city of lubbock TEXAS

MASTER DRAINAGE PLAN

2010 Update

July 2010

PSC PARKHILLSMITH&COOPER

In Association With

HR HUGO REED AND ASSOCIATES, INC.

CITY OF LUBBOCK, TEXAS
MASTER DRAINAGE PLAN:
2010 UPDATE

MAYOR
TOM MARTIN

CITY COUNCIL

PAUL R. BEANE
VICTOR HERNANDEZ
JIM GILBREATH
TODD R. KLEIN
KAREN GIBSON
FLOYD PRICE

CITY MANAGER
LEE ANN DUMBAULD

CHIEF OPERATIONS OFFICER
MARSHA REED, P.E.

STORM WATER MANAGEMENT
MICHAEL G. KEENUM, P.E.

PSC PARKHILLSMITH&COOPER

In Association With

HR HUGO REED AND ASSOCIATES, INC.

CITY OF LUBBOCK, TEXAS
MASTER DRAINAGE PLAN:
2010 UPDATE

ENGINEER'S SEALS

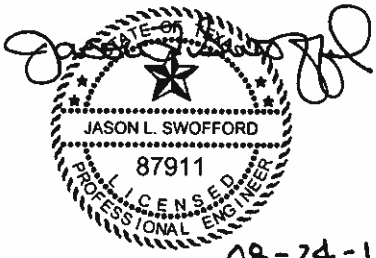
This Master Drainage Plan: 2010 Update was developed for the City of Lubbock, Texas, based on available information and using the ordinary standard of care for such professional engineering services at the time and place of performance in accordance with the agreed scope of services. An engineering team consisting of engineers and support staff from Parkhill, Smith & Cooper, Inc., and Hugo Reed & Associates, Inc., performed the services. Master Drainage Plan: 2010 Update contents are an Executive Summary, Table of Contents, Section 1: Introduction; Section 2: Playa System A; Section 3: Playa System B; Section 4: Playa System C; Section 5: Playa System D; Section 6: Playa System E; Section 7: Playa System F; Section 8: Playa System G; Section 9: Playa System J; Section 10: Playa System K; Section 11: Playa System M; Section 12: Playa System N; Section 13: Playa System P; Section 14: Playa System Q; Section 15: Playa System R; Section 16: Playa System S; Section 17: Playa System T; and Appendix A: Western Contributing Areas. Existing text and graphics were imported from the 1997 Lubbock Master Drainage Plan and 1997 Wolfforth Master Drainage Plan in accordance with the scope of services. The adjustments to the importation of text and graphics were to the graphical NAD 1983 coordinates (from NAD 1927 coordinates) and text to 1988 NAVD elevations (from 1929 NGVD elevations), however, these previous studies were not re-studied nor confirmed. Information from the FEMA Flood Insurance Study incorporated as applicable was not re-studied nor confirmed. Prior HEC-1 and HEC-2 models were converted to HEC-HMS and HEC-RAS, with adjustment by factor or notation, to 1988 NAVD. For those areas not previously master drainage planned, new HEC-HMS and HEC-RAS models and new graphics were developed. Any changes to this Master Drainage Plan: 2010 Update are the responsibility of the person, persons, entity and/or entities making such changes. The responsible Engineers for this 2010 Update are as assigned below.

Executive Summary, Table of Contents, Section 1: Introduction; Appendix A: Western Contributing Areas (Parkhill, Smith & Cooper, Inc.)

8-24-10

F-560

Section 2: Playa System A; Section 3: Playa System B; Section 4: Playa System C; Section 5: Playa System D; Section 6: Playa System E, Section 9: Playa System J; Section 11: Playa System M; Section 13: Playa System P; Section 14: Playa System Q (Hugo Reed & Associates, Inc.)



F-760 08-24-10

Section 7: Playa System F; Section 8: Playa System G; Section 10: Playa System K; Section 12: Playa System N; Section 15: Playa System R; Section 16: Playa System S; Section 17: Playa System T; (Parkhill, Smith & Cooper, Inc.)

