation of reduced rights, this approach was adopted to mitigate a complete loss of a portion of a water right that is guaranteed by the Act. Terms such as “secondary,” “supplemental,” and “junior” have been used to categorize these Interruptible Rights.

Permitted groundwater users are divided into three categories: municipal, industrial, and irrigation water users. Under proportional adjustment, all permits will be adjusted and some will be granted Interruptible Rights.

This regulatory assessment conducted a review of IRP data and proposed adjustment calculations for 2004 permits. Once the final percentages are known (when the Authority has taken final action on all pending IRP applications), and not before, the final amount of Interruptible Rights will be determined because additional Proportional Adjustments will have to take place. The assessment of the potential impacts of the Proposed Rules on the regulated community relies substantially on the Authority’s Draft Programmatic Assessment (RPC, 2000).

As of November 1, 2003, approved uninterruptible IRPs total approximately 502,517 acre-feet per year. A PA-2 factor was therefore calculated to reduce permitted withdrawals to 450,000 acre-feet per year as required by the Act and the Authority's Proposed Rules. The PA-2 factor constitutes a 10.45 percent reduction for 2004 IRPs. Other pending IRP applications have not been finalized but are anticipated to constitute roughly an additional 60,000 acre-feet per year, most likely requiring an additional PA-2 Proportional Adjustment prior to January 1, 2005.

After the PA-2 Proportional Adjustment, most IRPs will include Uninterruptible and Interruptible Rights. The use of Uninterruptible Rights will reflect at least two considerations: 1) the extent to which such rights may be curtailed during droughts by the Authority’s adopted DM/CPM rules, and 2) the relationship of the rights to demand. The Proposed Rules would allow Interruptible Rights to be available for wells in the San Antonio Pool only when the Aquifer level, as measured at Index Well J-17, is greater than 665 feet msl; or for wells in the Uvalde Pool, when the Aquifer level, as measured at Index Well J-27, is greater than 865 feet msl.

Interruptible Rights should not have an appreciable effect on the volume of water withdrawn from the Aquifer in the near future, with the exception of the possible hydroclimatological scenarios described in **Chapter 3.0**. The volume of water that can be withdrawn from the Aquifer each year is limited by demand, which is a function of population and weather, lack of significant storage into which Aquifer water could be placed when available through Interruptible Rights, and regulations such as the DM/CPM Rules of the Authority.

Water levels will be very high at the beginning of 2004. Based on an evaluation of January 1 water levels since 1980, it is likely that at least one additional year between 2005 and 2007 will also start out with high Index Well J-17 water levels. If water levels at the beginning of a year are high, then all first quarter withdrawals could be applied to Interruptible Rights. During these years, once the Index Well J-17 water level reaches 665 feet msl, the full amount of Uninterruptible Rights would then be available until the Aquifer fell below DM/CPM trigger levels.

Economic impacts can be summarized as follows. Users would avoid the substantial costs of contributing through Aquifer management fees to compensation for certain proportional adjustments required under the current rules. Municipal and industrial users would benefit most, as under the current provisions of the Act and Authority rules, they would bear a disproportionate burden of these costs. If reducing uninterruptible IRPs to 450,000 acre-feet per year is to be financed with Aquifer management fees over a short period of time (as allowed under Section 1.29 (b) "...and programs authorized under this article,") then the \$2 limit for irrigation users (Section 1.29 (c)) would effectively shift much of the cost of reducing withdrawals to 450,000 acre-feet per year to M&I users because of Section 1.29 (e), as interpreted by the Authority. The Proposed Rules would eliminate the potential relative advantage to irrigation users arising from the Aquifer management fee rate cap of \$2 per acre-foot for the withdrawal reduction program to 450,000 acre-feet per year.

