RESOLUTION NO. 4529-2011

A RESOLUTION OF THE CITY OF GRAND PRAIRIE, TEXAS, APPROVING THE CITY OF GRAND PRAIRIE'S CITY-WIDE DRAINAGE MASTER PLAN FOR CEDAR CREEK.

WHEREAS, The "City-Wide Drainage Master Plan for Cedar Creek" (the Plan) provides, within budget constraints, comprehensive, updated technical data for the cost-effective management of flood or storm waters in the Cedar Creek watershed; and

WHEREAS, the Plan addresses existing flooding, erosion, and sedimentation problems within the watershed and provides planning alternatives and design concepts to help alleviate potential flood damages; and

WHEREAS, the Plan provides the City of Grand Prairie with the necessary updated drainage information to coordinate future development according to the City's drainage requirements to help minimize existing and potential flood damages within the Cedar Creek watershed; and

WHEREAS, any revisions to the floodplain and the floodways identified in these studies shall also include ultimate development conditions and shall be for the whole creek as determined in these studies and not for portions of it to ensure that there are no downstream adverse effects; required submittals to FEMA shall be for the whole creek (as determined in these studies) and not for portions of it; and

WHEREAS, the recommendations, alternatives and design concepts of this report shall be incorporated for all future development as well as CIP budget considerations, set the standard for future drainage master plans, address existing flooding problems as well as possible developer participation projects;

NOW THEREFORE, BE IT RESOLVED, BY THE CITY COUNCIL OF THE CITY OF GRAND PRAIRIE, TEXAS THAT:

SECTION 1. That the City of Grand Prairie, Texas, approves and adopts the "City-Wide Drainage Master Plan for Cedar Creek".

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF GRAND PRAIRIE, TEXAS, ON THIS THE 18th DAY OF OCTOBER, 2011.

APPROVED:

Charles England, Mayor

ATTEST:

City Secretary

APPROVED AS TO FORM:

City Attorney

City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek (Y#0845)

for

City of Grand Prairie

Prepared by:

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16000 Dallas Parkway
Suite 350
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TBPE Reg. No. F-3580

August 2011

Table of Contents

I. Introduction I-1
A. Acknowledgments I-1
B. Purpose of Study I-1
C. City Ordinances and Development Requirements I-1
D. Watershed Description I-2
D.1 Major Streams and Tributaries I-2
D.2 Unique Attributes of Watershed I-3
E. Principal Erosion and Flooding Problems I-3
E.1 Drainage Complaint Database I-3
E.2 Hot Spot Locations I-3
F. Pertinent Study and Technical Data Related to Watershed Prior to Cedar Creek Master Plan Preparation I-4
F.1 Existing Data I-4
II. Hydrologic Studies II-1
A. General II-1
B. Watershed II-1
C. Land Use II-2
D. Impervious Coverage II-2
E. Soil Types II-2
F. Loss Rates II-2
G. Unit Hydrograph Methodology II-3
H. Rainfall II-3
I. Flood Routing II-3
III. Hydraulic Studies III-1
A. Hydraulic Analyses III-1
IV. Hydrologic and Hydraulic Study Results IV-1
A. Hydrologic Study Results IV-1
B. Hydraulic Study Results IV-3
C. Quality Assurance / Quality Control IV-3
V. Floodplain Mapping V-1
VI. Roadway Crossings VI-1
A. Evaluation of Existing Roadway Crossings VI-1
B. Evaluation of Proposed and Future Roadway Crossings VI-1
VII. Alternatives for Streams and Open Channels VII-1

A. Areas of Concern VII-1
B. Improvement Projects VII-1
B.1 Improvement Project #1a – Increased Flood Protection at Robinson Road Crossing VII-2
B.2 Improvement Project #1b – Increased Flood Protection at Prairie Lane VII-2
B.3 Improvement Project #2 – Protection of Polo Road Embankment and Meandering Bank in the Vicinity of Station 89+00 ..... VII-3
B.4 Improvement Project #3 – Protection of 18-inch Sanitary Sewer Line Crossing at Station 94+55 ..... VII-3
B.5 Improvement Project #4 – Protection of 18-inch Sanitary Sewer Line at Station 116+60 ..... VII-4
B.6 Improvement Project #5 – Protection of 18-inch Sanitary Sewer Line at Stations 125+00 and 123+65 ..... VII-4
B.7 Improvement Project #6 – Protection of 18-inch and 8-inch Sanitary Sewer Line Crossings at Station 139+90 and Station 135+50 ..... VII-5
B.8 Improvement Project #7 – Hydrogeomorphic Stability of Creek at Station 130+75 ..... VII-5
B.9 Improvement Project #8 – Protection of 8-inch Sanitary Sewer Line and Scour Hole at Station 158+00 ..... VII-5
B.10 Improvement Project #9 – Protection of 15-inch Sanitary Sewer Line and Concrete Flume at Stations 154+60, 153+40, and 153+00 ..... VII-6
B.11 Improvement Project #10 – Protection of 90-inch Storm Drain Outfall Structure at Station 149+50 ..... VII-6
B.12 Improvement Project #11 – Protection of Storm Drain Outfall Structures at Various Locations Along the Creek VII-6
B.13 Improvement Project #12 – Periodic Maintenance Projects VII-7
C. Other Improvements Evaluated VII-7
C.1 Increased Flood Protection at Matthew Road Crossing VII-7
C.2 Floodplain Reclamation of Original Cedar Creek Alignment (Downstream of 72-inch Outfall at Robinson Road) VII-7
VIII. Storm Water Infrastructure Analysis VIII-1
IX. Channel Stability Assessment/Erosion Hazard Analysis IX-1
A. Overview IX-1
B. Field Observations IX-1
C. Hydrogeomorphic Analysis IX-1
D. Recommended Improvements IX-3
X. Dams/Levees/Detention/Drainage Reviews X-1
A. Dams/Levees X-1
B. Detention Ponds X-1
B.1 Detention Pond Evaluation X-4

XI. Maintenance – (Cedar Creek)..... XI-1
XII. Preliminary Quantities/Estimates of Probable Cost XII-1
XIII. Evaluation & Prioritization/Phasing & Implementation..... XIII-1
A. Evaluation & Prioritization..... XIII-1
1. Ranking Criteria..... XIII-1
2. Ranking Methodology..... XIII-2
B. Phasing & Implementation..... XIII-4
XIV. Short Term Priorities & Long Term Plan XIV-1
A. Short-Term Priorities Implementation..... XIV-1
B. Long-Term Plan Implementation..... XIV-1
XV. Master Study Plan Wrap-up & Recommendations for Future Action..... XV-1
A. Streams and Open Channels..... XV-1
B. Future Studies & Report..... XV-1
C. Future Development in the Watershed..... XV-1

List of Tables

Table II-1 - Rainfall Depth/Duration for the Cedar Creek Study Area II-3
Table IV-1 - Subbasin Characteristics IV-1
Table IV-2 - Existing Discharges IV-1
Table IV-3 - Ultimate Discharges IV-2
Table VII-1 - Erosion Site Locations VII-1
Table VII-2 - Improvement Project Priority Classification VII-2
Table VII-3 - WSEL Comparison for Flood Plain Reclamation of Original Cedar Creek Alignment VII-8
Table IX-1 - Equilibrium vs. Existing Slope IX-2
Table IX-2 - Equilibrium Channel Dimensions IX-2
Table XII-1 – Breakdown of Opinion of Probably Costs XII-1
Table XIII-1 - Short Term & Long-Term Implementation Plan XIII-6

List of Figures

Figure 1 – Vicinity Area Map
Figure 2 – Drainage Area Map
Figure 3 – Land Use Map
Figure 4 – Future Land Use Map
Figure 5 – Soils Map
Figure 6 – Topographic Work Map
Figure 7 – Exiting Flood Profiles
Figure 8 – Ultimate Flood Profiles
Figure 9 – Proposed Improvements Plan & Profile Sheets

List of Appendices

Appendix A – Pertinent Figures
Appendix B – Pertinent Tables
Appendix C.1 –HEC-HMS Results
Appendix C.2 – HEC-RAS Results
Appendix D – Storm Drain Model Output (StormCAD)
Appendix E.1 – Cedar Creek Channel Assessment for the City of Grand Prairie
Appendix E.2 – Roadway Crossing Evaluation
Appendix E.3 – Improvement Project Photo Log
Appendix E.4 – QA/QC Response to Comments
Appendix F – CD-ROM

Executive Summary

The City-wide Drainage Master Plan for Cedar Creek provides comprehensive, updated technical data for the management of the Cedar Creek watershed. The information presented in this report provides planning alternatives and design concepts, and will supply the City of Grand Prairie with the necessary updated drainage information to coordinate future development and help minimize existing and potential erosion damages within the Cedar Creek watershed. This study is in compliance with the requirements set forth in the "City-wide Drainage Master Plan Roadmap."

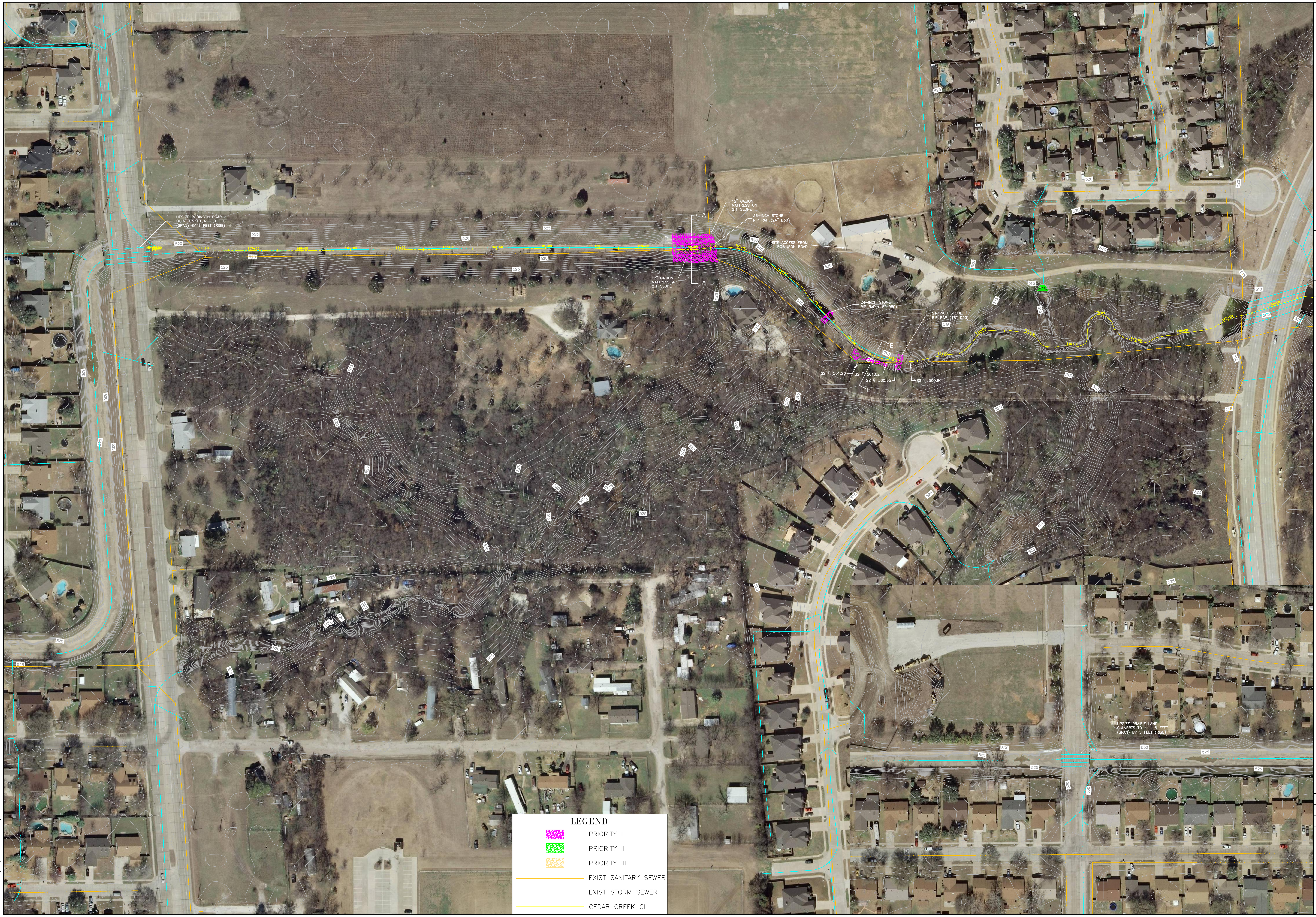
Three of the six crossings along Cedar Creek are currently inundated by the 100-year flood in the Cedar Creek watershed. The watershed is currently 65% residential, 25% vacant, 6% commercial and 4% agricultural. Upstream of Robinson Road, the watershed consists of all residential development with some scattered vacant lots. The watershed downstream of Robinson Road is generally residential development with some vacant areas, and scattered with areas of agricultural and commercial land use.

Based on a hydrogeomorphic analysis, AECOM determined that the creek would downcut in an attempt to reach its desired equilibrium slope. The improvement projects recommended in this report primarily consist of erosion protection, sanitary sewer line protection, and upsizing of crossings that provide a greater level of flood protection and access.

A process of assigning ranking factors was utilized to rate short-term and long-term priority projects based on criteria from Section II.G of the City of Grand Prairie City-wide Drainage Master Plan Road Map and is described in detail in ***Section XIII*** of this report.

Many of the recommended improvement projects, when implemented, will require regular maintenance and continued inspection of the watershed to ensure their integrity. AECOM is also recommending periodic maintenance of the Bardin Road, Polo Road, and Carrier Parkway crossings. Based on field observations and survey data, all three crossings are experiencing on average 1 to 3 feet of siltation, and should be regularly cleaned to ensure all the culverts are capable of passing their design flows.

This report is intended to be a living document that can be updated as additional information becomes available.



MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM

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16000 DALLAS PARKWAY
SUITE 350
DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK OVERALL PROJECT MAP

CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	1"= 100'

OVERALL CIP MAP

AECOM No.:
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Plot Time: Aug 11, 2011 @ 12:39pm sukheswallaz

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

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CEDAR CREEK
OVERALL PROJECT MAP
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
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OVERALL CIP MAP

AECOM No.:
File: Q:\30931-GrandPrairie\60157406_CedarCreekMDP\CADD\Sheet\C1-CedarCreek-Overall.dwg
Plot Time: Aug 11, 2011 @ 12:40pm sukheswallaz

Short-Term & Long-Term Implementation Plan

Cedar Creek Watershed

	Capital Improvement Project	Project Size & Short-Term/Long-Term	Step 1 - Initial Ranking Factor - Estimate of Probable Cost vs. # Structures Benefited [1]			Step 2 - Second Ranking Factor - Cost to Benefit of Roadway Number of Citizens Impacted [2]							Step 3 - Tax Value of Benefited Property Structures [7]		Sum of 1st, 2nd, and 3rd Factors - Step 4	Initial Rank - Step 4	100-Year Ultimate Discharge at CIP Location - Step 5		Final Rank - Step 6
			# Structures	Cost	1st Factor [1]	Type	Roadway Flood Event Protection	Roadway % Citizens Protected [3]	Roadway % Citizens Impacted [4]	Roadway # Citizens Impacted [5]	Cost to Benefit Roadway # Citizens Impacted [6]	2nd Factor	Tax Value of Property Structures Benefited	3rd Factor	Total	Rank [8]	Ultimate Q_{100}	Sorting [9]	Rank [10]
1	**Project 1** - Robinson Road & Prairie Lane Crossings	Medium/Short-Term	0	$547,000	4	PD4	25-year	70%	30%	2340	$233.76	1	$0	20	25	1	2,630	1	1
2	**Project 2** - RB & Polo Rd Embankment Protection at RS 89+00	Small/Short-Term	0	$464,000	3	M4U	100-year	100%	n/a	n/a	n/a	2	$0	20	25	2	3,920	2	2
3	**Project 3** - SS & LB Protection at RS 94+55	Small/Short-Term	0	$40,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,920	3	3
4	**Project 4** - SS & LB Protection at RS 116+60	Small/Short-Term	0	$298,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	4	4
5	**Project 5** - SS & LB Protection at RS 125+00 & 123+65	Small/Short-Term	0	$325,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	5	5
6	**Project 6** - SS Protection at RS 139+90 & 135+50	Small/Short-Term	0	$61,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	6	6
7	**Project 7** - Prevention of Knick Point Migration at RS 130+75	Small/Short-Term	0	$37,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	7	7
8	**Project 8** - SS & Scour Protection at RS 158+00	Small/Short-Term	0	$288,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	2,630	8	8
9	**Project 9** - SS & Concrete Flume Protection at RS 154+60, 153+40, & 153+00	Small/Short-Term	0	$176,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	2,515	9	9
10	**Project 10** - SD Outfall Protection at RS 149+50	Small/Short-Term	0	$41,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	2,515	10	10
11	**Project 11** - Various SD Outfall Protection	Small/Long-Term	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	n/a	3	n/a	11	11
12	**Project 12** - Periodic Maintenance	Small/Long-Term	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	n/a	3	n/a	12	12

1 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 1
2 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 2
3 Based on approximation, using logarithmic chart, with 1-Year Event coverage protecting 0% of traffic volume and 100-Year Event coverage protecting 100% of traffic volume
4 Percent Impacted = 100% minus % of Roadway Citizens Protected (approximate)
5 Number Impacted = % Impacted multiplied by [No. Lanes * 4 Hours Impacted * Hourly Volume Per Lane * Level of Service "C" Traffic Volume]
6 Cost of CIP divided by Roadway # Citizens Impacted
7 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 3
8 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 4
9 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 5
10 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 6

Additional Notes:

a. Phased projects shall be ranked in order of Phasing (i.e. Phase 1 shall be ranked higher than Phase 2, etc.)

I. Introduction

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

I. Introduction

A. Acknowledgments

AECOM would like to acknowledge the significant contributions of all City of Grand Prairie staff in preparation of the City-wide Drainage Master Plan. In particular, the following individuals have provided invaluable input and assistance:

Romin Khavari – City Engineer

Gabriel Johnson – Floodplain Administrator

Stephen Crawford – Halff Associates

B. Purpose of Study

This study is in compliance with the requirements set forth in the "City-wide Drainage Master Plan Road Map." The purpose of the Cedar Creek Drainage Master Plan is to provide comprehensive, updated technical data for the management of the Cedar Creek watershed streams and storm water infrastructure. The information presented in this report will provide the City of Grand Prairie with the necessary updated drainage information to coordinate future development according to the City's drainage requirements and help minimize existing and potential flood and erosion damages within the Cedar Creek watershed. The Cedar Creek Drainage Master Plan provides recommended channel improvements to alleviate existing and potential flooding and erosion and stabilize stream banks while helping Cedar Creek reach its equilibrium state. Estimates of probable costs to implement these recommended improvements are also included.

This report compiles existing and newly developed data for the Cedar Creek watershed into one document. This Drainage Master Plan also provides a summary of the procedures used for the technical analyses, a summary of results of these analyses, and supporting technical data and illustrative figures. The technical analyses performed include a detailed hydrologic and hydraulic study of Cedar Creek, as well as a detailed study of the stream geomorphology performed by Peter Allen, PhD., PG.

Specific objectives of the Drainage Master Plan for Cedar Creek:

I. Collect all relevant data, including current topographic data, project area as-builts, survey data, existing and future land use, and soils data.
II. Prepare existing and ultimate conditions HEC-HMS 3.4 and HEC-RAS 4.1.0 models for the 10-, 50-, 100-, and 500-year storm events and perform a roadway crossing evaluation for all crossings along Cedar Creek in the project area.
III. Perform a channel stability and erosion hazard assessment to include a detailed geomorphology study of the channel's characteristics.
IV. Perform a restoration analysis to analyze factors influencing the stream's stability, and formulate conceptual alternatives to help stabilize the stream.
V. Prepare pre-design estimates of probable construction costs for the conceptual alternative improvements.

C. City Ordinances and Development Requirements

As part of the City-wide Drainage Master Plan study, the City's Drainage Design Manual and existing development requirements were reviewed to determine their adequacy to prevent future flooding and

erosion issues. The lower portion of the Cedar Creek watershed is only partially developed at this time and proper drainage requirements and responsible development of the watershed will help prevent future erosion damages.

The City of Grand Prairie is especially progressive in their storm water management program. The City's Drainage Design Manual was updated as recently as October of 2010 and is intended to "…protect the general health, safety, and welfare of the public by reducing flooding potential, controlling excessive runoff, minimizing erosion and siltation problems, and eliminating damage to public facilities resulting from uncontrolled storm water runoff."

Articles 14 and 15 of the Unified Development Code, included in the City's Drainage Design Manual, contain the City ordinances for Drainage and Floodplain Management, respectively. Requirements include the elevation of new construction a minimum of one foot above the ultimate 100-year floodplain or two feet above the existing conditions floodplain, whichever is higher. Construction of detention basins is required when downstream facilities are not adequately sized to convey a design storm based on current City criteria for hydraulic capacity. Post project peak flows are not allowed to exceed the existing condition peak flows unless sufficient downstream capacity above existing discharge conditions is available. When required, detention facilities are to be designed such that peak discharges or velocities are not increased when compared to pre-project conditions for the 2-, 10-, and 100-year floods.

The City ordinances allow for responsible development of the watershed such that flood risks to future structures can be minimized. The ordinances also allow for protection of existing structures so that future development will not increase the flooding hazard in areas that do not have the capacity to convey increased flood discharges. Upon review of the City's Drainage Design Manual and existing development requirements, it has been determined that the requirements in combination with the technical data provided in the report are adequate to properly manage the watershed going forward.

D. Watershed Description

The study area is applicable to Cedar Creek (FEMA Stream 8C5), located in Grand Prairie, Dallas County, Texas (***Figure 1***). The Cedar Creek watershed is located north of Joe Pool Lake and south of Interstate 20, bounded by Lake Ridge Parkway to the west, and Bardin Road to the east. The watershed has a total area of approximately 1,130 acres (1.77 square miles) and drains generally from west to east through a series of storm drains, culverts and open channels until it reaches the limits of the study, just downstream of Bardin Road (***Figure 2***). The study reach of Cedar Creek extends approximately 17,280 feet (3.27 miles), from just downstream of Kite Road to approximately 170 feet downstream of Bardin Road.

Based on existing land use, the watershed was found to be mainly residential, with scattered vacant, commercial, and agricultural areas (***Figure 3***). The upper portion of the watershed, from Kite Road to Robinson Road, is fully developed consisting primarily of residential lots with a small amount of undeveloped lots. The future land use (***Figure 4***) shows most of these vacant lots as a residential classification with the currently agricultural land in the middle reaches of the watershed zoned for commercial and residential classifications.

D.1 Major Streams and Tributaries

The watershed consists of approximately 17,280 linear feet of Cedar Creek and no other significant streams or tributaries. Cedar Creek is designated as a detailed 100-year flood hazard zone (AE) according to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panels 0445J and 0465J, Dallas County and Incorporated Areas effective August 23, 2001. The effective mapping was revised on March 29, 2007 by Case No.06-06B413P (Carter & Burgess Inc. LOMR).

D.2 Unique Attributes of Watershed

The Cedar Creek watershed has erosion issues along the natural portion of the creek where it is encroaching in to existing utilities such as sanitary sewers. The upper half of the watershed drains in to a concrete-lined channel which is large enough to convey the 100-year storm event. The lower half (downstream of Robinson Road) of the creek is natural with all creek-side houses outside the 100-year floodplain. As such, there are no known flooding complaints reported for the Cedar Creek watershed.

E. Principal Erosion and Flooding Problems

Beginning in 1972, the Cedar Creek watershed began its transition from an agricultural area to the largely residential area it is today. This development has resulted in increased runoff entering the channel. The reach between Kite Road and Robinson Road, that runs through residential neighborhoods is concrete-lined and currently has no erosion issues. Between Robinson Road and Bardin Road, Cedar Creek is in its natural state except for a concrete flume that runs from Robinson Road to approximately 1,000 feet east of Robinson Road. Although this reach is experiencing severe erosion and bank failures the creek is generally not near any homes and does not pose an immediate threat to any habitable structures. However, these erosion issues are posing a serious threat to an existing 18-inch sanitary sewer that parallels the creek and crosses it at several locations. The bank failures and general instability of the creek are also beginning to undercut the existing roadway embankment of Polo Road, between the Polo Road and Bardin Road crossings.

Appendix E.1 discusses in detail specific areas of change in the channel and key erosion sites. As indicated earlier, much of the erosion and bank instabilities found throughout Cedar Creek are due to downcutting as the creek attempts to stabilize to its equilibrium slope. As outlined in Dr. Allen's report, a typical stream life span goes through four stages. A majority of Cedar Creek is in Stage II with a small portion upstream of Polo Parkway in Stage III. Downcutting is commonly found in Stage II streams; where the stream incises until its side slopes reach a critical slope failure height. As it widens and deepens in Stage III, it will reduce the tractive force and velocity of the water and at a certain point begin to stabilize through deposition (Stage IV). A solution to remediate the specific erosion problems occurring along the creek are discussed in detail in ***Section VI*** of the report.

The City of Grand Prairie's floodplain management has helped prevent flooding problems throughout much of the Cedar Creek watershed. The concrete lined portion of Cedar Creek has been designed to carry the 100-year frequency storm, and as result any flooding issues along this portion of the channel are due to roadway crossings being undersized. The natural portion of Cedar Creek runs through a largely undeveloped area, and therefore causes no flood complaints.

E.1 Drainage Complaint Database

AECOM obtained the latest drainage compliant information from the City of Grand Prairie and evaluated all current drainage complaints. None of the existing drainage complaints appeared to be a result of Cedar Creek flooding. In all cases, the complaints were far from the creek itself and consisted of street and property flooding due to inadequate inlet/storm drain capacity. No drainage related complaints were found in the database along Cedar Creek near the Prairie Lane, Matthew Road, and Robinson Road crossings where current modeling shows a possibility of flooding in homeowner's yards.

E.2 Hot Spot Locations

Hot spot locations for the Cedar Creek watershed were located along Nadine and Sandra Lane between Matthew and Robinson Road. The City has recently completed an ongoing project to address these hot spot areas.

F. Pertinent Study and Technical Data Related to Watershed Prior to Cedar Creek Master Plan Preparation

F.1 Existing Data

I. 2006 Carter and Burgess Letter of Map Revision (LOMR): FEMA Case No.06-06-B413P

In 2006, Carter and Burgess performed a LOMR on a portion of Cedar Creek from approximately 2,500 upstream of Carrier Parkway to approximately 620 feet upstream of Polo Road, which became effective on March 29, 2007. The LOMR was prepared to incorporate updated topographic information, channel relocation, the construction of 5-10'x8' box culverts at Carrier Parkway, an overflow weir, and the placement of fill along Cedar Creek from immediately downstream of Robinson Road to approximately 620 upstream of Polo Road. The hydraulic study resulted in a revised delineation of the regulatory floodway, decreases and increases in the Special Flood Hazard Area (SFHA) width, and increased and decreased Base Flood Elevations (BFEs) for the revised reach.

II. Hydrologic Studies

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

II. Hydrologic Studies

A. General

A hydrologic analysis was conducted by AECOM for the Cedar Creek watershed utilizing the U.S. Army Corps of Engineers (USACE) HEC-HMS (Version 3.4) computer program. HEC-HMS models were developed for both existing and ultimate (i.e., fully developed) hydrologic conditions.

Drainage boundaries were delineated based on 2009 City of Grand Prairie 1-foot contours and available City storm drain information. All drainage boundaries were verified during AECOM's field reconnaissance trip on June 16, 2010. The overall drainage area map is shown in ***Figure 2***.

The 2-, 5-, 10-, 25-, 50-, 100-, and 500-year storm events were developed and analyzed for this study. AECOM utilized the detailed watershed delineation, existing and future land use determinations, and the hydrologic soil coverage to develop the HEC-HMS model for the Cedar Creek watershed. The City of Grand Prairie Drainage Design Manual, Volume 1 (November 2008) along with Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55) were used as guidelines for the hydrologic analysis.

B. Watershed

Cedar Creek is a tributary to Mountain Creek located in Grand Prairie, Texas, originating just downstream of the Kite Road storm drain outfall and generally flowing eastward before turning north approximately 1,850 feet downstream of Bardin Road. The total contributing watershed area draining to Cedar Creek is approximately 1,130 acres or 1.77 square miles.

Cedar Creek is approximately 3.27 miles in length with an average slope of 0.38%. In terms of geomorphic characteristics, Cedar Creek can be split into four distinct segments:

- Kite Road to Robinson Road,
- Robinson Road to Carrier Parkway,
- Carrier Parkway to Polo Parkway, and
- Polo Parkway to Bardin Road.

From the Kite Road storm drain outfall to Robinson Road (approximately 7,480 feet) the creek is concrete lined. This segment of Cedar Creek runs through a residential development and is well-maintained. At Robinson Road the channel transitions to a concrete-lined bottom with natural earthen, grass/tree-lined banks. Approximately 1,090 feet downstream of Robinson Road the channel becomes completely natural as it continues to Carrier Parkway. This segment, from Robinson to Carrier, consists of "rural" housing and is well manicured. From Carrier Parkway to Polo Parkway the natural channel meanders through a heavily wooded area until it opens up at Friendship Park, approximately 860 feet upstream of Polo Parkway. From Polo Parkway to downstream of Bardin Road the channel remains natural and is surrounded by light to heavy woods.

For this study, the Cedar Creek watershed was subdivided into 12 subbasins. Watershed characteristics such as drainage area, land use, soil type, and lag time were determined for each subbasin.

C. Land Use

Existing

Existing land use for Cedar Creek was provided by the City of Grand Prairie and was based on their 2009 zoning. Based on the existing land use, the watershed was found to be approximately 65% residential, 25% vacant, 6% commercial and 4% agricultural. Upstream of Robinson Road, the watershed consists of all residential development with some scattered vacant lots. The watershed downstream of Robinson Road is generally residential development or vacant areas, with scattered areas of agricultural land and commercial development. ***Figure 3*** illustrates the existing conditions land use for the Cedar Creek watershed.

Future

Future land use for Cedar Creek was provided by the City of Grand Prairie and was based on the 2009 zoning maps. Based on the future land use the watershed will be approximately 82% residential, 11% vacant, 7% commercial and no agricultural areas. ***Figure 4*** illustrates the anticipated future conditions land use for the Cedar Creek watershed.

D. Impervious Coverage

Percent impervious is a function of the various land uses within a watershed. *The City of Grand Prairie Drainage Design Manual Volume 1 (December, 2010), Table 4.1C* was used as a guide to assign percent impervious values to specific land use areas. Each project parcel was assigned a land use type and a corresponding percent impervious was assigned to that parcel. A composite percent impervious was computed for each of the 12 subbasins for both existing and ultimate conditions.

E. Soil Types

The Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database was used to calculate each subbasin's curve number. The project area is approximately 95% Hydrologic Soil Type D, with a small portion of Type B soils found between Robinson Road and Carrier Parkway and in the downstream extents of the creek. The hydrologic soils for the Cedar Creek watershed are shown in ***Figure 5***.

The antecedent moisture condition (AMC) defines the soil moisture condition prior to a storm. AMC-II was used in this study for the average soil moisture conditions.

F. Loss Rates

The Curve Number Loss methodology developed by the NRCS was used to estimate infiltration losses. Curve numbers were computed based on a composite percentage of soil types within each subbasin. Group B soils were assigned a curve number of 61 and Group D soils were assigned a curve number of 80 based on *Technical Release-55 Table 2.2c*, for pasture, grassland, or range for good hydrologic condition.

The above discussed hydrologic parameters were computed for existing and ultimate conditions and can be found in ***Table IV.1***.

G. Unit Hydrograph Methodology

The SCS Unit Hydrograph methodology was used to develop lag times for each subbasin. The time of concentration for each of the 12 subbasins was calculated using the Grand Prairie Drainage Design guidelines for overland (sheet) flow and shallow concentrated flow and an assumed velocity of six feet per second (fps) for channelized flow.

H. Rainfall

The standard 24-hour rainfall duration storm event, for watersheds larger than 500 acres, was used to establish rainfall parameters for the Cedar Creek watershed. Point rainfall depths were obtained from Table 5.4B – Depth-Duration Data of The City of Grand Prairie's Drainage Design Manual (December 2010).

Table II-1 - Rainfall Depth/Duration for the Cedar Creek Study Area

Return Period	Point Rainfall Depths (inches) for Cedar Creek Study Area							
(years)	5-min	15-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
1-yr	0.39	0.76	1.49	1.81	1.99	2.41	2.80	3.21
2-yr	0.49	1.04	1.85	2.22	2.45	2.91	3.45	3.95
5-yr	0.57	1.22	2.45	3.00	3.30	3.90	4.70	5.40
10-yr	0.63	1.36	2.86	3.55	3.85	4.65	5.50	6.40
25-yr	0.73	1.56	3.35	4.15	4.55	5.45	6.50	7.50
50-yr	0.80	1.71	3.82	4.65	5.15	6.20	7.35	8.52
100-yr	0.87	1.87	4.25	5.20	5.70	6.92	8.40	9.55
500-yr	1.00	2.20	5.40	6.60	7.40	8.80	10.50	12.00

* Table 5.4B - City of Grand Prairie Drainage Design Manual (December 2010)

I. Flood Routing

The Modified-Puls routing method was used to establish storage-outflow relationships based on steady state HEC-RAS analyses developed for Cedar Creek. A multi-profile HEC-RAS 4.1.0 run was created for existing conditions, and the results from this run were used to develop storage-outflow relationships for the reaches along Cedar Creek.

III. Hydraulic Studies

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845

III. Hydraulic Studies

A. Hydraulic Analyses

The hydraulic analysis for the study was performed using HEC-RAS v4.1.0. This program determines the water surface elevations (WSELs) based on geometric characteristics along the stream. The geometric characteristics include cross sections, channel length, channel slope, and Manning's n-values. An existing conditions HEC-RAS model was developed and existing and ultimate flows were run through the model.

Cross sections were placed where hydraulic changes occurred in the system and at the upstream and downstream faces of hydraulic structures. Cross sections were cut from the 2009 city-wide 1-foot contour data using HEC-GeoRAS (Version 4.2.93). These cross sections were supplemented with field survey data performed by Marshall Lancaster and Associates (MLA) in July 2010. Cross section locations are displayed in ***Figure 6*****.**

Manning's n-values were assigned to each cross section based on AECOM's field reconnaissance, 2009 aerial photos, and digital photos taken by AECOM and MLA. A Manning's n-value of 0.015 was assumed for all concrete-lined portions of the channel. For modeling purposes, it was assumed that all culvert structures had no sediment or debris accumulation during a flood event.

The Modified-Puls routing method was used to account for storage in the floodplain along Cedar Creek and its corresponding effect on hydrograph timing and peak discharge. ***Figure 2*** shows the analysis points along the creek.

Lateral Weir at Robinson Road

Approximately, 1000 feet upstream of the Robinson Road crossing, Cedar Creek makes an abrupt 90-degree turn to the north and runs parallel to Robinson Road before turning back to the east and passing through the culverts under Robinson Road. Based on initial model runs, it was determined that flows could potentially escape from the right overbank (Robinson Road roadway profile) and overtop the road prior to reaching the culvert crossing. This resulted in flow lost from the west side (upstream face) to the east side (downstream face) of Robinson Road. In order to account for this transfer of flow, a lateral weir was placed between cross-sections 17754 and 17041. These cross-sections were truncated at the upstream face cross-section (17007) of Robinson Road. The tail water for the lateral weir was set to the upstream face of Robinson Road. In terms of modeling, this would allow the upstream face of Robinson Road and the culverts to see the full flow approaching Robinson Road and allow the model to determine an appropriate headwater elevation based on the existing culvert capacity and roadway profile.

The starting WSEL for the model was based on the normal depth slope (0.19%) of Cedar Creek. Computed peak discharges from AECOM's HEC-HMS hydrologic model for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year frequency floods for both existing and ultimate conditions were entered into the HEC-RAS hydraulic model. A CD containing all hydrologic and hydraulic models used in the study is included with this report in ***Appendix F***.

IV. Hydrologic and Hydraulic Study Results

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

IV. Hydrologic and Hydraulic Study Results

A. Hydrologic Study Results

AECOM prepared a detailed HEC-HMS hydrologic model for the Cedar Creek watershed to analyze the existing and ultimate watershed conditions for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year frequency storm events. The Modified-Puls routing method was used to attenuate the runoff hydrographs for Cedar Creek.

Table IV.1 is a list of computed hydrologic parameters including drainage areas, lag times, composite curve numbers, and percent impervious for existing and ultimate conditions.

Table IV-1 - Subbasin Characteristics

Subbasin	Drainage Area (ac.)	Existing Lag Time (min.)	Ultimate Lag Time (min.)	Composite Base Curve Number	Existing % Impervious	Ultimate % Impervious
S-1	139	18.17	7.77	80	45	60
S-2	143	19.62	19.62	80	62	63
S-3	62	13.12	13.12	80	61	61
S-4	66	15.68	15.68	80	38	39
S-5	83	14.43	14.43	80	63	64
S-6	83	16.82	16.82	78	30	32
S-7	183	14.43	14.43	79	48	61
S-8	116	46.96	16.59	76	35	49
S-9	79	15.63	15.63	80	23	26
S-10	79	10.81	10.81	80	46	62
S-11	21	22.79	22.79	79	23	25
S-12	75	11.90	11.90	77	49	51

A complete summary of calculated discharges for existing and ultimate conditions is shown in ***Table IV.2*** and ***Table IV.3***, respectively. ***Figure 2*** can be referenced for subbasin and analysis point locations corresponding to the ones used in the tables. A copy of the HEC-HMS results is located in ***Appendix C.1***.

Table IV-2 - Existing Discharges

Analysis Point	Description	Contributing Drainage Area (sq mi)	Peak Discharge (cfs)						
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
J-1	Kite Road Storm Sewer Outfall	0.22	260	390	480	580	660	740	925
J-2	Matthew Road Crossing	0.44	500	725	930*	1,150	1,315	1,460	1,800

Analysis Point	Description	Contributing Drainage Area (sq mi)	Peak Discharge (cfs)						
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
J-3	Prairie Lane Crossing	0.64	660	940	1,170*	1,525	1,840	2,095	2,520
J-5	Robinson Road Crossing	0.77	740	1,055	1,275	1,540	1,970*	2,350	3,015
J-6	Tributary Confluence	0.90	745	1,110	1,350	1,605	1,915	2,225	2,945
J-7	Carrier Pkwy Crossing	1.37	955	1,490	1,840	2,200	2,555	2,975	3,985
J-9	Polo Road Crossing	1.49	970	1,550	1,935	2,345	2,685	3,090	4,155
J-10	412-ft D/S of Polo Road	1.65	1,005	1,640	2,070	2,535	2,925	3,290	4,375
J-12	Bardin Road Crossing	1.76	1,015	1,685	2,140	2,630	3,055	3,445	4,525

*Storm event overtopping crossing (represented by shaded cell)

Table IV-3 - Ultimate Discharges

Analysis Point	Description	Contributing Drainage Area (sq mi)	Peak Discharge (cfs)						
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
J-1	Kite Road Storm Sewer Outfall	0.22	415	575	680	805	900	995	1,200
J-2	Matthew Road Crossing	0.54	630	925*	1,120	1,335	1,500	1,665	2,055
J-3	Prairie Lane Crossing	0.64	775	1,155*	1,435	1,905	2,125	2,315	2,860
J-5	Robinson Road Crossing	0.77	835	1,225	1,470	1,895*	2,380	2,695	3,390
J-6	Tributary Confluence	0.90	845	1,250	1,505	1,835	2,165	2,485	3,230
J-7	Carrier Pkwy Crossing	1.37	1,055	1,675	2,090	2,510	2,900	3,335	4,445
J-9	Polo Road Crossing	1.49	1,080	1,770	2,220	2,690	3,080	3,500	4,665
J-10	412-ft D/S of Polo Road	1.65	1,125	1,900	2,395	2,925	3,355	3,805	4,980
J-12	Bardin Road Crossing	1.76	1,145	1,955	2,475	3,045	3,500	3,975	5,165

*Storm event overtopping crossing (represented by shaded cell)

The differences in flows from existing to ultimate conditions are due to anticipated development within the watershed. This results in an increase in percent impervious and a reduction in lag times, resulting in larger ultimate conditions flows.

B. Hydraulic Study Results

The HEC-RAS hydraulic model of Cedar Creek and the City of Grand Prairie 2009 1-foot contour data were used to delineate the 100-year existing and ultimate floodplains. The floodplains were delineated using RAS Mapper and manually altered in areas with available field survey data. The delineations of the existing and ultimate 100-year floodplains are illustrated in the Topographic Work Map (***Figure 6***). Flood profiles of Cedar Creek for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year frequency floods are provided for existing conditions in ***Figure 7*** and ultimate conditions in ***Figure 8***. HEC-RAS output files of Cedar Creek for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year frequency floods are provided for existing and ultimate conditions in ***Appendix C.2.***

The hydraulic results indicate that the ultimate 100-year flood elevations are slightly higher than the existing 100-year flood elevations. The average increase is approximately 0.3 feet, with the maximum increase of 0.81 feet occurring just downstream of Kite Road.

C. Quality Assurance / Quality Control

Quality assurance / quality control for the hydrologic and hydraulic studies was performed by a third party reviewer (Halff Associates) in September 2010 and April 2011. The QA/QC comments and responses are included in ***Appendix E.4*** of this report.

V. Floodplain Mapping

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

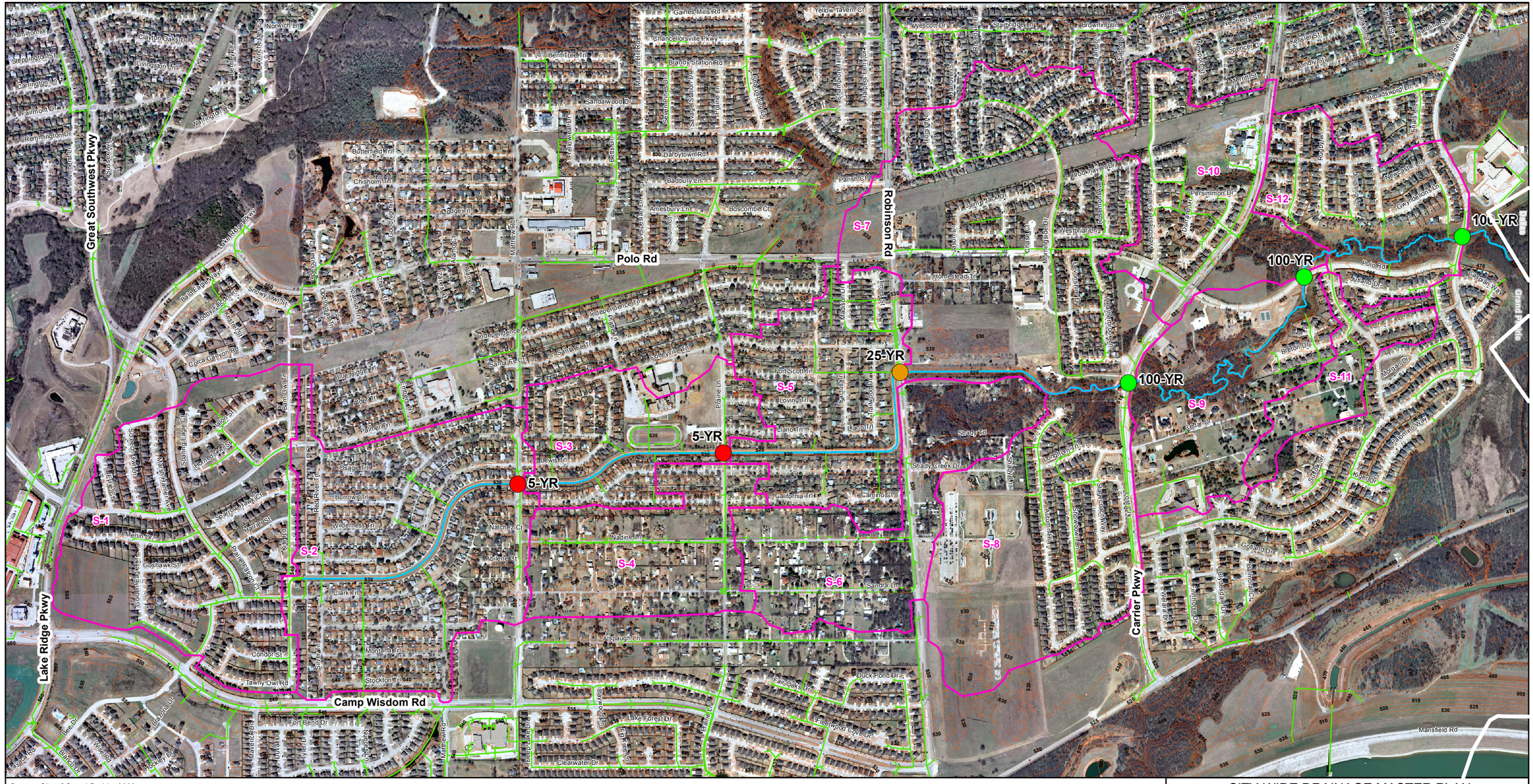
V. Floodplain Mapping

As part of the City-wide Drainage Master Plan for Cedar Creek, AECOM was originally contracted to map Cedar Creek using the City of Grand Prairie 2009 LIDAR data. AECOM prepared a Letter of Map Revision (LOMR) application for submittal dated August 11, 2010; however, during the submittal meeting the City informed AECOM of a pending Cooperating Technical Partner (CTP) agreement between the City and FEMA that would cover the remapping effort of Cedar Creek moving forward. At that point, it was decided to abandon the LOMR application and pursue the mapping of Cedar Creek under a separate contract named the Cedar Creek FEMA CTP Mapping (Y#0880). This project includes preparation of hydrology and hydraulic data as well as the preparation of Digital Flood Insurance Rate Maps (DFIRMs). The existing and ultimate 100-year floodplains prepared for Cedar Creek as part of this drainage master plan can be found in *Figures 6a and 6b*.

VI. Roadway Crossings

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)



Source: City of Grand Prairie, 2009

Legend

Flood Protection

- 100-YR
- 25-YR
- 5-YR

- Cedar Creek Stream Centerline
- Watersheds
- Storm Sewers
- 5-ft Contours

N

0 1,000 2,000 Feet

CITY-WIDE DRAINAGE MASTER PLAN FOR CEDAR CREEK (Y#0845)

ROADWAY CROSSINGS

AECOM TECHNICAL SERVICES, INC.
16000 DALLAS PARKWAY, SUITE 350
DALLAS, TEXAS 75248
WWW.AECOM.COM
TBPE REG. NO. F-3580

Date: 08/11	Project No.: 60185331	Figure VI-1

VI. Roadway Crossings

A. Evaluation of Existing Roadway Crossings

AECOM performed a Roadway Crossing Evaluation (***Appendix E.2***) for Cedar Creek. The crossings were evaluated on their level of protection against the existing and ultimate 2-, 5-, 10-, 25-, 50-, 100- and 500-year frequency storm events. It was determined that the Bardin Road, Polo Road, and Carrier Parkway crossings are able to pass all flood events for existing and ultimate conditions assuming the crossings are maintained free and clear of sediment and debris accumulation.

Based on AECOM's site visits and MLA's survey data, it should be noted that these three crossings experienced 1 to 3 feet of siltation on average. The Robinson Road crossing will be overtopped by the 50-year existing condition and larger storm events as well as the 25-year and larger ultimate conditions storm events. The Prairie Lane and Matthew Road crossings will be overtopped by the 10-year existing conditions and 5-year ultimate conditions storm events. Pertinent hydraulic data for existing and ultimate conditions for each crossing can found in ***Table VI.1***.

Table VI.1 – Roadway Crossing Summary

Crossing	Description	Upstream Channel Station	Upstream Flow Line (ft)	Min Over--toping Elev (ft)	Existing 100-year WSEL at US Face (ft)	Ultimate 100-Year WSEL at US Face (ft)	Existing Conditions Flood Frequency Protection
Matthew Road	3-8'x4' CBC	12832	526.36	533.00	533.64	533.74	5-year
Prairie Lane	4-8'x4' CBC	19610	523.09	530.00	531.21	531.34	5-year
Robinson Road	4-9'x5' CBC	17007	519.27	529.00	529.75	530.00	25-year
Carrier Parkway	5-12'x8' CBC	14399	501.64	516.15	509.54	509.92	100-year
Polo Road	6-10'x8' CBC	10557	478.65	491.33	487.27	487.80	100-year
Bardin Road	8-10'x7' CBC	7989	467.23	480.68	476.53	477.17	100-year

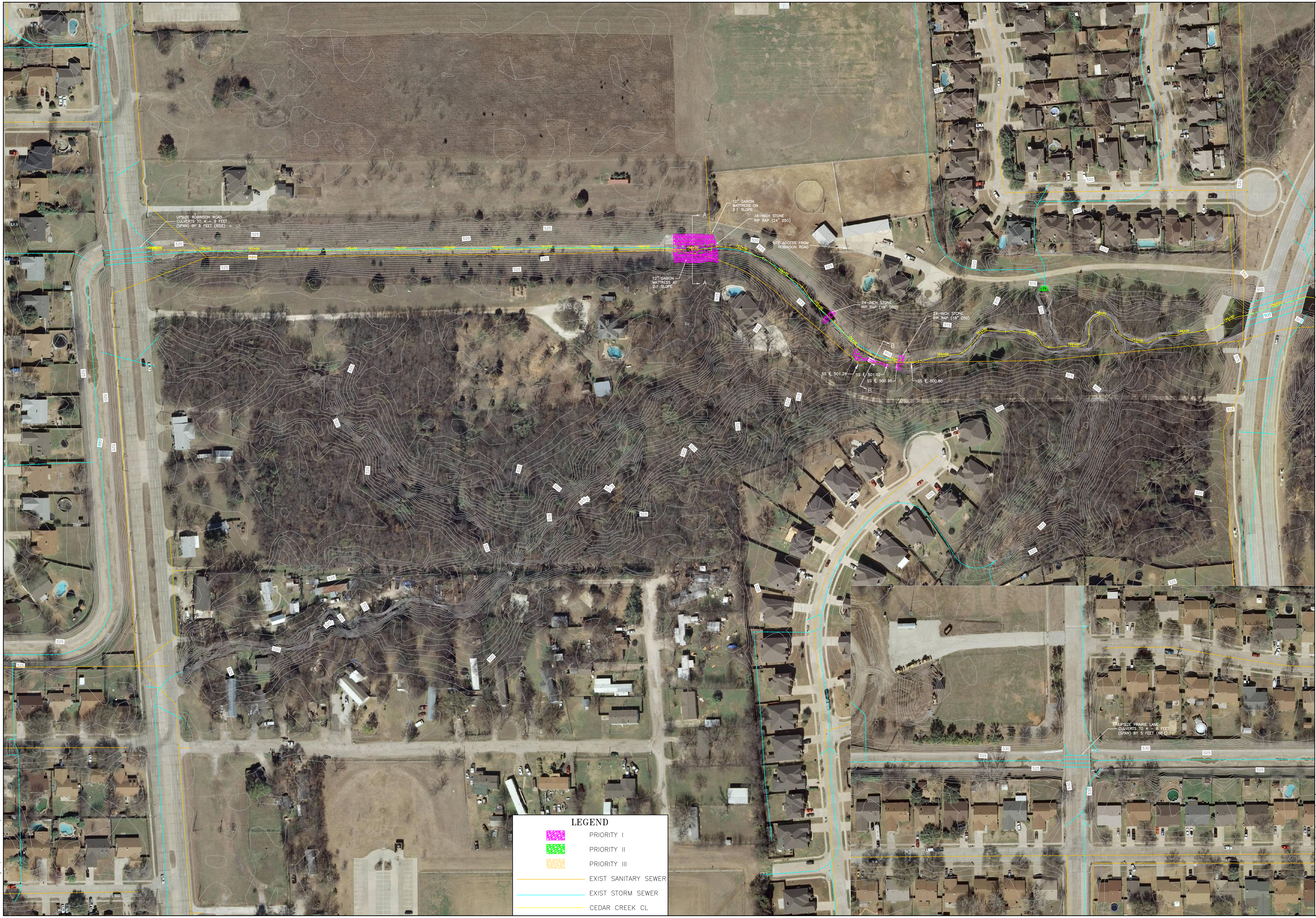
B. Evaluation of Proposed and Future Roadway Crossings

There are no proposed and future roadway crossings planned along Cedar Creek at this time.

