2018 WATER DISTRIBUTION SYSTEM MASTER PLAN

Submitted To

LEWISVILLE

Deep Roots. Broad Wings. Bright Future.

Submitted By

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
SPECIALIZING IN CIVIL ENGINEERING FOR MUNICIPALITIES AND GOVERNMENTAL AGENCIES

July 2018

Texas Firm F526

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July 31, 2018

Mr. Keith Marvin
Director of Public Services
City of Lewisville
1100 N. Kealy, Suite D
Lewisville, Texas 75029

Re: Water Distribution System Master Plan

Dear Mr. Marvin:

This report presents the results from the 2018 Water Distribution Master Plan. Included in this report is the revised population projections from the 2018 Land Use Assumptions. It also includes the impact of the removal of the Lord & Clem tracts and incorporating Lakewood Hills into the Lewisville water distribution system. The system was designed for a buildout residential population of approximately 163,162 people and to meet the demand rate for the non-residential land uses within the existing planning boundaries. The maximum daily demand for design of the system at buildout was calculated to be 58.10 million gallons per day.

We are available at your convenience to assist the City in the development of the water distribution system.

Sincerely,

John W. Birkhoff, P.E.

Andrew Mata, Jr., P.E.

CITY OF LEWISVILLE, TEXAS
2018 WATER DISTRIBUTION SYSTEM REPORT

INDEX

CITY OF LEWISVILLE, TEXAS
2018 WATER DISTRIBUTION SYSTEM REPORT

GENERAL

Previous analyses have been performed for the City of Lewisville's Water Distribution System, which have resulted in long-range plans for the system. The latest of these reports was completed in 2011. Since 2011, projected conditions have changed enough to warrant a new analysis of the system to take into account the new information from the 2018 Land Use Assumptions prepared by Freese & Nichols and the removal of the Lord and Clem tracts from the master plan.

Although the proposed system is designed to accommodate the ultimate development of the city, it should be examined at intervals and revised to conform to any new conditions, which may arise in the future. Likewise, prior to undertaking a major expenditure, an examination should be made to verify that design criteria used in developing the overall plan is still valid.

The purpose of this report is to present a comprehensive plan for the development of a water distribution system to serve the full growth of the City of Lewisville. This plan is based on the best available information on existing land uses and the 2018 Land Use Assumptions, prepared for the City of Lewisville by Freese and Nichols, Inc. for areas within the City Limits and the City's Extra Territorial Jurisdiction (E.T.J.). A major change is the removal of the Lord & Clem tract from the master plan.

This Master Plan is the basis of the water impact fee analysis.

DEFINITIONS

The design of the water distribution system involves various rates of water use, which are generally referred to as water demand. The three most significant rates and a definition of each are:

A. Maximum Daily Demand: This is the total amount of water used during the day of heaviest consumption in any given year and the minimum rate which the high service pumps must be capable of pumping. Water must be supplied to the pumps at this rate.

B. Maximum Hourly Demand: This is the rate at which water is drawn from the entire distribution system during the hour of maximum consumption on the day of maximum demand. This rate is generally of a short duration and is most economically provided for by the use of elevated storage in addition to water supplied to the system by pumps. The distribution system, including storage and pumping capacity, must be able to satisfy this demand.

C. Minimum Hourly Demand: This is the rate at which water is drawn from the entire distribution system during the hour of minimum demand on the day of maximum demand. This demand rate is used in the water distribution analysis to determine the adequacies of the system to replenish elevated storage tanks and ground storage reservoirs.

PLANNING AREA

The planning area for this report includes the entire area within the current city limits along with portions of the Lakewood Hills (remnants of Lord & Clem tracts) and the Castle Hills Subdivisions. The proposed system is designed to serve that planning area and includes approximately 22,223-acres or 34.7 square miles. Of the 34.7 square miles, approximately 16.2 square miles is expected to be residential, approximately 10.1 square miles being retail, commercial and industrial and the remaining 8.4 square miles being parks, open space and flood plain. This area is divided into three separate service area, generally referred to as 692.5, 735, and 740 Service Area. In the 692.5 Service Area, the City is expecting continued redevelopment at three locations along the DCTA corridor, also known at Transit Oriented Development areas that consist of a total of 573.0 acres. These three TOD areas are known as the Lewisville Lake Station, the Old Town Station, and the Hebron 121 Station and are located on **Figure 1**.

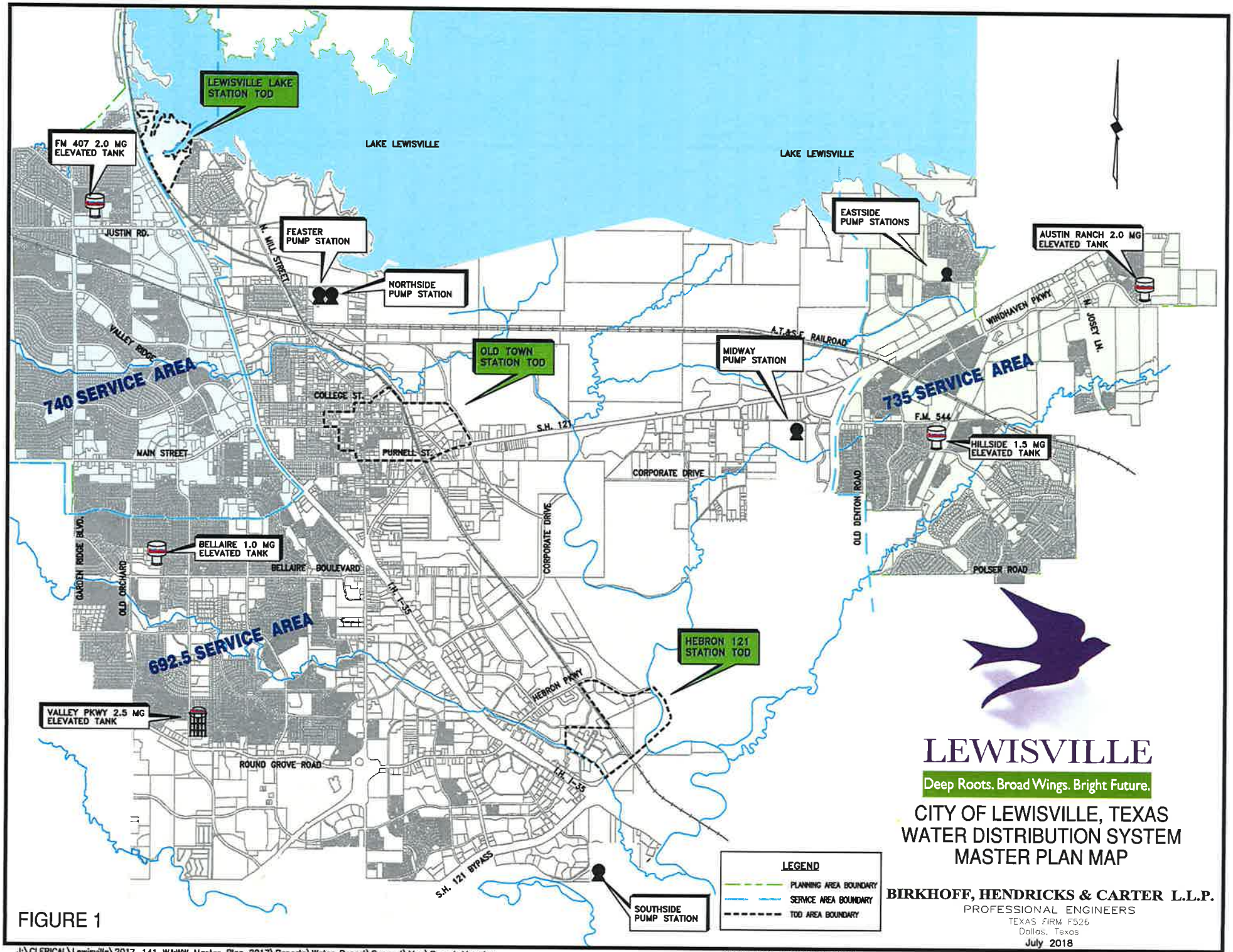

FIGURE 1

LEWISVILLE

Deep Roots. Broad Wings. Bright Future.

