

Cardwell Branch Watershed Master Plan

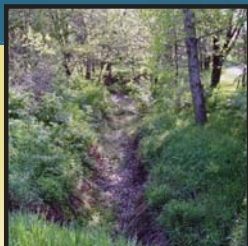
September 2007

Study Report

CDM

In Association With:
Applied Ecological Services

*Mead & Hunt
Heartland Center*



The background of the page is an aerial photograph of a rural landscape, showing a grid of fields and some buildings. Overlaid on this are several semi-transparent colored rectangles: a large blue one in the top left, a yellow one in the top right, a large yellow one in the bottom left, and a blue one in the bottom right. A solid black vertical bar runs along the right edge of the page.

CDM

9200 Ward Pkwy, Ste 500 | Kansas City, MO 64114 | 816.444.8270 | www.CDM.com

Cardwell Branch

Watershed Master Plan

STUDY REPORT

September 2007

CDM

Contents

Executive Summary	ES-1
-------------------------	------

Section 1 - Introduction and Purpose

1.1	Introduction.....	1-1
1.2	Goals and Objectives	1-2
1.3	Public Participation Process	1-4
1.3.1	Open House Events.....	1-4
1.3.2	Newsletter and Website	1-5
1.3.3	Information Meetings	1-5

Section 2 - Watershed Inventory and Methodology

2.1	Watershed Inventory	2-1
2.2	Phase 1 Summary Discussion	2-2
2.3	Study Methodology	2-7
2.3.1	Hydrologic and Hydraulic Evaluation.....	2-7
2.3.2	Geomorphic Evaluation.....	2-7
2.3.3	Water Quality Assessment.....	2-7

Section 3 - Water Quality Assessment

3.1	Introduction.....	3-1
3.2	USGS Stream-Ecology Assessment	3-1
3.3	Methodology	3-2
3.3.1	Natural Resource Assessment	3-2
3.3.2	Stream Asset Inventory	3-3
3.3.3	Recommendation Rationale.....	3-4
3.4	Results and Conclusions.....	3-5
3.4.1	Natural Resource Assessment Results	3-5
3.4.2	Stream Asset Inventory Results.....	3-8
3.4.3	Conclusions	3-11
3.5	Watershed Management Recommendations.....	3-11
3.5.1	Riparian Corridor Enhancements	3-11
3.5.2	Stormwater Management Practices	3-12
3.5.3	Opportunity Area Locations.....	3-17
3.5.4	Vegetative Maintenance/Restoration/Protection Efforts	3-17
3.5.5	Habitat Corridors and Connectivity.....	3-18
3.5.6	Stream Stabilization Measures	3-19

Section 4 - Fluvial Geomorphic Evaluation

4.1	Introduction.....	4-1
4.2	USGS Geomorphic Assessment.....	4-1
4.3	Geomorphic Field Reconnaissance	4-3

4.4	Evaluation Results	4-3
4.4.1	Stream Stage Classification	4-3
4.4.2	Summary Discussion	4-5
4.5	Stream Improvements.....	4-6
Section 5 - Capital Improvement Projects		
5.1	Problem Identification	5-1
5.1.1	Drainage Infrastructure	5-1
5.1.2	Habitable Buildings.....	5-1
5.1.3	Natural Streams	5-2
5.2	Primary Problem Area Improvements	5-3
5.2.1	Capital Improvement Projects	5-3
5.2.2	Prioritization	5-14
5.3	Secondary Problem Area Improvements	5-15
5.3.1	Habitable Building	5-15
5.3.2	Natural Streams	5-20
Section 6 - Implementation		
6.1	Policy and Ordinances	6-1
6.2	Maintenance and Funding	6-1
6.3	Education Program.....	6-2
6.4	Coordination Efforts.....	6-2
Section 7 - Glossary of Terms and References		7-1
Appendices		
<i>Appendix A - Digital Deliverables</i>		
<i>Appendix B - Public Participation Materials</i>		
<i>Appendix C - Stream Reach Descriptions/USGS Data Tables</i>		
<i>Appendix D - Drainage Structure Design Data</i>		
<i>Appendix E - Opinion of Probable Construction Costs</i>		
<i>Appendix F - Priority Ranking Worksheets</i>		
<i>Appendix G - Structural BMP Implementation Guidance</i>		

Tables

5-1 Cardwell Branch Priority Ranking Results5-15

Figures

1-1 Cardwell Branch Study Area Map 1-1
1-2 City of Lincoln Comprehensive Watershed Management Plan..... 1-3
2-1 Cardwell Branch Floodprone Areas2-3
2-2 Tile 1 Floodprone Area Map 2-4
2-3 Tile 2 Floodprone Area Map2-5
2-4 Tile 3 Floodprone Area Map 2-6
3-1 Cardwell Branch Existing Woodland Riparian Corridors and Native Prairie.....3-7
3-2 Cardwell Branch Stream Quality Rating 3-9
3-3 Cardwell Branch Watershed Management Recommendations3-16
4-1 Channel Evaluation Model (Simon 1989) 4-2
4-2 Cardwell Branch Geomorphic Processes..... 4-4
4-3 Cardwell Branch Shear Stress Values 4-7
4-4 Newbury-Style Grade Control Structure..... 4-8
5-1 Cardwell Branch CIP Locations 5-4
5-2 Cardwell Branch Secondary Problem Area Locations.....5-16
5-3 Cardwell Branch Potential Regional Detention Basin5-18

Acronyms

AES	Applied Ecological Services
BMP	best management practice
CD	compact disc
CDM	Camp Dresser & McKee Inc.
City	City of Lincoln
CIPs	capital improvement projects
County	Lancaster County
CRP	Conservation Reserve Program
CWA	Clean Water Act
DO	dissolved oxygen
EPA	U. S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	geographic information system
HC	Heartland Center for Leadership Development
LID	low impact development
M&H	Mead & Hunt
Master Plan	Cardwell Branch Watershed Master Plan
NDEQ	Nebraska Department of Environmental Quality
NPDES	National Pollutant Discharge Elimination System
NRD	Natural Resources District
SAI	stream asset inventory
USGS	United States Geologic Survey
WMA	wildlife management area
WQCV	water quality control volume
WSEs	water surface elevations