APPENDIX B:

East 11th and 12th Street Redevelopment Infrastructure Report

Urban Design Group

Infrastructure Report
Draft 1-09-12

Project Approach

Urban Design Group evaluated the water, wastewater, drainage and electric utilities by reviewing the existing GIS and service maps and meeting with City of Austin staff from each department. Information on existing service and future improvements was provided by the staff within the Austin Water Utility, Austin Energy and Watershed Protection. A visual site visit was performed with Austin Energy staff to further understand the complexities with the overhead utility system. A review was done of the only permitted site plan for new construction on E. 12th. This project, Terrazas on Twelfth (1000 E. 12th Street) was approved in 2007 and is currently seeking a administrative extension of the site plan to August 2012 since construction has not occurred. Review of this permitted site plan helped to inform what densities might occur on a consolidation of lots along this corridor if required to meet City of Austin site plan regulations.

Although Preliminary Engineering was not a part of the scope of this project, UDG did look at the projected densities along E. 12th Street and converted these projected uses/square footages to LUE's, the planning demand unit used by the Austin Water Utility. These demands were then applied to the system using existing size, capacity and condition information from the Austin Water Utility.

Cost estimation was accomplished without the benefit of preliminary engineering and relied on recent construction cost experience and input from City of Austin staff.

Austin Energy (AE)

Austin Energy Policies
AE is regulated by the Public Utilities Commission (PUC) and these rate regulations dictate that AE must serve any potential customer and that service is provided via the installation of overhead utilities. In Austin, if underground electric lines are desired the cost difference between overhead and underground is borne by the developer. In City-funded corridor projects, utilities can be relocated or installed underground but the project's CIP funding must pay for this rather than it be a service cost to AE. An example of a project funding underground utility relocation was the East 11th Street Redevelopment. The cost of that relocation was approximately $705,000.

Existing System
Existing electric power service to the East 11th and 12th Street area is a comprehensive and redundant system. It is capable of serving a diverse and dense system of redevelopment. East 12th Street right-of-way contains transmission lines as well as

distribution lines. The transmission lines are the higher over-head lines supported by the taller metal poles. Distribution lines are present on lower wooden poles along with numerous other communication utilities other than AE.

The transmission lines originate from the Brackenridge Substation located downtown. Transmission lines run in loop systems, therefore, 12th Street contains a series of the taller transmission lines running out of the substation and into the neighborhood and then back to connect with the substation. A majority of East 12th Street has these lines which run east – west with points such as at Comal Street where the system turns to the south. Unfortunately AE grid maps do not show the Transmission lines only distribution. *Exhibit 1* is provided to the extent of overhead electrical distribution lines in the area.

Underground Utilities

Overhead transmission lines such as the ones located on E. 12th Street can be buried requiring approximately thirty foot easements to contain the underground conduit. Cost for burying these lines would run approximately $300 to $400 per linear foot per phase of power. The difficulty in estimating the cost to bury overhead utilities is increased by the existence of other communication utilities on AE poles. Each of these utilities, which could be as many as four or five, will charge a project in order to relocate their lines underground. Until one is actually designing a street reconstruction project, it is impossible to accurately determine how electric and communication systems can be reconfigured to allow for underground relocation. Due to these complexities, a planning estimate for underground relocation of only electrical distribution lines would be $1 million per mile. (source:AE) An additional design constraint for utility relocations is the current configuration of individual services to each lot along a corridor. Many of the existing buildings are old and would require on-site electric service reconfiguration and possible building upgrades. It is sometimes possible to relocate overhead utilities from the public street to a rear alley. There are alleys to the north and south of East 12th Street. These alleys are not complete along the whole corridor, although a majority of the tracts have both street and alley access. The challenge in constructing electric distribution lines within an alley is the need to accommodate an installation/service truck which is 26 feet wide when its outriggers are extended. Older alleys present challenges in meeting this design criteria.

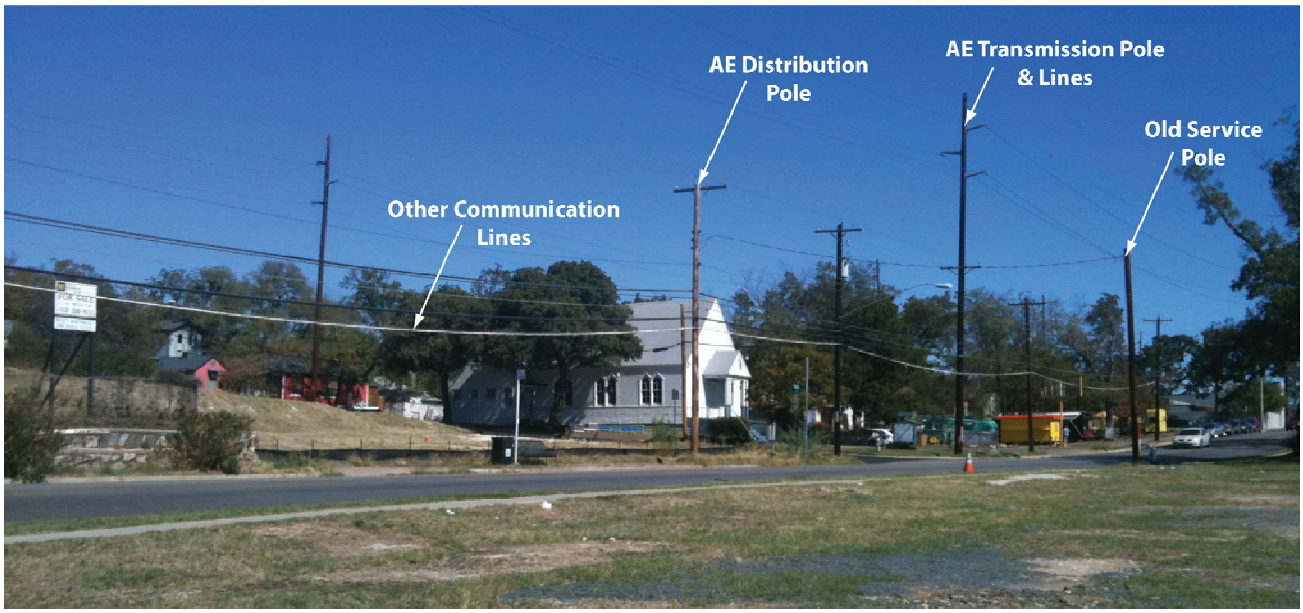
The transmission lines within 12th Street are required to provide service not only to East 11th and 12th, but a greater area east of IH-35. These transmission lines provide a secure and multiple-feed system for this area but it is large enough to provide for the future construction of higher density development including large-scale employment centers east of IH35. According to AE they could serve any redevelopment project within the East 11th and 12th Street corridors.

Underground Utility challenges

With a thirty foot easement requirement to locate these transmission lines underground and the additional requirements of water, wastewater, gas and other communications within the existing right-of-way of East 12th Street which varies from 50 to 60 feet wide, it is highly unlikely the lines could be buried. Moving the overhead lines to another

overhead location would most likely be extremely expensive and still not remove the lines from sight.

What can we do?
These transmission lines are approximately thirty to fifty feet above ground. Due to the heavier transmission wire, the span between transmission poles can be greater than required for the lighter distribution wire. The visual clutter along East 12th Street is most prevalent on the wooden distribution poles which contain other utilities. These utilities



tend to have larger diameters as shown in the picture above.

A fair amount of visual clutter could be removed by requiring the other communication utilities to relocate underground. Their conduit and easement requirements are much less than AE. Additionally, there may be service poles along the corridor that could be removed or reduced during a street design project.

Conceptual Cost estimates
Without the benefit of even preliminary design it is difficult to establish a cost to relocate some of the overhead utilities to underground. With the existence of both East-West and North-South Transmission mains along 12th there are many constraints to rerouting of services and removal of poles in the transition from overhead to underground. Using the experiences of the East 7th Street Improvement project and input from AE staff, it is possible to make improvements to the overhead visual clutter which could range from relocating only the franchise utilities to underground to burying as much as feasible of overhead distribution. It is recommended that a budget of $4 million could serve to considerably improve the overhead utility condition along 12th Street. A preliminary engineering design would be required to further refine this estimate.

Austin Water Utility (AWU)

Austin Water Utility Policies

The AWU Utility Development Services (UDS) Division addresses customer needs when water and wastewater service is being requested. The UDS Division conducts Subdivision Reviews, Site Plan Reviews, and Zoning Reviews regarding water and wastewater service. Specific development plans are reviewed as proposed to determine if system improvements are needed to provide required levels of service. This is done through the Service Extension Request (SER) process. Austin Water Utility's Capital Improvements Program includes a component aimed at replacing aging pipes that are found to be reaching the end of their useful life. As would be expected, pipes in the central city that are part of the original system are given a high priority.

As a project is planned along E. 12th Street, the developer should prepare and submit an SER to the AWU as early in the process as possible. The SER process will enable the AWU to establish any water and wastewater service requirements in order to serve the proposed development. It is an opportunity to work early in the planning process to inform the AWU of pending development so they can best assess service requirements in the area. If any upgrades are required it is the process to establish the funding requirements whether it be the private sector, public sector or a joint funding.

Existing System (information provided by AWU)

Water

There is an existing 12-inch water main along 12th Street, which is interconnected to the water distribution system at all cross streets, including two 24-inch transmission mains (one at Navasota Street and one at Airport Boulevard). The 12-inch water main along 12th Street from San Bernard Street to Airport Boulevard is a ductile iron main that was installed around 1999. All other mains in the area appear to be older cast iron mains. The existing 12-inch main along 12th Street is anticipated to meet current and future development demands, including fire flows up to approximately 3500 gpm. Some of the mains along the cross-streets that are 6-inch or smaller may require replacement if a future development requires a significant demand along those mains, rather than the 12-inch main along 12th Street. *Exhibit 2* shows the water system.

Wastewater

Exhibit 3 shows the wastewater system and the different drainage areas along E. 12th Street. In general all the drainage areas have strong wastewater collection systems to support redevelopment with the weakest system in Drainage Area 1and 3. Area 1 is the area from IH-35 to San Bernard. An analysis (*Exhibit 4*) by the AWU reports that the system in Drainage Area 1 would support the addition of one or two 4 story mixed-use block developments before upgrades would most likely be needed to the system. Area 3 is the area east of Chicon to Poquito. The Utility indicates that this area is served by old

original lines located in the alleys. If increased density is planned for this area then upgrades would be needed.

The system in 12th Street which runs from IH35 to San Bernard Street has the original 8-inch and 6-inch pipes in it. These pipes serve a comparatively small 7 block area that extends north to 14th Street. In 12th Street there is some capacity available for new development. According to AWU it could serve another 150 to 300 LUE's. A typical one-block, 4-story mixed use development can range from 75 to 150 LUEs. Thus, these existing lines in 12th Street can accommodate a variety of development depending on the number of LUEs and the point of connection, before line upsizing would be required.

As a part of the ACWP project, the East 11th and East 12th Street areas were studied by Severn Trent in 2003 as part of the Govalle 4 SSES study. Earth Tech reviewed the SSES recommendations and prepared a Tech Memo in 2004 to confirm the sewer segments that would go forward with design and construction. Included as *Exhibit 5* is the *Executive Summary of the Tech Memo* prepared by ACWP and a map of the segments they recommended. Although there were some lines recommended for replacement in the area the study did not consider the defects in E 12th street to be very severe and they were not recommended for replacement. The segments constructed as a part of ACWP are the San Bernard St WW Improvements, Angelina St WW Improvements, and Manor Comal Rosewood WW Improvements.

In recent condition assessment work, the existing old 12th Street and Branch Street lines were found to be in generally good condition. Some point repair needs were identified and one 260-ft segment was identified for possible replacement related to observation of pipe cracking. The 12th Street pipes flow to an old high capacity (high slope) 8-inch line in Branch Street and then to new 12-inch PVC pipes in Branch Street and 11th Street. These lines have capacity for high-density, multi-story development.

These lines flow to the 10-inch line that crosses under I35 and then joins with the line from the new Robertson Hill development at a connection with the new 12-inch PVC line that ties these areas into the 36-inch Waller Creek interceptor. The 10-inch line was found to be in good condition when inspected in 2006. This 10" under IH 35 was repaired in 2008.

Between San Bernard and Chicon

This section of 12th Street contains a installed 8-inch and 12-inch PVC pipe which has capacity available for new development. Most of the downstream system has been upgraded recently, making capacity available for new development in a large area.

Poquito Intersection

At the intersection of 12th Street and Poquito Street there are no wastewater lines in the streets. Service is provided via the lines in the alleys to the north and south. Three of the four alleys still have the old original small lines in them, so any large development would have to look at whether new pipes are needed at the particular one-block location from both a capacity and a condition standpoint. In the next block to the east, at Alamo Street,

the downstream system has been upgraded to a 15-inch PVC line, making capacity available for new development in a large area.

Water and Wastewater Summary

In summary, the water system in 12th Street is adequate to service future redevelopment of the area.

The wastewater system is strong except for two sections of older clay pipe, approximately 1650 LF of 6"/8"from San Bernard to Branch and 350 LF of 6" in the southern alley in the block east of Chicon. According to service and maintenance staff at the AWU the segment west of San Bernard does have additional service capacity and is performing adequately. Preliminary calculations show that the proposed densities along E. 12th which will flow to this line could be accommodated by the existing system. When the block east of Chicon is redeveloped it will depend on whether it is done on a lot by lot basis as to the timing of the wastewater line replacement. Should one small lot redevelop it might not require waste water upgrade whereas if the whole block is rebuilt as one development then the upgrade would be incorporated into that project.