CITY OF LEWISVILLE, TEXAS WATER DISTRIBUTION SYSTEM MASTER PLAN MAP

BIRKHOFF, HENDRICKS & CARTER L.L.P.
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Dallas, Texas

July 2018

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PLOTTED BY: JLE ON 7/23/2018

POPULATION

The demand for water in a community is closely related to its residential population. Total population of a fully developed area dictates the ultimate size of facilities required, whereas the rate of growth is important to determine the timing of the construction of particular projects.

The projected buildout residential population of Lewisville used in this analysis is approximately 163,162 including the Castle Hills, and Lakewood Hills, with approximately 39,203 people located in the 740 Service Area, approximately 83,110 people located in the 692.5 Service Area, and approximately 40,849 people located in the 735 Service Area. The decrease in population compared to the 2011 report is attributable to not annexing Lord and Clem and revised population projections in the City's 2018 land use assumptions. The residential population for Lewisville is based on information from the Lewisville Land Use Assumption Report prepared by Freese and Nichols, Inc., March 2018. The actual population of Lewisville since 1980, together with the estimated population to build-out, is shown on **Plate No. 1**, **Table No. 1** and **Table No. 2**:

TABLE NO. 1

Service Area	2018 Population*	Buildout Population*
740 Lewisville	29,761	39,203
692.5 Lewisville	72,348	83,110
735 Lewisville	3,424	14,634
735 Castle Hills	15,091	26,215
735 Total	**18,515**	**40,849**

* Freese & Nichols, Inc. Land Use Plan

PLATE NO. 1 POPULATION GRAPH

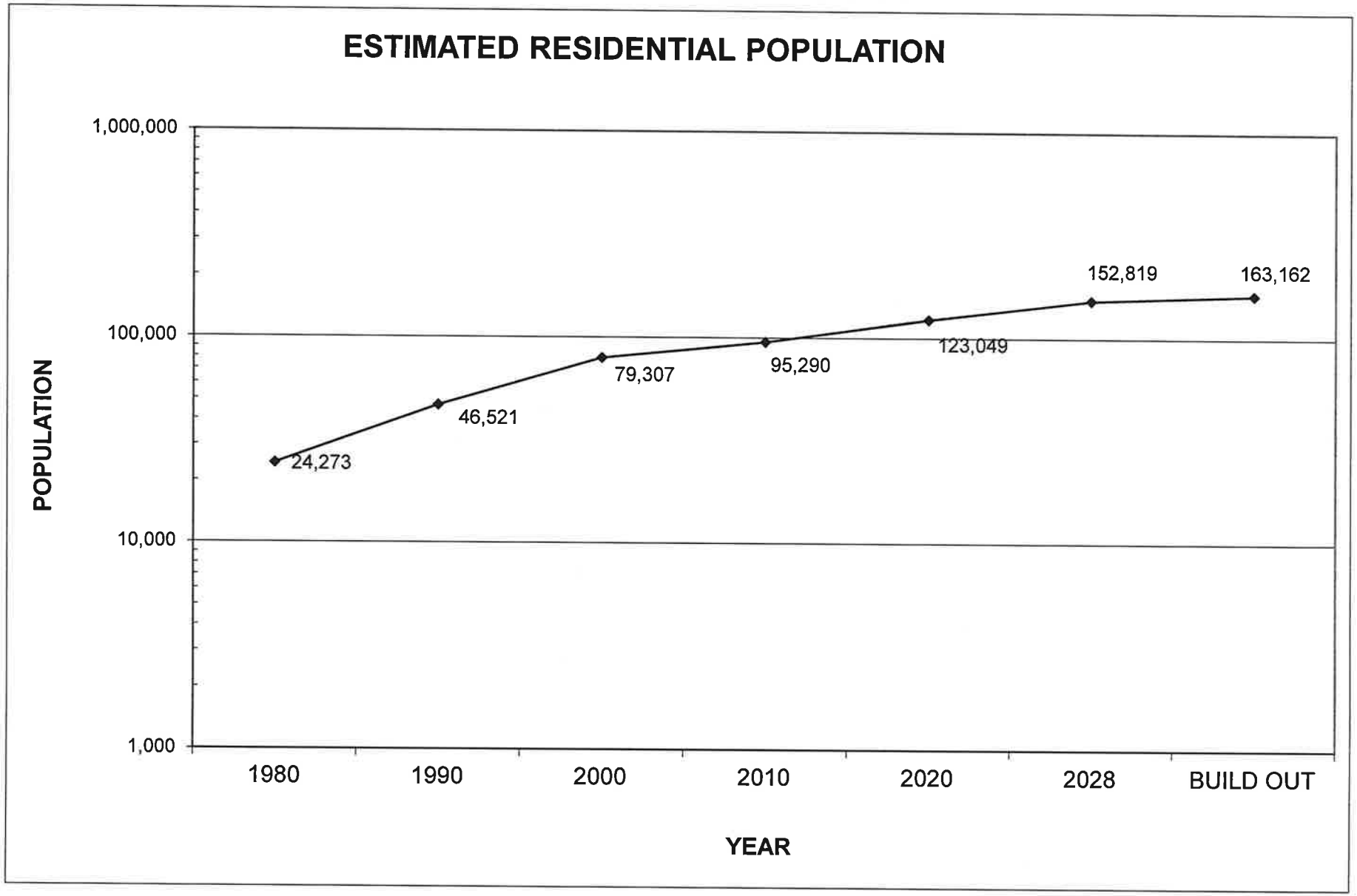


TABLE NO. 2

RESIDENTIAL POPULATION PROJECTIONS

Year	Status	2018 Report Population
1980	Actual	24,273
1990	Actual	46,521
2000	Actual	79,307
2006	Actual	89,100
2010	Actual	95,290
2015	Actual	99,480
2018	Actual	119,874
2020	Estimated	123,049
2028	Estimated	152,819
Build Out	Estimated	*163,162

* *The 1997 Report projected buildout to 2020, the 2006 Report projected buildout to 2021, the 2010 Report projects buildout to 2030, and the 2018 Report projects buildout to be 2039.*

Based on this, the buildout population is expected to be reached around the year 2039, but could change with actual growth, changes in economic conditions or changes in development impacts. Since the estimated water demand in this analysis is based on growth projections, any future change will directly affect estimated demand rates and facility needs. The densities used for calculating the buildout residential population are shown on **Table No. 3**.

TABLE NO. 3

RESIDENTIAL UNIT AND POPULATION DENSITIES BY SERVICE AREA

692 SERVICE AREA

Land Use	Units Per Acre	Population Per Unit
Low Density	4.0	3.0
Town Home Residential	8.0	3.0
High Density Residential	19.0	2.3
Old Town Residential	5.0	2.2
Mobile Home Park Residential	10.0	2.2
Mixed Use Residential	15.0	2.1

735 SERVICE AREA

Land Use	Units Per Acre	Population Per Unit
Low/Medium/Town Home Residential Density	6.0	3.0
High Density Residential	12.0	2.0
Mixed Use Residential	15.0	2.1

740 SERVICE AREA

Land Use	Units Per Acre	Population Per Unit
Low Density	4.0	3.0
Town Home Residential	8.0	3.0
High Density Residential	19.0	2.3
Old Town Residential	5.0	2.2
Mobile Home Park Residential	10.0	2.2
Mixed Use Residential	15.0	2.1

PROJECTED WATER USE

Analysis and design of the proposed water distribution system is based on the maximum water demand anticipated and the proposed future land use in Lewisville. Demand studies completed in surrounding Cities from the summer of 1980, the mid 1990's, and the year 2000 were reviewed in formulating the design demands for this analysis. These studies show the year of 1980 to remain the year of record since water demand rates far exceeded any that have been experienced, largely because of extreme hot summer weather. A demand study completed from the summer of 2017 shows that water demands rates decreased from the previous studies. This is most likely due to the community being more aware of water conservation, water restrictions, and limited water days. This is a trend that other North Central Texas communities are experiencing post draught/extreme water restrictions. Water demand studies are now proceeding for a number of cities in the North Central Texas for the summer of 2018 which his expected to be hot and dry. As demand is better defined, the effects on Lewisville is the water treatment expansions and rehabilitation of pump station will be known. Clarity of per capita usage will determine if a plant expansion is required and if smaller pumps can be considered as pumps are replaced. The peaking factor is the ratio of the maximum hour usage to maximum day usage. The peaking factor of 1.65 for low density residential was utilized in this study.