VII. Alternatives for Streams and Open Channels

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)



MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM

AECOM TECHNICAL SERVICES, INC.
16000 DALLAS PARKWAY
SUITE 350
DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK
OVERALL PROJECT MAP

CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	1"= 100'

FIGURE VII-1
SHEET 1 OF 2

AECOM No.:
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Plot Time: Aug 11, 2011 @ 12:39pm sukheswallaz

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

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TBPE REG. NO. F-3580

CEDAR CREEK
OVERALL PROJECT MAP

CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	1"= 100'

FIGURE VII-1
SHEET 2 OF 2

AECOM No.:
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Plot Time: Aug 11, 2011 @ 12:40pm sukheswallaz

VII. Alternatives for Streams and Open Channels

A. Areas of Concern

AECOM, in conjunction with City staff, evaluated the flooding and erosion sites and the recommendations from the hydrogeomorphic study (***Appendix E.1***) to prepare a list of areas of immediate and potential concern. ***Table VII.1*** presents the flooding and erosion sites along the creek.

Table VII-1 - Erosion Site Locations

Station	Description
169+43	Robinson Road overtopping during 50-year flood event
158+00	Large scour hole; 8" SS line 1.7' below channel bottom
154+60	Seepage and undercutting of concrete flume
153+40	Right bank erosion; 15" SS line 2-5 feet from right bank
153+00	Seepage and undercutting of concrete flume
149+50	Scour underneath apron/ headwall of storm drain outfall
139+90	18" SS line under creek; Prevention of knick point progression
135+50	18" SS line under creek; Prevention of knick point progression
130+75	Prevention of knick point progression
125+00	Left bank erosion; 18" SS line protection; Prevention of knick point progression
123+65	Left bank erosion; 18" SS line protection; Prevention of knick point progression
116+60	Left bank erosion; 18" SS line protection; Prevention of knick point progression
94+55	Left bank erosion; 18" SS line protection; Prevention of knick point progression
89+00	Deteriorating roadway embankment toe; Prevention of knick point progression

B. Improvement Projects

AECOM developed twelve (12) stream and open channel improvement projects (***Table VII.2***) within the Cedar Creek watershed which consisted of erosion protection, sanitary sewer line protection, hydrogeomorphic related projects, and proposed roadway/stream crossing improvements for existing crossings being overtopped by various flooding events. A process of assigning ranking factors was utilized to rate short-term and long-term priority projects based on criteria from **Section II.G** of the City of Grand Prairie City-wide Drainage Master Plan Road Map and as described in detail in ***Section XIII*** of this report. A detailed breakdown of the cost estimates for each of these improvement projects is included in ***Appendix B***.

Table VII-2 - Improvement Project Priority Classification

Improvement Project #	Description	OPPC
Project 1a	Increased Flood Protection at Robinson Road	$373,000
Project 1b	Increased Flood Protection at Prairie Lane	$174,000
Project 2	RB & Polo Rd Embankment Protection at RS 89+00	$464,000
Project 3	SS & LB Protection at RS 94+55	$40,000
Project 4	SS & LB Protection at RS 116+60	$298,000
Project 5	SS & LB Protection at RS 125+00 & 123+65	$325,000
Project 6	SS Protection at RS 139+90 & 135+50	$61,000
Project 7	Prevention of Knick Point Migration at RS 130+75	$37,000
Project 8	SS & Scour Protection at RS 158+00	$288,000
Project 9	SS & Concrete Flume Protection at RS 154+60, 153+40, & 153+00	$176,000
Project 10	SD Outfall Protection at RS 149+50	$41,000
Project 11	Various SD Outfall Protection	n/a
Project 12	Periodic Maintenance	n/a

* OPPC – Opinion of Probable Project Cost

Each of the improvement projects are described in further detail below. ***Figure 9*** presents plan and profile sheets of the proposed improvement projects.

B.1 Improvement Project #1a – Increased Flood Protection at Robinson Road Crossing

Based on AECOM's hydraulic analysis of Cedar Creek, the Robinson Road crossing was found to be undersized for the existing conditions 50-year storm event. On further analysis it was determined that upsizing this crossing to provide ultimate 100-year storm event protection would require significant improvements to the existing channel upstream and downstream of the crossing. Due to the limited right-of-way along the trapezoidal channel and the significant cost associated with constructing a deeper concrete-lined replacement channel, AECOM considered upsizing the Robinson Road crossing to pass the existing 50-year storm event without overtopping.

In order to convey the existing 50-year flow, it was determined that the crossing would require 4-9'x8' box culverts. The current 4-9'x5' box culvert configuration at Robinson Road is in good condition; therefore, it was determined that the boxes could be raised from 5 feet to 8 feet high, leaving the sides and bottom of the existing boxes as is. This modification would provide significant cost savings to the City instead of removal and replacement of the existing culverts entirely. The Opinion of Probable Project Cost (OPPC) for the proposed improvements to the Robinson Road crossing is $373,000.

B.2 Improvement Project #1b – Increased Flood Protection at Prairie Lane

Based on AECOM's hydraulic analysis, the Prairie Lane crossing was found to be undersized for the existing conditions 10-year storm event. In order to provide 100-year protection at Prairie Lane, the concrete-lined trapezoidal channel between Prairie Lane and Robinson Road would have to be upsized in order to reduce the tail water on Prairie Lane. Due to economic reasons this was considered to be not feasible; therefore, it was determined to provide a 10-year level of design protection for Prairie Lane. This would involve raising the height of the existing box culverts from 4 feet to 5 feet while leaving the sides and bottom of the boxes as-is. The final configuration would be

4-8'x5' and the OPCC for the proposed improvements at Prairie Lane is $174,000 (does not include separate mobilization/demobilization costs).

Due to the nature of replacement of the Robinson Road and Prairie Lane crossings, it is recommended to construct these projects together, which will in turn save the City cost associated with contractor mobilization and demobilization (approximately $52,000).

B.3 Improvement Project #2 – Protection of Polo Road Embankment and Meandering Bank in the Vicinity of Station 89+00

This is a short-term priority project due to the immediate concern of:

- the expanding scour hole in the vicinity of station 89+50 that is deteriorating the toe of the roadway embankment along Polo Road,
- preventing the incision point occurring in the vicinity of station 87+00 from migrating upstream in to the meander, and
- hydrogeomorphic stability of the creek.

This improvement project consists of installing a gabion basket wall to protect the right bank (looking downstream) of the creek against further migration into the embankment of Polo Road to the south. Page 1 of ***Appendix E.3*** shows a picture of the improvement location. The gabion wall will consist of stacked 3'x3' baskets laid on a 0.5:1 slope with select fill and filter fabric. 36-inch stone rip rap (D_{50} = 24 inches) will also be placed along the bottom of the channel and embedded up to 1-foot into the bottom of the channel in order to protect the toe of the gabion wall from undercutting. A 2'x2' reinforced concrete beam will run longitudinally along the second row of gabions and will have rock anchors (tie-backs) spaced every 10 feet as shown by typical Section E-E on ***Figure 9***, Sheet 7 of 7. The concrete beam and tie-backs are to ensure the stability of the gabion wall. The top of the gabion wall will end at the existing channel banks due to the flat right overbank in this area.

In order to prevent the incision point occurring in the vicinity of station 87+00 from migrating upstream, a rock chute will be placed between station 87+40 and station 87+10 that ties in with the gabion wall at station 87+40 and the outfall protection from an existing storm drain outfall at station 87+20. The rock chute will consist of 36-inch stone rip rap (D_{50} = 24 inches) placed across the bottom of the channel and embedded up to 1-foot into the bottom of the channel.

The project can be constructed within City-owned property limits and access will likely be from Bardin Road. The parking lot and open spaces at Friendship Park can be used temporarily as a staging area for construction. Access to the site will require clearing of some existing trees. Improvement Project #2 has an OPPC of $464,000.

B.4 Improvement Project #3 – Protection of 18-inch Sanitary Sewer Line Crossing at Station 94+55

This is a short-term priority project due to the immediate concern of:

- erosion occurring along the left bank (looking downstream) of the creek at approximate station 94+55,
- protection of the 18-inch sewer line crossing under the creek, and
- hydrogeomorphic stability of the creek.

This improvement project consists of installing a 20-foot long rock chute centered on the existing 18-inch sewer line crossing at approximate station 94+55. The rock chute is intended to prevent the progression of knick points upstream while protecting the existing sewer line from being exposed. The rock chute will consist of 36-inch stone rip rap (D_{50} = 24 inches) embedded up to 1-foot into the bottom of the channel. The upstream and downstream ends of the chute will be embedded 3 feet into

the bottom of the channel to prevent undermining of the structure. Sheet 5 of 6 in ***Figure 9*** presents the plan and profile view of this improvement.

The project can be constructed within City-owned property limits and access will likely be from Bardin Road. The parking lot and open spaces at Friendship Park can be used temporarily as a staging area for construction. Access to the site will require clearing of some existing trees. Improvement Project #3 has an OPPC of $40,000.

B.5 Improvement Project #4 – Protection of 18-inch Sanitary Sewer Line at Station 116+60

This is a short-term priority project due to the immediate concern of:

- erosion occurring along the left bank (looking downstream) of the creek at approximate station 116+60,
- protection of the 18-inch sewer line running along the eroding bank of the creek, and
- hydrogeomorphic stability of the creek.

This improvement project consists of installing a gabion basket wall to protect the left bank of the creek against further migration towards the existing 18-inch sewer line running parallel to the meandering bank at approximate station 116+60. Page 2 of ***Appendix E.3*** shows a picture of the improvement location. The gabion wall will consist of stacked 3'x3' baskets laid on a 0.5:1 slope with select fill and filter fabric. 36-inch stone rip rap (D_{50} = 24 inches) will also be placed along the bottom of the channel and embedded up to 1-foot in to the bottom of the channel in order to protect the toe of the gabion wall from undercutting. A 2'x2' reinforced concrete beam will run longitudinally along the second row of gabions and will have rock anchors (tie-backs) spaced every 10 feet as shown by typical Section D-D on ***Figure 9***, Sheet 7 of 7. The concrete beam and tie-backs are to ensure the stability of the gabion wall.

The project can be constructed within City-owned property limits and access will likely be from Polo Road and through the parking lot of Friendship Park that is directly north of this site. The parking lot and open spaces at Friendship Park can be used temporarily as a staging area for construction. Access to the site will require clearing of some existing trees. Improvement Project #4 has an OPPC of $298,000.

B.6 Improvement Project #5 – Protection of 18-inch Sanitary Sewer Line at Stations 125+00 and 123+65

This is a short-term priority project due to the immediate concern of:

- erosion occurring along the left bank (looking downstream) of the creek at approximate station 125+00 and station 123+65,
- protection of the 18-inch sewer line running along the eroding bank of the creek, and
- hydrogeomorphic stability of the creek.

This improvement project consists of installing a gabion basket wall to protect the left bank of the creek against further migration towards the existing 18-inch sewer line running parallel to the meandering bank at approximate stations 125+00 and 123+65. Page 3 of ***Appendix E.3*** shows a picture of the improvement location. The gabion wall will consist of stacked 3'x3' baskets laid on a 0.5:1 slope with compacted select fill and filter fabric. 36-inch stone rip rap (D_{50} = 24 inches) will also be placed along the bottom of the channel and embedded up to 1-foot in to the bottom of the channel in order to protect the toe of the gabion wall from undercutting. A 2'x2' reinforced concrete beam will run longitudinally along the second row of gabions and will have rock anchors (tie-backs) spaced every 10 feet as shown by typical Section C-C on ***Figure 9***, Sheet 7 of 7. The concrete beam and tie-backs are to ensure the stability of the gabion wall.

The project can be constructed within City-owned property limits. Access will likely be from Polo Road and through the parking lot of Our Redeemer Lutheran Church that is directly north of this site. The parking lot and open spaces at Friendship Park can be used temporarily as a staging area for construction. Access to the site will require clearing of some existing trees and coordination with the church will be required for access. Improvement Project #5 has an OPPC of $325,000.

B.7 Improvement Project #6 – Protection of 18-inch and 8-inch Sanitary Sewer Line Crossings at Station 139+90 and Station 135+50

This is a short-term priority project due to the potential concern of:

- protection of the 18-inch and 8-inch sewer lines crossing the creek, and
- hydrogeomorphic stability of the creek.

This improvement project consists of installing a 20-foot long rock chute centered on the existing 18-inch and 8-inch sewer line crossings at approximate station 139+90 and station 135+50, respectively. These rock chutes are intended to prevent the progression of knick points upstream while protecting the existing sewer lines from being exposed. The rock chutes will consist of 36-inch stone rip rap (D_{50} = 24 inches) embedded up to 1-foot into the bottom of the channel. The upstream and downstream ends of the chute will be embedded 3 feet into the bottom of the channel to prevent undermining of the structure. Sheet 3 of 6 in ***Figure 9*** presents the plan and profile view of this improvement.

The project can be constructed within City-owned property limits and access will likely be from Carrier Parkway. Access to the site will require clearing of some existing trees. Improvement Project #6 has an OPPC of $61,000.

B.8 Improvement Project #7 – Hydrogeomorphic Stability of Creek at Station 130+75

This is a short-term priority project due to the projected behavior of the creek over the next decade and its effect on hard points along the creek, in this case Carrier Parkway. The improvement project consists of a rock chute made up of 36-inch stone rip rap (D_{50} = 24 inches) placed across the bottom of the channel and embedded up to 1-foot in to the bottom of the channel as shown in Sheet 3 of 6 in ***Figure 9***. Improvement Project #7 has an OPPC of $37,000.

B.9 Improvement Project #8 – Protection of 8-inch Sanitary Sewer Line and Scour Hole at Station 158+00

This is a short-term priority project due to the immediate concern of:

- the erosive impacts on the surrounding property,
- the 8-inch sanitary sewer line which is approximately 1.7 feet below the bottom of the channel (as per City as-built P-1059, Sheet 3), and
- the stability of the concrete flume and drop structures at the upstream tie-in location.

This improvement project consists of 36-inch stone rip rap (D_{50} = 24 inches) extending approximately 90 linear feet (LF) from the downstream edge of the concrete drop structure to approximately 10 feet downstream of the 8-inch sanitary sewer line crossing at approximate station 157+65 along the bottom of the channel. The sides of the channel will be protected with a 12-inch thick gabion mattress at 2:1 (horizontal:vertical) side slopes. The top and bottom of the side slopes will have 3'x3' gabion basket key walls running along the length of the improvement in order to hold the side slopes in place. Page 4of ***Appendix E.3*** shows a picture of the improvement location. Typical Section A-A on ***Figure 9***, Sheet 7 of 7 provides a graphical representation of the improvement project.

The project can be constructed within City-owned property limits. Access to this area will likely be from Robinson Road and will require coordination with the current landowner. Improvement Project #8 has an Opinion of Probable Project Cost (OPPC) of $288,000.

B.10 Improvement Project #9 – Protection of 15-inch Sanitary Sewer Line and Concrete Flume at Stations 154+60, 153+40, and 153+00

This is a short-term priority project due to the immediate concern of:

- erosion occurring along the right bank (looking downstream) of the creek at approximate station 153+40,
- seepage and undercutting of concrete flume structure, and
- protection of a 15-inch sewer line running within 2-5 feet of the eroding right bank.

This improvement project consists of installing 36-inch stone rip rap (D_{50} = 24 inches) for approximately 15 feet upstream and downstream of the concrete flume structure. This will prevent further undercutting and seepage of flow under the concrete flume, thereby protecting the flume from the potential of future failure. This project will also protect the existing 15-inch PVC sanitary sewer line that runs parallel to the right bank (looking downstream) and crosses underneath Cedar Creek near station 153+00. Existing erosion along the bend in the concrete flume at approximate station 153+40 is another access point for water to undercut the flume. Protecting this area serves a dual purpose of preventing further undercutting of the concrete flume as well as protecting the sanitary sewer line underneath the flume. Page 5 of ***Appendix E.3*** shows a picture of the improvement location.

Protection for the bend at station 153+40 will require placement of stone rip rap (D_{50} = 18 inches) at a 2:1 side slope to a minimum depth of 24 inches. Select compact fill will be required at this location prior to placement of the stone rip rap. Typical Section B-B on ***Figure 9***, Sheet 7 of 7 provides a graphical representation of the structure.

The project can be constructed within City-owned property limits. Access to this area will likely be from Robinson Road and will require coordination with the current landowner. Improvement Project #9 has an OPPC of $176,000.

B.11 Improvement Project #10 – Protection of 90-inch Storm Drain Outfall Structure at Station 149+50

This is a short-term priority project due to the potential concern of scour underneath the apron/headwall of the storm drain outfall. This improvement project consists of placing 36-inch stone rip rap (D_{50} = 24 inches) just downstream of the apron. This will protect the integrity of the outfall's headwall against scour, and protect the banks and trees from falling into the creek. Page 7 of ***Appendix E.3*** shows a picture of this improvement location. Sheet 1 of 6 in ***Figure 9*** presents the plan and profile view of this improvement. Improvement Project #10 has an OPPC of $41,000.

B.12 Improvement Project #11 – Protection of Storm Drain Outfall Structures at Various Locations Along the Creek

This is a long-term priority project due to the maintenance aspect associated with all other storm drain outfall structures that discharge in to the creek and have a potential of affecting the storm drain pipe and receiving channel if not periodically monitored and maintained. These locations are identified in Sheets 1-6 of ***Figure 9*** as Priority III sites. No cost estimate was prepared for these items due to the varied nature of these outfall locations.

B.13 Improvement Project #12 – Periodic Maintenance Projects

AECOM recommends periodic maintenance of the Bardin Road, Polo Road, and Carrier Parkway crossings. Based on field observations and survey data, all three crossings are experiencing on average 1 to 3 feet of siltation, and should be regularly cleaned to ensure all the culverts are capable of passing their design flows.

C. Other Improvements Evaluated

C.1 Increased Flood Protection at Matthew Road Crossing

Based on AECOM's hydraulic analysis of Cedar Creek, the Matthew Road crossing (3-8'x4' box culverts) was found to be undersized for the existing conditions 10-year storm event. On further analysis it was determined that upsizing the crossing to provide existing conditions 100-year storm event protection would require significant improvements to the existing trapezoidal channel downstream of this crossing. Currently the existing conditions 100-year tail water produced by the downstream trapezoidal channel is approximately 0.03 feet above the top of road at Matthew Road. Due to the limited right-of-way (ROW) along the trapezoidal channel and the significant cost associated with constructing a deeper concrete-lined replacement channel that would provide 100-year protection at this crossing, AECOM considered keeping the existing flow lines and widths of each crossing and increasing the culvert height in to the existing roadway subgrade. Upsizing from 3-8'x4' box culverts to 3-8'x5' box culverts will not provide additional flood protection at this crossing as the 10-year existing conditions storm event would continue to overtop the road. In order to pass the existing 10-year storm event, Matthew Road would need to be upsized to 4-8'x4' box culverts which would involve adding an additional barrel to the current culvert configuration. Due to the limited ROW available in the upstream and downstream channel, it was determined that it would not be an economically feasible option.

Furthermore, upsizing Matthew Road would have a direct effect on the Prairie Lane crossing downstream. Currently as per Improvement Project #1b, Prairie Lane would pass the 10-year existing conditions storm event if the existing boxes were raised by 1-foot. If Matthew Road was upsized to pass the 10-year existing conditions storm event, then the Prairie Lane boxes would need to be raised by 2 feet which would not be possible due to existing roadway profile and minimum pavement thicknesses. As a result, Prairie Lane would then need to be upsized horizontally by adding an additional barrel which would present the same ROW and economic challenges as discussed above for Matthew Road. When the trapezoidal channel between Matthew Road and Robinson Road is considered for replacement due to maintenance reasons, the City should revisit the Matthew Road and Prairie Lane crossings and evaluate the benefits of upsizing these crossings at that time. Also, it should be noted that any additional upsizing improvements at Prairie Lane, over and above those mentioned in Improvement Project #1b, should be hydrologically and hydraulically evaluated for its effects on the Robinson Road crossing due to the potential of releasing additional flow downstream that may impact flooding conditions and the flood protection level of Robinson Road.

C.2 Floodplain Reclamation of Original Cedar Creek Alignment (Downstream of 72-inch Outfall at Robinson Road)

In 1978, the Cedar Creek alignment from approximately 850 feet upstream of Robinson Road to approximately 1,500 feet downstream of Robinson Road was rerouted to where it stands today. The original creek alignment crossed under Robinson Road where the existing creek now turns to the north and proceeds to culvert crossing. The pre-1978 Cedar Creek is currently captured by a 72-inch storm drain that discharges approximately 900 feet south of the Robinson Road crossing. From this point, the original creek alignment makes its way down to the existing Cedar Creek and merges at

approximate river station 153+38. The floodplain area of the portion of the original creek from the 72-inch outfall to station 153+38 is currently modeled as an ineffective flow area in the HEC-RAS model.

At the City's request, AECOM looked at filling in the floodplain area downstream of Robinson Road along the original Cedar Creek alignment and evaluate the WSEL impacts on the main channel. In HEC-RAS this involved modeling the floodplain with blocked obstructions rather than ineffective flow areas. No significant impacts were seen on the WSELs along the existing Cedar Creek due to this improvement from the downstream face of Robinson Road (cross-section 16903) to just downstream of the confluence of the existing Cedar Creek and the original Cedar Creek alignments (cross-section 15338) as shown ***Table VII.3***. A Section 404 Individual Permit through the USACE will likely be required before filling in the tributary of Cedar Creek.

Table VII-3 - WSEL Comparison for Flood Plain Reclamation of Original Cedar Creek Alignment

Blocked Obstruction D/S of Robinson				Ineffectives D/S of Robinson				Change	
Station	Profile	WSEL (ft)	Velocity (ft/s)	Station	Profile	WSEL (ft)	Velocity (ft/s)	Δ WSEL (ft)	Δ Velocity (ft/s)
Robinson Road									
16903	ULT100	528.75	4.21	16903	ULT100	528.75	4.21	0.00	0.00
16884	ULT100	528.71	4.20	16884	ULT100	528.71	4.20	0.00	0.00
16849	ULT100	528.59	4.62	16849	ULT100	528.59	4.62	0.00	0.00
16812	ULT100	528.43	5.06	16812	ULT100	528.43	5.06	0.00	0.00
16724	ULT100	528.11	5.22	16724	ULT100	528.11	5.22	0.00	0.00
16575	ULT100	527.53	5.25	16575	ULT100	527.53	5.25	0.00	0.00
16420	ULT100	526.78	5.67	16420	ULT100	526.78	5.67	0.00	0.00
16260	ULT100	526.15	5.31	16260	ULT100	526.15	5.31	0.00	0.00
16122	ULT100	525.54	5.63	16122	ULT100	525.54	5.63	0.00	0.00
15979	ULT100	524.26	7.38	15979	ULT100	524.26	7.38	0.00	0.00
15860	ULT100	523.75	7.61	15860	ULT100	523.75	7.61	0.00	0.00
Drop Structure									
15857	ULT100	523.74	6.34	15857	ULT100	523.74	6.34	0.00	0.00
15837	ULT100	523.75	6.20	15837	ULT100	523.75	6.20	0.00	0.00
15825	ULT100	521.66	12.84	15825	ULT100	521.66	12.84	0.00	0.00
Drop - Transition to Natural Channel									
15820	ULT100	521.65	6.89	15820	ULT100	521.66	6.89	0.01	0.00
15806	ULT100	521.63	6.83	15806	ULT100	521.63	6.83	0.00	0.00
15748	ULT100	520.66	10.24	15748	ULT100	520.67	10.24	0.01	0.00
15659	ULT100	519.25	12.79	15659	ULT100	519.23	12.83	-0.02	0.04
15546	ULT100	518.07	11.93	15546	ULT100	518.05	12.00	-0.02	0.07
15432	ULT100	515.70	9.69	15432	ULT100	515.82	12.00	0.12	2.31
15338	ULT100	514.33	11.47	15338	ULT100	514.33	11.47	0.00	0.00

VIII. Storm Water Infrastructure Analysis

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

VIII. Storm Water Infrastructure Analysis

IX. Channel Stability Assessment/Erosion Hazard Analysis

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

IX. Channel Stability Assessment/Erosion Hazard Analysis

A. Overview

Peter Allen, PhD, PG performed a hydrogeomorphic study of Cedar Creek to evaluate and prioritize erosion locations along the creek. Typically, the assessment of the stability of stream channels is driven by the frequency and magnitude of channel discharges, the slope and depth of the water, the amount of sediment being moved, and the size of the sediment. The stream will react to these variables by adjusting through changes in channel slope, channel depth and cross section. The key to assessing the stability of the channel is to quantify the driving variables, assess what changes the stream will undergo, and what the stream will ultimately look like over a specified period of time. The hydrogeomorphic report is found in ***Appendix E.1***.

Based on historic aerial photography, the Cedar Creek watershed was agricultural land use from the late 1800's to about 1972. Beginning in 1972, the upstream portion of the watershed was developed into residential neighborhoods. Then in the late 1990's the lower portion of the watershed experienced significant growth. Currently, the Cedar Creek watershed is fully built out except for a large tract of land in the middle of the watershed that is currently vacant. The change in land use over the past 40 years has significantly increased the runoff into Cedar Creek, which has resulted in erosion at several locations.

B. Field Observations

Methods utilized in surveying the channels consisted of assessment of channel hydrology and hydraulics (AECOM), walking the channel, recording channel dimensions, determining channel process, and identifying potential structural problems.

The channel survey was conducted every 200 feet with distances measured using a string-line. For each reach, data for the channel bottom, side slopes, and structural channel dimensions were compiled as discussed in Dr. Allen's geomorphic report (***Appendix E.1****; Section 6.2*).

C. Hydrogeomorphic Analysis

The hydrogeomorphic analysis entailed a walk-through of the natural portion of Cedar Creek, including preparing detailed field notes, taking photographs, and identifying certain definitive characteristics of channel erosion. The analysis also included a study of the channel evolution and potential degradation with time. The analysis divided Cedar Creek into three separate reaches. Reach 1 begins approximately 1,090-feet downstream of Robinson Road and extends to Carrier Parkway. Reach 2 begins at Carrier Parkway and extends to Polo Road. Reach 3 begins at Polo Road and extends to Bardin Road.

It was determined that the channel will continue to downcut to achieve equilibrium over time, based on the existing channel slope, bed material, and effective discharge. Downcutting will occur at approximately 4.6 feet per 1,000 feet if left unchecked. The analysis concluded that a conservative estimate of the stable channel slope is approximately 0.0009 feet/feet (0.09%). ***Table V.1*** compares the equilibrium slope to the existing slope and indicates the number of required drop structures to prevent the estimated level of degradation from occurring. The 3-foot drop is used as an upper limit of usually accepted drop structure heights.

Table IX-1 - Equilibrium vs. Existing Slope

Station	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Degradation (ft) - Number of Drops @ 3ft
15806 - 14557	0.0009	0.0065	7.0 ft - 2 drops
14134 - 10665	0.0009	0.0058	16.9 ft - 6 drops
10348 - 7989	0.0009	0.0049	8.4 ft - 3 drops

As the discharge through the channel increases, as is the case with the developing Cedar Creek watershed, the channel will tend to reduce its slope through degradation. As it degrades, it will go through a series of four stages shown in ***Figure 21*** of ***Appendix E.1***. A channel typically downcuts in Stage II causing the banks to eventually fail. The widening and deepening in Stage III reduces the tractive force and velocity of the water, which in turn reduces the rate of downcutting to a point where it stops and starts stabilizing through deposition. By Stage IV, the channel has restabilized its banks and created a new lowered floodplain.

As can be seen in ***Figures 23 & 24*** of ***Appendix E.1***, Cedar Creek is predominately Stage I and II in the Robinson to Carrier reach and the Polo to Bardin reach. The middle reach from Carrier to Polo appears to be between Stages I through IV. At Stages III and IV it is very costly to control the stream, as the channel has already down cut enough to cause large bank failures and is generally much wider than its Stage II counterpart. Drop structures are typically recommended for streams entering Stage II.

The hydrogeomorphic analysis of Cedar Creek concluded that the creek will be finished responding to the recent land use changes during the next decade, and will continue to adapt to future land use changes over the next 20 years. Dr. Allen analyzed several methods (Regional Regime Equations, Simons and Albertson, and Hey) to predict the future channel dimensions of Cedar Creek. ***Table V.2*** shows the station, effective discharge (1.25-year flood event) and equilibrium channel dimensions for Cedar Creek.

Table IX-2 - Equilibrium Channel Dimensions

Type	Qeff (cfs)	Width (ft)	Depth (ft)	Qeff (cfs)	Width (ft)	Depth (ft)
	Above Station 14134			**Below Station 14134**		
Regional Curve	459	20.00	4.50	584	23.00	4.90
Simons and Albertson	459	44.00	5.70	584	49.80	6.25
Hey	459	25.70	3.40	584	28.50	3.73
Mean		**29.90**	**4.53**		**33.77**	**4.96**

Based on this analysis, it was determined that Cedar Creek will ultimately widen up to approximately 30 feet in bottom width over the next decade as it transitions to Stage IV of its evolution.

Robinson Road to Carrier Parkway

This reach has a large scour hole just downstream from the end of the concrete lined portion. At station 154+00 there is a short run of channelized section that is experiencing scour at the entrance and bank erosion on both sides. Downstream of the short channelized section the channel is incising with evidence of overbank deposition.

Carrier Parkway to Polo Road

Just downstream of Carrier Parkway the creek widens and meanders and there is only minor bank/bed scour. Woody debris dams have been formed and there are abundant amounts of litter present. There is evidence of overbank deposition. The channel begins incising near station 138+50 and there is an abundance of fallen trees resulting in tree dams. Station 126+00 is the approximate location of the transition from incising to downcutting and widening. This area is represented by the channel deepening, undercut banks, and fallen trees. Station 118+00 is the approximate location of the creek changing from Stage II to Stage III (knick point location). ***Figure 61*** of ***Appendix E.1*** illustrates the progression of the knick point. The channel is significantly wider downstream of the knick point as it is mostly finished degrading and is now depositing sediment. Approximately 190 feet upstream of Polo Parkway there is an existing drop structure that controls the upstream grade.

Polo Road to Bardin Road

Downstream of Polo Road the creek is currently in Stage I with pooled and meandering sections. At station 91+00 the creek begins the transition from Stage I to Stage II. At this point, channel incision, degradation, and widening are taking place. Near station 89+50 the outside meander is cutting under grouted rip-rap that was put in place to protect the embankment of Polo Road. At approximately station 88+00 there is a major incision. Downstream of the incision, to Bardin Road, the channel appears to be stable.

D. Recommended Improvements

Based on the hydrogeomorphic report, AECOM placed 9 grade control structures throughout the reach in an attempt to minimize the effect of the creek's desire to downcut to achieve its predicted equilibrium slope of 0.0009 ft/ft. These grade control structures will act as hard points and prevent the knick point from migrating past them. Each grade control structure will reset the creek's equilibrium slope at the upstream side of the grade control structure, thereby preventing a large drop (more than three feet) at any single location.

The grade control structures were placed at approximate locations where the down cutting will reach a maximum of 3 feet based on the current creek bed slope and the projected equilibrium slope. AECOM also took into consideration sanitary sewer line crossings when determining the placement of these grade control structures. Apart from the grade control structures, AECOM also recommended bank protection where needed and other erosion control measures such as filling in scour holes with large rocks. The location of these recommended improvements are presented in plan and profile sheets (***Figure 9***) and summarized in ***Tables VII.1*** and ***VII.2*** of ***Section VII***.

X. Dams/Levees/Detention/Drainage Reviews

X. Dams/Levees/Detention/Drainage Reviews

A. Dams/Levees

The Cedar Creek watershed contains no dams or levees.

B. Detention Ponds

AECOM identified one detention pond within the Cedar Creek watershed. The detention pond is located on private property, along Cedar Drive just east of Carrier Parkway. The following photos were taken of this pond in June 2010 to document the condition of the pond and any maintenance, outfall or erosion issues associated with the pond.

Figure X-1 – Detention Pond (facing South)

Figure X-2 – Detention Pond (facing South-West)

Figure X-3 – Detention Pond Outfall Flume (facing South)

Figure X-4 – Detention Pond Outfall (facing South)

Figure X-5 – Detention Pond Inlet Erosion (facing South-East)

B.1 Detention Pond Evaluation

Visual examination of the private detention pond revealed that the pond itself is in good condition and seems to be well maintained by the property owner. The outfall structure contains a chain-link fence, that if not regularly cleaned will cause a backup. The concrete inlet collecting runoff from Cedar Drive has been compromised and is need of repair. Other than the possibility of a blockage due to the chain-link fence and the erosion issues around the inlet (***Figure X-5***), the pond can be considered in good condition.

XI. Maintenance – (Cedar Creek)

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

XI. Maintenance – (Cedar Creek)

XII. Preliminary Quantities/Estimates of Probable Cost

AECOM Technical Services, Inc.

City-wide Drainage Master Plan for Cedar Creek (Y#0845)

XII. Preliminary Quantities/Estimates of Probable Cost

Preliminary quantities and estimates of probable cost were calculated for stream and open channel alternatives from ***Section VII*** of this report. A detailed breakdown of the cost estimates for each of these improvement projects can be found in ***Appendix B***.

This cost analysis is presented for budgeting purposes only. It uses current TxDOT low bid average costs where available, and current construction bid information from projects in the surrounding area for all other unit costs. The total figures below include breakdowns for all projects (except outfall improvement and periodic maintenance projects.)

Table XII-1 – Breakdown of Opinion of Probable Costs

Total Cost of All Improvement Projects	**$ 2,277,000**
Robinson Road Increased Flood Protection	$ 373,000
Prairie Lane Increased Flood Protection	$ 174,000
Protection of Polo Road embankment and meandering bank in the vicinity of station 89+00	$ 464,000
Protection of 18-inch sewer line crossing at station 94+55	$ 40,000
Protection of 18-inch sewer line at station 116+60	$ 298,000
Protection of 18-inch sewer line at stations 125+00 and 123+65	$ 325,000
Protection of 18-inch and 8-inch sewer line crossing at station 139+90 and station 135+50	$ 61,000
Hydrogeomorphic stability of creek at station 130+75	$ 37,000
Protection of 8-inch sewer line and scour hole at Station 158+00	$ 288,000
Protection of 15-inch sewer line and concrete flume at stations 154+60, 153+40, and 153+00	$ 176,000
Protection of 90-inch storm drain outfall structure at station 149+50	$ 41,000

XIII. Evaluation & Prioritization/Phasing & Implementation

XIII. Evaluation & Prioritization/Phasing & Implementation

A. Evaluation & Prioritization

AECOM developed twelve (12) stream and open channel alternatives that are described in detail in ***Section VII*** of this report. AECOM evaluated and prioritized the 12 alternatives within the Cedar Creek watershed which consisted of erosion protection, sanitary sewer line protection, and upsizing of crossings that provide a greater level of flood protection and access. A process of assigning ranking factors was utilized to rate short-term and long-term priority projects based on criteria from Section II.G of the City of Grand Prairie City-wide Drainage Master Plan Road Map. Refer to ***Table XIII.1*** for the final proposed CIP rankings. The following is a brief summary of the criteria and methodology utilized to rank short-term and long-term priority projects to be incorporated into the overall City-wide implementation plan.

1. Ranking Criteria

i. *Number of properties/structures benefited* - The number of structures benefited by the reduction in flood damage was determined for each proposed CIP alternative. There were no structures benefitted for any of the proposed CIP projects by the reduction in flood or erosion damage.

ii. *Estimates of probable cost* - A preliminary cost-estimate was determined for each proposed CIP alternative and then categorized as follows:

- **Small Projects -** Less than $500,000
- **Medium Projects** - $500,000 to $1,500,000
- **Large Projects -** $1,500,000 to $5,000,000
- **Extra-Large Projects -** $5,000,000 to $10,000,000
- **Super Size Projects -** Greater than $10,000,000

iii. *Roadway Type Benefited* - Each proposed CIP alternative roadway was categorized based on existing roadway type. Categories include **HWY, P7U, P6D, P4D, P3U, M5U, M4U, M3U, C2U,** and **No Roadway** (if no roadway benefits are included with project).

iv. *Roadway Flood Event Protection* - The level of flood protection, if no improvements were made, was determined for each proposed CIP alternative roadway crossing. AECOM described existing roadway crossing protection based on the following storm events: 2-year, 5-year, 10-year, 25-year, 50-year, or 100-year (existing).

v. *Roadway Citizens Protected/Impacted* - Per Ranking Factor #3 below, an approximate percentage of total roadway citizens impacted was determined for each proposed CIP alternative if no improvements were made.

vi. *Ultimate 100-Year Discharge*-. The ultimate 100-year discharge was determined for each proposed CIP alternative location.

2. Ranking Methodology

i. *Ranking Factor #1-* The initial ranking factor was based on the estimate of probable cost versus the number of properties/structures benefited:

Determine Initial Ranking Factor		No. of Properties/Structures Benefited		
		High > 10	Medium 5 to 10	Small < 5
Estimate of Probable Cost ($)	Small < $500k	1	2	3
	Medium $500k - $1.5M	2	3	4
	Large > $1.5M	3	4	5
	X-Large > $5M	6	7	8
	Super-Size > $10M	9	10	11

ii. *Ranking Factor #2 -* A second ranking factor was determined based on the number of citizens impacted, by potential for roadway shutdowns if no improvements were made on existing roadways, and by a cost to benefit ratio of proposed improvements per roadway citizens impacted.

Step 1 - Determine Existing Roadway Type

Roadway Type
HWY
P7U
P6D
P4D
P3U
M5U
M4U
M3U
C2U

Step 2 - Determine Existing Conditions Roadway Flood Event Protection and Percentage of Roadway Citizens Protected

Roadway Flood Event Protection	Percentage of Citizens Protected [1]
1-Year	0%
2-Year	15%
5-Year	35%
10-Year	50%
25-Year	70%
50-Year	85%

Roadway Flood Event Protection	Percentage of Citizens Protected [1]
100-Year	100%

[1] Based on approximation, using logarithmic chart, with 1-Year Event coverage protecting 0% and with 100-Year Event protecting 100%

Step 3 - Determine Percentage of Roadway Citizens Impacted 100% minus percentage of citizens protected

100% minus percentage of citizens protected in Sub-Step 2

Step 4 - Determine Number of Roadway Citizens Impacted

Roadway Type Benefited	Percentage of Citizens Protected [1]
HWY	20800
P7U	12740
P6D	11700
P4D	7800
P3U	5460
M5U	8450
M4U	6760
M3U	5070
C2U	2730

[1] Based on percentage of citizens impacted multiplied by [No. Lanes * 4 hours impacted * hourly volume per lane * Level of Service C Traffic Volume (see table below)]

Grand Prairie Classification	NCTCOG Classification	Lanes	Hourly Service Vol./lane	NCTCOG LOS*			Current UDC "LOS C" Traffic Volume
				Roadway Capacity LOS E	LOS D	LOS C	
P7U	Principal Arterial-Undiv.	7	700	49,000	39,200	31,850	42,000
P6D	Principal Arterial-Divided	6	750	45,000	36,000	29,250	42,000
P4D	Principal Arterial-Divided	4	750	30,000	24,000	19,500	28,000
P3U	Principal Arterial-Undiv.	3	700	21,000	16,800	13,650	18,000
M5U	Minor Arterial	5	650	32,500	26,000	21,125	28,000
M4U	Minor Arterial	4	650	26,000	20,800	16,900	22,000
M3U	Minor Arterial	3	650	19,500	15,600	12,675	18,000
C2U	Collector	2	525	10,500	8,400	6,825	10,000
L2U	Local Street	2	525	10,500	8,400	6,825	8,000
LU	Local Street	1	525	5,250	4,200	3,413	8,000
R2U	Rural Street	2	525	10,500	8,400	6,825	8,000

* = from the Dallas-Fort Worth Regional Travel Model Manual, Exhibits 23 and 24
NCTCOG capacity: LOS E = (# lanes) * 10 * (NCTCOG Hourly Service Volume per Lane)
NCTCOG capacity: LOS D = (LOS E) * .8
NCTCOG capacity: LOS C = (LOS E) * .65

Step 5 - Divide Cost to Benefit of Roadway Number of Citizens Impacted

Divide the estimate of probable cost by the results from Step 4 to determine the cost to benefit ratio (in dollars)

Step 6 - Develop Second Ranking Factor with highest rank being the lowest cost to benefit ratio

iii. *Ranking Factor #3-.* A third ranking factor was determined based on the total tax value of all the properties with structures that are benefited by the project from Ranking Factor #1. The Third Ranking Factor was based on the table below.

Total Tax Value of Properties with Structures Benefited	Third Ranking Factor
$2,000,000 +	1
≥ $1,900,000	2
≥ $1,800,000	3
≥ $1,700,000	4
≥ $1,600,000	5
≥ $1,500,000	6
≥ $1,400,000	7
≥ $1,300,000	8
≥ $1,200,000	9
≥ $1,100,000	10
≥ $1,000,000	11
≥ $900,000	12
≥ $800,000	13
≥ $700,000	14
≥ $600,000	15
≥ $500,000	16
≥ $400,000	17
≥ $300,000	18
≥ $200,000	19
$0 to $199,999	20

iv. *Initial Ranking* - A total ranking factor was determined using the summation of Ranking Factors #1, #2, and #3. The initial ranking of proposed CIP alternatives was determined with the top ranked (#1) project having the lowest total ranking factor.

v. *Final Ranking* - If two or more projects had the same initial ranking, the projects were sorted further using the ultimate 100-year discharge at each project location. The higher ranked of these projects was the one with the greatest ultimate 100-year discharge at the project location.

B. Phasing & Implementation

Final Short-term Priorities Implementation

Short-term Priority CIPs could generally be described as those projects with an initial ranking factor of 1, 2, or 3 from the matrix under Ranking Factor #1 above. The Short-term Priority projects would become the City's key Capital Improvement Projects for immediate implementation, contingent upon City Council approval and allocated funding. Prior to beginning the construction process on these projects, the following key issues may need to be examined:

- Public or private participation in funding and implementation
- Drainage right-of-way or easement needs
- Permitting – FEMA, NCTCOG, U.S. Army Corps of Engineers,, TCEQ, or EPA
- Public or neighborhood meetings to describe the project and receive citizen feedback
- Adherence of the project to the City's ordinances and standards for construction

Final Long-term Plan Implementation

All other CIPs not classified as Short-term priorities will be considered **Long-term CIPs**. These need to be planned properly with funding allocated for future construction, contingent of City Council approval. Projects that could be constructed by phasing (i.e. will phasing provide immediate benefits or does the whole project need to be constructed for benefits to occur) would need to be re-evaluated by eat Phase and re-ranked accordingly with the other CIP alternatives.

For the Long-term projects, the following key issues may need to be examined:

- All the Short-term issues listed above
- Longer range funding plans for larger projects, including phasing (look into State and Federal grants and construction loans)
- More global view, watershed-wide or regional type projects (look into cooperative efforts with U.S. Army Corps of Engineers, NCTCOG, or adjacent communities)
- Examine how increased development of the City's flood warning system could provide further benefits to these areas until funding is allocated for project implementation.
- Non-structural measures including:
    - **Buy-out Program –** City would need to decide on perpetual maintenance of poperty or re-selling property after measures are taken to remove lot from flood hazard. Recommend pursuit of City funding, if available, or associated grants (see CWDMP Roadmap Section II.D – Funding Opportunities), if applicable.
    - Enforce new and/or improved development standards to restrict future development in flood hazard areas

Table XIII.1 - Short-Term & Long-Term Implementation Plan

Cedar Creek Watershed

	Capital Improvement Project	Project Size & Short-Term/Long-Term	Step 1 - Initial Ranking Factor - Estimate of Probable Cost vs. # Structures Benefited [1]			Step 2 - Second Ranking Factor - Cost to Benefit of Roadway Number of Citizens Impacted [2]							Step 3 - Tax Value of Benefited Property Structures [7]		Sum of 1st, 2nd, and 3rd Factors - Step 4	Initial Rank - Step 4	100-Year Ultimate Discharge at CIP Location - Step 5		Final Rank - Step 6
			# Structures	Cost	1st Factor [1]	Type	Roadway Flood Event Protection	Roadway % Citizens Protected [3]	Roadway % Citizens Impacted [4]	Roadway # Citizens Impacted [5]	Cost to Benefit Roadway # Citizens Impacted [6]	2nd Factor	Tax Value of Property Structures Benefited	3rd Factor	Total	Rank [8]	Ultimate Q_{100}	Sorting [9]	Rank [10]
1	**Project 1** - Robinson Road & Prairie Lane Crossings	Medium/Short-Term	0	$547,000	4	PD4	25-year	70%	30%	2340	$233.76	1	$0	20	25	1	2,630	1	1
2	**Project 2** - RB & Polo Rd Embankment Protection at RS 89+00	Small/Short-Term	0	$464,000	3	M4U	100-year	100%	n/a	n/a	n/a	2	$0	20	25	2	3,920	2	2
3	**Project 3** - SS & LB Protection at RS 94+55	Small/Short-Term	0	$40,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,920	3	3
4	**Project 4** - SS & LB Protection at RS 116+60	Small/Short-Term	0	$298,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	4	4
5	**Project 5** - SS & LB Protection at RS 125+00 & 123+65	Small/Short-Term	0	$325,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	5	5
6	**Project 6** - SS Protection at RS 139+90 & 135+50	Small/Short-Term	0	$61,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	6	6
7	**Project 7** - Prevention of Knick Point Migration at RS 130+75	Small/Short-Term	0	$37,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	3,370	7	7
8	**Project 8** - SS & Scour Protection at RS 158+00	Small/Short-Term	0	$288,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	2,630	8	8
9	**Project 9** - SS & Concrete Flume Protection at RS 154+60, 153+40, & 153+00	Small/Short-Term	0	$176,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	2,515	9	9
10	**Project 10** - SD Outfall Protection at RS 149+50	Small/Short-Term	0	$41,000	3	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	25	2	2,515	10	10
11	**Project 11** - Various SD Outfall Protection	Small/Long-Term	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	n/a	3	n/a	11	11
12	**Project 12** - Periodic Maintenance	Small/Long-Term	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	$0	20	n/a	3	n/a	12	12

1 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 1
2 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 2
3 Based on approximation, using logarithmic chart, with 1-Year Event coverage protecting 0% of traffic volume and 100-Year Event coverage protecting 100% of traffic volume
4 Percent Impacted = 100% minus % of Roadway Citizens Protected (approximate)
5 Number Impacted = % Impacted multiplied by [No. Lanes * 4 Hours Impacted * Hourly Volume Per Lane * Level of Service "C" Traffic Volume]
6 Cost of CIP divided by Roadway # Citizens Impacted
7 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 3
8 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 4
9 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 5
10 Refer to City-Wide Drainage Master Plan Road Map, Section II.G - Implementation Plan - Step 6

Additional Notes:

a. Phased projects shall be ranked in order of Phasing (i.e. Phase 1 shall be ranked higher than Phase 2, etc.)

XIV. Short Term Priorities & Long Term Plan

XIV. Short Term Priorities & Long Term Plan

A. Short-Term Priorities Implementation

Improvement projects 1 through 10 should be considered short-term priorities, due to the immediate flooding or erosion threat posed by each. If left unchecked, a major roadway crossing such as Robinson Road (Project 1) will be continually overtopped by smaller frequency storms and the erosive forces of Cedar Creek will continue to downcut until it reaches its equilibrium slope (Projects 2-10).

B. Long-Term Plan Implementation

Improvement projects 11 and 12 should be considered for long-term implementation. Improvement project 11 requires the City to continually inspect all storm drain outfall locations to ensure they are not compromised.

Improvement project 12 suggests periodic maintenance at all stream crossing locations. Based on field observations and survey data, Bardin Road, Polo Road, and Carrier Parkway crossings are currently experiencing 1 to 3 feet of siltation. AECOM recommends that these three crossing as well as all others be regularly cleaned to ensure all the culverts are capable of passing their design flows..

XV. Master Study Plan Wrap-up & Recommendations for Future Action

XV. Master Study Plan Wrap-up & Recommendations for Future Action

The City-wide Drainage Master Plan for the Cedar Creek watershed provides comprehensive, updated technical data for the management of Cedar Creek. This report addresses existing flooding, erosion, and sedimentation problems within the watershed and provides planning alternatives and design concepts to help alleviate any existing/potential problems. The information presented in this report will provide the City of Grand Prairie with the necessary updated drainage information to coordinate future development and help minimize existing and potential future problems within the Cedar Creek watershed.

A. Streams and Open Channels

Due to rapid upstream development, beginning in 1972, and the corresponding increase in runoff, portions of Cedar Creek are experiencing severe erosion and bank failures. These erosion issues and bank instabilities are due to downcutting as the creek attempts to stabilize to its equilibrium slope. Dr. Peter Allen's hydrogeomorphic study of Cedar Creek concluded that the portion of the creek between Carrier Parkway and Polo Road will downcut up to as much as 16 feet if left unchecked. As a result of the erosion and downcutting, an existing 18-inch sanitary sewer line that parallels Cedar Creek and crosses it in several locations is in danger of being undercut. The bank failures and general instability of the creek are also beginning to undercut the existing roadway embankment along Polo Parkway. ***Section VII*** of this report presents the recommended alternatives to remediate the current and future erosion damages occurring along Cedar Creek. Along with the erosion control recommendations, AECOM analyzed all the stream crossings and made improvement recommendations where necessary (***Section VII***).

B. Future Studies & Report

Future studies and technical data should be incorporated into this report as they become available. Maintenance of the City-wide Drainage Master Plan document will be critical to keeping the document accurate. Future LOMRs and watershed studies should be included as attachments in this same document. Final hydrologic and hydraulic models should be added to ***Appendix C.1*** *and* ***C.2*** respectively.

C. Future Development in the Watershed

The Cedar Creek watershed has a large undeveloped tract of land (approximately 70 acres), currently zoned agricultural, in the middle reaches that has a potential for producing significant additional runoff when it is developed. Though this Drainage Master Plan accounts for the full development of the watershed, including tracts like this, it would be beneficial for the City to maintain existing discharges from a water quality standpoint. It should be noted that unmitigated development of these tracts has been considered in the hydrologic and hydraulic analysis of the report and though no negative impacts to life or property is expected due to the additional runoff, all new development should be independently evaluated for its potential impact downstream using the guidelines set forth in the most current City of Grand Prairie Drainage Design Manual at that time.

The Cedar Creek watershed has a medium-sized tract of undeveloped land (approximately 15 acres) in the upper reaches that is currently agricultural in land use but is zoned for commercial/retail development in the future. The Drainage Master Plan analysis accounts for the increase in runoff from the developed site and its effects downstream. There would be an additional 255 cfs (100-year event) released in to the channel at the Kite Road outfall predominantly due to the development of

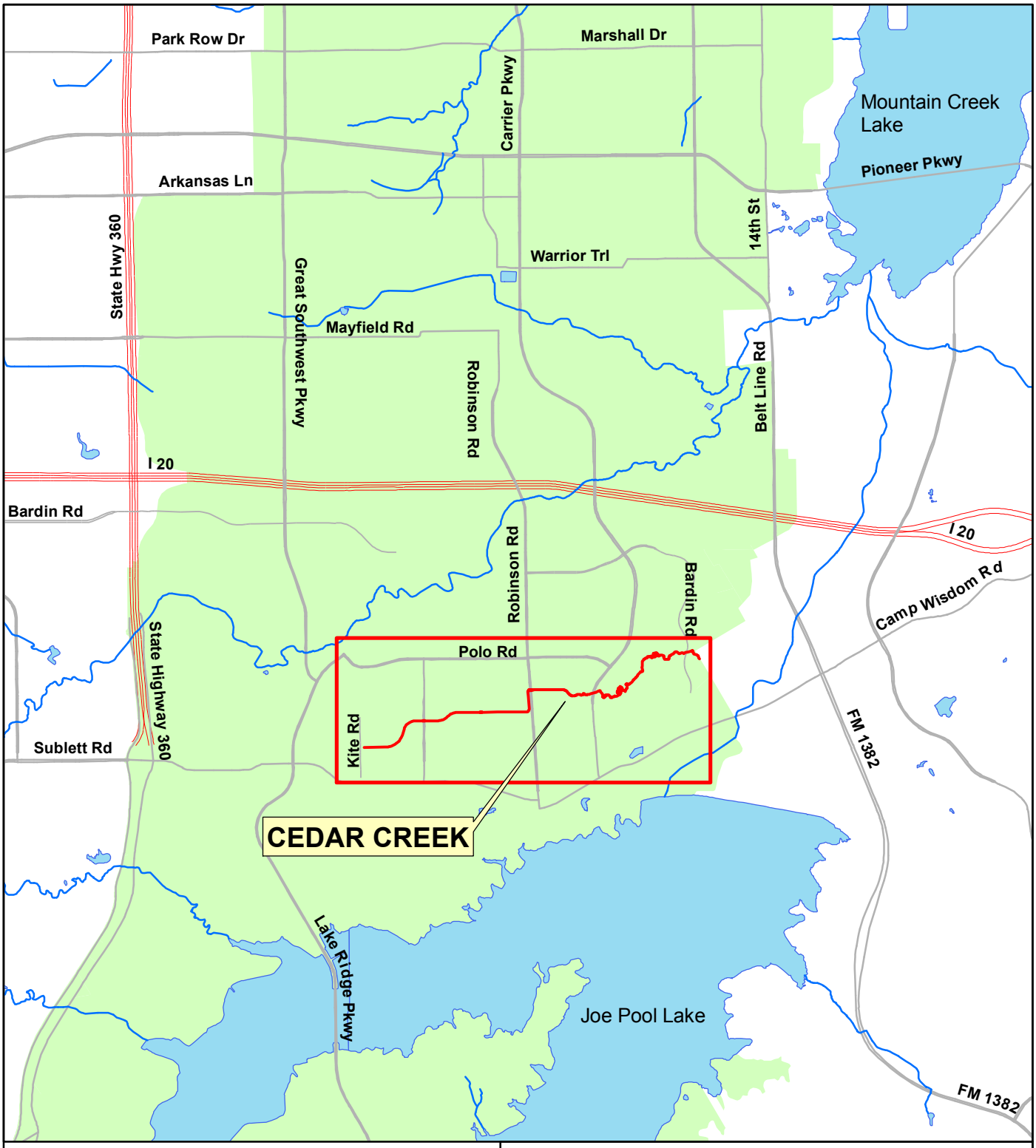
this site. This increase has a potential impact on the flood protection capacity at Robinson Road. which is capable of passing the existing 25-year storm event. The upsized Robinson Road crossing as detailed in ***Section VII*** of the report is designed to carry the existing conditions 50-year event and the 25-year ultimate conditions event with the proposed site fully built out. Maintaining proposed runoff from the site to existing condition levels will essentially provide 50-year ultimate conditions protection at the Robinson Road crossing. This will save the City cost associated with upsizing the Robinson Road crossings in the future to carry the unmitigated ultimate conditions 50-year storm event.

