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Explanatory Report for Proposed Desired Future Conditions of the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, Groundwater Management Area 10

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Abbreviations

DFC	Desired Future Conditions
GCD	Groundwater Conservation District
GMA	Groundwater Management Area
MAG	Modeled Available Groundwater
TWDB	Texas Water Development Board

1. Description of Groundwater Management Area 10 and its Northern Subdivision

Groundwater Conservation Districts (GCDs, or districts) were created, typically by legislative action, to provide for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions. The individual GCDs overlying each of the major aquifers or, for some aquifers, their geographic subdivisions were aggregated by the Texas Water Development Board (TWDB) acting under legislative mandate to form Groundwater Management Areas (GMAs). Each GMA is charged with facilitating joint planning efforts for all aquifers wholly or partially within its GMA boundaries that are considered relevant to joint regional planning.

Groundwater Management Area 10 was delineated based primarily on the extent of the San Antonio and Barton Springs segments of the Fresh Edwards (Balcones Fault Zone) Aquifer, but it also includes the underlying down-dip Trinity Aquifer. Other aquifers in GMA 10 include the Leona Gravel, Buda Limestone, Austin Chalk, and the Saline Edwards (Balcones Fault Zone) aquifers. The planning area of Groundwater Management Area 10 includes all or parts of Bexar, Caldwell, Comal, Guadalupe, Hays, Kinney, Medina, Travis, and Uvalde counties (Figure 1). GCDs in Groundwater Management Area 10 include all or parts of Barton Springs/Edwards Aquifer Conservation District, Edwards Aquifer Authority, Kinney County Groundwater Conservation District, Medina County Groundwater Conservation District, Plum Creek Conservation District, and Uvalde County Underground Water Conservation District (Figure 1).

As mandated in Texas Water Code § 36.108, districts in a GMA are required to submit Desired Future Conditions (DFCs) of the groundwater resources in their GMA to the executive administrator of the TWDB, unless that aquifer is deemed to be non-relevant for the purposes of joint planning. According to Texas Water Code § 36.108 (d-3), the district representatives shall produce a Desired Future Conditions Explanatory Report for the management area and submit to the TWDB a copy of the Explanatory Report.

GMA 10 has designated the Saline Edwards (Balcones Fault Zone) Aquifer in the northern subdivision of the GMA as a relevant aquifer for purposes of joint planning. This document is the preliminary Explanatory Report for this aquifer.