8-24-10

F-560

CITY OF LUBBOCK, TEXAS
MASTER DRAINAGE PLAN:
2010 UPDATE

EXECUTIVE SUMMARY

1. GENERAL

In 1997, the City of Lubbock adopted its first Master Drainage Plan. In 2008, the City of Lubbock retained Parkhill, Smith & Cooper, Inc., in association with Hugo Reed & Associates, Inc., to provide professional engineering services to update the 1997 Master Drainage Plan and incorporate new areas of detailed study into the updated plan. This Executive Summary provides a cursory overview of the Master Drainage Plan: 2010 Update.

2. PROJECT SCOPE

The general scope of the project involved several major aspects:

A. Incorporate the graphics and tabular data from the September 28, 2007 effective Flood Insurance Study (FIS) in those watershed subareas where the FIS will govern for playa lake water surface elevations and lake overflow accommodation. This map coverage is primarily related to areas considered already fully urbanized as of the 2007 effective date of the FIS.

B. Incorporate the graphics and data from the 1997 Lubbock Master Drainage Plan with graphical translation from the NAD1927 horizontal coordinate system to the NAD1983 coordinate system, plus data conversion from the 1929NGVD vertical datum to the 1988NAVD vertical datum.

C. Develop data and graphical representations for playa lake water surfaces and lake overflows in the new additional study areas.

D. Convert the existing hydrologic and hydraulic computer simulation models from the 1997 Master Drainage Plan to the 1988NAVD vertical datum.

E. Develop new hydrologic and hydraulic computer simulation models for the new study areas.

F. Develop new shape files and data attributes for the city's Geographical Information System (GIS).

It can be seen from the above list that the master planning effort involved the merging of different datasets, different model simulations, and different graphics sets. The overall master drainage planning area can be seen in Figure ES-1.

2. DETAILED STUDY AREAS

There were 16 detailed study areas investigated or incorporated by the engineering team.

Figure ES-1 shows that the master planning study areas, or FIS-based study areas, mainly lie in western and southern Lubbock with two playa systems (System J and System M) studied in the northeastern portion of the city. These playa lake systems, or study areas, are labeled as Systems A, B, C, D, E, F, G, J, K, M, N, P, Q, R, S, and T. Many of these are continuations of the playa system designations contained in the FIS, however several are new designations where the FIS did not designate or label playa lake systems. The alphabetic labels "H" and "I" were not used since those labels were used

in the FIS for playa systems unaffected or not included in this master drainage plan. Also, the letter "L" was not used for playa lake system designation since "L" is the prefix for each playa lake's identifier.

The detailed study areas plus those areas incorporated from the FIS encompass approximately 242 square miles and 273 playa lakes. Additional areas in Hockley County had the potential to impact Playa Lake Systems B, D and E and the potential impact has been accounted even though detailed contour maps were not available. The additional western areas in Hockley County encompassed an additional 91.5 square miles and an additional 72 playa lakes. These additional western areas are shown in Appendix A of the Master Drainage Plan: 2010 Update and were analyzed only for their potential runoff impacts to the detailed study area.

3. MAPS

For the study, the engineering team used digital one-foot contour maps from the City of Lubbock's map archives, derived from the year 2005 and prior aerial mapping efforts. For areas that lay outside of the one-foot city map coverage, digital USGS maps were used.

4. COMPUTER SIMULATIONS

The master drainage plan development involved extensive computer model data development, or extensive conversion of prior models, and simulations of the computer models to establish predicted playa lake water surface elevations and establish predicted flow rates for those playa lakes expected to overflow. The simulations are based on a 24-hour storm event that, using probability analysis, has a one percent chance of occurrence in any given year. This event is referred to as a 100-year 24-hour storm, which for Lubbock is a 6.8-inch rainfall in a 24-hour period. For lakes that do not overflow, and are predicted to not overflow in a 500-year 24-hour event, then that 500-year event was also included in the analyses. A 500-year 24-hour event, again using probability, has a 0.2 percent chance of occurrence in any given year. For Lubbock, the 500-year 24-hour event is 8.38 inches of rainfall precipitation.