The findings of this report for fully developed (ultimate) conditions is based on a set of engineering assumptions and best available zoning information and therefore an independent evaluation of the impacts of proposed development anywhere in the watershed should be performed on a case-by-case basis.

Appendix A

Pertinent Figures for Cedar Creek (Y#0845)

AECOM



Legend

- Cedar Creek
- City of Grand Prairie

N

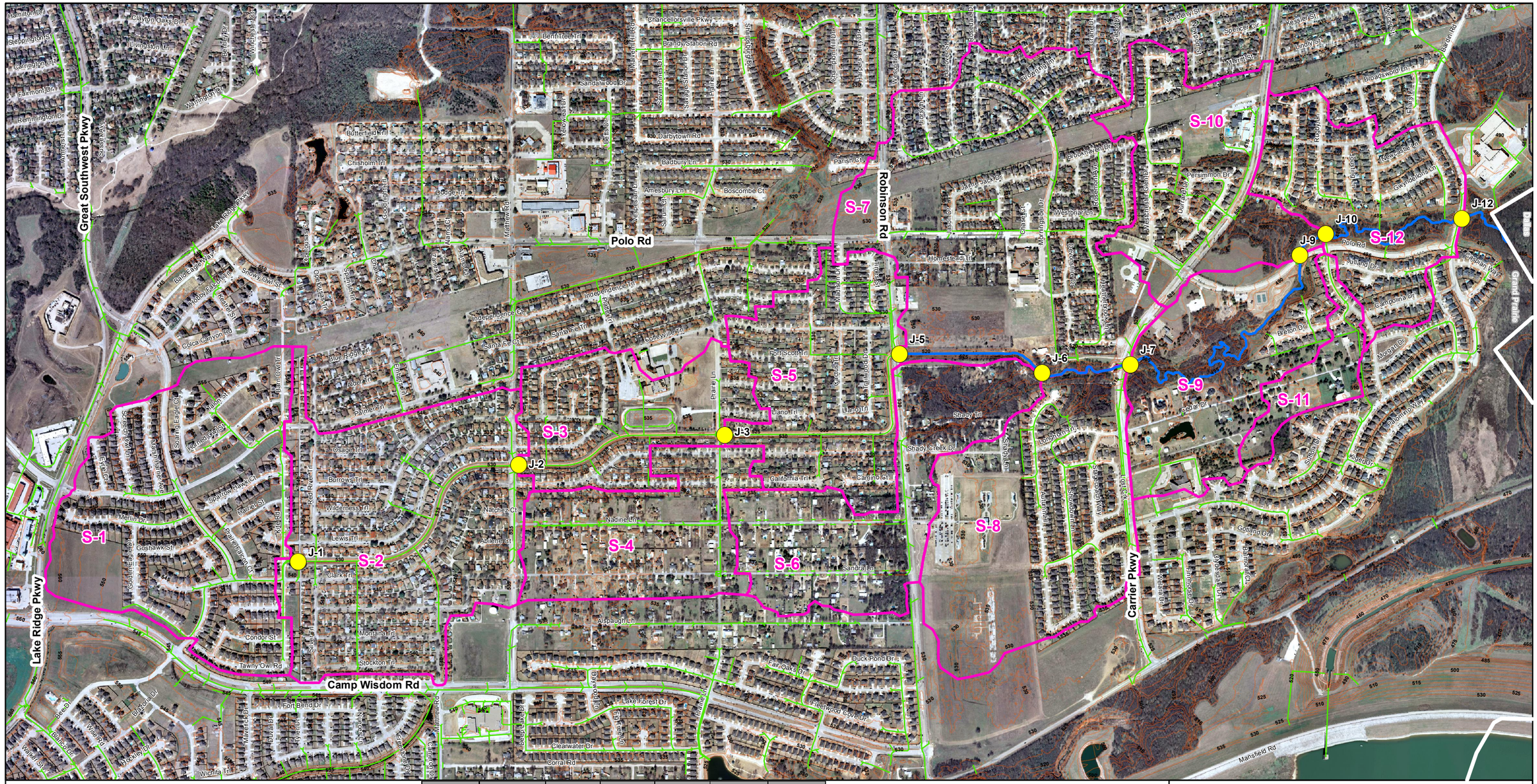
0 1 2 Miles

CITY-WIDE DRAINAGE MASTER PLAN FOR CEDAR CREEK (Y#0845)

VICINITY MAP

AECOM TECHNICAL SERVICES, INC.
16000 DALLAS PARKWAY, SUITE 350
DALLAS, TEXAS 75248
WWW.AECOM.COM
TBPE REG. NO. F-3580

Date: 08/11	Project No.: 60185331	Figure 1



Source: City of Grand Prairie, 2009

Legend

- Analysis Point
- Cedar Creek Stream Centerline
- Watersheds
- Storm Sewers
- 5-ft Contours

Subbasin	Drainage Area (ac.)	Existing Lag Time (min.)	Ultimate Lag Time (min.)	Composite Base Curve Number	Existing % Impervious	Ultimate % Impervious
S-1	139	18.17	7.77	80	45	60
S-2	143	19.62	19.62	80	62	63
S-3	62	13.12	13.12	80	61	61
S-4	66	15.68	15.68	80	38	39
S-5	83	14.43	14.43	80	63	64
S-6	83	16.82	16.82	78	30	32
S-7	183	14.43	14.43	79	48	61
S-8	116	46.96	16.59	76	35	49
S-9	79	15.63	15.63	80	23	26
S-10	79	10.81	10.81	80	46	62
S-11	21	22.79	22.79	79	23	25
S-12	75	11.90	11.90	77	49	51

N

0 1,000 2,000 Feet

CITY-WIDE DRAINAGE MASTER PLAN FOR CEDAR CREEK (Y#0845)

DRAINAGE AREA MAP

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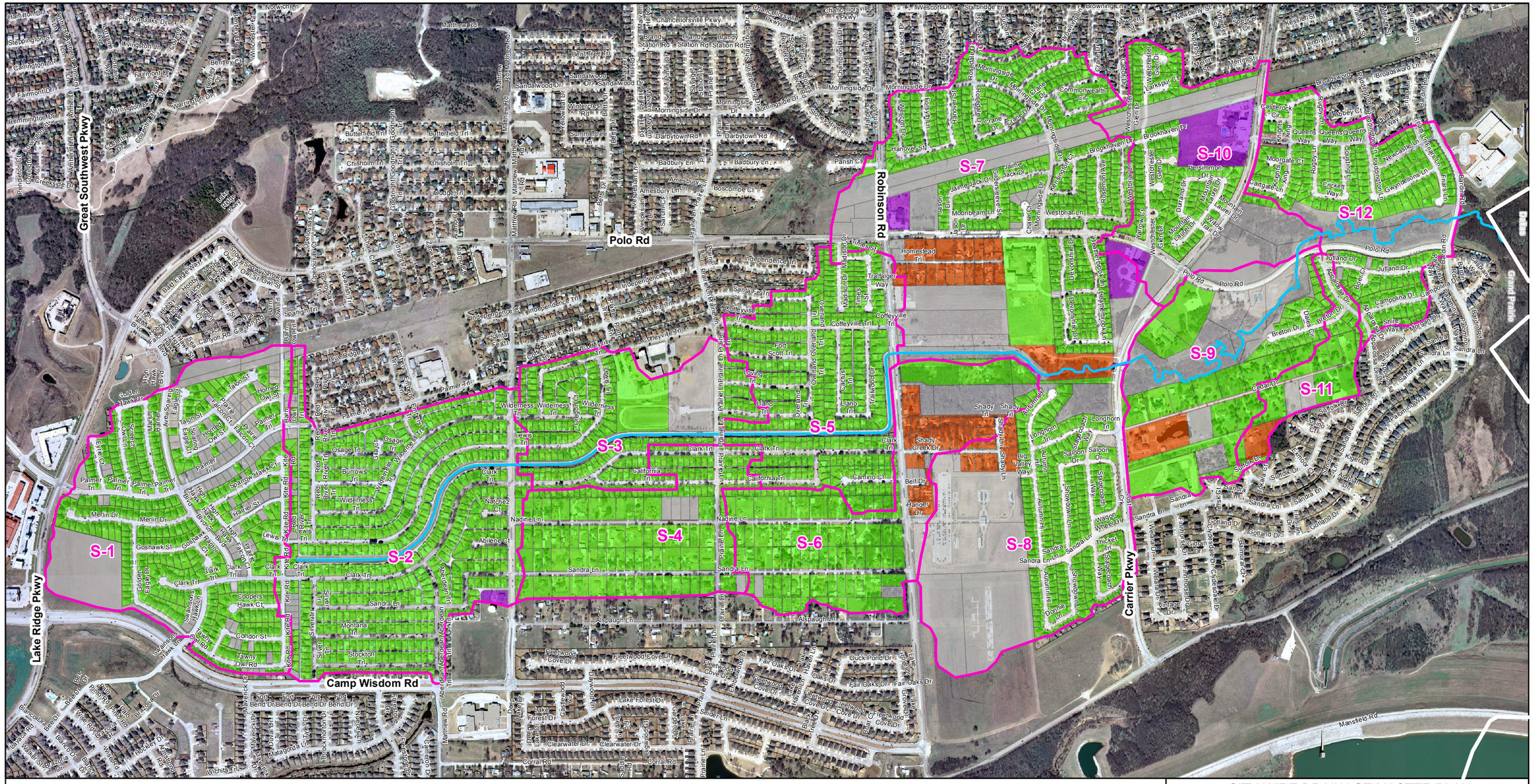
Date: 08/11 | Project No.: 60185331 | Figure 2



Source: City of Grand Prairie, 2009

Legend

Existing Land Use

- Agricultural
- Commercial
- Residential
- Vacant
- ROW

- Cedar Creek Stream Centerline
- Watersheds

N

0 1,000 2,000 Feet

CITY-WIDE DRAINAGE MASTER PLAN FOR CEDAR CREEK (Y#0845)

EXISTING LAND USE MAP

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DALLAS, TEXAS 75248
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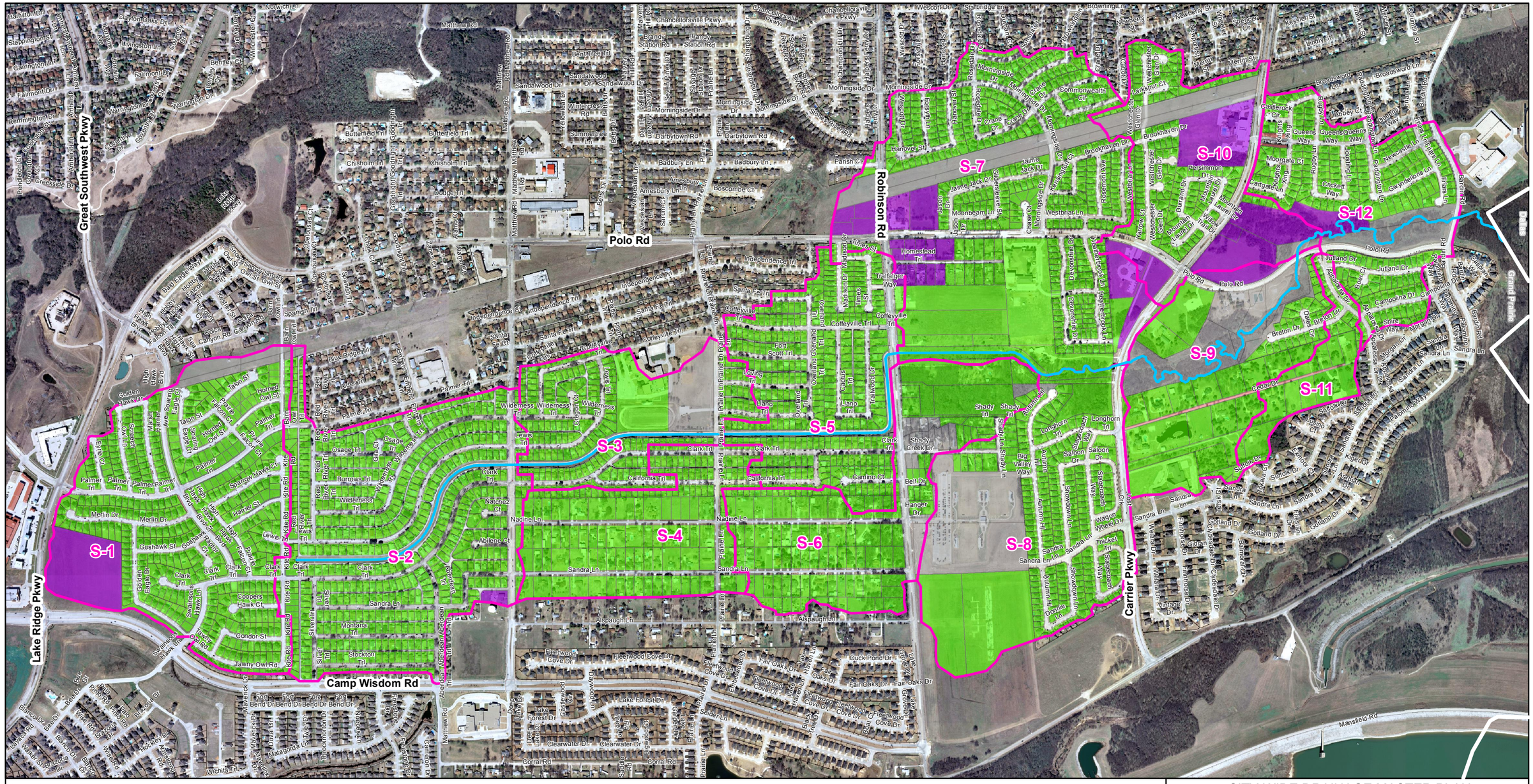
Date: 08/11	Project No.: 60185331	Figure 3



Source: City of Grand Prairie, 2009

Legend

Future Land Use

- Commercial
- Residential
- Vacant
- ROW

- Cedar Creek Stream Centerline
- Watersheds

N

0 1,000 2,000 Feet

CITY-WIDE DRAINAGE MASTER PLAN
FOR
CEDAR CREEK (Y#0845)

FUTURE LAND USE MAP

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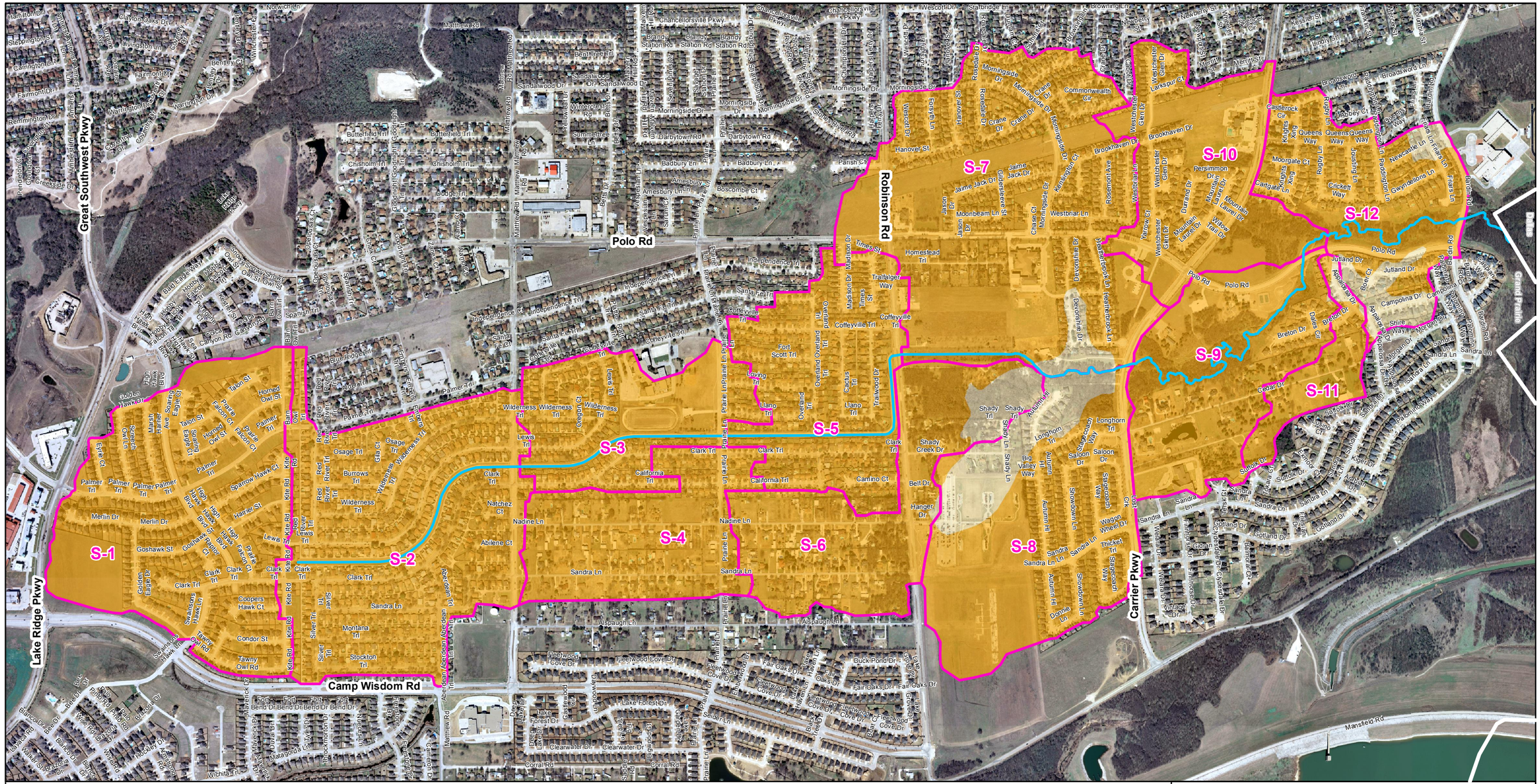
Date: 08/11	Project No.: 60185331	Figure 4



Source: City of Grand Prairie, 2009

Legend

Soils

- Hydrologic Soil Type B
- Hydrologic Soil Type D
- Cedar Creek Stream Centerline
- Watersheds

N

0 1,000 2,000 Feet

CITY-WIDE DRAINAGE MASTER PLAN FOR CEDAR CREEK (Y#0845)

SOILS MAP

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Date: 08/11	Project No.: 60185331	Figure 5

NOTES
1. 1-ft contours provided by City of Grand Prairie, 2009.
2. Aerial photography provided by City of Grand Prairie, 2009
3. Vertical datum based of National Geodetic Vertical Datum of 1988 (NGVD 88).
4. The lateral weir was modeled as described in Section III.A of the Cedar Creek Drainage Master Plan.

Legend

- Cedar Creek Stream Centerline
- Cross Sections
- Lateral Weir
- Storm Drains
- Existing 100-Year Floodplain
- Sanitary Sewer Lines
- Ultimate 100-Year Floodplain

N

0 200 400

Feet

CITY-WIDE DRAINAGE MASTER PLAN
FOR
CEDAR CREEK (Y#0845)

TOPOGRAPHIC WORK MAP
(ROBINSON ROAD TO BARDIN ROAD)

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DALLAS, TEXAS 75248
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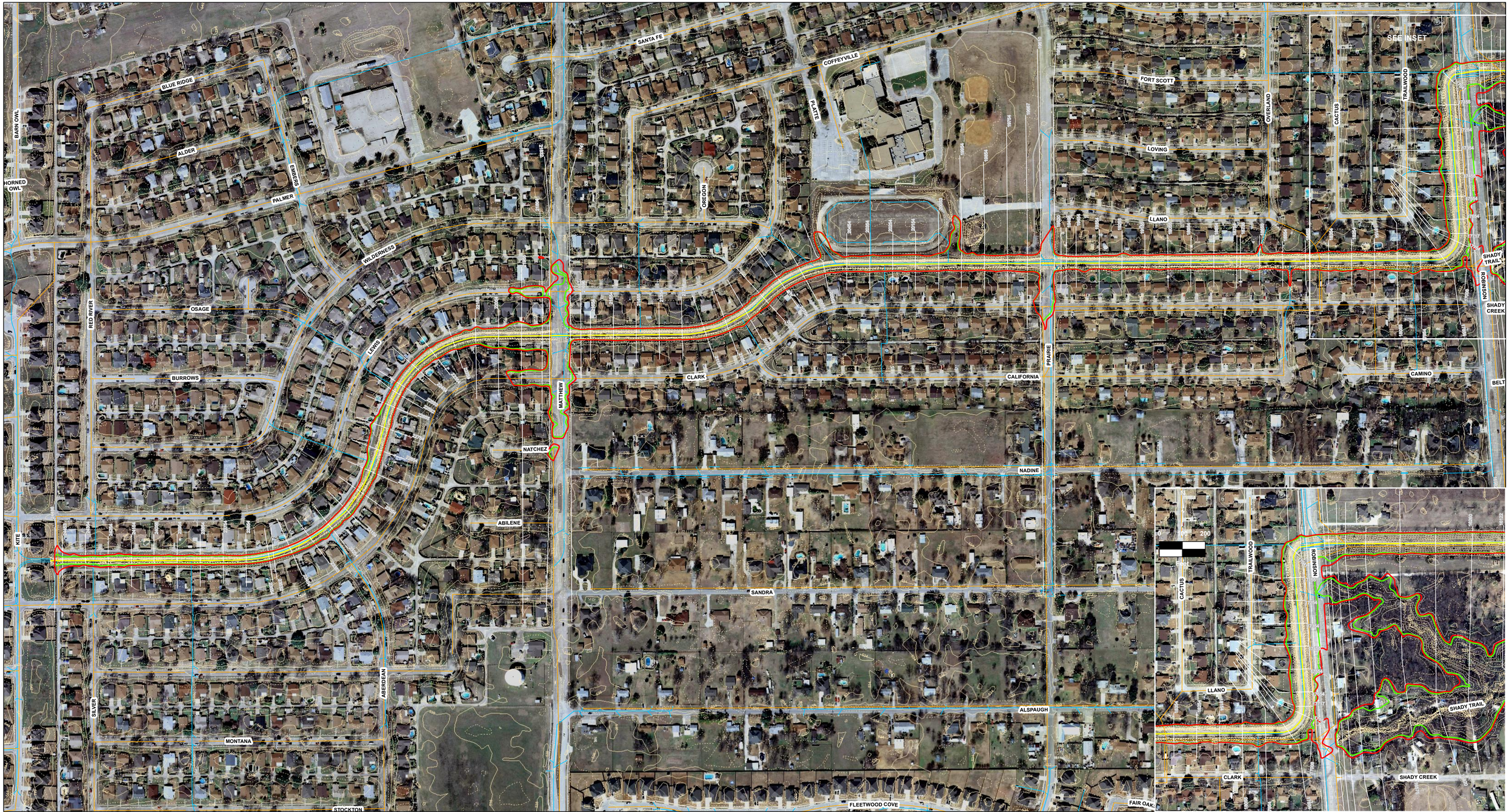
DATE: 08/11	PROJECT NO.: 60185331	Figure 6a



NOTES
1. 1-ft contours provided by City of Grand Prairie, 2009.
2. Aerial photography provided by City of Grand Prairie, 2009
3. Vertical datum based of National Geodetic Vertical Datum of 1988 (NGVD 88).

Legend

- Cedar Creek Stream Centerline
- Storm Drains
- Sanitary Sewer Lines
- 19+22 Cross Sections
- Existing 100-Year Floodplain
- Ultimate 100-Year Floodplain

N

0 200 400 Feet

CITY-WIDE DRAINAGE MASTER PLAN
FOR
CEDAR CREEK (Y#0845)

TOPOGRAPHIC WORK MAP
(KITE ROAD TO ROBINSON ROAD)

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DALLAS, TEXAS 75248
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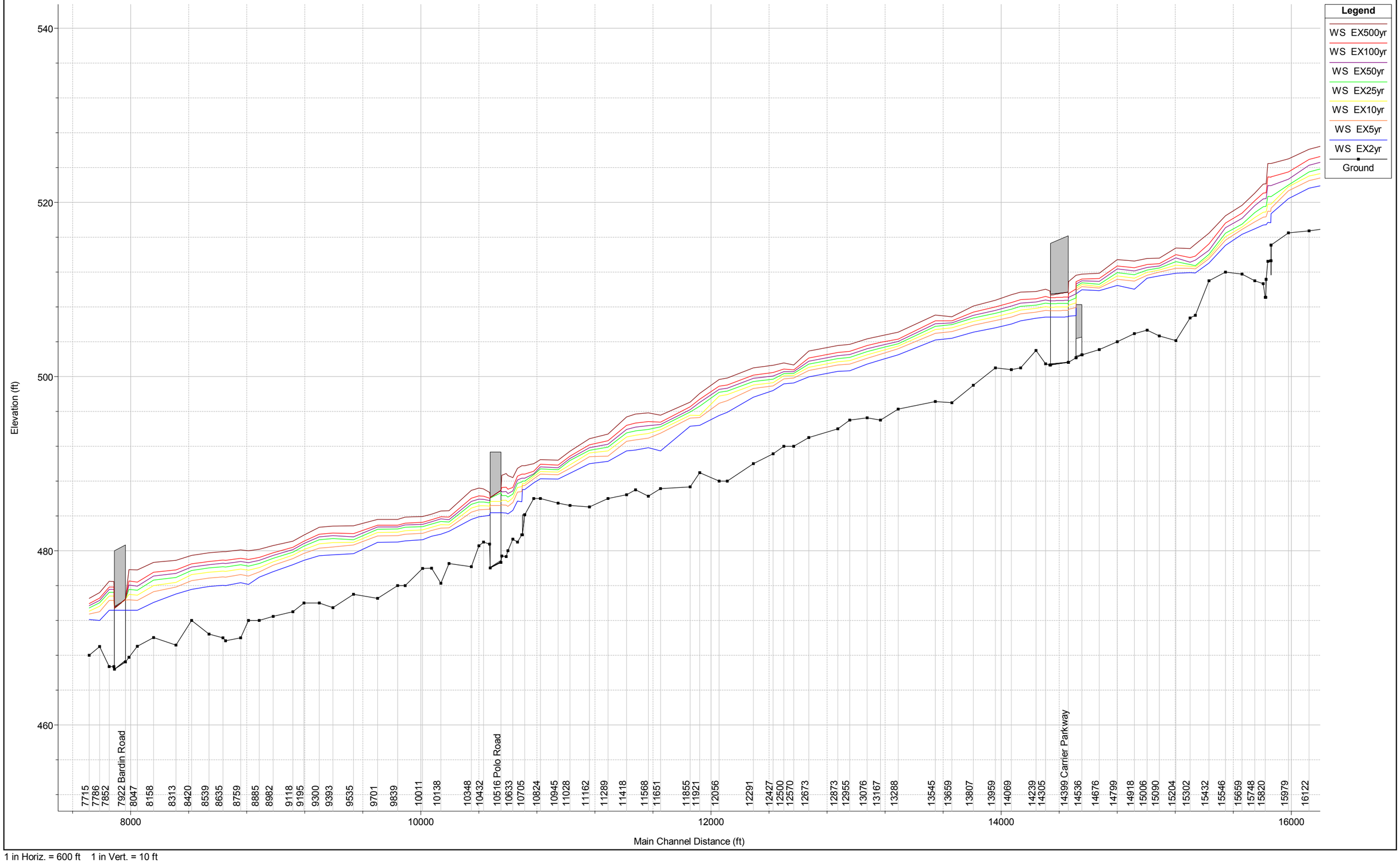
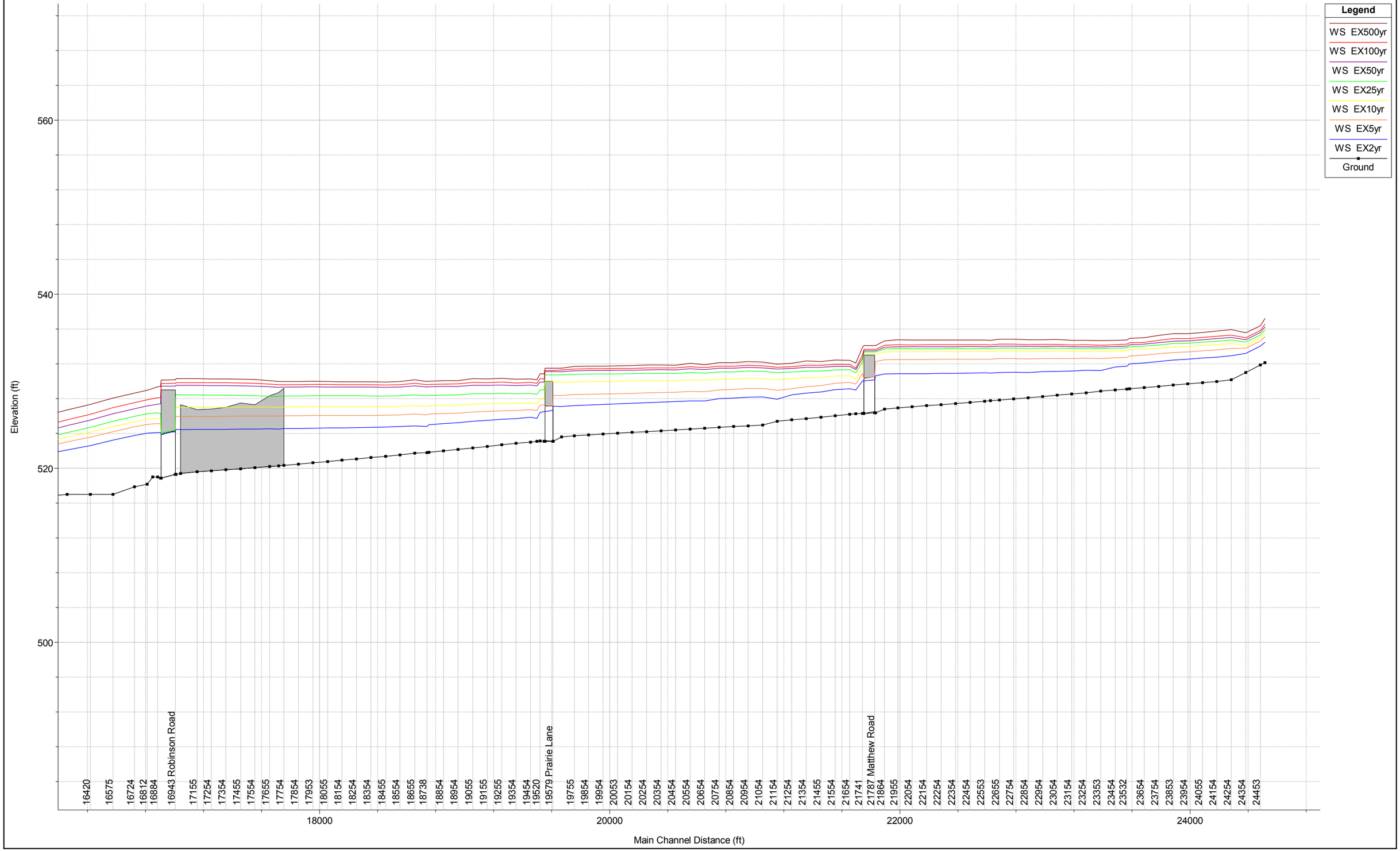
DATE: 08/11 | PROJECT NO.: 60185331 | Figure 6b

FIGURE 7 - Drainage Master Plan for Cedar Creek: Existing Conditions



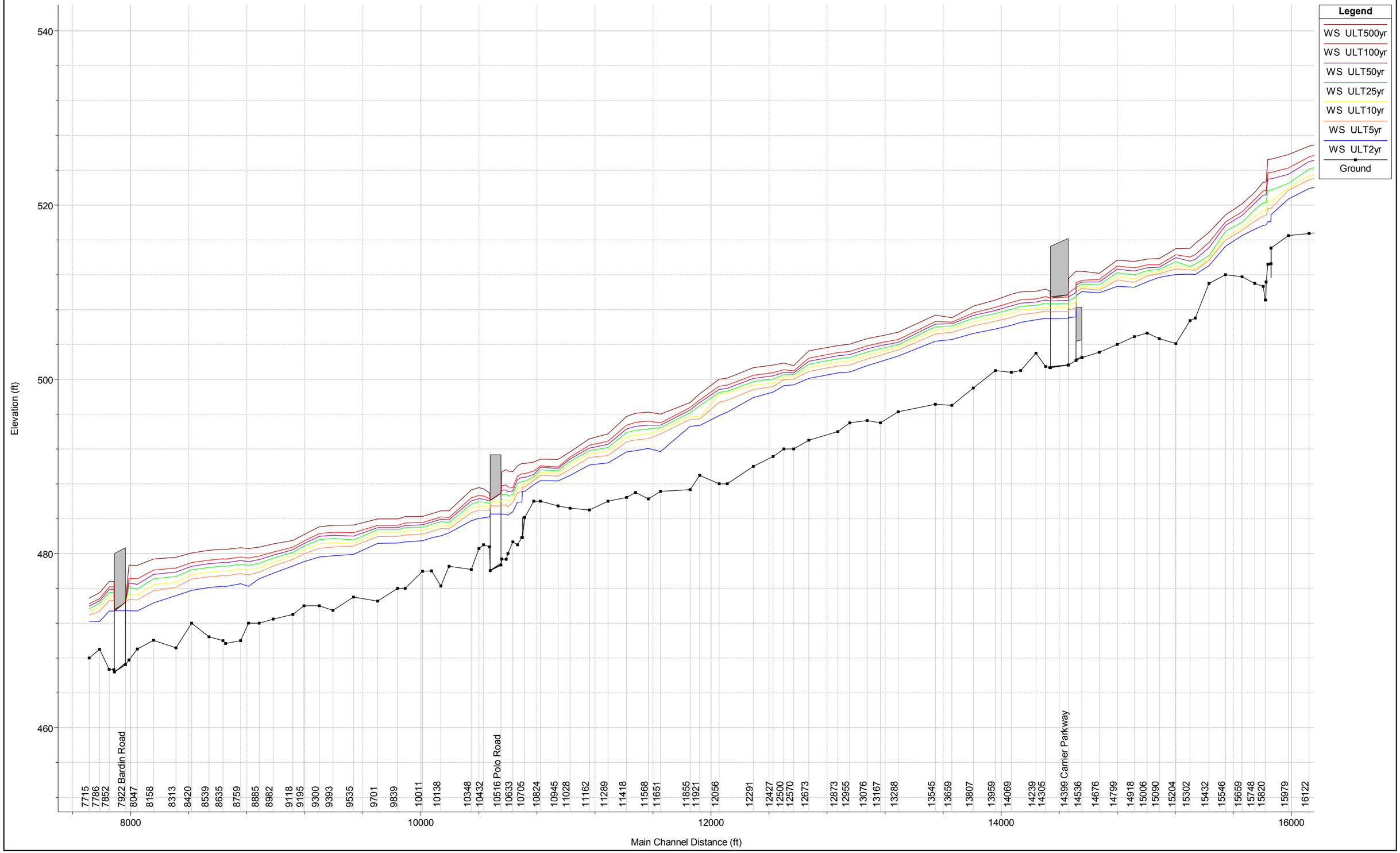
1 in Horiz. = 600 ft 1 in Vert. = 10 ft

Drainage Master Plan for Cedar Creek: Existing Conditions



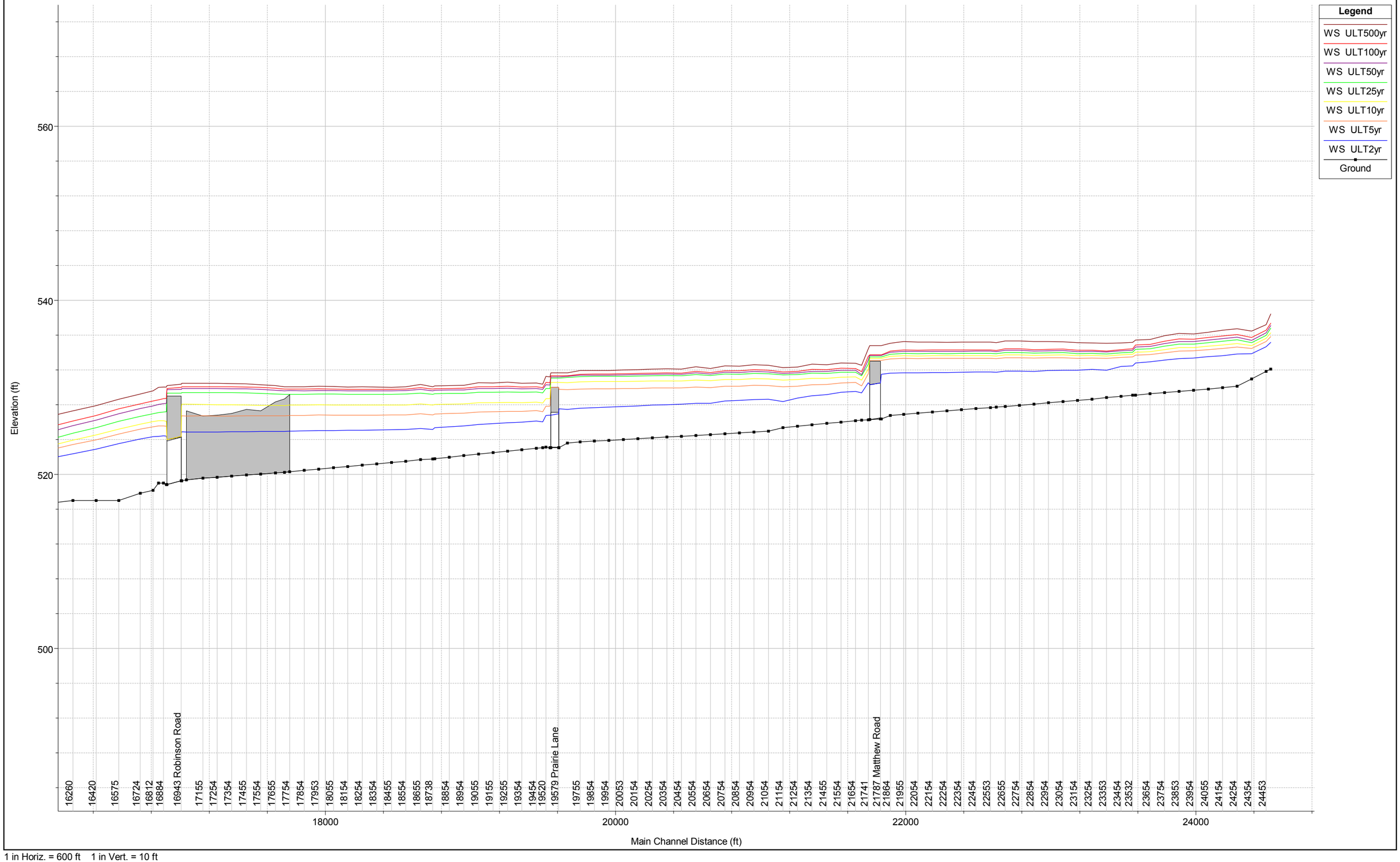
1 in Horiz. = 600 ft 1 in Vert. = 10 ft

FIGURE 8 - Drainage Master Plan for Cedar Creek: Ultimate Conditions

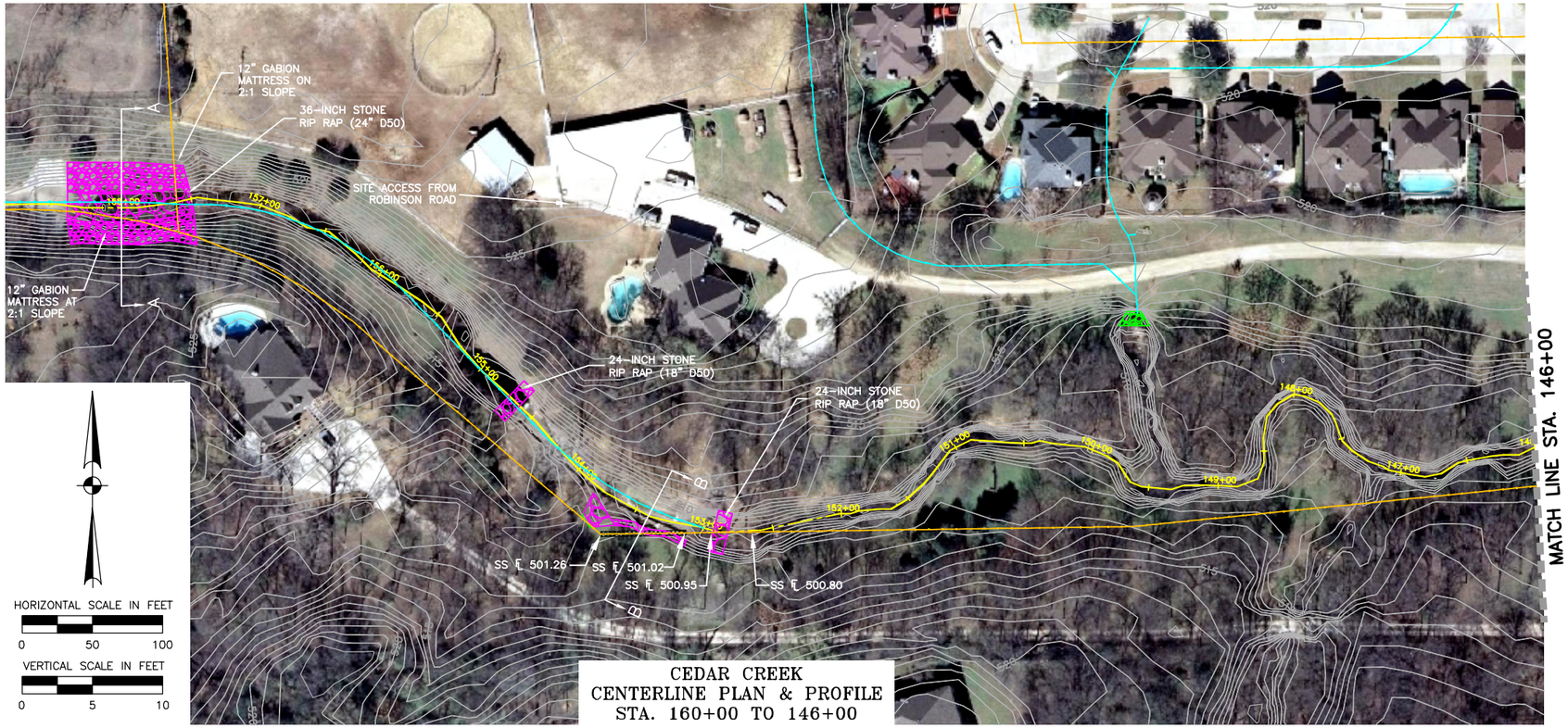


1 in Horiz. = 600 ft 1 in Vert. = 10 ft

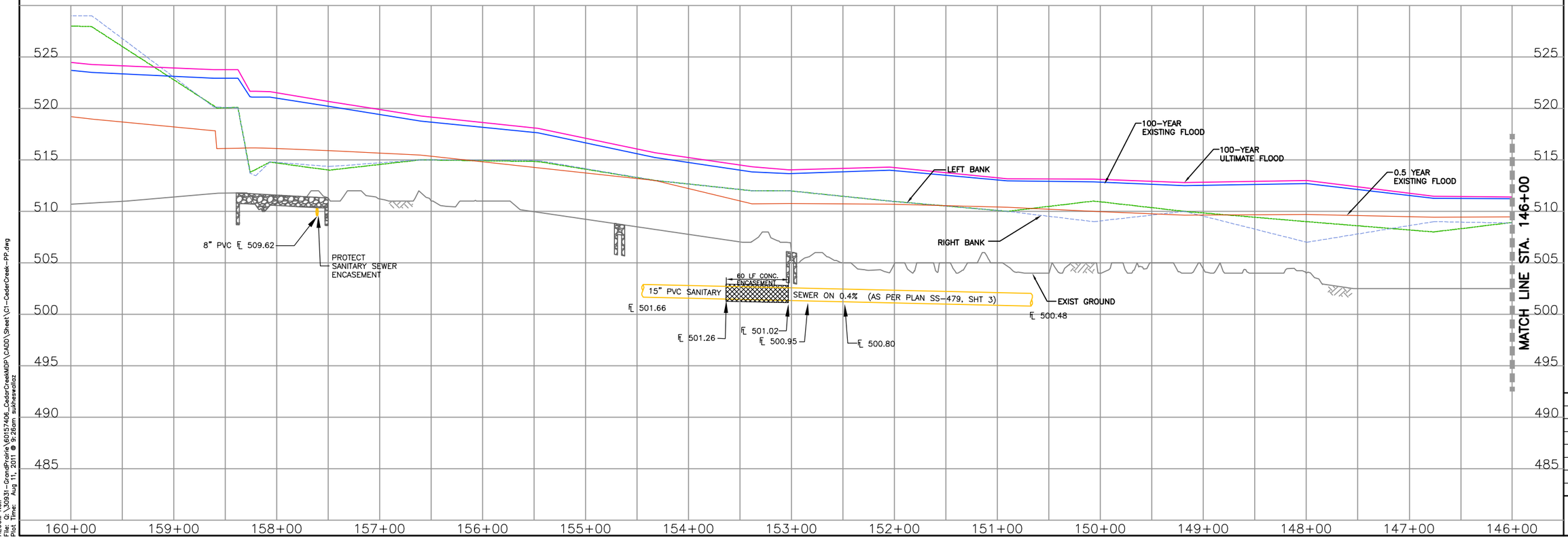
Drainage Master Plan for Cedar Creek: Ultimate Conditions



1 in Horiz. = 600 ft 1 in Vert. = 10 ft



CEDAR CREEK
CENTERLINE PLAN & PROFILE
STA. 160+00 TO 146+00



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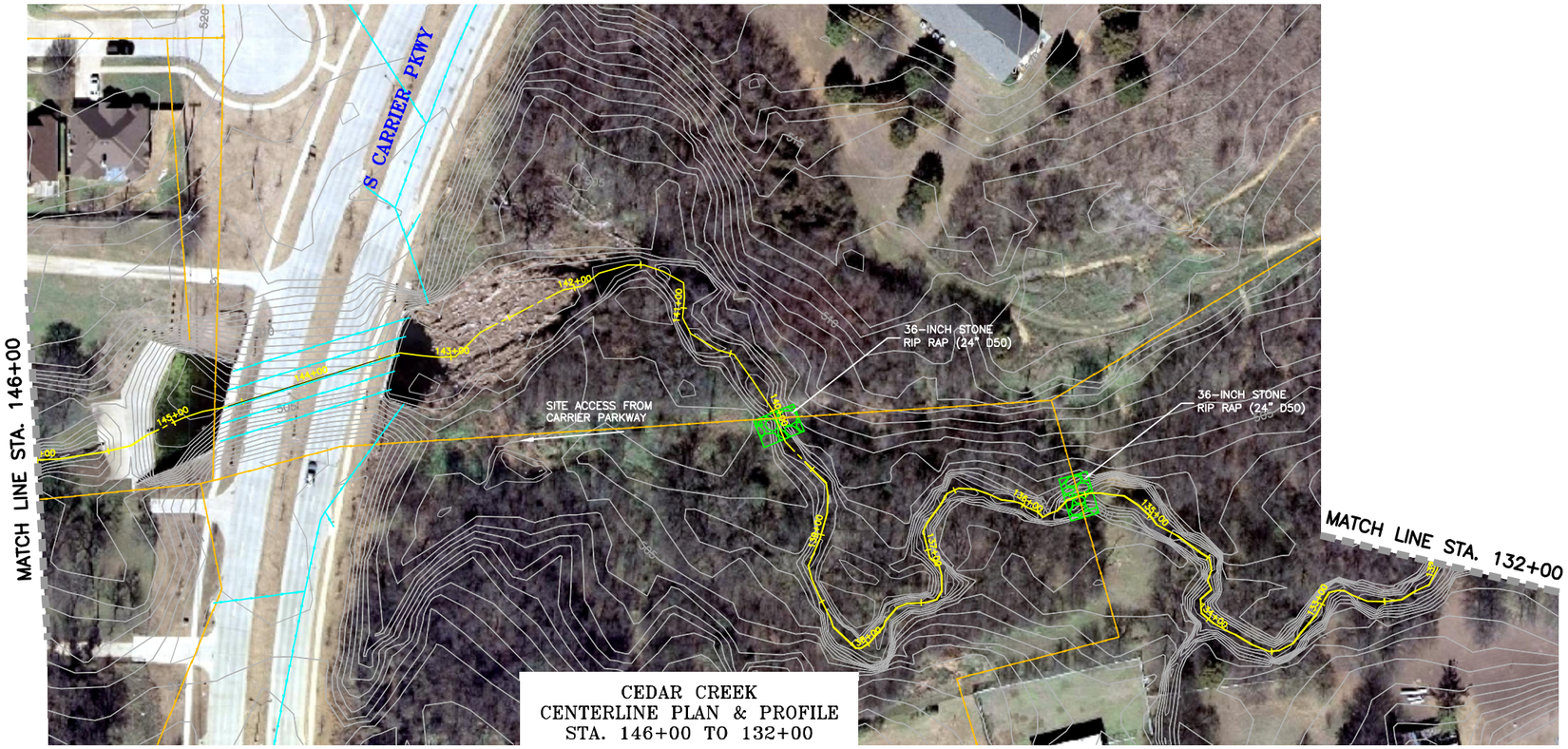
MARK	DATE	MADE BY	CHECK'D	DESCRIPTION
				REVISIONS

AECOM TECHNICAL SERVICES, INC.
ACCESS DALLAS PARKWAY
SUITE 350
DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK
CENTERLINE PLAN & PROFILE
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	H: 1"=50', V: 1"=5'

FIGURE 9
SHEET 1 OF 7



CEDAR CREEK
CENTERLINE PLAN & PROFILE
STA. 146+00 TO 132+00

HORIZONTAL SCALE IN FEET
0 50 100

VERTICAL SCALE IN FEET
0 5 10

LEGEND
- PRIORITY I
- PRIORITY II
- PRIORITY III
- EXIST SANITARY SEWER
- EXIST STORM SEWER
- CEDAR CREEK CL

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
				REVISIONS

AECOM TECHNICAL SERVICES, INC.
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SUITE 350
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CEDAR CREEK
CENTERLINE PLAN & PROFILE
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
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DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	H: 1"=50', V: 1"=5'

