INTRODUCTION

The intent of this Storm Drainage System Study is to review all available information on storm drainage in Lucas, make an analysis of the existing system, establish a database to be used to prepare a plan, and make recommendations with the cost estimates of the improvements to the existing storm drainage systems within the City.

The topography of Lucas consists of both level and gently rolling terrain. The majority of the population within the Lucas city limits is located in relatively flat areas with few deep drainage channels. As a result, localized flooding can be a problem, especially where culvert and drainage ditches are obstructed with vegetation or debris.

To help minimize property damage from flooding during periods of intense rainfall, the drainage system for a community must be addressed, sized and properly maintained. The public has come to expect that no damage will result to property from storm drainage or high water and gives no thought to the location of neighborhoods in relation to ground elevation and drainage flows. All of these factors directly affect the surface storm drainage immediately adjacent to homes and/or business structures. Storm drainage facilities required for a city may include inlets, storm sewers, culverts, bridges, French drains, concrete lined channels, natural drainage channels, overflow swales, creeks, rivers, retention ponds and lakes.

STORM DRAINAGE INVENTORY

INVENTORY

An inventory survey was completed in April of 2004 to determine the present condition of the drainage system and to identify the drainage system in and around the City of Lucas. The existing storm water facilities in the City of Lucas were catalogued and are illustrated in Figure 8.1. The approximate length, size and type of all public drainage structures within the city limits have been identified and are detailed in Appendix 8.1.

The storm drainage system of Lucas currently consists of a system of bar ditches, channels, bridges and numerous culverts. These facilities carry storm water run-off within Lucas to the eventual terminus outside the city limits. No underground system exists.

Annual precipitation is approximately 34 inches per year. The rains are heaviest in spring and fall.

The streets in the City crowned to promote open ditch drainage on each side. No curb and gutter exists.

The Federal Emergency Management Agency (FEMA) provides flood insurance rate maps that depict the 100-year and 500-year flood plains. These flood plains cover those areas that would most likely be inundated with storm water during the heaviest rains typically occurring in the area over the specified 100 or 500 years. The regulatory 100-year floodway defines the area where buildings are not eligible for flood insurance, while those located in the 100-year floodway fringe are eligible once flood proofing is implemented. The goal of this program is to curtail development in flood plains, thereby reducing damage to structures and minimizing the danger to people during flooding.

The City of Lucas is a participating city in the National Flood Insurance Program (NFIP) and figure 8.1 illustrates the approximate locations of the flood plains.

The City of Lucas is responsible for the maintenance of most of the above drainage features. However both the County and the Texas Department of Transportation (TXDOT) control those facilities in the extraterritorial jurisdiction and along some of the major roadways in and around the City.

STORM DRAINAGE ANALYSIS

The entire City relies on storm water drainage to be carried on the surface within bar ditches and well-defined unimproved drainage channels. No curb and gutter exists. As mentioned earlier, the drainage pattern varies within Lucas as some areas of the City are flatter than others.

GENERAL PROBLEMS

Creeks:

While flooding creeks can pose significant flooding problems, none exist in the City.

Bar Ditches and Water Channels:

A significant portion of the flooding that occurs in the City is associated with man-made bar ditches and culverts being inundated with rainwater flowing off adjacent properties while following the natural topographical lay of the City. Despite the proper construction and operation of the majority of these ditches, some are not able to deal with the intense storm water flows brought on by heavy rains. As a result, water is often left standing in intersections and yards of homes after rain has subsided. This water is a breeding ground for mosquitoes, contributes to premature street damage and is a visual blight on the City.

Street System:

Manmade structures such as the street system do not lend themselves to adequate drainage since the facilities exist perpendicular to the natural flow lines. This occurrence is evident in throughout the City. This can allow storm water to prematurely damage roadways.

Drainage Facilities:

In an attempt to identify problems and make needed recommendations, a complete inventory of drainage facilities within the City of Lucas was made. As a result, a total of 219 facilities have been identified, 68 of which are 50 per cent or more blocked with siltation, crushed or can be characterized as overgrown with vegetation. These facilities are in need of attention.