Hydrological computer simulations for the new study areas were performed in the U.S. Army Corps of Engineers HEC-HMS simulation software. Computer simulations incorporated from the 1997 Master Drainage Plan were converted from HEC-1 to HEC-HMS. HEC-1, the hydrological software used for that prior 1997 study, is no longer supported by the Corps of Engineers.

Hydraulic computer simulations for the new study areas were performed using the U.S. Army Corps of Engineers HEC-RAS simulation software. Computer simulations incorporated from the 1997 Master Drainage Plan were converted from HEC-2 to HEC-RAS. HEC-2, the hydraulics software used for that prior 1997 study, is no longer supported by the Corps of Engineers.

HEC-HMS and HEC-RAS are public domain software programs that have been approved by the Federal Emergency Management Agency for flood insurance studies under the National Flood Insurance Program. The software can be downloaded for use directly from the U.S. Army Corps of Engineers Hydrologic Engineering Center web site, or can be purchased on disc for a nominal fee from third-party authorized vendors.

5. PLAYA LAKE CLASSIFICATION

The consulting engineering team classified the playa lakes in the master drainage plan update according to the classifications defined and adopted in the City of Lubbock Drainage Criteria Manual. The playa lake classifications are overflow, marginally non-overflow and true non-overflow. The classifications by playa system are summarized in Table ES-1 along with the playa classification definitions.

6. GEOGRAPHIC INFORMATION SYSTEM

As noted under the earlier project scope paragraphs, the engineering team also developed graphics and data for the city's geographic information system (GIS). Shape files of the lake water level graphics and lake overflow graphics can be electronically overlaid onto the city's aerial photographs and/or contour maps by internal users or external users of the city's mapping web site. Data files, called attribute files in the GIS nomenclature, were formatted as part of the GIS deliverable. Once a lake shape graphic is pulled onto a computer screen, then selecting the lake shape will bring up numerical data such as the predicted water surface elevation and so forth. These GIS shape and attribute files have been loaded onto the city's mapping web site and are available for use.

7. SUMMARY

The City of Lubbock authorized updating the 1997 Master Drainage Plan by converting the 1997 plan to more current horizontal and vertical datums, adding new detailed study areas, and incorporating Flood Insurance Study information where deemed appropriate. Such an updated planning effort was necessary due to newly annexed areas experiencing development pressures, and the migration by FEMA to the newer NAD1983 horizontal coordinate system and the 1988NGVD vertical datum. The planning effort focused on fully-urbanized watershed simulations around playa lakes and potential playa lake overflow routes.

The Lubbock Master Drainage Plan: 2010 Update, in conjunction with the City of Lubbock Drainage Criteria Manual, will serve the city well for the following reasons:

A. Development in predicted flood-prone areas can be avoided or mitigated and the potential for flood-prone problems associated with future annexations can be reduced.
B. Playa lake overflow routes have been identified, thus providing developers and city staff with information where greenbelts, channels, structural measures, or increased finished floor elevations might be necessary.
C. The Master Drainage Plan: 2010 Update information can be used to help protect the safety and welfare of the public and associated property, and help reduce the future potential for flood damages and financial loss. Avoidance of flood damages through proper planning is much more economical than retro-fitting structural drainage systems once urbanization has occurred.
D. The digital GIS files developed for the electronic interface with the city's mapping base will allow developers from any part of the United States to see where their anticipated development might be affected by predicted playa lake water surface levels or predicted playa lake overflows.
E. The City has an extensive library of hydrological and hydraulic computer models of the planning area for future analyses.