Conceptual Cost estimates

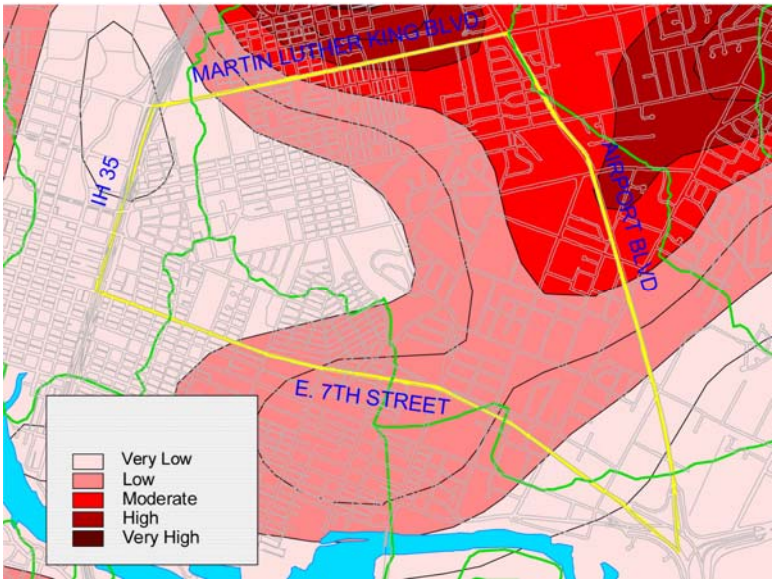
Looking just at 12th Street there is approximately 2000 LF of older waste water line that should be replaced at some time in the future. Since it is performing adequately and has additional capacity available it is not an AWU priority. AWU focuses on areas that require immediate upgrade for existing and site permitted future uses. At this conceptual phase, it is estimated that the replacement cost for only the waste water lines could be $450/LF or $900,000. The AWU has reoccurring CIP projects that provide for existing system upgrades. Funding possibilities for this future replacement within the AWU are the following two CIP categories: *Wastewater Collection Systems, Project ID 6943 and Replacement or Deteriorated Infrastructure, Project ID 2231.*

Stormwater

The East 12th Street study area falls within the Waller Creek and Boggy Creek Watersheds. The division line is roughly St. Bernard St. Exhibit 6 shows the existing drainage areas and systems. Basically, there are very few inlets within the 12th Street right-of-way. Within the Waller Creek section, stormwater drains within the street section to inlets located at Curve St. and Branch St. The system that picks up this drainage was built in the late 1990's as a part of the SCIP II Improvement Project. This Waller Creek drainage system is adequate for future redevelopment.

Within the Boggy Creek section, the downstream infrastructure is extremely old and under-capacity. Deficiencies in the system were studied by the Watershed Protection and Development Review Department as part of the *Report to City Council: Central East Austin Storm Drain Study, June 7, 2001*. This study identified over $65 Million of drainage system upgrades for the central East Austin area. The report notes that although the lines draining East 12th Street are old and undersized, the East 11th and 12th area was

identified as very low for localized flooding problems and, therefore, storm sewer upgrades are a lower priority. There is no identified funded storm sewer project for this area. A copy of the report is included as *Exhibit 7*.



If a redevelopment project proposes increased impervious cover over the existing conditions, then the project would be required to provide stormwater detention as are all projects within the City of Austin. Watershed Engineering staff indicated that a waiver to detention would be possible within this area if the project's engineer could satisfy the requirements of that code section. It is possible that should a large redevelopment project be proposed for this area, then off-site stormwater improvements may be required. This analysis is done on a project-by-project basis. Examples of off-site requirements can range from installation of a new curb inlet to upgrade of storm sewer line.

Streetscape Improvements

There is continuous sidewalk along E. 12th although some of it is in minor disrepair. Should the City consider a corridor improvement project for this area one could look to the recently completed East 7th Street Improvement Project. The cost of that 1.23 mile project was $11 million. This included more utility upgrades then would be required on 12th and very little overhead relocation. Of the $11million, the cost was about $8.5 million for the sidewalks, landscape, pavers, pedestrian crossings, art, wayfinding. Applying a pro-rata amount to E. 12th would be about $5 million.

It should be pointed out that all corridors are unique in the design challenges to address existing conditions, utility locations, private property access and opportunities to construct landscaping and public space amenities. A project cost also depends on the bidding climate at the time which was very favorable for the East 7th Street project. A budget of $5 million would accommodate a level of streetscape enhancements. A preliminary engineering design would be required to further refine this estimate.

Electric data provided by Austin Energy
Storm sewer data was compiled from Watershed Protection Dept.,COA.
Data was compiled from existing data or from field.

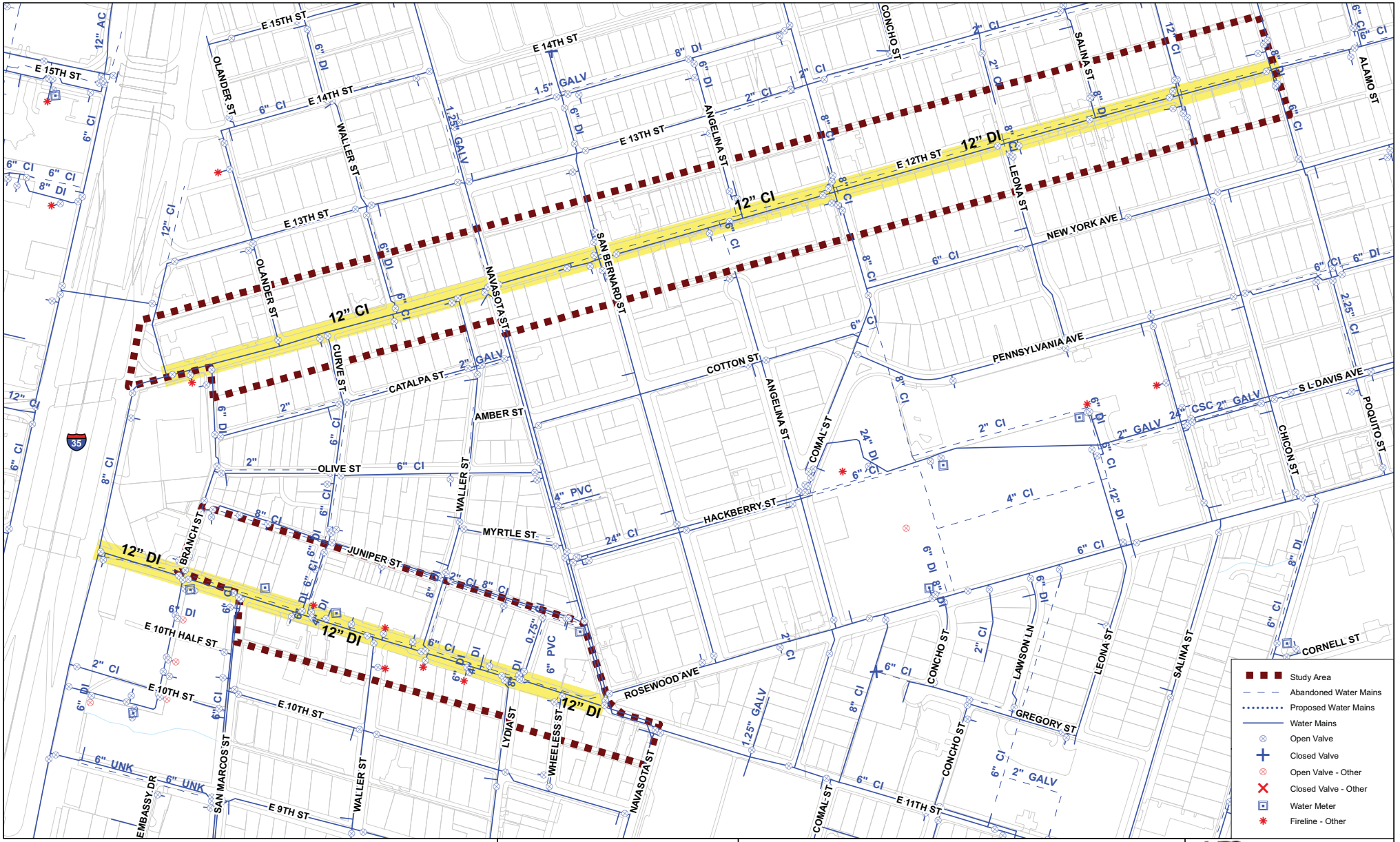
0 50 100 150 Feet

E. 11th and 12th St. Redevelopment - Electric Map

UDG Urban Design Group
3660 Stoneridge Rd., #E101
Austin, TX 78746
512.347.0040
general@udg.com www.udg.com

Study Area

Exhibit 1



The Water Map was prepared from data compiled from the COA.

E. 11th and 12th Street Redevelopment - Water Map

Urban Design Group
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Austin, TX 78746
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general@udg.com www.udg.com

Exhibit 2

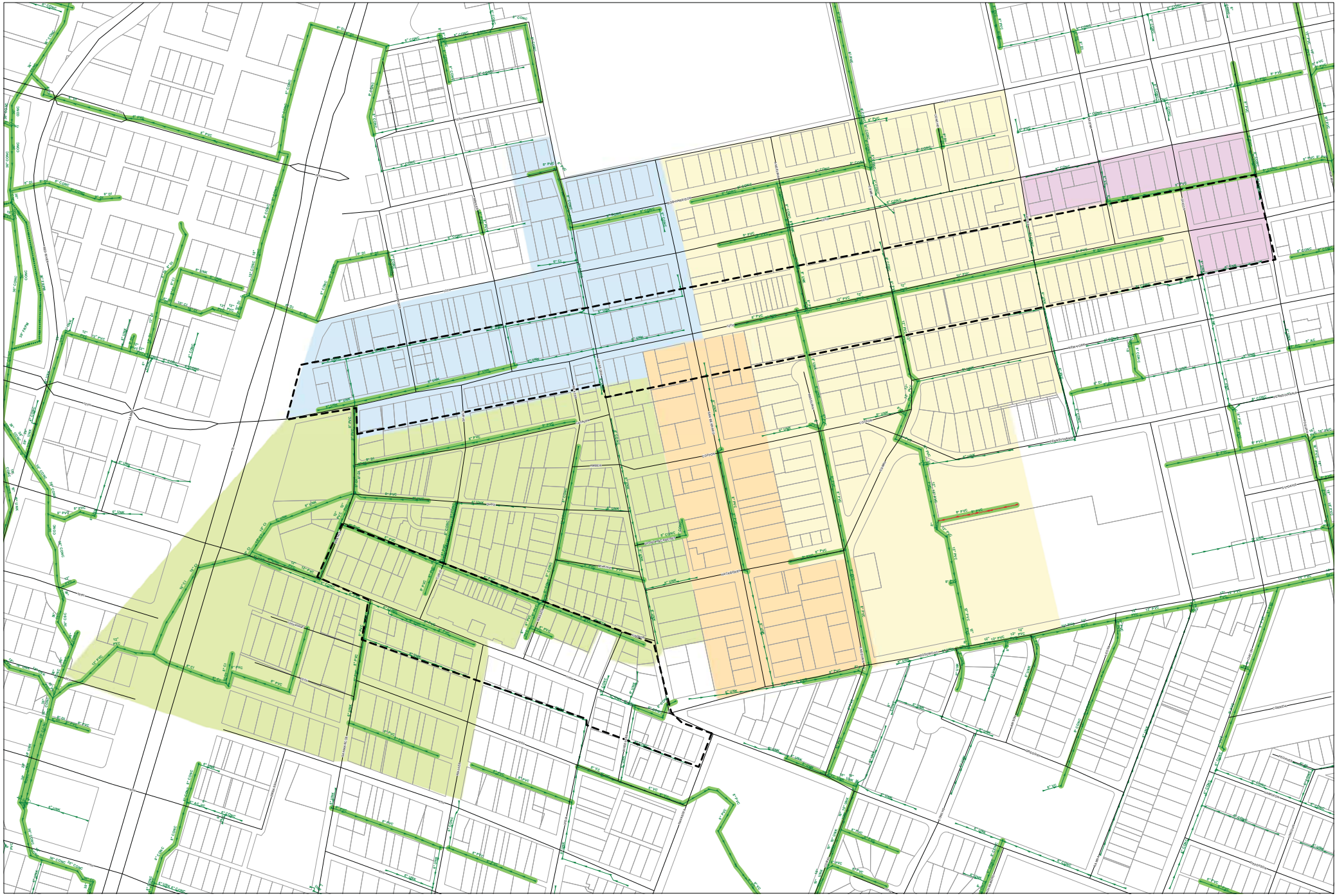

Exhibit 3

In Service Gravity Main
Proposed Gravity Main
In Service Gravity Main - Other
8" or Larger Wastewater Line
Redevelopment Area Boundary
WW Drainage Area 1
WW Drainage Area 2
WW Drainage Area 3
WW Drainage Area 4
WW Drainage Area 5

N

0 160 320
Feet

City of Austin
Austin Water Utility
Plotted: 11/3/2011

12th Street
Wastewater Mains
Produced by GIS Services

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City of Austin
Austin Water Utility
Water Resources Management Program
Systems Planning Division
Systems Planning and Analysis Branch
Technical Memorandum

Report Type: Capacity Analysis & Assessment of Existing Infrastructure

Location: East 12th Street from I-35 to Poquito Street

Date: May 24, 2010

Water Pressure Zone(s): Central

Wastewater Treatment: South Austin Regional WWTP

Wastewater Basin(s): Waller Lower
Town Lake
Boggy Lower

Introduction

The primary objective of the Austin Water Utility (AWU) Systems Planning Division is to provide analysis of the water distribution and wastewater collection systems to insure adequate infrastructure capacities are available, and to identify areas for system improvement. This objective is achieved by performing hydraulic model analyses to identify system deficiencies, evaluating proposals for new facilities, long-range facility planning and area studies, evaluating strategies for water and wastewater system operations, analyzing land use assumptions to forecast demand by small areas, and integrating Geographic Information Systems (GIS) tools into the planning process.