In analyzing the drainage system, adequate facilities exist under intersection rights-of-ways throughout the majority of the City.

In regard to the drainage facilities of Lucas, problems with culverts were identified citywide. **14 percent** are at least 50 percent plugged and/or crushed and need immediate maintenance. For this reason, it is recommended that improvements be made to increase the capacity of these existing facilities in order to expedite run-off past these areas towards the natural drainage ways. This lack of maintenance contributes to localized flooding along many streets and could cause some homes to become inundated with water.

LOCAL PRIORITIZED ACTIONS

1. Establish a Maintenance Program: To enable existing and proposed drainage facilities to carry the maximum possible flow without entering into a major capital improvement program, the City needs to initiate a ditch maintenance program. This program should include the reworking and deepening of existing bar ditches and cleaning out or replacing deteriorated and silted culverts. Great attention should be placed upon this program before each rainy system. As a general rule, bar ditches should be constructed at a 4:1 slope so they can be mowed by individual property owners. The program should also include the routine removal of debris and mowing of bar ditches. Finally, culverts should be cleaned and replaced as necessary. The estimated cost of such a program is $3.00/lf, excluding driveway and drainage pipe.

2. Modify Existing System: In addition to maintaining the existing drainage system, modifications may be necessary to eliminate severe localized flooding. Examples include re-sloping bar ditches.

SPECIFIC PROBLEM AREAS

An analysis of the areas within the community where local flooding has occurred was conducted. As a result, a total of five (5) areas were identified and have been illustrated in Figure 8.1. During a hard rain, the bar ditches along the roadways in these areas become virtual rivers as extreme water flows rush in. The severe siltation and improper slope of some of these ditches prevents water from being expelled quickly enough. In some cases, this causes pools to form in yards and intersections. Other times, water simply overflows out of the bar ditches, cascading over roadways.

STORM DRAINAGE PLAN AND RECOMMENDATIONS

Any plan that is developed to improve the drainage in the City must be coordinated with plans to improve the road system. Poor drainage not only causes localized flooding that could threaten some property, but flooding on and near the roadways in the City is responsible for much of the damage that exists in the roadways. Poor drainage or lack of drainage causes the pavement and road base to deteriorate. The weight of normal traffic on the road travels over the weakened areas, breaks down the surface and causes potholes to form. Most cities attempt to patch the potholes for a temporary fix. However, complete reconstruction of roadways that includes new drainage, preferably curb and gutter, is usually required to assure a long life for the roadway.

The primary efforts that can be completed by the City to address local flooding are: constant maintenance to address potholes and pavement surface failures; and drainage ditch maintenance. Through this study and other more extensive studies of the roads and drainage systems, the City can get a good understanding of the costs and construction involved to repair the roadways and drainage systems.

The affect of development on the drainage in the City must be addressed for the future. Since development increases impermeable cover (from structures, roads, driveways, etc.), an acceptable amount of permeable ground cover in the City must be maintained to allow water to be absorbed and minimize run-off. Special bricks or other special construction material may be used and the City can also develop regulations such as a landscape ordinance that requires developments to keep a minimum percentage of the native trees and vegetation or to plant new vegetation. If left unregulated, development could ultimately seal the ground from water absorption, and increase the speed and amount of run-off and the chances for additional flooding.

Several different methods are used in various areas in the state to control streams and areas that are prone to flooding. These methods can either directly control the flooding stream or control drainage ways and creeks that "feed" the major drainage channel, lessening the amount and speed of water.

Some measures that can be used to control flooding include, but are not limited to:

- ✓ Retention Ponds - Permanent walls or earthen berms intended to hold storm water for absorption and evaporation.
- ✓ Detention Ponds - Similar to retention ponds; intended to slow down the runoff of storm water. Designed to hold water from a higher intensity (100-year) flood and release it at the rate of a lower intensity (10-year) flood.
- ✓ Porous Paving - An alternative type of paving that allows for absorption of storm water into the ground instead of forcing it into the City's storm water system.
- ✓ Levees - Similar to retention ponds; a form of terracing that hold storm water for absorption and evaporation.
- ✓ Channelization - Consists of the shaping of a stream, including the potential paving of the banks or entire drainage way to direct the removal of storm water.