The following tables summarizes the residential demand rates in gallons per capita per day (g.p.c.d.) and nonresidential demand rates in gallons per acre per day (g.p.a.d.) by Service Area utilized in calculating Lewisville's buildout maximum day and hour water demands. The mixed-use areas utilized a lower maximum day demand rate, but a higher non-residential demand rate. Utilizing a lower per capita demand reduced the maximum daily demand by approximately 6.7 MGD. **Table No. 4A** and **4B** shows 2018 demands utilized in the 692.5 and 735 Service Areas.

TABLE NO. 4A

692.5 SERVICE AREA DESIGN WATER DEMAND RATES

Land Use	Residential		Non-Residential	
	Max Day Per Capita g.p.c.d.	Max. Hour Per Capita g.p.c.d.	Max. Day Per Acre g.p.a.d.	Max. Hour Per Acre g.p.a.d.
Low Density Residential	250	413		
Town Home Residential	250	413		
High Density Residential	250	413		
Mobile Home Park Residential	200	396		
Mixed Use Residential	225	400		
Mixed Use Non-Residential			3,000	3,900
Government/Institutional/Public			1,980	3,168
Office			1,540	2,464
Retail			1,540	2,464
Commercial			1,540	2,464
Industrial			1,980	3,168
Parks			1,540	2,464
Flood Plain			0	0
Agricultural / Open Space (AO)			1,540	2,464

TABLE NO. 4B
740 SERVICE AREA DESIGN WATER DEMAND RATES

Land Use	Residential		Non-Residential	
	Max Day Per Capita g.p.c.d.	Max. Hour Per Capita g.p.c.d.	Max. Day Per Acre g.p.a.d.	Max. Hour Per Acre g.p.a.d.
Low Density Residential	250	413		
Town Home Residential	250	413		
High Density Residential	250	413		
Mobile Home Park Residential	200	396		
Mixed Use Residential	225	400		
Mixed Use Non-Residential			3,000	3,900
Government/Institutional/Public			1,980	3,168
Office			1,540	2,464
Retail			1,540	2,464
Commercial			1,540	2,464
Industrial			1,980	3,168
Parks			1,540	2,464
Flood Plain			0	0
Agricultural / Open Space (AO)			1,540	2,464

The 735 Service Area utilized the same non-residential demand rates shown on Table No. 3, but different residential demand rates. **Table No. 5** illustrates the 735 Service Area has higher Low Density Residential demand rates for Maximum Day demands with a peaking factor of 1.65 for the Maximum Hourly demand rate.

TABLE NO. 5

735 SERVICE AREA DESIGN WATER DEMAND RATES

Land Use	Residential	
	Max Day Per Capita g.p.c.d.	**Max Hour Per Capita g.p.c.d.**
Low/Medium/Town Home Density Residential	350	578
High Density Residential	350	578
Mixed Use Residential	225	371

Table No. 6 summarizes the projected buildout demands being placed on the water distribution system by service area.

TABLE NO. 6

DESIGN WATER DEMANDS BY SERVICE AREA

Service Area and Land Use	Maximum Daily Demand (MGD)	Maximum Hourly Demand (MGD)
692.5 Service Area Residential	20.8	34.3
692.5 Service Area Non-Residential	11.0	18.2
692.5 Service Area Sub-Total:	**31.8**	**52.5**
735 Service Area Residential	12.9	21.3
735 Service Area Non-Residential	1.7	2.8
735 Service Area Sub-Total:	**14.6**	**24.1**
740 Service Area Residential	9.8	16.2
740 Service Area Non-Residential	1.9	3.1
740 Service Area Sub-Total:	**11.7**	**19.3**
Total:	**58.1**	**95.9**

Table No. 7 compares this report's buildout demands with the previous years' reports.

TABLE NO. 7

DESIGN WATER DEMANDS
MASTER PLAN REPORT COMPARISON

Report Year	Buildout Population	Maximum Daily Demand (MGD)	Maximum Hourly Demand (MGD)
1997	149,459	64.40	119.40
2006	166,365	67.50	127.90
2010	186,403	73.11	138.28
2018	163,162	58.10	95.90

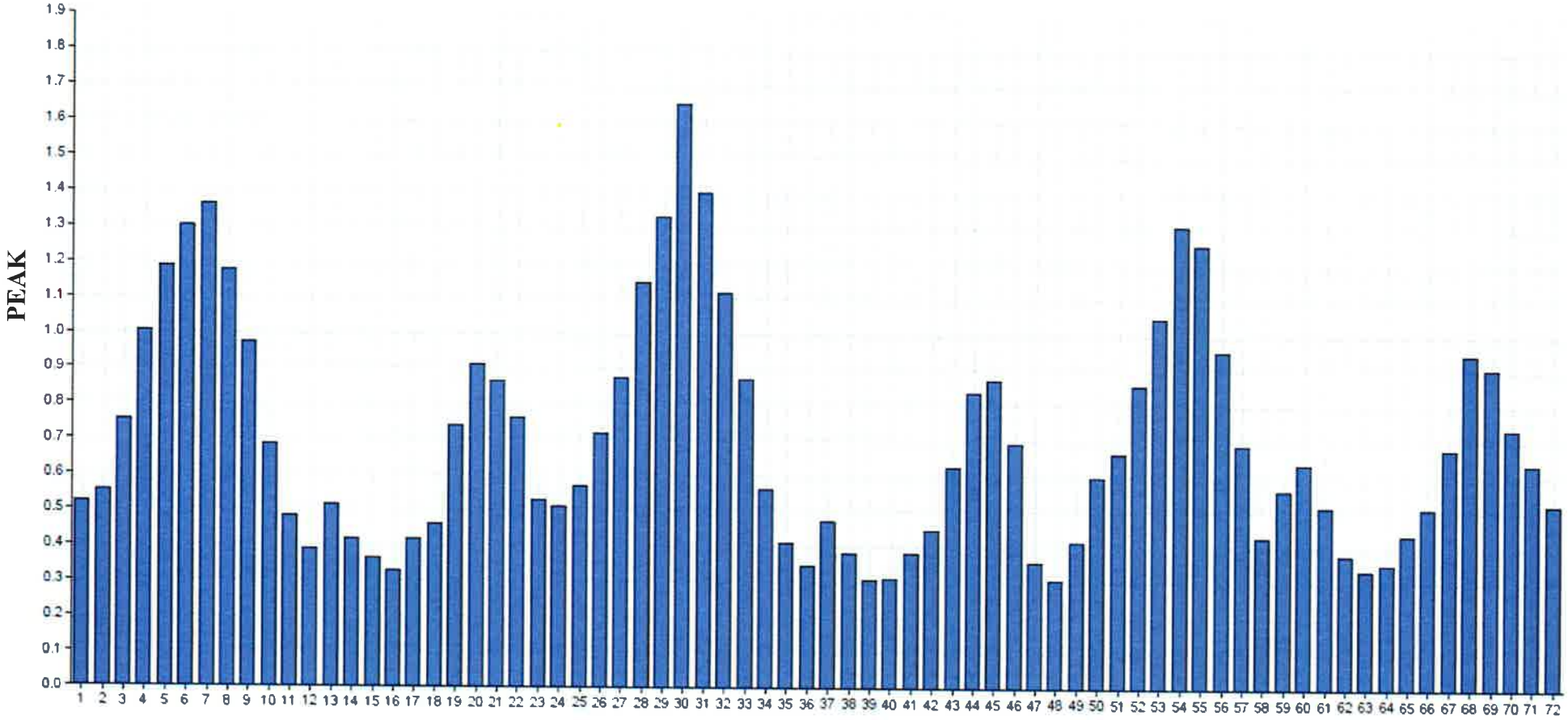
Most of the distribution lines have been constructed. Those lines have been sized for peak hour demands and utilized a maximum daily demand rate of 350 gpcd as the base throughout the network. The lower maximum daily demand has been used in the 692.5 and 740 Service Area to project water supply and to size high service pump stations as they are rehabilitated in future years. The lower demand for these service areas are based on recent water usage.