FIGURE 9
SHEET 2 OF 7

AECOM No:
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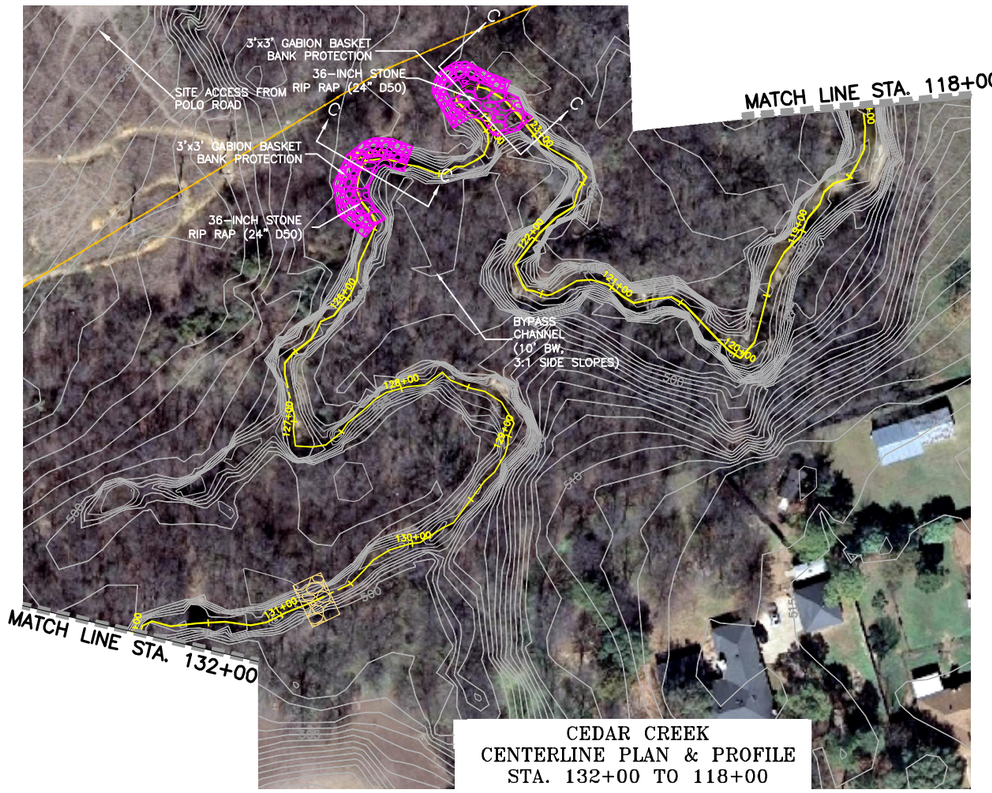


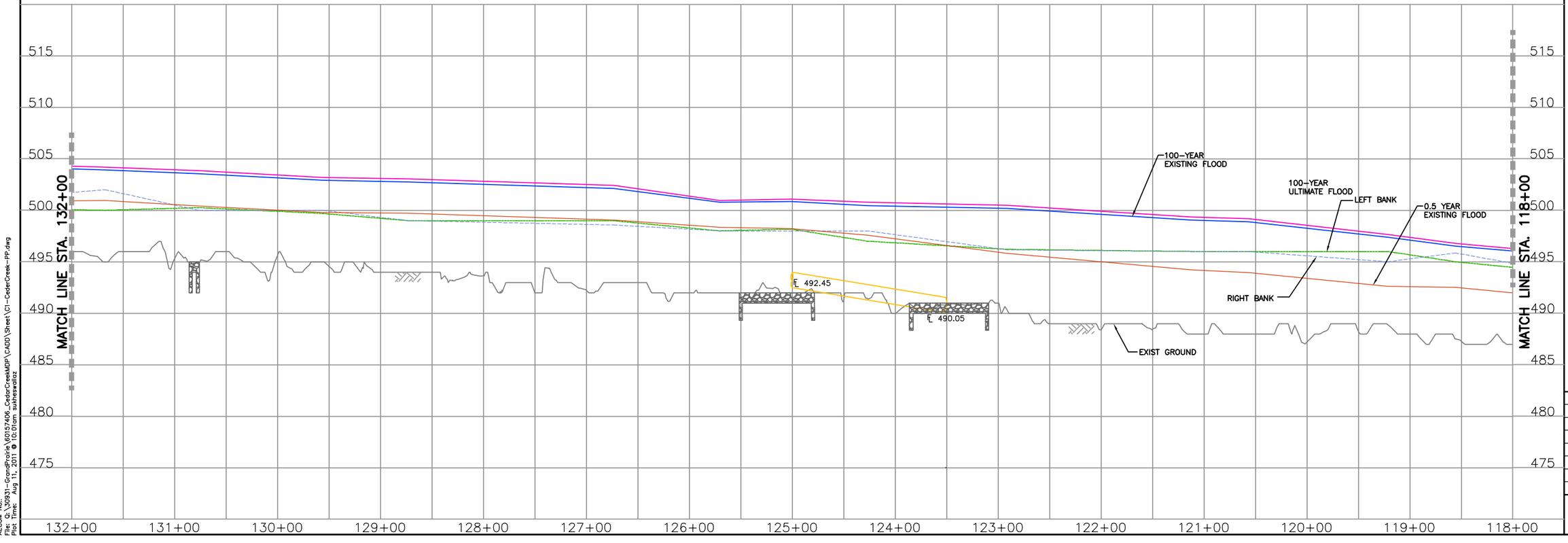
CEDAR CREEK
CENTERLINE PLAN & PROFILE
STA. 132+00 TO 118+00

HORIZONTAL SCALE IN FEET
0 50 100

VERTICAL SCALE IN FEET
0 5 10

LEGEND

- PRIORITY I
- PRIORITY II
- PRIORITY III
- EXIST SANITARY SEWER
- EXIST STORM SEWER
- CEDAR CREEK CL



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				REVISIONS

AECOM TECHNICAL SERVICES, INC.
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DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK
CENTERLINE PLAN & PROFILE
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	H: 1"=50', V: 1"=5'

FIGURE 9
SHEET 3 OF 7

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Plot Time: Aug 11, 2011 @ 10:01am sukhesvalloz

CEDAR CREEK
CENTERLINE PLAN & PROFILE
STA. 118+00 TO 104+00

HORIZONTAL SCALE IN FEET
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VERTICAL SCALE IN FEET
0 5 10

LEGEND

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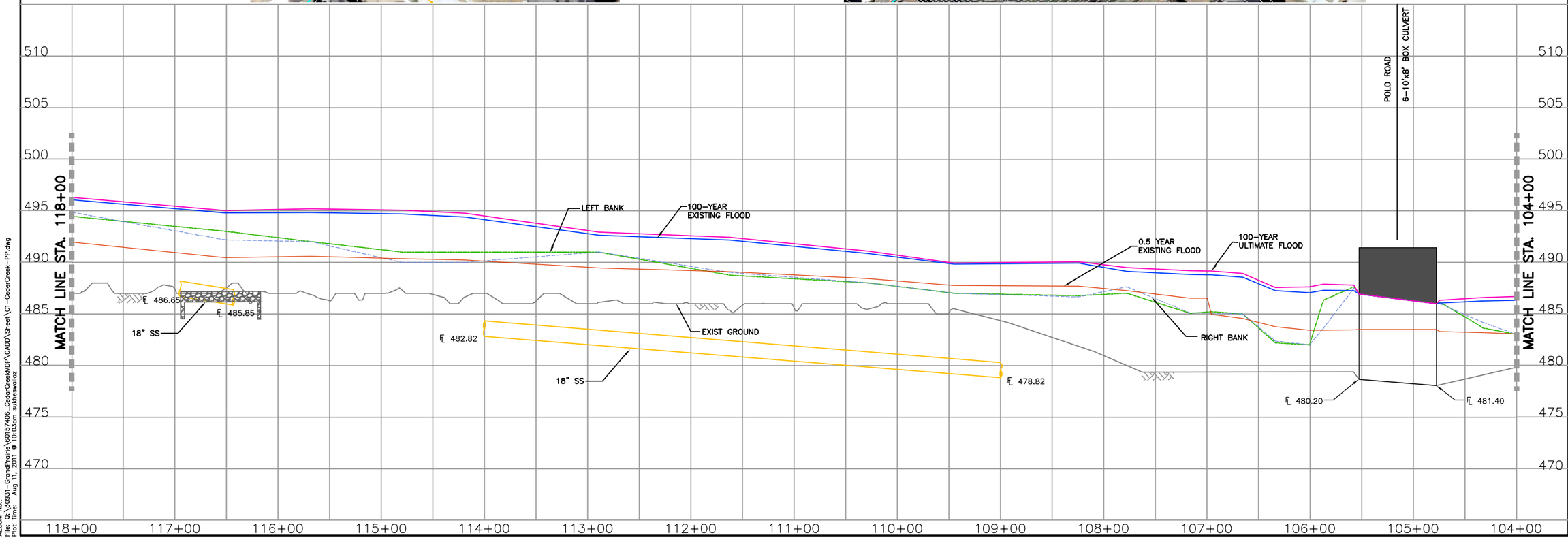
- PRIORITY II
- PRIORITY III
- EXIST SANITARY SEWER
- EXIST STORM SEWER
- CEDAR CREEK CL



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				REVISIONS

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DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK
CENTERLINE PLAN & PROFILE
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
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FIGURE 9
SHEET 4 OF 7

AECOM No:
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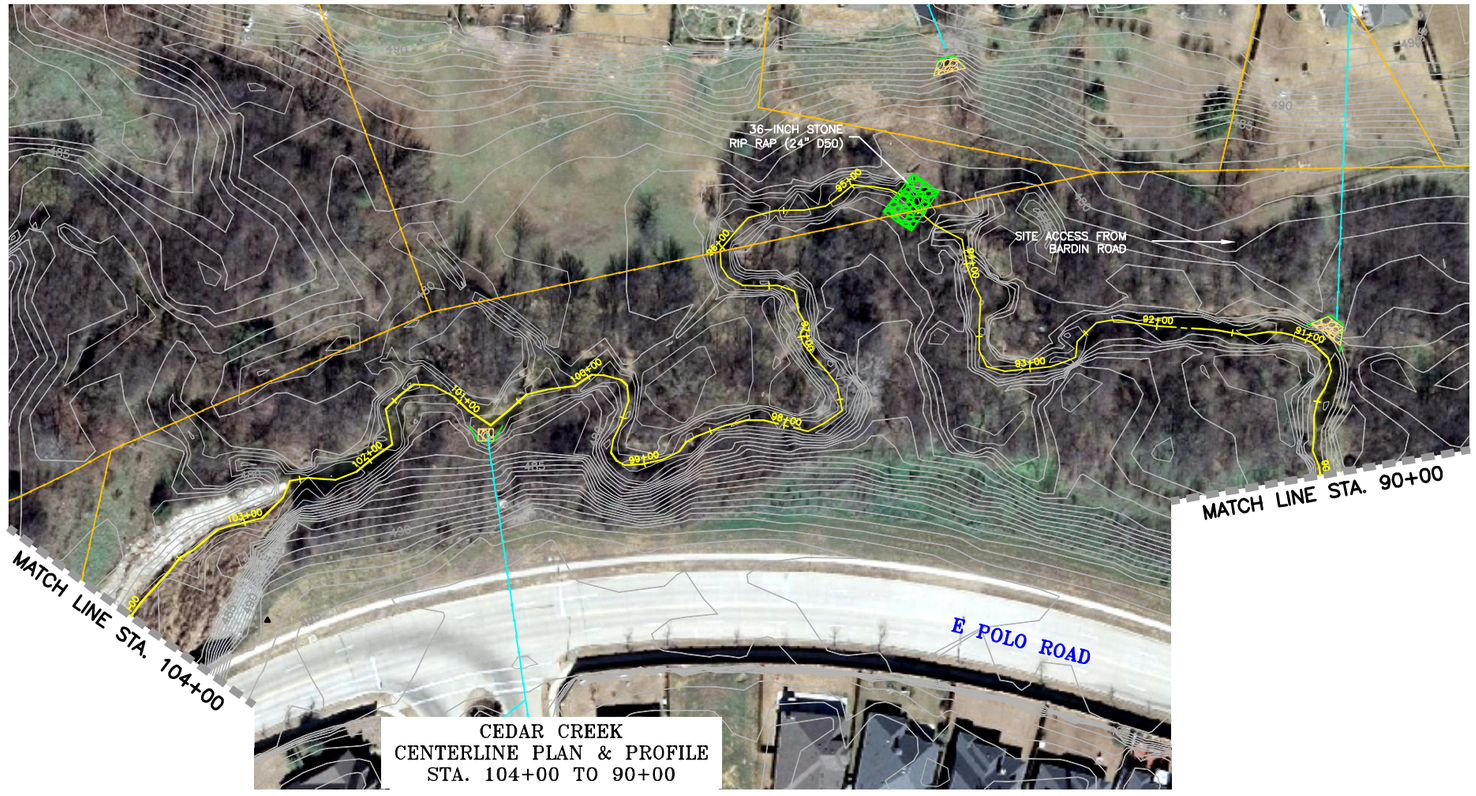


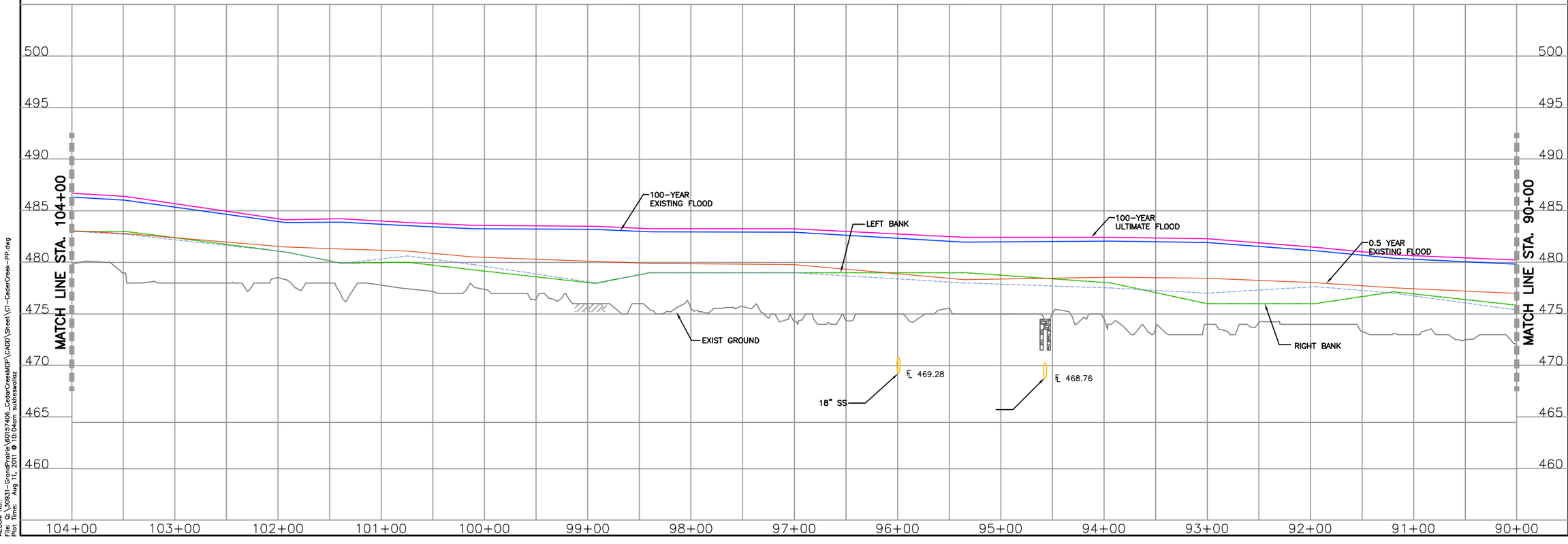
HORIZONTAL SCALE IN FEET
0 50 100

VERTICAL SCALE IN FEET
0 5 10

LEGEND

- PRIORITY I
- PRIORITY II
- PRIORITY III
- EXIST SANITARY SEWER
- EXIST STORM SEWER
- CEDAR CREEK CL

CEDAR CREEK
CENTERLINE PLAN & PROFILE
STA. 104+00 TO 90+00



MARK	DATE	MADE BY	CHECKED	DESCRIPTION
				REVISIONS

AECOM TECHNICAL SERVICES, INC.
16000 DALLAS PARKWAY
SUITE 350
DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK
CENTERLINE PLAN & PROFILE
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	H: 1"=50', V: 1"=5'

FIGURE 9
SHEET 5 OF 7

AECOM No:
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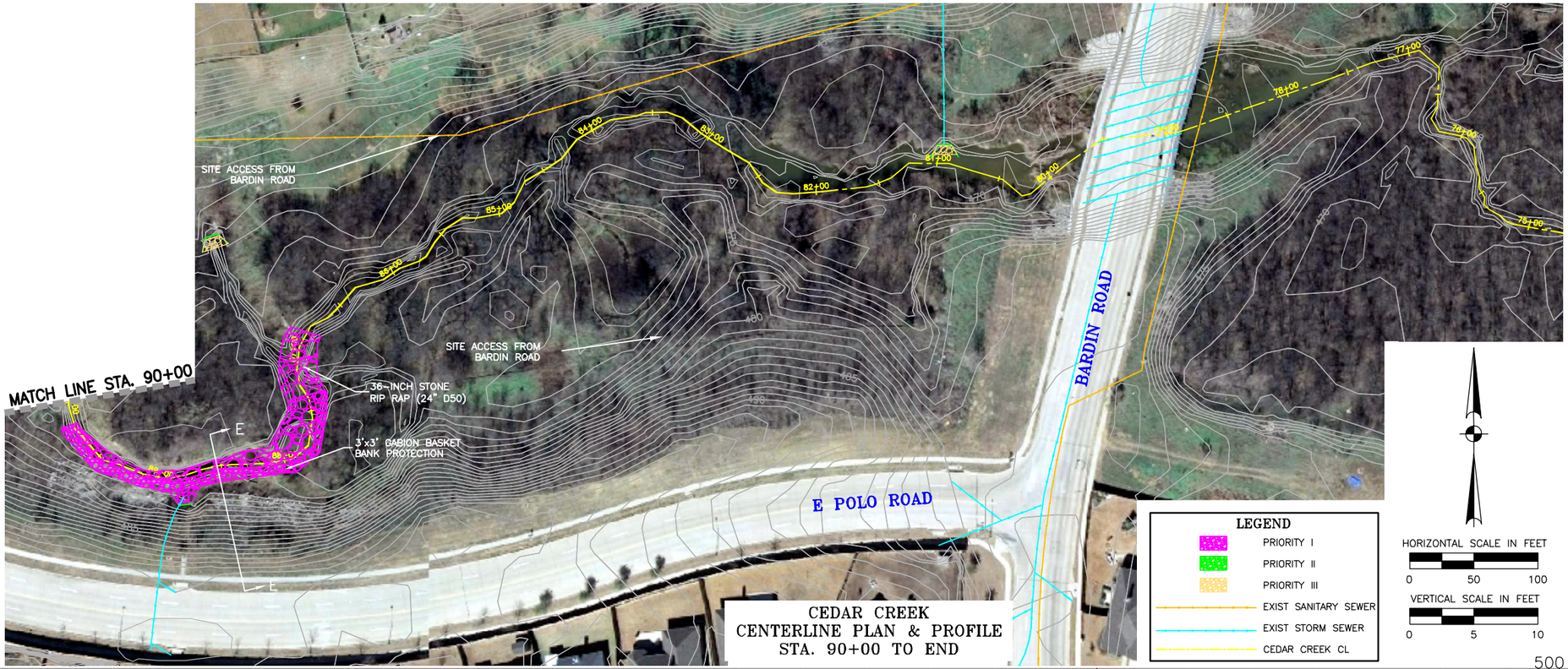


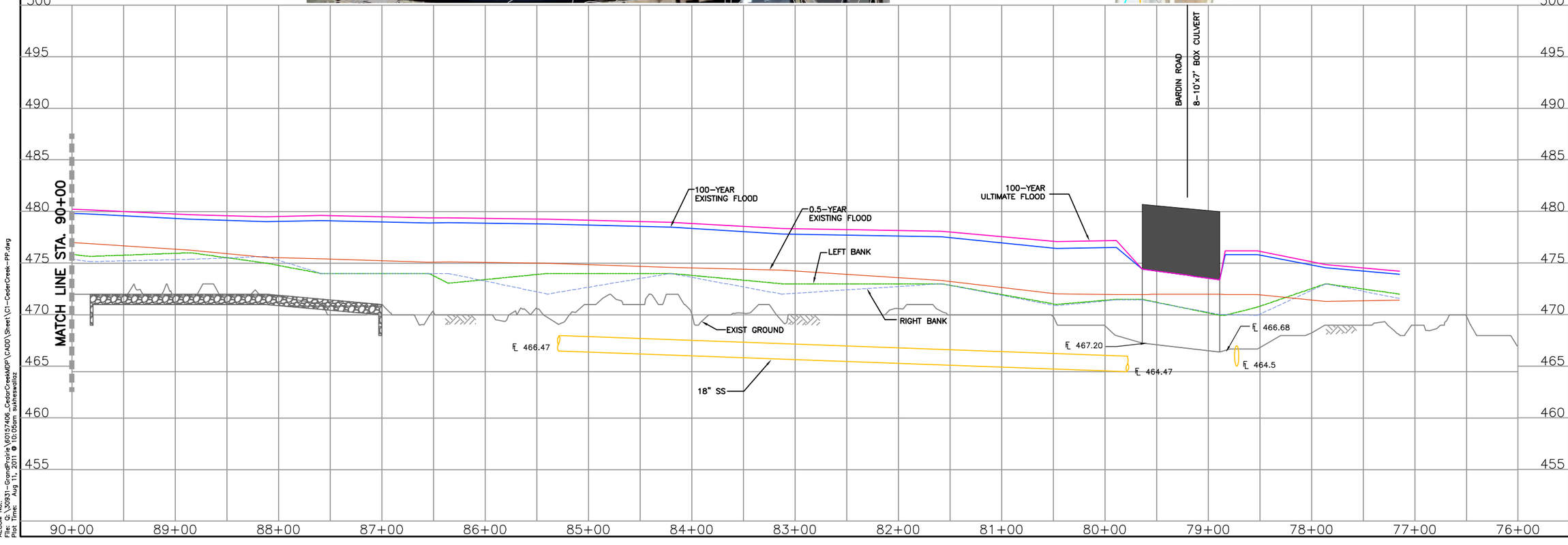
CEDAR CREEK
CENTERLINE PLAN & PROFILE
STA. 90+00 TO END

LEGEND

- PRIORITY I
- PRIORITY II
- PRIORITY III
- EXIST SANITARY SEWER
- EXIST STORM SEWER
- CEDAR CREEK CL

HORIZONTAL SCALE IN FEET
0 50 100

VERTICAL SCALE IN FEET
0 5 10



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				REVISIONS

AECOM TECHNICAL SERVICES, INC.
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SUITE 350
DALLAS, TEXAS 75248
TBPE REG. NO. F-3580

CEDAR CREEK
CENTERLINE PLAN & PROFILE
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	H: 1"=50', V: 1"=5'

FIGURE 9
SHEET 6 OF 7

AECOM No:
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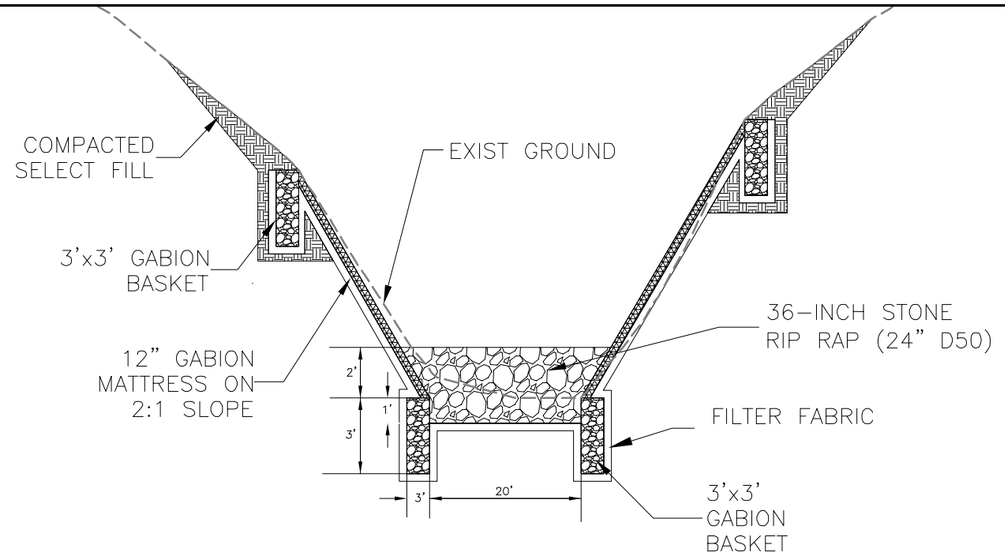

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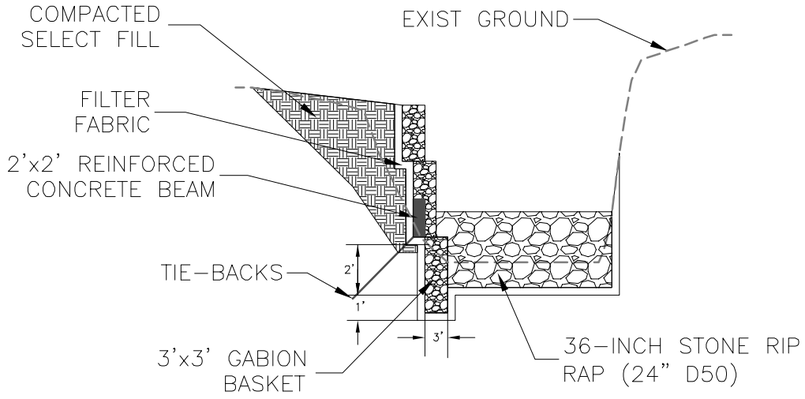

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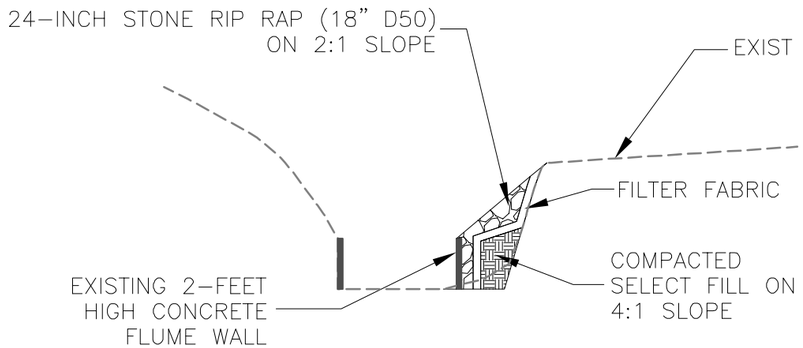

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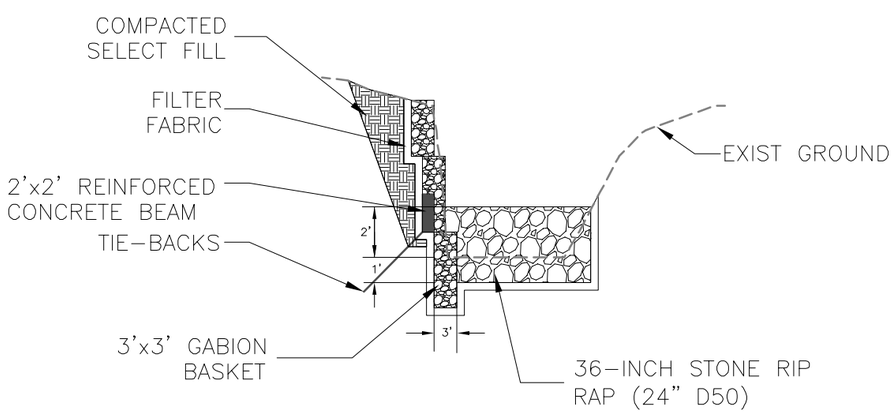
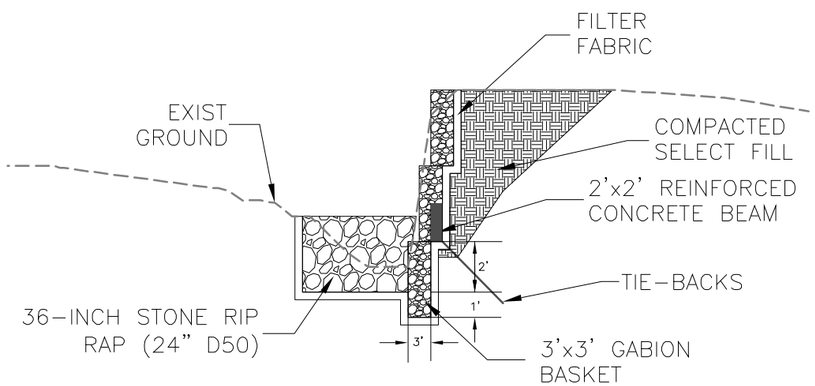


SECTION C–C



SECTION E–E

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AECOM TECHNICAL SERVICES, INC.
ACCOTT DALLAS PARKWAY
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DALLAS, TEXAS 75248
TBPE REG. NO. F–3580

CEDAR CREEK
TYPICAL SECTIONS
CITY OF GRAND PRAIRIE
DALLAS COUNTY, TEXAS

PROJECT NO:	60185331
CAD DWG FILE:	
DESIGNED BY:	AECOM
DRAWN BY:	AECOM
DEPT CHECK:	–
PROJ CHECK:	–
DATE:	AUGUST 2011
SCALE:	N.T.S.

FIGURE 9
SHEET 7 OF 7

AECOM No.:
File: 60185331_GrandPrairie\60157408_CedarCreekMDP\CADD\Sheet\01–CederCreek–PP.dwg
Plot Time: Aug 11, 2011 @ 10:49am sukhewaltz

Appendix B

Breakdown of Cost Estimates for Cedar Creek (Y#0845)

AECOM

APPENDIX E - OPINION OF PROBABLE PROJECT COST ESTIMATES
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

This cost analysis is presented for budgeting purposes only. It utilizes current TxDOT low bid average costs where available, and uses current construction bid information from projects in the surrounding area for all other unit costs. The total figures below include breakdowns for all three priority projects (except Priority III outfall improvement projects)

GRAND TOTAL OPINION OF PROBABLE PROJECT COSTS

Total Cost of All Improvement Projects	**$**	**2,277,000**
Robinson Road Increased Flood Protection	$	373,000
Prairie Lane Increased Flood Protection	$	174,000
Protection of Polo Road embankment and meandering bank in the vicinity of station 89+00	$	464,000
Protection of 18-inch sewer line crossing at station 94+55	$	40,000
Protection of 18-inch sewer line at station 116+60	$	298,000
Protection of 18-inch sewer line at stations 125+00 and 123+65	$	325,000
Protection of 18-inch and 8-inch sewer line crossing at station 139+90 and station 135+50	$	61,000
Hydrogeomorphic stability of creek at station 130+75	$	37,000
Protection of 8-inch sewer line and scour hole at Station 158+00	$	288,000
Protection of 15-inch sewer line and concrete flume at stations 154+60, 153+40, and 153+00	$	176,000
Protection of 90-inch storm drain outfall structure at station 149+50	$	41,000

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #1a - Robinson Road Increased Flood Protection

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Mobilization and Demobilization	1	LS	$ 40,000	$ 40,000
Remove 8" Reinforced Concrete Pavement	600	SY	$ 15	$ 9,000
Replace 8" Reinforced Concrete Pavement	600	SY	$ 90	$ 54,000
12" PVC Water	90	LF	$ 50	$ 4,500
Modify 9x5 CBC to 9x8 CBC	400	LF	$ 260.00	$ 103,400
Replace Railing (C223)	100	LF	$ 110.00	$ 11,000
MBGF Transition and TAS	2	EA	$ 2,000.00	$ 4,000
Replace Headwalls	6	CY	$ 500.00	$ 2,970
Traffic Control	1	LS	$ 10,000	$ 10,000
Site Restoration	1	LS	$ 10,000	$ 10,000
SUBTOTAL IMPROVEMENT ITEMS				**$ 249,000**
CONTINGENCIES (30%)				$ 75,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 324,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 49,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 1a				**$ 373,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

Improvement Project #1b - Prairie Lane Increased Flood Protection

Item Description	Estimated Quantity	Unit		Unit Price		Total Amount
Mobilization and Demobilization	1	LS	$	-	$	-
Remove 8" Reinforced Concrete Pavement	250	SY	$	15	$	3,750
Replace 8" Reinforced Concrete Pavement	250	SY	$	90	$	22,500
8" Cast Iron Water Line	80	LF	$	55.00	$	11,000
Modify 8x4 CBC to 8x5 CBC	200	LF	$	230.00	$	46,200
Replace Railing (C223)	100	LF	$	110.00	$	11,000
MBGF Transition and TAS	2	EA	$	2,000.00	$	4,000
Replace Headwalls	6	CY	$	500.00	$	2,970
Traffic Control	1	LS	$	5,000	$	5,000
Site Restoration	1	LS	$	10,000	$	10,000
SUBTOTAL IMPROVEMENT ITEMS					**$**	**116,000**
CONTINGENCIES (30%)					$	35,000
TOTAL PROBABLE COST OF CONSTRUCTION					**$**	**151,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)					$	23,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 1b					**$**	**174,000**
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 1a & 1b					**$**	**547,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #2 – Protection of Polo Road embankment and meandering bank in the vicinity of station 89+00

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Polo Road Roadway Embankment Protection				
Site Preparation/Access/Mobilization	1	LS	$ 100,000.00	$ 100,000
Excavation	1,300	CY	$ 25.00	$ 32,500
36-inch Stone Rip Rap (Dry)	430	CY	$ 100.00	$ 43,000
3' x 3' Gabions (PVC Wiring)	180	CY	$ 200.00	$ 36,000
Tie-Back Gabion Wall	90	CY	$ 420.00	$ 37,800
Compacted Select Fill	620	CY	$ 30.00	$ 18,600
Filter Fabric	1,040	SY	$ 2.00	$ 2,080
Seeding	450	SY	$ 2.00	$ 900
Sodding	600	SY	$ 5.00	$ 3,000
SUBTOTAL IMPROVEMENT ITEMS (POLO ROAD ROADWAY EMBANKMENT PROTECTION)				**$ 274,000**
CONTINGENCIES (30%)				$ 83,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 357,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 54,000
OPINION OF PROBABLE PROJECT COST (POLO ROAD ROADWAY EMBANKMENT PROTECTION)				**$ 411,000**

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Rock Chute at Storm Drain Outfall				
Excavation	160	CY	$ 25.00	$ 4,000
36-inch Stone Rip Rap (Dry)	120	CY	$ 100.00	$ 12,000
Filter Fabric	100	SY	$ 2.00	$ 200
SUBTOTAL IMPROVEMENT ITEMS (ROCK CHUTE AT STORM DRAIN OUTFALL)				**$ 17,000**
CONTINGENCIES (30%)				$ 6,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 23,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $5,000)				$ 5,000
OPINION OF PROBABLE PROJECT COST (ROCK CHUTE AT STORM DRAIN OUTFALL)				**$ 28,000**

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Storm Drain Outfall Protection				
Removal/Clearing of debris	1	LS	$ 5,000.00	$ 5,000
Excavation	100	CY	$ 25.00	$ 2,500
36-inch Stone Rip Rap (Dry)	70	CY	$ 100.00	$ 7,000
Filter Fabric	70	SY	$ 2.00	$ 140
SUBTOTAL IMPROVEMENT ITEMS (STORM DRAIN OUTFALL PROTECTION)				**$ 15,000**
CONTINGENCIES (30%)				$ 5,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 20,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $5,000)				$ 5,000
OPINION OF PROBABLE PROJECT COST (STORM DRAIN OUTFALL PROTECTION)				**$ 25,000**
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 2				**$ 464,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #3 – Protection of 18-inch sewer line crossing at station 94+55

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Site Preparation/Access (Small)	1	LS	$ 10,000.00	$ 10,000
Excavation	140	CY	$ 25.00	$ 3,500
36-inch Stone Rip Rap (Dry)	100	CY	$ 100.00	$ 10,000
Filter Fabric	80	SY	$ 2.00	$ 160
SUBTOTAL IMPROVEMENT ITEMS				**$ 24,000**
CONTINGENCIES (30%)				$ 8,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 32,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $8,000)				$ 8,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 3				**$ 40,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #4 – Protection of 18-inch sewer line at station 116+60

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
18-inch Sewer Protection at Station 116+60				
Site Preparation/Access/Mobilization	1	LS	$ 100,000.00	$ 100,000
Excavation	480	CY	$ 25.00	$ 12,000
36-inch Stone Rip Rap (Dry)	370	CY	$ 100.00	$ 37,000
3' x 3' Gabions (PVC Wiring)	90	CY	$ 200.00	$ 18,000
Tie-Back Gabion Wall	50	CY	$ 420.00	$ 21,000
Compacted Select Fill	280	CY	$ 30.00	$ 8,400
Filter Fabric	700	SY	$ 2.00	$ 1,400
Seeding	550	SY	$ 2.00	$ 1,100
SUBTOTAL IMPROVEMENT ITEMS (SEWER PROTECTION AT STATION 116+60)				**$ 199,000**
CONTINGENCIES (30%)				$ 60,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 259,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 39,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 4				**$ 298,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #5 – Protection of 18-inch sewer line at stations 125+00 and 123+65

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
18-inch Sewer Protection at Station 125+00				
Site Preparation/Access/Mobilization	1	LS	$ 100,000.00	$ 100,000
Excavation	340	CY	$ 25.00	$ 8,500
36-inch Stone Rip Rap (Dry)	200	CY	$ 100.00	$ 20,000
3' x 3' Gabions (PVC Wiring)	60	CY	$ 200.00	$ 12,000
Tie-Back Gabion Wall	40	CY	$ 420.00	$ 16,800
Compacted Select Fill	100	CY	$ 30.00	$ 3,000
Filter Fabric	440	SY	$ 2.00	$ 880
Seeding	170	SY	$ 2.00	$ 340
SUBTOTAL IMPROVEMENT ITEMS (SEWER PROTECTION AT STATION 125+00)				**$ 162,000**
CONTINGENCIES (30%)				$ 49,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 211,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 32,000
OPINION OF PROBABLE PROJECT COST (SEWER PROTECTION AT STATION 125+00)				**$ 243,000**

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
18-inch Sewer Protection at Station 123+65				
Site Preparation/Access/Mobilization	0	LS	$ 100,000.00	$ -
Excavation	300	CY	$ 25.00	$ 7,500
36-inch Stone Rip Rap (Dry)	180	CY	$ 100.00	$ 18,000
3' x 3' Gabions (PVC Wiring)	60	CY	$ 200.00	$ 12,000
Tie-Back Gabion Wall	30	CY	$ 420.00	$ 12,600
Compacted Select Fill	90	CY	$ 30.00	$ 2,700
Filter Fabric	390	SY	$ 2.00	$ 780
Seeding	150	SY	$ 2.00	$ 300
SUBTOTAL IMPROVEMENT ITEMS (SEWER PROTECTION AT STATION 123+65)				**$ 54,000**
CONTINGENCIES (30%)				$ 17,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 71,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 11,000
OPINION OF PROBABLE PROJECT COST (SEWER PROTECTION AT STATION 123+65)				**$ 82,000**

TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 5	**$ 325,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #6 – Protection of 18-inch and 8-inch sewer line crossing at station 139+90 and station 135+50

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
18-inch Sewer Protection at Station 139+90				
Site Preparation/Access (Small)	1	LS	$ 10,000.00	$ 10,000
Excavation	140	CY	$ 25.00	$ 3,500
36-inch Stone Rip Rap (Dry)	80	CY	$ 100.00	$ 8,000
Filter Fabric	70	SY	$ 2.00	$ 140
SUBTOTAL IMPROVEMENT ITEMS				**$ 22,000**
CONTINGENCIES (30%)				$ 7,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 29,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $8,000)				$ 8,000
OPINION OF PROBABLE PROJECT COST (18-INCH SEWER PROTECTION AT STATION 139+90)				**$ 37,000**

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
8-inch Sewer Protection at Station 135+50				
Site Preparation/Access (Small)	0	LS	$ 10,000.00	$ -
Excavation	140	CY	$ 25.00	$ 3,500
36-inch Stone Rip Rap (Dry)	80	CY	$ 100.00	$ 8,000
Filter Fabric	70	SY	$ 2.00	$ 140
SUBTOTAL IMPROVEMENT ITEMS				**$ 12,000**
CONTINGENCIES (30%)				$ 4,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 16,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $8,000)				$ 8,000
OPINION OF PROBABLE PROJECT COST (18-INCH SEWER PROTECTION AT STATION 135+50)				**$ 24,000**

TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 6	**$ 61,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #7 – Hydrogeomorphic stability of creek at station 130+75

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Site Preparation/Access (Small)	1	LS	$ 10,000.00	$ 10,000
Excavation	140	CY	$ 25.00	$ 3,500
36-inch Stone Rip Rap (Dry)	80	CY	$ 100.00	$ 8,000
Filter Fabric	70	SY	$ 2.00	$ 140
SUBTOTAL IMPROVEMENT ITEMS				**$ 22,000**
CONTINGENCIES (30%)				$ 7,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 29,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $8,000)				$ 8,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 7				**$ 37,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #8 – Protection of 8-inch sewer line and scour hole at Station 158+00

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Site Preparation/Access/Mobilization	1	LS	$ 100,000.00	$ 100,000
Excavation	640	CY	$ 25.00	$ 16,000
36-inch Stone Rip Rap (Dry)	270	CY	$ 100.00	$ 27,000
3' x 3' Gabions (PVC Wiring)	120	CY	$ 200.00	$ 24,000
12" Gabion Mat (PVC Wiring)	410	SY	$ 40.00	$ 16,400
Compacted Select Fill	160	CY	$ 30.00	$ 4,800
Filter Fabric	920	SY	$ 2.00	$ 1,840
Seeding	660	SY	$ 2.00	$ 1,320
SUBTOTAL IMPROVEMENT ITEMS				**$ 192,000**
CONTINGENCIES (30%)				$ 58,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 250,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 38,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 8				**$ 288,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #9 – Protection of 15-inch sewer line and concrete flume at stations 154+60, 153+40, and 153+00

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount
Site Preparation/Access/Mobilization	1	LS	$ 100,000.00	$ 100,000
Excavation (Sta. 154+60)	70	CY	$ 25.00	$ 1,750
Excavation (Sta. 153+40)	10	CY	$ 25.00	$ 250
Excavation (Sta. 153+00)	70	CY	$ 25.00	$ 1,750
36-inch Stone Rip Rap-Dry (Sta. 154+60)	50	CY	$ 100.00	$ 5,000
36-inch Stone Rip Rap-Dry (Sta. 153+40)	20	CY	$ 100.00	$ 2,040
36-inch Stone Rip Rap-Dry (Sta. 153+00)	50	CY	$ 100.00	$ 5,000
Filter Fabric	50	SY	$ 2.00	$ 100
Sodding	150	SY	$ 5.00	$ 750
SUBTOTAL IMPROVEMENT ITEMS				**$ 117,000**
CONTINGENCIES (30%)				$ 36,000
TOTAL PROBABLE COST OF CONSTRUCTION				**$ 153,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (15%)				$ 23,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 9				**$ 176,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

OPINION OF PROBABLE PROJECT COSTS
Drainage Master Plan for Cedar Creek (Y#0845)
Grand Prairie, TX
May 12, 2011

Improvement Project #10 – Protection of 90-inch storm drain outfall structure at station 149+50

Item Description	Estimated Quantity	Unit		Unit Price		Total Amount
Site Preparation/Access (Small)	1	LS	$	10,000.00	$	10,000
Removal/Clearing of debris	1	LS	$	5,000.00	$	5,000
Excavation	100	CY	$	25.00	$	2,500
36-inch Stone Rip Rap (Dry)	70	CY	$	100.00	$	7,000
Filter Fabric	70	SY	$	2.00	$	140
SUBTOTAL IMPROVEMENT ITEMS (STORM DRAIN OUTFALL PROTECTION)					**$**	**25,000**
CONTINGENCIES (30%)					$	8,000
TOTAL PROBABLE COST OF CONSTRUCTION					**$**	**33,000**
ENGINEERING SERVICES (PLANNING, ENGINEERING, SURVEYING) (GREATER OF 15% OR $8,000)					$	8,000
TOTAL ESTIMATE OF PROBABLE PROJECT COSTS FOR IMPROVEMENT PROJECT 10					**$**	**41,000**

NOTE: This estimate is for planning only and not intended for bid or construction purposes.

AECOM

Appendix C.1

HEC-HMS v3.4 Results for Cedar Creek (Y#0845)

AECOM

Existing 2-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (AC-FT)
S-2	0.222989	284.2	01Jan2010, 12:22	32.7
S-1	0.215415	258.4	01Jan2010, 12:20	28.0
J-1	0.215415	258.4	01Jan2010, 12:20	28.0
R J1-J2	0.215415	242.1	01Jan2010, 12:34	27.9
J-2	0.438404	497.0	01Jan2010, 12:26	60.6
R J2-J3	0.438404	482.2	01Jan2010, 12:34	60.5
S-4	0.103870	128.6	01Jan2010, 12:18	12.8
S-3	0.102112	157.6	01Jan2010, 12:16	14.9
J-3	0.644386	659.1	01Jan2010, 12:26	88.2
R J3-J4	0.644386	648.2	01Jan2010, 12:32	88.1
J-4	0.644386	648.2	01Jan2010, 12:32	88.1
R J4-J5	0.644386	640.2	01Jan2010, 12:36	88.1
S-5	0.130127	195.0	01Jan2010, 12:16	19.2
J-5	0.774513	736.6	01Jan2010, 12:32	107.3
R J5-J6	0.774513	692.3	01Jan2010, 12:48	106.8
S-6	0.129167	138.5	01Jan2010, 12:20	14.2
J-6	0.903680	743.3	01Jan2010, 12:46	121.0
R J6-J7	0.903680	741.9	01Jan2010, 12:48	120.9
S-7	0.287461	387.4	01Jan2010, 12:16	37.7
S-8	0.180810	104.2	01Jan2010, 12:52	19.9
J-7	1.371951	954.4	01Jan2010, 12:44	178.5
R J7-J9	1.371951	939.6	01Jan2010, 12:58	177.8
S-9	0.124013	138.9	01Jan2010, 12:18	13.4
J-9	1.495964	968.8	01Jan2010, 12:58	191.2
R J9-J10	1.495964	966.9	01Jan2010, 13:00	191.1
S-10	0.123070	189.8	01Jan2010, 12:12	16.1
S-11	0.032422	28.8	01Jan2010, 12:26	3.4
J-10	1.651456	1001.7	01Jan2010, 12:58	210.7
R J10-J12	1.651456	995.1	01Jan2010, 13:06	210.1
S-12	0.117781	169.0	01Jan2010, 12:14	15.1
J-12	1.769237	1014.5	01Jan2010, 13:06	225.2

Existing 5-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	414.9	01Jan2010, 12:22	4.34
S-1	0.215415	389.9	01Jan2010, 12:20	3.98
J-1	0.215415	389.9	01Jan2010, 12:20	3.98
R J1-J2	0.215415	364.9	01Jan2010, 12:34	3.98
J-2	0.438404	722.7	01Jan2010, 12:28	4.16
R J2-J3	0.438404	703.5	01Jan2010, 12:38	4.16
S-4	0.103870	195.7	01Jan2010, 12:18	3.84
S-3	0.102112	224.7	01Jan2010, 12:16	4.33
J-3	0.644386	939.3	01Jan2010, 12:30	4.13
R J3-J4	0.644386	931.2	01Jan2010, 12:36	4.13
J-4	0.644386	931.2	01Jan2010, 12:36	4.13
R J4-J5	0.644386	921.9	01Jan2010, 12:40	4.12
S-5	0.130127	278.1	01Jan2010, 12:16	4.37
J-5	0.774513	1052.5	01Jan2010, 12:34	4.17
R J5-J6	0.774513	1018.8	01Jan2010, 12:50	4.15
S-6	0.129167	219.9	01Jan2010, 12:20	3.54
J-6	0.903680	1105.8	01Jan2010, 12:46	4.06
R J6-J7	0.903680	1104.8	01Jan2010, 12:48	4.06
S-7	0.287461	574.0	01Jan2010, 12:16	4.00
S-8	0.180810	175.0	01Jan2010, 12:52	3.51
J-7	1.371951	1485.9	01Jan2010, 12:38	3.97
R J7-J9	1.371951	1476.4	01Jan2010, 12:50	3.96
S-9	0.124013	220.5	01Jan2010, 12:18	3.52
J-9	1.495964	1549.1	01Jan2010, 12:48	3.92
R J9-J10	1.495964	1548.0	01Jan2010, 12:48	3.92
S-10	0.123070	276.8	01Jan2010, 12:12	4.01
S-11	0.032422	47.3	01Jan2010, 12:26	3.44
J-10	1.651456	1636.6	01Jan2010, 12:44	3.92
R J10-J12	1.651456	1631.8	01Jan2010, 12:52	3.91
S-12	0.117781	248.9	01Jan2010, 12:14	3.94
J-12	1.769237	1681.3	01Jan2010, 12:50	3.91

Existing 10-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	502.6	01Jan2010, 12:22	5.44
S-1	0.215415	478.1	01Jan2010, 12:20	5.06
J-1	0.215415	478.1	01Jan2010, 12:20	5.06
R J1-J2	0.215415	462.6	01Jan2010, 12:30	5.05
J-2	0.438404	927.1	01Jan2010, 12:28	5.25
R J2-J3	0.438404	885.1	01Jan2010, 12:36	5.24
S-4	0.103870	240.5	01Jan2010, 12:18	4.91
S-3	0.102112	269.7	01Jan2010, 12:16	5.43
J-3	0.644386	1169.1	01Jan2010, 12:32	5.22
R J3-J4	0.644386	1148.8	01Jan2010, 12:40	5.21
J-4	0.644386	1148.8	01Jan2010, 12:40	5.21
R J4-J5	0.644386	1132.0	01Jan2010, 12:44	5.21
S-5	0.130127	333.8	01Jan2010, 12:16	5.47
J-5	0.774513	1272.0	01Jan2010, 12:34	5.25
R J5-J6	0.774513	1243.8	01Jan2010, 12:52	5.23
S-6	0.129167	274.9	01Jan2010, 12:20	4.58
J-6	0.903680	1348.6	01Jan2010, 12:46	5.13
R J6-J7	0.903680	1347.7	01Jan2010, 12:48	5.13
S-7	0.287461	699.2	01Jan2010, 12:16	5.08
S-8	0.180810	224.0	01Jan2010, 12:52	4.53
J-7	1.371951	1839.1	01Jan2010, 12:38	5.04
R J7-J9	1.371951	1829.8	01Jan2010, 12:50	5.02
S-9	0.124013	275.0	01Jan2010, 12:18	4.57
J-9	1.495964	1934.2	01Jan2010, 12:44	4.98
R J9-J10	1.495964	1933.2	01Jan2010, 12:46	4.98
S-10	0.123070	334.7	01Jan2010, 12:12	5.09
S-11	0.032422	59.9	01Jan2010, 12:26	4.48
J-10	1.651456	2068.6	01Jan2010, 12:40	4.98
R J10-J12	1.651456	2061.4	01Jan2010, 12:48	4.96
S-12	0.117781	302.7	01Jan2010, 12:14	5.00
J-12	1.769237	2139.5	01Jan2010, 12:46	4.97

Existing 25-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	600.6	01Jan2010, 12:22	6.57
S-1	0.215415	576.5	01Jan2010, 12:20	6.17
J-1	0.215415	576.5	01Jan2010, 12:20	6.17
R J1-J2	0.215415	567.9	01Jan2010, 12:28	6.16
J-2	0.438404	1147.1	01Jan2010, 12:26	6.36
R J2-J3	0.438404	1133.0	01Jan2010, 12:32	6.35
S-4	0.103870	290.8	01Jan2010, 12:18	6.01
S-3	0.102112	321.1	01Jan2010, 12:16	6.55
J-3	0.644386	1522.4	01Jan2010, 12:32	6.33
R J3-J4	0.644386	1417.6	01Jan2010, 12:40	6.32
J-4	0.644386	1417.6	01Jan2010, 12:40	6.32
R J4-J5	0.644386	1378.4	01Jan2010, 12:44	6.32
S-5	0.130127	397.4	01Jan2010, 12:16	6.60
J-5	0.774513	1536.1	01Jan2010, 12:42	6.36
R J5-J6	0.774513	1487.6	01Jan2010, 12:54	6.34
S-6	0.129167	335.9	01Jan2010, 12:20	5.66
J-6	0.903680	1603.7	01Jan2010, 12:50	6.24
R J6-J7	0.903680	1602.4	01Jan2010, 12:52	6.23
S-7	0.287461	841.1	01Jan2010, 12:16	6.19
S-8	0.180810	276.7	01Jan2010, 12:52	5.60
J-7	1.371951	2197.6	01Jan2010, 12:34	6.14
R J7-J9	1.371951	2189.2	01Jan2010, 12:46	6.12
S-9	0.124013	335.7	01Jan2010, 12:18	5.66
J-9	1.495964	2341.3	01Jan2010, 12:40	6.08
R J9-J10	1.495964	2339.8	01Jan2010, 12:42	6.08
S-10	0.123070	401.6	01Jan2010, 12:12	6.20
S-11	0.032422	73.6	01Jan2010, 12:26	5.56
J-10	1.651456	2531.0	01Jan2010, 12:38	6.08
R J10-J12	1.651456	2519.7	01Jan2010, 12:44	6.06
S-12	0.117781	364.4	01Jan2010, 12:14	6.10
J-12	1.769237	2629.8	01Jan2010, 12:42	6.06