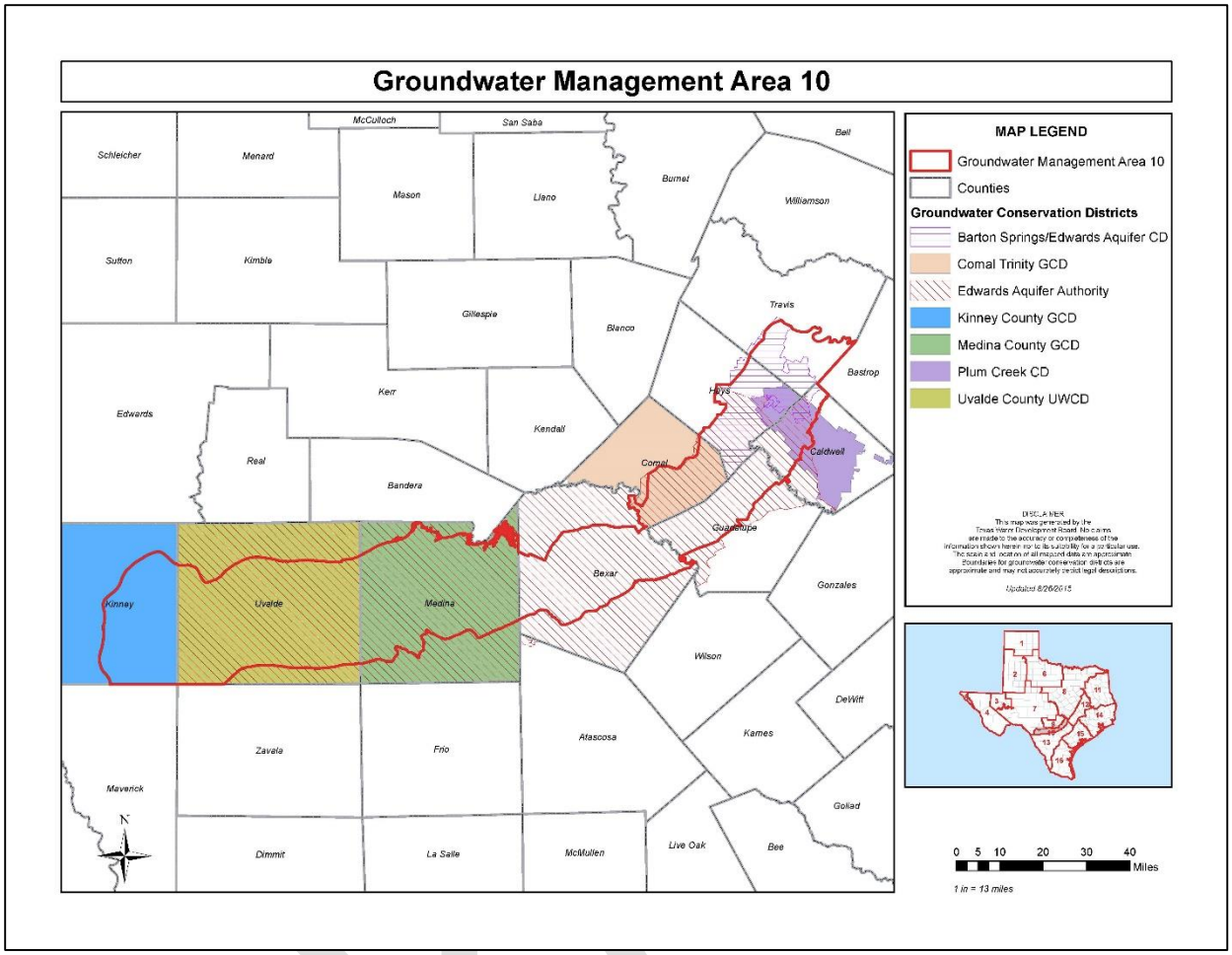

Figure 1. Map of the administrative boundaries of GMA10 designated for joint-planning purposes and the GCDs in the GMA (From Texas Water Development Board website)

2. Aquifer Description

The saline portion of the Edwards (Balcones Fault Zone) Aquifer is down-dip (southeast) of the Edwards (Balcones Fault Zone) Aquifer in the northern subdivision of GMA 10--approximately shown in Figure 2. Hunt et al., (2014) provide an updated map of the saline zone of the Edwards Aquifer for much of the northern subdivision of GMA10.

The term "saline zone" is used to describe the area east of the freshwater zone where groundwater can be produced that contains greater than 1,000 mg/L TDS. Water with less than 1,000 mg/L (or ppm) is considered fresh, generally does not need treatment, and is suitable for most uses. Brackish groundwater generally describes water with 1,000 to 10,000 mg/L TDS (George et al., 2011; NGWA, 2010).

The northern subdivision of GMA 10 for the Saline Edwards (Balcones Fault Zone) Aquifer is located within the Regional Water Planning Areas K and L, and is included in portions of Barton Springs/Edwards Aquifer Conservation District and Plum Creek Conservation District. As shown in Figure 2, this aquifer includes portions of Hays, Travis and Caldwell counties. It

excludes the jurisdictional area of the Edwards Aquifer Authority, inasmuch as the EAA and its enabling legislation do not distinguish between fresh water and saline water in the Edwards.

