TECHNCIAL MEMORANDUM

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CC: Scott Cole, P.E., Freese and Nichols, Inc.

FROM: Melissa Brunger, P.E., Freese and Nichols, Inc.

SUBJECT: Eastern Hills Golf Course Subdivision Water System Evaluation

DATE: September 11, 2014

PROJECT: FNI Project No. GND14376

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1.0 INTRODUCTION

The purpose of this memorandum is to document the evaluation of water supply for the proposed Eastern Hills Golf Course subdivision. The existing Eastern Hills Golf Course has approximately 166 developable acres and is located on the western shores of Lake Ray Hubbard south of Centerville Road.

The scope of work included hydraulic analysis to determine the number of lots that can be added to the existing water system. Hydraulic modeling was used to identify recommended connections to existing water lines for fire flow, looping, and redundancy. The development will be served by the City of Garland's East Pressure Plane. The analysis is based on meeting Texas Commission on Environmental Quality (TCEQ) capacity requirements and the water system planning criteria used in the City of Garland's *Broadway Pump Station Investigation and Water Capital Improvement Plan (CIP)*, performed by Freese and Nichols, Inc. (FNI) in 2006.

2.0 PROJECTED WATER DEMANDS

Since a site layout was not available for the proposed subdivision, the number of lots was estimated based on the density of surrounding residential communities. Based on a review of neighboring communities and discussion with City staff, a gross average of 3 residential parcels/acre was used for the hydraulic analysis. The recommended density equates to approximately 500 lots in the proposed Eastern Hills subdivision.

Historical population data and annual water deliveries from Garland's wholesale water provider, North Texas Municipal Water District (NTMWD), for the last twenty years are displayed in **Table 1**. Based on a review of these historical records, it is recommended that an average day per capita water usage of 160 gallons per capita day (gpcd) be used to calculate the Eastern Hills Golf Course subdivision water usage. Recommended peaking factors from the 2006 CIP report were utilized for this study; a maximum day to average day peaking factor of 2.15 and peak hour to maximum day peaking factor of 1.50 were recommended for future planning. Projected city-wide demands from the 2006 CIP report were also utilized for this study.

Table 1
Historical City of Garland Population and Water Usage

Year	Estimated Population	Deliveries from NTMWD (MG)	Average Day Per Capita (gpcd)
1994	193,005	10,495	149
1995	195,952	11,410	160
1996	197,426	11,298	157
1997	200,106	11,026	151
1998	201,824	13,657	185
1999	203,883	12,707	171
2000	205,869	13,450	179
2001	209,030	12,324	162
2002	221,202	12,401	154
2003	222,651	13,045	161
2004	220,657	12,063	150
2005	221,588	13,316	165
2006	222,432	13,204	163
2007	224,988	11,203	136
2008	225,000	13,054	159
2009	225,865	11,522	140
2010	226,915	13,038	157
2011	227,726	13,386	161
2012	228,060	11,675	140
2013	231,618	10,608	125
Average			**156**

Calculated water demand projections for Eastern Hills Golf Course subdivision are displayed in **Table 2.** Updated Buildout water demand projections for the entire East Pressure Plane including the Eastern Hills Golf Course subdivision are presented in **Table 3.**

Table 2
Projected Population and Water Demands – Eastern Hills Subdivision

Total Units	Population[1]	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
500	1,500	0.24	0.52	0.77

[1] Based on 3 people/connection

Table 3
Buildout Water Demands – East Pressure Plane

	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
2006 CIP Report[1]	23.8	52.1	78.2
Cypress Cove Development[2]	0.5	1.1	1.6
Eastern Hills Golf Course Subdivision	0.2	0.5	0.8
Total East Pressure Plane	**24.5**	**53.7**	**80.6**

[1] Water demand projections are based on the City of Garland's *Broadway Pump Station Investigation and Water Capital Improvement Plan (CIP),* performed by FNI in 2006. The split between the East Pressure Plane and West Pressure Plane water demands has been modified since the 2006 report based on pressure plane boundary modifications made by City staff.
[2] Water demand projections are based on the *Cypress Cove Water System Evaluation,* performed by FNI in 2010.

3.0 HYDRAULIC ANALYSIS

Hydraulic analyses were performed to evaluate the impact of the proposed Eastern Hills Golf Course subdivision on the existing water distribution system. The H2OMAP Water model was utilized to assist with the assessment of pumping, storage, and pipeline facilities and to determine recommended connections to existing water lines. The projected water demands for the Eastern Hills Golf Course subdivision were input into the City's H2OMAP Water model and analyzed with existing and proposed Buildout water demands in the City of Garland's East Pressure Plane. In addition, the model update included adding recently constructed projects and pressure plane modifications based on discussions with water system operations staff.