Existing 50-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	680.8	01Jan2010, 12:22	7.55
S-1	0.215415	656.5	01Jan2010, 12:20	7.15
J-1	0.215415	656.5	01Jan2010, 12:20	7.15
R J1-J2	0.215415	648.3	01Jan2010, 12:28	7.13
J-2	0.438404	1310.6	01Jan2010, 12:26	7.35
R J2-J3	0.438404	1308.7	01Jan2010, 12:28	7.33
S-4	0.103870	331.1	01Jan2010, 12:18	6.98
S-3	0.102112	361.4	01Jan2010, 12:16	7.54
J-3	0.644386	1837.5	01Jan2010, 12:28	7.31
R J3-J4	0.644386	1803.7	01Jan2010, 12:32	7.30
J-4	0.644386	1803.7	01Jan2010, 12:32	7.30
R J4-J5	0.644386	1718.3	01Jan2010, 12:36	7.30
S-5	0.130127	447.5	01Jan2010, 12:16	7.59
J-5	0.774513	1969.9	01Jan2010, 12:34	7.34
R J5-J6	0.774513	1754.1	01Jan2010, 12:48	7.31
S-6	0.129167	385.8	01Jan2010, 12:20	6.62
J-6	0.903680	1912.4	01Jan2010, 12:46	7.21
R J6-J7	0.903680	1908.0	01Jan2010, 12:48	7.21
S-7	0.287461	953.4	01Jan2010, 12:16	7.16
S-8	0.180810	322.4	01Jan2010, 12:52	6.55
J-7	1.371951	2553.2	01Jan2010, 12:44	7.11
R J7-J9	1.371951	2539.1	01Jan2010, 12:54	7.08
S-9	0.124013	384.5	01Jan2010, 12:18	6.62
J-9	1.495964	2684.3	01Jan2010, 12:40	7.05
R J9-J10	1.495964	2682.9	01Jan2010, 12:40	7.04
S-10	0.123070	452.7	01Jan2010, 12:12	7.18
S-11	0.032422	85.1	01Jan2010, 12:26	6.52
J-10	1.651456	2920.9	01Jan2010, 12:36	7.04
R J10-J12	1.651456	2908.2	01Jan2010, 12:42	7.02
S-12	0.117781	412.3	01Jan2010, 12:14	7.07
J-12	1.769237	3050.4	01Jan2010, 12:40	7.03

Existing 100-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	759.3	01Jan2010, 12:22	8.56
S-1	0.215415	735.2	01Jan2010, 12:20	8.15
J-1	0.215415	735.2	01Jan2010, 12:20	8.15
R J1-J2	0.215415	722.1	01Jan2010, 12:28	8.13
J-2	0.438404	1456.4	01Jan2010, 12:26	8.35
R J2-J3	0.438404	1451.3	01Jan2010, 12:28	8.34
S-4	0.103870	370.9	01Jan2010, 12:18	7.98
S-3	0.102112	401.5	01Jan2010, 12:16	8.55
J-3	0.644386	2093.9	01Jan2010, 12:24	8.31
R J3-J4	0.644386	2079.5	01Jan2010, 12:28	8.30
J-4	0.644386	2079.5	01Jan2010, 12:28	8.30
R J4-J5	0.644386	2016.9	01Jan2010, 12:32	8.30
S-5	0.130127	497.3	01Jan2010, 12:16	8.59
J-5	0.774513	2347.3	01Jan2010, 12:32	8.35
R J5-J6	0.774513	2030.0	01Jan2010, 12:48	8.32
S-6	0.129167	434.8	01Jan2010, 12:20	7.60
J-6	0.903680	2223.7	01Jan2010, 12:46	8.21
R J6-J7	0.903680	2219.0	01Jan2010, 12:48	8.21
S-7	0.287461	1065.1	01Jan2010, 12:16	8.16
S-8	0.180810	366.9	01Jan2010, 12:52	7.53
J-7	1.371951	2972.4	01Jan2010, 12:44	8.11
R J7-J9	1.371951	2949.7	01Jan2010, 12:52	8.08
S-9	0.124013	432.8	01Jan2010, 12:18	7.61
J-9	1.495964	3085.3	01Jan2010, 12:50	8.04
R J9-J10	1.495964	3083.9	01Jan2010, 12:52	8.04
S-10	0.123070	504.1	01Jan2010, 12:12	8.18
S-11	0.032422	96.4	01Jan2010, 12:26	7.50
J-10	1.651456	3287.8	01Jan2010, 12:36	8.04
R J10-J12	1.651456	3277.1	01Jan2010, 12:42	8.02
S-12	0.117781	460.4	01Jan2010, 12:14	8.06
J-12	1.769237	3444.1	01Jan2010, 12:40	8.02

Existing 500-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	947.8	01Jan2010, 12:22	10.96
S-1	0.215415	922.8	01Jan2010, 12:22	10.53
J-1	0.215415	922.8	01Jan2010, 12:22	10.53
R J1-J2	0.215415	904.6	01Jan2010, 12:30	10.51
J-2	0.438404	1798.8	01Jan2010, 12:28	10.74
R J2-J3	0.438404	1779.4	01Jan2010, 12:32	10.72
S-4	0.103870	463.6	01Jan2010, 12:18	10.36
S-3	0.102112	493.2	01Jan2010, 12:16	10.95
J-3	0.644386	2515.3	01Jan2010, 12:26	10.70
R J3-J4	0.644386	2513.7	01Jan2010, 12:28	10.69
J-4	0.644386	2513.7	01Jan2010, 12:28	10.69
R J4-J5	0.644386	2508.1	01Jan2010, 12:30	10.68
S-5	0.130127	611.7	01Jan2010, 12:16	11.00
J-5	0.774513	3012.4	01Jan2010, 12:26	10.73
R J5-J6	0.774513	2674.9	01Jan2010, 12:46	10.69
S-6	0.129167	550.5	01Jan2010, 12:20	9.96
J-6	0.903680	2944.8	01Jan2010, 12:44	10.59
R J6-J7	0.903680	2940.2	01Jan2010, 12:46	10.58
S-7	0.287461	1322.3	01Jan2010, 12:18	10.54
S-8	0.180810	481.3	01Jan2010, 12:52	9.86
J-7	1.371951	3983.7	01Jan2010, 12:40	10.47
R J7-J9	1.371951	3951.9	01Jan2010, 12:50	10.44
S-9	0.124013	544.8	01Jan2010, 12:18	9.97
J-9	1.495964	4150.1	01Jan2010, 12:48	10.40
R J9-J10	1.495964	4148.0	01Jan2010, 12:50	10.40
S-10	0.123070	617.4	01Jan2010, 12:12	10.57
S-11	0.032422	123.7	01Jan2010, 12:26	9.85
J-10	1.651456	4372.7	01Jan2010, 12:46	10.40
R J10-J12	1.651456	4366.2	01Jan2010, 12:52	10.37
S-12	0.117781	568.4	01Jan2010, 12:14	10.44
J-12	1.769237	4520.6	01Jan2010, 12:42	10.38

Ultimate 2-Year

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	285.8	01Jan2010, 12:22	2.77
S-1	0.215415	410.4	01Jan2010, 12:10	2.72
J-1	0.215415	410.4	01Jan2010, 12:10	2.72
R J1-J2	0.215415	339.8	01Jan2010, 12:22	2.71
J-2	0.438404	625.6	01Jan2010, 12:22	2.74
R J2-J3	0.438404	590.8	01Jan2010, 12:32	2.74
S-4	0.103870	129.4	01Jan2010, 12:18	2.33
S-3	0.102112	157.6	01Jan2010, 12:16	2.74
J-3	0.644386	771.3	01Jan2010, 12:28	2.67
R J3-J4	0.644386	757.5	01Jan2010, 12:34	2.67
J-4	0.644386	757.5	01Jan2010, 12:34	2.67
R J4-J5	0.644386	744.3	01Jan2010, 12:38	2.67
S-5	0.130127	196.1	01Jan2010, 12:16	2.79
J-5	0.774513	832.7	01Jan2010, 12:34	2.69
R J5-J6	0.774513	788.5	01Jan2010, 12:48	2.68
S-6	0.129167	140.7	01Jan2010, 12:20	2.10
J-6	0.903680	840.4	01Jan2010, 12:46	2.59
R J6-J7	0.903680	838.4	01Jan2010, 12:48	2.59
S-7	0.287461	420.7	01Jan2010, 12:16	2.71
S-8	0.180810	217.0	01Jan2010, 12:18	2.37
J-7	1.371951	1050.7	01Jan2010, 12:38	2.59
R J7-J9	1.371951	1040.0	01Jan2010, 12:52	2.58
S-9	0.124013	141.9	01Jan2010, 12:18	2.09
J-9	1.495964	1077.7	01Jan2010, 12:50	2.54
R J9-J10	1.495964	1076.4	01Jan2010, 12:52	2.54
S-10	0.123070	208.6	01Jan2010, 12:12	2.76
S-11	0.032422	29.2	01Jan2010, 12:26	2.01
J-10	1.651456	1122.0	01Jan2010, 12:50	2.54
R J10-J12	1.651456	1118.2	01Jan2010, 12:58	2.54
S-12	0.117781	171.5	01Jan2010, 12:14	2.45
J-12	1.769237	1142.2	01Jan2010, 12:56	2.53

Ultimate 5-Year

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	416.4	01Jan2010, 12:22	4.37
S-1	0.215415	571.0	01Jan2010, 12:10	4.31
J-1	0.215415	571.0	01Jan2010, 12:10	4.31
R J1-J2	0.215415	511.9	01Jan2010, 12:18	4.30
J-2	0.438404	923.3	01Jan2010, 12:20	4.34
R J2-J3	0.438404	856.8	01Jan2010, 12:30	4.33
S-4	0.103870	196.4	01Jan2010, 12:18	3.86
S-3	0.102112	224.7	01Jan2010, 12:16	4.33
J-3	0.644386	1154.9	01Jan2010, 12:28	4.25
R J3-J4	0.644386	1112.1	01Jan2010, 12:36	4.25
J-4	0.644386	1112.1	01Jan2010, 12:36	4.25
R J4-J5	0.644386	1088.1	01Jan2010, 12:38	4.25
S-5	0.130127	279.1	01Jan2010, 12:16	4.39
J-5	0.774513	1222.2	01Jan2010, 12:36	4.27
R J5-J6	0.774513	1160.1	01Jan2010, 12:48	4.25
S-6	0.129167	222.0	01Jan2010, 12:20	3.58
J-6	0.903680	1245.9	01Jan2010, 12:46	4.16
R J6-J7	0.903680	1243.8	01Jan2010, 12:48	4.15
S-7	0.287461	604.2	01Jan2010, 12:16	4.29
S-8	0.180810	327.7	01Jan2010, 12:20	3.89
J-7	1.371951	1674.2	01Jan2010, 12:26	4.15
R J7-J9	1.371951	1655.1	01Jan2010, 12:40	4.13
S-9	0.124013	223.2	01Jan2010, 12:18	3.58
J-9	1.495964	1769.7	01Jan2010, 12:38	4.09
R J9-J10	1.495964	1766.6	01Jan2010, 12:40	4.08
S-10	0.123070	293.4	01Jan2010, 12:12	4.35
S-11	0.032422	47.7	01Jan2010, 12:26	3.49
J-10	1.651456	1899.3	01Jan2010, 12:38	4.09
R J10-J12	1.651456	1884.1	01Jan2010, 12:44	4.08
S-12	0.117781	251.2	01Jan2010, 12:14	3.98
J-12	1.769237	1953.4	01Jan2010, 12:44	4.08

Ultimate 10-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	504.0	01Jan2010, 12:22	5.46
S-1	0.215415	678.0	01Jan2010, 12:10	5.41
J-1	0.215415	678.0	01Jan2010, 12:10	5.41
R J1-J2	0.215415	639.8	01Jan2010, 12:16	5.40
J-2	0.438404	1119.5	01Jan2010, 12:18	5.43
R J2-J3	0.438404	1032.2	01Jan2010, 12:28	5.42
S-4	0.103870	241.2	01Jan2010, 12:18	4.93
S-3	0.102112	269.7	01Jan2010, 12:16	5.43
J-3	0.644386	1432.8	01Jan2010, 12:26	5.34
R J3-J4	0.644386	1355.4	01Jan2010, 12:34	5.34
J-4	0.644386	1355.4	01Jan2010, 12:34	5.34
R J4-J5	0.644386	1308.8	01Jan2010, 12:40	5.33
S-5	0.130127	334.7	01Jan2010, 12:16	5.49
J-5	0.774513	1466.2	01Jan2010, 12:38	5.36
R J5-J6	0.774513	1397.5	01Jan2010, 12:50	5.34
S-6	0.129167	276.8	01Jan2010, 12:20	4.63
J-6	0.903680	1503.4	01Jan2010, 12:48	5.24
R J6-J7	0.903680	1501.3	01Jan2010, 12:50	5.23
S-7	0.287461	727.5	01Jan2010, 12:16	5.39
S-8	0.180810	403.0	01Jan2010, 12:20	4.94
J-7	1.371951	2087.9	01Jan2010, 12:24	5.22
R J7-J9	1.371951	2056.1	01Jan2010, 12:38	5.20
S-9	0.124013	277.5	01Jan2010, 12:18	4.64
J-9	1.495964	2215.3	01Jan2010, 12:36	5.16
R J9-J10	1.495964	2211.0	01Jan2010, 12:38	5.15
S-10	0.123070	350.0	01Jan2010, 12:12	5.45
S-11	0.032422	60.3	01Jan2010, 12:26	4.53
J-10	1.651456	2392.7	01Jan2010, 12:36	5.16
R J10-J12	1.651456	2371.7	01Jan2010, 12:44	5.15
S-12	0.117781	304.8	01Jan2010, 12:14	5.05
J-12	1.769237	2470.3	01Jan2010, 12:42	5.14

Ultimate 25-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	601.9	01Jan2010, 12:22	6.59
S-1	0.215415	805.0	01Jan2010, 12:10	6.54
J-1	0.215415	805.0	01Jan2010, 12:10	6.54
R J1-J2	0.215415	747.8	01Jan2010, 12:18	6.52
J-2	0.438404	1334.1	01Jan2010, 12:20	6.56
R J2-J3	0.438404	1338.4	01Jan2010, 12:22	6.55
S-4	0.103870	291.5	01Jan2010, 12:18	6.03
S-3	0.102112	321.1	01Jan2010, 12:16	6.55
J-3	0.644386	1901.0	01Jan2010, 12:22	6.46
R J3-J4	0.644386	1807.0	01Jan2010, 12:26	6.46
J-4	0.644386	1807.0	01Jan2010, 12:26	6.46
R J4-J5	0.644386	1637.2	01Jan2010, 12:32	6.45
S-5	0.130127	398.3	01Jan2010, 12:16	6.62
J-5	0.774513	1890.9	01Jan2010, 12:32	6.48
R J5-J6	0.774513	1679.6	01Jan2010, 12:46	6.45
S-6	0.129167	337.8	01Jan2010, 12:20	5.71
J-6	0.903680	1830.3	01Jan2010, 12:44	6.35
R J6-J7	0.903680	1826.7	01Jan2010, 12:46	6.34
S-7	0.287461	868.1	01Jan2010, 12:16	6.51
S-8	0.180810	487.5	01Jan2010, 12:20	6.04
J-7	1.371951	2509.4	01Jan2010, 12:24	6.33
R J7-J9	1.371951	2477.2	01Jan2010, 12:36	6.31
S-9	0.124013	338.1	01Jan2010, 12:18	5.73
J-9	1.495964	2688.2	01Jan2010, 12:34	6.26
R J9-J10	1.495964	2683.8	01Jan2010, 12:36	6.26
S-10	0.123070	416.1	01Jan2010, 12:12	6.58
S-11	0.032422	74.0	01Jan2010, 12:26	5.61
J-10	1.651456	2924.9	01Jan2010, 12:34	6.27
R J10-J12	1.651456	2906.4	01Jan2010, 12:40	6.25
S-12	0.117781	366.4	01Jan2010, 12:14	6.15
J-12	1.769237	3042.2	01Jan2010, 12:38	6.25

Ultimate 50-Year

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	682.1	01Jan2010, 12:22	7.58
S-1	0.215415	898.3	01Jan2010, 12:10	7.53
J-1	0.215415	898.3	01Jan2010, 12:10	7.53
R J1-J2	0.215415	822.6	01Jan2010, 12:20	7.51
J-2	0.438404	1498.5	01Jan2010, 12:20	7.54
R J2-J3	0.438404	1487.4	01Jan2010, 12:24	7.53
S-4	0.103870	331.7	01Jan2010, 12:18	7.01
S-3	0.102112	361.4	01Jan2010, 12:16	7.54
J-3	0.644386	2120.2	01Jan2010, 12:20	7.45
R J3-J4	0.644386	2142.0	01Jan2010, 12:24	7.44
J-4	0.644386	2142.0	01Jan2010, 12:24	7.44
R J4-J5	0.644386	2033.9	01Jan2010, 12:28	7.43
S-5	0.130127	448.3	01Jan2010, 12:16	7.61
J-5	0.774513	2377.1	01Jan2010, 12:28	7.46
R J5-J6	0.774513	1964.5	01Jan2010, 12:44	7.43
S-6	0.129167	387.6	01Jan2010, 12:20	6.67
J-6	0.903680	2163.2	01Jan2010, 12:42	7.32
R J6-J7	0.903680	2157.5	01Jan2010, 12:44	7.32
S-7	0.287461	978.9	01Jan2010, 12:16	7.49
S-8	0.180810	556.3	01Jan2010, 12:20	7.00
J-7	1.371951	2899.1	01Jan2010, 12:38	7.31
R J7-J9	1.371951	2878.1	01Jan2010, 12:46	7.28
S-9	0.124013	386.8	01Jan2010, 12:18	6.70
J-9	1.495964	3077.6	01Jan2010, 12:34	7.24
R J9-J10	1.495964	3075.9	01Jan2010, 12:36	7.23
S-10	0.123070	466.3	01Jan2010, 12:12	7.57
S-11	0.032422	85.5	01Jan2010, 12:26	6.57
J-10	1.651456	3353.3	01Jan2010, 12:34	7.24
R J10-J12	1.651456	3336.9	01Jan2010, 12:40	7.22
S-12	0.117781	414.3	01Jan2010, 12:14	7.13
J-12	1.769237	3498.5	01Jan2010, 12:38	7.22

Ultimate 100-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	760.5	01Jan2010, 12:22	8.59
S-1	0.215415	993.6	01Jan2010, 12:10	8.53
J-1	0.215415	993.6	01Jan2010, 12:10	8.53
R J1-J2	0.215415	924.7	01Jan2010, 12:18	8.52
J-2	0.438404	1660.1	01Jan2010, 12:18	8.55
R J2-J3	0.438404	1628.7	01Jan2010, 12:26	8.54
S-4	0.103870	371.5	01Jan2010, 12:18	8.00
S-3	0.102112	401.5	01Jan2010, 12:16	8.55
J-3	0.644386	2314.2	01Jan2010, 12:22	8.45
R J3-J4	0.644386	2305.4	01Jan2010, 12:24	8.45
J-4	0.644386	2305.4	01Jan2010, 12:24	8.45
R J4-J5	0.644386	2283.8	01Jan2010, 12:28	8.44
S-5	0.130127	498.0	01Jan2010, 12:16	8.62
J-5	0.774513	2694.2	01Jan2010, 12:26	8.47
R J5-J6	0.774513	2252.8	01Jan2010, 12:42	8.44
S-6	0.129167	436.5	01Jan2010, 12:20	7.66
J-6	0.903680	2484.9	01Jan2010, 12:42	8.33
R J6-J7	0.903680	2478.2	01Jan2010, 12:44	8.32
S-7	0.287461	1089.2	01Jan2010, 12:16	8.50
S-8	0.180810	624.1	01Jan2010, 12:20	7.99
J-7	1.371951	3333.5	01Jan2010, 12:36	8.31
R J7-J9	1.371951	3309.8	01Jan2010, 12:46	8.29
S-9	0.124013	434.9	01Jan2010, 12:18	7.68
J-9	1.495964	3500.0	01Jan2010, 12:42	8.24
R J9-J10	1.495964	3498.8	01Jan2010, 12:44	8.23
S-10	0.123070	516.9	01Jan2010, 12:12	8.58
S-11	0.032422	96.7	01Jan2010, 12:26	7.55
J-10	1.651456	3801.0	01Jan2010, 12:34	8.24
R J10-J12	1.651456	3787.4	01Jan2010, 12:40	8.23
S-12	0.117781	462.3	01Jan2010, 12:14	8.12
J-12	1.769237	3974.6	01Jan2010, 12:38	8.22

Ultimate 500-Year

HEC-HMS 3.4 [Q:\30931-GrandPrairie\60157406_CedarCreekMDP\PROJECT\04...

Hydrologic Element	Drainage Area (MI2)	Peak Discha... (CFS)	Time of Peak	Volume (IN)
S-2	0.222989	948.9	01Jan2010, 12:22	10.99
S-1	0.215415	1195.8	01Jan2010, 12:10	10.93
J-1	0.215415	1195.8	01Jan2010, 12:10	10.93
R J1-J2	0.215415	1143.7	01Jan2010, 12:16	10.91
J-2	0.438404	2053.1	01Jan2010, 12:18	10.95
R J2-J3	0.438404	1993.9	01Jan2010, 12:26	10.93
S-4	0.103870	464.1	01Jan2010, 12:18	10.38
S-3	0.102112	493.2	01Jan2010, 12:16	10.95
J-3	0.644386	2857.4	01Jan2010, 12:22	10.85
R J3-J4	0.644386	2851.6	01Jan2010, 12:24	10.84
J-4	0.644386	2851.6	01Jan2010, 12:24	10.84
R J4-J5	0.644386	2849.1	01Jan2010, 12:26	10.83
S-5	0.130127	612.4	01Jan2010, 12:16	11.02
J-5	0.774513	3386.8	01Jan2010, 12:24	10.86
R J5-J6	0.774513	2915.6	01Jan2010, 12:42	10.82
S-6	0.129167	552.0	01Jan2010, 12:20	10.02
J-6	0.903680	3226.5	01Jan2010, 12:40	10.70
R J6-J7	0.903680	3223.1	01Jan2010, 12:42	10.69
S-7	0.287461	1342.8	01Jan2010, 12:16	10.89
S-8	0.180810	784.6	01Jan2010, 12:20	10.36
J-7	1.371951	4440.7	01Jan2010, 12:36	10.69
R J7-J9	1.371951	4397.3	01Jan2010, 12:44	10.66
S-9	0.124013	546.6	01Jan2010, 12:18	10.05
J-9	1.495964	4662.4	01Jan2010, 12:42	10.61
R J9-J10	1.495964	4658.4	01Jan2010, 12:44	10.60
S-10	0.123070	628.5	01Jan2010, 12:12	10.98
S-11	0.032422	124.0	01Jan2010, 12:26	9.91
J-10	1.651456	4976.8	01Jan2010, 12:38	10.62
R J10-J12	1.651456	4963.2	01Jan2010, 12:46	10.59
S-12	0.117781	570.0	01Jan2010, 12:14	10.49
J-12	1.769237	5161.2	01Jan2010, 12:42	10.59

Appendix C.2

HEC-RAS v4.1.0 Results for Cedar Creek (Y#0845)

AECOM

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	24486	EX0.5yr	135.00	532.12	533.69	533.69	534.35	0.003249	6.50	20.77	15.86	1.00
Creek	24486	EX1yr	190.00	532.12	534.05	534.05	534.84	0.003106	7.16	26.55	16.80	1.00
Creek	24486	EX2yr	260.00	532.12	534.45	534.45	535.38	0.002947	7.76	33.50	17.85	1.00
Creek	24486	EX5yr	390.00	532.12	535.08	535.08	536.23	0.002773	8.60	45.34	19.52	0.99
Creek	24486	EX10yr	480.00	532.12	535.44	535.44	536.74	0.002761	9.13	52.55	20.47	1.00
Creek	24486	EX25yr	580.00	532.12	535.84	535.84	537.25	0.002656	9.52	60.92	21.52	1.00
Creek	24486	EX50yr	660.00	532.12	536.21	536.21	537.62	0.002495	9.54	70.23	34.33	0.98
Creek	24486	EX100yr	740.00	532.12	536.57	536.57	537.94	0.002099	9.45	85.90	51.12	0.91
Creek	24486	EX500yr	925.00	532.12	537.19	537.19	538.55	0.001726	9.60	124.33	75.18	0.85
Creek	24486	ULT2yr	415.00	532.12	535.18	535.18	536.38	0.002777	8.77	47.34	19.79	1.00
Creek	24486	ULT5yr	575.00	532.12	535.83	535.83	537.22	0.002648	9.49	60.61	21.48	1.00
Creek	24486	ULT10yr	680.00	532.12	536.28	536.28	537.70	0.002425	9.57	73.06	38.44	0.97
Creek	24486	ULT25yr	805.00	532.12	536.81	536.81	538.17	0.001923	9.47	99.10	59.02	0.88
Creek	24486	ULT50yr	900.00	532.12	537.10	537.10	538.48	0.001788	9.62	117.73	70.81	0.86
Creek	24486	ULT100yr	995.00	532.12	537.36	537.36	538.75	0.001675	9.74	138.33	105.73	0.84
Creek	24486	ULT500yr	1200.00	532.12	538.45	538.45	539.08	0.000701	7.36	424.98	379.45	0.57
Creek	24453	EX0.5yr	135.00	531.85	533.31	533.31	533.92	0.003266	6.27	21.52	17.74	1.00
Creek	24453	EX1yr	190.00	531.85	533.65	533.65	534.37	0.003100	6.85	27.75	19.20	1.00
Creek	24453	EX2yr	260.00	531.85	534.01	534.01	534.87	0.002960	7.41	35.10	20.76	1.00
Creek	24453	EX5yr	390.00	531.85	534.59	534.59	535.63	0.002804	8.19	47.63	23.13	1.01
Creek	24453	EX10yr	480.00	531.85	534.93	534.93	536.08	0.002734	8.61	55.73	24.55	1.01
Creek	24453	EX25yr	580.00	531.85	535.30	535.30	536.53	0.002647	8.90	65.13	26.61	1.00
Creek	24453	EX50yr	660.00	531.85	535.57	535.57	536.85	0.002617	9.07	72.75	28.69	1.00
Creek	24453	EX100yr	740.00	531.85	535.82	535.82	537.14	0.002588	9.23	80.16	30.58	1.00
Creek	24453	EX500yr	925.00	531.85	536.36	536.36	537.75	0.002240	9.49	101.39	55.57	0.96
Creek	24453	ULT2yr	415.00	531.85	534.68	534.68	535.76	0.002778	8.31	49.95	23.55	1.01
Creek	24453	ULT5yr	575.00	531.85	535.28	535.28	536.51	0.002649	8.89	64.64	26.47	1.00
Creek	24453	ULT10yr	680.00	531.85	535.63	535.63	536.92	0.002614	9.12	74.56	29.16	1.01
Creek	24453	ULT25yr	805.00	531.85	535.99	535.99	537.37	0.002609	9.42	85.48	31.85	1.01
Creek	24453	ULT50yr	900.00	531.85	536.26	536.26	537.68	0.002361	9.54	96.46	49.35	0.98
Creek	24453	ULT100yr	995.00	531.85	536.57	536.57	537.95	0.002039	9.48	114.86	69.79	0.93
Creek	24453	ULT500yr	1200.00	531.85	537.19	537.19	538.45	0.001526	9.21	170.76	103.09	0.82
Creek	24354	EX0.5yr	135.00	530.99	532.46	532.46	533.08	0.003260	6.33	21.33	17.24	1.00
Creek	24354	EX1yr	190.00	530.99	532.80	532.80	533.55	0.003095	6.92	27.48	18.60	1.00
Creek	24354	EX2yr	260.00	530.99	533.18	533.18	534.05	0.002976	7.50	34.67	20.09	1.01
Creek	24354	EX5yr	390.00	530.99	533.78	533.78	534.82	0.002797	8.19	47.62	23.00	1.00
Creek	24354	EX10yr	480.00	530.99	534.12	534.12	535.27	0.002742	8.59	55.89	24.74	1.01
Creek	24354	EX25yr	580.00	530.99	534.48	534.48	535.72	0.002668	8.92	65.02	26.62	1.01
Creek	24354	EX50yr	660.00	530.99	534.74	534.74	536.04	0.002630	9.17	71.99	27.96	1.01
Creek	24354	EX100yr	740.00	530.99	534.98	534.98	536.34	0.002560	9.35	79.10	29.19	1.00
Creek	24354	EX500yr	925.00	530.99	535.57	535.46	536.99	0.002115	9.58	98.31	37.37	0.94
Creek	24354	ULT2yr	415.00	530.99	533.87	533.87	534.95	0.002794	8.32	49.87	23.49	1.01
Creek	24354	ULT5yr	575.00	530.99	534.46	534.46	535.69	0.002670	8.90	64.58	26.53	1.01
Creek	24354	ULT10yr	680.00	530.99	534.81	534.81	536.12	0.002583	9.18	74.08	28.33	1.00
Creek	24354	ULT25yr	805.00	530.99	535.14	535.14	536.58	0.002561	9.60	83.90	31.16	1.01
Creek	24354	ULT50yr	900.00	530.99	535.39	535.39	536.90	0.002407	9.85	92.13	34.61	0.99
Creek	24354	ULT100yr	995.00	530.99	535.73	535.63	537.21	0.002074	9.80	104.61	40.36	0.94
Creek	24354	ULT500yr	1200.00	530.99	536.46	536.10	537.86	0.001532	9.59	139.99	57.93	0.83
Creek	24254	EX0.5yr	135.00	530.14	532.02		532.34	0.001344	4.58	29.46	19.89	0.66
Creek	24254	EX1yr	190.00	530.14	532.45		532.83	0.001209	4.93	38.50	21.31	0.65
Creek	24254	EX2yr	260.00	530.14	532.93		533.37	0.001124	5.30	49.05	22.93	0.64
Creek	24254	EX5yr	390.00	530.14	533.75		534.24	0.000973	5.64	69.11	26.22	0.61
Creek	24254	EX10yr	480.00	530.14	534.31		534.81	0.000815	5.68	84.84	30.02	0.57
Creek	24254	EX25yr	580.00	530.14	534.72		535.28	0.000782	6.04	97.68	33.44	0.57
Creek	24254	EX50yr	660.00	530.14	535.01		535.63	0.000766	6.32	107.92	35.93	0.58
Creek	24254	EX100yr	740.00	530.14	535.30		535.96	0.000751	6.57	118.55	39.35	0.58
Creek	24254	EX500yr	925.00	530.14	535.92		536.67	0.000710	7.03	145.52	46.83	0.57
Creek	24254	ULT2yr	415.00	530.14	533.83		534.36	0.001011	5.82	71.31	26.56	0.63
Creek	24254	ULT5yr	575.00	530.14	534.63		535.22	0.000837	6.15	94.83	32.71	0.59
Creek	24254	ULT10yr	680.00	530.14	535.03		535.68	0.000803	6.49	108.42	36.10	0.59
Creek	24254	ULT25yr	805.00	530.14	535.46		536.18	0.000774	6.85	125.17	41.34	0.59
Creek	24254	ULT50yr	900.00	530.14	535.78		536.55	0.000747	7.07	139.18	45.21	0.59
Creek	24254	ULT100yr	995.00	530.14	536.09		536.90	0.000724	7.27	153.75	50.68	0.58
Creek	24254	ULT500yr	1200.00	530.14	536.74		537.61	0.000666	7.59	193.47	70.11	0.57
Creek	24154	EX0.5yr	135.00	529.96	531.87		532.21	0.001285	4.64	29.09	18.41	0.65
Creek	24154	EX1yr	190.00	529.96	532.30		532.70	0.001252	5.11	37.17	19.82	0.66
Creek	24154	EX2yr	260.00	529.96	532.76		533.24	0.001213	5.55	46.83	21.39	0.66
Creek	24154	EX5yr	390.00	529.96	533.58		534.13	0.001071	5.97	65.30	24.11	0.64
Creek	24154	EX10yr	480.00	529.96	534.17		534.72	0.000951	5.95	80.74	28.63	0.61
Creek	24154	EX25yr	580.00	529.96	534.58		535.19	0.000898	6.31	92.97	31.40	0.61
Creek	24154	EX50yr	660.00	529.96	534.87		535.54	0.000875	6.59	102.47	33.40	0.61
Creek	24154	EX100yr	740.00	529.96	535.15		535.87	0.000855	6.84	112.12	35.73	0.61
Creek	24154	EX500yr	925.00	529.96	535.76		536.59	0.000813	7.35	135.90	43.40	0.61
Creek	24154	ULT2yr	415.00	529.96	533.65		534.24	0.001126	6.19	67.05	24.35	0.66
Creek	24154	ULT5yr	575.00	529.96	534.47		535.12	0.000986	6.47	89.61	30.66	0.63
Creek	24154	ULT10yr	680.00	529.96	534.86		535.58	0.000934	6.80	102.30	33.37	0.63
Creek	24154	ULT25yr	805.00	529.96	535.29		536.09	0.000894	7.17	117.39	37.15	0.63

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	24154	ULT50yr	900.00	529.96	535.62		536.46	0.000860	7.40	129.84	40.65	0.62
Creek	24154	ULT100yr	995.00	529.96	535.92		536.81	0.000833	7.61	143.10	46.45	0.62
Creek	24154	ULT500yr	1200.00	529.96	536.57		537.52	0.000760	7.93	178.67	62.82	0.60
Creek	24055	EX0.5yr	135.00	529.82	531.75		532.08	0.001232	4.59	29.44	18.35	0.64
Creek	24055	EX1yr	190.00	529.82	532.18		532.58	0.001207	5.06	37.52	19.69	0.65
Creek	24055	EX2yr	260.00	529.82	532.65		533.12	0.001174	5.51	47.18	21.18	0.65
Creek	24055	EX5yr	390.00	529.82	533.48		534.03	0.001032	5.92	65.84	23.84	0.63
Creek	24055	EX10yr	480.00	529.82	534.08		534.63	0.000875	5.95	80.73	26.07	0.59
Creek	24055	EX25yr	580.00	529.82	534.47		535.10	0.000868	6.40	91.35	28.72	0.60
Creek	24055	EX50yr	660.00	529.82	534.75		535.45	0.000872	6.74	99.58	30.71	0.61
Creek	24055	EX100yr	740.00	529.82	535.01		535.78	0.000872	7.06	108.09	32.97	0.61
Creek	24055	EX500yr	925.00	529.82	535.60		536.50	0.000861	7.66	129.14	39.06	0.62
Creek	24055	ULT2yr	415.00	529.82	533.54		534.13	0.001101	6.17	67.27	24.03	0.65
Creek	24055	ULT5yr	575.00	529.82	534.35		535.02	0.000958	6.57	87.92	27.89	0.63
Creek	24055	ULT10yr	680.00	529.82	534.73		535.48	0.000940	6.98	99.03	30.56	0.63
Creek	24055	ULT25yr	805.00	529.82	535.14		535.99	0.000930	7.43	112.37	34.14	0.64
Creek	24055	ULT50yr	900.00	529.82	535.45		536.37	0.000915	7.73	123.27	37.36	0.64
Creek	24055	ULT100yr	995.00	529.82	535.73		536.71	0.000906	8.01	134.26	40.48	0.64
Creek	24055	ULT500yr	1200.00	529.82	536.34		537.43	0.000865	8.47	161.34	49.34	0.64
Creek	23954	EX0.5yr	135.00	529.68	531.61		531.95	0.001289	4.69	28.77	17.81	0.65
Creek	23954	EX1yr	190.00	529.68	532.03		532.45	0.001275	5.20	36.54	19.08	0.66
Creek	23954	EX2yr	260.00	529.68	532.50		533.00	0.001247	5.67	45.84	20.49	0.67
Creek	23954	EX5yr	390.00	529.68	533.34		533.92	0.001090	6.09	64.07	23.01	0.64
Creek	23954	EX10yr	480.00	529.68	533.96		534.53	0.000924	6.09	78.88	24.87	0.60
Creek	23954	EX25yr	580.00	529.68	534.34		535.01	0.000931	6.56	88.67	26.99	0.62
Creek	23954	EX50yr	660.00	529.68	534.61		535.35	0.000941	6.93	96.23	28.86	0.63
Creek	23954	EX100yr	740.00	529.68	534.87		535.69	0.000945	7.26	104.10	31.28	0.63
Creek	23954	EX500yr	925.00	529.68	535.44		536.41	0.000941	7.91	123.67	36.95	0.65
Creek	23954	ULT2yr	415.00	529.68	533.38		534.01	0.001181	6.38	65.07	23.14	0.67
Creek	23954	ULT5yr	575.00	529.68	534.20		534.91	0.001042	6.77	85.09	26.19	0.65
Creek	23954	ULT10yr	680.00	529.68	534.58		535.38	0.001026	7.20	95.38	28.62	0.65
Creek	23954	ULT25yr	805.00	529.68	534.98		535.89	0.001026	7.70	107.43	32.32	0.66
Creek	23954	ULT50yr	900.00	529.68	535.27		536.26	0.001012	8.00	117.57	35.29	0.67
Creek	23954	ULT100yr	995.00	529.68	535.55		536.61	0.001006	8.31	127.65	38.00	0.67
Creek	23954	ULT500yr	1200.00	529.68	536.14		537.33	0.000969	8.82	151.96	44.36	0.67
Creek	23853	EX0.5yr	135.00	529.54	531.51		531.82	0.001172	4.50	29.98	18.50	0.62
Creek	23853	EX1yr	190.00	529.54	531.94		532.32	0.001150	4.97	38.24	19.93	0.63
Creek	23853	EX2yr	260.00	529.54	532.42		532.87	0.001112	5.39	48.22	21.52	0.63
Creek	23853	EX5yr	390.00	529.54	533.28		533.79	0.000947	5.73	68.12	24.39	0.60
Creek	23853	EX10yr	480.00	529.54	533.92		534.43	0.000799	5.69	84.39	26.72	0.56
Creek	23853	EX25yr	580.00	529.54	534.31		534.89	0.000827	6.10	95.14	28.57	0.58
Creek	23853	EX50yr	660.00	529.54	534.60		535.23	0.000821	6.41	103.45	30.30	0.59
Creek	23853	EX100yr	740.00	529.54	534.87		535.56	0.000813	6.69	112.05	32.76	0.59
Creek	23853	EX500yr	925.00	529.54	535.47		536.27	0.000789	7.23	133.31	38.39	0.60
Creek	23853	ULT2yr	415.00	529.54	533.32		533.88	0.001034	6.01	69.03	24.51	0.63
Creek	23853	ULT5yr	575.00	529.54	534.17		534.79	0.000938	6.32	91.04	27.79	0.61
Creek	23853	ULT10yr	680.00	529.54	534.56		535.25	0.000898	6.66	102.46	30.06	0.61
Creek	23853	ULT25yr	805.00	529.54	534.98		535.75	0.000877	7.07	115.70	33.80	0.62
Creek	23853	ULT50yr	900.00	529.54	535.29		536.12	0.000853	7.33	126.77	36.77	0.62
Creek	23853	ULT100yr	995.00	529.54	535.58		536.47	0.000840	7.58	137.72	39.44	0.62
Creek	23853	ULT500yr	1200.00	529.54	536.20		537.18	0.000795	8.01	163.80	45.24	0.61
Creek	23754	EX0.5yr	135.00	529.40	531.37		531.70	0.001213	4.61	29.29	17.75	0.63
Creek	23754	EX1yr	190.00	529.40	531.79		532.20	0.001215	5.13	37.04	18.98	0.65
Creek	23754	EX2yr	260.00	529.40	532.26		532.75	0.001201	5.62	46.30	20.35	0.66
Creek	23754	EX5yr	390.00	529.40	533.14		533.69	0.001026	5.98	65.24	22.91	0.62
Creek	23754	EX10yr	480.00	529.40	533.79		534.34	0.000809	5.95	81.63	29.06	0.57
Creek	23754	EX25yr	580.00	529.40	534.16		534.80	0.000833	6.47	92.87	32.12	0.59
Creek	23754	EX50yr	660.00	529.40	534.41		535.14	0.000858	6.86	101.48	34.34	0.60
Creek	23754	EX100yr	740.00	529.40	534.67		535.47	0.000869	7.20	110.63	36.56	0.61
Creek	23754	EX500yr	925.00	529.40	535.25		536.18	0.000871	7.84	132.97	41.65	0.63
Creek	23754	ULT2yr	415.00	529.40	533.14		533.77	0.001160	6.36	65.27	22.91	0.66
Creek	23754	ULT5yr	575.00	529.40	533.98		534.68	0.000965	6.74	87.31	30.64	0.63
Creek	23754	ULT10yr	680.00	529.40	534.35		535.15	0.000963	7.19	99.26	33.79	0.64
Creek	23754	ULT25yr	805.00	529.40	534.74		535.65	0.000974	7.70	113.09	37.13	0.65
Creek	23754	ULT50yr	900.00	529.40	535.04		536.02	0.000959	7.99	124.76	39.58	0.65
Creek	23754	ULT100yr	995.00	529.40	535.32		536.36	0.000956	8.29	136.03	42.34	0.66
Creek	23754	ULT500yr	1200.00	529.40	535.94		537.08	0.000909	8.75	163.92	48.18	0.65
Creek	23654	EX0.5yr	135.00	529.26	531.23		531.57	0.001253	4.70	28.70	17.13	0.64
Creek	23654	EX1yr	190.00	529.26	531.64		532.08	0.001282	5.28	36.00	18.21	0.66
Creek	23654	EX2yr	260.00	529.26	532.09		532.63	0.001305	5.84	44.49	19.39	0.68
Creek	23654	EX5yr	390.00	529.26	532.98		533.58	0.001107	6.21	62.76	21.70	0.64
Creek	23654	EX10yr	480.00	529.26	533.66		534.25	0.000852	6.17	79.02	27.41	0.58
Creek	23654	EX25yr	580.00	529.26	534.01		534.71	0.000898	6.75	89.08	29.82	0.61
Creek	23654	EX50yr	660.00	529.26	534.24		535.05	0.000951	7.22	96.23	31.86	0.63
Creek	23654	EX100yr	740.00	529.26	534.47		535.36	0.000992	7.65	103.64	33.95	0.65
Creek	23654	EX500yr	925.00	529.26	534.98		536.07	0.001042	8.45	122.47	39.31	0.68

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	23654	ULT2yr	415.00	529.26	532.93		533.64	0.001321	6.74	61.59	21.56	0.70
Creek	23654	ULT5yr	575.00	529.26	533.79		534.57	0.001081	7.12	82.62	28.43	0.66
Creek	23654	ULT10yr	680.00	529.26	534.12		535.03	0.001116	7.68	92.54	30.77	0.68
Creek	23654	ULT25yr	805.00	529.26	534.45		535.52	0.001186	8.35	103.22	33.84	0.71
Creek	23654	ULT50yr	900.00	529.26	534.72	533.91	535.89	0.001201	8.75	112.56	36.51	0.72
Creek	23654	ULT100yr	995.00	529.26	534.95	534.19	536.23	0.001233	9.16	121.27	38.98	0.74
Creek	23654	ULT500yr	1200.00	529.26	535.52	534.77	536.94	0.001196	9.72	145.27	45.00	0.74
Creek	23554	EX0.5yr	135.00	529.12	531.12		531.45	0.001180	4.60	29.36	17.37	0.62
Creek	23554	EX1yr	190.00	529.12	531.53		531.95	0.001219	5.17	36.72	18.47	0.65
Creek	23554	EX2yr	260.00	529.12	531.98		532.49	0.001247	5.74	45.32	19.68	0.67
Creek	23554	EX5yr	390.00	529.12	532.90		533.47	0.001031	6.04	64.55	22.15	0.62
Creek	23554	EX10yr	480.00	529.12	533.61		534.16	0.000767	5.96	82.12	28.28	0.56
Creek	23554	EX25yr	580.00	529.12	533.95		534.61	0.000814	6.54	92.45	30.80	0.58
Creek	23554	EX50yr	660.00	529.12	534.18		534.94	0.000866	7.00	99.71	32.15	0.61
Creek	23554	EX100yr	740.00	529.12	534.41		535.25	0.000907	7.42	107.05	33.43	0.63
Creek	23554	EX500yr	925.00	529.12	534.92		535.95	0.000961	8.22	124.96	36.37	0.66
Creek	23554	ULT2yr	415.00	529.12	532.82		533.50	0.001263	6.61	62.77	21.93	0.69
Creek	23554	ULT5yr	575.00	529.12	533.71		534.46	0.000994	6.92	85.24	29.08	0.64
Creek	23554	ULT10yr	680.00	529.12	534.05		534.91	0.001030	7.47	95.41	31.37	0.66
Creek	23554	ULT25yr	805.00	529.12	534.38		535.39	0.001101	8.14	105.99	33.25	0.69
Creek	23554	ULT50yr	900.00	529.12	534.64		535.76	0.001117	8.53	115.07	34.78	0.70
Creek	23554	ULT100yr	995.00	529.12	534.87	534.03	536.09	0.001153	8.95	123.14	36.08	0.72
Creek	23554	ULT500yr	1200.00	529.12	535.44	534.59	536.81	0.001131	9.54	144.55	39.34	0.72
Creek	23532	EX0.5yr	135.00	529.10	530.92		531.40	0.002016	5.57	24.25	16.18	0.80
Creek	23532	EX1yr	190.00	529.10	531.30		531.90	0.002019	6.21	30.61	17.20	0.82
Creek	23532	EX2yr	260.00	529.10	531.70		532.44	0.002054	6.88	37.80	18.29	0.84
Creek	23532	EX5yr	390.00	529.10	532.72		533.43	0.001386	6.75	57.77	21.00	0.72
Creek	23532	EX10yr	480.00	529.10	533.49		534.13	0.000985	6.42	75.88	28.79	0.62
Creek	23532	EX25yr	580.00	529.10	533.82		534.58	0.001038	7.03	85.89	31.41	0.65
Creek	23532	EX50yr	660.00	529.10	534.03		534.91	0.001108	7.54	92.68	33.14	0.68
Creek	23532	EX100yr	740.00	529.10	534.24		535.22	0.001164	8.00	99.68	35.19	0.70
Creek	23532	EX500yr	925.00	529.10	534.73	533.99	535.91	0.001211	8.81	118.44	40.23	0.73
Creek	23532	ULT2yr	415.00	529.10	532.48	532.18	533.44	0.002016	7.85	52.86	20.37	0.86
Creek	23532	ULT5yr	575.00	529.10	533.50		534.41	0.001395	7.66	76.26	28.89	0.74
Creek	23532	ULT10yr	680.00	529.10	533.80	533.20	534.86	0.001458	8.29	85.18	31.23	0.77
Creek	23532	ULT25yr	805.00	529.10	534.06	533.64	535.34	0.001611	9.13	93.55	33.40	0.82
Creek	23532	ULT50yr	900.00	529.10	534.29	533.92	535.70	0.001643	9.58	101.65	35.75	0.83
Creek	23532	ULT100yr	995.00	529.10	534.45	534.19	536.03	0.001765	10.18	107.30	37.30	0.87
Creek	23532	ULT500yr	1200.00	529.10	535.17	534.76	536.76	0.001473	10.31	136.73	44.62	0.81
Creek	23454	EX0.5yr	135.00	528.98	530.83		531.23	0.001551	5.07	26.62	16.64	0.71
Creek	23454	EX1yr	190.00	528.98	531.22	530.82	531.73	0.001609	5.73	33.17	17.58	0.73
Creek	23454	EX2yr	260.00	528.98	531.62		532.26	0.001693	6.42	40.47	18.57	0.77
Creek	23454	EX5yr	390.00	528.98	532.68		533.30	0.001159	6.35	61.44	21.17	0.66
Creek	23454	EX10yr	480.00	528.98	533.46		534.04	0.000870	6.09	78.80	23.75	0.58
Creek	23454	EX25yr	580.00	528.98	533.79		534.49	0.000934	6.71	87.60	29.86	0.61
Creek	23454	EX50yr	660.00	528.98	533.99		534.80	0.001008	7.23	94.15	33.70	0.64
Creek	23454	EX100yr	740.00	528.98	534.20		535.11	0.001067	7.69	101.23	36.25	0.66
Creek	23454	EX500yr	925.00	528.98	534.70	533.76	535.80	0.001118	8.49	121.01	43.11	0.69
Creek	23454	ULT2yr	415.00	528.98	532.40		533.26	0.001732	7.45	55.70	20.49	0.80
Creek	23454	ULT5yr	575.00	528.98	533.45		534.28	0.001256	7.31	78.64	23.62	0.70
Creek	23454	ULT10yr	680.00	528.98	533.74		534.73	0.001338	7.97	86.26	29.01	0.73
Creek	23454	ULT25yr	805.00	528.98	533.99	533.38	535.19	0.001511	8.83	93.88	33.55	0.78
Creek	23454	ULT50yr	900.00	528.98	534.21	533.67	535.55	0.001564	9.32	101.63	36.39	0.80
Creek	23454	ULT100yr	995.00	528.98	534.35	533.97	535.87	0.001705	9.95	106.81	38.23	0.84
Creek	23454	ULT500yr	1200.00	528.98	535.12	534.58	536.62	0.001370	9.96	140.69	49.12	0.78
Creek	23353	EX0.5yr	135.00	528.84	530.34	530.33	530.99	0.003244	6.50	20.78	15.78	1.00
Creek	23353	EX1yr	190.00	528.84	530.71	530.69	531.49	0.003006	7.08	26.83	16.72	0.99
Creek	23353	EX2yr	260.00	528.84	531.21	531.08	532.04	0.002459	7.30	35.61	17.99	0.91
Creek	23353	EX5yr	390.00	528.84	532.58		533.18	0.001112	6.24	62.46	21.43	0.64
Creek	23353	EX10yr	480.00	528.84	533.40		533.95	0.000769	5.94	82.17	29.74	0.55
Creek	23353	EX25yr	580.00	528.84	533.72		534.39	0.000834	6.55	92.83	35.43	0.58
Creek	23353	EX50yr	660.00	528.84	533.93		534.69	0.000905	7.06	100.33	38.35	0.61
Creek	23353	EX100yr	740.00	528.84	534.13		534.99	0.000962	7.51	108.35	42.07	0.64
Creek	23353	EX500yr	925.00	528.84	534.64	533.63	535.67	0.001002	8.26	132.60	52.85	0.66
Creek	23353	ULT2yr	415.00	528.84	531.98	531.82	533.04	0.002339	8.27	50.18	19.93	0.92
Creek	23353	ULT5yr	575.00	528.84	533.35		534.16	0.001159	7.22	80.67	28.82	0.68
Creek	23353	ULT10yr	680.00	528.84	533.62	532.83	534.59	0.001254	7.90	89.33	33.83	0.71
Creek	23353	ULT25yr	805.00	528.84	533.85	533.24	535.04	0.001440	8.79	97.34	37.23	0.77
Creek	23353	ULT50yr	900.00	528.84	534.07	533.56	535.39	0.001495	9.28	105.86	40.81	0.79
Creek	23353	ULT100yr	995.00	528.84	534.19	533.84	535.70	0.001653	9.94	111.00	43.38	0.84
Creek	23353	ULT500yr	1200.00	528.84	535.08	534.48	536.45	0.001217	9.65	157.81	62.74	0.74
Creek	23254	EX0.5yr	135.00	528.65	530.31		530.69	0.001555	4.91	27.50	18.05	0.70
Creek	23254	EX1yr	190.00	528.65	530.73		531.18	0.001462	5.40	35.16	18.81	0.70
Creek	23254	EX2yr	260.00	528.65	531.26		531.77	0.001274	5.72	45.45	19.79	0.67
Creek	23254	EX5yr	390.00	528.65	532.61		533.04	0.000700	5.29	73.76	22.25	0.51
Creek	23254	EX10yr	480.00	528.65	533.43		533.84	0.000529	5.19	93.58	28.55	0.46