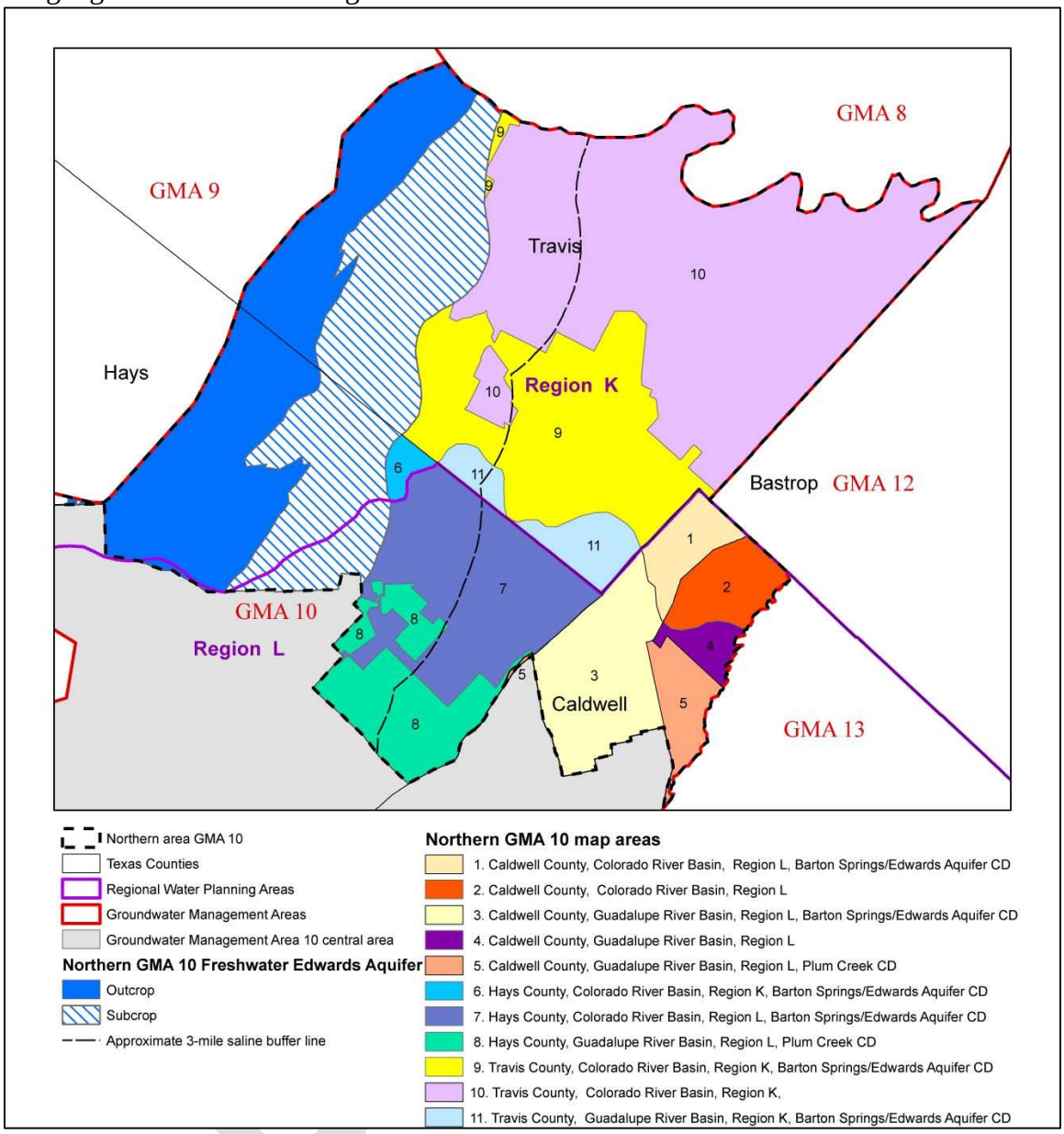

Figure 2. Map showing the extent of the saline portion of the Edwards (Balcones Fault Zone) Aquifer in the northern subdivision of Groundwater Management Area 10. Figure from Bradley (2011).

3. Desired Future Conditions

The proposed DFC for the Northern Saline Edwards is as follows: *No more than 75 feet of regional average potentiometric surface drawdown due to pumping when compared to pre-development conditions.* This DFC is being proposed to replace the DFC adopted in the first round of planning. The policy and technical justifications for this DFC are described in the remainder of this report.

The second round of proposed DFCs was approved at the GMA10 meeting on March 14, 2016 to be available for consideration during the 90-day public comment period and a public hearing held by each GCD. After the comment period and public hearings, the proposed DFCs were adopted at the GMA meeting on XXXX, XX, XXXX. Resolution No. 2016-xx is attached in Appendix A.

4. Policy Justification

The DFC for the Saline Edwards (Balcones Fault Zone) Aquifer in the northern subdivision of GMA 10 was adopted after considering the following factors specified in Texas Water Code §36.108 (d):

1. Aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another:
    a. for each aquifer, subdivision of an aquifer, or geologic strata; and
    b. for each geographic area overlying an aquifer
2. The water supply needs and water management strategies included in the state water plan;
3. Hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge;
4. Other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water;
5. The impact on subsidence;
6. Socioeconomic impacts reasonably expected to occur;
7. The impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002;
8. The feasibility of achieving the DFC; and,
9. Any other information relevant to the specific DFCs.

These factors and their relevance to establishing the DFCs are discussed in appropriate detail in corresponding subsections within Section 6 of this Explanatory Report.

5. Technical Justification

The DFC adopted during the first round of joint planning was expressed as: "Well drawdown at the saline-freshwater interface (the so called Edwards "bad water line") in the northern subdivision of GMA 10 that averages no more than 5 feet and does not exceed a maximum of 25 feet at any one point on the interface."

The TWDB developed a method described in GTA Aquifer Assessment 10-35 MAG (Bradley, 2011) that uses analytical solutions to estimate modeled available groundwater. The drawdown at any one point on the interface of no more than 25 feet was determined to be the constraining factor. Thus, the resulting MAG is very small. However, the expression of only 5 feet of average drawdown throughout the area is also very conservative and would likely also result in a small MAG.

New information from modeling results of a U.S. Geological Survey study (Brakefield and others, 2015) confirm what Barton Springs/Edwards Aquifer Conservation District staff and others have concluded from other hydrologic data and studies—that the saline - freshwaterinterface is in fact relatively stable and has little potential for the movement of

brackish water into the freshwater zone. Conversely, the risk of movement of freshwater into the saline zone is also assumed to be low.

The groundwater conservation districts in GMA 10 regard the saline zone as an alternative water supply that poses little threat to the freshwater Edwards—and in fact its use can lessen demands placed upon it. Barton Springs/Edwards Aquifer Conservation District also has rules in place (management zones and buffers) that address potential pumping projects along the interface of the saline zone. This being the case, it is prudent to restate the DFC for this area to take into account the new information and allow for development of this important alternative supply source.