WATER DISTRIBUTION SYSTEM ANALYSIS

Analysis of the buildout water distribution system is based on the ultimate water demand anticipated and the geographical distribution of the water demand. The design of the proposed water distribution system is based on three separate demand conditions. The first condition is used to determine the buildout supply from the combination of the City's Water Treatment Plant and purchased treated water from Dallas Water Utilities (DWU) which is based on the maximum daily demand. This demand rate is the minimum supply and minimum pumping required by the system. The second condition utilizes the maximum hourly demand rate on the day of maximum demand. Maximum hourly demand rates are used to size distribution lines and to determine the volume of elevated storage. The size of existing and proposed distribution lines is shown on the Master Plan Map presented at the end of this report. The third condition is the minimum hourly demand rate on the day of maximum demand. This rate is used to analyze the refill rates of elevated storage. These three demand conditions were modeled over a three-day period (72 hours) with an Extended Period Simulation (EPS). The 72-hour EPS was developed with the use of a diurnal curve that is used to peak the water demand in the model from a minimum hourly demand condition through a maximum daily demand condition and to a maximum hourly demand condition. The design diurnal curve utilized in the model was created from Lewisville SCADA data in 2006 through 2009, and comparisons of diurnal curves generated in other North Central Texas Cities similar to Lewisville. **Plate No. 2** represents the design 72-hour diurnal curve input into the buildout EPS model. Modeling the water distribution system over a 72-hour period allowed for a check of the ability to draw down and refill ground storage reservoirs and elevated storage tanks and to determine the anticipated system pressures under severe conditions. From the SCADA data and comparing the total maximum hour demand to the total maximum day demand, the system experienced a global peak factor of 1.65 used to increase the maximum daily demands in the hydraulic model. This exceeds the Texas Commission of Environmental Quality (TCEQ) minimum standards of 1.25.

PLATE NO. 2

72-HOUR EPS DIURNAL CURVE



SERVICE AREAS

The City's existing water distribution system currently operates in three service areas, the 692.5 Service Area, the 735 Service Area, and the 740 Service Area. These three service areas are in three separate pressure zones, which are based off the High Water Level (HWL) of the elevated storage tanks in that particular service area, in relation to the ground level the establishes the pressure range for the service areas.

1) 692.5 Service Area

The 692.5 Service Area is generally located between the 740 and 735 Service Areas, to the City's north, south, and west boundary limits. Ground elevations range from 415 feet MSL to 600 feet MSL. Currently and at buildout, the Bellaire Elevated Tank, the Valley Parkway Elevated Tank, the Feaster Pump Station, the Southside Pump Station, and the Midway Pump Station supply water to the 692.5 Service Area.

2) 735 Service Area

The 735 Service Area is generally located from east of the State Highway (SH) 121 Bypass (Sam Rayburn Tollway) to the City's north, south, and east boundary limits. Ground Elevations range from 455 feet MSL to 615 feet MSL. Currently and at buildout, the Austin Ranch Elevated Tank, Castle Hills Elevated Tank (future in Lewisville system), and Eastside Pump Station supply water to the 735 Service Area.

3) 740 Service Area

The 740 Service Area is generally located from the City's west boundary limits to west of Interstate Highway (IH) 35, and north of Fox Avenue. The ground surface elevations within the 740 Service Area range from 615 feet MSL to 450 feet MSL. Currently and at buildout, the F.M. 407 Elevated Tank and the Northside Pump Station will supply water to the 740 Service Area.

WATER SUPPLY

The City currently treats raw water from Lake Lewisville (purchased from Dallas Water Utilities (DWU)) at the City's Water Treatment Plant, and also purchases treated water from Dallas Water Utilities. DWU supplies potable water to three delivery points through rate of flow controllers (ROFC). The three DWU delivery points are the Southside Pump Station known as the Lake Vista ROFC, Midway Pump Station known as the Midway ROFC and the Eastside Pump Station known as the Kine-Pac ROFC. The Lewisville Water Treatment Plant supplies water to the City's Feaster Pump Station and the City's Northside Pump Station.

DWU has their ROFC's set to the City's current supply needs, with anticipated future increases until it reaches its maximum supply dictated by the supply line's maximum capacity. The Lake Vista ROFC (Southside PS) is currently set at 3.0 MGD, and 6.0 MGD is needed for build-out. The Kine-Pac ROFC (Eastside PS) is currently set at 3.0 MGD, and 12.4 MGD is needed for build-out. The Midway ROFC (Midway PS) is currently set at 3.0 MGD, and 15.0 MGD is needed for build-out. The total supply by DWU at buildout will be 33.4 MGD.

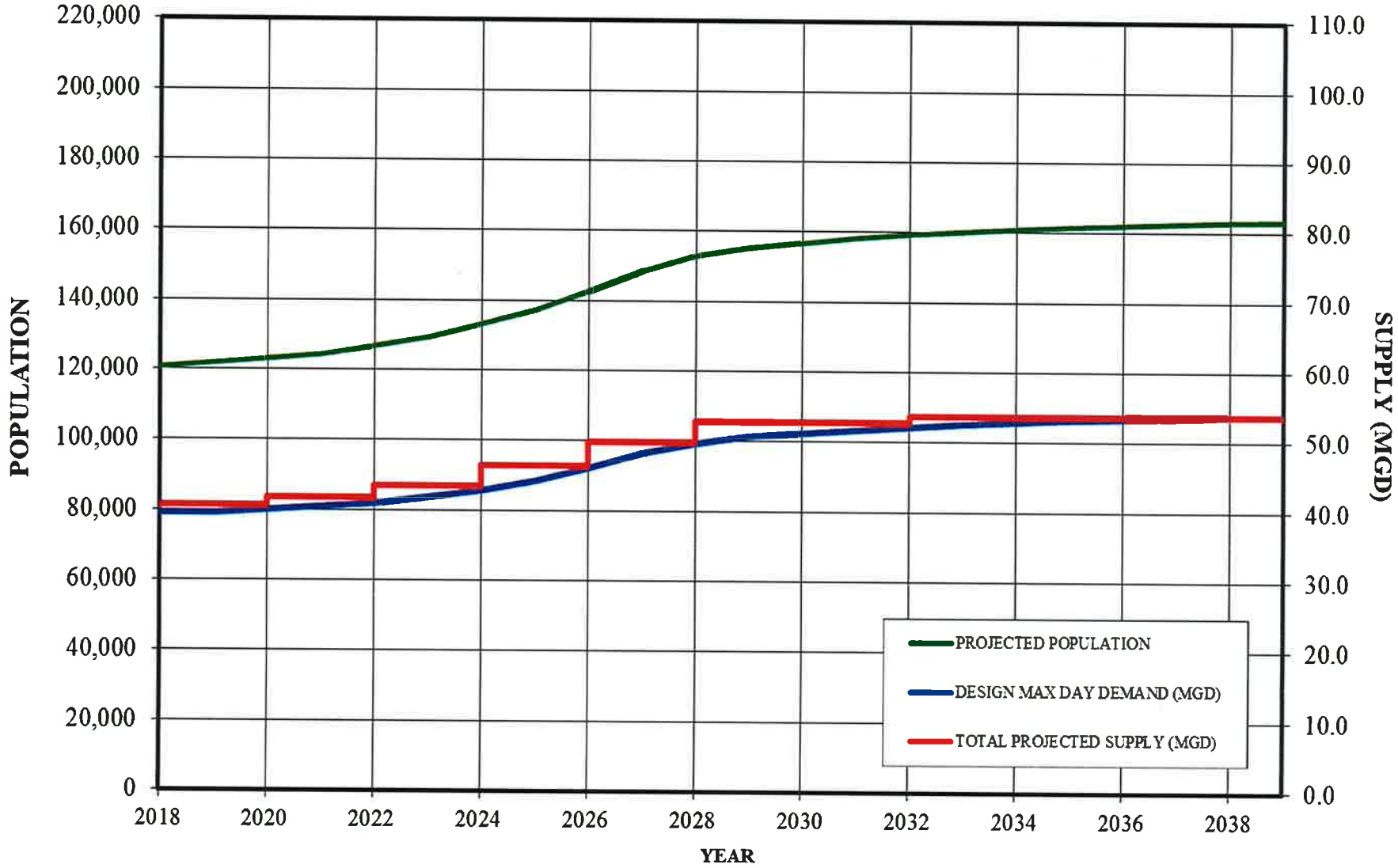
At build-out, the City's Water Treatment Plant will need to have a capacity of 20.4 MGD. This is a decrease from the 2011 report of 39.7 MGD. This is due to the decrease in the build-out population projections and a decrease in per capita usage. This population change decreased the pumpage needed to supply the demand. Based on a per capita demand of 250 gpcd for the 692.5 and 740 Service Area and 350 gpcd for the 735 Service Area and Upper Trinity water being supplied to a large part of the Castle Hills area, no additional plant expansions are envisioned in this study. All additional supply will need to be obtained by increasing supply from DWU to their maximum capacity. **Table No. 8** summarizes the projected buildout supply at each delivery point. **Exhibit 1** shows the projected population, supply, and max day demand from 2018 to buildout.