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	23254	EX25yr	580.00	528.65	533.76		534.27	0.000590	5.78	103.71	32.41	0.49
Creek	23254	EX50yr	660.00	528.65	533.97		534.57	0.000650	6.26	110.67	34.83	0.52
Creek	23254	EX100yr	740.00	528.65	534.17		534.86	0.000702	6.70	118.03	37.55	0.54
Creek	23254	EX500yr	925.00	528.65	534.67		535.53	0.000767	7.49	138.76	44.40	0.58
Creek	23254	ULT2yr	415.00	528.65	532.06		532.76	0.001319	6.71	61.82	21.25	0.69
Creek	23254	ULT5yr	575.00	528.65	533.39		534.00	0.000781	6.27	92.63	28.16	0.55
Creek	23254	ULT10yr	680.00	528.65	533.68		534.42	0.000863	6.91	101.19	31.49	0.59
Creek	23254	ULT25yr	805.00	528.65	533.92		534.84	0.001003	7.72	109.06	34.26	0.64
Creek	23254	ULT50yr	900.00	528.65	534.14		535.18	0.001059	8.19	117.09	37.20	0.66
Creek	23254	ULT100yr	995.00	528.65	534.28	533.30	535.46	0.001173	8.79	122.23	39.04	0.70
Creek	23254	ULT500yr	1200.00	528.65	535.09	533.88	536.29	0.000981	8.91	158.72	52.83	0.66
Creek	23154	EX0.5yr	135.00	528.51	530.16		530.53	0.001592	4.93	27.38	18.29	0.71
Creek	23154	EX1yr	190.00	528.51	530.59		531.03	0.001434	5.35	35.54	19.16	0.69
Creek	23154	EX2yr	260.00	528.51	531.16		531.64	0.001190	5.56	46.73	20.29	0.65
Creek	23154	EX5yr	390.00	528.51	532.57		532.97	0.000620	5.04	77.39	23.11	0.49
Creek	23154	EX10yr	480.00	528.51	533.40		533.78	0.000466	4.93	99.18	34.18	0.43
Creek	23154	EX25yr	580.00	528.51	533.74		534.20	0.000517	5.48	111.98	41.42	0.46
Creek	23154	EX50yr	660.00	528.51	533.95		534.49	0.000567	5.92	121.07	44.77	0.49
Creek	23154	EX100yr	740.00	528.51	534.16		534.77	0.000608	6.31	130.84	48.93	0.51
Creek	23154	EX500yr	925.00	528.51	534.69		535.42	0.000646	6.98	159.53	59.38	0.53
Creek	23154	ULT2yr	415.00	528.51	531.96		532.62	0.001231	6.52	63.65	21.89	0.67
Creek	23154	ULT5yr	575.00	528.51	533.36		533.91	0.000696	5.98	97.57	32.93	0.53
Creek	23154	ULT10yr	680.00	528.51	533.65		534.31	0.000766	6.57	108.19	39.90	0.56
Creek	23154	ULT25yr	805.00	528.51	533.89		534.72	0.000885	7.33	118.36	43.80	0.61
Creek	23154	ULT50yr	900.00	528.51	534.13		535.04	0.000923	7.74	129.19	48.21	0.62
Creek	23154	ULT100yr	995.00	528.51	534.27	533.11	535.31	0.001014	8.28	136.26	51.05	0.66
Creek	23154	ULT500yr	1200.00	528.51	535.16		536.14	0.000789	8.16	189.46	68.81	0.60
Creek	23054	EX0.5yr	135.00	528.37	530.04		530.37	0.001378	4.58	29.46	20.19	0.67
Creek	23054	EX1yr	190.00	528.37	530.52		530.88	0.001146	4.81	39.47	21.67	0.63
Creek	23054	EX2yr	260.00	528.37	531.13		531.50	0.000893	4.88	53.31	23.57	0.57
Creek	23054	EX5yr	390.00	528.37	532.60		532.88	0.000402	4.29	93.01	32.52	0.41
Creek	23054	EX10yr	480.00	528.37	533.44		533.71	0.000287	4.20	122.82	38.51	0.36
Creek	23054	EX25yr	580.00	528.37	533.79		534.12	0.000319	4.66	136.75	41.42	0.38
Creek	23054	EX50yr	660.00	528.37	534.01		534.40	0.000350	5.04	146.12	43.26	0.40
Creek	23054	EX100yr	740.00	528.37	534.23		534.67	0.000377	5.38	155.78	45.09	0.42
Creek	23054	EX500yr	925.00	528.37	534.77		535.31	0.000410	6.01	181.39	49.60	0.45
Creek	23054	ULT2yr	415.00	528.37	531.98		532.46	0.000875	5.58	74.39	26.20	0.58
Creek	23054	ULT5yr	575.00	528.37	533.42		533.81	0.000420	5.06	121.80	38.29	0.43
Creek	23054	ULT10yr	680.00	528.37	533.73		534.20	0.000460	5.55	134.06	40.87	0.46
Creek	23054	ULT25yr	805.00	528.37	534.00		534.57	0.000528	6.17	145.33	43.11	0.49
Creek	23054	ULT50yr	900.00	528.37	534.25		534.89	0.000552	6.53	156.39	45.20	0.51
Creek	23054	ULT100yr	995.00	528.37	534.41		535.14	0.000603	6.97	163.87	46.56	0.54
Creek	23054	ULT500yr	1200.00	528.37	535.26		536.00	0.000512	7.10	206.57	55.29	0.51
Creek	22954	EX0.5yr	135.00	528.23	529.91		530.23	0.001360	4.54	29.76	20.56	0.66
Creek	22954	EX1yr	190.00	528.23	530.43		530.77	0.001054	4.65	40.86	22.25	0.60
Creek	22954	EX2yr	260.00	528.23	531.07		531.41	0.000795	4.66	55.84	24.33	0.54
Creek	22954	EX5yr	390.00	528.23	532.58		532.84	0.000351	4.08	96.27	29.66	0.38
Creek	22954	EX10yr	480.00	528.23	533.43		533.68	0.000256	4.03	124.04	38.14	0.34
Creek	22954	EX25yr	580.00	528.23	533.78		534.09	0.000288	4.49	138.31	45.39	0.36
Creek	22954	EX50yr	660.00	528.23	534.00		534.36	0.000318	4.87	149.06	52.54	0.39
Creek	22954	EX100yr	740.00	528.23	534.21		534.63	0.000342	5.20	161.49	59.61	0.40
Creek	22954	EX500yr	925.00	528.23	534.76		535.26	0.000367	5.76	197.37	71.05	0.43
Creek	22954	ULT2yr	415.00	528.23	531.93		532.37	0.000775	5.33	77.83	27.09	0.55
Creek	22954	ULT5yr	575.00	528.23	533.40		533.76	0.000378	4.87	122.75	37.58	0.41
Creek	22954	ULT10yr	680.00	528.23	533.70		534.14	0.000417	5.36	135.06	42.99	0.44
Creek	22954	ULT25yr	805.00	528.23	533.97		534.51	0.000483	5.98	147.52	51.58	0.48
Creek	22954	ULT50yr	900.00	528.23	534.22		534.83	0.000505	6.32	161.68	59.67	0.49
Creek	22954	ULT100yr	995.00	528.23	534.38		535.07	0.000550	6.74	171.71	62.96	0.51
Creek	22954	ULT500yr	1200.00	528.23	535.27		535.93	0.000445	6.72	235.91	82.05	0.48
Creek	22854	EX0.5yr	135.00	528.09	529.77		530.09	0.001387	4.60	29.32	20.01	0.67
Creek	22854	EX1yr	190.00	528.09	530.33		530.66	0.001009	4.62	41.09	21.70	0.59
Creek	22854	EX2yr	260.00	528.09	531.00		531.33	0.000754	4.62	56.31	23.71	0.53
Creek	22854	EX5yr	390.00	528.09	532.55		532.80	0.000340	4.05	96.80	29.13	0.38
Creek	22854	EX10yr	480.00	528.09	533.41		533.65	0.000249	4.00	127.49	47.47	0.33
Creek	22854	EX25yr	580.00	528.09	533.75		534.06	0.000279	4.46	145.75	58.50	0.36
Creek	22854	EX50yr	660.00	528.09	533.97		534.32	0.000307	4.81	159.40	65.78	0.38
Creek	22854	EX100yr	740.00	528.09	534.19		534.59	0.000328	5.12	174.31	68.77	0.39
Creek	22854	EX500yr	925.00	528.09	534.75		535.21	0.000346	5.62	214.39	74.68	0.41
Creek	22854	ULT2yr	415.00	528.09	531.85		532.29	0.000772	5.36	77.45	26.24	0.55
Creek	22854	ULT5yr	575.00	528.09	533.36		533.72	0.000371	4.85	125.30	46.11	0.41
Creek	22854	ULT10yr	680.00	528.09	533.67		534.10	0.000410	5.33	140.76	55.58	0.43
Creek	22854	ULT25yr	805.00	528.09	533.93		534.46	0.000473	5.93	156.47	64.29	0.47
Creek	22854	ULT50yr	900.00	528.09	534.18		534.77	0.000489	6.24	173.67	68.67	0.48
Creek	22854	ULT100yr	995.00	528.09	534.35		535.01	0.000530	6.64	185.12	70.44	0.50
Creek	22854	ULT500yr	1200.00	528.09	535.26		535.87	0.000416	6.52	253.99	80.68	0.46
Creek	22754	EX0.5yr	135.00	527.95	529.72		529.95	0.000945	3.87	34.86	23.58	0.56

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	22754	EX1yr	190.00	527.95	530.32		530.55	0.000648	3.82	49.71	25.55	0.48
Creek	22754	EX2yr	260.00	527.95	531.01		531.24	0.000484	3.81	68.16	28.00	0.43
Creek	22754	EX5yr	390.00	527.95	532.58		532.75	0.000221	3.35	117.19	34.73	0.31
Creek	22754	EX10yr	480.00	527.95	533.44		533.61	0.000163	3.32	149.62	41.88	0.28
Creek	22754	EX25yr	580.00	527.95	533.80		534.01	0.000184	3.70	165.16	45.91	0.30
Creek	22754	EX50yr	660.00	527.95	534.02		534.27	0.000205	4.03	176.22	74.37	0.32
Creek	22754	EX100yr	740.00	527.95	534.25		534.53	0.000220	4.30	193.34	77.28	0.33
Creek	22754	EX500yr	925.00	527.95	534.81		535.15	0.000234	4.75	239.19	84.83	0.35
Creek	22754	ULT2yr	415.00	527.95	531.89		532.19	0.000500	4.41	94.20	31.73	0.45
Creek	22754	ULT5yr	575.00	527.95	533.41		533.66	0.000240	4.00	148.40	41.54	0.33
Creek	22754	ULT10yr	680.00	527.95	533.73		534.03	0.000265	4.40	162.14	45.22	0.36
Creek	22754	ULT25yr	805.00	527.95	534.00		534.38	0.000308	4.93	174.98	74.16	0.39
Creek	22754	ULT50yr	900.00	527.95	534.27		534.68	0.000321	5.20	194.91	77.55	0.40
Creek	22754	ULT100yr	995.00	527.95	534.44		534.91	0.000347	5.53	208.70	79.81	0.42
Creek	22754	ULT500yr	1200.00	527.95	535.34		535.79	0.000281	5.51	286.27	92.48	0.38
Creek	22655	EX0.5yr	135.00	527.82	529.67		529.86	0.000687	3.48	38.79	23.92	0.48
Creek	22655	EX1yr	190.00	527.82	530.29		530.48	0.000500	3.50	54.27	25.91	0.43
Creek	22655	EX2yr	260.00	527.82	530.99		531.19	0.000393	3.55	73.28	28.35	0.39
Creek	22655	EX5yr	390.00	527.82	532.57		532.72	0.000209	3.15	124.02	37.56	0.30
Creek	22655	EX10yr	480.00	527.82	533.44		533.59	0.000149	3.09	160.01	45.37	0.26
Creek	22655	EX25yr	580.00	527.82	533.80		533.98	0.000167	3.44	176.84	49.10	0.28
Creek	22655	EX50yr	660.00	527.82	534.03		534.24	0.000183	3.73	188.29	51.49	0.30
Creek	22655	EX100yr	740.00	527.82	534.25		534.50	0.000197	3.99	200.22	53.88	0.31
Creek	22655	EX500yr	925.00	527.82	534.81		535.12	0.000215	4.45	232.27	60.87	0.33
Creek	22655	ULT2yr	415.00	527.82	531.86		532.13	0.000433	4.18	99.29	32.19	0.42
Creek	22655	ULT5yr	575.00	527.82	533.41		533.63	0.000219	3.73	158.67	45.09	0.32
Creek	22655	ULT10yr	680.00	527.82	533.73		533.99	0.000240	4.10	173.64	48.41	0.33
Creek	22655	ULT25yr	805.00	527.82	534.01		534.33	0.000275	4.56	187.62	51.35	0.36
Creek	22655	ULT50yr	900.00	527.82	534.28		534.63	0.000287	4.82	201.50	54.13	0.37
Creek	22655	ULT100yr	995.00	527.82	534.45		534.86	0.000313	5.15	211.13	55.97	0.39
Creek	22655	ULT500yr	1200.00	527.82	535.34		535.75	0.000266	5.25	266.37	69.75	0.37
Creek	22592	EX0.5yr	135.00	527.74	529.57		529.81	0.000897	3.89	34.69	21.90	0.54
Creek	22592	EX1yr	190.00	527.74	530.21		530.44	0.000619	3.86	49.23	23.49	0.47
Creek	22592	EX2yr	260.00	527.74	530.92		531.15	0.000480	3.92	66.40	25.24	0.43
Creek	22592	EX5yr	390.00	527.74	532.51		532.71	0.000239	3.56	111.69	34.96	0.32
Creek	22592	EX10yr	480.00	527.74	533.38		533.57	0.000181	3.54	145.82	43.31	0.29
Creek	22592	EX25yr	580.00	527.74	533.72		533.96	0.000208	3.97	161.13	46.57	0.31
Creek	22592	EX50yr	660.00	527.74	533.94		534.22	0.000233	4.32	171.35	48.62	0.33
Creek	22592	EX100yr	740.00	527.74	534.15		534.47	0.000255	4.64	181.88	50.58	0.35
Creek	22592	EX500yr	925.00	527.74	534.68		535.09	0.000286	5.22	210.28	55.93	0.37
Creek	22592	ULT2yr	415.00	527.74	531.75		532.09	0.000534	4.70	88.35	27.31	0.46
Creek	22592	ULT5yr	575.00	527.74	533.32		533.61	0.000272	4.30	143.26	42.74	0.35
Creek	22592	ULT10yr	680.00	527.74	533.62		533.97	0.000307	4.76	156.37	45.58	0.37
Creek	22592	ULT25yr	805.00	527.74	533.87		534.30	0.000363	5.35	167.93	47.95	0.41
Creek	22592	ULT50yr	900.00	527.74	534.11		534.60	0.000386	5.69	179.86	50.24	0.43
Creek	22592	ULT100yr	995.00	527.74	534.25		534.82	0.000430	6.10	187.28	51.54	0.45
Creek	22592	ULT500yr	1200.00	527.74	535.14		535.72	0.000368	6.22	237.23	61.01	0.43
Creek	22553	EX0.5yr	135.00	527.69	529.58		529.76	0.000637	3.41	39.63	23.77	0.47
Creek	22553	EX1yr	190.00	527.69	530.23		530.41	0.000459	3.42	55.59	25.66	0.41
Creek	22553	EX2yr	260.00	527.69	530.93		531.12	0.000365	3.49	74.48	27.70	0.38
Creek	22553	EX5yr	390.00	527.69	532.53		532.69	0.000187	3.17	124.08	35.84	0.28
Creek	22553	EX10yr	480.00	527.69	533.40		533.56	0.000142	3.16	158.26	42.40	0.26
Creek	22553	EX25yr	580.00	527.69	533.75		533.94	0.000163	3.55	173.36	44.92	0.28
Creek	22553	EX50yr	660.00	527.69	533.97		534.20	0.000182	3.86	183.38	46.52	0.30
Creek	22553	EX100yr	740.00	527.69	534.18		534.45	0.000199	4.15	193.63	48.11	0.31
Creek	22553	EX500yr	925.00	527.69	534.72		535.06	0.000225	4.69	220.97	54.01	0.34
Creek	22553	ULT2yr	415.00	527.69	531.78		532.05	0.000415	4.17	99.45	31.01	0.41
Creek	22553	ULT5yr	575.00	527.69	533.35		533.58	0.000211	3.83	156.19	42.04	0.31
Creek	22553	ULT10yr	680.00	527.69	533.66		533.93	0.000238	4.24	169.31	44.26	0.33
Creek	22553	ULT25yr	805.00	527.69	533.91		534.26	0.000280	4.76	180.94	46.13	0.37
Creek	22553	ULT50yr	900.00	527.69	534.16		534.56	0.000298	5.07	192.66	47.96	0.38
Creek	22553	ULT100yr	995.00	527.69	534.32		534.77	0.000331	5.44	200.14	49.10	0.40
Creek	22553	ULT500yr	1200.00	527.69	535.20		535.67	0.000289	5.60	248.55	62.15	0.39
Creek	22454	EX0.5yr	135.00	527.56	529.53		529.70	0.000549	3.23	41.74	24.24	0.43
Creek	22454	EX1yr	190.00	527.56	530.20		530.36	0.000400	3.25	58.45	26.27	0.38
Creek	22454	EX2yr	260.00	527.56	530.91		531.08	0.000322	3.33	78.08	28.50	0.35
Creek	22454	EX5yr	390.00	527.56	532.52		532.66	0.000185	3.01	129.61	36.49	0.28
Creek	22454	EX10yr	480.00	527.56	533.40		533.54	0.000135	2.97	164.28	42.88	0.25
Creek	22454	EX25yr	580.00	527.56	533.75		533.92	0.000152	3.32	179.68	45.66	0.27
Creek	22454	EX50yr	660.00	527.56	533.97		534.17	0.000169	3.60	189.95	47.43	0.28
Creek	22454	EX100yr	740.00	527.56	534.19		534.42	0.000184	3.87	200.62	50.60	0.30
Creek	22454	EX500yr	925.00	527.56	534.73		535.02	0.000204	4.35	230.59	59.13	0.32
Creek	22454	ULT2yr	415.00	527.56	531.76		532.01	0.000378	4.01	103.47	32.01	0.39
Creek	22454	ULT5yr	575.00	527.56	533.35		533.55	0.000201	3.60	162.15	42.47	0.30
Creek	22454	ULT10yr	680.00	527.56	533.66		533.90	0.000224	3.97	175.54	44.93	0.32
Creek	22454	ULT25yr	805.00	527.56	533.92		534.22	0.000261	4.44	187.50	47.02	0.35
Creek	22454	ULT50yr	900.00	527.56	534.17		534.51	0.000276	4.72	199.70	50.32	0.36

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	22454	ULT100yr	995.00	527.56	534.33		534.72	0.000304	5.06	207.78	52.76	0.38
Creek	22454	ULT500yr	1200.00	527.56	535.22		535.63	0.000258	5.17	261.22	67.30	0.36
Creek	22354	EX0.5yr	135.00	527.43	529.49		529.64	0.000471	3.07	43.99	24.61	0.40
Creek	22354	EX1yr	190.00	527.43	530.17		530.32	0.000350	3.10	61.31	26.77	0.36
Creek	22354	EX2yr	260.00	527.43	530.89		531.05	0.000290	3.19	81.57	29.44	0.34
Creek	22354	EX5yr	390.00	527.43	532.51		532.64	0.000152	2.89	135.99	38.26	0.26
Creek	22354	EX10yr	480.00	527.43	533.39		533.52	0.000115	2.88	173.15	46.51	0.23
Creek	22354	EX25yr	580.00	527.43	533.74		533.90	0.000132	3.24	189.90	50.17	0.25
Creek	22354	EX50yr	660.00	527.43	533.96		534.15	0.000148	3.52	201.19	52.53	0.27
Creek	22354	EX100yr	740.00	527.43	534.18		534.40	0.000162	3.79	212.97	56.08	0.28
Creek	22354	EX500yr	925.00	527.43	534.72		535.00	0.000182	4.27	246.21	65.74	0.30
Creek	22354	ULT2yr	415.00	527.43	531.74		531.97	0.000345	3.84	108.18	33.68	0.38
Creek	22354	ULT5yr	575.00	527.43	533.34		533.53	0.000172	3.50	170.67	45.96	0.28
Creek	22354	ULT10yr	680.00	527.43	533.65		533.88	0.000194	3.87	185.17	49.14	0.30
Creek	22354	ULT25yr	805.00	527.43	533.90		534.19	0.000229	4.35	198.21	51.91	0.33
Creek	22354	ULT50yr	900.00	527.43	534.15		534.48	0.000243	4.62	211.66	55.67	0.35
Creek	22354	ULT100yr	995.00	527.43	534.31		534.69	0.000270	4.96	220.51	58.40	0.37
Creek	22354	ULT500yr	1200.00	527.43	535.21		535.60	0.000232	5.08	280.23	74.49	0.35
Creek	22254	EX0.5yr	135.00	527.30	529.46		529.59	0.000391	2.87	47.08	25.38	0.37
Creek	22254	EX1yr	190.00	527.30	530.15		530.28	0.000296	2.91	65.21	27.63	0.33
Creek	22254	EX2yr	260.00	527.30	530.88		531.02	0.000247	3.02	86.18	30.01	0.31
Creek	22254	EX5yr	390.00	527.30	532.50		532.63	0.000137	2.80	140.15	38.59	0.25
Creek	22254	EX10yr	480.00	527.30	533.39		533.51	0.000106	2.81	178.37	47.97	0.22
Creek	22254	EX25yr	580.00	527.30	533.73		533.89	0.000123	3.16	195.60	51.67	0.24
Creek	22254	EX50yr	660.00	527.30	533.95		534.13	0.000138	3.45	207.17	54.02	0.26
Creek	22254	EX100yr	740.00	527.30	534.17		534.38	0.000151	3.71	219.16	56.68	0.27
Creek	22254	EX500yr	925.00	527.30	534.71		534.98	0.000171	4.19	252.14	64.65	0.30
Creek	22254	ULT2yr	415.00	527.30	531.72		531.93	0.000294	3.68	112.62	32.80	0.35
Creek	22254	ULT5yr	575.00	527.30	533.33		533.51	0.000158	3.41	175.65	47.36	0.27
Creek	22254	ULT10yr	680.00	527.30	533.63		533.85	0.000180	3.79	190.52	50.61	0.29
Creek	22254	ULT25yr	805.00	527.30	533.89		534.17	0.000213	4.26	203.84	53.35	0.32
Creek	22254	ULT50yr	900.00	527.30	534.14		534.45	0.000228	4.53	217.56	56.32	0.33
Creek	22254	ULT100yr	995.00	527.30	534.29		534.66	0.000253	4.87	226.36	58.29	0.35
Creek	22254	ULT500yr	1200.00	527.30	535.19		535.57	0.000223	5.02	285.83	83.23	0.34
Creek	22154	EX0.5yr	135.00	527.17	529.44	528.32	529.55	0.000344	2.74	49.23	25.78	0.35
Creek	22154	EX1yr	190.00	527.17	530.13	528.61	530.25	0.000267	2.79	67.98	28.41	0.32
Creek	22154	EX2yr	260.00	527.17	530.86	528.93	530.99	0.000226	2.89	89.83	31.22	0.30
Creek	22154	EX5yr	390.00	527.17	532.50	529.45	532.61	0.000119	2.67	150.82	46.62	0.23
Creek	22154	EX10yr	480.00	527.17	533.39	529.76	533.50	0.000092	2.67	197.78	59.28	0.21
Creek	22154	EX25yr	580.00	527.17	533.73	530.06	533.87	0.000106	2.99	219.25	64.34	0.23
Creek	22154	EX50yr	660.00	527.17	533.96	530.32	534.11	0.000119	3.25	233.81	67.67	0.24
Creek	22154	EX100yr	740.00	527.17	534.17	530.54	534.36	0.000130	3.49	249.13	72.46	0.26
Creek	22154	EX500yr	925.00	527.17	534.73	531.01	534.95	0.000145	3.92	292.94	86.70	0.27
Creek	22154	ULT2yr	415.00	527.17	531.70	529.54	531.90	0.000279	3.53	117.70	36.63	0.34
Creek	22154	ULT5yr	575.00	527.17	533.33	530.07	533.49	0.000137	3.23	194.39	58.45	0.26
Creek	22154	ULT10yr	680.00	527.17	533.64	530.37	533.83	0.000155	3.58	212.94	62.86	0.28
Creek	22154	ULT25yr	805.00	527.17	533.89	530.71	534.14	0.000183	4.02	229.71	66.75	0.30
Creek	22154	ULT50yr	900.00	527.17	534.15	530.95	534.42	0.000195	4.26	247.26	71.84	0.31
Creek	22154	ULT100yr	995.00	527.17	534.31	531.17	534.62	0.000216	4.57	258.83	75.62	0.33
Creek	22154	ULT500yr	1200.00	527.17	535.22	531.67	535.53	0.000184	4.64	339.21	101.67	0.31
Creek	22054	EX0.5yr	135.00	527.04	529.42		529.52	0.000269	2.51	53.69	26.63	0.31
Creek	22054	EX1yr	190.00	527.04	530.12		530.22	0.000215	2.60	73.00	28.79	0.29
Creek	22054	EX2yr	260.00	527.04	530.85		530.97	0.000191	2.73	95.37	31.96	0.28
Creek	22054	EX5yr	390.00	527.04	532.49		532.60	0.000099	2.60	159.10	49.65	0.21
Creek	22054	EX10yr	480.00	527.04	533.38		533.49	0.000080	2.63	210.10	65.17	0.20
Creek	22054	EX25yr	580.00	527.04	533.73		533.86	0.000093	2.96	233.97	72.64	0.22
Creek	22054	EX50yr	660.00	527.04	533.95		534.10	0.000105	3.22	250.49	77.52	0.23
Creek	22054	EX100yr	740.00	527.04	534.17		534.34	0.000115	3.46	268.05	83.66	0.24
Creek	22054	EX500yr	925.00	527.04	534.72		534.94	0.000131	3.90	318.65	100.78	0.26
Creek	22054	ULT2yr	415.00	527.04	531.69		531.87	0.000216	3.38	124.41	38.19	0.31
Creek	22054	ULT5yr	575.00	527.04	533.32		533.48	0.000119	3.20	206.18	64.11	0.24
Creek	22054	ULT10yr	680.00	527.04	533.63		533.81	0.000136	3.54	226.62	70.36	0.26
Creek	22054	ULT25yr	805.00	527.04	533.88		534.12	0.000162	3.98	245.47	76.07	0.29
Creek	22054	ULT50yr	900.00	527.04	534.14		534.40	0.000173	4.23	265.53	82.76	0.30
Creek	22054	ULT100yr	995.00	527.04	534.29		534.59	0.000193	4.54	278.76	87.39	0.32
Creek	22054	ULT500yr	1200.00	527.04	535.21		535.51	0.000168	4.63	373.13	124.88	0.30
Creek	21955	EX0.5yr	135.00	526.91	529.40	528.10	529.49	0.000227	2.34	57.73	27.98	0.29
Creek	21955	EX1yr	190.00	526.91	530.11	528.36	530.20	0.000183	2.43	78.10	30.11	0.27
Creek	21955	EX2yr	260.00	526.91	530.84	528.66	530.94	0.000166	2.56	101.49	33.49	0.26
Creek	21955	EX5yr	390.00	526.91	532.50	529.14	532.58	0.000095	2.35	169.77	53.77	0.21
Creek	21955	EX10yr	480.00	526.91	533.39	529.43	533.47	0.000072	2.34	225.47	89.98	0.19
Creek	21955	EX25yr	580.00	526.91	533.74	529.74	533.84	0.000082	2.63	251.90	116.43	0.20
Creek	21955	EX50yr	660.00	526.91	533.96	529.96	534.08	0.000092	2.85	270.35	136.44	0.21
Creek	21955	EX100yr	740.00	526.91	534.18	530.18	534.32	0.000100	3.06	294.61	178.48	0.22
Creek	21955	EX500yr	925.00	526.91	534.74	530.66	534.91	0.000108	3.38	366.65	229.12	0.24
Creek	21955	ULT2yr	415.00	526.91	531.68	529.23	531.84	0.000223	3.14	132.15	40.20	0.31

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	21955	ULT5yr	575.00	526.91	533.33	529.73	533.45	0.000108	2.84	221.40	86.04	0.23
Creek	21955	ULT10yr	680.00	526.91	533.64	530.02	533.79	0.000121	3.14	244.14	107.83	0.24
Creek	21955	ULT25yr	805.00	526.91	533.90	530.35	534.09	0.000142	3.52	265.35	131.15	0.27
Creek	21955	ULT50yr	900.00	526.91	534.16	530.59	534.37	0.000151	3.74	291.94	176.84	0.28
Creek	21955	ULT100yr	995.00	526.91	534.32	530.82	534.56	0.000165	3.98	311.27	188.49	0.29
Creek	21955	ULT500yr	1200.00	526.91	535.26	531.33	535.47	0.000126	3.85	585.09	313.48	0.26
Creek	21864	EX0.5yr	135.00	526.78	529.39	527.92	529.47	0.000193	2.27	59.41	26.10	0.27
Creek	21864	EX1yr	190.00	526.78	530.09	528.19	530.18	0.000168	2.43	78.26	27.63	0.25
Creek	21864	EX2yr	260.00	526.78	530.82	528.49	530.93	0.000157	2.62	99.10	29.24	0.25
Creek	21864	EX5yr	390.00	526.78	532.46	528.99	532.57	0.000094	2.63	163.08	48.81	0.21
Creek	21864	EX10yr	480.00	526.78	533.35	529.29	533.46	0.000081	2.72	224.42	132.62	0.20
Creek	21864	EX25yr	580.00	526.78	533.68	529.61	533.83	0.000098	3.10	257.87	158.33	0.22
Creek	21864	EX50yr	660.00	526.78	533.89	529.84	534.07	0.000112	3.39	280.29	171.66	0.24
Creek	21864	EX100yr	740.00	526.78	534.10	530.07	534.30	0.000125	3.66	303.31	198.90	0.25
Creek	21864	EX500yr	925.00	526.78	534.63	530.55	534.89	0.000147	4.18	366.62	251.68	0.28
Creek	21864	ULT2yr	415.00	526.78	531.64	529.08	531.82	0.000196	3.36	127.30	39.01	0.29
Creek	21864	ULT5yr	575.00	526.78	533.27	529.59	533.44	0.000122	3.31	217.37	125.64	0.24
Creek	21864	ULT10yr	680.00	526.78	533.56	529.90	533.77	0.000144	3.71	245.23	149.59	0.26
Creek	21864	ULT25yr	805.00	526.78	533.80	530.25	534.07	0.000176	4.21	269.80	165.58	0.29
Creek	21864	ULT50yr	900.00	526.78	534.04	530.49	534.34	0.000192	4.50	295.81	191.88	0.31
Creek	21864	ULT100yr	995.00	526.78	534.17	530.72	534.53	0.000218	4.86	311.36	206.17	0.33
Creek	21864	ULT500yr	1200.00	526.78	535.09	531.19	535.44	0.000188	4.92	572.99	364.90	0.31
Creek	21832	EX0.5yr	270.00	526.36	529.22	527.97	529.42	0.000404	3.51	76.98	30.83	0.39
Creek	21832	EX1yr	375.00	526.36	529.90	528.33	530.12	0.000374	3.82	98.21	32.31	0.39
Creek	21832	EX2yr	500.00	526.36	530.60	528.71	530.87	0.000353	4.11	121.60	33.87	0.38
Creek	21832	EX5yr	725.00	526.36	532.26	529.31	532.52	0.000212	4.05	182.10	82.91	0.31
Creek	21832	EX10yr	930.00	526.36	533.11	529.81	533.40	0.000203	4.39	303.31	248.47	0.31
Creek	21832	EX25yr	1150.00	526.36	533.36	530.28	533.75	0.000260	5.11	410.36	292.69	0.36
Creek	21832	EX50yr	1315.00	526.36	533.49	530.62	533.96	0.000313	5.68	446.62	329.70	0.40
Creek	21832	EX100yr	1460.00	526.36	533.64	530.89	534.19	0.000349	6.10	492.39	397.82	0.42
Creek	21832	EX500yr	1800.00	526.36	534.09	531.48	534.75	0.000400	6.82	639.00	600.80	0.45
Creek	21832	ULT2yr	630.00	526.36	531.51	529.06	531.78	0.000270	4.12	154.30	46.54	0.35
Creek	21832	ULT5yr	925.00	526.36	533.10	529.79	533.39	0.000201	4.37	302.68	246.72	0.31
Creek	21832	ULT10yr	1120.00	526.36	533.34	530.23	533.71	0.000250	5.00	405.13	287.98	0.35
Creek	21832	ULT25yr	1335.00	526.36	533.49	530.65	533.98	0.000321	5.75	448.44	332.00	0.40
Creek	21832	ULT50yr	1500.00	526.36	533.69	530.97	534.25	0.000358	6.20	505.61	412.87	0.43
Creek	21832	ULT100yr	1665.00	526.36	533.74	531.25	534.41	0.000426	6.80	522.77	431.71	0.46
Creek	21832	ULT500yr	2055.00	526.36	534.81	531.89	535.36	0.000319	6.50	1192.39	934.45	0.41
Creek	21787 Matthew Road		Culvert									
Creek	21741	EX0.5yr	270.00	526.27	528.88	528.10	529.15	0.000710	4.10	65.83	31.93	0.50
Creek	21741	EX1yr	375.00	526.27	529.44	528.44	529.75	0.000648	4.48	83.72	32.66	0.49
Creek	21741	EX2yr	500.00	526.27	530.02	528.79	530.38	0.000611	4.86	102.89	33.44	0.49
Creek	21741	EX5yr	725.00	526.27	530.90	529.36	531.36	0.000582	5.46	132.95	37.41	0.49
Creek	21741	EX10yr	930.00	526.27	531.57	529.82	532.12	0.000565	5.96	160.59	43.50	0.49
Creek	21741	EX25yr	1150.00	526.27	532.18	530.27	532.83	0.000564	6.48	189.13	49.95	0.50
Creek	21741	EX50yr	1315.00	526.27	532.63	530.60	533.34	0.000558	6.81	213.81	76.16	0.51
Creek	21741	EX100yr	1460.00	526.27	533.03	530.86	533.79	0.000541	7.02	250.92	144.59	0.50
Creek	21741	EX500yr	1800.00	526.27	533.89	531.46	534.73	0.000508	7.44	341.01	265.75	0.50
Creek	21741	ULT2yr	630.00	526.27	530.55	529.13	530.97	0.000595	5.22	120.79	34.14	0.49
Creek	21741	ULT5yr	925.00	526.27	531.58	529.79	532.12	0.000557	5.92	160.82	43.55	0.49
Creek	21741	ULT10yr	1120.00	526.27	532.11	530.22	532.74	0.000563	6.40	185.38	48.81	0.50
Creek	21741	ULT25yr	1335.00	526.27	532.68	530.63	533.40	0.000558	6.85	217.32	87.47	0.51
Creek	21741	ULT50yr	1500.00	526.27	533.17	531.01	533.93	0.000526	7.03	265.23	157.18	0.50
Creek	21741	ULT100yr	1665.00	526.27	533.59	531.23	534.39	0.000512	7.24	308.33	221.18	0.50
Creek	21741	ULT500yr	2055.00	526.27	534.43	531.87	535.35	0.000507	7.82	426.09	440.96	0.51
Creek	21696	EX0.5yr	270.00	526.25	528.13	528.13	528.93	0.002990	7.15	37.76	23.76	1.00
Creek	21696	EX1yr	375.00	526.25	528.55	528.55	529.50	0.002817	7.85	47.80	24.78	1.00
Creek	21696	EX2yr	500.00	526.25	528.97	528.97	530.10	0.002725	8.54	58.54	25.84	1.00
Creek	21696	EX5yr	725.00	526.25	529.66	529.66	531.04	0.002561	9.44	76.84	27.55	1.00
Creek	21696	EX10yr	930.00	526.25	530.25	530.19	531.78	0.002363	9.93	93.70	29.03	0.97
Creek	21696	EX25yr	1150.00	526.25	530.95	530.73	532.52	0.001937	10.05	115.92	35.91	0.90
Creek	21696	EX50yr	1315.00	526.25	531.31	531.09	533.01	0.001870	10.48	129.41	39.37	0.90
Creek	21696	EX100yr	1460.00	526.25	531.48	531.40	533.40	0.002009	11.15	136.35	41.04	0.94
Creek	21696	EX500yr	1800.00	526.25	532.08	532.08	534.28	0.001958	12.00	162.58	46.81	0.95
Creek	21696	ULT2yr	630.00	526.25	529.38	529.38	530.66	0.002620	9.09	69.31	26.86	1.00
Creek	21696	ULT5yr	925.00	526.25	530.19	530.19	531.76	0.002486	10.08	91.74	28.86	1.00
Creek	21696	ULT10yr	1120.00	526.25	530.83	530.65	532.42	0.002040	10.10	111.76	34.77	0.92
Creek	21696	ULT25yr	1335.00	526.25	531.35	531.13	533.07	0.001859	10.52	131.19	39.80	0.90
Creek	21696	ULT50yr	1500.00	526.25	531.47	531.47	533.51	0.002132	11.48	136.05	40.97	0.97
Creek	21696	ULT100yr	1665.00	526.25	531.81	531.81	533.94	0.002029	11.77	150.49	44.24	0.96
Creek	21696	ULT500yr	2055.00	526.25	532.56	532.56	534.89	0.001846	12.38	186.02	51.42	0.94
Creek	21654	EX0.5yr	270.00	526.18	528.23		528.71	0.001512	5.54	48.78	27.14	0.73
Creek	21654	EX1yr	375.00	526.18	528.67		529.26	0.001492	6.15	60.95	28.45	0.74
Creek	21654	EX2yr	500.00	526.18	529.13		529.83	0.001478	6.74	74.20	29.81	0.75
Creek	21654	EX5yr	725.00	526.18	529.85		530.73	0.001435	7.51	96.57	31.98	0.76

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	21654	EX10yr	930.00	526.18	530.62		531.53	0.001121	7.63	122.83	36.11	0.70
Creek	21654	EX25yr	1150.00	526.18	531.30		532.28	0.000975	7.96	148.68	40.02	0.67
Creek	21654	EX50yr	1315.00	526.18	531.69		532.76	0.000957	8.34	164.66	42.55	0.67
Creek	21654	EX100yr	1460.00	526.18	531.93		533.12	0.000997	8.80	175.18	44.52	0.69
Creek	21654	EX500yr	1800.00	526.18	532.40	531.50	533.89	0.001118	9.88	196.77	48.32	0.74
Creek	21654	ULT2yr	630.00	526.18	529.55		530.36	0.001463	7.23	87.13	31.08	0.76
Creek	21654	ULT5yr	925.00	526.18	530.56		531.49	0.001171	7.72	120.68	35.78	0.71
Creek	21654	ULT10yr	1120.00	526.18	531.20		532.17	0.001004	7.95	144.45	39.36	0.68
Creek	21654	ULT25yr	1335.00	526.18	531.74		532.82	0.000954	8.38	166.67	42.93	0.67
Creek	21654	ULT50yr	1500.00	526.18	531.97		533.21	0.001027	8.97	176.78	44.81	0.70
Creek	21654	ULT100yr	1665.00	526.18	532.19		533.58	0.001093	9.52	186.86	46.61	0.73
Creek	21654	ULT500yr	2055.00	526.18	532.76	531.94	534.45	0.001167	10.53	214.80	51.28	0.77
Creek	21554	EX0.5yr	270.00	526.02	528.09		528.56	0.001518	5.50	49.11	27.71	0.73
Creek	21554	EX1yr	375.00	526.02	528.53		529.10	0.001464	6.07	61.80	29.07	0.73
Creek	21554	EX2yr	500.00	526.02	529.00		529.68	0.001418	6.60	75.79	30.49	0.74
Creek	21554	EX5yr	725.00	526.02	529.74		530.57	0.001368	7.30	99.33	33.20	0.74
Creek	21554	EX10yr	930.00	526.02	530.57		531.40	0.001020	7.28	128.69	38.10	0.67
Creek	21554	EX25yr	1150.00	526.02	531.28		532.16	0.000866	7.54	157.45	43.05	0.63
Creek	21554	EX50yr	1315.00	526.02	531.68		532.64	0.000843	7.88	175.29	46.02	0.63
Creek	21554	EX100yr	1460.00	526.02	531.93		532.99	0.000873	8.29	187.03	47.87	0.65
Creek	21554	EX500yr	1800.00	526.02	532.42		533.74	0.000968	9.28	211.34	52.38	0.69
Creek	21554	ULT2yr	630.00	526.02	529.44		530.21	0.001393	7.06	89.29	31.89	0.74
Creek	21554	ULT5yr	925.00	526.02	530.51		531.35	0.001071	7.38	126.20	37.66	0.68
Creek	21554	ULT10yr	1120.00	526.02	531.17		532.05	0.000895	7.53	152.71	42.23	0.64
Creek	21554	ULT25yr	1335.00	526.02	531.73		532.70	0.000839	7.91	177.53	46.38	0.63
Creek	21554	ULT50yr	1500.00	526.02	531.97		533.07	0.000899	8.46	188.82	48.19	0.66
Creek	21554	ULT100yr	1665.00	526.02	532.20		533.43	0.000952	8.96	200.13	50.34	0.68
Creek	21554	ULT500yr	2055.00	526.02	532.80		534.28	0.001001	9.86	232.02	55.95	0.71
Creek	21455	EX0.5yr	270.00	525.86	527.91		528.40	0.001553	5.63	47.99	26.51	0.74
Creek	21455	EX1yr	375.00	525.86	528.34		528.95	0.001564	6.29	59.61	27.81	0.76
Creek	21455	EX2yr	500.00	525.86	528.77		529.52	0.001608	6.97	71.73	29.11	0.78
Creek	21455	EX5yr	725.00	525.86	529.47		530.41	0.001597	7.79	93.03	31.56	0.80
Creek	21455	EX10yr	930.00	525.86	530.42		531.28	0.001096	7.46	125.15	36.99	0.69
Creek	21455	EX25yr	1150.00	525.86	531.17		532.07	0.000897	7.64	155.08	43.03	0.64
Creek	21455	EX50yr	1315.00	525.86	531.57		532.55	0.000871	7.98	173.06	46.30	0.64
Creek	21455	EX100yr	1460.00	525.86	531.80		532.89	0.000914	8.43	183.99	48.16	0.66
Creek	21455	EX500yr	1800.00	525.86	532.26		533.63	0.001030	9.48	206.75	51.91	0.71
Creek	21455	ULT2yr	630.00	525.86	529.17		530.05	0.001629	7.53	83.70	30.44	0.80
Creek	21455	ULT5yr	925.00	525.86	530.35		531.24	0.001160	7.58	122.45	36.40	0.70
Creek	21455	ULT10yr	1120.00	525.86	531.04		531.95	0.000937	7.66	149.80	42.02	0.65
Creek	21455	ULT25yr	1335.00	525.86	531.62		532.61	0.000867	8.02	175.34	46.69	0.64
Creek	21455	ULT50yr	1500.00	525.86	531.83		532.97	0.000948	8.62	185.28	48.37	0.67
Creek	21455	ULT100yr	1665.00	525.86	532.04		533.33	0.001012	9.15	195.82	50.10	0.70
Creek	21455	ULT500yr	2055.00	525.86	532.62	531.68	534.17	0.001071	10.09	226.44	54.99	0.73
Creek	21354	EX0.5yr	270.00	525.70	527.77		528.24	0.001468	5.50	49.09	26.90	0.72
Creek	21354	EX1yr	375.00	525.70	528.20		528.79	0.001484	6.16	60.92	28.23	0.74
Creek	21354	EX2yr	500.00	525.70	528.62		529.35	0.001538	6.84	73.10	29.54	0.77
Creek	21354	EX5yr	725.00	525.70	529.34		530.24	0.001541	7.60	95.38	32.83	0.79
Creek	21354	EX10yr	930.00	525.70	530.38		531.15	0.000994	7.03	132.62	39.03	0.65
Creek	21354	EX25yr	1150.00	525.70	531.17		531.95	0.000782	7.12	165.61	45.25	0.60
Creek	21354	EX50yr	1315.00	525.70	531.58		532.43	0.000751	7.41	185.17	48.83	0.60
Creek	21354	EX100yr	1460.00	525.70	531.82		532.76	0.000782	7.81	197.19	50.93	0.61
Creek	21354	EX500yr	1800.00	525.70	532.30		533.47	0.000868	8.75	222.63	55.12	0.66
Creek	21354	ULT2yr	630.00	525.70	529.03		529.87	0.001567	7.38	85.33	31.07	0.79
Creek	21354	ULT5yr	925.00	525.70	530.30		531.10	0.001061	7.16	129.48	38.51	0.67
Creek	21354	ULT10yr	1120.00	525.70	531.04		531.83	0.000821	7.15	159.84	44.20	0.61
Creek	21354	ULT25yr	1335.00	525.70	531.63		532.49	0.000747	7.44	187.65	49.27	0.60
Creek	21354	ULT50yr	1500.00	525.70	531.85		532.83	0.000810	7.98	198.66	51.19	0.62
Creek	21354	ULT100yr	1665.00	525.70	532.08		533.18	0.000858	8.46	210.45	53.16	0.65
Creek	21354	ULT500yr	2055.00	525.70	532.69		534.00	0.000891	9.27	244.76	58.52	0.67
Creek	21254	EX0.5yr	270.00	525.54	527.58	527.23	528.08	0.001618	5.70	47.37	26.51	0.75
Creek	21254	EX1yr	375.00	525.54	527.99	527.62	528.63	0.001642	6.39	58.72	27.85	0.78
Creek	21254	EX2yr	500.00	525.54	528.41	528.04	529.19	0.001699	7.09	70.52	29.17	0.80
Creek	21254	EX5yr	725.00	525.54	529.11		530.08	0.001657	7.90	91.77	31.42	0.81
Creek	21254	EX10yr	930.00	525.54	530.24		531.04	0.000999	7.19	129.39	35.91	0.66
Creek	21254	EX25yr	1150.00	525.54	531.03		531.86	0.000801	7.32	160.59	42.58	0.61
Creek	21254	EX50yr	1315.00	525.54	531.44		532.34	0.000784	7.67	178.38	45.99	0.61
Creek	21254	EX100yr	1460.00	525.54	531.66		532.68	0.000832	8.13	188.79	47.87	0.63
Creek	21254	EX500yr	1800.00	525.54	532.04		533.37	0.000989	9.30	207.67	51.38	0.70
Creek	21254	ULT2yr	630.00	525.54	528.78	528.42	529.71	0.001755	7.71	81.67	30.37	0.83
Creek	21254	ULT5yr	925.00	525.54	530.15		530.98	0.001074	7.34	126.10	35.11	0.68
Creek	21254	ULT10yr	1120.00	525.54	530.90		531.74	0.000841	7.35	154.89	41.46	0.62
Creek	21254	ULT25yr	1335.00	525.54	531.49		532.40	0.000781	7.70	180.67	46.41	0.61
Creek	21254	ULT50yr	1500.00	525.54	531.68		532.74	0.000868	8.32	189.62	48.02	0.64
Creek	21254	ULT100yr	1665.00	525.54	531.85		533.07	0.000956	8.93	198.00	49.51	0.68
Creek	21254	ULT500yr	2055.00	525.54	532.35	531.34	533.88	0.001068	10.02	224.06	55.05	0.73

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	21154	EX0.5yr	270.00	525.38	527.07	527.07	527.84	0.003041	7.02	38.46	25.43	1.01
Creek	21154	EX1yr	375.00	525.38	527.46	527.46	528.39	0.002882	7.71	48.65	26.68	1.01
Creek	21154	EX2yr	500.00	525.38	527.93	527.88	528.96	0.002544	8.13	61.51	28.18	0.97
Creek	21154	EX5yr	725.00	525.38	528.94		529.92	0.001667	7.92	91.59	31.42	0.82
Creek	21154	EX10yr	930.00	525.38	530.17		530.94	0.000881	7.06	133.06	37.53	0.62
Creek	21154	EX25yr	1150.00	525.38	530.98		531.78	0.000719	7.21	166.73	45.58	0.58
Creek	21154	EX50yr	1315.00	525.38	531.38		532.26	0.000711	7.57	185.94	49.65	0.59
Creek	21154	EX100yr	1460.00	525.38	531.60		532.59	0.000760	8.04	197.01	51.86	0.61
Creek	21154	EX500yr	1800.00	525.38	531.96		533.26	0.000920	9.24	216.43	55.53	0.68
Creek	21154	ULT2yr	630.00	525.38	528.38	528.26	529.49	0.002295	8.45	74.53	29.62	0.94
Creek	21154	ULT5yr	925.00	525.38	530.07		530.87	0.000949	7.20	129.36	36.57	0.64
Creek	21154	ULT10yr	1120.00	525.38	530.84		531.65	0.000754	7.24	160.49	44.17	0.59
Creek	21154	ULT25yr	1335.00	525.38	531.43		532.32	0.000709	7.61	188.43	50.16	0.59
Creek	21154	ULT50yr	1500.00	525.38	531.61		532.65	0.000795	8.24	197.74	52.00	0.62
Creek	21154	ULT100yr	1665.00	525.38	531.77		532.97	0.000885	8.86	206.13	53.61	0.66
Creek	21154	ULT500yr	2055.00	525.38	532.26	531.22	533.77	0.001001	9.97	233.60	58.63	0.71
Creek	21054	EX0.5yr	270.00	524.96	527.17		527.49	0.000888	4.53	59.62	29.89	0.57
Creek	21054	EX1yr	375.00	524.96	527.66		528.05	0.000874	5.04	74.44	31.18	0.57
Creek	21054	EX2yr	500.00	524.96	528.18		528.65	0.000845	5.48	91.23	32.58	0.58
Creek	21054	EX5yr	725.00	524.96	529.15		529.68	0.000710	5.86	123.82	35.61	0.55
Creek	21054	EX10yr	930.00	524.96	530.30		530.79	0.000456	5.66	169.00	43.51	0.46
Creek	21054	EX25yr	1150.00	524.96	531.11		531.65	0.000405	5.93	207.55	51.69	0.44
Creek	21054	EX50yr	1315.00	524.96	531.52		532.12	0.000412	6.27	229.88	55.96	0.45
Creek	21054	EX100yr	1460.00	524.96	531.76		532.44	0.000442	6.67	243.46	58.51	0.47
Creek	21054	EX500yr	1800.00	524.96	532.19		533.07	0.000530	7.64	269.37	63.09	0.52
Creek	21054	ULT2yr	630.00	524.96	528.65		529.19	0.000847	5.91	106.55	33.81	0.59
Creek	21054	ULT5yr	925.00	524.96	530.21		530.72	0.000481	5.74	165.16	42.71	0.47
Creek	21054	ULT10yr	1120.00	524.96	530.97		531.51	0.000419	5.93	200.60	50.29	0.45
Creek	21054	ULT25yr	1335.00	524.96	531.57		532.18	0.000412	6.31	232.75	56.50	0.45
Creek	21054	ULT50yr	1500.00	524.96	531.78		532.49	0.000460	6.82	244.83	58.76	0.48
Creek	21054	ULT100yr	1665.00	524.96	531.98		532.79	0.000508	7.32	256.46	60.86	0.51
Creek	21054	ULT500yr	2055.00	524.96	532.53		533.55	0.000577	8.24	291.71	67.47	0.55
Creek	20954	EX0.5yr	270.00	524.86	527.11		527.40	0.000815	4.34	62.22	31.49	0.54
Creek	20954	EX1yr	375.00	524.86	527.60		527.96	0.000794	4.79	78.26	33.31	0.55
Creek	20954	EX2yr	500.00	524.86	528.14		528.55	0.000765	5.16	96.87	35.71	0.55
Creek	20954	EX5yr	725.00	524.86	529.14		529.59	0.000625	5.37	135.01	40.78	0.52
Creek	20954	EX10yr	930.00	524.86	530.32		530.72	0.000373	5.08	186.98	46.95	0.42
Creek	20954	EX25yr	1150.00	524.86	531.15		531.58	0.000325	5.29	227.49	52.00	0.40
Creek	20954	EX50yr	1315.00	524.86	531.57		532.05	0.000328	5.59	250.38	56.23	0.41
Creek	20954	EX100yr	1460.00	524.86	531.82		532.36	0.000350	5.94	264.50	58.69	0.43
Creek	20954	EX500yr	1800.00	524.86	532.27		532.97	0.000415	6.78	291.86	63.28	0.47
Creek	20954	ULT2yr	630.00	524.86	528.62		529.09	0.000762	5.51	114.38	38.09	0.56
Creek	20954	ULT5yr	925.00	524.86	530.23		530.65	0.000395	5.16	182.78	46.48	0.43
Creek	20954	ULT10yr	1120.00	524.86	531.01		531.44	0.000336	5.29	220.44	50.74	0.41
Creek	20954	ULT25yr	1335.00	524.86	531.62		532.11	0.000327	5.62	253.31	56.75	0.41
Creek	20954	ULT50yr	1500.00	524.86	531.84		532.41	0.000364	6.08	266.06	58.96	0.43
Creek	20954	ULT100yr	1665.00	524.86	532.05		532.70	0.000399	6.51	278.42	61.03	0.46
Creek	20954	ULT500yr	2055.00	524.86	532.62		533.44	0.000447	7.30	315.29	67.03	0.49
Creek	20854	EX0.5yr	270.00	524.77	527.02		527.32	0.000808	4.36	61.96	30.80	0.54
Creek	20854	EX1yr	375.00	524.77	527.51		527.88	0.000792	4.84	77.43	32.10	0.55
Creek	20854	EX2yr	500.00	524.77	528.05		528.48	0.000765	5.26	95.00	33.63	0.55
Creek	20854	EX5yr	725.00	524.77	529.04		529.52	0.000629	5.60	129.73	37.29	0.52
Creek	20854	EX10yr	930.00	524.77	530.24		530.68	0.000395	5.36	179.80	46.65	0.43
Creek	20854	EX25yr	1150.00	524.77	531.06		531.54	0.000351	5.62	221.25	54.28	0.42
Creek	20854	EX50yr	1315.00	524.77	531.47		532.01	0.000358	5.95	244.66	58.25	0.43
Creek	20854	EX100yr	1460.00	524.77	531.71		532.32	0.000386	6.34	258.49	60.54	0.45
Creek	20854	EX500yr	1800.00	524.77	532.11		532.91	0.000470	7.29	283.91	64.64	0.50
Creek	20854	ULT2yr	630.00	524.77	528.51		529.01	0.000772	5.69	110.77	34.96	0.56
Creek	20854	ULT5yr	925.00	524.77	530.14		530.60	0.000417	5.44	175.50	45.79	0.44
Creek	20854	ULT10yr	1120.00	524.77	530.92		531.40	0.000363	5.62	213.80	53.00	0.42
Creek	20854	ULT25yr	1335.00	524.77	531.52		532.07	0.000358	5.98	247.66	58.75	0.43
Creek	20854	ULT50yr	1500.00	524.77	531.72		532.36	0.000404	6.49	259.56	60.72	0.46
Creek	20854	ULT100yr	1665.00	524.77	531.91		532.65	0.000449	6.98	270.97	62.54	0.48
Creek	20854	ULT500yr	2055.00	524.77	532.44		533.38	0.000515	7.88	305.93	68.16	0.52
Creek	20754	EX0.5yr	270.00	524.67	526.95		527.23	0.000771	4.26	63.31	31.53	0.53
Creek	20754	EX1yr	375.00	524.67	527.45		527.79	0.000755	4.72	79.40	33.17	0.54
Creek	20754	EX2yr	500.00	524.67	527.99		528.40	0.000722	5.11	97.90	34.96	0.54
Creek	20754	EX5yr	725.00	524.67	529.00		529.45	0.000596	5.37	134.89	38.30	0.50
Creek	20754	EX10yr	930.00	524.67	530.23		530.63	0.000363	5.08	187.13	47.55	0.41
Creek	20754	EX25yr	1150.00	524.67	531.06		531.49	0.000319	5.31	229.62	54.92	0.40
Creek	20754	EX50yr	1315.00	524.67	531.48		531.96	0.000323	5.62	253.46	58.60	0.41
Creek	20754	EX100yr	1460.00	524.67	531.71		532.26	0.000348	5.98	267.50	60.64	0.42
Creek	20754	EX500yr	1800.00	524.67	532.13		532.84	0.000422	6.87	293.29	64.25	0.47
Creek	20754	ULT2yr	630.00	524.67	528.45		528.93	0.000725	5.50	114.48	36.49	0.55
Creek	20754	ULT5yr	925.00	524.67	530.13		530.55	0.000384	5.16	182.67	46.73	0.42
Creek	20754	ULT10yr	1120.00	524.67	530.92		531.35	0.000330	5.31	222.02	53.68	0.40
Creek	20754	ULT25yr	1335.00	524.67	531.53		532.02	0.000323	5.65	256.51	59.05	0.41