The newly proposed DFC is an expression of average drawdown of the potentiometric surface. Table 1 is an estimate of modeled available groundwater using an analytical approach commonly used by TWDB. The aquifer storage coefficient and surface areas are from Bradley (2011). The modeled available groundwater is estimated by multiplying the average drawdown (75 feet) by the dimensionless storage coefficient (7.0×10^{-4}) and the area (163,111 acres) to get 8,564 acre-feet per year. As other inflows and outflows are considered to be negligible (described later in this report), this approach treats the aquifer as a closed system.

Table 1. Estimation of Modeled Available Groundwater (MAG) by using the TWDB analytical approach. Areas and properties are the same as those used in Bradley (2011).

	Barton Springs/Edwards Aquifer Conservation District	**Plum Creek Conservation District**	**Non-District Areas**	**Total**
Desired Future Condition (feet of drawdown)	No more than 75 feet of regional average potentiometric surface drawdown due to pumping when compared to pre-development conditions			
Storage Coefficient (dimensionless)	7.0×10^{-4}			
Areal extent (acres)	72,363	15,478	75,270	163,111
Estimated Modeled Available Groundwater (acre-feet per year)	**3,799**	**813**	**3,952**	**8,564**

6. Consideration of Designated Factors

In accordance with Texas Water Code § 36.108 (d-3), the district representatives shall produce a Desired Future Condition Explanatory Report. The report must include documentation of how nine factors identified in Texas Water Code §36.108(d) were considered and how the proposed DFC impacts each factor. The following sections of the Explanatory Report summarize the information that the GCDs used in their deliberations and discussions.

6.1 Aquifer Uses or Conditions

6.1.1 Description of Factors in the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, GMA 10

The discussion in this section is taken from the Barton Springs/Edwards Aquifer Conservation District Management Plan (Barton Springs/Edwards Aquifer Conservation District, 2013). Groundwater use within the Barton Springs/Edwards Aquifer Conservation District is comprised primarily of pumpage from the freshwater Edwards (Balcones Fault Zone) Aquifer with a small but increasing component of pumpage from the Trinity Aquifer. An incidental amount of groundwater is derived from the Taylor and Austin Groups and more geologically recent alluvial deposits. These withdrawals, however, are largely from exempt wells and are not subject to permitting. Given the current Barton Springs/Edwards Aquifer Conservation District management scheme of conditional permitting and the drought restrictions and curtailment requirements associated with mandatory interruptible-supply for new pumpage authorizations for the freshwater Edwards (Balcones Fault Zone) Aquifer, it is likely that future groundwater production will trend more towards pumpage from the Middle and Lower Trinity Aquifers and, eventually, the Saline Edwards (Balcones Fault Zone) Aquifer.

Data presented in Table 2 are a compilation of the Barton Springs/Edwards Aquifer Conservation District monthly meter readings reported by the Barton Springs/Edwards Aquifer Conservation District permittees and are therefore, a more accurate representation of actual District groundwater use than estimates provided by the TWDB (http://www.twdb.texas.gov/waterplanning/waterusesurvey/historical-pumpage.asp). The reported use data are organized by Major Aquifer, County and Management Zone in Table 2. These data include neither Exempt Use, which is primarily from the freshwater Edwards (Balcones Fault Zone) Aquifer and is estimated to be about 105,000,000 gallons (322.2 acre-ft) annually, nor non-exempt domestic use under the District's Non-exempt Domestic Use (recently re-designated "Limited Production") General Permit, which is also primarily from the freshwater portion of Edwards (Balcones Fault Zone) Aquifer and is estimated to be about 20,600,000 gallons (63.2 acre-ft) annually. None of this production is known to be from the saline zone.

Estimates of current use of the saline portion of the aquifer for areas outside Barton Springs/Edwards Aquifer Conservation District were not available from TWDB, but are believed to be small as well.

6.1.2 DFC Considerations

The Saline portion of the Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 is not currently a significant water source in the area. However, pressure on the primary source of groundwater in the area – the freshwater Edwards (Balcones Fault Zone) Aquifer – has led to the need for viable alternative supplies. The proposed DFC allows for a modeled available groundwater that is far above the current use of the aquifer and is designed to make room for development of the aquifer as an alternative supply while protecting existing groundwater supplies.