END

TABLE ES-1 PLAYA LAKE CLASSIFICATIONS BY SYSTEM					
Playa System	**Detailed Study Area (Acres)**	**Total No. of Playa Lakes Studied**	**No. of Overflow Playa Lakes[1]**	**No. of Marginally Non-Overflow Playa Lakes[2]**	**No. of True Non-Overflow Playa Lakes[3]**
A	5,235	11	9	0	2
B	7,300	13	3	0	10
C	6,110	6	4	0	2
D	18,000	22	11	1	10
E	26,768	47	30	3	14
F	5,888	15	12	0	3
G	11,900	24	8	2	14
J	3,938	10	7	2	1
K	25,500	43	24	1	18
M	1,834	4	4	0	0
N	6,952	16	5	1	10
P	10,085	17	13	1	3
Q	1,875	4	3	0	1
R	18,530	36	22	0	14
S	1,965	2	2	0	0
T	2,837	3	1	0	2
Total	154,718	273	158	11	104

Notes:

[1]An overflow playa lake is a lake that does not have sufficient storage capacity to totally contain the combined storm runoff volume from its sub-basin's initial condition runoff, plus its sub-basin's urbanized condition 100-year 24-hour storm event runoff plus the volume contributed to it from upstream overflow playa lakes. The initial condition for all playa lakes is 70 percent sub-basin runoff from a two-inch storm (1.4 inches of runoff) in playa lake storage prior to the 100-year 24-hour storm event (6.8 inches of rainfall).

[2]A marginally non-overflow playa lake has sufficient storage volume to totally contain the combined runoff from its sub-basin's initial condition runoff plus its sub-basin's urbanized condition 100-year 24-hour storm event runoff plus the volume contributed to it from upstream overflow playa lakes. The predicted water surface elevation based on the combined runoff volumes is one-half foot or less below the playa lake's natural overflow crest elevation.

[3]A true non-overflow playa lake has sufficient storage volume to totally contain the combined runoff from its sub-basin's initial condition runoff plus its sub-basin's urbanized condition 100-year 24-hour runoff plus the volume contributed to it from upstream overflow playa lakes. The predicted water surface elevation based on the combined runoff volumes is greater than one-half foot below the playa lake's natural overflow crest elevation.

Both the marginally non-overflow and the true non-overflow playa lakes may exhibit overflow characteristics when analyzed for the 500- year 24-hour storm event (8.38 inches of rainfall).

N

5000' 2500' 0 5000' 10000' 20000'

LEGEND

Study Area Limits 2010 MDP	SYSTEM P	Name of 2010 MDP Study Areas
Study Area Limits 2007 FIS	SYSTEM F	Name of 2007 FIS Study Areas
Study Area Limits 1997 MDP	SYSTEM G	Name of 1997 MDP Study Areas
City Limits 2010		
187 Section Numbers		

CITY OF LUBBOCK, TEXAS
MASTER DRAINAGE PLAN

JULY 2010

FIGURE ES-1
EXECUTIVE SUMMARY

HUGO REED AND ASSOCIATES, INC.

PARKHILL SMITH & COOPER

CITY OF LUBBOCK, TEXAS
MASTER DRAINAGE PLAN

TABLE OF CONTENTS

EXECUTIVE SUMMARY
TABLE OF CONTENTS

SECTION 1: INTRODUCTION
1.1 General
1.2 Scope
1.3 Procedure
1.4 Hydrologic Conditions
1.4.1 Soils
1.4.2 Existing Land Use
1.4.3 Future Land Use
1.4.4 Times of Concentration
1.4.5 Lake Storage
1.5 Hydraulic Conditions
1.6 Computer Models
1.7 Master Plan Limitations
1.8 Label Conventions
1.9 Legend
1.10 Master Plan Format
Figure 1-1

SECTION 2: PLAYA SYSTEM A
2.1 General
2.2 Western Contributing Areas
2.3 Playa Lakes
2.4 Overflow Routes
2.5 System A Plan Maps
Table 2-1 – 2-2
Figure 2-1 – 2-13
Table AA-1 – AA-3

SECTION 3: PLAYA SYSTEM B
3.1 General
3.2 Western Contributing Areas (1997 LMDP)
3.3 Playa Lakes
3.4 Overflow Routes
3.5 System B Plan Maps
Table 3-1 – 3-2
Figure 3-1 – 3-17
Table AB-1 – AB-3

SECTION 4: PLAYA SYSTEM C
4.1 General
4.2 Western Contributing Areas
4.3 Playa Lakes
4.4 Overflow Routes
4.5 System C Plan Maps
4.6 Additional Lakes
Table 4-1 – 4-2
Figure 4-1 – 4-14