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	20754	ULT50yr	1500.00	524.67	531.73		532.30	0.000364	6.12	268.61	60.80	0.43
Creek	20754	ULT100yr	1665.00	524.67	531.92		532.58	0.000404	6.58	280.21	62.43	0.46
Creek	20754	ULT500yr	2055.00	524.67	532.46		533.30	0.000461	7.42	315.46	67.26	0.50
Creek	20654	EX0.5yr	270.00	524.58	526.69		527.12	0.001384	5.25	51.39	28.98	0.70
Creek	20654	EX1yr	375.00	524.58	527.18		527.68	0.001242	5.68	66.02	30.27	0.68
Creek	20654	EX2yr	500.00	524.58	527.72		528.29	0.001114	6.03	82.85	31.69	0.66
Creek	20654	EX5yr	725.00	524.58	528.77		529.36	0.000832	6.17	117.54	34.44	0.59
Creek	20654	EX10yr	930.00	524.58	530.08		530.58	0.000459	5.66	172.63	48.31	0.46
Creek	20654	EX25yr	1150.00	524.58	530.92		531.45	0.000397	5.88	216.34	56.12	0.44
Creek	20654	EX50yr	1315.00	524.58	531.33		531.92	0.000402	6.21	240.17	59.88	0.45
Creek	20654	EX100yr	1460.00	524.58	531.55		532.21	0.000437	6.62	253.33	61.82	0.47
Creek	20654	EX500yr	1800.00	524.58	531.90		532.78	0.000544	7.67	275.53	64.98	0.53
Creek	20654	ULT2yr	630.00	524.58	528.16		528.82	0.001109	6.50	96.91	32.83	0.67
Creek	20654	ULT5yr	925.00	524.58	529.98		530.49	0.000490	5.77	167.67	47.34	0.47
Creek	20654	ULT10yr	1120.00	524.58	530.78		531.31	0.000413	5.89	208.35	54.77	0.45
Creek	20654	ULT25yr	1335.00	524.58	531.38		531.97	0.000402	6.24	243.24	60.34	0.45
Creek	20654	ULT50yr	1500.00	524.58	531.56		532.25	0.000459	6.80	253.79	61.89	0.48
Creek	20654	ULT100yr	1665.00	524.58	531.71		532.52	0.000517	7.34	263.51	63.29	0.51
Creek	20654	ULT500yr	2055.00	524.58	532.19		533.22	0.000605	8.33	295.00	67.62	0.56
Creek	20554	EX0.5yr	270.00	524.49	526.65		526.97	0.000925	4.51	59.83	31.44	0.58
Creek	20554	EX1yr	375.00	524.49	527.17		527.54	0.000855	4.91	76.45	33.23	0.57
Creek	20554	EX2yr	500.00	524.49	527.73		528.15	0.000793	5.22	95.78	35.71	0.56
Creek	20554	EX5yr	725.00	524.49	528.81		529.25	0.000609	5.28	137.42	41.18	0.51
Creek	20554	EX10yr	930.00	524.49	530.15		530.50	0.000334	4.74	200.87	54.51	0.40
Creek	20554	EX25yr	1150.00	524.49	531.00		531.37	0.000281	4.89	251.09	63.34	0.37
Creek	20554	EX50yr	1315.00	524.49	531.42		531.83	0.000281	5.15	278.89	67.75	0.38
Creek	20554	EX100yr	1460.00	524.49	531.66		532.11	0.000302	5.47	294.89	70.28	0.39
Creek	20554	EX500yr	1800.00	524.49	532.05		532.65	0.000365	6.29	323.60	74.79	0.44
Creek	20554	ULT2yr	630.00	524.49	528.19		528.67	0.000802	5.60	112.53	38.00	0.57
Creek	20554	ULT5yr	925.00	524.49	530.04		530.41	0.000358	4.83	195.33	53.43	0.41
Creek	20554	ULT10yr	1120.00	524.49	530.85		531.22	0.000293	4.90	242.02	61.85	0.38
Creek	20554	ULT25yr	1335.00	524.49	531.48		531.88	0.000281	5.17	282.46	68.29	0.38
Creek	20554	ULT50yr	1500.00	524.49	531.67		532.15	0.000316	5.61	295.88	70.44	0.40
Creek	20554	ULT100yr	1665.00	524.49	531.85		532.40	0.000351	6.03	308.62	72.46	0.43
Creek	20554	ULT500yr	2055.00	524.49	532.38		533.07	0.000398	6.79	348.74	78.55	0.46
Creek	20454	EX0.5yr	270.00	524.39	526.56		526.88	0.000915	4.52	59.79	31.09	0.57
Creek	20454	EX1yr	375.00	524.39	527.08		527.46	0.000843	4.91	76.45	32.80	0.57
Creek	20454	EX2yr	500.00	524.39	527.65		528.07	0.000773	5.23	95.55	34.65	0.56
Creek	20454	EX5yr	725.00	524.39	528.73		529.18	0.000550	5.40	135.11	38.67	0.49
Creek	20454	EX10yr	930.00	524.39	530.06		530.46	0.000325	5.08	192.19	48.29	0.40
Creek	20454	EX25yr	1150.00	524.39	530.90		531.33	0.000293	5.34	235.50	55.37	0.39
Creek	20454	EX50yr	1315.00	524.39	531.30		531.79	0.000304	5.69	258.80	59.65	0.40
Creek	20454	EX100yr	1460.00	524.39	531.51		532.07	0.000334	6.10	271.34	61.82	0.42
Creek	20454	EX500yr	1800.00	524.39	531.83		532.59	0.000428	7.12	291.87	65.22	0.48
Creek	20454	ULT2yr	630.00	524.39	528.09		528.59	0.000776	5.66	111.25	36.12	0.57
Creek	20454	ULT5yr	925.00	524.39	529.95		530.37	0.000345	5.17	187.11	47.41	0.41
Creek	20454	ULT10yr	1120.00	524.39	530.75		531.19	0.000303	5.34	227.61	54.15	0.39
Creek	20454	ULT25yr	1335.00	524.39	531.35		531.85	0.000305	5.72	261.82	60.18	0.40
Creek	20454	ULT50yr	1500.00	524.39	531.51		532.10	0.000352	6.26	271.59	61.86	0.43
Creek	20454	ULT100yr	1665.00	524.39	531.65		532.35	0.000402	6.78	280.49	63.36	0.46
Creek	20454	ULT500yr	2055.00	524.39	532.10		533.01	0.000487	7.79	309.71	68.52	0.51
Creek	20354	EX0.5yr	270.00	524.30	526.47		526.78	0.000893	4.47	60.47	31.34	0.57
Creek	20354	EX1yr	375.00	524.30	527.01		527.37	0.000812	4.84	77.54	32.96	0.56
Creek	20354	EX2yr	500.00	524.30	527.58		527.99	0.000740	5.16	96.97	34.69	0.54
Creek	20354	EX5yr	725.00	524.30	528.69		529.12	0.000568	5.27	137.60	38.71	0.49
Creek	20354	EX10yr	930.00	524.30	530.05		530.41	0.000320	4.83	198.24	52.09	0.39
Creek	20354	EX25yr	1150.00	524.30	530.90		531.29	0.000280	5.03	246.35	61.53	0.37
Creek	20354	EX50yr	1315.00	524.30	531.31		531.75	0.000286	5.33	272.63	66.21	0.38
Creek	20354	EX100yr	1460.00	524.30	531.52		532.02	0.000312	5.70	286.86	68.65	0.40
Creek	20354	EX500yr	1800.00	524.30	531.86		532.52	0.000394	6.63	310.58	72.77	0.45
Creek	20354	ULT2yr	630.00	524.30	528.02		528.51	0.000756	5.59	112.62	36.04	0.56
Creek	20354	ULT5yr	925.00	524.30	529.94		530.32	0.000343	4.92	192.67	50.88	0.40
Creek	20354	ULT10yr	1120.00	524.30	530.75		531.14	0.000291	5.04	237.49	59.90	0.38
Creek	20354	ULT25yr	1335.00	524.30	531.36		531.80	0.000286	5.36	276.02	66.80	0.38
Creek	20354	ULT50yr	1500.00	524.30	531.53		532.05	0.000329	5.85	287.21	68.71	0.41
Creek	20354	ULT100yr	1665.00	524.30	531.68		532.28	0.000373	6.33	297.51	70.43	0.44
Creek	20354	ULT500yr	2055.00	524.30	532.14		532.92	0.000445	7.24	331.71	79.58	0.49
Creek	20254	EX0.5yr	270.00	524.20	526.39		526.69	0.000867	4.40	61.33	31.83	0.56
Creek	20254	EX1yr	375.00	524.20	526.94		527.29	0.000773	4.74	79.12	33.44	0.54
Creek	20254	EX2yr	500.00	524.20	527.52		527.92	0.000701	5.04	99.16	35.25	0.53
Creek	20254	EX5yr	725.00	524.20	528.65		529.06	0.000535	5.10	142.10	40.74	0.48
Creek	20254	EX10yr	930.00	524.20	530.04		530.38	0.000290	4.68	204.30	49.87	0.37
Creek	20254	EX25yr	1150.00	524.20	530.89		531.26	0.000257	4.89	249.84	57.39	0.36
Creek	20254	EX50yr	1315.00	524.20	531.30		531.71	0.000264	5.20	274.30	62.24	0.37
Creek	20254	EX100yr	1460.00	524.20	531.51		531.98	0.000290	5.57	287.60	65.04	0.39
Creek	20254	EX500yr	1800.00	524.20	531.84		532.48	0.000369	6.50	309.75	69.46	0.44

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	20254	ULT2yr	630.00	524.20	527.96		528.43	0.000726	5.47	115.19	37.10	0.55
Creek	20254	ULT5yr	925.00	524.20	529.93		530.28	0.000310	4.76	198.90	48.87	0.38
Creek	20254	ULT10yr	1120.00	524.20	530.74		531.11	0.000266	4.90	241.54	56.10	0.37
Creek	20254	ULT25yr	1335.00	524.20	531.35		531.77	0.000265	5.23	277.49	62.93	0.37
Creek	20254	ULT50yr	1500.00	524.20	531.51		532.01	0.000305	5.72	287.86	65.10	0.40
Creek	20254	ULT100yr	1665.00	524.20	531.66		532.24	0.000348	6.19	297.42	67.04	0.43
Creek	20254	ULT500yr	2055.00	524.20	532.11		532.87	0.000417	7.10	329.38	73.15	0.47
Creek	20154	EX0.5yr	270.00	524.11	526.30		526.61	0.000891	4.47	60.42	31.31	0.57
Creek	20154	EX1yr	375.00	524.11	526.85		527.21	0.000787	4.80	78.21	32.95	0.55
Creek	20154	EX2yr	500.00	524.11	527.44		527.84	0.000715	5.09	98.15	34.90	0.54
Creek	20154	EX5yr	725.00	524.11	528.60		529.01	0.000496	5.14	142.29	41.37	0.47
Creek	20154	EX10yr	930.00	524.11	530.00		530.35	0.000278	4.75	208.56	54.04	0.37
Creek	20154	EX25yr	1150.00	524.11	530.85		531.23	0.000249	4.98	258.31	62.90	0.36
Creek	20154	EX50yr	1315.00	524.11	531.26		531.68	0.000258	5.29	284.93	67.29	0.37
Creek	20154	EX100yr	1460.00	524.11	531.47		531.95	0.000284	5.67	298.96	69.49	0.39
Creek	20154	EX500yr	1800.00	524.11	531.78		532.44	0.000365	6.63	321.42	72.86	0.44
Creek	20154	ULT2yr	630.00	524.11	527.88		528.35	0.000753	5.53	113.97	37.27	0.56
Creek	20154	ULT5yr	925.00	524.11	529.89		530.25	0.000296	4.83	202.58	52.93	0.38
Creek	20154	ULT10yr	1120.00	524.11	530.71		531.08	0.000258	4.98	249.14	61.32	0.36
Creek	20154	ULT25yr	1335.00	524.11	531.31		531.74	0.000258	5.33	288.39	67.84	0.37
Creek	20154	ULT50yr	1500.00	524.11	531.47		531.98	0.000299	5.83	299.06	69.51	0.40
Creek	20154	ULT100yr	1665.00	524.11	531.61		532.20	0.000342	6.32	308.70	70.97	0.43
Creek	20154	ULT500yr	2055.00	524.11	532.04		532.83	0.000415	7.26	340.86	75.64	0.48
Creek	20053	EX0.5yr	270.00	524.01	526.21		526.51	0.000846	4.38	61.58	31.59	0.55
Creek	20053	EX1yr	375.00	524.01	526.78		527.12	0.000741	4.68	80.07	33.44	0.53
Creek	20053	EX2yr	500.00	524.01	527.38		527.77	0.000669	4.96	100.71	35.48	0.52
Creek	20053	EX5yr	725.00	524.01	528.56		528.95	0.000451	5.03	145.94	41.98	0.45
Creek	20053	EX10yr	930.00	524.01	529.98		530.32	0.000259	4.68	212.84	53.04	0.36
Creek	20053	EX25yr	1150.00	524.01	530.83		531.20	0.000236	4.94	262.91	64.76	0.35
Creek	20053	EX50yr	1315.00	524.01	531.24		531.66	0.000245	5.26	290.58	71.01	0.36
Creek	20053	EX100yr	1460.00	524.01	531.44		531.92	0.000272	5.64	305.41	75.10	0.38
Creek	20053	EX500yr	1800.00	524.01	531.75		532.40	0.000351	6.61	329.35	80.56	0.44
Creek	20053	ULT2yr	630.00	524.01	527.82		528.27	0.000690	5.41	116.53	37.18	0.54
Creek	20053	ULT5yr	925.00	524.01	529.87		530.22	0.000276	4.77	206.90	52.03	0.37
Creek	20053	ULT10yr	1120.00	524.01	530.69		531.06	0.000244	4.94	253.48	62.54	0.35
Creek	20053	ULT25yr	1335.00	524.01	531.29		531.71	0.000246	5.29	294.23	72.40	0.36
Creek	20053	ULT50yr	1500.00	524.01	531.44		531.95	0.000287	5.80	305.40	75.10	0.39
Creek	20053	ULT100yr	1665.00	524.01	531.58		532.17	0.000329	6.29	315.55	77.46	0.42
Creek	20053	ULT500yr	2055.00	524.01	532.01		532.79	0.000402	7.24	350.65	85.12	0.47
Creek	19954	EX0.5yr	270.00	523.92	526.12		526.43	0.000869	4.44	60.85	31.26	0.56
Creek	19954	EX1yr	375.00	523.92	526.70		527.05	0.000751	4.72	79.52	33.18	0.54
Creek	19954	EX2yr	500.00	523.92	527.31		527.70	0.000671	4.98	100.35	35.19	0.52
Creek	19954	EX5yr	725.00	523.92	528.52		528.91	0.000447	5.01	146.23	41.90	0.45
Creek	19954	EX10yr	930.00	523.92	529.96		530.29	0.000252	4.64	216.46	56.13	0.35
Creek	19954	EX25yr	1150.00	523.92	530.82		531.18	0.000229	4.88	268.94	68.48	0.35
Creek	19954	EX50yr	1315.00	523.92	531.22		531.63	0.000240	5.21	299.64	82.49	0.36
Creek	19954	EX100yr	1460.00	523.92	531.43		531.89	0.000264	5.58	316.72	86.09	0.38
Creek	19954	EX500yr	1800.00	523.92	531.73		532.36	0.000341	6.52	343.81	93.90	0.43
Creek	19954	ULT2yr	630.00	523.92	527.74		528.20	0.000705	5.44	115.88	36.87	0.54
Creek	19954	ULT5yr	925.00	523.92	529.85		530.19	0.000269	4.72	210.07	54.93	0.36
Creek	19954	ULT10yr	1120.00	523.92	530.67		531.03	0.000237	4.88	259.12	64.54	0.35
Creek	19954	ULT25yr	1335.00	523.92	531.27		531.69	0.000240	5.24	303.90	83.63	0.36
Creek	19954	ULT50yr	1500.00	523.92	531.42		531.92	0.000279	5.73	316.61	86.07	0.39
Creek	19954	ULT100yr	1665.00	523.92	531.56		532.13	0.000320	6.22	328.06	88.21	0.42
Creek	19954	ULT500yr	2055.00	523.92	531.95	529.25	532.74	0.000407	7.27	379.07	224.82	0.47
Creek	19854	EX0.5yr	270.00	523.83	526.04		526.34	0.000865	4.43	60.94	31.26	0.56
Creek	19854	EX1yr	375.00	523.83	526.63		526.97	0.000740	4.68	80.19	33.53	0.53
Creek	19854	EX2yr	500.00	523.83	527.25		527.63	0.000663	4.90	101.99	36.48	0.52
Creek	19854	EX5yr	725.00	523.83	528.50		528.86	0.000428	4.83	150.92	42.30	0.44
Creek	19854	EX10yr	930.00	523.83	529.95		530.26	0.000236	4.45	219.30	52.60	0.34
Creek	19854	EX25yr	1150.00	523.83	530.81		531.15	0.000214	4.69	267.51	59.72	0.33
Creek	19854	EX50yr	1315.00	523.83	531.22		531.60	0.000223	5.00	292.64	64.07	0.34
Creek	19854	EX100yr	1460.00	523.83	531.42		531.86	0.000248	5.37	305.69	66.43	0.37
Creek	19854	EX500yr	1800.00	523.83	531.72		532.32	0.000323	6.32	326.04	69.95	0.42
Creek	19854	ULT2yr	630.00	523.83	527.69		528.13	0.000694	5.33	118.20	38.52	0.54
Creek	19854	ULT5yr	925.00	523.83	529.84		530.15	0.000251	4.53	213.26	51.64	0.35
Creek	19854	ULT10yr	1120.00	523.83	530.66		531.00	0.000221	4.69	258.68	58.48	0.34
Creek	19854	ULT25yr	1335.00	523.83	531.27		531.66	0.000224	5.04	295.91	64.67	0.35
Creek	19854	ULT50yr	1500.00	523.83	531.42		531.88	0.000262	5.52	305.57	66.41	0.38
Creek	19854	ULT100yr	1665.00	523.83	531.55		532.09	0.000302	6.01	314.20	67.92	0.40
Creek	19854	ULT500yr	2055.00	523.83	531.96		532.69	0.000373	6.95	343.27	72.80	0.45
Creek	19755	EX0.5yr	270.00	523.73	525.95		526.25	0.000842	4.40	61.34	31.05	0.55
Creek	19755	EX1yr	375.00	523.73	526.56		526.90	0.000707	4.64	80.85	32.94	0.52
Creek	19755	EX2yr	500.00	523.73	527.19		527.56	0.000632	4.89	102.18	35.10	0.51
Creek	19755	EX5yr	725.00	523.73	528.45		528.81	0.000429	4.84	150.59	42.42	0.44
Creek	19755	EX10yr	930.00	523.73	529.93		530.23	0.000234	4.44	221.95	54.45	0.34

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	19755	EX25yr	1150.00	523.73	530.79		531.13	0.000212	4.67	272.19	62.19	0.33
Creek	19755	EX50yr	1315.00	523.73	531.20		531.58	0.000221	4.98	298.27	65.92	0.34
Creek	19755	EX100yr	1460.00	523.73	531.40		531.83	0.000246	5.35	311.53	67.79	0.36
Creek	19755	EX500yr	1800.00	523.73	531.69		532.29	0.000321	6.30	331.74	70.53	0.42
Creek	19755	ULT2yr	630.00	523.73	527.61		528.05	0.000687	5.38	117.20	37.15	0.53
Creek	19755	ULT5yr	925.00	523.73	529.81		530.13	0.000249	4.52	215.61	53.40	0.35
Creek	19755	ULT10yr	1120.00	523.73	530.64		530.98	0.000219	4.67	262.95	60.85	0.34
Creek	19755	ULT25yr	1335.00	523.73	531.25		531.63	0.000222	5.01	301.65	66.40	0.34
Creek	19755	ULT50yr	1500.00	523.73	531.40		531.85	0.000260	5.50	311.32	67.76	0.37
Creek	19755	ULT100yr	1665.00	523.73	531.52		532.06	0.000300	5.98	319.87	68.94	0.40
Creek	19755	ULT500yr	2055.00	523.73	531.93		532.65	0.000372	6.93	348.71	72.75	0.45
Creek	19667	EX0.5yr	270.00	523.60	525.85	525.17	526.18	0.000887	4.55	59.36	29.39	0.56
Creek	19667	EX1yr	375.00	523.60	526.47	525.53	526.83	0.000748	4.81	77.94	30.90	0.53
Creek	19667	EX2yr	500.00	523.60	527.09	525.92	527.50	0.000678	5.12	97.67	32.42	0.52
Creek	19667	EX5yr	725.00	523.60	528.36	526.53	528.77	0.000457	5.17	143.53	42.08	0.45
Creek	19667	EX10yr	930.00	523.60	529.85	527.02	530.21	0.000262	4.81	216.80	55.87	0.36
Creek	19667	EX25yr	1150.00	523.60	530.70	527.50	531.10	0.000245	5.11	267.65	63.68	0.35
Creek	19667	EX50yr	1315.00	523.60	531.09	527.83	531.55	0.000261	5.48	293.20	67.10	0.37
Creek	19667	EX100yr	1460.00	523.60	531.27	528.10	531.80	0.000293	5.91	305.34	68.83	0.39
Creek	19667	EX500yr	1800.00	523.60	531.50	528.72	532.24	0.000398	7.04	321.25	71.03	0.46
Creek	19667	ULT2yr	630.00	523.60	527.48	526.28	527.99	0.000750	5.71	110.33	33.36	0.55
Creek	19667	ULT5yr	925.00	523.60	529.73	527.01	530.10	0.000279	4.90	210.11	54.76	0.37
Creek	19667	ULT10yr	1120.00	523.60	530.55	527.44	530.95	0.000253	5.11	258.19	62.30	0.36
Creek	19667	ULT25yr	1335.00	523.60	531.14	527.88	531.60	0.000262	5.52	296.53	67.58	0.37
Creek	19667	ULT50yr	1500.00	523.60	531.26	528.18	531.82	0.000311	6.08	304.62	68.73	0.40
Creek	19667	ULT100yr	1665.00	523.60	531.36	528.48	532.02	0.000366	6.66	310.99	69.62	0.44
Creek	19667	ULT500yr	2055.00	523.60	531.68	529.14	532.59	0.000476	7.82	334.03	72.75	0.50
Creek	19610	EX0.5yr	360.00	523.09	525.88	524.64	526.09	0.000395	3.62	99.47	39.30	0.40
Creek	19610	EX1yr	500.00	523.09	526.49	525.00	526.75	0.000380	4.06	123.00	40.65	0.40
Creek	19610	EX2yr	660.00	523.09	527.11	525.36	527.43	0.000367	4.49	146.89	42.02	0.41
Creek	19610	EX5yr	940.00	523.09	528.36	525.93	528.72	0.000290	4.82	194.94	52.51	0.38
Creek	19610	EX10yr	1170.00	523.09	529.88	526.36	530.16	0.000180	4.26	298.16	65.80	0.30
Creek	19610	EX25yr	1525.00	523.09	530.71	526.95	531.07	0.000197	4.86	395.79	188.87	0.32
Creek	19610	EX50yr	1840.00	523.09	531.07	527.44	531.53	0.000238	5.51	477.77	267.17	0.36
Creek	19610	EX100yr	2095.00	523.09	531.21	527.81	531.77	0.000287	6.13	514.04	276.25	0.39
Creek	19610	EX500yr	2520.00	523.09	531.47	528.42	532.22	0.000364	7.07	591.63	302.01	0.45
Creek	19610	ULT2yr	775.00	523.09	527.53	525.60	527.88	0.000359	4.76	162.80	45.99	0.41
Creek	19610	ULT5yr	1155.00	523.09	529.76	526.34	530.05	0.000187	4.29	290.52	64.64	0.31
Creek	19610	ULT10yr	1435.00	523.09	530.57	526.81	530.91	0.000188	4.68	370.90	173.67	0.31
Creek	19610	ULT25yr	1905.00	523.09	531.09	527.54	531.58	0.000253	5.69	482.78	268.36	0.37
Creek	19610	ULT50yr	2125.00	523.09	531.22	527.86	531.79	0.000294	6.21	517.11	276.81	0.40
Creek	19610	ULT100yr	2315.00	523.09	531.34	528.12	531.99	0.000326	6.61	552.54	290.37	0.42
Creek	19610	ULT500yr	2860.00	523.09	531.67	528.86	532.55	0.000422	7.73	651.17	306.16	0.48
Creek	19579 Prairie Lane		Culvert									
Creek	19548	EX0.5yr	360.00	523.08	525.52	524.64	525.80	0.000657	4.20	85.69	38.52	0.50
Creek	19548	EX1yr	500.00	523.08	526.01	525.02	526.37	0.000662	4.77	104.77	39.61	0.51
Creek	19548	EX2yr	660.00	523.08	526.49	525.38	526.94	0.000667	5.34	123.51	40.67	0.53
Creek	19548	EX5yr	940.00	523.08	527.26	525.95	527.84	0.000656	6.12	153.47	44.95	0.54
Creek	19548	EX10yr	1170.00	523.08	527.95	526.34	528.57	0.000622	6.32	188.80	50.04	0.53
Creek	19548	EX25yr	1525.00	523.08	528.97	526.95	529.66	0.000522	6.66	243.78	58.33	0.50
Creek	19548	EX50yr	1840.00	523.08	529.87	527.44	530.60	0.000452	6.87	301.70	79.25	0.48
Creek	19548	EX100yr	2095.00	523.08	530.24	527.83	531.07	0.000484	7.38	338.86	115.84	0.50
Creek	19548	EX500yr	2520.00	523.08	530.80	528.38	531.81	0.000524	8.11	419.19	295.60	0.53
Creek	19548	ULT2yr	775.00	523.08	526.81	525.63	527.31	0.000671	5.71	135.76	41.37	0.54
Creek	19548	ULT5yr	1155.00	523.08	527.86	526.34	528.49	0.000651	6.37	184.17	49.35	0.54
Creek	19548	ULT10yr	1435.00	523.08	528.70	526.81	529.38	0.000550	6.60	228.39	55.39	0.51
Creek	19548	ULT25yr	1905.00	523.08	529.86	527.53	530.64	0.000487	7.12	300.91	78.57	0.50
Creek	19548	ULT50yr	2125.00	523.08	530.28	527.86	531.13	0.000487	7.43	343.99	120.54	0.51
Creek	19548	ULT100yr	2315.00	523.08	530.54	528.13	531.47	0.000505	7.77	377.10	172.63	0.52
Creek	19548	ULT500yr	2860.00	523.08	531.21	528.83	532.35	0.000554	8.65	507.39	463.57	0.55
Creek	19520	EX0.5yr	360.00	523.13	525.41	524.78	525.75	0.000971	4.72	76.26	39.41	0.60
Creek	19520	EX1yr	500.00	523.13	525.91	525.16	526.33	0.000915	5.17	96.79	41.60	0.60
Creek	19520	EX2yr	660.00	523.13	526.43	525.54	526.91	0.000864	5.56	118.74	43.62	0.59
Creek	19520	EX5yr	940.00	523.13	527.25	526.11	527.81	0.000773	6.02	156.21	47.52	0.58
Creek	19520	EX10yr	1170.00	523.13	527.94	526.53	528.54	0.000640	6.21	190.15	50.95	0.54
Creek	19520	EX25yr	1525.00	523.13	528.98	527.12	529.62	0.000501	6.40	246.22	56.64	0.50
Creek	19520	EX50yr	1840.00	523.13	529.90	527.56	530.55	0.000415	6.51	300.34	61.78	0.47
Creek	19520	EX100yr	2095.00	523.13	530.27	527.89	531.01	0.000437	6.95	324.02	64.03	0.49
Creek	19520	EX500yr	2520.00	523.13	530.85	528.44	531.73	0.000469	7.63	361.90	67.59	0.51
Creek	19520	ULT2yr	775.00	523.13	526.77	525.79	527.29	0.000839	5.79	133.87	45.13	0.59
Creek	19520	ULT5yr	1155.00	523.13	527.85	526.51	528.46	0.000676	6.28	185.31	50.44	0.56
Creek	19520	ULT10yr	1435.00	523.13	528.71	526.98	529.34	0.000537	6.38	230.76	55.13	0.51
Creek	19520	ULT25yr	1905.00	523.13	529.89	527.62	530.59	0.000447	6.75	299.85	61.74	0.49
Creek	19520	ULT50yr	2125.00	523.13	530.32	527.94	531.07	0.000439	7.00	326.89	64.31	0.49
Creek	19520	ULT100yr	2315.00	523.13	530.58	528.18	531.40	0.000452	7.30	344.22	65.96	0.50
Creek	19520	ULT500yr	2860.00	523.13	531.26	528.84	532.27	0.000494	8.14	390.46	70.36	0.53

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	19498	EX0.5yr	360.00	523.09	524.90	524.89	525.67	0.002918	7.06	51.02	32.64	0.99
Creek	19498	EX1yr	500.00	523.09	525.30	525.29	526.24	0.002762	7.80	64.12	33.64	1.00
Creek	19498	EX2yr	660.00	523.09	525.73	525.68	526.82	0.002554	8.38	78.76	34.73	0.98
Creek	19498	EX5yr	940.00	523.09	526.61	526.31	527.73	0.001850	8.50	110.57	36.98	0.87
Creek	19498	EX10yr	1170.00	523.09	527.38		528.47	0.001416	8.37	139.90	40.67	0.78
Creek	19498	EX25yr	1525.00	523.09	528.49		529.56	0.000972	8.29	190.01	48.44	0.67
Creek	19498	EX50yr	1840.00	523.09	529.45		530.49	0.000751	8.25	239.19	54.49	0.61
Creek	19498	EX100yr	2095.00	523.09	529.74		530.95	0.000820	8.91	255.22	56.21	0.64
Creek	19498	EX500yr	2520.00	523.09	530.14		531.66	0.000947	9.99	278.08	58.57	0.70
Creek	19498	ULT2yr	775.00	523.09	526.03	525.95	527.20	0.002395	8.67	89.36	35.50	0.96
Creek	19498	ULT5yr	1155.00	523.09	527.21		528.38	0.001599	8.67	133.27	38.51	0.82
Creek	19498	ULT10yr	1435.00	523.09	528.19		529.27	0.001076	8.35	175.75	46.60	0.70
Creek	19498	ULT25yr	1905.00	523.09	529.38		530.53	0.000844	8.66	235.09	54.01	0.65
Creek	19498	ULT50yr	2125.00	523.09	529.77		531.01	0.000827	8.98	257.16	56.41	0.65
Creek	19498	ULT100yr	2315.00	523.09	529.97		531.33	0.000878	9.45	268.16	57.56	0.67
Creek	19498	ULT500yr	2860.00	523.09	530.36	529.37	532.17	0.001081	10.93	291.27	59.89	0.75
Creek	19454	EX0.5yr	360.00	523.00	524.96		525.50	0.001727	5.91	60.95	34.36	0.78
Creek	19454	EX1yr	500.00	523.00	525.39		526.06	0.001698	6.58	75.98	35.77	0.80
Creek	19454	EX2yr	660.00	523.00	525.84		526.63	0.001631	7.13	92.52	37.25	0.80
Creek	19454	EX5yr	940.00	523.00	526.73		527.58	0.001287	7.40	127.02	40.18	0.73
Creek	19454	EX10yr	1170.00	523.00	527.50		528.34	0.000990	7.39	158.59	42.63	0.66
Creek	19454	EX25yr	1525.00	523.00	528.60		529.46	0.000725	7.48	207.79	47.22	0.59
Creek	19454	EX50yr	1840.00	523.00	529.54		530.42	0.000586	7.55	254.69	52.47	0.55
Creek	19454	EX100yr	2095.00	523.00	529.84		530.86	0.000640	8.16	270.86	54.14	0.58
Creek	19454	EX500yr	2520.00	523.00	530.27		531.55	0.000737	9.15	294.39	56.59	0.63
Creek	19454	ULT2yr	775.00	523.00	526.16		527.01	0.001565	7.42	104.42	38.29	0.79
Creek	19454	ULT5yr	1155.00	523.00	527.34		528.24	0.001105	7.60	152.10	42.14	0.70
Creek	19454	ULT10yr	1435.00	523.00	528.30		529.17	0.000789	7.49	194.12	45.81	0.61
Creek	19454	ULT25yr	1905.00	523.00	529.47		530.44	0.000651	7.90	251.42	52.13	0.58
Creek	19454	ULT50yr	2125.00	523.00	529.88		530.92	0.000645	8.23	272.81	54.33	0.58
Creek	19454	ULT100yr	2315.00	523.00	530.08		531.23	0.000686	8.66	284.02	55.49	0.60
Creek	19454	ULT500yr	2860.00	523.00	530.52		532.04	0.000834	9.99	308.88	58.07	0.67
Creek	19354	EX0.5yr	360.00	522.84	524.80		525.33	0.001681	5.86	61.39	34.06	0.77
Creek	19354	EX1yr	500.00	522.84	525.23		525.89	0.001659	6.56	76.25	35.19	0.79
Creek	19354	EX2yr	660.00	522.84	525.68		526.47	0.001598	7.13	92.56	36.38	0.79
Creek	19354	EX5yr	940.00	522.84	526.61		527.45	0.001250	7.37	127.60	39.36	0.72
Creek	19354	EX10yr	1170.00	522.84	527.41		528.24	0.000954	7.30	160.61	42.88	0.65
Creek	19354	EX25yr	1525.00	522.84	528.54		529.38	0.000694	7.37	212.37	48.93	0.58
Creek	19354	EX50yr	1840.00	522.84	529.50		530.35	0.000560	7.43	261.62	54.08	0.53
Creek	19354	EX100yr	2095.00	522.84	529.80		530.79	0.000614	8.04	278.11	55.72	0.56
Creek	19354	EX500yr	2520.00	522.84	530.22		531.47	0.000712	9.03	301.97	58.01	0.61
Creek	19354	ULT2yr	775.00	522.84	526.00		526.86	0.001539	7.44	104.21	37.21	0.78
Creek	19354	ULT5yr	1155.00	522.84	527.25		528.13	0.001075	7.53	153.51	42.04	0.68
Creek	19354	ULT10yr	1435.00	522.84	528.24		529.09	0.000756	7.38	197.88	47.27	0.60
Creek	19354	ULT25yr	1905.00	522.84	529.43		530.36	0.000624	7.79	257.96	53.71	0.56
Creek	19354	ULT50yr	2125.00	522.84	529.84		530.84	0.000620	8.10	280.11	55.92	0.57
Creek	19354	ULT100yr	2315.00	522.84	530.04		531.16	0.000660	8.54	291.51	57.02	0.59
Creek	19354	ULT500yr	2860.00	522.84	530.47		531.95	0.000809	9.87	316.39	59.36	0.66
Creek	19255	EX0.5yr	360.00	522.67	524.67		525.16	0.001526	5.61	64.15	35.72	0.74
Creek	19255	EX1yr	500.00	522.67	525.12		525.72	0.001462	6.21	80.57	37.11	0.74
Creek	19255	EX2yr	660.00	522.67	525.60		526.30	0.001370	6.68	98.84	38.58	0.74
Creek	19255	EX5yr	940.00	522.67	526.58		527.30	0.001036	6.80	138.26	42.25	0.66
Creek	19255	EX10yr	1170.00	522.67	527.42		528.12	0.000770	6.69	175.81	47.32	0.59
Creek	19255	EX25yr	1525.00	522.67	528.58		529.28	0.000554	6.73	235.73	56.39	0.52
Creek	19255	EX50yr	1840.00	522.67	529.55		530.26	0.000445	6.76	294.46	64.50	0.48
Creek	19255	EX100yr	2095.00	522.67	529.87		530.68	0.000484	7.29	315.35	67.12	0.51
Creek	19255	EX500yr	2520.00	522.67	530.33		531.33	0.000552	8.15	346.64	71.08	0.55
Creek	19255	ULT2yr	775.00	522.67	525.94		526.68	0.001298	6.92	111.95	39.60	0.73
Creek	19255	ULT5yr	1155.00	522.67	527.25		527.99	0.000870	6.91	167.70	46.19	0.62
Creek	19255	ULT10yr	1435.00	522.67	528.27		528.98	0.000604	6.74	218.78	53.87	0.54
Creek	19255	ULT25yr	1905.00	522.67	529.49		530.26	0.000494	7.08	290.45	63.96	0.51
Creek	19255	ULT50yr	2125.00	522.67	529.91		530.73	0.000488	7.35	317.90	67.43	0.51
Creek	19255	ULT100yr	2315.00	522.67	530.13		531.03	0.000516	7.73	332.66	69.30	0.53
Creek	19255	ULT500yr	2860.00	522.67	530.61		531.79	0.000618	8.86	366.87	73.57	0.58
Creek	19155	EX0.5yr	360.00	522.50	524.51		525.00	0.001514	5.61	64.12	35.36	0.73
Creek	19155	EX1yr	500.00	522.50	524.98		525.57	0.001447	6.19	80.84	37.09	0.74
Creek	19155	EX2yr	660.00	522.50	525.48		526.16	0.001332	6.59	100.10	39.06	0.73
Creek	19155	EX5yr	940.00	522.50	526.51		527.19	0.000957	6.60	142.37	43.00	0.64
Creek	19155	EX10yr	1170.00	522.50	527.38		528.03	0.000684	6.51	181.18	46.88	0.56
Creek	19155	EX25yr	1525.00	522.50	528.55		529.22	0.000505	6.60	239.38	52.50	0.50
Creek	19155	EX50yr	1840.00	522.50	529.52		530.21	0.000416	6.69	292.74	57.13	0.47
Creek	19155	EX100yr	2095.00	522.50	529.83		530.63	0.000457	7.25	310.64	58.66	0.50
Creek	19155	EX500yr	2520.00	522.50	530.26		531.28	0.000532	8.15	336.50	60.81	0.54
Creek	19155	ULT2yr	775.00	522.50	525.83		526.55	0.001251	6.80	113.92	40.33	0.71
Creek	19155	ULT5yr	1155.00	522.50	527.19		527.90	0.000774	6.72	172.75	45.99	0.59
Creek	19155	ULT10yr	1435.00	522.50	528.24		528.91	0.000548	6.60	223.36	51.03	0.52

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	19155	ULT25yr	1905.00	522.50	529.46		530.21	0.000462	7.00	288.98	56.80	0.49
Creek	19155	ULT50yr	2125.00	522.50	529.87		530.69	0.000462	7.31	312.81	58.85	0.50
Creek	19155	ULT100yr	2315.00	522.50	530.08		530.98	0.000493	7.70	325.20	59.88	0.52
Creek	19155	ULT500yr	2860.00	522.50	530.52		531.73	0.000607	8.91	352.06	62.08	0.58
Creek	19055	EX0.5yr	360.00	522.33	524.38		524.85	0.001453	5.53	65.15	35.74	0.72
Creek	19055	EX1yr	500.00	522.33	524.85		525.42	0.001370	6.05	82.58	37.63	0.72
Creek	19055	EX2yr	660.00	522.33	525.38		526.02	0.001243	6.41	103.03	39.94	0.70
Creek	19055	EX5yr	940.00	522.33	526.46		527.08	0.000851	6.32	148.82	44.71	0.61
Creek	19055	EX10yr	1170.00	522.33	527.35		527.95	0.000603	6.21	190.49	48.72	0.53
Creek	19055	EX25yr	1525.00	522.33	528.54		529.15	0.000446	6.30	251.70	54.25	0.48
Creek	19055	EX50yr	1840.00	522.33	529.53		530.15	0.000369	6.39	307.27	58.84	0.44
Creek	19055	EX100yr	2095.00	522.33	529.84		530.57	0.000406	6.92	325.86	60.29	0.47
Creek	19055	EX500yr	2520.00	522.33	530.28		531.20	0.000473	7.79	352.74	62.40	0.51
Creek	19055	ULT2yr	775.00	522.33	525.74		526.41	0.001157	6.58	117.79	41.49	0.69
Creek	19055	ULT5yr	1155.00	522.33	527.17		527.80	0.000683	6.42	181.42	47.83	0.56
Creek	19055	ULT10yr	1435.00	522.33	528.23		528.84	0.000483	6.30	234.94	52.79	0.49
Creek	19055	ULT25yr	1905.00	522.33	529.46		530.15	0.000409	6.69	303.38	58.53	0.47
Creek	19055	ULT50yr	2125.00	522.33	529.87		530.62	0.000410	6.98	328.11	60.46	0.47
Creek	19055	ULT100yr	2315.00	522.33	530.09		530.91	0.000438	7.36	340.98	61.45	0.49
Creek	19055	ULT500yr	2860.00	522.33	530.53		531.64	0.000539	8.52	369.01	63.73	0.55
Creek	18954	EX0.5yr	360.00	522.16	524.22		524.70	0.001448	5.58	64.48	34.57	0.72
Creek	18954	EX1yr	500.00	522.16	524.69		525.28	0.001380	6.16	81.16	35.96	0.72
Creek	18954	EX2yr	660.00	522.16	525.21		525.88	0.001259	6.57	100.49	37.52	0.71
Creek	18954	EX5yr	940.00	522.16	526.33		526.99	0.000837	6.53	144.29	41.03	0.60
Creek	18954	EX10yr	1170.00	522.16	527.23		527.89	0.000619	6.50	182.63	44.66	0.54
Creek	18954	EX25yr	1525.00	522.16	528.41		529.10	0.000479	6.68	239.35	51.32	0.49
Creek	18954	EX50yr	1840.00	522.16	529.39		530.10	0.000405	6.82	292.39	56.88	0.46
Creek	18954	EX100yr	2095.00	522.16	529.67		530.52	0.000455	7.44	308.50	58.44	0.50
Creek	18954	EX500yr	2520.00	522.16	530.05		531.13	0.000549	8.45	330.91	60.61	0.55
Creek	18954	ULT2yr	775.00	522.16	525.58		526.29	0.001183	6.79	114.21	38.59	0.70
Creek	18954	ULT5yr	1155.00	522.16	527.03		527.73	0.000702	6.72	173.76	43.58	0.57
Creek	18954	ULT10yr	1435.00	522.16	528.10		528.78	0.000514	6.66	223.54	49.53	0.51
Creek	18954	ULT25yr	1905.00	522.16	529.31		530.09	0.000454	7.16	287.48	56.39	0.49
Creek	18954	ULT50yr	2125.00	522.16	529.71		530.56	0.000461	7.50	310.52	58.64	0.50
Creek	18954	ULT100yr	2315.00	522.16	529.90		530.86	0.000498	7.94	321.72	59.71	0.52
Creek	18954	ULT500yr	2860.00	522.16	530.23		531.56	0.000648	9.34	342.23	61.70	0.60
Creek	18854	EX0.5yr	360.00	521.99	524.09		524.55	0.001336	5.44	66.23	34.76	0.69
Creek	18854	EX1yr	500.00	521.99	524.58		525.14	0.001273	6.00	83.36	36.13	0.70
Creek	18854	EX2yr	660.00	521.99	525.12		525.75	0.001155	6.38	103.38	37.68	0.68
Creek	18854	EX5yr	940.00	521.99	526.28		526.90	0.000767	6.31	149.11	41.24	0.58
Creek	18854	EX10yr	1170.00	521.99	527.20		527.81	0.000565	6.28	188.78	45.34	0.51
Creek	18854	EX25yr	1525.00	521.99	528.40		529.04	0.000441	6.46	247.24	52.43	0.47
Creek	18854	EX50yr	1840.00	521.99	529.38		530.05	0.000374	6.61	301.87	58.24	0.45
Creek	18854	EX100yr	2095.00	521.99	529.66		530.46	0.000422	7.21	318.37	59.86	0.48
Creek	18854	EX500yr	2520.00	521.99	530.04		531.06	0.000509	8.20	341.33	62.06	0.53
Creek	18854	ULT2yr	775.00	521.99	525.49		526.16	0.001084	6.60	117.50	38.73	0.67
Creek	18854	ULT5yr	1155.00	521.99	526.99		527.65	0.000643	6.50	179.50	44.22	0.54
Creek	18854	ULT10yr	1435.00	521.99	528.08		528.72	0.000472	6.45	230.95	50.55	0.48
Creek	18854	ULT25yr	1905.00	521.99	529.30		530.03	0.000419	6.94	296.75	57.72	0.47
Creek	18854	ULT50yr	2125.00	521.99	529.70		530.50	0.000426	7.28	320.45	60.06	0.48
Creek	18854	ULT100yr	2315.00	521.99	529.89		530.79	0.000462	7.71	331.93	61.17	0.50
Creek	18854	ULT500yr	2860.00	521.99	530.22		531.47	0.000602	9.07	352.87	63.22	0.58
Creek	18754	EX0.5yr	360.00	521.82	523.96		524.42	0.001296	5.43	66.28	33.87	0.68
Creek	18754	EX1yr	500.00	521.82	524.43		525.00	0.001275	6.06	82.58	35.16	0.70
Creek	18754	EX2yr	660.00	521.82	524.99		525.64	0.001148	6.43	102.70	36.69	0.68
Creek	18754	EX5yr	940.00	521.82	526.21		526.82	0.000753	6.30	149.37	41.61	0.57
Creek	18754	EX10yr	1170.00	521.82	527.15		527.76	0.000552	6.26	191.35	47.02	0.51
Creek	18754	EX25yr	1525.00	521.82	528.36		529.00	0.000430	6.44	252.10	53.42	0.47
Creek	18754	EX50yr	1840.00	521.82	529.35		530.01	0.000366	6.58	307.90	58.74	0.44
Creek	18754	EX100yr	2095.00	521.82	529.63		530.41	0.000414	7.19	324.25	60.17	0.47
Creek	18754	EX500yr	2520.00	521.82	529.99		531.01	0.000504	8.20	346.69	62.88	0.53
Creek	18754	ULT2yr	775.00	521.82	525.37		526.06	0.001081	6.64	116.65	37.72	0.67
Creek	18754	ULT5yr	1155.00	521.82	526.93		527.58	0.000630	6.48	181.27	45.91	0.54
Creek	18754	ULT10yr	1435.00	521.82	528.04		528.67	0.000461	6.42	235.29	51.69	0.48
Creek	18754	ULT25yr	1905.00	521.82	529.26		529.99	0.000411	6.92	302.46	58.26	0.47
Creek	18754	ULT50yr	2125.00	521.82	529.66		530.46	0.000419	7.25	326.30	60.35	0.48
Creek	18754	ULT100yr	2315.00	521.82	529.85		530.74	0.000456	7.69	337.57	61.63	0.50
Creek	18754	ULT500yr	2860.00	521.82	530.17		531.41	0.000601	9.08	357.59	64.34	0.58
Creek	18738	EX0.5yr	360.00	521.79	523.66	523.57	524.37	0.002505	6.75	53.29	32.38	0.93
Creek	18738	EX1yr	500.00	521.79	524.15	523.97	524.96	0.002128	7.20	69.46	33.68	0.88
Creek	18738	EX2yr	660.00	521.79	524.78		525.59	0.001627	7.25	91.00	35.35	0.80
Creek	18738	EX5yr	940.00	521.79	526.10		526.80	0.000894	6.70	140.52	40.26	0.62
Creek	18738	EX10yr	1170.00	521.79	527.08		527.74	0.000625	6.56	184.12	48.16	0.54
Creek	18738	EX25yr	1525.00	521.79	528.31		528.99	0.000470	6.66	248.16	55.46	0.49
Creek	18738	EX50yr	1840.00	521.79	529.31		530.00	0.000393	6.77	306.46	60.54	0.46
Creek	18738	EX100yr	2095.00	521.79	529.58		530.40	0.000444	7.39	322.94	61.90	0.49