Table 2. Use of the Edwards (Balcones Fault Zone) and Trinity Aquifers in the Barton Springs/Edwards Aquifer Conservation District for the years 2007–2010 by county and aquifer management zone (the Barton Springs/Edwards Aquifer Conservation District Management Plan) (in gallons and acre-ft)

	Edwards (Balcones Fault Zone) Aquifer		**Trinity Aquifers**		**Totals**
	Freshwater Zones	**Saline Zone**	**Middle Trinity**	**Lower Trinity**	
Hays County					
2007	862,705,785	0	0	-	**862,705,785**
	2,648	0	0	-	**2,648**
2008	1,130,608,005	0	0	-	**1,130,608,005**
	3,470	0	0	-	**3,470**
2009	892,759,134	0	0	-	**892,759,134**
	2,740	0	0	-	**2,740**
2010	1,079,339,042	0	0	-	**1,079,339,042**
	3,312	0	0	-	**3,312**
2011	1,171,615,241	0	8,937,000	-	**1,180,552,241**
	3,596	0	27	-	**3,623**
Travis County					
2007	619,854,938	0	129,680	3,508,300	**623,492,918**
	1,902	0	0.4	11	**1,913**
2008	831,133,678	0	111,640	9,107,100	**840,352,418**
	2,551	0	0.3	28	**2,579**
2009	704,741,741	0	139,510	5,801,300	**710,682,551**
	2,163	0	0.4	18	**2,181**
2010	659,006,656	0	81,520	6,449,900	**665,538,076**
	2,022	0	0.3	20	**2,042**
2011	850,458,404	0	1,502,910	5,694,600	**857,655,914**
	2,610	0	5	17	**2,632**

6.2. Water-Supply Needs

6.2.1 Description of Factors in the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, GMA 10

The discussion in this section is taken from the Barton Springs/Edwards Aquifer Conservation District Management Plan (Barton Springs/Edwards Aquifer Conservation District, 2013) and the Plum Creek Conservation District Management Plan (Plum Creek Conservation District, 2012). For estimating projected water supply needs (i.e., water demand vs. supply) the districts used data extracted from the State Water Plan and provided by the TWDB. The TWDB provides water-supply needs estimates by decade as well as by county. A summary of the projected water-supply needs is provided in Table 3 by decade in acre-ft/yr.

The projections in Table 3 show that for the State Water Plan planning period (2010-2060), there is a progressively increasing water-supply deficit, increasing from 5,422 acre-ft in 2020 up to 134,012 acre-ft in 2060. These water-supply needs in the area arise primarily from and are

dominated by the burgeoning growth on the southern fringe of the Austin metropolitan area, and also in the gradual diminution of the surface-water supplies, as reservoir capacity decreases with time. As in prior plans, some of the water-demand deficits in the area in the out-years (the later years in the planning period) include numerous contractual shortages. These contractual shortages will be addressed on an *ad-hoc* basis, through the renewal and expansion of contracts with wholesale water suppliers and the contractual reallocation of existing supplies in order to address the projected water demands for these and other area water-user groups. But even so, it is projected that there will be unmet needs under drought-of-record conditions and in the out-years.

Table 3. Projected water-supply needs in the counties containing the Saline Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 for the State Water Plan planning period 2010-2060. All values in acre-feet per year. Negative values indicate a need whereas a positive value would indicate a surplus.

	2010	2020	2030	2040	2050	2060
Travis	-3,538	-11,053	-14,067	-18,134	-55,470	-92,045
Hays	-1,674	-5,738	-11,146	-18,871	-28,549	-36,273
Caldwell	-210	-892	-1,910	-3,054	-4,300	-5,694
Totals	**-5,422**	**-17,683**	**-27,123**	**-40,059**	**-88,319**	**-134,012**

6.2.2 DFC Considerations

The population growth of the Austin-San Marcos metropolitan area is creating demand for additional water supplies from all sources, both within and outside of the northern subdivision. The DFC allows for considerable drawdown of the Saline Edwards (Balcones Fault Zone) Aquifer to encourage its use in the future as an alternative water supply that, based on our current understanding of the aquifer, poses little threat to conditions in the freshwater Edwards Aquifer.

6.3 Water-Management Strategies

6.3.1 Description of Factors in the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, GMA 10

The discussion in this section is taken from the Barton Springs/Edwards Aquifer Conservation District Management Plan (Barton Springs/Edwards Aquifer Conservation District, 2013), the Plum Creek Conservation District Management Plan (Plum Creek Conservation District, 2012), and the 2012 State Water Plan, which relies on the Water Planning Group Plans.

Water management strategies for the northern subdivision included in the regional and state water plans are diverse, arising from the increasing deficit in supply relative to the burgeoning demand in the northern subdivision. Strategies include increased public/municipal water conservation, drought management, use/transfer of available or re-allocated surface water supplies, purchase of water from wholesale water providers, purchase of Carrizo-Wilcox water, development of the Trinity Aquifer, Edwards/Middle Trinity aquifer storage and recovery, and, of special importance for this report, the development of the saline zone of the Edwards (Balcones Fault Zone) water. Details of the water management strategies in Caldwell, Hays and Travis counties are included in Appendix B. Table 4 below includes the water management

strategies that target development of the saline zone of the Edwards (Balcones Fault Zone) Aquifer.

Table 4. Projected water management strategies utilizing the Saline Edwards (Balcones Fault Zone) Aquifer in counties in the northern subdivision of GMA 10 in the 2012 State Water Plan.

