

## **IV. Existing Stormwater System Data**

### **A. Data and Information Sources**

As shown in Table IV-1, data is available to help Leavenworth manage its stormwater conveyance system. However, as the system develops, additional types of information will become available, and its management will become increasingly important. The Public Works Department must decide not only how data will be collected, processed, organized, and distributed, but also what information is necessary to properly plan, regulate, design, build, and maintain the physical system.

The foresight of Leavenworth's Public Works Department in developing a city-wide Geographic Information System (GIS) has proven very beneficial to the completion of this master plan and the inclusion of a data management component. The use of GIS has made it possible to develop this master plan and to initiate the data management strategy for the stormwater conveyance system. The data entered and stored in the GIS include historic flooding locations, questionnaire responses, and hydrologic and hydraulic modeling data.

Table IV-1 presents a summary of data collected and used in this study. A brief description of the contents of each piece of information is provided in Appendix C.

### **B. Stormwater Ordinances and Design Criteria Assessment**

The City of Leavenworth regulates its stormwater system through the following documents:

- Zoning Ordinance 1985 as Amended through July 1992, City of Leavenworth.
  - Article II. District Regulations, Section 21.212 Flood Plain.
  - Article V. Site Plan Review.
- "Report on Stormwater Drainage, Leavenworth, Kansas," 1967, Black & Veatch.
- Memo to City Public Works Department from City Attorney, May 1995.

**Table IV-1  
Summary of Data Collected**

Number	Title of Document
<b><u>Utility Maps</u></b>	
1	Stormwater Sewer Maps (M.J. Harden) Sections 1, 2, 3, 4 (SE), 6 (SW), 7 (NW,SW), 9(NE), 10, 11, 12, 13 (NE,NW), 14 (NE,NW), 15 (NE), 18 (NW), 25 (SE,SW,NW), 26, 27, 34, 35, 36
2	Leavenworth, Kansas Scale: 1 inch = 500 feet
<b><u>Data on Recent Improvement Projects</u></b>	
3	Storm Drainage Improvements 17th St. & Vilas St. Leavenworth, Kansas  Storm Drainage Improvements 5th Ave. & South St. Leavenworth, Kansas
4	4th Street at the Veteran's Hospital Access Road Leavenworth, Kansas
5	Hometown Village P.U.D. Phase I
6	Storm Sewer Line 1 As-Built Plans Leavenworth Plaza Shop Center
7	Grading Plan - WalMart Storm Sewer Profiles
<b><u>Development Plans</u></b>	
8	State of Kansas Department of Transportation Kansas Project West Leavenworth Trafficway Leavenworth County City of Leavenworth
9	West Leavenworth Annexation Plan Future Land Use Existing Land Use
10	City of Leavenworth, Kansas 760 Cherokee Drainage Improvements

**Table IV-1  
Summary of Data Collected**

Number	Title of Document
<b><u>Aerial Photos</u></b>	
11	Aerial photos of the Leavenworth area:  T.8.S., R.22.E; Sections: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36  T.9.S., R.22.E; Sections: 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29  T.9.S., R.23.E; Sections: 6, 7, 18, 19, 30  T.8.S., R.23.E; Section 31
<b><u>FEMA Flood Plain Studies and Maps</u></b>	
12	Flood Insurance Study, County of Leavenworth, Kansas Unincorporated Areas
13	Flood Insurance Study City of Leavenworth, Kansas
<b><u>Complaint Files and Reports</u></b>	
14	Stormwater Management Questionnaire
15	Telephone Memorandum
<b><u>City Design Standards for Storm Sewers</u></b>	
16	Shawnee Steel & Welding, Inc. 6" Steel Inlet Frame-Welded
17	City of Leavenworth, Kansas Office of the City Engineer Type "A" Curb Inlet Detail
18	City of Leavenworth, Kansas Asphaltic Concrete Paving C. & G. Details
<b><u>City Ordinances/Codes</u></b>	
19	Zoning Ordinance 1985 as Amended through July 1992, City of Leavenworth

<b>Table IV-1 Summary of Data Collected</b>	
Number	Title of Document
<b><u>Soils Reports</u></b>	
20	State Soil Geographic Data Base (STATSGO)
<b><u>Corps of Engineers Studies</u></b>	
21	Flood Plain Information Five Mile Creek Leavenworth, Kansas
22	Flood Plain Information Three Mile Creek Leavenworth, Kansas
<b><u>USGS Maps and Studies</u></b>	
23	Leavenworth Quadrangle Map
<b><u>Other Past Studies</u></b>	
24	Report on Stormwater Drainage Leavenworth, Kansas
25	City of Leavenworth FEMA Damage Report, Site 1 through 33
<b><u>Street and Bridge Data</u></b>	
26	City of Leavenworth, Kansas Bridges (20 or more feet in length)
27	Map of Leavenworth, Kansas Wards & Precincts
28	Shopping Guide and Membership Directory
29	Figure 16 Arterial and Collector Streets
30	Report on 1993, Biennial Bridge Inspection
31	Bridge Reports and Inventory System for Kansas (BRISK) diskette, Version 2, Release 3
32	Construction Layout, Bridge over Three Mile Creek
33	7th Street Bridge over Three Mile Creek, Construction Layout
34	Construction Layout, Bridge over Three Mile Creek
35	Construction Layout & Geology, Bridge over Three Mile Creek