Interruptible Rights are relatively uncertain. The value of Interruptible Rights would probably be highest to those users who could take advantage of an uncertain supply, that is, a user with available storage. Interruptible Rights would be of greatest value to municipal and industrial users who develop costly non-Edwards water supplies. For these users, using existing Aquifer wells when Interruptible Rights are available would likely cost less than the non-Edwards supply. Because of their unreliability, Interruptible Rights are likely to be of less value to users who do not have available storage, including most municipal, and industrial users who continue to use the Aquifer as their sole source of supply.

Regarding downstream flows, based on the relationship between springflows and contributions to the bay and estuary, it would not be unreasonable to conclude that the withdrawal of Interruptible Rights under the Proposed Rules could have slightly negative, if unquantifiable, impacts on these resources. These impacts would potentially be most severe during drought conditions. The withdrawal of Interruptible Rights would, however, take place mostly during periods of high precipitation and streamflow. A hypothetical scenario can be considered whereby drought conditions existed in the Guadalupe Basin and above average precipitation and recharge occurred in the recharge zone portion of the Nueces and San Antonio Basins leading to high Aquifer levels. Under this improbable set of circumstances, the withdrawal of Interruptible Rights and possible impacts to springflow and subsequent downstream flows could occur.

There is little evidence that creation of Interruptible Rights by the Proposed Rules would directly increase Aquifer demand during wet periods, except for the planned implementation of Aquifer storage and recovery (ASR). Under this Aquifer management strategy, water during higher Aquifer levels (above 665 msl) could be pumped from the Aquifer using Interruptible Rights and stored for future use during dryer periods. The ASR project would have positive effects on springflow by reducing demand for Aquifer pumping during dryer periods because stored surplus water could be utilized.

During non-drought conditions, effects of the Proposed Rules may result in decreased Aquifer levels and associated decreased springflow. However, estimates of springflow and biological impacts suggest that the Proposed Rules would have, at the very most, minimal or negligible impact to the Aquifer and its biological resources. Any adverse impacts would be substantially mitigated by the ability to transfer water from the Aquifer during wet periods using Interruptible Rights when the Aquifer level is above 665 msl at Index Well J-17 for future storage and recovery to reduce pumping demand and protect springflow when droughts occur. Additional mitigation would also be provided through implementation of biological and Aquifer management measures identified in the Authority's proposed Habitat Conservation Plan currently under development.

Impacts on the Authority include additional monitoring and enforcement responsibilities to oversee recording of Interruptible and Uninterruptible Rights used to ensure that Interruptible Rights waters are withdrawn only when the Index Well levels exceed the specified trigger levels. As the effects of the Proposed Rules take effect it may become necessary to provide more regulatory definition for purposes of monitoring compliance. Subsequent rule making for this purpose may create the need for additional staff. Even if

additional staff is not indicated for the period between the effective date of the Proposed Rules and December, 2007, it would be prudent to update the Strategic Plan to reflect these changes.

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APPENDIX A
PROPOSED RULES CHAPTER 711
SUBCHAPTERS E, G, & K

**EDWARDS AQUIFER AUTHORITY
RULEMAKING**

Title: **EDWARDS AQUIFER AUTHORITY RULES
Ch. 711 (Groundwater Withdrawal Permits)
Subchapters E (Groundwater Withdrawal Permits), G (Groundwater Available for Permitting; Proportional Adjustment; Equal Percentage Reduction) and K (Additional Groundwater Supplies)**

Rule Type: **Proposed Rules (PRs)**

Prepared By: Darcy Alan Frownfelter, General Counsel
Hunter Burkhalter

Approved By: Gregory M. Ellis, General Manager

Date Prepared: October 14, 2003

Effective Date: _____, 200__
Board approves FRs: _____, 200__
Permits Committee approves FRs: _____, 200__
GM approves FRs: _____, 200__
Public Hearing on PRs: _____, 200__
GM determines: Assessment needed: Oct. 14, 2003
Board approves PRs: Oct. 14, 2003 (sent to GM for assessment and public comment)
Permits Committee approves PRs: _____, 200__
GM approves PRs: Oct. 9, 2003

CHAPTER 711. GROUNDWATER WITHDRAWALS

Subchapter E. Groundwater Withdrawal Permits

Section

...