County	Water Management Strategy	Entity	Volume (acre-feet per year)					
			2010	2020	2030	2040	2050	2060
Hays	Development of Saline Zone of Edwards-BFZ Aquifer	Buda	0	0	0	0	0	500
Hays	Development of Saline Zone of Edwards-BFZ Aquifer	Cimarron Park Water Company	0	0	250	350	500	600
Hays	Development of Saline Zone of Edwards-BFZ Aquifer	County-Other	0	250	2,500	2,500	5,000	6,000
Totals			**0**	**250**	**2,750**	**2,850**	**5,500**	**7,100**

6.3.2 DFC Considerations

The proposed DFCs allow for development of the saline portion of the Edwards (Balcones Fault Zone) Aquifer in the northern subdivision of GMA 10 as contemplated in the water management strategies in the 2012 State Water Plan. The estimated modeled available groundwater of 8,564 acre-feet per year is greater than the peak use in the water management strategies of 7,100 acre-feet per year.

6.4 Hydrological Conditions

6.4.1 Description of Factors in the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, GMA 10

6.4.1.1 Total Estimated Recoverable Storage

Texas statute requires that the total estimated recoverable storage of relevant aquifers be determined (Texas Water Code § 36.108) by the TWDB. Texas Administrative Code Rule §356.10 (Texas Administrative Code, 2011) defines the total estimated recoverable storage as the estimated amount of groundwater within an aquifer that accounts for hypothetical recovery scenarios that range between 25 percent and 75 percent of the porosity-adjusted aquifer volume.

Total estimated recoverable storage values may include a mixture of water-quality types, including fresh, brackish, and saline groundwater, because the available data and the existing Groundwater Availability Models do not permit the differentiation between different water-quality types. The total estimated recoverable storage values do not take into account the effects of land surface subsidence, degradation of water quality, or any changes to surface-water/groundwater interaction that may occur due to pumping.

Though the total estimated recoverable storage may include saline groundwater, the estimates are limited to the official aquifer boundaries as defined by TWDB as opposed to the geologic formation boundaries. For instance, in Figure 2, the saline portion of the Edwards (Balcones Fault Zone) Aquifer is defined as the portion of the aquifer that is east and south of the official Edwards (Balcones Fault Zone) Aquifer boundary defined by TWDB. Though the Edwards geologic formation is present and contains recoverable saline groundwater, it is outside the official boundary of the aquifer. For this reason, TWDB has not developed estimates of the total estimated recoverable storage for the saline portion of the Edwards (Balcones Fault Zone) Aquifer (Jones and others, 2013).

6.4.1.2 Average Annual Recharge

As the Saline portion of the Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 is outside the official boundary of the Edwards (Balcones Fault Zone) Aquifer, the Texas Water Development Board does not develop estimates of average annual recharge, inflows, and outflows. This portion of the aquifer is also not included in a groundwater availability model for the Edwards (Balcones Fault Zone) Aquifer. However, some information is still known about the dynamics of potential inflows and outflows from other sources.

The Saline portion of the Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 is confined above by younger Cretaceous-age formations of the Taylor Group that are generally not significant sources of groundwater (USGS and TWDB, 2006). The saline portion of the aquifer, therefore, does not receive direct recharge from precipitation.

6.4.1.3 Inflows

As the Saline Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 is not in direct communication with the land surface, any flows into and out of the aquifer must occur as lateral flows from the fresh portion of the aquifer to the east or as vertical flows from overlying or underlying formations. Based on information from a recent USGS study and observations of Barton Springs/Edwards Aquifer Conservation District staff, the saline-freshwater interface is relatively stable (Brakefield and others, 2015). That is, the movement of groundwater into the saline portion of the aquifer from the freshwater portion of the aquifer is small.

The amount of cross-formational inflow (subsurface recharge) occurring through adjacent aquifers into the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer is unknown, although it is thought to be relatively small on the basis of water-budget analyses for surface recharge and discharge (Barton Springs/Edwards Aquifer Conservation District, 2013; Slade et al., 1985). Recent studies by the Barton Springs/Edwards Aquifer Conservation District and others have shown some potential for cross-formational flow both to and from the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer. Sources of cross-formational flow are discussed below and include the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer and the Trinity Aquifer.

Subsurface flow into the freshwater portion of the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer from the adjacent San Antonio segment located to the southwest is limited when compared with surface recharge (Slade et al., 1985). Hauwert et al. (2004) indicated that flow across the southern boundary of the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer is probably insignificant under normal conditions. Though these studies were primarily focused on the freshwater portion of the Edwards (Balcones Fault Zone) Aquifer, it is believed that the finding of limited interaction with the San Antonio segment hold for the saline portion of the aquifer as well.