One of the most successful measures implemented in the State is the detention pond system. Many municipalities, as a part of flood management, have implemented a detention requirement for sites as small as an acre. However, numerous small detention facilities can be difficult to construct and maintain or have a significant effect during peak flooding periods. Large, regional detention facilities designed for larger acreage can often prove more efficient. Though technically possible and adequate to reduce the amount of major channel enlargement required to handle a flood, detention ponds are usually not economical and will not solve existing flooding alone. Detention ponds can be detrimental to existing development due to implementation costs, loss of land, maintenance, and health hazards.

Since the major drainage problems in Lucas cannot be directly addressed by these methods, the City must determine what steps may be taken both currently and in the future for improvement of drainage within the City. In order to address existing problems, the City must develop a program for the increased maintenance of the existing drainage system. Future plans can include the design and construction of drainage facilities.

Certain administrative controls can be implemented which gives the City control over development in flood areas. A flood prevention ordinance preventing construction in the flood plain is one example of a land use control. This ordinance could regulate development that would not allow people to construct buildings, especially homes, in areas prone to flooding in order to protect them from loss of property or loss of life. This type of ordinance would prohibit a building permit for any structure in a flood hazard area. Land subject to flooding could be controlled administratively through zoning for parks, open space or agricultural use.

Another method of regulating land use in flood hazard areas is through the subdivision ordinance. The primary control that may be imposed through the ordinance is to require the installation of an underground storm sewer system that meets minimum City standards for the subdivision. The developer of a proposed subdivision would be required to construct an underground storm sewer system including curb and gutter to protect the new development from local flooding. If each new development within the City and the ETJ is required to install such improvements, the City would then be closer to developing a functional drainage system.

In addition, any proposed residential subdivision would be required to limit the amount of impervious cover in the development (streets, driveways, etc.) in order to regulate the volume of run-off of new development, as compared to the natural runoff rate before the development. This type of control would allow new facilities to be constructed without major modifications to the existing, natural drainage system. In addition, the City may also require all future developments (commercial and industrial as well as residential) to provide sufficient drainage easements to accommodate future runoff and potential facilities.

GOALS AND OBJECTIVES

GOAL 1: PROTECT ALL CITIZENS OF LUCAS FROM FLOODING AND HEALTH PROBLEMS CAUSED BY POOR DRAINAGE.

OBJECTIVE 1.1:
Provide all prospective homebuyers and home builders with information from the Federal Emergency Management Agency (FEMA) about flood plains within the City by making FEMA flood rate maps regarding flood plains in the City available at city hall.

OBJECTIVE 1.2:
By the end of 2008, establish a ditch maintenance program.

OBJECTIVE 1.3:
Annually inspect existing drainage system to ensure proper functionality.

OBJECTIVE 1.4:
When possible, identify those specific drainage and street improvements, which should be undertaken concurrently to maximize expenditures.

OBJECTIVE 1.5:
By the end of this planning period, eliminate localized flooding in the areas identified in this study.

GOAL 2: PLAN FOR THE IMPACT OF FUTURE DEVELOPMENT BOTH WITHIN THE CITY AND THE EXTRA-TERRITORIAL JURISDICTION.

OBJECTIVE 2.1:

Document the enforcement of City codes and subdivision ordinances for new development. Through various City restrictions, the City can minimize the impact of new development on future drainage patterns. By requiring plans for runoff control, such as the construction of curb and or retention ponds, the City can ease the pressure on the watershed as the City becomes more developed.

PROPOSED IMPROVEMENTS

As part of the Drainage Plan, a Phased Action Plan listing priorities, estimated costs and possible funding sources has been developed and is presented below. The physical aspects of the plan are graphically presented in Figure 8.2.