Additionally, we have coordinated this planning work with the AWU Utility Development Services (UDS) Division, which addresses customer needs when water and wastewater service is being requested. The UDS Division conducts Subdivision Reviews, Site Plan Reviews, and Zoning Reviews regarding water and wastewater service. The UDS Division serves the City of Austin by determining optimum solutions for the water and wastewater systems of its existing and future developments. Possible systems include traditional water and wastewater systems, Alternative Wastewater Collection Systems, Decentralized Wastewater Systems, and On-Site Sewage Facilities for private property and include both residential and commercial applications.

As requested, the AWU has analyzed the water and wastewater infrastructure along East 12th Street from I-35 to Poquito Street. Furthermore, specific development plans will be reviewed as proposed to determine if system improvements are needed to provide required levels of service. This is done through the Service Extension Request (SER) process. In the SER process the basic concept of the "Living Unit Equivalent" (LUE), which is the amount of flow from a typical single-family residence, is used as a measure for comparing water demand and wastewater load generation among the various types of land uses. In addition to LUEs, fire flow demands are also used to determine appropriate water main sizing.

Austin Water Utility's Capital Improvements Program includes a component aimed at replacing aging pipes that are found to be reaching the end of their useful life. As would be expected, pipes in the central city that are part of the original system are given a high priority.

The results of the water and wastewater analyses are as follows:

Water Distribution System in 12th Street – I-35 to Poquito Street

There is an existing 12-inch water main along 12th Street, which is interconnected to the water distribution system at all cross streets, including two 24-inch transmission mains (one at Navasota Street and one at Airport Boulevard).

The 12-inch water main along 12th Street from San Bernard Street to Airport Boulevard is a ductile iron main that was installed around 1999. All other mains in the area appear to be older cast iron mains.

The existing 12-inch main along 12th Street is anticipated to meet current and future development demands, including fire flows up to approximately 3500 gpm. Some of the mains along the cross-streets that are 6-inch or smaller may require replacement if a future development requires a significant demand along those mains, rather than the 12-inch main along 12th Street. A full assessment of potential water main improvements required for a future development would be completed during the SER process previously described.

Wastewater Capacity Assessment Update – 12th Street – I35 to Poquito Street

West of San Bernard

12th Street from I35 to San Bernard Street has the original 8-inch and 6-inch pipes in it. These pipes serve a comparatively small 7 block area that extends north to 14th Street. This represents an LUE loading in the 70 to 100 LUE range. Pipes this size in good condition can handle 2 to 3 times this amount of loading, so in terms of the existing pipes in 12th Street there is some capacity available for new development.

A typical one-block, 4-story mixed use development can range from 75 to 150 LUEs. Thus, the existing lines in 12th Street can accommodate one or possibly two such developments, depending on the number of LUEs and the point of connection, before line upsizing would be required.

In recent condition assessment work, the existing old 12th Street and Branch Street lines were found to be in generally good condition. Some point repair needs were identified and one 260-ft segment was identified for possible replacement related to observation of pipe cracking.

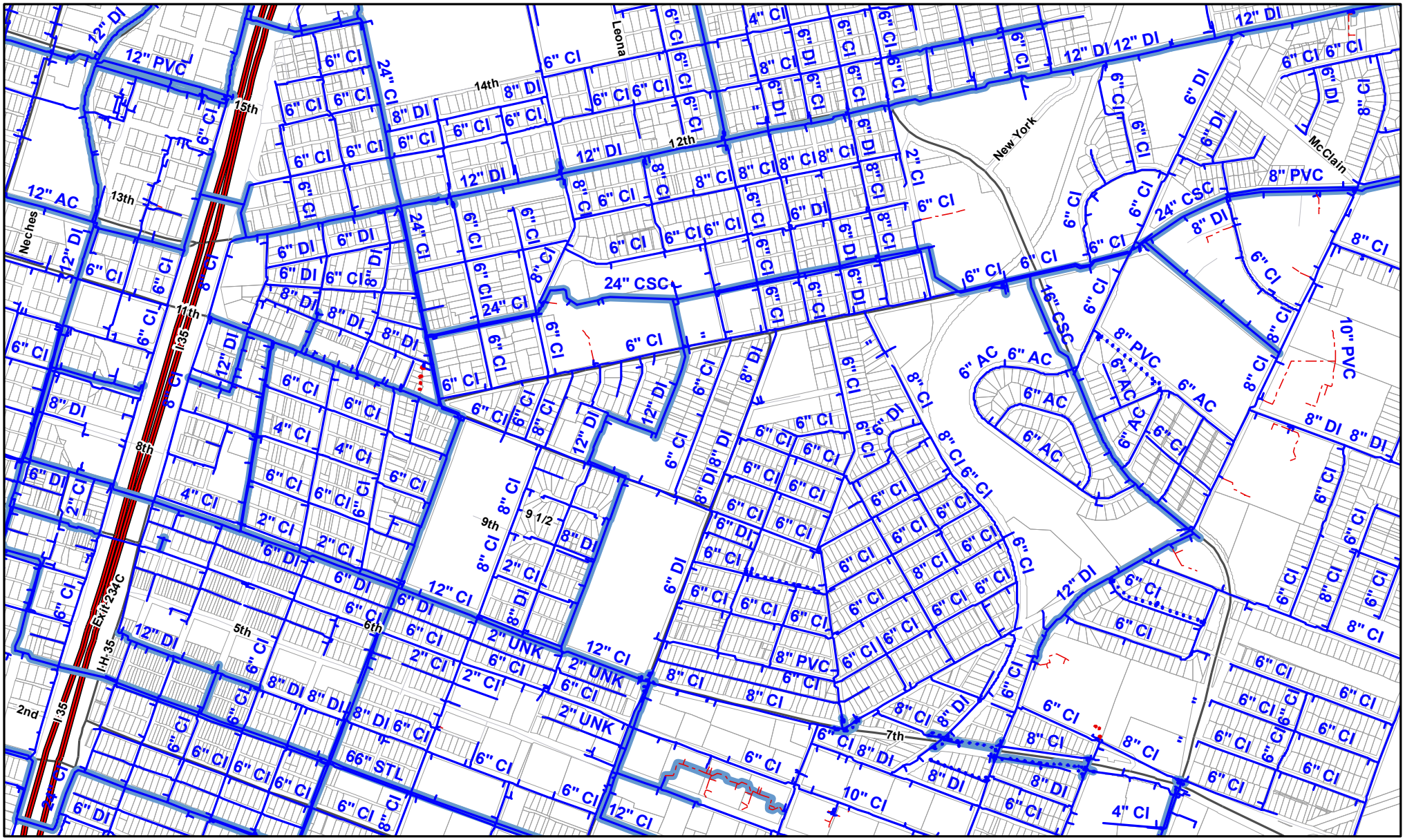
The 12th Street pipes flow to an old high capacity (high slope) 8-inch line in Branch Street and then to new 12-inch PVC pipes in Branch Street and 11th Street. These lines have capacity for high-density, multi-story development. These lines flow to the 10-inch line that crosses under I35 and then joins with the line from the new Robertson Hill development at a connection with the new 12-inch PVC line that ties these areas into the 36-inch Waller Creek interceptor. The 10-inch line was found to be in good condition when inspected in 2006. These 10-inch and 12-inch lines serve the comparatively small area west of San Bernard Street and have capacity available for some multi-story development. Extensive multi-story development in this I35 corridor area would require evaluation of actual flow conditions in these lines with respect to proposed development density in order to determine if more capacity were needed.

Between San Bernard and Chicon

This 12th Street pipe system is recently installed 8-inch and 12-inch PVC pipe which has capacity available for new development. Most of the downstream system has been upgraded recently, making capacity available for new development in a large area.

Poquito Intersection

At the intersection of 12th Street and Poquito Street there are no wastewater lines in the streets. Service is provided via the lines in the alleys to the north and south. Three of the four alleys still have the old original small lines in them, so any large development would have to look at whether new pipes are needed at the particular one-block location from both a capacity and a condition standpoint. In the next block to the east, at Alamo Street, the downstream system has been upgraded to a 15-inch PVC line, making capacity available for new development in a large area.



Water Mains

Proposed Water Mains

Water Mains - Other

12" and Larger Water Line

N

0 500 1,000

Feet

City of Austin

Austin Water Utility

May 2009

12th Street Water Mains

Produced by GIS Services

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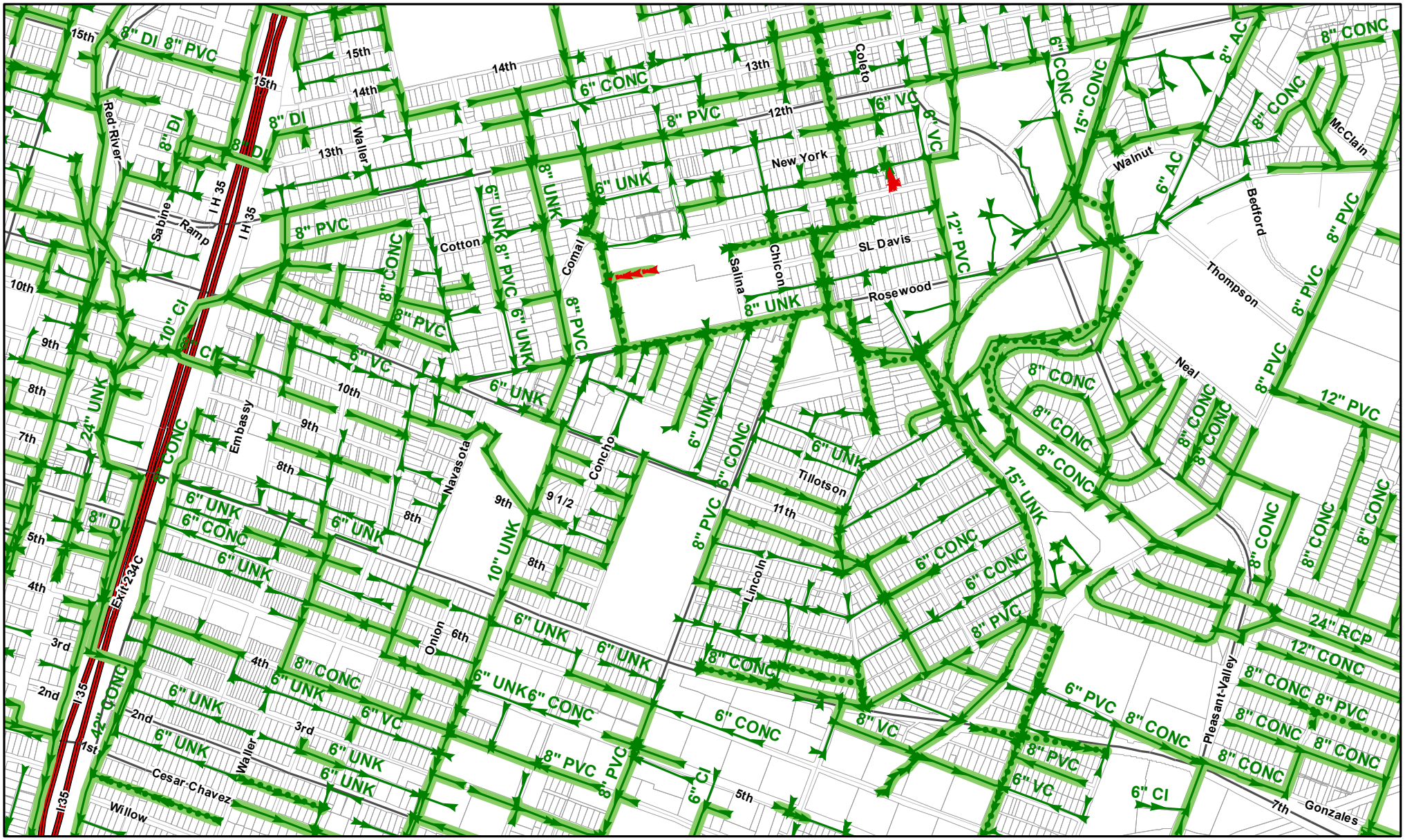

In Service Gravity Main

Proposed Gravity Main

In Service Gravity Main - Other

8" or Larger Wastewater Line

N

0 500 1,000

Feet

City of Austin
Austin Water Utility
May 2009

12th Street Wastewater Mains

Produced by GIS Services

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FINAL TECHNICAL MEMORANDUM

GOVALLE 4

July 13, 2004

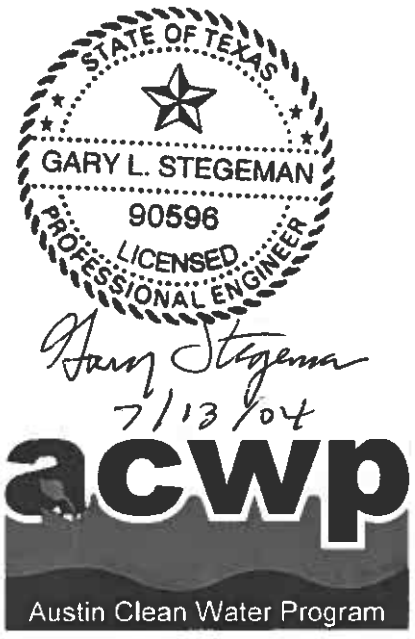


Exhibit 5

- ST's main line rehabilitation and replacement cost estimates did not include rehabilitation or replacement of adjoining manholes.
- ST's unit costs did not include an allowance for the rehabilitation of the creek; however, only approximately 0.4% of the entire system (approximately 1,900 ft.) recommended for rehabilitation and replacement by ST were located in or adjacent to creek beds.