In addition, Brakefield and others (2015) estimated that vertical flow into the Saline Edwards (Balcones Fault Zone) Aquifer was very limited. This is consistent with findings in the Barton Springs/Edwards Aquifer Conservation District management plan that inflow from the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer - as a whole, not just the saline portion - is not significant (Barton Springs/Edwards Aquifer Conservation District, 2013).

For the purposes of developing desired future conditions and estimated modeled available groundwater, we have considered inflows to the Saline Edwards (Balcones Fault Zone) Aquifer to be negligible.

6.4.1.4 Discharge

Leakage from the saline-water zone into the freshwater zone is probably minimal, although leakage appears to influence water chemistry at Barton Springs during low-flow conditions (Senger and Kreitler, 1984; Slade et al., 1986). On the basis of a geochemical evaluation, Hauwert and others (2004) state that the saline-water zone contribution could be as high as 3 percent for Old Mill Spring and 0.5 percent for Main and Eliza Springs under low-flow conditions of 17 cubic feet per second (combined) Barton Springs flow. These estimates were independently recalculated and corroborated by Johns (2006) and are similar to the results of Garner and Mahler (2007). Under normal flow conditions outflow from the saline-water zone would be smaller. Massei et al. (2007) noted that specific conductance of Barton Springs increased 20 percent under the 2000 drought condition, probably from saline-water zone contribution. The spring outlets are located along faults that may serve as local conduits for leakage from the saline zone and possibly the underlying Trinity Aquifer, and the contributions at the springs may not be representative of leakage across the entire area of the saline zone.

For the purposes of developing desired future conditions and estimated modeled available groundwater, we have considered outflows from the Saline Edwards (Balcones Fault Zone) Aquifer to be negligible.

6.4.1.5 Other Environmental Impacts Including Springflow and Groundwater/Surface-Water Interaction

As described in previous sections relating to inflows and discharges, our current understanding of the Saline portion of the Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 is that it is largely isolated from springs and surface process such as interaction with surface water. Development of the saline zone will involve desalination and management of

brine and other residuals from desalination facilities, requiring use of environmentally sound practices that do not materially affect the biosphere, including current or future water supplies. We do not expect that the proposed DFCs will create detrimental environmental impacts.

6.4.2 DFC Considerations

Analysis of the hydrological conditions of the Saline portion of the Edwards (Balcones Fault Zone) Aquifer in the Northern Subdivision of GMA 10 indicates that the aquifer can serve as an alternative water supply that poses little threat to the freshwater Edwards (Balcones Fault Zone) Aquifer. However, since it has not seen large development historically, the amount of information available for how the saline portion of the aquifer will respond to significant pumping is extremely sparse, so a conservative approach to developing this resource is believed warranted, at least initially. The proposed DFC allows for considerable drawdown and a significantly larger amount of modeled available groundwater than the DFC proposed in 2010. If this development of the aquifer is realized, aquifer monitoring and future studies will allow for updates to the understanding and consideration of the hydrological conditions presented here.

7. Subsidence Impacts

Subsidence has historically not been an issue with the Edwards (Balcones Fault Zone) Aquifer in GMA 10. The aquifer matrix in the northern subdivision is well-indurated and the amount of pumping does not create compaction of the host rock and/or subsidence of the land surface. Hence, the proposed DFCs are not affected by and do not affect land-surface subsidence or compaction of the aquifer.

8. Socioeconomic Impacts Reasonably Expected to Occur

8.1 Description of Factors in the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, GMA 10

Administrative rules require that regional water planning groups evaluate the impacts of not meeting water needs as part of the regional water planning process. The executive administrator shall provide available technical assistance to the regional water planning groups, upon request, on water supply and demand analysis, including methods to evaluate the social and economic impacts of not meeting needs [§357.7 (4)]. Staff of the TWDB's Water Resources Planning Division designed and conducted a report in support of the South Central Texas Regional Water Planning Group (Region L) and also the Lower Colorado Regional Water Planning Group (Region K). The report "Socioeconomic Impacts of Projected Water Shortages for the South Central Texas Regional Water Planning Area (Region L)" was prepared for the TWDB by the regional water planning group in support of the 2011 South Central Texas Regional Water Plan and is illustrative of these types of analyses; it is included in this preliminary Explanatory Report as Appendix C.

The report on socioeconomic impacts summarizes the results of the TWDB analysis and discusses the methodology used to generate the results for Region L. These reports are

supportive of an affirmative cost-benefit assessment of the water management strategies and the socioeconomic impact of not promulgating those strategies.

8.2 DFC Considerations

The proposed DFC allows for development of the Saline portion of the Edwards (Balcones Fault Zone) Aquifer above what is called for in the water management strategies in the 2012 State Water Plan. For this reason, the proposed DFC will not have a socioeconomic impact associated with an unmet water need.