Phase I

Ensure proper bar ditch operation along the following section of roadway:

STREET SECTION	FROM	TO
White Rock Trail	all	

Construction activities shall include cleaning/deepening bar ditches as well as providing proper slopes. Culvert # 154 should also be examined to ensure proper functionality. This project should be coordinated with the Street Plan.

Cost: All work will be performed by City crews.

Phase II

Ensure proper bar ditch operation along the following sections of roadway:

STREET SECTION	FROM	TO
Orchard Road	all	
Citrus Way	all	
Orange Cove	all	
Mandarin Cove	all	
Lemon Cove	all	
Lime Cove	all	

Construction activities shall include cleaning/deepening bar ditches.

Cost: All work will be performed by City crews.

Phase III

Ensure proper bar ditch operation along the following sections of roadway:

STREET SECTION	FROM	TO
Woodmore Drive	all	
Highland Circle	all	
Crestview Circle	all	

Construction activities shall include cleaning/deepening bar ditches. Culvert # 76 should also be examined to ensure proper functionality.

Cost: All work will be performed by City crews.

Phase IV

Ensure proper bar ditch operation along the following sections of roadway:

STREET SECTION	FROM	TO
West Lucas Road	Farm to Market 2551	County Road 262
Stinson Road	Parker Road	Culvert #18

Construction activities shall include cleaning/deepening bar ditches. Culvert # 20 should also be examined to ensure proper functionality.

Cost: All work will be performed by City crews.

The physical aspects of the plan are graphically presented in Figure 8.2.

POSSIBLE FINANCIAL SOURCES:

The following is a listing of sources which may be utilized to assist with future drainage projects:

- ✓ The City's General Fund
- ✓ Bonds
- ✓ Grants through the Office of Rural Community Affairs
- ✓ Drainage fees on utility bills. As the area becomes more developed, proper drainage will become an increasing problem and impact fees normally are not used for street and drainage improvements. Because of drainage problems in other cities, drainage fees to pay for improvements such as channelization have been implemented.
- ✓ City participation
- ✓ Individuals who are required to perform community service can often be utilized to do some of the required labor. Often times, this can be accomplished by participating with local governmental units and the county judicial system.
- ✓ Texas Department of Transportation (TXDOT)
- ✓ Texas Department of Agriculture

APPENDIX 9.1
CITY OF LUCAS
EXISTING DRAINAGE FACILITIES

CON = Reinforced Concrete Pipe
CMP = Corrugated Metal Pipe
CIP - Cast Iron Pipe
CH - Channel
BR - Bridge

Number	Size	Length	Type	Headwall	Water	Weeds	Plugged	Crushed	Comment
1	32	100	CON	Yes	No	No	No	No	(2 facilities)
2	32	60	CON	Yes	No	No	No	No	(3 facilities)
3	24	60	CON	Yes	No	No	No	No	(3 facilities)
4	32	60	CON	Yes	No	No	No	No	(2 facilities)
5	32	60	CON	Yes	No	No	No	No	(2 facilities)
6	9' x 3'	40	CON	Yes	No	No	No	No	
7	9' x 3'	40	CON	Yes	No	No	No	No	
8	32	40	CON	Yes	No	No	No	No	(2 facillities)
9	18	40	CON	Yes	No	No	No	No	(2 facillities)
10	32	30	CMP	No	No	No	No	Yes	
11	32	40	CON	Yes	No	No	No	No	
12	24	40	CON	Yes	Yes	No	No	No	(3 facillities)
13	18	30	CMP	No	No	No	Yes	Yes	
14	36	50	CON	No	No	Yes	No	No	
15	36	30	CON	No	Yes	Yes	No	No	
16	24	30	CMP	No	Yes	Yes	No	No	
17	32	30	CMP	No	Yes	No	Yes	No	
18	80	40	CIP	Yes	Yes	No	No	No	(2 facillities)
19	32	30	CMP	No	Yes	Yes	No	No	
20	24	30	CMP	No	No	No	Yes	No	
21	24	40	CMP	Yes	No	No	No	No	
22	18	30	CMP	No	No	Yes	No	No	
23	24	60	CON	No	No	No	No	No	
24	18	60	CON	No	No	No	No	No	
25	9' x 6'	40	CON	Yes	No	No	No	No	
26	32	30	CMP	No	No	No	No	No	
27	32	40	CMP	No	No	No	No	Yes	