It is recommended that the City continue water demand studies to verify residential per capita demands as the City approaches buildout. Expansion to the water treatment plant and replacement of pumps at high service pump stations may be impacted by changes in the per capita demand rates, or population changes.

CITY OF LEWISVILLE

EXHIBIT 1

MAX. DAY DEMANDS PROJECTED SUPPLY



** City of Lewisville and Castle Hills*

TABLE NO. 8

SUPPLY BY SERVICE AREA
WATER TREATMENT PLANT AND DWU

Delivery Point	Buildout (MGD)	Current 2018 (MGD)
692.5 Service Area		
WTP – Feaster PS	8.7	12.4
DWU – Lake Vista ROFC (Southside PS)	6.0	3.0
DWU – Midway ROFC (Midway PS)	15.0	3.0
DWU – Kine-Pac ROFC (Eastside PS)	2.1	0.0
Subtotal: 692.5 Service Area	**31.8**	**18.4**
735 Service Area		
DWU – Kine-Pac ROFC (Eastside PS)	10.3	3.0
DWU – Midway ROFC (Midway PS)*	0.0	0.0
Upper Trinity Supply (Castle Hills)	4.8	4.8
Subtotal: 735 Service Area	**15.1**	**7.8**
740 Service Area		
WTP – Northside PS	11.7	8.0
Subtotal: 740 Service Area	**11.7**	**8.0**
Total Supply:	**58.6**	**34.2**

* Backup only to 692.5 Service Area

PUMP STATIONS & GROUND STORAGE RESERVOIRS

A. Feaster Pump Station (692.5 Service Area)

The existing Feaster Pump Station is located at Lewisville's Water Treatment Plant site and is one of three pump stations that serve the 692.5 Service Area. It is currently supplied by the Water Treatment Plant. At the present time the pump station has five pumps for a rated pumping capacity of 27.5 MGD with the largest pump out of service per TCEQ guide lines.

Pump No.	Rated Capacity (MGD)	TDH (Ft.)
1	6.1	240
2	8.0	150
3	4.8	140
4	9.0	252
5	9.0	150

The total maximum hour pumping capacity calculated at Feaster Pump Station in the hydraulic water model at build out is approximately 12.4 MGD.

The Feaster and North Side Pump Stations utilize the same ground storage reservoir (water treatment plant clear wells). Currently there is a total 7.0-MG of ground storage. The 7.0-MG is composed of three 2.0 MGD concrete reservoirs and one 1.0 MGD concrete reservoir. No additional storage is required. The schematic of the Feaster Pump Station is shown in Figure 2.

B. Southside Pump Station (692.5 Service Area)

The Southside pump station is located on Lake Vista Drive and serves the 692.5 Service Area. DWU currently supplies the pump station site with 3.0 MGD supply, and at buildout can supply it with up to 6.0 MGD through the existing Lake Vista ROFC. The pump station has one pump rated at 2.9 MGD with a total dynamic head of 246 feet (pump one), one pump rated 4.3 MGD with a total dynamic head of 246 feet (Pump two) and two pumps rated at 6.0 MGD with a total dynamic head of 246 feet (pumps three and four), for a rated pumping capacity of 13.2 MGD with the largest pump out of service.

Pump No.	Rated Capacity (MGD)	TDH (Ft.)
1	2.88	246
2	4.32	246
3	6.05	246
5	6.05	246

The total maximum hour pumping capacity calculated at the Southside Pump Station in the hydraulic water model at build out is approximately 9.1 MGD.

Currently there is one 2.0 MG prestressed concrete ground storage reservoir. The schematic for the Southside Pump Station is shown in Figure 3. A proposed 2.0 MG reservoir is projected in the future for reliability purposes.

FIGURE NO. 2

LEWISVILLE

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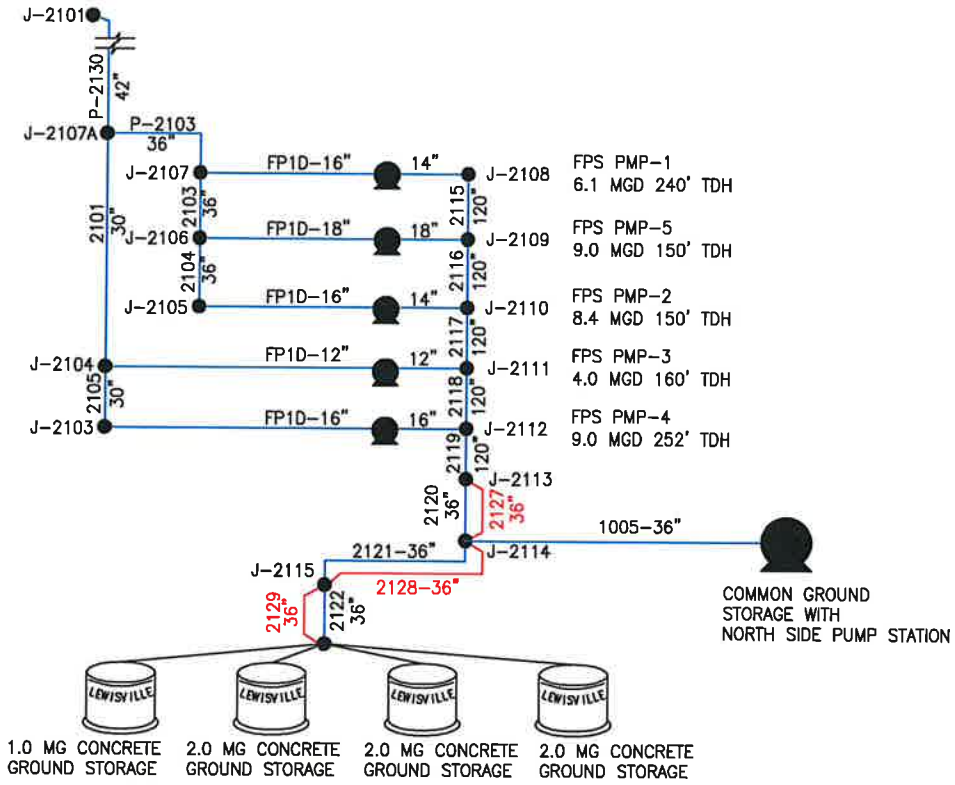
SCHEMATIC LAYOUT



RATED PUMP STATION
CAPACITY 27.5 MGD
WITH LARGEST PUMP
OUT OF SERVICE

LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING WATER PUMP
- PROPOSED WATER PUMP
- EXISTING GROUND STORAGE
- PROPOSED GROUND STORAGE

CITY OF LEWISVILLE, TEXAS

FEASTER PUMP STATION

692.5 SERVICE AREA

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DALLAS, TEXAS

Aug, 2018

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FIGURE NO. 3

LEWISVILLE

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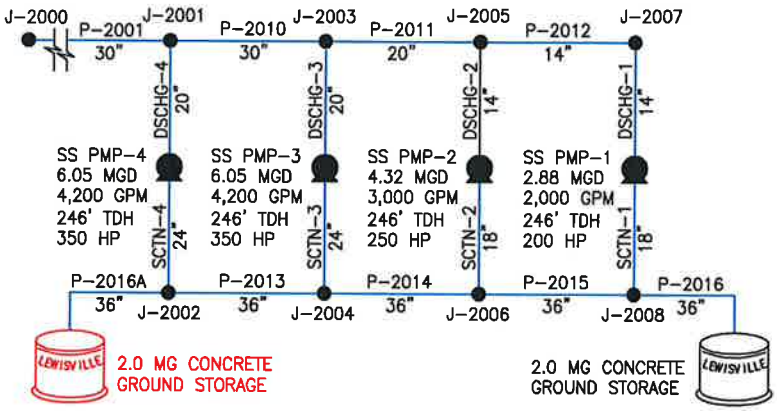
SCHEMATIC LAYOUT