SECTION 5: PLAYA SYSTEM D
5.1 General
5.2 Western Contributing Areas (1997 LMDP)
5.3 Playa Lakes
5.4 Overflow Routes
5.5 System D Plan Maps
Table 5-1 – 5-2
Figure 5-1 – 5-32
Table AD-1 – AD-3

SECTION 6: PLAYA SYSTEM E
6.1 General
6.2 Western Contributing Areas (1997 LMDP)
6.3 Playa Lakes
6.4 Overflow Routes
6.5 System E Plan Maps
Table 6-1 – 6-2
Figure 6-1 – 6-42
Table AE-1 – AE-3

SECTION 7: PLAYA SYSTEM F
7.1 General
7.2 Western Contributing Areas
7.3 Playa Lakes
7.4 Overflow Routes
7.5 System F Plan Maps
Table 7-1 – 7-2
Figure 7-1 – 7-12
Table AF-1 – AF-3

SECTION 8: PLAYA SYSTEM G
8.1 General
8.2 Western Contributing Areas
8.3 Playa Lakes
8.4 Overflow Routes
8.5 System G Plan Maps
Table 8-1 – 8-2
Figure 8-1 – 8-21
Table AG-1 – AG-3

SECTION 9: PLAYA SYSTEM J
9.1 General
9.2 Western Contributing Areas
9.3 Playa Lakes
9.4 Overflow Routes
9.5 System J Plan Maps
Table 9-1 – 9-2
Figure 9-1 – 9-11
Table AJ-1 – AJ-3

SECTION 10: PLAYA SYSTEM K
10.1 General
10.2 Western Contributing Areas
10.3 Playa Lakes
10.4 Overflow Routes
10.5 System K Plan Maps
Table 10-1 – 10-2
Figure 10-1 – 10-30
Table AK-1 – AK-3

SECTION 11: PLAYA SYSTEM M
11.1 General
11.2 Western Contributing Areas
11.3 Playa Lakes
11.4 Overflow Routes
11.5 System M Plan Maps
Table 11-1 – 11-2
Figure 11-1 – 11-8
Table AM-1 – AM-3

SECTION 12: PLAYA SYSTEM N
12.1 General
12.2 Western Contributing Areas
12.3 Playa Lakes
12.4 Overflow Routes
12.5 System N Plan Maps
Table 12-1 – 12-2
Figure 12-1 – 12-11
Table AN-1 – AN-3

SECTION 13: PLAYA SYSTEM P
13.1 General
13.2 Western Contributing Areas
13.3 Playa Lakes
13.4 Overflow Routes
13.5 System P Plan Maps
Table 13-1 – 13-2
Figure 13-1 – 13-18
Table AP-1 – AP-3

SECTION 14: PLAYA SYSTEM Q
14.1 General
14.2 Western Contributing Areas
14.3 Playa Lakes
14.4 Overflow Routes
14.5 System Q Plan Maps
Table 14-1 – 14-2
Figure 14-1 – 14-6
Table AQ-1 – AQ-3

SECTION 15: PLAYA SYSTEM R
15.1 General
15.2 Western Contributing Areas
15.3 Playa Lakes
15.4 Overflow Routes
15.5 System R Plan Maps
Table 15-1 – 15-2
Figure 15-1 – 15-27
Table AR-1 – AR-3

SECTION 16: PLAYA SYSTEM S
16.1 General
16.2 Western Contributing Areas
16.3 Playa Lakes
16.4 Overflow Routes
16.5 System S Plan Maps
Table 16-1 – 16-2
Figure 16-1 – 16-5
Table AS-1 – AS-3

SECTION 17: PLAYA SYSTEM T
17.1 General
17.2 Western Contributing Areas
17.3 Playa Lakes
17.4 Overflow Routes
17.5 System T Plan Maps
Table 17-1 – 17-2
Figure 17-1 – 17-6
Table AT-1 – AT-3

APPENDIX A
Figure A-1 – A-6