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28	24	30	CMP	No	No	No	No	Yes	
29	24	30	CMP	No	No	No	No	Yes	
30	24	40	CON	No	No	No	No	No	
31	24	50	CMP	No	No	No	No	Yes	
32	9' x 6'	30	CON	Yes	No	No	No	No	
33	24	24	CON	No	No	No	Yes	Yes	
34	18	24	CON	Yes	No	Yes	No	No	
35	72	24	CON	Yes	No	No	No	No	
36	24	24	CON	Yes	No	No	Yes	No	
37	24	24	CON	No	No	No	No	No	
38	24	24	CON	No	No	No	No	No	
39	24	30	CON	No	No	Yes	No	No	
40	24	30	CON	No	No	Yes	No	No	
41	24	30	CON	No	No	Yes	No	No	
42	42	60	CMP	No	No	Yes	No	No	
43	30	60	CON	No	No	Yes	Yes	No	
44	24	40	CMP	No	No	No	No	No	
45	18	30	CON	No	No	No	No	No	(3 facillities)
46	24	30	CON	Yes	No	No	No	No	
47	18	40	CON	Yes	No	No	No	No	
48	24	24	CON	Yes	No	No	No	No	
49	24	30	CON	Yes	No	No	No	No	
50	24	24	CON	Yes	No	No	No	No	
51	18	20	CON	Yes	No	No	No	No	
52	36	50	CON	No	No	No	No	No	(2 facillities)
53	72	30	CIP	No	No	No	No	No	
54	36	30	CON	No	No	No	No	No	Box on one end
55	42	30	CON	No	No	No	No	No	
56	36	30	CMP	No	No	No	No	No	
57	36	100	CMP	No	No	No	No	No	

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CITY OF LUCAS
EXISTING DRAINAGE FACILITIES

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58	24	30	CON	No	No	No	No	No	
59	24	30	CMP	No	No	No	No	No	
60	24	30	CMP	No	No	No	No	No	
61	24	30	CMP	No	No	No	No	Yes	
62	36	30	CMP	No	No	No	No	No	
63	24	30	CMP	No	No	No	Yes	Yes	
64	24	30	CMP	No	No	No	No	Yes	
65	24	30	CMP	No	No	No	Yes	Yes	
66	24	30	CMP	No	No	No	No	Yes	
67	24	30	CON	Yes	Yes	No	No	No	
68	12' x 8'	60	CON	Yes	Yes	No	No	No	
69	18	30	CON	Yes	No	No	No	No	
70	36	40	CON	Yes	Yes	No	No	No	
71	18	30	CON	No	No	No	No	No	
72	18	24	CON	No	No	No	No	No	
73	18	24	CON	No	No	No	No	No	
74	18	24	CON	No	No	No	Yes	No	
75	60	30	CON	No	No	No	No	No	
76	12	24	CON	No	No	No	Yes	No	
77	24	50	CON	No	No	No	No	No	
78	18	30	CON	No	No	Yes	No	No	
79	36	30	CON	No	No	No	No	No	(2 facillities)
80	24	30	CMP	Yes	No	No	No	No	
81	24	30	CON	Yes	No	No	No	No	(2 facillities)
82	18	24	CON	No	No	Yes	No	No	
83	18	40	CON	No	No	No	No	No	
84	18	24	CON	No	No	No	No	No	
85	42	30	CON	No	No	No	No	No	
86	24	30	CON	No	No	No	No	No	(2 facillities)
87	24	30	CMP	No	No	No	No	No	