The ACWP has prepared a modified list of replacement and rehabilitation projects, identified in this technical memorandum, that should be implemented in order to eliminate sources of major inflow and infiltration (I/I) and SSO's in the Govalle 4 sub-basin. The estimated total project cost to implement ACWP's recommendations is $8,418,790, which includes the estimated construction cost of the proposed improvements, a 10% contingency, and a 15% allowance for engineering, legal, and administrative services.

The ACWP cost estimate differs from ST's estimate due to increases in ACWP rehabilitation unit cost estimates, the inclusion of manhole replacement/rehabilitation costs along lines scheduled for replacement or rehabilitation, and additional sewer line replacements recommended by the Utility based on recent SSO investigations. In addition, the ACWP obtained from the utility a list of property owner Service Requests that indicated potential problems along smaller diameter lines. The ACWP requested that additional Closed Circuit Television (CCTV) footage be conducted inside and immediately adjacent to the original sub-basin boundaries to determine the types and severity of defects in the local system. As a result, the ACWP recommended that an additional 26,622 feet of sewer lines be replaced or rehabilitated for a total of 38,080 feet, including the replacement of adjoining manholes along these line segments, which resulted in large increases to the overall construction cost estimate.

BACKGROUND

The Environmental Protection Agency (EPA) issued an Administrative Order (AO) to the City on April 29, 1999. The EPA found that the City's wastewater collection facilities were not in compliance with the City's NPDES Permits or the Clean Water Act. The AO requires that the City take corrective action to improve the collection system to avoid future Sewer System Overflows (SSO's) in accordance with a prescribed schedule.

The City contracted with several consulting firms to perform Sewer System Evaluation Surveys (SSES) for the purpose of identifying problem areas within the sewer system and to recommend improvements to the system. The City directed each firm to use a priority system in order to determine which of the recommended improvements were the most imperative. The following defines each priority:

- ***Priority 1*** *- SSO Elimination, including hydraulic deficiencies and structural defects that result in overflows.*
- ***Priority 2*** *- Rehabilitation of assets with moderate to severe structural defects and I/I deficiencies not attributable to SSO's.*
- ***Priority 3*** *- Scheduled Preventive Maintenance, including the evaluation of all remaining pipe segments on a phased schedule.*

- ***Priority 4*** *- Rehabilitation of infrastructure identified in Priority 3.*

This technical memorandum covers the Govalle 4 sub-basin, which is located in the Central/East area of the Govalle Interceptor Basin. The sub-basin is bounded by Speedway, Lavaca, and I-35 to the West, East 44th and Manor Road to the North, Shady Lane and Airport Boulevard to the East, and Town Lake to the South (See Figure 1).

Approximately 486,339 linear feet (or 92 miles) of sewer pipeline ranging from 6 to 48-inches in diameter serves the sub-basin. The majority of the system's pipe is 6- and 8-inch diameter and the drainage area of the Govalle 4 sub-basin is approximately 3,031 acres. In addition, the Govalle 4 system utilizes two lift stations, the Canterbury LS and the Gonzales LS.

As of the date of this Memorandum, the City had identified two hundred eighty (280) individual dry weather and sixty-three (63) repeat SSO's reported within the Govalle 4 sub-basin since 1995 as shown in Figure 2.

SUMMARY OF REPORTS PROVIDED BY ST

ST studied the wastewater collection system and recommended improvements intended to eliminate SSO's in the Govalle 4 sub-basin. ST's Draft SSES Report, dated January 2003 was reviewed and analyzed by the ACWP. ST's study consisted of the following sections:

Dry/Wet Weather F low Monitoring

Flow was monitored with twenty-seven (27) flow monitors stationed throughout the sub-basin. In addition, six of the City's permanent flow monitors were used to augment the data collected from the temporary network. Flow monitoring occurred November 5, 2001 through January 2002.

Manhole Inspection

ST physically inspected 1,884 manholes within the collection system. ST did not classify any of the defects found as Priority 1, and consequently did not recommend rehabilitation to any of the manholes.

Smoke Testing

Smoke testing was performed on 486,339 linear feet of sewer lines to identify sources of I/I entering the sewer collection system. Typical defects encountered during the smoke testing included broken cleanouts and caps, and lateral leaks.

APPENDIX A

ST's Priority 1 Sewer Line and Private Lateral Rehabilitation Recommendations

ST's Priority 1 Sewer Line Rehabilitation/Parallel Recommendations

Pipe Segment	Size	Length	Rehabilitation Method	Cost Estimate
J23-455-J23-496	24	334	Pipe Burst	$66,800
J23-456-J23-455	24	40	Pipe Burst	$8,000
J24-313-J24-312	15	117	CIPP	$17,020
J24-536-J24-293	8	242	Fold N Form	$62,140
J24-541-J24-307	6	128	Fold N Form	$15,120
J24-542-J24-541	6	1	Point Repair	$3,190
J24-654-J24-T859	12	250	Pipe Burst	$26,800
J25-237-J25-236	6	246	Fold N Form	$39,840
K21-193-K21-192	15	193.6	Line Upsize	$28,072
K21-214-K21-281	6	1	Point Repair	$1,800
K21-216-K21-284	6	369	Fold N Form	$77,220
K21-281-K21-193	15	508.5	Line Upsize	$73,733
K21-314-K21-313	15	200.1	Line Upsize	$28,014
K21-375-K21-T540	6	215	Fold N Form	$35,800
K21-439-K21-281	15	13.1	Line Upsize	$1,900
K22-165-K22-365	12	98.4	Line Upsize	$11,808
K22-222-K22-497	10	387.1	Line Upsize	$50,323
K22-223-K22-222	10	65.6	Line Upsize	$8,528
K22-224-K22-223	10	75.5	Line Upsize	$9,815
K22-225-K22-224	10	78.7	Line Upsize	$10,231
K22-226-K22-225	10	101.7	Line Upsize	$13,221
K22-227-K22-226	10	108.3	Line Upsize	$14,079
K22-256A-K22-256	10	223.1	Line Upsize	$29,003
K22-256-K22-227	10	236.2	Line Upsize	$30,706
K22-257-K22-256A	10	377.3	Line Upsize	$49,049
K22-258-K22-257	8	311.7	Line Upsize	$37,404
K22-265-K22-264	8	249.3	Line Upsize	$29,916

Pipe Segment	Size	Length	Rehabilitation Method	Cost Estimate
K22-365-K22-269	8	236.2	Line Upsize	$28,344
K22-393-K22-403	12	194	Pipe Burst	$21,536
K22-497-K22-645	10	19.7	Line Upsize	$2,561
K22-500-K22-649	15	187	Line Upsize	$27,115
K22-644-K22-643	15	131.2	Line Upsize	$19,024
K22-645-K22-644	18	446.2	Line Upsize	$64,699
K22-646-K22-645	18	59.1	Line Upsize	$8,570
K22-647-K22-723	18	269	Line Upsize	$39,005
K22-648-K22-647	18	180.4	Line Upsize	$26,158
K22-649-K22-648	15	170.6	Line Upsize	$24,737
K22-652-K22-677	12	226.4	Line Upsize	$31,695
K22-653-K22-652	12	377.3	Line Upsize	$52,822
K22-677-K22-651	12	150.9	Line Upsize	$21,126
K22-718-K22-653	12	177.2	Line Upsize	$24,808
K22-723-K22-646	18	75.5	Line Upsize	$10,948
K23-254-K23-529	8	9.8	Line Upsize	$1,274
K23-2-K23-643	8	173.9	Line Upsize	$24,346
K23-316-K23-536	8	49.2	Line Upsize	$6,888
K23-3-K23-2	8	170.6	Line Upsize	$23,884
K23-454-K23-468	8	173.9	Line Upsize	$24,346
K23-466-K23-480	12	59.1	Line Upsize	$8,274
K23-468-K23-467	8	190.3	Line Upsize	$26,642
K23-477-K22-718	12	341.2	Line Upsize	$47,768
K23-478-K23-524	12	187	Line Upsize	$26,180
K23-479-K23-T705	12	13.1	Line Upsize	$1,834
K23-480-K23-479	12	364.2	Line Upsize	$50,988
K23-481-K23-466	12	275.6	Line Upsize	$38,584
K23-4-K23-3	8	137.8	Line Upsize	$19,292
K23-524-K23-477	12	49.2	Line Upsize	$6,888

Pipe Segment	Size	Length	Rehabilitation Method	Cost Estimate
K23-529-K23-8	8	429.8	Line Upsize	$55,874
K23-533-K23-5	8	75.5	Line Upsize	$10,193
K23-536-K23-454	8	118.1	Line Upsize	$16,534
K23-564-K23-95	6	249.3	Line Upsize	$29,916
K23-5-K23-4	8	210	Line Upsize	$28,350
K23-603-K23-606	8	98.4	Line Upsize	$12,792
K23-609-K23-245	8	16.4	Line Upsize	$2,132
K23-643-K23-696	8	75.5	Line Upsize	$10,570
K23-696-K23-316	8	55.8	Line Upsize	$7,810
K23-6-K23-533	8	52.5	Line Upsize	$7,088
K23-75-K23-603	8	200.1	Line Upsize	$26,013
K23-7-K23-6	8	131.2	Line Upsize	$17,712
K23-8-K23-7	8	337.9	Line Upsize	$45,617
K23-T705-K23-478	12	75.5	Line Upsize	$10,570
L23-399-L23-404	8	384	Line Upsize	$49,920
			Sub-Total	$1,820,959

REPLACE 382 LF EXISTING
15" WITH 15" LINE
MH J23-456 TO J23-496

REPLACE 2574 LF EXISTING
6" & 8" WITH 12" LINE
MH K23-258 TO K23-8

CITY OF
WASTEW
IMPROVE

REPLACE 984 LF EXISTING
24" WITH 24" LINE
MH J23-496 TO J23-364

REPL
8" W
MH K

REPLACE 875 LF EXISTING
6" WITH 8" LINE
MH K23-443 TO K23-20

REPLACE 624 LF
EXISTING 6" WITH 8"
MH K23-19 TO K23-35

REPLACE 538 LF EXISTING
12" WITH 12" LINE
MH K22-161 TO K22-159

REPLACE 252 LF
EXISTING 6" WITH 8" LINE
MH K22-285 TO K22-159

REPLACE 1887 LF
EXISTING 8" WITH 12" LINE
MH K22-932 TO K22-258

REPLACE 515 LF
EXISTING 6" WITH 8" LINE
MH K22-181 TO K22-180

REPLACE 197 LF
EXISTING 6" WITH 8" LINE
MH K22-228 TO K22-227

OVE
RIS

REPLACE 215 LF
EXISTING 15" WITH 15" LINE
MH J22-595 TO J22-592

REPLACE 681 LF
EXISTING 6" WITH 8" LINE
MH K22-271 TO K22-256

REPLACE 548 LF
EXISTING 6" WITH 8" LINE
MH K22-178 TO K22-157

E 146 LF
WITH CIPP
J22-591

REPLACE 518 LF
EXISTING 6" WITH 8" LINE
MH K22-236 TO K22-223

REPLACE 742 LF
EXISTING 6" WITH 8" LINE
MH K22-147 TO K22-81

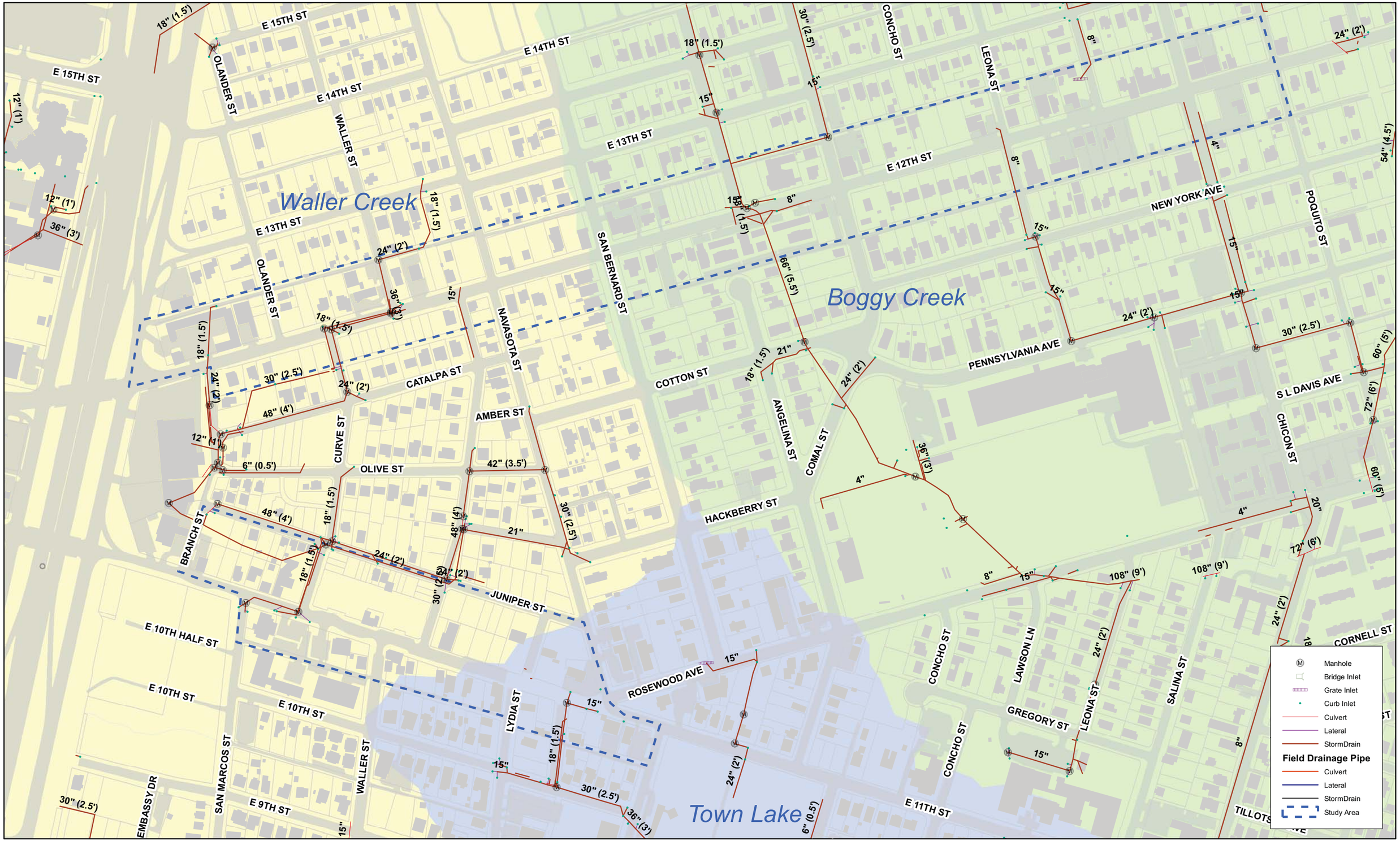
REPLACE 494 LF
EXISTING 6" WITH 8" LINE
MH K22-79 TO K22-383