9. Private Property Impacts

9.1 Description of Factors in the Saline Edwards (Balcones Fault Zone) Aquifer in Northern Subdivision, GMA 10

The interests and rights in private property, including ownership and the rights of GMA10 landowners and their lessees and assigns in groundwater, are recognized under Texas Water Code Section 36.002. The legislature affirmed that a landowner owns the groundwater below the surface of the landowner's land as real property. Joint planning must take into account the impacts on those rights in the process of establishing DFCs, including the property rights of both existing and future groundwater users. Nothing should be construed as granting the authority to deprive or divest a landowner, including a landowner's lessees, heirs, or assigns, of the groundwater ownership and rights described by this section. At the same time, the law holds that no landowner is guaranteed a certain amount of such groundwater below the surface of his/her land.

Texas Water Code Section 36.002 does not: (1) prohibit a district from limiting or prohibiting the drilling of a well by a landowner for failure or inability to comply with minimum well spacing or tract size requirements adopted by the district; (2) affect the ability of a district to regulate groundwater production as authorized under Section 36.113, 36.116, or 36.122 or otherwise under this chapter or a special law governing a district; or (3) require that a rule adopted by a district allocate to each landowner a proportionate share of available groundwater for production from the aquifer based on the number of acres owned by the landowner.

9.2 DFC Considerations

The DFC is designed to allow for development of the presently unused aquifer as an alternative water supply in a manner that does not harm other property owners. The DFC does not prevent use of the groundwater by landowners either now or in the future, although ultimately total use of the groundwater in the aquifer is restricted by the aquifer condition, and that may affect the amount of water that any one landowner could use, either at particular times or all of the time.

10. Feasibility of Achieving the DFCs

The feasibility of achieving a DFC directly relates to the ability of the Groundwater Conservation Districts to manage the Saline portion of the Edwards (Balcones Fault Zone) Aquifer to achieve the DFC, including promulgating and enforcing rules and other board actions

that support the DFC. The feasibility of achieving this goal is limited by (1) the finite nature of the resource and how it responds to drought; and (2) the pressures placed on this resource by the high level of economic and population growth within the area served by this resource.

Texas state law provides Groundwater Conservation Districts with the responsibility and authority to conserve, preserve, and protect these resources and to ensure the recharge and prevention of waste of groundwater and control of subsidence in the management area. State law also provides that GMAs assist in that endeavor by joint regional planning that balances aquifer protection and highest practicable production of groundwater. The feasibility of achieving these goals could be altered if state law is revised or interpreted differently than is currently the case.

The caveats above notwithstanding, there are no current hydrological or regulatory conditions that call into question the feasibility of achieving the DFC.

11. Discussion of Other DFCs Considered

No other expression of DFC of the Saline portion of the Edwards (Balcones Fault Zone) Aquifer in the GMA's northern subdivision was considered. GMA 10 evaluated alternative amounts of drawdown for the DFC expression, including larger amounts of drawdown. The proposed DFC specifies an amount of drawdown that is not unreasonably large or small, and that should be readily achieved on the basis of currently known information about the aquifer.

12. Discussion of Other Recommendations

12.1 Advisory Committees

An Advisory Committee for GMA10 has not been established.

12.2 Public Comments

Each GCD must hold a public meeting within 90 days after the GMA approves its DFCs. During this meeting, the GCD needs to document stakeholder input. This input is to be submitted by a report from the GCD to the GMA within 90 days after the GMA approves its DFC.

GCDs in GMA 10 have not yet approved its second round of DFCs. The GCDs have not yet held public meetings to gather public comment on the DFCs. No public comments have yet been offered regarding the Saline portion of the Edwards (Balcones Fault Zone) Aquifer.

A draft of the Explanatory Report may be used as supporting documents to inform the public before such hearings and meetings are held.

13. Any Other Information Relevant to the Specific DFCs

No additional information relevant to the specific desired future conditions has been identified.

14. Provide a Balance between the Highest Practicable Level of Groundwater Production and the Conservation, Preservation, Protection, Recharging, and Prevention of Waste of Groundwater and Control of Subsidence in the Management Area

The "DFC Considerations" discussed in previous sections (especially 6.x.2, 8.2, 9.2, 10, and 11) provide the context in which the balancing factor is being addressed. But the Texas Water Development Board has not developed guidance on how to approach this factor. It is up to the Groundwater Conservation Districts to determine how to approach it for each relevant aquifer, whether in a qualitative, quantitative, or combination manner. In addition, the Groundwater Conservation Districts need to include stakeholder input so that this factor can be more confidently addressed.

Each Groundwater Conservation District must hold a public meeting within 90 days after the Groundwater Management Area approves its Desired Future Conditions. During this meeting, the Groundwater Conservation District will document stakeholder input regarding whether the Desired Future Conditions provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area. This input is to be submitted by a report from the Groundwater Conservation District to the Groundwater Management Area within 90 days after the Groundwater Management Area approves its Desired Future Conditions. The information in the aggregated reports from the GCDs in GMA 10 will then be incorporated into the final Explanatory Report submitted to the TWDB for promulgation and use in calculating modeled available groundwater.

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