<b>Table IV-1 Summary of Data Collected</b>	
Number	Title of Document
36	Construction Project 1961-54
37	Construction Project 1964-75
38	Construction Project 1964-75
39	Ottawa Street Bridge and Approach at Three Mile Creek, Sheets 1 & 2 of 10
40	Project No. 52U-0807-01, 083-164, Sheet 3 of 14
41	Project 1967-10
42	5th Street Bridge over Three Mile Creek
43	6th Street Bridge and Approach at Three Mile Creek
44	Construction Layout, 10th Street Bridge
45	Construction Layout, Bridge over Five Mile Creek
46	Construction Layout, U.S.-73 over Five Mile Creek
47	Limit Street Bridge over Five Mile Creek
48	Shrine Park Road Bridge over Five Mile Creek Construction Layout
<b><u>Hydrologic Data</u></b>	
49	Rainfall Intensity Tables for Counties in Kansas
50	Final Report K-TRAN Research Project KU-93-5 Rainfall Inputs for Simulation of Design Floods in Kansas
<b><u>Historical Flooding Data</u></b>	
51	Historic Flooding Locations, B&V Memorandum
<b><u>References</u></b>	
52	Stormwater Management Model, Version 4, User's Manual
53	XP-SWMM User's Manual, Version 2
<b><u>Other</u></b>	
54	Missouri River Gauge Data

These documents provide authority for the City to control the quality and conveyance of stormwater, and the technical criteria to design and operate a stormwater conveyance system.

Article II. District Regulations, Section 21.212 Flood Plain, of the zoning ordinance, addresses development in the flood plain and outlines the limitations on development in the flood plain for different types of structures and land uses. According to this source, the provisions for flood plain protection are adopted pursuant to the authorization contained in Kansas Statutes Annotated, Sections 12-705, 12-707, 12-710, and 12-734-735.

The intent of Article V. Site Plan Review of the zoning ordinance is to provide the City with sufficient information to review all development proposals and assure compliance with the requirements established in these regulations.

Storm sewer design criteria are based on the following recommendations in the 1967 Black & Veatch study:

- Calculation of peak flow rates using the Rational Method.
- The level of protection in residential areas should be for a five-year return period storm, a 10-year return period storm in commercial and high value areas, and a 100-year return period storm where topography would cause deep water in commercial and high value areas.
- Calculation of conveyance system capacities using Manning's equation.

A new storm drainage design manual was prepared concurrently with this master plan report. This document specifies the design criteria for a storm sewer system. Information provided includes capacity requirements; channel and sewer pipe sizes, grades, materials, depths and locations; sewer manholes, inlets, extraneous connections; and provisions for siltation/soil erosion control and stormwater retention/detention. A separate subdivision manual contains requirements related to construction documents.

In May of 1995, the Leavenworth City Attorney presented to the Public Works Department a summary of the City's legal responsibilities regarding storm drainage. The presentation focused on legal issues for municipalities in Kansas. A list of specific questions was developed jointly by the Citizen's Stormwater Committee, Public Works staff, and Black & Veatch staff, and the attorney's responses have been incorporated into the General Policy, as indicated in Chapter VII of this report.

In general, the City's stormwater ordinances are adequate but not in an easily retrievable form. Each city has its own method for analysis, design, and enforcement of stormwater-related policies. There is no single correct method or policy--the policies that are in line with the City's philosophy for stormwater management are best and most appropriate for the City officials and the residents. Policies/regulations that are not included in the new storm drainage design manual, but which the City may wish to review, include the following:

- **Other Design Tools**

The Rational Formula is the hydrologic design method stipulated in the new Storm Drainage Design manual. It is a widely used and appropriate method for estimating flows for the design of stormwater conveyance systems. With the development of this master plan, the City may want to consider expanding the hydrology section to include XP-SWMM as a basis for the analysis and design of conveyance system components for subcatchments larger than a stipulated area.

- **More Stringent Flood Plain Regulations**

Although not generally favored by developers and land owners, stringent flood plain regulations, in addition to those adopted by FEMA, can prove beneficial in the future. The City may consider restricting construction in the flood plain to minimum elevation above the 100-year floodwater level.

- **Include Property Acquisition as a Standard Improvement Alternative**

Although purchase of properties is detrimental to the City's tax base, property acquisition can be a cost-effective method of reducing the extent of flood damage, and redevelopment of the property to a park or open space (designed to allow flooding), can produce recreational and aesthetic benefits that far outweigh the loss of tax revenue.