REPLACE 338 LF
EXISTING 6" WITH 8" LINE
MH K21-81 TO K21-80

REPLACE 890 LF
EXISTING 6" WITH 8" LINE
MH K22-73 TO K22-60

8" LINE
L-204

REMOVE BLO
AND RETELE



Storm sewer data was compiled from Watershed Protection Dept.,COA.
Data was compiled from existing data or from field.

STORM SEWER MAP

East 11th and 12th Street Redevelopment Strategy Project

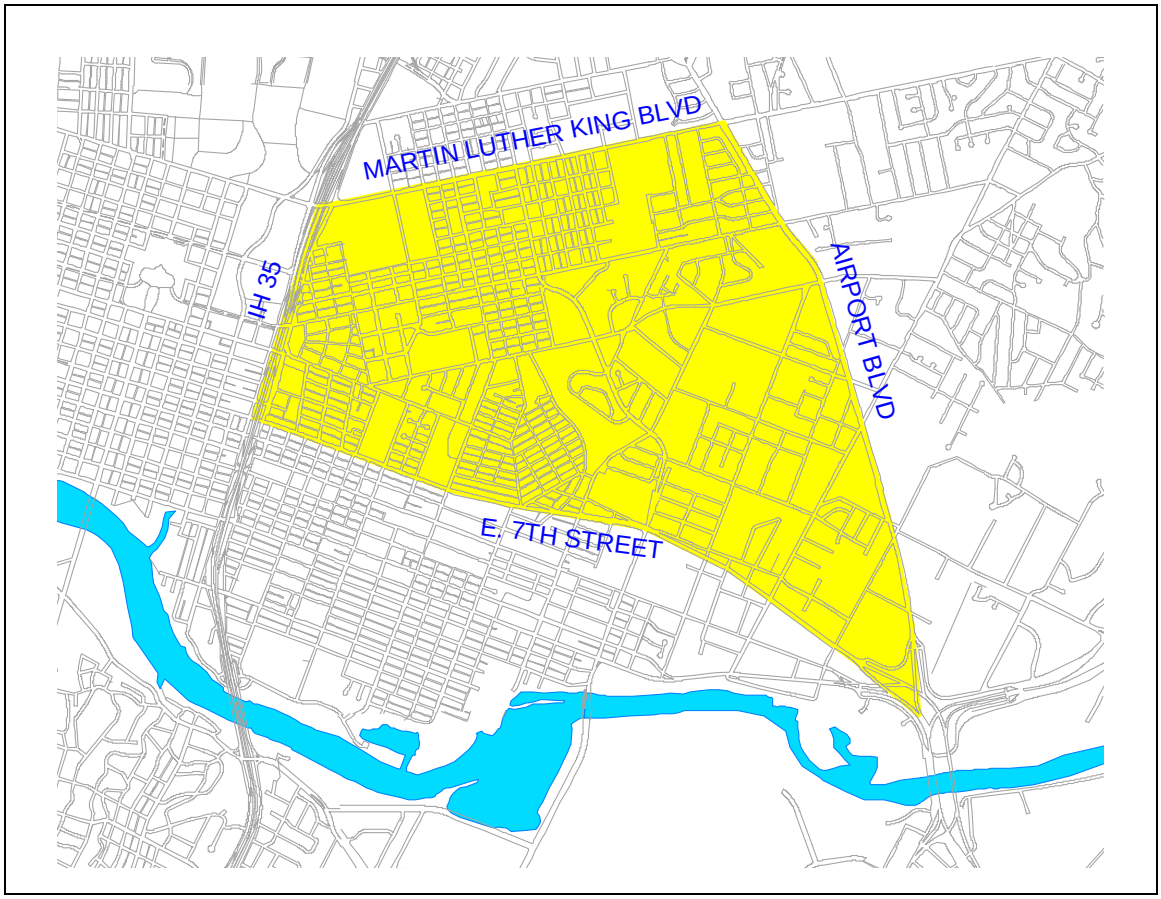
Prepared by Urban Design Group for Economic and Planning Systems

NOVEMBER 10, 2011

0 150 300 450 Feet

Exhibit 6

REPORT TO CITY COUNCIL: CENTRAL EAST AUSTIN STORM DRAIN STUDY



City of Austin
Watershed Protection and Development Review Department
Watershed Engineering Division

June 7, 2001

Exhibit 7

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ACKNOWLEDGEMENTS

This report was prepared for the Austin City Council per Resolution No. 010215-51 on behalf of Jesus Garza, City Manager. This report was prepared by the Watershed Engineering Division of the City of Austin's Watershed Protection and Development Review Department under the general supervision of Michael J. Heitz, AIA, Department Director, Joe Pantalion, P.E., Assistant Director, and George E. Oswald, P.E., Division Manager. The authors wish to thank all City staff members, Managers, and Directors for their valuable contribution to the preparation of this report.

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Prepared for

The Austin City Council

EXECUTIVE SUMMARY

Central East Austin area is defined to be the area bounded by IH35, Martin Luther King Jr. Boulevard, Airport Boulevard, and East 7th street. The study area crosses portions of five watersheds - Boggy Creek, Town Lake, Waller Creek, Colorado River, and Tannehill. Boggy Creek comprises approximately 78% of the study area.

Localized flooding typically results from outdated storm drain systems and occurs outside of the 100-year flood plain. Curb inlets and storm drain piping networks are most often used for mitigating localized flooding in highly urbanized areas. The Watershed Protection and Development Review Department's master plan has identified several levels of severity for localized flooding citywide. The severity levels are very high, high, moderate, low and very low. The severity levels were developed from customer complaint records using a Geographical Information System as the information management/analysis tool. Severity levels were assigned based on the density of complaint records. The localized flood levels of severity range from high to very low in Central East Austin.

There are 132 public storm drains systems in Central East Austin. The oldest existing storm drains is about 70 years old. The average age of the 132 existing systems is approximately 40 years. The pipe structural conditions and hydraulic flow capacity are generally good throughout the study area. It is not anticipated that an aggressive replacement of the existing storm drains is necessary at this time.

The hydraulic flow capacity of the storm drain system in Central East Austin can be improved in several locations (see Table 4.1 for specific locations). There are Thirty-three (33) systems that are recommended for upgrades to existing systems or as new systems to provide the needed drainage capacity. The estimated total cost for the 33 storm drainage system upgrades is approximately $65,000,000.

The major findings of this study are the following:

- Average age of all existing storm drain systems is about 40 years
- Existing pipe conditions are generally good
- Thirty-three (33) storm drain systems were identified for upgrades in study area
- Priority in study area is high to very low (with the majority being moderate to very low) based upon Master Plan findings
- Priority order of the 33 storm drain system upgrades should proceed according to severity within the study area and coordinated with other city departments' capital improvements
- Scheduled upgrades should be coordinated with other city capital improvement projects and would generally require 3 years for implementation after funding becomes available
- Total estimated cost is about $65 million dollars (year 2001 estimate)

Historically, the Watershed Protection and Development Review Department has funded Capital Improvement Projects through both general obligation bonds and the drainage fee revenue. Currently, there are no funds available for the recommended upgrades identified in this study. Additional funds may be obtained either through a future bond election or by an increase in the drainage utility fee, or some combination of both.

Once funding is secured, it is recommended that the priority order of implementing storm drain system upgrades be based on two factors: 1) mitigating localized flooding in the most severe areas, and 2) coordinating with other city infrastructure departments' capital improvement projects.

1.0 INTRODUCTION

1.1 History

Boggy Creek is the primary drainage system in the Central East Austin study area. The United State Army Corps of Engineers completed major constructed channel improvements for lower Boggy Creek in the 1980's. As a result of the channel improvements, 1,500 homes were protected from the 100-year flood plain.

The secondary drainage system (localized storm drainage system) is composed of storm drainpipes, curb inlets, manholes, minor channels, roadside ditches, and culverts. "Localized flooding" is the term given to areas where flooding occurs due to inadequacies in the secondary drainage system, not necessarily as a result of creek flooding. Outdated storm drains applies to storm drain systems designed and/or installed under drainage criteria in effect before January 1977. Since 1977, all storm drain systems are required to safely manage the 100-year storm event. When the secondary drainage system is outdated, localized flooding may occur. Many storm drains in the downtown and urban watershed area are outdated.

Information is being gathered from two sources to help analyze localized flooding. The two sources are on-going drainage complaints from customers, which began to be collected in 1988 and the 1996 flood survey. The complaints are geographically located using a Geographical Information System (GIS) program that creates dots on a map per each complaint. The GIS program can also establish the concentration areas of customer complaints that help to identify possible areas for infrastructure improvements. The concentration areas were adjusted to five levels, which rate as either very high, high, moderate, low or very low.

Preliminary recommendations for storm drain upgrades have been developed for most areas in the urban watersheds with special emphasis in the very high and high critical localized flood areas. More detailed analysis and specific designs will occur, as funding

becomes available for project development. Implementing capital improvement projects can satisfy most customer complaints relating to localized flooding at a lower cost than buyouts.

1.2 Study Boundaries

This report concentrates an area of study identified as Central East Austin. The study boundaries are Interstate 35, Martin Luther King Jr. Boulevard, Airport Boulevard, and East 7th Street. Central East Austin fall within the Waller Creek, Boggy Creek, Town Lake watersheds and very small portions of Colorado River and Tannehill. Figure 1 illustrates the various watersheds within the study area. The largest portion, 78% of the study area, lies in the Boggy Creek watershed.

Figure 1.1

Watershed Boundaries

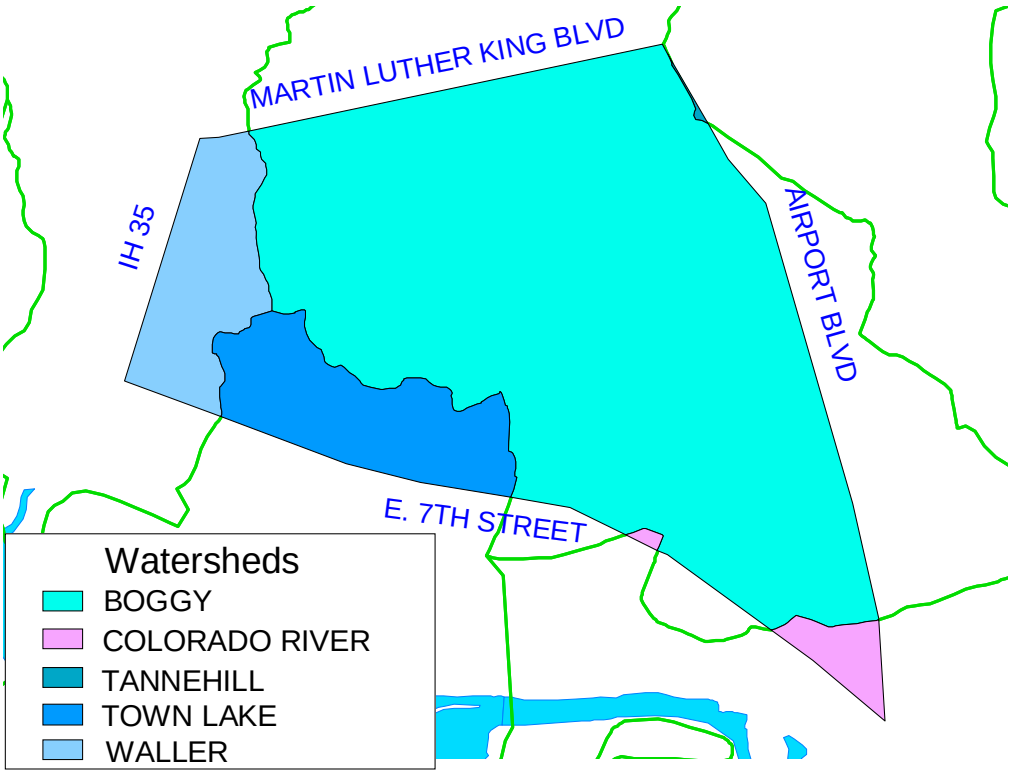


Table 1.1 lists the watersheds, respective acreage, and percentage of study area.