3.1 TCEQ Pumping Evaluation

An evaluation of pumping capacity available to serve the proposed Eastern Hills Golf Course subdivision was performed. As a public water utility, the City of Garland must comply with the rules and regulations for public water systems set forth by the TCEQ in Chapter 290. The City is required to

meet the TCEQ pumping capacity requirements presented in **Table 4**. **Table 5** provides information on the City's East Pressure Plane pump stations.

The City currently has less than 200 gallons per connection of elevated storage capacity, so the service pumping capacity requirement is the lesser of (2)(a) or (2)(b) in **Table 4**. A comparison of the projected peak hour water demands summarized in **Table 3,** and the East Pressure Plane's firm pumping capacity in **Table 5** indicates the existing system has adequate firm pumping capacity to serve the Eastern Hills Golf Course subdivision. **Therefore, no pumping improvements are required.**

Table 4
TCEQ Pumping Requirements

Elevated Storage Capacity	Service Pumping Capacity Requirement[1]
≥ 200 gallons per connection	**(1)** Two service pumps with a minimum combined capacity of 0.6 gpm per connection at each pressure plane.
< 200 gallons per connection	**(2)** The lesser of (a) or (b):
	(a) Total pumping capacity of 2.0 gpm per connection
	(b) Total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service

[1] According to 30 TAC §290.45(b)(2)(F)

Table 5
East Pressure Plane Pump Stations

Pump ID	Rated Flow (gpm)	Rated Flow (MGD)	Rated Head (ft)
Firewheel Pump 1	1,750	2.5	230
Firewheel Pump 2	3,500	5.0	230
Firewheel Pump 3	3,500	5.0	230
Firewheel Pump 4	7,000	10.1	230
Firewheel Pump 5	7,000	10.1	230
Firewheel Pump 6	7,000	10.1	230
Firewheel Pump 7	7,000	10.1	230
Broadway Pump 1	1,736	2.5	175
Broadway Pump 2	3,472	5.0	175
Broadway Pump 3	4,861	7.0	175
Broadway Pump 4	6,250	9.0	175
Broadway Pump 5	6,250	9.0	175
Broadway Pump 6	6,250	9.0	175
Lavon Pump 3	1,735	2.5	210
Lavon Pump 4	1,735	2.5	210
Lavon Pump 5	3,470	5.0	210
Total Capacity	**72,509**	**104.4**	-
Firm Capacity (1)	**65,509**	**94.3**	-
Firm Capacity (2)	**55,789**	**80.3**	-

(1) Capacity with largest of all East Pressure Plane pumps out of service
(2) Capacity with largest pump at each individual East Pressure Plane Pump Station out of service

3.2 TCEQ Storage Evaluation

The City is required to meet the TCEQ total storage capacity requirement of 200 gallons per connection. A summary of the City's existing storage facilities is presented in **Table 6**. Based on this criteria, the existing total storage volume of 46.85 MG can support up to 234,250 connections, which greatly exceeds the 86,593 existing system connections plus 500 connections for the proposed subdivision. **Therefore, the existing system can support the Eastern Hills Golf Course subdivision from a total storage standpoint.**

Table 6
Summary of Storage Facilities

Storage Facility	Pressure Plane	Type	Volume (MG)
Firewheel GST#1	East	Ground	5.00
Firewheel GST#2	East	Ground	6.00
Lavon GST	East/West	Ground	5.00
Broadway GST#1	East	Ground	5.00
Broadway GST#2	East	Ground	7.50
Commerce EST	East	Elevated	2.50
Apollo GST	West	Ground	5.00
Northside GST	West	Ground	5.00
Wallace GST	West	Ground	3.50
Lawler EST	West	Elevated	2.00
Forest EST	West	Elevated	0.35
Total			**46.85**

The typical TCEQ elevated storage capacity requirement is 100 gallons/connection. However, the City currently has an elevated storage capacity waiver from TCEQ requiring only 40 gallons/connection of elevated storage. With the existing 2.5 MG Commerce Elevated Storage Tank (EST) in the East Pressure Plane and the waiver, 62,500 connections are allowable in the East Pressure Plane before additional elevated storage is required. The current number of connections in the East Pressure Plane is approximately 50,000, and there are 500 proposed connections in the Eastern Hills Golf Course subdivision. **Therefore, adding the Eastern Hills Golf Course subdivision does not trigger the need for an additional elevated storage tank based on the requirement in the waiver from TCEQ.**