SOUTHSIDE PUMP STATION (692.5 SERVICE AREA)

RATED PUMP STATION
CAPACITY 13.25 MGD
WITH LARGEST PUMP
OUT OF SERVICE

LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING WATER PUMP
- PROPOSED WATER PUMP
- EXISTING GROUND STORAGE
- PROPOSED GROUND STORAGE

CITY OF LEWISVILLE, TEXAS

SOUTHSIDE PUMP STATION
692.5 SERVICE AREA

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
PROFESSIONAL ENGINEERS – Texas Firm F526
DALLAS, TEXAS

Jul, 2018

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C. Midway Pump Station (692.5 & 735 Service Areas)

The Midway Pump Station is located on Midway Road, west of F.M.544. The Midway Pump Station serves both the 692.5 and 735 Service Area. DWU currently supplies 3.0 MGD, at buildout DWU can supply up to 15.0 MGD of treated water at the Midway Pump Station delivery point. The pump station consist of five pumps, each pump rated at 6.7 MGD with a total dynamic head of 234 feet, for a total rated pumping capacity of 26.8 MGD with the largest pump out of service. Four pumps are dedicated to the 692.5 Service Area, and one pump is dedicated to the 735 Service Area. This pump station was designed to allow for various pump combinations to the two service areas in case of an emergency.

Pump No.	Rated Capacity (MGD)	TDH (Ft.)
1 (692.5)	6.67	234
2 (692.5)	6.67	234
3 (692.5)	6.67	234
4 (692.5)	6.67	234
5 (735)	6.67	234

The total maximum hour pumping capacity calculated utilizing the hydraulic model for Midway Pump Station serving the 692.5 service area at build out is approximately 16.3 MGD.

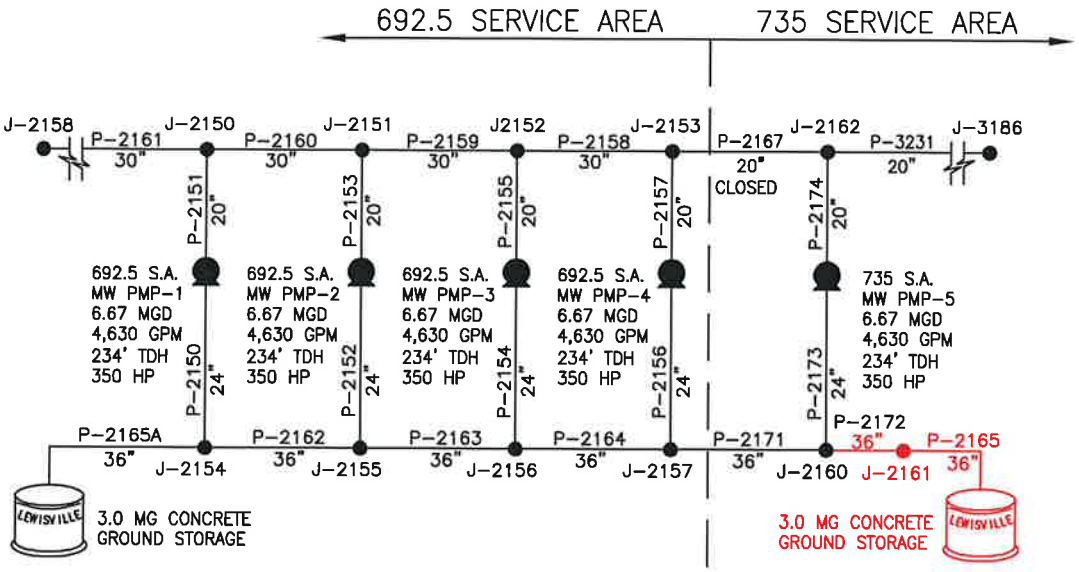
A proposed 3.0-MG ground storage reservoir is recommended for reliability purposes. The schematic for the Midway Pump Station is shown in **Figure 4**.

FIGURE NO. 4

LEWISVILLE

Deep Roots. Broad Wings. Bright Future.

SCHEMATIC LAYOUT



MIDWAY PUMP STATION (692.5/735 SERVICE AREA)

692.5 S.A. RATED PUMP STATION CAPACITY 20.0 MGD WITH LARGEST PUMP OUT OF SERVICE

735 S.A. RATED PUMP STATION CAPACITY 6.67 MGD WITH LARGEST PUMP OUT OF SERVICE

LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING WATER PUMP
- PROPOSED WATER PUMP
- EXISTING GROUND STORAGE
- PROPOSED GROUND STORAGE

CITY OF LEWISVILLE, TEXAS

MIDWAY PUMP STATION
692.5 & 735 SERVICE AREAS

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DALLAS, TEXAS

Jul, 2018

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D. Eastside Pump Station (735 Service Area)

The existing Eastside Pump Station is located along Lake Ridge Road and currently serves both the 692.5 and 735 Service Areas. The buildout service area includes Castle Hills. DWU currently supplies this station with 3.0 MGD through their existing Kine-Pac ROFC located at the Eastside Pump Station site. At buildout, its supply from DWU will be 12.4 MGD. Presently there are four pumps rated at 3.0 MGD with a total dynamic head of 246 feet for a total rated pumping capacity of 9.0 MGD with the largest pump out of service. The water model calculated that at build out the maximum hour pumping rate at Eastside Pump Station is 11.3 MGD.

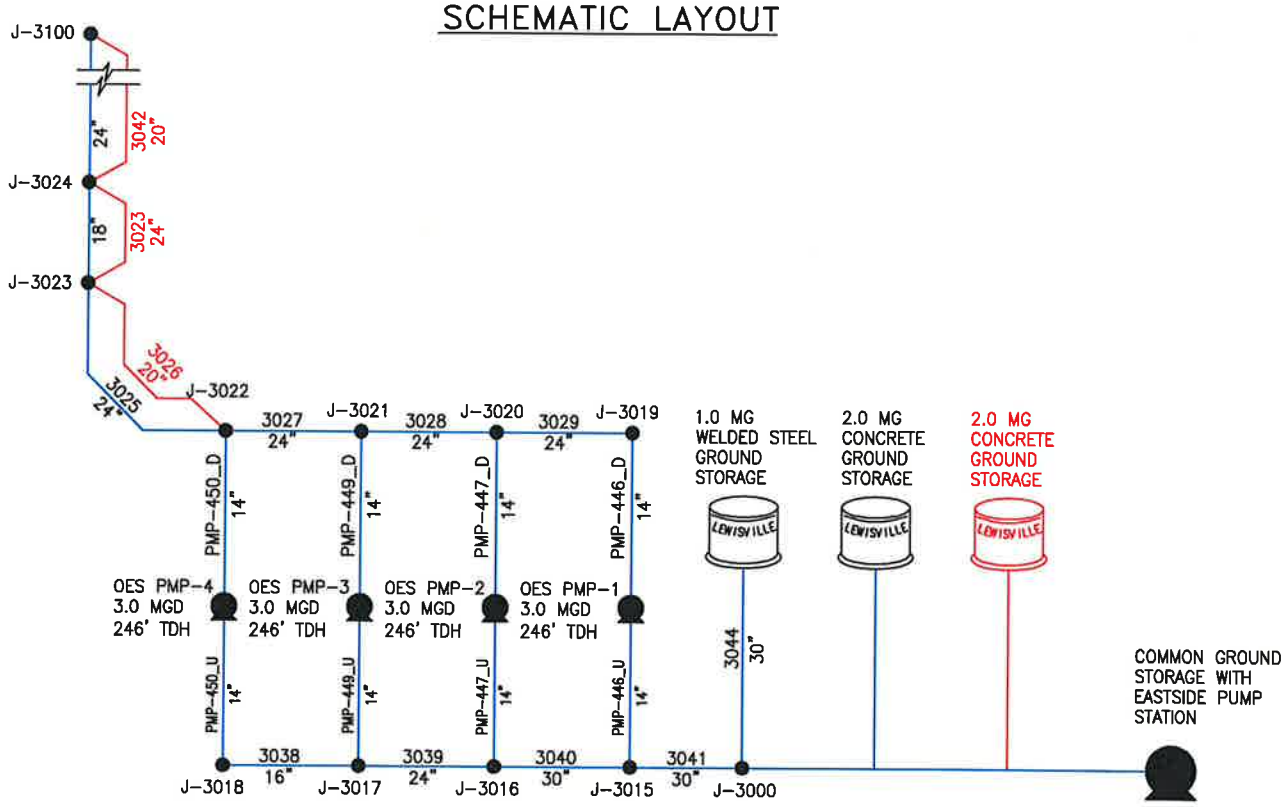
The amount of ground storage required for this pump station is 3.0 MG. There is a 2.0 MG Prestressed Concrete Reservoir and a 1.0-MG Steel Ground Storage Reservoir serving for existing ground storage. If space is available, we recommend a 2.0 MG concrete tank be considered in lieu of the 1.0 MG required. We also recommend installing larger pumps whenever the Eastside Pump Station needs to be rehabilitated in order to meet buildout demand. The schematic for the pump station is shown on **Figure 5**.