Table 1.1

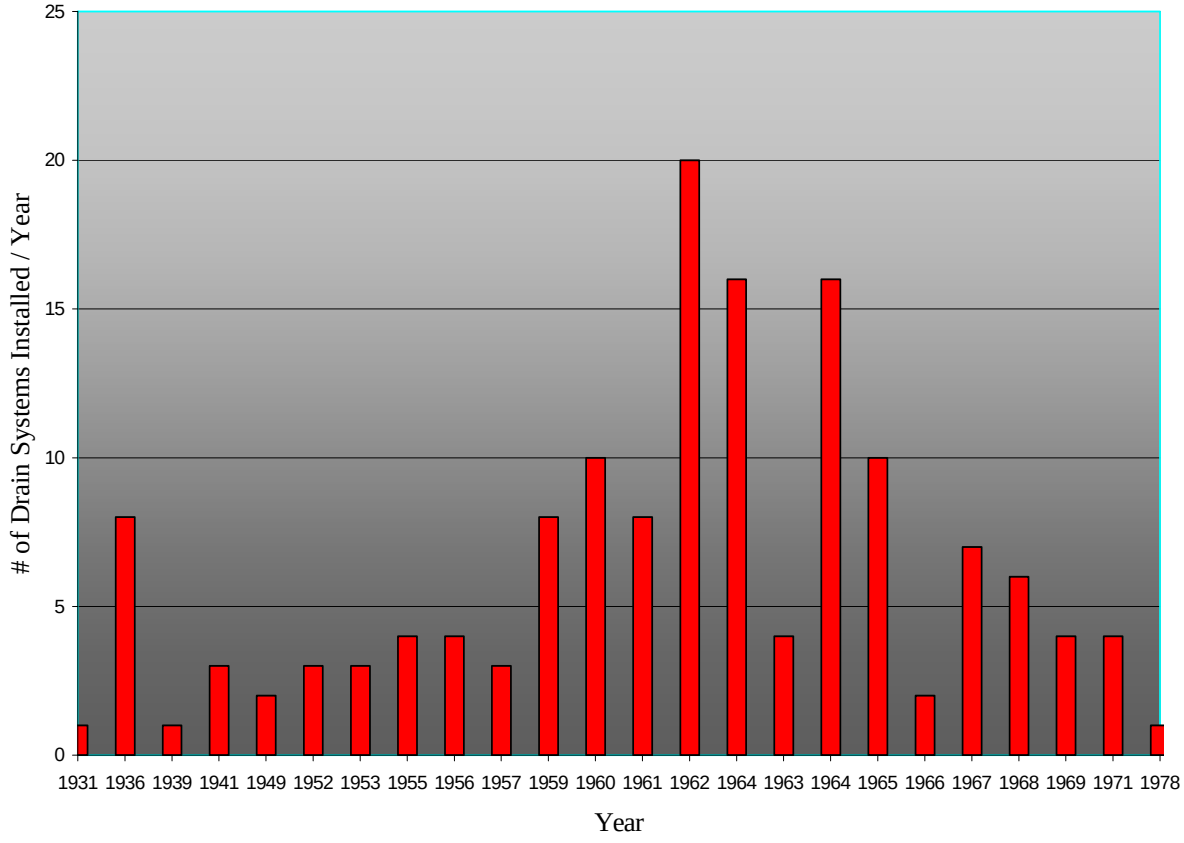
Watersheds Area

Watersheds	Acres	% of Study Area
Boggy Creek	1494	78%
Town Lake	207	11%
Waller Creek	169	9%
Colorado River	42	2%
Tannehill	1	0%
	1913	100%

2.0 STORM DRAIN AGE

City records indicate that approximately 131 storm drainage systems in the study area were installed as early as 1931. The average age of these systems is 40 years old. Un-reinforced concrete pipes were predominantly utilized up to around 1967. The normal life expectancy for this pipe material is about 40 years but may be longer in favorable conditions. In Central East Austin, 44% of the existing storm drains were placed into service by 1962. By 2007, the number of 40-year old systems will rise to 84%. As is noted in the next section, the existing pipe conditions do not indicate any concern for an aggressive replacement schedule at this time. A more pressing issue is the lack of some existing storm drains to carry the anticipated storm flows according to current criteria. Based upon preliminary engineering findings in this report, there are 33-storm drain system recommended for upgrades. Please see Section III Adequacy in this report for further details.

Figure 2.1
Age of Drainage Systems in Central East Austin



3.0 STORM DRAIN CONDITION

Unlike sanitary sewers, state law does not require a regular visual inspection for storm drains. The Water and Wastewater Department has a television inspection program established to visually inspect sanitary sewer lines twice a year. The Watershed Protection and Development Review Department does not have a television inspection program and must rely on the Water and Wastewater Department for assistance with specific requests. It would be cost prohibitive to visually inspect all storm drains in the city or even in this study area.

In lieu of television inspections, a 40-year veteran of the WPD field operations staff was interviewed. According to the field operations staff member, most storm drains in the study area are generally in fair condition. Field operation has experienced more failures due to age west of the Interstate. Part of this is due to the fact that much of central east Austin was un-paved until the 1960's. According to WPD field operation's staff, pipe repairs has been minimal in the study area. It is recommended that pipe conditions continue to be monitored through field operation work requests. If the frequency of repair or replacement begins to increase, a more aggressive plan may need to be implemented.

4.0 STORM DRAIN ADEQUACY

Outdated storm drains means storm drains designed and/or installed under drainage criteria in effect before January 1977. When the secondary drainage system is outdated, localized flooding may occur. Many storm drains in the downtown and urban watershed areas are outdated. As has been pointed out, 84% of the existing storm drains in the study area will be 40 years old or older by 2007. Generally, outdated storm drains have approximately 30-50% of the capacity specified by current city design criteria. This means some of the existing storm drain trunk lines may need to be increased by several pipe sizes to meet current drainage design criteria. A recent example for a downtown line along Guadalupe Street required an existing 30-inch diameter trunk line to be replaced by a 48-inch diameter line.

Preliminary engineering analysis included determining the amount of excess runoff (hydrology) and the pipe flow capacity (hydraulics).

Hydrology

Drainage areas, impervious cover, slope, travel time (time of concentration), design storm intensities. The Rational Method was used to determine runoff flow rates. This method is described in the City's Drainage Criteria Manual and is widely accepted.

Hydraulics

Using a computer model called Hydraflow, input values for pipe slopes, pipe material, pipe sizes, curb inlets geometry, manhole sizes provided the pipe flow capacity of individual storm drain systems.

New and replacement storm drains were designed to meet current drainage criteria. Table 2 summarizes the number of storm drain upgrades for each watershed in the study area.

Table 4.1
Drainage System Upgrade Locations and Cost Estimates

System ID	Location	Citywide Master Plan Priority	Total Cost Estimate
Boggy Creek			
B1	Airport Blvd @ Goodwinn Ave	High	$92,707
B2	Thompson St (Tillery St to Springdale Rd)	Moderate	$4,626,835
B3	Tillery St @ Bengston St	Moderate	$92,707
B4	Tillery Street @ Oak Springs Rd	Moderate	$2,588,094
B5	Sol Wilson Ave (near Ridgeway Dr)	Moderate	$92,849
B6	East 16th Street @ Maples Ave	Moderate	$4,710,059
B7	East 12th St @ Railroad	Moderate	$357,509
B8	Miriam Ave @ East 14th St	Moderate	$865,761
B9	Alexander Ave & E 14th St	Moderate	$1,725,348
B10	Clifford Ave @ East 17th St	Moderate	$664,402
B11	Mansell Ave @ Glissman Rd	Low	$114,090
B12	7th Street @ Gunter Street	Low	$575,388
B13	Springdale Rd @ Creek	Low	$17,796
B14	Gunter St and Neal St	Low	$1,598,862
B15	East 7th Street (Calles to Pleasant Valley Rd)	Low	$658,416
B16	Govalle Ave @ Webberville Rd	Low	$930,695
B17	Webberville Rd (Pleasant Valley Rd to Neal St)	Low	$553,846
B18	Goodwinn @ Webberville Rd	Low	$1,071,532
B19	Pleasant Valley Rd North @ Zaragosa St	Low	$385,818
B20	Pleasnt Valley Rd @ Castro Rd	Low	$67,595
B21	Glen Oaks Dr and Walter St	Low	$704,504
B22	E. 14th St @ Maple Ave	Low	$2,719,980
B23	Shady Ln (Boggy Creek to Gonzales St)	Very Low	$787,834
B24	Poquito/Chicon St (Cornell St to E. 12th St)	Very Low	$3,682,820
B25	Chicon St @ Rosewood Ave	Very Low	$262,933
B26	Comal St (Rosewood Ave to E.14th St)	Very Low	$4,158,646
B27	Comal St (E. 13th to MLK)	Very Low	$3,591,427
B28	Rosewood Ave & Walnut Ave	Very Low	$380,703
B29	Oak Spring near Ridgeway Dr	Very Low	$118,104
B30	Chicon St (Tillotson Ave to Comell St)	Very Low	$394,400
	Subtotal Cost for Boggy Creek		$38,591,660
Town Lake			
T1	Comal St @ East 7th St	Low	$3,922,260
T2	Pedernales St (E. 7th St to Colorado River)	Low	$21,868,918
	Subtotal Cost for Town Lake		$25,791,178
Waller Creek			
W1	Juniper, Catalpa, E 12th Streets	Very Low	$660,743
	Total Improvement Cost		**$65,043,581**

Please see Section IV Recommendations for the priority order assignment of specific systems.

5.0 RECOMMENDATIONS

5.1 Priority of Upgrades

The Watershed Protection and Development Review Department has included localized flooding needs in it's master plan. Figure 5.1, Critical Localized Flood Areas identifies areas that vary between very high, high, moderate, low and very low across the City of Austin. These areas were obtained from two sources - customer flooding complaints since 1988 and the 1996 customer flood survey. Several truisms formulate the basis for the current critical localized flood areas. These truisms are:

1. Not everyone is aware of the threat of localized flooding in their area. In the most recent 25 years, only Shoal Creek experienced the "100-year" or 1% chance per year storm event.
2. Not everyone who has experienced localized flooding calls the city to complain. Either they choose not to complain or they do not know how to file a complaint through the drainage complaint hot line; 499-3366.
3. The Watershed Protection and Development Review Department is most aware of those localized flood prone areas where the department has record of a complaint. Specific study areas, such as this study, add to a more comprehensive understanding of all of the needs.

In the future it is anticipated that the entire drainage infrastructure will be sufficiently inventoried, such that computer modeling and analysis will further refine prioritization or critical areas. Of primary importance is the depth of inundation for a given storm event, say the 25-year, in order to rank the priorities for upgrades.

Figure 5.1
Critical Localized Flood Areas – Citywide

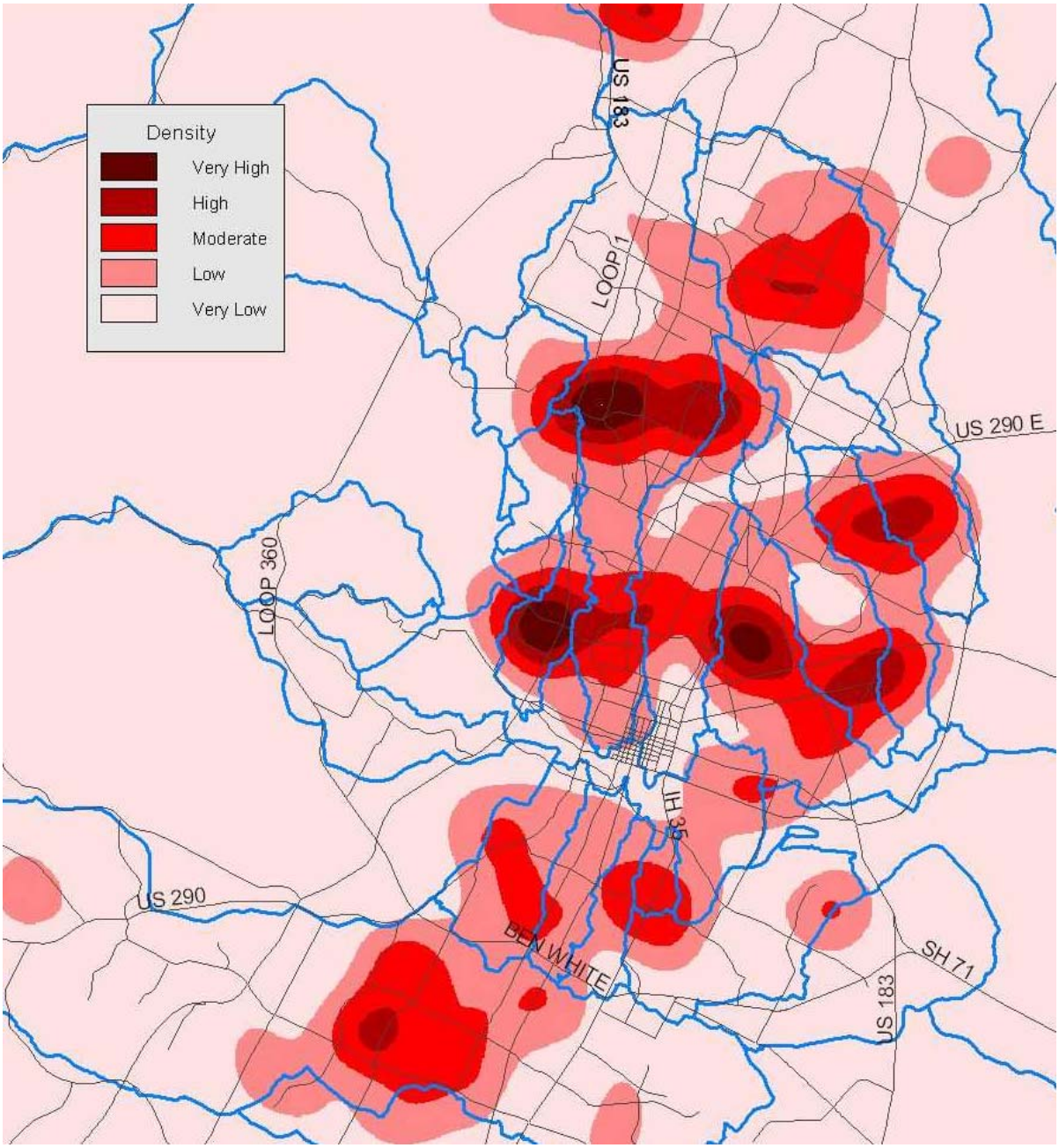


Figure 5.1 identifies the critical localized flood areas for the study area from the citywide master plan in more detail. Within the study area, the critical localized flood area categories vary between high to very low.