711.98

§ 711.98 Initial Regular Permits

...

(m) The board shall issue withdrawal amounts to an applicant for an initial regular permit pursuant to § 711.176 of this chapter (Groundwater Withdrawal Amount for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts) or as modified by § 711.180 of this chapter (Voluntary Waiver of Applications for Initial Regular Permits).

Subchapter G. Groundwater Available for Permitting; Proportional Adjustment; Equal Percentage Reduction

Section

...

711.164 Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits

...

711.176 Groundwater Withdrawal Amount for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts

§ 711.164 Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits

(a) Except as provided by subsection (c), unless increased pursuant to § 1.14(d) of the Act and Subchapter K of this chapter (Additional Groundwater Supplies), the amount of groundwater from the Aquifer that the board may permit to be withdrawn on an uninterruptible basis pursuant to initial regular permits, and additional regular permits for the period from the effective date of these rules through December 31, 2007, shall not exceed 450,000 acre-feet for each calendar year under the following Aquifer conditions:

(1) for wells in the San Antonio pool, whenever the water level of the Aquifer as measured at well J-17 is greater than 650 feet above mean sea level;

(2) for wells in the Uvalde pool, whenever the water level of the Aquifer as measured at well J-27 is greater than 845 feet above mean sea level.

...

§ 711.176 Groundwater Withdrawal Amounts for Initial Regular Permits; Interruptible Withdrawals of Phase-2 Proportional Amounts

...

(b) If the aggregate maximum historical use of all applicants to be issued initial regular permits exceeds the amount of groundwater available for permitting in § 711.164(a) of this chapter (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits), then an applicant shall receive an initial regular permit authorizing the withdrawal of groundwater from the Aquifer in the following amount:

...

(6) if the applicant qualifies for an irrigator or historical average minimum, a PA-2 amount is calculated pursuant to § 711.172(g)(7) and (8) of this chapter (Proportional Adjustment of Initial Regular Permits), and the applicant's irrigator or historical average minimum (or where an irrigator applicant qualifies for both minimums, the greater of the two) is greater than the applicant's PA-2 amount, then in an amount equal to the applicant's PA-2 amount. In such a case, the difference, in acre-feet, between the applicant's PA-2 amount and the

applicable minimum may, through December 31, 2007, be withdrawn on an Interruptible basis by the applicant only under the following Aquifer conditions:

(A) for wells in the San Antonio Pool, whenever the water level of the Aquifer as measured at well J-17 is greater than 665 feet above mean sea level; or

(B) for wells in the Uvalde Pool, whenever the water level of the Aquifer as measured at well J-27 is greater than 865 feet above mean sea level.

Subchapter K. Additional Groundwater Supplies

Section

...

711.304 Allocation of Additional Groundwater Supplies

§ 711.304 Allocation of Additional Groundwater Supplies

If the board issues an order under § 711.302 of this chapter (Board Order Increasing the Permitted Withdrawal Cap), the additional groundwater shall be allocated as follows:

...

(2) if the additional groundwater supplies are attributable to a water management strategy identified in § 711.294 of this chapter (Water Management Strategies) and the water management strategy is paid for or implemented by the Authority, then the additional groundwater will be allocated, to the extent water is available, to restore on a *pro rata* basis any reductions from initial regular permittees' maximum historical use in the following order of priority:

(A) conversion of the Interruptible PA-2 amount into an uninterruptible withdrawal amount under § 711.164(a) (Groundwater Available for Permitted Withdrawals for Initial and Additional Regular Permits) of this subchapter;

(B) retirements of initial regular permits made pursuant to § 1.21(c) of the Act and subchapter H (Withdrawal Reductions and Regular Permit Retirement Rules) of chapter 715 (Comprehensive Water Management Plan Implementation); and

(C) any proportionally adjusted amounts under § 711.172(h) of this chapter (Proportional Adjustment of Initial Regular Permits).