Although the city is currently operating under an elevated storage waiver from TCEQ, there is no guarantee that this waiver will be granted in the future. Therefore, it is recommended that the City update its Water Master Plan with considerations for providing a minimum of 100 gallons/connection of elevated storage in both pressure planes at Buildout. For reference, without the waiver from TCEQ, the existing East Pressure Plane with the Eastern Hills Golf Course subdivision would require over 5 MG in total elevated storage. The existing Commerce EST provides 2.5 MG of elevated storage. Therefore, an additional future 3.0 MG elevated storage tank (resulting in a total of 5.5 MG) in the East Pressure Plane would be required to meet the TCEQ requirement of 100 gallons/connection and allow for additional growth.

3.3 Hydraulic Modeling

Hydraulic analysis using the H2OMAP Water model was performed for the existing and Buildout systems for four operating conditions: average day, maximum day, peak hour, and maximum day with fire flow. The TCEQ required minimum pressure within a distribution system is 35 psi under peak hour demand conditions. TCEQ also requires residual pressures throughout the system to be 20 psi and higher under fire flow conditions. The system demands for each condition were derived from the 2006 CIP Report with Eastern Hills Golf Course subdivision added, and the ground storage tanks on the suction side of the pump stations were assumed to be half full for every operating condition. The pump status and elevated tank levels were adjusted for each model run to simulate typical operational parameters associated with each demand condition. The plans for on-site internal water lines within the Eastern Hills Golf Course subdivision were not available, so the entire Eastern Hills Golf Course subdivision demand was assigned to a model node in the middle of the proposed subdivision.

Peak hour and maximum day with fire flow are typically the controlling demand conditions when assessing the adequacy of water distribution system infrastructure sizing. Hydraulic modeling indicated that the existing water system can provide adequate fire flow and redundancy to the Eastern Hills Golf Course subdivision based on the proposed connections shown on **Figure 1**. **The modeling showed that a looped 12-inch feed through the proposed development is required to provide adequate capacity and redundancy.**

While constructing water lines through established residential areas can be challenging, two feasible water system connections were identified as part of this study. The first recommended connection is on the south side of the proposed development and ties into an existing 12-inch on Club Creek Boulevard. The proposed water line runs through an existing subdivision, and **Figure 2** displays the location of an open lot on Bluffview Drive where the proposed water line can be constructed. The second recommended connection is to the existing 42-inch on the west side of the development near the golf course entrance. A connection on the north side of the development was investigated, but the minimum recommended connection size is a 12-inch water line.