FIGURE NO. 5

LEWISVILLE

Deep Roots. Broad Wings. Bright Future.

SCHEMATIC LAYOUT



EASTSIDE PUMP STATION (735 SERVICE AREA)

RATED PUMP STATION
CAPACITY 9.0 MGD
WITH LARGEST PUMP
OUT OF SERVICE

LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING WATER PUMP
- PROPOSED WATER PUMP
- EXISTING GROUND STORAGE
- PROPOSED GROUND STORAGE

CITY OF LEWISVILLE, TEXAS

EASTSIDE PUMP STATION
735 SERVICE AREA

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
PROFESSIONAL ENGINEERS – Texas Firm F526
DALLAS, TEXAS

Jul, 2018

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E. Northside Pump Station (740 Service Area)

The Northside Pump Station is located at Lewisville's Water Treatment Plant Site and serves the 740 Service Area. It is projected that at build out the service area will have a maximum day demand of approximately 11.7 MGD. The Northside Pump Station currently has one pump rated at 2.5 MGD with a total dynamic head of 198 feet (pump one), one pump rated at 4.0 MGD with a total dynamic head of 198 feet (Pump two), one pump rated at 7.3 MGD with a total dynamic head of 201 feet (Pump three) and one pump rated at 7.3 MGD with a total dynamic head of 201 feet (Pump four). The current total rated pumping capacity of the North Side Pump Station is 13.8 MGD with the largest pump out of service.

The water model calculated that at build out, the total maximum hourly pumping capacity at the Northside Pump Station is 13.2 MGD.

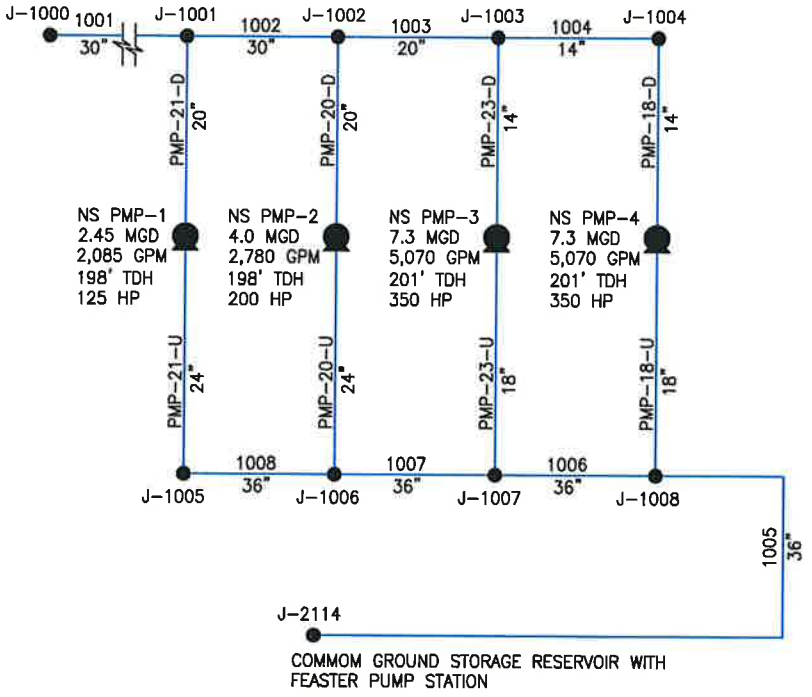
At the present time, the North Side Pump Station shares the same existing 7.0 MG of ground storage with the Feaster Pump Station. The schematic for the Northside Pump Station is shown in **Figure 6**.

FIGURE NO. 6

LEWISVILLE

Deep Roots. Broad Wings. Bright Future.

SCHEMATIC LAYOUT



NORTHSIDE PUMP STATION
(740 SERVICE AREA)

RATED PUMP STATION
CAPACITY 13.80 MGD
WITH LARGEST PUMP
OUT OF SERVICE

LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING WATER PUMP
- PROPOSED WATER PUMP
- EXISTING GROUND STORAGE
- PROPOSED GROUND STORAGE

CITY OF LEWISVILLE, TEXAS

NORTHSIDE PUMP STATION
740 SERVICE AREA

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
PROFESSIONAL ENGINEERS – Texas Firm F526
DALLAS, TEXAS

Jul, 2018

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Table No. 9 summarizes the pump stations capacity at buildout compared to the Maximum Daily Demand as shown on **Table No. 6**.

TABLE NO. 9

PUMP STATION FIRM CAPACITY AT BUILDOUT BY SERVICE AREA

Pump Station Site	Pumping Firm Capacity (MGD)	Maximum Daily Demand (MGD)
692.5 Service Area		
Feaster Pump Station	27.5	
Southside Pump Station	13.2	
Midway Pump Station	20.1	
Subtotal: 692.5 Service Area	**60.8**	**31.8**
735 Service Area		
Eastside Pump Station	9.0	
Midway Pump Station	6.7	
Subtotal: 735 Service Area	**15.7**	**14.6**
740 Service Area		
Northside Pump Station	13.8	
Subtotal: 740 Service Area	**13.8**	**11.7**
TOTAL PUMPING CAPACITY:	**90.3**	**58.1**

GROUND STORAGE RESERVOIRS

Ground storage within the system is necessary to provide a dependable supply during periods of high demand, emergencies or disruption in supply. The volume of ground storage in this report was designed to match the pump stations' pumping capacity in MGD for a draw down period of 6 hours, or a 12-hour average day demand draw down. **Table No. 10** summarizes the projected ground storage required for each pump station site and the projected buildout storage.

Eastside, Southside, and Midway Pump Stations are supplied by Dallas Water Utilities. At the sites, ground storage is also utilized to extend bumps in supply that can cover an increase in the demand change in the DWU rate structure. Having two reservoirs at a pump station site provides reliability to the distribution system.

TABLE NO. 10

GROUND STORAGE SUMMARY

Pump Station Site	Pumping Capacity (MGD)	Required Storage (MG)	Existing Storage (MG)	Buildout Storage (MG)
Feaster/Northside	41.3	6.0	7.0	7.0
Southside	13.2	2.0	2.0	4.0
Eastside	9.0	3.0	3.0	5.0
Midway	26.8	3.0	3.0	6.0
Total:	**90.3**	**14.0**	**15.0**	**22.0**

ELEVATED STORAGE TANKS

The volume of elevated storage is based on the difference of the maximum daily demand (pumpage) and the maximum hourly demand rate. This volume in conjunction with pumpage will meet the projected peak hourly demands in the system. The minimum amount of elevated storage required by the Texas Commission on Environmental Quality (TCEQ) is 100 gallons per connection. The existing number of connections is estimated to be 39,958. At 100 gallons per connection, the TCEQ minimum volume of elevated storage required for the existing distribution system is approximately 4.0 million gallons. The existing system meets TCEQ's requirements for minimum elevated storage. For buildout, comparing the buildout population with the existing population, the estimated buildout number of connections is approximately 52,791. The TCEQ minimum elevated storage volume required would equate to 5.3 million gallons. The City has 9.0 million gallons of elevated storage that will be sufficient and also meet TCEQ requirements, as shown on **Table No. 11**.