Figure 5.2

Critical Localized Flood Areas – Study Area

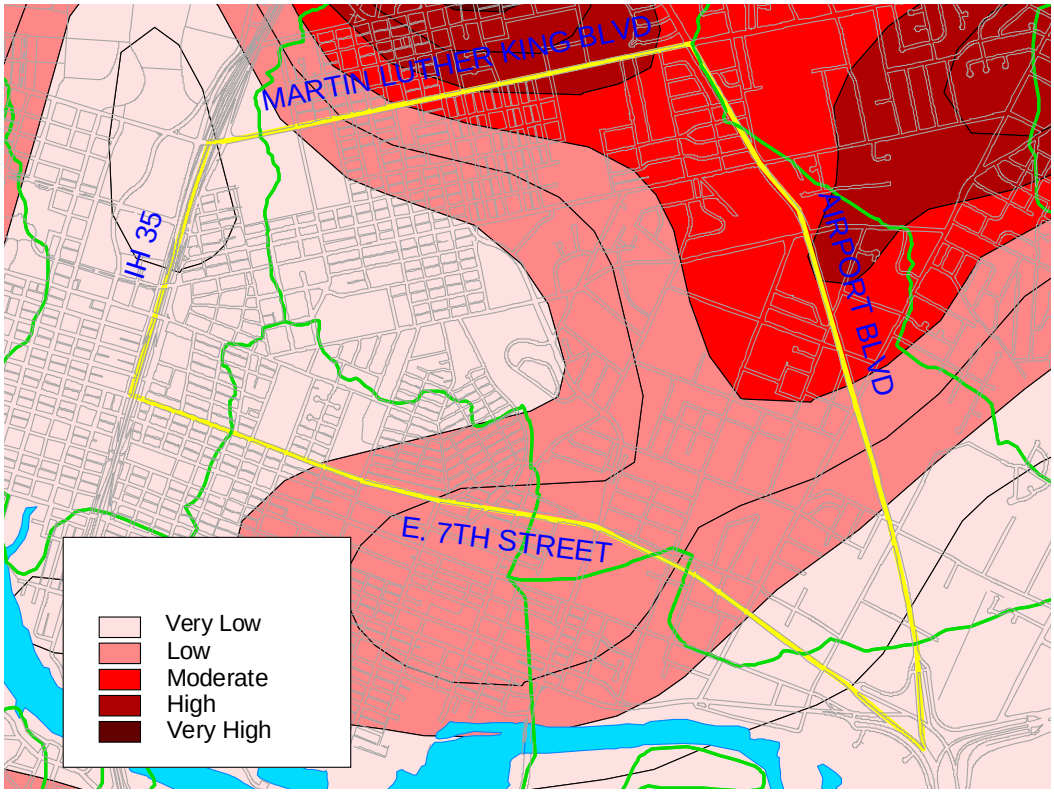


Table 5.1

Localized Flood Severity Based On Citywide Analysis

Boggy Creek	**High to Very Low**
Town Lake	**Low**
Waller Creek	**Very Low**

If the City Council approves adequate funding for all or some of the 33 drainage system upgrades identified in this study area, then it is recommended that they proceed by the area of severity as identified by the master plan. In Central East Austin, storm system upgrades should begin in the Boggy Creek watersehd. More detailed analysis at preliminary engineering and design phases will likely provide more specific information to the recommended priority order of implementation. Coordination with other city departments' capital improvements should also be considered.

The East 11th and 12th Street Corridor Drainage Improvements Project (a.k.a. SCIP II) is located within the study area (Waller Creek watershed) and greatly reduces the need for additional drainage improvements as is reflected in Tables 4.1 and 5.1.

5.2 Cost Estimates

Preliminary cost estimates are based upon three factors, which are estimated quantities, multiplier factor for other construction items, and multiplier factor for other project costs. First factor, quantities for the primary drainage infrastructure items include storm drainpipes, curb inlets, headwalls, manholes and pavement repair. Second factor was derived from recent certified bids for similar drainage projects. Approximately 45% the construction contracts were for large drainage items. Therefore, a multiplier of 2.22 was used to cover items such as mobilization, traffic control, erosion controls, and utility adjustments. The third factor is a 1.6 multiplier to cover project management, construction management, surveying, testing, design and inspection. All three factors,

when applied, provide a total estimated cost for each project. Typically, the design phase identifies specific items to include with the construction contract documents; therefore some preliminary estimates may vary from the final cost. Table 4, Drainage System Upgrade Estimated Cost summarize the anticipated total cost of all upgrades at current prices. Thus, the estimated total project cost = (preliminary estimate) x (2.22) x (1.6). See Total Project Cost Estimates in the Appendix for more details.

Table 5.2

System Upgrade Cost Summary

Watershed	No. of System Upgrades	Estimated Project Costs
Boggy Creek	30	$ 38,591,660
Town Lake	2	$ 25,791,178
Waller Creek	1	$ 660,743
		$ 65,043,581

Details are provided in "Central East Austin Drainage System Upgrades" (see Appendix)

5.3 Schedule of Completion

Coordination with other city improvement projects may dictate the schedule in order to minimize impacts to neighborhoods and street cuts during construction. This study has been sent for review to the Water and Wastewater, Public Works, Parks and Recreation Departments as an effort of project coordination. Schedule of project implementation will also be dictated by the funding availability. It generally take 3 years, after funding becomes available, to implement a capital improvement project from preliminary engineering study through final construction completion.

6.0 FUNDING SOURCE FOR COMPLETION OF UPGRADES BY SEGMENTS

Historically, the Watershed Protection and Development Review Department has funded Capital Improvement Projects through both general obligation bonds and the drainage fee revenue. Currently, there are no funds available for the recommended upgrades identified in this study. Additional funds may be obtained either through a future bond election or by an increase in the drainage utility fee, or some combination of both.

7.0 CONCLUSION

- Average age of all existing storm drain systems is about 40 years
- Existing pipe conditions are generally good
- Thirty-three (33) storm drain systems were identified for upgrades in study area
- Priority in study area is very low to moderate based upon Master Plan findings
- Priority order of the 33 storm drain system upgrades should proceed according to severity within the study area and coordinated with other city departments' capital improvements
- Scheduled upgrades should be coordinated with other city cips and would generally require 3 years for implementation after funding becomes available
- Total estimated cost is about $65 million dollars (year 2001 estimate)

APPENDIX

A. Recommended Upgrades
B. Total Project Cost Estimates
C. System Age Determination

Recommended Upgrades

Recommended Upgrades
100 Year Floodplain
Study Boundary

ADDING CURB INLET(S) ONLY
B3, B11, B13, and B20

B6
B8
B10
B22
B9
B27
B7
B5
B26
B4
B1
W1
B25
B24
B28
B18
B30
B16
B21
B17
B2
B19
B14
T1
T2
B15
B12
B23

N

System Name	Study Location	Facillity Condition	Pipe size	Length	Pipe Cost Estimate	Inlet	Headwall	Manhole	Pavmt. Repair Cost	Preliminary Drainage Cost (PDC)	Preliminary Construction Cost (PCC) (PDC x 2.22)	Total Project Cost Estimate (PCC x 1.6)	Watershed Total Project Cost Estimate
B1	Airport Blvd @ Goodwinn Ave	Outdated	18"	100	$ 7,500				$ 2,600	$ 10,100			
						2				$ 8,000			
							1			$ 8,000			
										$ 26,100	$ 57,942	$ 92,707	
B2	Airport blvd. @ Thompson St.	Outdated											
			18"	3000	$ 225,000				$ 78,000	$ 303,000			
			24"	1600	$ 136,000				$ 48,000	$ 184,000			
			4'x2'	1200	$ 210,000				$ 54,000	$ 264,000			
			36"	400	$ 48,000				$ 15,200	$ 63,200			
			4'x3'	160	$ 32,000				$ 7,200	$ 39,200			
			6'x4'	880	$ 312,400				$ 52,800	$ 365,200			
						7				$ 28,000			
								8		$ 32,000			
							3			$ 24,000			
										$ 1,302,600	$ 2,891,772	$ 4,626,835	
B3	Tillery St @ Bengston St	Outdated	18"	100	$ 7,500				$ 2,600	$ 10,100			
						2				$ 8,000			
							1			$ 8,000			
										$ 26,100	$ 57,942	$ 92,707	
B4	Tillery Street @ Oak Springs Rd	Outdated											
			18"	650	$ 48,750				$ 16,900	$ 65,650			
			24"	925	$ 78,625				$ 27,750	$ 106,375			
			30"	935	$ 98,175				$ 31,790	$ 129,965			
			36"	440	$ 52,800				$ 16,720	$ 69,520			
			48"	670	$ 157,450				$ 30,150	$ 187,600			
			54"	120	$ 30,600				$ 5,880	$ 36,480			
			60"	220	$ 61,600				$ 11,440	$ 73,040			
						10				$ 40,000			
								3		$ 12,000			
							1			$ 8,000			
										$ 728,630	$ 1,617,559	$ 2,588,094	
B5	Sol Wilson Ave (near Ridgeway Dr)	Outdated	18"	140	$ 10,500				$ 3,640	$ 14,140			
						1				$ 4,000			
							1			$ 8,000			
										$ 26,140	$ 58,031	$ 92,849	
B6	East 16th Street @ Maples Ave.	Outdated											
			18"	1080	$ 81,000				$ 28,080	$ 109,080			
			24"	850	$ 72,250				$ 25,500	$ 97,750			
			30"	300	$ 31,500				$ 10,200	$ 41,700			
			36"	500	$ 60,000				$ 19,000	$ 79,000			
			48"	750	$ 176,250				$ 33,750	$ 210,000			
			54"	500	$ 127,500				$ 24,500	$ 152,000			
			72"	1300	$ 422,500				$ 78,000	$ 500,500			
						18				$ 72,000			
							4			$ 32,000			
								8		$ 32,000			
										$ 1,326,030	$ 2,943,787	$ 4,710,059	

System Name	Study Location	Facillity Condition	Pipe size	Length	Pipe Cost Estimate	Inlet	Headwall	Manhole	Pavmt. Repair Cost	Preliminary Drainage Cost (PDC)	Preliminary Construction Cost (PCC) (PDC x 2.22)	Total Project Cost Estimate (PCC x 1.6)	Watershed Total Project Cost Estimate
B7	East 12th St @ Railroad	Outdated											
			18"	400	$ 30,000				$ 10,400	$ 40,400			
			24"	350	$ 29,750				$ 10,500	$ 40,250			
						3				$ 12,000			
							1			$ 8,000			
										$ 100,650	$ 223,443	$ 357,509	
B8	Miriam Ave @ East 14th St	Outdated											
			18"	645	$ 48,375				$ 16,770	$ 65,145			
			24"	250	$ 21,250				$ 7,500	$ 28,750			
			30"	370	$ 38,850				$ 12,580	$ 51,430			
			36"	395	$ 47,400				$ 15,010	$ 62,410			
						6				$ 24,000			
								4		$ 4,004			
							1			$ 8,000			
										$ 243,739	$ 541,101	$ 865,761	
B9	Alexander Ave & E 14th St	Outdated											
			18"	770	$ 57,750				$ 20,020	$ 77,770			
			24"	470	$ 39,950				$ 14,100	$ 54,050			
			30"	800	$ 84,000				$ 27,200	$ 111,200			
			36"										
			42"	520	$ 91,000				$ 21,320	$ 112,320			
			48"	180	$ 42,300				$ 8,100	$ 50,400			
						13				$ 52,000			
								5		$ 20,000			
							1			$ 8,000			
										$ 485,740	$ 1,078,343	$ 1,725,348	
B10	Clifford Ave @ E. 17th St	Outdated											
			24"	700	$ 59,500				$ 21,000	$ 80,500			
			30"	450	$ 47,250				$ 15,300	$ 62,550			
						6				$ 24,000			
								3		$ 12,000			
							1			$ 8,000			
										$ 187,050	$ 415,251	$ 664,402	Use only 2/3 of; combine with system B25
B11	Mansell Ave. @ Glissman Rd.	Outdated											
			18"	120	$ 9,000				$ 3,120	$ 12,120			
						3			$ -	$ 12,000			
							1		$ -	$ 8,000			
										$ 32,120	$ 71,306	$ 114,090	
B12	E.7th Street @ Gunter St.	Outdated											
			18"	150	$ 11,250				$ 3,900	$ 15,150			
			30"	360	$ 37,800				$ 12,240	$ 50,040			
			54"	200	$ 51,000				$ 9,800	$ 60,800			
						5				$ 20,000			
								2		$ 8,000			
							1			$ 8,000			
										$ 161,990	$ 359,618	$ 575,388	