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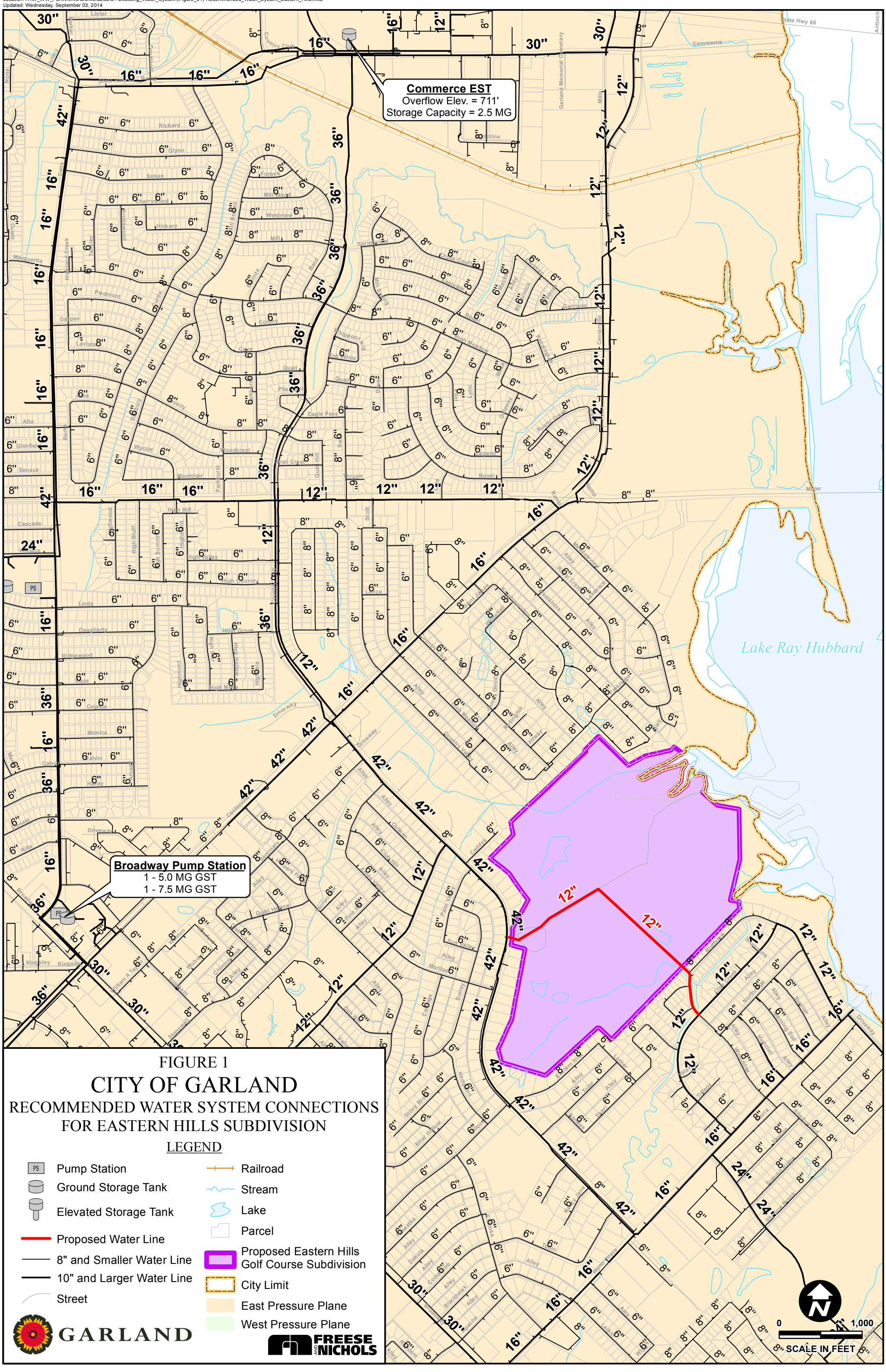

FIGURE 1

CITY OF GARLAND

RECOMMENDED WATER SYSTEM CONNECTIONS FOR EASTERN HILLS SUBDIVISION

Figure 2
Proposed Water Line Route to Connect to the Existing Water System

Model results indicate that pressures near the Eastern Hills Golf Course subdivision with the recommended improvements are well above the TCEQ minimum pressure of 35 psi. Based on 10 foot ground contours, elevations within the Eastern Hills Golf Course subdivision range from approximately 440 feet to 520 feet. Pressures within the subdivision are expected to range from 65 psi to over 100 psi. Average day model runs indicated that a portion of the Eastern Hills Golf Course subdivision would experience pressures of over 80 psi under average conditions since the hydraulic gradient in the East pressure Plane is 711 feet (overflow elevation of Commerce EST). Therefore, it is recommended that the City require pressure reducing valves (PRVs) on individual service connections if the adopted plumbing code requires it. Model results indicated that the additional demand associated with Eastern Hills Golf Course subdivision have no appreciable impact on the discharge pressure at Broadway Pump Station.

Available fire flow with the proposed water system connections under Buildout maximum day demand conditions at the TCEQ minimum of 20 psi in the Eastern Hills Golf Course subdivision exceeds 3,500 gpm, which is well above typical residential requirements.

4.0 SUMMARY AND RECOMMENDATIONS

Figure 1 displays the recommended water system connections for the proposed Eastern Hills Golf Course subdivision. The following list provides a summary of the findings and recommendations identified in this memorandum:

- A looped 12-inch feed that ties into the existing 12-inch water line on Club Creek Boulevard and 42-inch line on Country Club Road is required to provide adequate fire flows and redundancy to the proposed development.
- The existing system can support the entire proposed Eastern Hills Golf Course subdivision with the proposed water system connections.
- The Eastern Hills Golf Course subdivision does not trigger the need for an additional elevated storage tank based on the requirement in the current waiver from TCEQ. However, an additional future 3.0 MG elevated storage tank in the East Pressure Plane would be required to meet the TCEQ requirement of 100 gallons/connection if the waiver is discontinued in the future.
- It is recommended that the City update its Water Master Plan with considerations for providing a minimum of 100 gallons/connection of elevated storage in both pressure planes at Buildout.
- Average day model runs indicated that a portion of the Eastern Hills Golf Course subdivision would experience pressures of over 80 psi under average conditions. It is recommended that the City require pressure reducing valves (PRVs) on individual service connections in the Eastern Hills Golf Course subdivision if the adopted plumbing code requires it.