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BR - Bridge

88	24	30	CMP	Yes	No	No	No	No	
89	27	40	CON	Yes	No	No	No	No	(3 facillities)
90	12'		CH	No	No	No	No	No	
91	24	40	CON	Yes	No	No	No	No	
92	12'		CH	No	No	No	No	No	
93	24	30	CON	Yes	No	No	No	No	(3 facillities)
94	24	40	CON	Yes	No	No	No	No	(3 facillities)
95	12'		CH	No	No	No	No	No	
96	8' x 3'	40	CON	Yes	No	No	No	No	(2 facillities)
97	24	30	CMP	No	No	No	No	No	
98	36	30	CMP	No	No	No	No	No	
99	42	30	CMP	No	No	No	No	No	(2 facillities)
100	24	30	CON	Yes	No	No	No	No	
101	24	70	CON	Yes	No	No	No	No	
102	24	30	CON	Yes	No	No	No	No	
103	24	40	CON	Yes	No	No	No	No	(2 facillities)
104	24	40	CON	Yes	No	No	No	No	(2 facillities)
105	24	50	CON	Yes	No	No	No	No	
106	24	50	CMP	Yes	No	No	No	No	
107	20	50	CMP	Yes	No	No	No	No	(2 facillities)
108	30	50	CMP	Yes	No	No	No	No	
109	27	40	CMP	Yes	No	No	No	No	
110	18	40	CMP	Yes	No	No	No	No	
111	48	40	CMP	Yes	No	No	No	No	
112	24	30	CON	No	No	Yes	No	No	
113	24	20	CON	No	No	Yes	No	No	
114	24	30	CON	No	No	No	No	No	
115	24	30	CON	No	No	No	No	No	
116	24	20	CON	No	No	No	No	No	
117	72	30	CMP	No	Yes	No	No	No	

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118	18	30	CON	Yes	No	No	No	No	
119	18	40	CON	Yes	No	No	No	No	
120		85	BR	No	No	No	No	No	
121	36	30	CMP	No	Yes	No	No	Yes	
122	24	40	CMP	No	No	Yes	No	No	
123	24	30	CMP	No	No	No	No	No	
124	12	24	CON	Yes	No	No	No	No	(2 facillities)
125	48	24	CMP	No	No	No	No	No	
126	30	24	CMP	No	No	No	No	No	
127	30	50	CMP	No	No	No	No	No	
128	30	50	CMP	No	No	No	No	No	
129	30	30	CMP	No	No	No	No	Yes	
130	24	24	CMP	No	No	No	No	No	
131	24	24	CMP	No	No	Yes	No	No	
132	0.6666667	24	CMP	No	No	No	No	Yes	(2 facillities)
133	24	30	CMP	No	No	No	No	No	
134		124	BR	No	No	No	No	No	
135	24	30	CMP	No	No	No	No	No	(2 facillities)
136	18	24	CON	No	No	No	No	No	
137		75	BR	No	No	No	No	No	
138	24	24	CMP	No	No	No	No	No	
139	30	24	CMP	No	No	No	No	No	(2 facillities)
140	42	24	CMP	No	No	No	Yes	No	
141	18	40	CON	Yes	No	No	No	No	
142	18	40	CON	Yes	No	No	No	No	
143	24	40	CON	Yes	No	No	No	No	(2 facillities)
144	24	40	CON	Yes	No	No	No	No	
145	24	40	CON	Yes	No	No	No	No	
146	24	40	CON	Yes	No	No	No	No	
147	24	40	CON	Yes	No	No	No	No	(2 facillities)