TABLE NO. 11
ELEVATED STORAGE CAPACITY
AT BUILDOUT

	Elevated Storage Tank	Service Area	Elevated Storage Capacity (MG)
	Valley Parkway Elevated Tank(All Steel Leg)	692.5	2.5
	Bellaire Elevated Tank (Composite)	692.5	1.0
*	IH-35 Elevated Tank(All Steel Leg)	692.5	0.5
	F.M. 407 Elevated Tank(Composite)	740.0	2.0
	Austin Ranch Elevated Tank(Composite)	735.0	2.0
	Castle Hills Elevated Tank(Composite)	735.0	1.5
	Total:		**9.0**

* *The IH-35 Elevated Tank is not currently in service, not included in total amount*

WATER TREATMENT PLANT

The existing production capacity of the water treatment plant is a firm 20.4 MGD. In addition to the DWU supply, the water treatment plant must be capable of producing a supply to meet the maximum daily demand. It is estimated at build out that the water treatment plant will need to have the capacity to produce 20.4 MGD. Sizing of the water treatment plant is based on the maximum day demand utilizing a per capita demand of 250 g.p.c.d. The per capita demand rate is lower than previous studies. The North Central Texas area is generally seeing a decrease in usage after the previous drought and water restrictions along with a strong public relations campaign by the water supplies. Continued monitoring of per capita usage should be conducted as Lewisville nears buildout to substantiate the continued low per capita demand and the determination of no water treatment plant expansion.

FIRE FLOW ANALYSIS

A fire hydrant is an element of the water distribution system that provides for public fire-protection service. The usage of a fire hydrant as a source of water for fighting a fire is the primary purpose for which the element is installed. A fire flow analysis was performed on the water distribution system utilizing the computer software. Each service area was analyzed for fire protection during the maximum daily demand at Build-out. Every junction node in each of the service areas was analyzed in order to meet the following constraints, which meet or exceed TECQ standards:

1) *Minimum Fire Flow Required for a Given Junction (1 hydrant) ..... 1.44 mgd (1,000 gpm)*

2) *Residual Pressure at the Fire Flow Junction ..... 20 psi*

3) *Minimum Acceptable System Pressure with a Fire in the System ..... 35 psi*

A single fire hydrant has a maximum discharge rate of 1.44 MGD (1,000 gpm). The analysis consisted of placing up to 1.44 MGD (the equivalent of using one fire hydrant with 3 outlet nozzles) at each junction node and requiring the water distribution system to maintain minimum pressures. All the junction nodes in each Service Area were analyzed in the Build-out Model. A fire flow was added to a junction node during the maximum daily demand run to determine if the system could deliver the required fire flow while maintaining a residual pressure at the node of 20-psi. In addition, all other nodes were checked to determine if pressures within the system could be maintained at a minimum design pressure 35-psi. Junction Node No. J-2347 (in the Lake Station TOD Area) had the least amount of available flow of 2.17 MGD after sustaining a residual pressure of 20-psi. A copy of the results of the fire flow analysis of the Build-out model can be found at the end of the report by Service Area.

PROPOSED LINES

Table No. 12 shows the proposed lines greater than twelve inches for the 692.5 Service Area and 735 Service Area.

TABLE NO. 12

PROPOSED PIPES IN SERVICE AREAS

692.5 SA - BUILDOUT PIPES		
ID (Char)	**Length (Ft.)**	**Diameter (in.)**
P-2626	2,946	24

735 SA - BUILDOUT PIPES		
ID (Char)	**Length (Ft.)**	**Diameter (in.)**
P-3231	2,364	20

HYDRAULIC ANALYSIS

A computer assisted analysis was performed utilizing H2ONET computer software to aide in developing an overall system of water mains, storage facilities and pump stations to efficiently serve the entire city as development is now envisioned. The resulting plan is shown on the water distribution map outside this report. The master plan map shows the size and location of all existing and future feeder mains as well as elevated storage facilities. Also shown are reference numbers on all pipes and pipe intersections or nodes. These numbers refer to additional information contained in the computer printout. Two computer analyses were undertaken: One for the maximum hourly demand on the day of maximum demand and one for the minimum hourly demand on the day of maximum demand.

The hydraulic information shown on the computer printout is described as follows:

1) **PipeNumber** - number shown on system map for each section of pipe between nodes.

2) **JunctionNode** - Pump Station, intersection of pipe, or water use point. The first node number indicates the flow entering a section of pipe, the second node number indicates flow leaving that section of pipe. A minus sign indicates the flow opposite of the node order.

3) **Length** - Distance between nodes in feet.

4) **Diameter** - Pipe diameter in inches.

5) **Roughness** - Coefficient of friction designated to the section of pipe.

6) **Boundary Node** - Pressure zone elevation based on U.S.C.& G.S. datum. Location of elevated storage tank.

7) **Demand** - Design flow at nodes in million gallons per day (MGD). A minus sign indicates flow into the system.

8) **Elevation** - Ground elevation at node based on U.S.C.& G.S. datum.

9) **ConnectingPipe** - Pipe number connecting to junction node.

10) **FlowRate** - Rate of flow in pipe section in million gallons per day.

11) **Headloss** - Friction headloss in section of pipe, in feet.

12) **Velocity** - Velocity of flow in section of pipe in feet per second (fps).

13) **HL/1000** - Friction loss in feet per thousand feet of pipe.

14) **GradeLine** - Elevation of water surface at node based on U.S.C. & G.S. datum (hydraulic gradient).

15) **Pressure** - Pressure in pounds per square inch (psi) at the node.

LEWISVILLE

Deep Roots. Broad Wings. Bright Future

WATER DISTRIBUTION SYSTEM MASTER PLAN 2018

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July, 2018

SCALE: 1"=5000'

PROPOSED LEWISVILLE LAKE STATION TOO

LAKE LEWISVILLE

FM 407 2.0 MG ELEVATED TANK

FEASTER PUMP STATION Capacity: 27.50 MGD

NORTHSIDE PUMP STATION Capacity: 13.8 MGD

740 SERVICE AREA

H-35 0.5 MG ELEVATED TANK

PROPOSED OLD TOWN STATION TOO

MIDWAY PUMP STATION Capacity: 26.80 MGD

EASTSIDE PUMP STATIONS Capacity: 18.0 MGD

AUSTIN RANCH 2.0 MG ELEVATED TANK

HILLSIDE 1.5 MG ELEVATED TANK

735 SERVICE AREA

BELLAIRE 1.0 MG ELEVATED TANK

692.5 SERVICE AREA

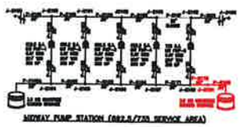
VALLEY PKWY 2.5 MG ELEVATED TANK

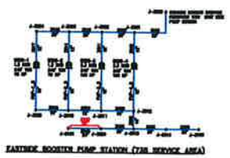
PROPOSED HEBRON/121 STATION TOO

SOUTHSIDE PUMP STATION Capacity: 13.2 MGD

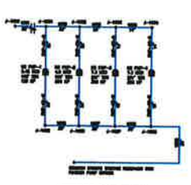
LEGEND

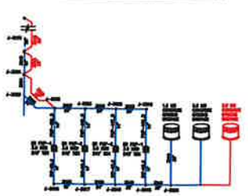
- EXISTING ELEVATED STORAGE TANK
- EXISTING GROUND STORAGE TANK
- PROPOSED GROUND STORAGE TANK
- EXISTING PUMP STATION
- PROPOSED PUMP STATION
- EXISTING WATER LINE AND SIZE
- PROPOSED WATER LINE AND SIZE
- DEMAND NODE AND NUMBER
- PLANNING AREA BOUNDARY
- SERVICE AREA BOUNDARY
- EXIST. DALLAS WATER UTILITIES WATERLINE
- FUTURE TOO AREAS

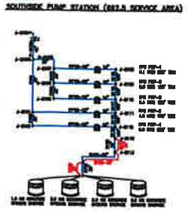

MIDWAY PUMP STATION (692.5/735 SERVICE AREA)


EASTSIDE BOOSTER PUMP STATION (735 SERVICE AREA)


SOUTHSIDE PUMP STATION (692.5 SERVICE AREA)


NORTHSIDE PUMP STATION (740 SERVICE AREA)


EASTSIDE PUMP STATION (735 SERVICE AREA)


FEASTER PUMP STATION (692.5 SERVICE AREA)

REVISED: 7/25/18 – JLe

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PLOT SCALE: 1:1

PLOT STYLE: ----

PLOTTED BY: JLe ON 8/1/2018

2018 WATER DISTRIBUTION SYSTEM MASTER PLAN

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JULY 2018