System Name	Study Location	Facillity Condition	Pipe size	Length	Pipe Cost Estimate	Inlet	Headwall	Manhole	Pavmt. Repair Cost	Preliminary Drainage Cost (PDC)	Preliminary Construction Cost (PCC) (PDC x 2.22)	Total Project Cost Estimate (PCC x 1.6)	Watershed Total Project Cost Estimate
B13	Springdale Rd @ Creek	Outdated	18"	10	$ 750				$ 260	$ 1,010			
						1				$ 4,000			
										$ 5,010	$ 11,122	$ 17,796	
B14	Gunter Street and Neal Street	Outdated											
			18"	270	$ 20,250				$ 7,020	$ 27,270			
			24"	120	$ 10,200				$ 3,600	$ 13,800			
			30"	610	$ 64,050				$ 20,740	$ 84,790			
			36"	545	$ 65,400				$ 20,710	$ 86,110			
			42"	1010	$ 176,750				$ 41,410	$ 218,160			
						1				$ 4,000			
								2		$ 8,000			
							1			$ 8,000			
										$ 450,130	$ 999,289	$ 1,598,862	
B15	E.7th Street (Calles to Pleasant Valley Rd)	Outdated											
			18"	150	$ 11,250				$ 3,900	$ 15,150			
			24"	830	$ 70,550				$ 24,900	$ 95,450			
			30"	75	$ 7,875				$ 2,550	$ 10,425			
			36"	230	$ 27,600				$ 8,740	$ 36,340			
						3				$ 12,000			
								2		$ 8,000			
							1	0		$ 8,000			
										$ 185,365	$ 411,510	$ 658,416	
B16	Govalles Ave @ Webberville Rd	Outdated											
			18"	240	$ 18,000				$ 6,240	$ 24,240			
			30"	140	$ 14,700				$ 4,760	$ 19,460			
			42"	670	$ 117,250				$ 27,470	$ 144,720			
			48"	120	$ 28,200				$ 5,400	$ 33,600			
						8				$ 32,000			
							1			$ 8,000			
										$ 262,020	$ 581,684	$ 930,695	
B17	Webberville Rd (Pleasant Valley Rd to Neal St)	Outdated											
			18"	300	$ 22,500				$ 7,800	$ 30,300			
			24"	675	$ 57,375				$ 20,250	$ 77,625			
						10				$ 40,000			
							1			$ 8,000			
										$ 155,925	$ 346,154	$ 553,846	
B18	Goodwinn @ Webberville Rd	Outdated											
			18"	750	$ 56,250				$ 19,500	$ 75,750			
			24"	140	$ 11,900				$ 4,200	$ 16,100			
			36"	450	$ 54,000				$ 17,100	$ 71,100			
			42"	420	$ 73,500				$ 17,220	$ 90,720			
						7				$ 28,000			
								3		$ 12,000			
							1			$ 8,000			
										$ 301,670	$ 669,707	$ 1,071,532	

System Name	Study Location	Facillity Condition	Pipe size	Length	Pipe Cost Estimate	Inlet	Headwall	Manhole	Pavmt. Repair Cost	Preliminary Drainage Cost (PDC)	Preliminary Construction Cost (PCC) (PDC x 2.22)	Total Project Cost Estimate (PCC x 1.6)	Watershed Total Project Cost Estimate
B19	Pleasant Valley Rd North @ Zaragosa St	Outdated	18"	150	$ 11,250				$ 3,900	$ 15,150			
			24"	110	$ 9,350				$ 3,300	$ 12,650			
			30"	380	$ 39,900				$ 12,920	$ 52,820			
						4				$ 16,000			
							1			$ 8,000			
								1		$ 4,000			
										$ 108,620	$ 241,136	$ 385,818	
B20	Pleasnt Valley Rd @ Castro Rd	Outdated	18"	30	$ 2,250				$ 780	$ 3,030			
						2				$ 8,000			
							1			$ 8,000			
										$ 19,030	$ 42,247	$ 67,595	
B21	Glen Oaks Dr and Walter St	Outdated											
			18"	300	$ 22,500				$ 7,800	$ 30,300			
			24"	310	$ 26,350				$ 9,300	$ 35,650			
			30"	410	$ 43,050				$ 13,940	$ 56,990			
			36"	300	$ 36,000				$ 11,400	$ 47,400			
							1			$ 8,000			
						3				$ 12,000			
								2		$ 8,000			
										$ 198,340	$ 440,315	$ 704,504	
B22	E 14th St @ Maple Ave	Outdated	18"	360	$ 27,000				$ 9,360	$ 36,360			
			60"	1200	$ 336,000				$ 62,400	$ 398,400			
			66"	750	$ 225,000				$ 42,000	$ 267,000			
						8				$ 32,000			
							2			$ 16,000			
								4		$ 16,000			
										$ 765,760	$ 1,699,987	$ 2,719,980	
B23	Shady Ln (Boggy Ck to Gonzales St)	Outdated	18"	20	$ 1,500				$ 520	$ 2,020			
						2			$ -	$ 8,000			
			18"	60	$ 4,500				$ 1,560	$ 6,060			
			30"	690	$ 72,450				$ 23,460	$ 95,910			
			36"	695	$ 83,400				$ 26,410	$ 109,810			
										$ 221,800	$ 492,396	$ 787,834	
B24	Poquito Street/Chicon St (Cornell St to E. 12th St)												
			18"	800	$ 60,000				$ 20,800	$ 80,800			
			24"	750	$ 63,750				$ 22,500	$ 86,250			
			30"	290	$ 30,450				$ 9,860	$ 40,310			
			42"	720	$ 126,000				$ 29,520	$ 155,520			
			48"	80	$ 18,800				$ 3,600	$ 22,400			
			9'x5'	850	$ 493,850				$ 69,700	$ 563,550			
						11				$ 44,000			
								5		$ 20,000			
							3			$ 24,000			
										$ 1,036,830	$ 2,301,763	$ 3,682,820	

System Name	Study Location	Facillity Condition	Pipe size	Length	Pipe Cost Estimate	Inlet	Headwall	Manhole	Pavmt. Repair Cost	Preliminary Drainage Cost (PDC)	Preliminary Construction Cost (PCC) (PDC x 2.22)	Total Project Cost Estimate (PCC x 1.6)	Watershed Total Project Cost Estimate
B25	Chicon St @ Rosewood Ave.	Outdated											
			18"	810	$ 60,750				$ 21,060	$ 81,810			
			24"	550	$ 46,750				$ 16,500	$ 63,250			
						6				$ 24,000			
								2		$ 8,000			
							1			$ 8,000			
										$ 185,060	$ 410,833	$ 657,333	Use only 1/3; combine with B30
B26	Comal St (Rosewood Ave to E.14th St)	Outdated											
			18"	1580	$ 118,500				$ 41,080	$ 159,580			
			24"	760	$ 64,600				$ 22,800	$ 87,400			
			30"	400	$ 42,000				$ 13,600	$ 55,600			
			36"	895	$ 107,400				$ 34,010	$ 141,410			
			5.5'x5'	1200	$ 562,800				$ 72,000	$ 634,800			
						14				$ 56,000			
								5		$ 20,000			
							2			$ 16,000			
										$ 1,170,790	$ 2,599,154	$ 4,158,646	
B27	Comal St (E13th to MLK)	Outdated											
			18"	3000	$ 225,000				$ 78,000	$ 303,000			
			24"	1600	$ 136,000				$ 48,000	$ 184,000			
			30"	1100	$ 115,500				$ 37,400	$ 152,900			
			36"										
			42"	700	$ 122,500				$ 28,700	$ 151,200			
			54"	500	$ 127,500				$ 24,500	$ 152,000			
						10				$ 40,000			
								5		$ 20,000			
							1			$ 8,000			
										$ 1,011,100	$ 2,244,642	$ 3,591,427	
B28	Rosewood Ave & Walnut Ave	Outdated											
			18"	240	$ 18,000				$ 6,240	$ 24,240			
			24"	440	$ 37,400				$ 13,200	$ 50,600			
			30"	60	$ 6,300				$ 2,040	$ 8,340			
						3				$ 12,000			
								1		$ 4,000			
							1			$ 8,000			
										$ 107,180	$ 237,940	$ 380,703	
B29	Oak Spring near Ridgeway Dr	outdated	18"	250	$ 18,750				$ 6,500	$ 25,250			
						$ 2				$ 8,000			
										$ 33,250	$ 73,815	$ 118,104	
B30	Chicon (Tillotson Ave to Cornell St)	Outdated											
			18"	810	$ 60,750				$ 21,060	$ 81,810			
			24"	550	$ 46,750				$ 16,500	$ 63,250			
						6				$ 24,000			
								2		$ 8,000			
							1			$ 8,000			Boggy Creek
										$ 185,060	$ 410,833	$ 657,333	**$ 38,591,659**

System Name	Study Location	Facillity Condition	Pipe size	Length	Pipe Cost Estimate	Inlet	Headwall	Manhole	Pavmt. Repair Cost	Preliminary Drainage Cost (PDC)	Preliminary Construction Cost (PCC) (PDC x 2.22)	Total Project Cost Estimate (PCC x 1.6)	Watershed Total Project Cost Estimate
T1	Comal St @ East 7th St	Outdated											
			18"	300	$ 22,500				$ 7,800	$ 30,300			
			24"	353	$ 30,005				$ 10,590	$ 40,595			
			30"	1215	$ 127,575				$ 41,310	$ 168,885			
			36"	990	$ 118,800				$ 37,620	$ 156,420			
			48"	1435	$ 337,225				$ 64,575	$ 401,800			
			54"	810	$ 206,550				$ 39,690	$ 246,240			
						10				$ 40,000			
								5		$ 20,000			
										$ 1,104,240	$ 2,451,413	**$ 3,922,260**	
T2	Perdenales St (E.7th St to Colorado River)	Outdated											
			18"	600	$ 45,000				$ 15,600	$ 60,600			
			24"	370	$ 31,450				$ 11,100	$ 42,550			
			30"	4100	$ 430,500				$ 139,400	$ 569,900			
			36"	1835	$ 220,200				$ 69,730	$ 289,930			
			42"	0	$ -				$ -	$ -			
			48"	1715	$ 403,025				$ 77,175	$ 480,200			
			54"	0	$ -				$ -	$ -			
			60"	470	$ 131,600				$ 24,440	$ 156,040			
			6'x5'	660	$ 309,540				$ 39,600	$ 349,140			
			7'x5'	2515	$ 1,275,105				$ 168,505	$ 1,443,610			
			9'x5'	1340	$ 778,540				$ 109,880	$ 888,420			
			9'x8'	2150	$ 1,492,100				$ 176,300	$ 1,668,400			
						30				$ 120,000			
								20		$ 80,000			
							1			$ 8,000			Town Lake
										$ 6,156,790	$ 13,668,074	**$ 21,868,918**	**$ 25,791,179**
W1	Juniper, Catalpa, E.12th Street	Outdated											
			18"	330	$ 24,750				$ 8,580	$ 33,330			
			24"	250	$ 21,250				$ 7,500	$ 28,750			
			30"	460	$ 48,300				$ 15,640	$ 63,940			
						11				$ 44,000			
								4		$ 16,000			Waller Creek
										$ 186,020	$ 412,964	**$ 660,743**	**$ 660,743**

System Age Survey:
IH-35 to Airport Blvb., 7th Street to MLK Blvd.

System Count	Year Installed	System Count	Year Installed	System Count	Year Installed			
1	1931	41	1960	81	1963		121	1968
2	1936	42	1960	82	1963		122	1968
3	1936	43	1960	83	1964		123	1968
4	1936	44	1960	84	1964		124	1969
5	1936	45	1960	85	1964		125	1969
6	1936	46	1960	86	1964		126	1969
7	1936	47	1960	87	1964		127	1969
8	1936	48	1960	88	1964		128	1971
9	1936	49	1960	89	1964		129	1971
10	1939	50	1960	90	1964		130	1971
11	1941	51	1961	91	1964		131	1971
12	1941	52	1961	92	1964		132	1978
13	1941	53	1961	93	1964			
14	1949	54	1961	94	1964			
15	1949	55	1961	95	1964			40 years or older
16	1952	56	1961	96	1964			
17	1952	57	1961	97	1964			Un-reinforced Concrete
18	1952	58	1961	98	1964			
19	1953	59	1962	99	1965			
20	1953	60	1962	100	1965			
21	1953	61	1962	101	1965			
22	1955	62	1962	102	1965			
23	1955	63	1962	103	1965			
24	1955	64	1962	104	1965			
25	1955	65	1962	105	1965			
26	1956	66	1962	106	1965			
27	1956	67	1962	107	1965			
28	1956	68	1962	108	1965			
29	1956	69	1962	109	1966			
30	1957	70	1962	110	1966			
31	1957	71	1962	111	1967			
32	1957	72	1962	112	1967			
33	1959	73	1962	113	1967			
34	1959	74	1962	114	1967			
35	1959	75	1962	115	1967			
36	1959	76	1962	116	1967			
37	1959	77	1962	117	1967			
38	1959	78	1962	118	1968			
39	1959	79	1963	119	1968			
40	1959	80	1963	120	1968			

1962	Median year installed	1960		Average year installed		
39	Median age of systems	42	yrs	Averag Age of Systems		
132	Number of drainage systems	70	yrs	Oldest System found		