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148	24	40	CON	Yes	No	No	No	No	
149	24	40	CON	Yes	No	Yes	No	No	
150	24	40	CON	Yes	No	Yes	No	No	
151	18	24	CON	Yes	No	No	No	No	
152	18	24	CON	Yes	No	No	No	No	
153	36	30	CON	Yes	Yes	No	No	No	
154	24	30	CON	Yes	No	No	Yes	No	
155		40	BR	No	No	No	No	No	
156	24	40	CON	No	No	No	No	No	
157	24	30	CIP	No	No	Yes	No	No	
158	36	40	CMP	No	No	No	No	No	
159		40	BR	No	No	No	No	No	
160	24	30	CON	No	No	No	No	No	
161	24	40	CON	No	No	No	No	No	
162	4' x 2'	50	CON	Yes	No	No	No	No	(2 facillities)
163	24	50	CON	Yes	No	No	No	No	(2 facillities)
164	24	30	CON	Yes	No	No	No	No	
165	24	50	CON	Yes	No	No	No	No	(4 facillities)
166	0.8571429	50	CMP	Yes	No	No	No	No	(2/3 facillities)
167	12' x 6'	30	CON	Yes	No	No	Yes	No	
168	24	40	CON	No	No	No	No	No	
169	18	40	CON	No	No	Yes	No	No	
170	48	30	CON	Yes	No	Yes	No	No	(8 facillities)
171	24	30	CON	No	No	No	No	No	
172	24	30	CMP	No	No	No	No	No	(2 facillities)
173	24	24	CMP	No	No	No	No	No	(2 facillities)
174	18	24	CON	No	No	No	No	No	
175	18	24	CON	No	No	No	No	No	
176	18	24	CON	No	No	No	No	No	
177	42	30	CON	Yes	Yes	No	No	No	(2 facillities)

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CITY OF LUCAS
EXISTING DRAINAGE FACILITIES

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178	72	30	CIP	Yes	Yes	No	No	No	
179	42	40	CMP	Yes	No	No	No	No	(2 facillities)
180		24	BR	No	No	No	No	No	
181	36	30	CMP	No	No	No	No	Yes	
182	6' x 6'	30	CON	No	No	No	No	No	
183	60	40	CMP	No	No	No	No	No	
184	30	40	CON	No	No	No	Yes	No	(2 facillities)
185		50	BR	No	No	No	No	No	
186	30	40	CMP	No	Yes	No	No	No	
187	24	30	CON	No	Yes	No	No	No	(3 facillities)
188	30	30	CON	No	No	No	No	No	
189	24	30	CON	No	No	No	No	No	
190	24	20	CMP	No	No	No	No	Yes	
191	18	30	CON	No	No	No	No	No	
192	24	24	CON	Yes	No	No	No	No	(2 facillities)
193	24	30	CON	No	No	No	No	No	
194	30	100	CON	No	No	No	No	No	
195	30	30	CON	Yes	No	No	No	No	
196	24	40	CON	Yes	No	Yes	No	No	
197	24	40	CMP	No	No	No	No	No	
198	96	40	CMP	No	No	No	No	No	
199	42	30	CMP	No	No	No	No	No	
200	48	40	CMP	No	Yes	No	No	No	
201	18	24	CMP	No	No	No	Yes	Yes	
202	24	30	CON	Yes	No	No	No	No	
203	24	30	CON	Yes	No	No	No	No	
204	24	30	CON	Yes	No	No	No	No	(2 facillities)
205	24	30	CON	Yes	No	No	No	No	
206	48	24	CON	Yes	No	No	No	No	
207	36	75	CON	Yes	No	No	Yes	No	Box on one end

APPENDIX 9.1
CITY OF LUCAS
EXISTING DRAINAGE FACILITIES

CON = Reinforced Concrete Pipe
CMP = Corrugated Metal Pipe
CIP - Cast Iron Pipe
CH - Channel
BR - Bridge

208	24	40	CON	No	No	Yes	No	No	
209	24	40	CON	No	No	Yes	No	No	
210	18	30	CON	No	No	No	No	No	
211	28	30	CON	No	No	No	No	No	Box on one end
212	72	30	CMP	No	No	No	No	No	
213	24	30	CMP	No	No	No	No	No	
214	24	24	CMP	No	No	Yes	No	Yes	(2 facillities)
215	24	50	CON	Yes	No	No	No	No	
216	36	100	CON	Yes	No	No	No	No	
217	48	40	CON	Yes	No	No	No	No	
218	48	24	CON	No	No	Yes	No	No	
219				No	No	No	No	No	NEED DATA

Source: 2004 Survey by Tim F. Glendening & Associates, Inc.