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	18738	EX500yr	2520.00	521.79	529.94		531.00	0.000542	8.42	345.14	63.68	0.54
Creek	18738	ULT2yr	775.00	521.79	525.18		526.02	0.001438	7.35	105.48	36.42	0.76
Creek	18738	ULT5yr	1155.00	521.79	526.84		527.57	0.000725	6.82	173.16	46.61	0.57
Creek	18738	ULT10yr	1435.00	521.79	527.98		528.66	0.000508	6.67	230.24	53.64	0.50
Creek	18738	ULT25yr	1905.00	521.79	529.21		529.98	0.000443	7.12	300.48	60.04	0.48
Creek	18738	ULT50yr	2125.00	521.79	529.62		530.45	0.000450	7.45	325.01	62.07	0.49
Creek	18738	ULT100yr	2315.00	521.79	529.80		530.73	0.000489	7.90	336.36	62.98	0.51
Creek	18738	ULT500yr	2860.00	521.79	530.09		531.39	0.000650	9.35	354.79	64.45	0.60
Creek	18655	EX0.5yr	360.00	521.71	523.61	523.37	524.14	0.001829	5.84	61.68	37.47	0.80
Creek	18655	EX1yr	500.00	521.71	524.19	523.74	524.74	0.001373	5.96	83.92	39.61	0.72
Creek	18655	EX2yr	660.00	521.71	524.86	524.12	525.41	0.001018	5.93	111.37	42.06	0.64
Creek	18655	EX5yr	940.00	521.71	526.21	524.70	526.67	0.000566	5.48	171.52	47.44	0.50
Creek	18655	EX10yr	1170.00	521.71	527.19	525.12	527.63	0.000399	5.39	221.32	63.41	0.44
Creek	18655	EX25yr	1525.00	521.71	528.43	525.71	528.89	0.000302	5.48	296.94	81.48	0.40
Creek	18655	EX50yr	1840.00	521.71	529.44	526.17	529.91	0.000254	5.58	362.06	96.39	0.37
Creek	18655	EX100yr	2095.00	521.71	529.74	526.51	530.30	0.000284	6.07	381.79	98.55	0.40
Creek	18655	EX500yr	2520.00	521.71	530.14	527.07	530.86	0.000339	6.88	409.29	100.92	0.44
Creek	18655	ULT2yr	775.00	521.71	525.28	524.35	525.84	0.000896	5.98	129.52	43.66	0.61
Creek	18655	ULT5yr	1155.00	521.71	526.96	525.10	527.45	0.000458	5.59	209.01	51.77	0.47
Creek	18655	ULT10yr	1435.00	521.71	528.10	525.55	528.56	0.000326	5.48	276.38	75.72	0.41
Creek	18655	ULT25yr	1905.00	521.71	529.36	526.27	529.88	0.000284	5.86	356.56	95.35	0.39
Creek	18655	ULT50yr	2125.00	521.71	529.77	526.54	530.34	0.000287	6.13	384.24	98.75	0.40
Creek	18655	ULT100yr	2315.00	521.71	529.98	526.79	530.61	0.000309	6.48	397.94	99.86	0.42
Creek	18655	ULT500yr	2860.00	521.71	530.35	527.50	531.22	0.000397	7.59	423.64	102.26	0.48
Creek	18554	EX0.5yr	360.00	521.51	523.51		523.96	0.001324	5.36	67.20	35.11	0.68
Creek	18554	EX1yr	500.00	521.51	524.10		524.60	0.001091	5.67	88.11	36.03	0.64
Creek	18554	EX2yr	660.00	521.51	524.77		525.31	0.000886	5.85	112.74	37.07	0.59
Creek	18554	EX5yr	940.00	521.51	526.10		526.61	0.000549	5.75	168.45	49.03	0.49
Creek	18554	EX10yr	1170.00	521.51	527.08		527.59	0.000418	5.75	220.34	56.08	0.44
Creek	18554	EX25yr	1525.00	521.51	528.32		528.85	0.000337	5.95	293.64	62.32	0.41
Creek	18554	EX50yr	1840.00	521.51	529.33		529.88	0.000294	6.11	358.92	67.42	0.39
Creek	18554	EX100yr	2095.00	521.51	529.59		530.25	0.000337	6.70	377.32	70.19	0.42
Creek	18554	EX500yr	2520.00	521.51	529.94		530.81	0.000417	7.67	402.52	73.84	0.47
Creek	18554	ULT2yr	775.00	521.51	525.18		525.75	0.000829	6.06	127.94	37.71	0.58
Creek	18554	ULT5yr	1155.00	521.51	526.85		527.39	0.000477	5.96	207.36	54.89	0.47
Creek	18554	ULT10yr	1435.00	521.51	527.99		528.52	0.000359	5.93	273.39	60.67	0.42
Creek	18554	ULT25yr	1905.00	521.51	529.23		529.84	0.000330	6.42	352.30	66.91	0.42
Creek	18554	ULT50yr	2125.00	521.51	529.63		530.30	0.000341	6.76	379.66	70.54	0.43
Creek	18554	ULT100yr	2315.00	521.51	529.81		530.56	0.000374	7.18	392.50	72.41	0.45
Creek	18554	ULT500yr	2860.00	521.51	530.09		531.15	0.000505	8.54	413.21	75.66	0.52
Creek	18455	EX0.5yr	360.00	521.36	523.40		523.82	0.001222	5.21	69.15	35.68	0.66
Creek	18455	EX1yr	500.00	521.36	524.02		524.49	0.000977	5.46	91.64	36.79	0.61
Creek	18455	EX2yr	660.00	521.36	524.72		525.21	0.000785	5.60	117.78	38.05	0.56
Creek	18455	EX5yr	940.00	521.36	526.08		526.55	0.000484	5.50	175.38	48.67	0.46
Creek	18455	EX10yr	1170.00	521.36	527.06		527.54	0.000376	5.55	226.05	54.09	0.42
Creek	18455	EX25yr	1525.00	521.36	528.30		528.81	0.000313	5.82	297.07	61.55	0.40
Creek	18455	EX50yr	1840.00	521.36	529.30		529.85	0.000279	6.04	362.81	69.87	0.39
Creek	18455	EX100yr	2095.00	521.36	529.56		530.22	0.000321	6.62	381.34	72.05	0.42
Creek	18455	EX500yr	2520.00	521.36	529.89		530.76	0.000402	7.62	405.82	74.92	0.47
Creek	18455	ULT2yr	775.00	521.36	525.14		525.66	0.000735	5.80	133.69	38.80	0.55
Creek	18455	ULT5yr	1155.00	521.36	526.83		527.34	0.000427	5.74	213.46	52.84	0.45
Creek	18455	ULT10yr	1435.00	521.36	527.97		528.48	0.000330	5.78	277.32	58.98	0.41
Creek	18455	ULT25yr	1905.00	521.36	529.20		529.81	0.000313	6.34	355.77	69.03	0.41
Creek	18455	ULT50yr	2125.00	521.36	529.59		530.27	0.000326	6.69	383.67	72.32	0.42
Creek	18455	ULT100yr	2315.00	521.36	529.77		530.53	0.000358	7.12	396.31	73.80	0.44
Creek	18455	ULT500yr	2860.00	521.36	530.02		531.10	0.000491	8.50	415.27	76.01	0.52
Creek	18354	EX0.5yr	360.00	521.21	523.31		523.70	0.001102	5.02	71.78	36.43	0.63
Creek	18354	EX1yr	500.00	521.21	523.96		524.38	0.000860	5.21	96.00	37.81	0.58
Creek	18354	EX2yr	660.00	521.21	524.68		525.12	0.000688	5.33	123.79	39.33	0.53
Creek	18354	EX5yr	940.00	521.21	526.07		526.49	0.000418	5.24	184.71	49.61	0.44
Creek	18354	EX10yr	1170.00	521.21	527.06		527.49	0.000327	5.30	237.47	55.97	0.40
Creek	18354	EX25yr	1525.00	521.21	528.30		528.77	0.000276	5.57	312.90	67.14	0.38
Creek	18354	EX50yr	1840.00	521.21	529.30		529.81	0.000247	5.79	386.17	78.57	0.37
Creek	18354	EX100yr	2095.00	521.21	529.57		530.17	0.000284	6.35	407.31	81.59	0.40
Creek	18354	EX500yr	2520.00	521.21	529.91		530.70	0.000354	7.29	435.68	85.48	0.45
Creek	18354	ULT2yr	775.00	521.21	525.10		525.57	0.000639	5.51	140.66	41.84	0.52
Creek	18354	ULT5yr	1155.00	521.21	526.82		527.28	0.000371	5.48	224.31	54.70	0.42
Creek	18354	ULT10yr	1435.00	521.21	527.97		528.44	0.000290	5.53	291.41	63.42	0.39
Creek	18354	ULT25yr	1905.00	521.21	529.20		529.76	0.000277	6.08	378.27	77.41	0.39
Creek	18354	ULT50yr	2125.00	521.21	529.60		530.22	0.000288	6.41	409.99	81.97	0.40
Creek	18354	ULT100yr	2315.00	521.21	529.78		530.47	0.000316	6.82	424.58	83.98	0.42
Creek	18354	ULT500yr	2860.00	521.21	530.04		531.03	0.000432	8.13	447.00	86.97	0.49
Creek	18254	EX0.5yr	360.00	521.06	523.23		523.58	0.000961	4.77	75.51	37.54	0.59
Creek	18254	EX1yr	500.00	521.06	523.91		524.29	0.000740	4.92	101.67	39.27	0.54
Creek	18254	EX2yr	660.00	521.06	524.65		525.04	0.000588	5.02	131.42	41.59	0.49
Creek	18254	EX5yr	940.00	521.06	526.06		526.44	0.000351	4.95	199.39	54.60	0.41

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	18254	EX10yr	1170.00	521.06	527.06		527.45	0.000278	5.02	256.82	59.98	0.37
Creek	18254	EX25yr	1525.00	521.06	528.31		528.73	0.000236	5.29	335.69	66.52	0.36
Creek	18254	EX50yr	1840.00	521.06	529.32		529.77	0.000214	5.51	407.39	77.34	0.35
Creek	18254	EX100yr	2095.00	521.06	529.58		530.13	0.000247	6.05	428.44	80.72	0.37
Creek	18254	EX500yr	2520.00	521.06	529.93		530.65	0.000309	6.96	456.94	85.22	0.42
Creek	18254	ULT2yr	775.00	521.06	525.08		525.50	0.000533	5.20	150.13	45.68	0.48
Creek	18254	ULT5yr	1155.00	521.06	526.82		527.24	0.000314	5.18	242.62	58.73	0.39
Creek	18254	ULT10yr	1435.00	521.06	527.98		528.40	0.000248	5.24	313.95	64.78	0.36
Creek	18254	ULT25yr	1905.00	521.06	529.22		529.72	0.000240	5.79	399.73	76.07	0.37
Creek	18254	ULT50yr	2125.00	521.06	529.61		530.17	0.000250	6.11	431.11	81.14	0.38
Creek	18254	ULT100yr	2315.00	521.06	529.79		530.43	0.000275	6.51	445.71	83.43	0.40
Creek	18254	ULT500yr	2860.00	521.06	530.06		530.96	0.000377	7.77	468.54	87.73	0.47
Creek	18154	EX0.5yr	360.00	520.91	523.17		523.48	0.000830	4.52	79.67	38.59	0.55
Creek	18154	EX1yr	500.00	520.91	523.87		524.21	0.000637	4.65	107.60	40.65	0.50
Creek	18154	EX2yr	660.00	520.91	524.63		524.98	0.000506	4.74	139.13	43.02	0.46
Creek	18154	EX5yr	940.00	520.91	526.05		526.39	0.000306	4.69	205.45	50.09	0.38
Creek	18154	EX10yr	1170.00	520.91	527.06		527.41	0.000246	4.79	258.45	55.60	0.35
Creek	18154	EX25yr	1525.00	520.91	528.30		528.70	0.000213	5.09	332.65	63.68	0.34
Creek	18154	EX50yr	1840.00	520.91	529.31		529.74	0.000194	5.32	400.60	71.20	0.33
Creek	18154	EX100yr	2095.00	520.91	529.58		530.10	0.000225	5.85	419.84	73.27	0.36
Creek	18154	EX500yr	2520.00	520.91	529.92		530.61	0.000282	6.73	445.48	76.15	0.41
Creek	18154	ULT2yr	775.00	520.91	525.06		525.44	0.000460	4.92	158.31	45.11	0.45
Creek	18154	ULT5yr	1155.00	520.91	526.82		527.19	0.000278	4.95	245.27	54.24	0.37
Creek	18154	ULT10yr	1435.00	520.91	527.97		528.36	0.000223	5.04	311.94	61.35	0.35
Creek	18154	ULT25yr	1905.00	520.91	529.21		529.69	0.000218	5.58	393.50	70.42	0.35
Creek	18154	ULT50yr	2125.00	520.91	529.61		530.14	0.000228	5.90	422.26	73.55	0.36
Creek	18154	ULT100yr	2315.00	520.91	529.79		530.39	0.000251	6.29	435.44	75.02	0.38
Creek	18154	ULT500yr	2860.00	520.91	530.06		530.91	0.000344	7.51	455.85	78.29	0.45
Creek	18055	EX0.5yr	360.00	520.76	523.11	522.29	523.40	0.000719	4.28	84.12	39.80	0.52
Creek	18055	EX1yr	500.00	520.76	523.84	522.67	524.14	0.000559	4.38	114.14	42.97	0.47
Creek	18055	EX2yr	660.00	520.76	524.61	523.04	524.92	0.000433	4.45	148.98	47.40	0.43
Creek	18055	EX5yr	940.00	520.76	526.06	523.62	526.35	0.000260	4.39	222.70	54.66	0.36
Creek	18055	EX10yr	1170.00	520.76	527.07	524.03	527.38	0.000209	4.48	280.63	59.95	0.33
Creek	18055	EX25yr	1525.00	520.76	528.32	524.61	528.67	0.000181	4.76	360.00	66.70	0.32
Creek	18055	EX50yr	1840.00	520.76	529.33	525.06	529.71	0.000166	4.98	431.08	134.66	0.31
Creek	18055	EX100yr	2095.00	520.76	529.60	525.40	530.06	0.000193	5.49	452.62	183.74	0.34
Creek	18055	EX500yr	2520.00	520.76	529.95	525.94	530.56	0.000242	6.33	483.32	226.03	0.38
Creek	18055	ULT2yr	775.00	520.76	525.05	523.29	525.38	0.000392	4.60	170.43	49.55	0.42
Creek	18055	ULT5yr	1155.00	520.76	526.83	524.02	527.16	0.000236	4.62	266.35	58.71	0.35
Creek	18055	ULT10yr	1435.00	520.76	527.99	524.48	528.33	0.000190	4.71	338.14	64.80	0.32
Creek	18055	ULT25yr	1905.00	520.76	529.23	525.14	529.65	0.000186	5.23	423.71	113.88	0.33
Creek	18055	ULT50yr	2125.00	520.76	529.63	525.43	530.10	0.000196	5.55	455.41	188.96	0.34
Creek	18055	ULT100yr	2315.00	520.76	529.82	525.68	530.34	0.000216	5.91	470.98	211.47	0.36
Creek	18055	ULT500yr	2860.00	520.76	530.09	526.35	530.85	0.000296	7.07	496.92	243.52	0.42
Creek	17953	EX0.5yr	360.00	520.61	523.06	522.15	523.32	0.000630	4.08	88.29	40.70	0.49
Creek	17953	EX1yr	500.00	520.61	523.81	522.51	524.08	0.000497	4.17	119.96	44.68	0.45
Creek	17953	EX2yr	660.00	520.61	524.59	522.88	524.87	0.000399	4.22	156.59	48.75	0.41
Creek	17953	EX5yr	940.00	520.61	526.06	523.49	526.32	0.000232	4.11	234.43	57.08	0.34
Creek	17953	EX10yr	1170.00	520.61	527.07	523.91	527.34	0.000185	4.19	295.22	62.38	0.31
Creek	17953	EX25yr	1525.00	520.61	528.33	524.49	528.64	0.000159	4.44	377.93	79.38	0.30
Creek	17953	EX50yr	1840.00	520.61	529.35	524.93	529.68	0.000146	4.65	451.05	214.85	0.29
Creek	17953	EX100yr	2095.00	520.61	529.63	525.24	530.02	0.000168	5.11	472.66	238.92	0.31
Creek	17953	EX500yr	2520.00	520.61	529.99	525.77	530.51	0.000210	5.88	502.68	270.20	0.35
Creek	17953	ULT2yr	775.00	520.61	525.04	523.14	525.33	0.000358	4.34	179.16	51.52	0.40
Creek	17953	ULT5yr	1155.00	520.61	526.83	523.88	527.12	0.000209	4.32	280.29	61.15	0.33
Creek	17953	ULT10yr	1435.00	520.61	528.00	524.35	528.30	0.000167	4.40	355.22	67.12	0.30
Creek	17953	ULT25yr	1905.00	520.61	529.25	525.00	529.62	0.000163	4.87	443.71	205.03	0.31
Creek	17953	ULT50yr	2125.00	520.61	529.66	525.28	530.06	0.000171	5.16	475.40	241.86	0.32
Creek	17953	ULT100yr	2315.00	520.61	529.84	525.51	530.30	0.000188	5.49	490.61	257.87	0.33
Creek	17953	ULT500yr	2860.00	520.61	530.14	526.16	530.79	0.000256	6.56	516.26	322.66	0.39
Creek	17854	EX0.5yr	360.00	520.46	523.02	522.00	523.26	0.000535	3.90	92.31	40.07	0.45
Creek	17854	EX1yr	500.00	520.46	523.77	522.37	524.03	0.000414	4.06	123.98	44.37	0.42
Creek	17854	EX2yr	660.00	520.46	524.55	522.74	524.83	0.000328	4.22	160.72	49.36	0.38
Creek	17854	EX5yr	940.00	520.46	526.02	523.30	526.29	0.000216	4.26	239.69	58.65	0.33
Creek	17854	EX10yr	1170.00	520.46	527.04	523.73	527.32	0.000180	4.38	302.70	65.11	0.31
Creek	17854	EX25yr	1525.00	520.46	528.29	524.30	528.62	0.000160	4.68	390.91	77.49	0.30
Creek	17854	EX50yr	1840.00	520.46	529.32	524.77	529.66	0.000147	4.88	478.84	206.32	0.29
Creek	17854	EX100yr	2095.00	520.46	529.59	525.15	530.00	0.000169	5.34	506.68	228.23	0.32
Creek	17854	EX500yr	2520.00	520.46	529.95	525.72	530.49	0.000210	6.12	546.79	256.05	0.36
Creek	17854	ULT2yr	775.00	520.46	525.00	522.97	525.30	0.000310	4.42	183.25	52.18	0.38
Creek	17854	ULT5yr	1155.00	520.46	526.79	523.70	527.10	0.000202	4.52	286.91	63.57	0.33
Creek	17854	ULT10yr	1435.00	520.46	527.96	524.15	528.28	0.000166	4.62	365.94	72.43	0.30
Creek	17854	ULT25yr	1905.00	520.46	529.21	524.87	529.60	0.000165	5.12	469.02	196.69	0.31
Creek	17854	ULT50yr	2125.00	520.46	529.62	525.19	530.05	0.000171	5.40	510.30	230.64	0.32
Creek	17854	ULT100yr	2315.00	520.46	529.81	525.44	530.28	0.000188	5.73	530.58	245.54	0.34
Creek	17854	ULT500yr	2860.00	520.46	530.08	526.13	530.76	0.000260	6.88	563.28	336.75	0.40

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	17755		Lat Struct									
Creek	17754	EX0.5yr	360.00	520.31	522.99	521.85	523.20	0.000447	3.66	98.46	41.05	0.42
Creek	17754	EX1yr	500.00	520.31	523.75	522.20	523.98	0.000366	3.83	130.44	43.30	0.39
Creek	17754	EX2yr	660.00	520.31	524.54	522.58	524.79	0.000312	3.98	165.66	45.63	0.37
Creek	17754	EX5yr	940.00	520.31	526.02	523.14	526.27	0.000205	4.02	236.85	51.50	0.32
Creek	17754	EX10yr	1170.00	520.31	527.03	523.56	527.30	0.000170	4.14	292.89	58.61	0.30
Creek	17754	EX25yr	1525.00	520.31	528.30	524.15	528.60	0.000151	4.43	375.82	73.26	0.29
Creek	17754	EX50yr	1840.00	520.31	529.32	524.62	529.64	0.000139	4.63	457.54	161.98	0.28
Creek	17754	EX100yr	2095.00	520.31	529.59	524.96	529.98	0.000160	5.08	481.67	176.80	0.30
Creek	17754	EX500yr	2520.00	520.31	529.95	525.50	530.46	0.000200	5.83	514.57	220.18	0.34
Creek	17754	ULT2yr	775.00	520.31	524.99	522.82	525.26	0.000297	4.16	186.39	47.16	0.37
Creek	17754	ULT5yr	1155.00	520.31	526.79	523.53	527.07	0.000191	4.27	278.73	56.77	0.31
Creek	17754	ULT10yr	1435.00	520.31	527.96	524.00	528.26	0.000158	4.38	352.03	69.11	0.29
Creek	17754	ULT25yr	1905.00	520.31	529.22	524.71	529.57	0.000156	4.86	448.75	156.14	0.30
Creek	17754	ULT50yr	2125.00	520.31	529.63	525.01	530.02	0.000163	5.13	484.72	178.64	0.31
Creek	17754	ULT100yr	2315.00	520.31	529.81	525.23	530.26	0.000179	5.46	501.47	191.98	0.32
Creek	17754	ULT500yr	2860.00	520.31	530.09	525.91	530.72	0.000244	6.50	527.83	255.61	0.38
Creek	17717	EX0.5yr	360.00	520.25	522.95	521.88	523.18	0.000506	3.87	93.08	38.89	0.44
Creek	17717	EX1yr	500.00	520.25	523.71	522.24	523.96	0.000413	4.06	123.24	40.66	0.41
Creek	17717	EX2yr	660.00	520.25	524.50	522.62	524.77	0.000351	4.23	156.15	43.68	0.39
Creek	17717	EX5yr	940.00	520.25	525.97	523.19	526.25	0.000240	4.26	224.88	49.42	0.34
Creek	17717	EX10yr	1170.00	520.25	526.99	523.62	527.29	0.000198	4.37	279.70	57.00	0.31
Creek	17717	EX25yr	1525.00	520.25	528.25	524.21	528.59	0.000175	4.66	356.78	65.49	0.31
Creek	17717	EX50yr	1783.04	520.25	529.30	524.63	529.64	0.000149	4.72	428.91	146.74	0.29
Creek	17717	EX100yr	1989.64	520.25	529.59	524.94	529.97	0.000165	5.07	450.26	163.47	0.30
Creek	17717	EX500yr	2347.53	520.25	529.96	525.43	530.45	0.000197	5.70	479.42	185.77	0.34
Creek	17717	ULT2yr	775.00	520.25	524.94	522.87	525.24	0.000337	4.43	175.86	45.40	0.39
Creek	17717	ULT5yr	1155.00	520.25	526.74	523.60	527.06	0.000224	4.51	265.66	55.42	0.33
Creek	17717	ULT10yr	1435.00	520.25	527.92	524.08	528.25	0.000182	4.61	335.27	63.21	0.31
Creek	17717	ULT25yr	1853.29	520.25	529.19	524.73	529.57	0.000169	4.97	421.15	141.57	0.31
Creek	17717	ULT50yr	2015.04	520.25	529.62	524.96	530.01	0.000167	5.11	452.89	165.51	0.31
Creek	17717	ULT100yr	2166.96	520.25	529.81	525.19	530.25	0.000178	5.36	467.74	176.76	0.32
Creek	17717	ULT500yr	2705.29	520.25	530.09	525.91	530.71	0.000248	6.46	490.03	194.08	0.38
Creek	17655	EX0.5yr	360.00	520.17	522.94	521.70	523.14	0.000413	3.57	100.73	40.97	0.40
Creek	17655	EX1yr	500.00	520.17	523.71	522.07	523.93	0.000345	3.76	133.12	43.80	0.38
Creek	17655	EX2yr	660.00	520.17	524.50	522.45	524.74	0.000277	3.93	169.43	47.49	0.35
Creek	17655	EX5yr	940.00	520.17	525.98	523.03	526.23	0.000187	4.01	244.98	54.70	0.31
Creek	17655	EX10yr	1170.00	520.17	527.00	523.43	527.27	0.000159	4.16	303.73	60.52	0.29
Creek	17655	EX25yr	1520.87	520.17	528.27	524.02	528.57	0.000143	4.45	387.03	72.70	0.28
Creek	17655	EX50yr	1649.39	520.17	529.35	524.21	529.60	0.000105	4.16	469.96	155.57	0.25
Creek	17655	EX100yr	1789.22	520.17	529.65	524.41	529.93	0.000109	4.34	496.20	171.64	0.25
Creek	17655	EX500yr	2064.35	520.17	530.06	524.80	530.39	0.000123	4.75	532.89	194.56	0.27
Creek	17655	ULT2yr	775.00	520.17	524.95	522.70	525.21	0.000265	4.13	191.03	49.64	0.35
Creek	17655	ULT5yr	1155.00	520.17	526.76	523.43	527.04	0.000178	4.28	288.86	58.97	0.31
Creek	17655	ULT10yr	1435.00	520.17	527.93	523.89	528.23	0.000150	4.41	363.22	69.15	0.29
Creek	17655	ULT25yr	1722.40	520.17	529.24	524.32	529.53	0.000120	4.41	461.44	150.25	0.27
Creek	17655	ULT50yr	1808.47	520.17	529.69	524.44	529.97	0.000109	4.36	499.42	173.55	0.26
Creek	17655	ULT100yr	1913.66	520.17	529.90	524.59	530.20	0.000113	4.50	518.05	184.35	0.26
Creek	17655	ULT500yr	2449.93	520.17	530.20	525.31	530.65	0.000165	5.55	546.35	206.12	0.32
Creek	17554	EX0.5yr	360.00	520.05	522.91	521.58	523.10	0.000370	3.45	104.37	41.16	0.38
Creek	17554	EX1yr	500.00	520.05	523.68	521.95	523.89	0.000319	3.64	137.37	44.57	0.37
Creek	17554	EX2yr	660.00	520.05	524.49	522.33	524.71	0.000267	3.79	174.63	48.15	0.34
Creek	17554	EX5yr	940.00	520.05	525.98	522.90	526.21	0.000176	3.84	252.31	56.62	0.30
Creek	17554	EX10yr	1170.00	520.05	527.00	523.34	527.25	0.000148	3.97	313.84	63.24	0.28
Creek	17554	EX25yr	1388.29	520.05	528.31	523.70	528.53	0.000108	3.85	402.63	96.26	0.25
Creek	17554	EX50yr	1313.19	520.05	529.42	523.59	529.56	0.000060	3.13	484.59	146.91	0.19
Creek	17554	EX100yr	1357.03	520.05	529.74	523.67	529.88	0.000056	3.10	512.08	163.61	0.18
Creek	17554	EX500yr	1521.63	520.05	530.17	523.91	530.33	0.000059	3.31	551.63	185.51	0.19
Creek	17554	ULT2yr	775.00	520.05	524.94	522.58	525.18	0.000253	3.97	196.68	50.28	0.34
Creek	17554	ULT5yr	1155.00	520.05	526.75	523.31	527.01	0.000166	4.09	298.24	61.58	0.29
Creek	17554	ULT10yr	1376.98	520.05	527.95	523.71	528.20	0.000126	4.02	377.72	69.55	0.26
Creek	17554	ULT25yr	1377.05	520.05	529.32	523.70	529.49	0.000068	3.32	476.85	141.96	0.20
Creek	17554	ULT50yr	1368.19	520.05	529.78	523.69	529.92	0.000056	3.12	515.46	165.70	0.18
Creek	17554	ULT100yr	1413.54	520.05	530.00	523.77	530.14	0.000055	3.13	535.30	176.75	0.18
Creek	17554	ULT500yr	1936.50	520.05	530.32	524.52	530.57	0.000091	4.13	566.94	193.12	0.24
Creek	17455	EX0.5yr	360.00	519.93	522.89	521.46	523.06	0.000327	3.29	109.33	42.18	0.36
Creek	17455	EX1yr	500.00	519.93	523.67	521.83	523.85	0.000286	3.49	143.42	45.73	0.35
Creek	17455	EX2yr	660.00	519.93	524.47	522.20	524.68	0.000243	3.63	181.95	49.57	0.33
Creek	17455	EX5yr	940.00	519.93	525.97	522.77	526.18	0.000160	3.69	262.35	57.70	0.28
Creek	17455	EX10yr	1170.00	519.93	527.00	523.21	527.23	0.000135	3.81	324.83	63.65	0.27
Creek	17455	EX25yr	1187.72	519.93	528.35	523.23	528.50	0.000071	3.15	415.69	103.25	0.20
Creek	17455	EX50yr	976.61	519.93	529.46	522.84	529.54	0.000030	2.24	497.94	150.72	0.13
Creek	17455	EX100yr	961.75	519.93	529.79	522.81	529.86	0.000026	2.11	526.67	168.31	0.12
Creek	17455	EX500yr	1046.13	519.93	530.23	522.99	530.30	0.000026	2.18	569.81	193.97	0.12
Creek	17455	ULT2yr	775.00	519.93	524.93	522.45	525.15	0.000230	3.81	204.83	52.01	0.33
Creek	17455	ULT5yr	1155.00	519.93	526.75	523.18	526.99	0.000151	3.93	309.06	62.19	0.28

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	17455	ULT10yr	1250.74	519.93	527.98	523.35	528.17	0.000094	3.50	390.13	69.08	0.23
Creek	17455	ULT25yr	1024.94	519.93	529.37	522.93	529.46	0.000034	2.37	490.57	146.54	0.14
Creek	17455	ULT50yr	968.71	519.93	529.83	522.83	529.90	0.000025	2.12	530.24	170.38	0.12
Creek	17455	ULT100yr	978.49	519.93	530.05	522.84	530.11	0.000024	2.08	551.50	182.53	0.12
Creek	17455	ULT500yr	1428.51	519.93	530.40	523.65	530.53	0.000045	2.92	589.02	205.31	0.17
Creek	17354	EX0.5yr	360.00	519.81	522.87	521.36	523.02	0.000296	3.19	113.01	42.58	0.34
Creek	17354	EX1yr	500.00	519.81	523.64	521.72	523.83	0.000244	3.41	147.45	45.89	0.33
Creek	17354	EX2yr	660.00	519.81	524.45	522.09	524.66	0.000208	3.63	186.10	49.80	0.31
Creek	17354	EX5yr	940.00	519.81	525.95	522.67	526.17	0.000150	3.77	266.88	59.18	0.28
Creek	17354	EX10yr	1166.50	519.81	526.98	523.08	527.21	0.000130	3.92	331.74	66.68	0.27
Creek	17354	EX25yr	986.97	519.81	528.37	522.76	528.48	0.000048	2.70	427.14	94.28	0.17
Creek	17354	EX50yr	700.60	519.81	529.48	522.17	529.53	0.000015	1.66	508.86	138.03	0.10
Creek	17354	EX100yr	639.41	519.81	529.81	522.04	529.85	0.000011	1.46	537.28	153.37	0.08
Creek	17354	EX500yr	662.41	519.81	530.25	522.09	530.28	0.000010	1.43	579.26	175.55	0.08
Creek	17354	ULT2yr	775.00	519.81	524.90	522.33	525.13	0.000204	3.84	208.84	51.77	0.31
Creek	17354	ULT5yr	1155.00	519.81	526.73	523.06	526.97	0.000146	4.05	315.01	64.85	0.28
Creek	17354	ULT10yr	1105.14	519.81	528.00	522.99	528.15	0.000071	3.18	401.05	69.23	0.20
Creek	17354	ULT25yr	741.77	519.81	529.40	522.26	529.44	0.000018	1.78	501.68	133.95	0.10
Creek	17354	ULT50yr	642.60	519.81	529.85	522.05	529.88	0.000011	1.46	540.78	155.19	0.08
Creek	17354	ULT100yr	622.80	519.81	530.07	522.01	530.10	0.000010	1.38	561.42	166.18	0.08
Creek	17354	ULT500yr	959.03	519.81	530.45	522.71	530.51	0.000020	2.03	599.30	185.50	0.11
Creek	17254	EX0.5yr	360.00	519.69	522.85	521.23	522.99	0.000258	3.08	116.85	42.15	0.32
Creek	17254	EX1yr	500.00	519.69	523.63	521.59	523.80	0.000219	3.35	150.90	45.06	0.31
Creek	17254	EX2yr	660.00	519.69	524.44	521.95	524.64	0.000193	3.59	188.57	48.08	0.30
Creek	17254	EX5yr	940.00	519.69	525.93	522.54	526.15	0.000144	3.78	267.69	58.58	0.27
Creek	17254	EX10yr	1132.61	519.69	526.98	522.88	527.20	0.000119	3.83	333.05	66.21	0.26
Creek	17254	EX25yr	765.46	519.69	528.40	522.20	528.46	0.000028	2.10	430.82	71.14	0.13
Creek	17254	EX50yr	474.25	519.69	529.50	521.53	529.52	0.000007	1.14	512.65	126.26	0.07
Creek	17254	EX100yr	452.41	519.69	529.82	521.48	529.84	0.000006	1.04	539.95	140.46	0.06
Creek	17254	EX500yr	448.89	519.69	530.27	521.47	530.28	0.000005	0.98	580.20	160.33	0.05
Creek	17254	ULT2yr	775.00	519.69	524.88	522.22	525.11	0.000192	3.82	210.56	50.48	0.31
Creek	17254	ULT5yr	1150.61	519.69	526.71	522.91	526.96	0.000141	4.06	315.63	64.89	0.28
Creek	17254	ULT10yr	915.18	519.69	528.03	522.49	528.13	0.000047	2.64	404.49	69.84	0.16
Creek	17254	ULT25yr	501.15	519.69	529.41	521.59	529.43	0.000008	1.21	505.77	122.05	0.07
Creek	17254	ULT50yr	455.49	519.69	529.86	521.48	529.88	0.000006	1.04	543.32	142.07	0.06
Creek	17254	ULT100yr	452.09	519.69	530.08	521.48	530.10	0.000005	1.01	562.99	151.71	0.06
Creek	17254	ULT500yr	532.47	519.69	530.48	521.65	530.49	0.000006	1.14	601.15	171.55	0.06
Creek	17155	EX0.5yr	360.00	519.57	522.83	521.10	522.96	0.000225	2.88	124.82	44.52	0.30
Creek	17155	EX1yr	500.00	519.57	523.62	521.45	523.77	0.000205	3.10	161.28	47.87	0.30
Creek	17155	EX2yr	660.00	519.57	524.44	521.83	524.61	0.000176	3.28	202.10	52.29	0.28
Creek	17155	EX5yr	940.00	519.57	525.95	522.39	526.13	0.000125	3.40	288.00	61.65	0.25
Creek	17155	EX10yr	1081.89	519.57	527.01	522.65	527.17	0.000091	3.27	357.35	68.45	0.22
Creek	17155	EX25yr	587.25	519.57	528.42	521.66	528.45	0.000014	1.44	456.71	72.81	0.09
Creek	17155	EX50yr	371.31	519.57	529.50	521.12	529.51	0.000004	0.80	540.49	86.17	0.05
Creek	17155	EX100yr	363.33	519.57	529.83	521.11	529.84	0.000003	0.75	569.42	91.35	0.04
Creek	17155	EX500yr	349.15	519.57	530.27	521.07	530.28	0.000002	0.68	610.98	162.58	0.04
Creek	17155	ULT2yr	775.00	519.57	524.89	522.07	525.08	0.000171	3.47	226.32	55.07	0.29
Creek	17155	ULT5yr	1134.82	519.57	526.73	522.75	526.93	0.000116	3.58	338.86	67.83	0.25
Creek	17155	ULT10yr	740.82	519.57	528.06	521.99	528.11	0.000026	1.91	430.50	70.94	0.12
Creek	17155	ULT25yr	391.99	519.57	529.42	521.18	529.43	0.000004	0.85	533.24	84.02	0.05
Creek	17155	ULT50yr	362.55	519.57	529.87	521.10	529.88	0.000003	0.74	572.98	91.84	0.04
Creek	17155	ULT100yr	365.19	519.57	530.09	521.11	530.10	0.000003	0.73	593.42	153.39	0.04
Creek	17155	ULT500yr	176.64	519.57	530.49	520.53	530.49	0.000001	0.34	632.68	176.07	0.02
Creek	17041	EX0.5yr	360.00	519.38	522.82	520.93	522.94	0.000189	2.76	130.60	42.89	0.28
Creek	17041	EX1yr	500.00	519.38	523.61	521.28	523.75	0.000179	3.03	165.10	44.82	0.28
Creek	17041	EX2yr	660.00	519.38	524.42	521.63	524.59	0.000164	3.26	204.14	49.66	0.27
Creek	17041	EX5yr	940.00	519.38	525.93	522.19	526.11	0.000125	3.42	288.26	63.53	0.25
Creek	17041	EX10yr	1066.01	519.38	527.00	522.42	527.16	0.000090	3.25	359.98	70.54	0.22
Creek	17041	EX25yr	498.79	519.38	528.43	521.27	528.45	0.000010	1.23	463.05	72.91	0.08
Creek	17041	EX50yr	323.85	519.38	529.51	520.83	529.51	0.000003	0.70	546.74	87.35	0.04
Creek	17041	EX100yr	319.54	519.38	529.83	520.81	529.84	0.000002	0.67	575.82	92.00	0.04
Creek	17041	EX500yr	303.08	519.38	530.27	520.76	530.28	0.000002	0.60	617.75	98.32	0.03
Creek	17041	ULT2yr	775.00	519.38	524.87	521.87	525.06	0.000166	3.47	226.96	51.79	0.28
Creek	17041	ULT5yr	1132.29	519.38	526.72	522.55	526.92	0.000117	3.60	340.54	69.28	0.25
Creek	17041	ULT10yr	647.55	519.38	528.06	521.61	528.11	0.000020	1.68	436.65	72.59	0.11
Creek	17041	ULT25yr	341.78	519.38	529.42	520.87	529.43	0.000003	0.75	539.36	86.13	0.04
Creek	17041	ULT50yr	318.37	519.38	529.87	520.81	529.88	0.000002	0.66	579.41	92.56	0.04
Creek	17041	ULT100yr	322.04	519.38	530.09	520.81	530.09	0.000002	0.65	600.03	95.70	0.04
Creek	17041	ULT500yr	2.86	519.38	530.49	519.50	530.49	0.000000	0.01	639.65	104.74	0.00
Creek	17008	EX0.5yr	360.00	519.27	522.83	520.73	522.92	0.000134	2.40	149.91	48.12	0.24
Creek	17008	EX1yr	500.00	519.27	523.62	521.06	523.73	0.000139	2.64	189.16	54.99	0.25
Creek	17008	EX2yr	660.00	519.27	524.45	521.39	524.57	0.000126	2.82	234.01	57.99	0.24
Creek	17008	EX5yr	940.00	519.27	525.96	521.93	526.09	0.000104	2.90	323.73	71.93	0.23
Creek	17008	EX10yr	1066.01	519.27	527.03	522.15	527.14	0.000077	2.67	444.08	211.74	0.20
Creek	17008	EX25yr	498.79	519.27	528.43	521.04	528.44	0.000006	0.85	1129.63	630.83	0.06
Creek	17008	EX50yr	323.85	519.27	529.51	520.63	529.51	0.000001	0.37	1928.34	766.14	0.02

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	17008	EX100yr	319.54	519.27	529.83	520.62	529.84	0.000001	0.33	2183.03	810.77	0.02
Creek	17008	EX500yr	303.08	519.27	530.27	520.58	530.27	0.000001	0.28	2564.90	901.53	0.02
Creek	17008	ULT2yr	775.00	519.27	524.90	521.62	525.04	0.000127	2.99	259.57	59.99	0.25
Creek	17008	ULT5yr	1132.29	519.27	526.76	522.26	526.90	0.000100	3.00	396.65	147.62	0.23
Creek	17008	ULT10yr	647.55	519.27	528.08	521.36	528.10	0.000014	1.24	916.57	596.16	0.09
Creek	17008	ULT25yr	341.78	519.27	529.43	520.68	529.43	0.000001	0.40	1863.80	760.90	0.03
Creek	17008	ULT50yr	318.37	519.27	529.87	520.62	529.87	0.000001	0.32	2214.67	816.57	0.02
Creek	17008	ULT100yr	322.04	519.27	530.09	520.63	530.09	0.000001	0.31	2401.30	894.36	0.02
Creek	17008	ULT500yr	2.86	519.27	530.49	519.40	530.49	0.000000	0.00	2759.28	916.17	0.00
Creek	17007	EX0.5yr	405.00	519.27	522.79	520.83	522.91	0.000171	2.81	143.94	47.99	0.27
Creek	17007	EX1yr	560.00	519.27	523.56	521.18	523.72	0.000162	3.15	177.63	54.77	0.27
Creek	17007	EX2yr	740.00	519.27	524.36	521.55	524.55	0.000156	3.49	212.33	57.68	0.28
Creek	17007	EX5yr	1055.00	519.27	525.84	522.12	526.07	0.000132	3.81	276.59	70.68	0.27
Creek	17007	EX10yr	1275.00	519.27	526.85	522.46	527.10	0.000117	3.98	320.71	180.49	0.26
Creek	17007	EX25yr	1540.00	519.27	528.11	522.87	528.37	0.000101	4.10	375.23	597.58	0.25
Creek	17007	EX50yr	1970.00	519.27	529.43	523.47	529.49	0.000044	2.28	1870.49	761.41	0.15
Creek	17007	EX100yr	2350.00	519.27	529.75	523.98	529.82	0.000049	2.47	2114.28	798.08	0.16
Creek	17007	EX500yr	3015.00	519.27	530.16	524.79	530.25	0.000062	2.88	2463.14	897.08	0.19
Creek	17007	ULT2yr	835.00	519.27	524.82	521.72	525.02	0.000147	3.60	232.26	59.40	0.27
Creek	17007	ULT5yr	1225.00	519.27	526.62	522.39	526.87	0.000120	3.94	310.72	124.37	0.26
Creek	17007	ULT10yr	1470.00	519.27	527.77	522.77	528.03	0.000106	4.08	360.54	564.99	0.25
Creek	17007	ULT25yr	1895.00	519.27	529.35	523.38	529.41	0.000043	2.24	1808.30	754.44	0.15
Creek	17007	ULT50yr	2380.00	519.27	529.79	524.01	529.85	0.000049	2.47	2145.63	804.13	0.16
Creek	17007	ULT100yr	2695.00	519.27	530.00	524.40	530.07	0.000054	2.65	2316.04	828.76	0.17
Creek	17007	ULT500yr	3390.00	519.27	530.36	525.23	530.46	0.000067	3.05	2646.33	905.08	0.20
Creek	16943 Robinson Road		Culvert									
Creek	16903	EX0.5yr	405.00	518.84	522.64	520.47	522.76	0.000232	2.73	148.29	67.91	0.25
Creek	16903	EX1yr	560.00	518.84	523.37	520.82	523.52	0.000241	3.14	178.10	75.48	0.27
Creek	16903	EX2yr	740.00	518.84	524.08	521.17	524.27	0.000254	3.57	207.17	83.87	0.28
Creek	16903	EX5yr	1055.00	518.84	525.09	521.76	525.37	0.000282	4.24	248.55	98.77	0.30
Creek	16903	EX10yr	1275.00	518.84	525.67	522.13	526.01	0.000303	4.68	272.36	114.67	0.32
Creek	16903	EX25yr	1540.00	518.84	526.28	522.55	526.69	0.000330	5.18	297.35	136.05	0.34
Creek	16903	EX50yr	1970.00	518.84	527.38	523.18	527.63	0.001683	4.00	492.99	185.97	0.31
Creek	16903	EX100yr	2350.00	518.84	528.12	523.70	528.38	0.001922	4.14	567.33	239.74	0.32
Creek	16903	EX500yr	3015.00	518.84	529.39	524.55	529.57	0.002393	3.62	963.30	626.18	0.31
Creek	16903	ULT2yr	835.00	518.84	524.41	521.36	524.63	0.000262	3.78	220.81	87.90	0.29
Creek	16903	ULT5yr	1225.00	518.84	525.54	522.05	525.87	0.000298	4.58	267.31	111.32	0.32
Creek	16903	ULT10yr	1470.00	518.84	526.12	522.45	526.52	0.000323	5.05	291.00	131.29	0.33
Creek	16903	ULT25yr	1895.00	518.84	527.22	523.07	527.47	0.001622	3.96	478.62	175.76	0.31
Creek	16903	ULT50yr	2380.00	518.84	528.18	523.73	528.44	0.001936	4.15	573.41	245.08	0.32
Creek	16903	ULT100yr	2695.00	518.84	528.75	524.15	529.02	0.002233	4.21	640.14	307.09	0.33
Creek	16903	ULT500yr	3390.00	518.84	530.05	525.00	530.13	0.001067	2.62	1840.88	1216.71	0.21
Creek	16884	EX0.5yr	405.00	519.00	522.64	520.61	522.75	0.000127	2.66	152.46	76.79	0.27
Creek	16884	EX1yr	560.00	519.00	523.37	520.96	523.51	0.000156	2.94	190.61	84.75	0.28
Creek	16884	EX2yr	740.00	519.00	524.09	521.34	524.25	0.000275	3.19	231.79	94.16	0.28
Creek	16884	EX5yr	1055.00	519.00	525.12	521.92	525.32	0.000291	3.60	293.32	119.28	0.29
Creek	16884	EX10yr	1275.00	519.00	525.71	522.26	525.95	0.000290	3.88	328.99	143.12	0.29
Creek	16884	EX25yr	1540.00	519.00	526.34	522.69	526.62	0.000295	4.20	366.61	183.99	0.30
Creek	16884	EX50yr	1970.00	519.00	527.34	523.30	527.60	0.001283	4.08	482.38	251.82	0.32
Creek	16884	EX100yr	2350.00	519.00	528.08	523.80	528.35	0.001442	4.18	562.01	332.62	0.33
Creek	16884	EX500yr	3015.00	519.00	529.35	524.52	529.54	0.001173	3.69	1035.99	525.72	0.29
Creek	16884	ULT2yr	835.00	519.00	524.43	521.52	524.60	0.000301	3.32	251.88	99.76	0.28
Creek	16884	ULT5yr	1225.00	519.00	525.59	522.19	525.81	0.000290	3.81	321.40	137.91	0.29
Creek	16884	ULT10yr	1470.00	519.00	526.18	522.56	526.44	0.000294	4.12	357.03	173.55	0.30
Creek	16884	ULT25yr	1895.00	519.00	527.18	523.20	527.44	0.001231	4.05	467.47	238.63	0.32
Creek	16884	ULT50yr	2380.00	519.00	528.14	523.84	528.41	0.001457	4.19	568.63	340.96	0.33
Creek	16884	ULT100yr	2695.00	519.00	528.71	524.18	528.99	0.001583	4.20	641.76	390.38	0.34
Creek	16884	ULT500yr	3390.00	519.00	530.04	524.85	530.11	0.000546	2.67	2017.85	1209.94	0.20
Creek	16849	EX0.5yr	405.00	519.00	522.60	520.86	522.74	0.000189	3.00	134.99	69.87	0.32
Creek	16849	EX1yr	560.00	519.00	523.34	521.25	523.50	0.000177	3.22	173.69	78.07	0.32
Creek	16849	EX2yr	740.00	519.00	524.05	521.65	524.24	0.000256	3.44	214.86	86.50	0.32
Creek	16849	EX5yr	1055.00	519.00	525.09	522.26	525.31	0.000504	3.76	280.65	132.32	0.32
Creek	16849	EX10yr	1275.00	519.00	525.69	522.61	525.93	0.000634	3.96	322.38	143.61	0.33
Creek	16849	EX25yr	1540.00	519.00	526.33	523.02	526.60	0.000852	4.16	369.78	199.42	0.34
Creek	16849	EX50yr	1970.00	519.00	527.25	523.63	527.55	0.001237	4.41	446.70	275.08	0.35
Creek	16849	EX100yr	2350.00	519.00	527.97	524.10	528.30	0.001526	4.56	515.77	334.71	0.36
Creek	16849	EX500yr	3015.00	519.00	529.14	524.84	529.47	0.001844	4.63	650.89	520.54	0.37
Creek	16849	ULT2yr	835.00	519.00	524.39	521.84	524.59	0.000349	3.55	235.53	90.81	0.32
Creek	16849	ULT5yr	1225.00	519.00	525.56	522.56	525.80	0.000606	3.91	313.24	141.27	0.33
Creek	16849	ULT10yr	1470.00	519.00	526.17	522.94	526.43	0.000782	4.11	357.31	189.11	0.33
Creek	16849	ULT25yr	1895.00	519.00	527.10	523.53	527.39	0.001176	4.37	433.23	254.94	0.35
Creek	16849	ULT50yr	2380.00	519.00	528.03	524.15	528.35	0.001563	4.56	521.39	338.88	0.36
Creek	16849	ULT100yr	2695.00	519.00	528.59	524.51	528.92	0.001794	4.62	583.16	384.99	0.36
Creek	16849	ULT500yr	3390.00	519.00	530.02	525.22	530.09	0.000563	2.71	2099.77	1196.62	0.20
Creek	16812	EX0.5yr	405.00	518.16	522.58	520.50	522.73	0.001628	3.03	133.83	65.46	0.31

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	16812	EX1yr	560.00	518.16	523.31	520.97	523.48	0.001839	3.31	169.10	73.65	0.32
Creek	16812	EX2yr	740.00	518.16	524.02	521.46	524.21	0.002020	3.58	206.68	86.58	0.33
Creek	16812	EX5yr	1055.00	518.16	525.03	522.14	525.27	0.002299	3.95	267.00	166.10	0.34
Creek	16812	EX10yr	1275.00	518.16	525.62	522.55	525.89	0.002448	4.16	306.17	202.15	0.35
Creek	16812	EX25yr	1540.00	518.16	526.24	522.99	526.54	0.002601	4.39	350.56	241.40	0.35
Creek	16812	EX50yr	1970.00	518.16	527.14	523.63	527.48	0.002777	4.70	419.45	289.73	0.36
Creek	16812	EX100yr	2350.00	518.16	527.84	524.12	528.21	0.002921	4.91	478.41	320.85	0.37
Creek	16812	EX500yr	3015.00	518.16	528.96	524.93	529.38	0.003278	5.17	583.47	487.40	0.38
Creek	16812	ULT2yr	835.00	518.16	524.34	521.67	524.56	0.002109	3.70	225.43	106.90	0.33
Creek	16812	ULT5yr	1225.00	518.16	525.49	522.44	525.75	0.002415	4.12	297.55	194.55	0.35
Creek	16812	ULT10yr	1470.00	518.16	526.08	522.87	526.38	0.002564	4.34	339.02	231.26	0.35
Creek	16812	ULT25yr	1895.00	518.16	526.99	523.53	527.32	0.002750	4.65	407.66	283.75	0.36
Creek	16812	ULT50yr	2380.00	518.16	527.89	524.18	528.27	0.002930	4.93	483.03	323.60	0.37
Creek	16812	ULT100yr	2695.00	518.16	528.43	524.57	528.83	0.003051	5.06	532.10	393.26	0.37
Creek	16812	ULT500yr	3390.00	518.16	529.60	525.33	530.02	0.003655	5.17	655.62	845.77	0.39
Creek	16724	EX0.5yr	405.00	517.85	522.33	520.75	522.52	0.003512	3.50	115.84	101.30	0.39
Creek	16724	EX1yr	560.00	517.85	523.04	521.22	523.26	0.003553	3.72	150.45	118.49	0.38
Creek	16724	EX2yr	740.00	517.85	523.74	521.68	523.98	0.003577	3.93	188.06	142.50	0.38
Creek	16724	EX5yr	1055.00	517.85	524.73	522.34	525.01	0.003617	4.24	248.87	184.95	0.38
Creek	16724	EX10yr	1275.00	517.85	525.32	522.73	525.62	0.003644	4.42	288.39	222.23	0.38
Creek	16724	EX25yr	1540.00	517.85	525.94	523.16	526.27	0.003701	4.62	333.03	284.10	0.39
Creek	16724	EX50yr	1970.00	517.85	526.82	523.78	527.19	0.003764	4.89	402.62	341.45	0.39
Creek	16724	EX100yr	2350.00	517.85	527.52	524.27	527.92	0.003807	5.08	462.25	405.61	0.39
Creek	16724	EX500yr	3015.00	517.85	528.62	524.99	529.06	0.003779	5.33	566.17	613.81	0.39
Creek	16724	ULT2yr	835.00	517.85	524.06	521.89	524.32	0.003590	4.03	206.99	153.74	0.38
Creek	16724	ULT5yr	1225.00	517.85	525.20	522.65	525.49	0.003634	4.38	279.71	206.75	0.38
Creek	16724	ULT10yr	1470.00	517.85	525.78	523.07	526.11	0.003688	4.57	321.40	268.55	0.39
Creek	16724	ULT25yr	1895.00	517.85	526.68	523.68	527.04	0.003750	4.85	390.68	331.68	0.39
Creek	16724	ULT50yr	2380.00	517.85	527.57	524.30	527.97	0.003809	5.10	466.92	410.89	0.39
Creek	16724	ULT100yr	2695.00	517.85	528.11	524.67	528.53	0.003803	5.22	516.24	533.85	0.39
Creek	16724	ULT500yr	3390.00	517.85	529.23	525.38	529.68	0.003960	5.40	628.17	741.93	0.40
Creek	16575	EX0.5yr	405.00	517.00	521.83	520.10	522.01	0.003256	3.38	119.96	90.11	0.37
Creek	16575	EX1yr	560.00	517.00	522.53	520.58	522.74	0.003421	3.65	153.57	109.67	0.37
Creek	16575	EX2yr	740.00	517.00	523.21	521.05	523.45	0.003525	3.89	190.42	145.85	0.37
Creek	16575	EX5yr	1055.00	517.00	524.20	521.74	524.47	0.003633	4.22	250.25	242.90	0.38
Creek	16575	EX10yr	1275.00	517.00	524.77	522.14	525.07	0.003697	4.41	289.17	271.87	0.38
Creek	16575	EX25yr	1540.00	517.00	525.38	522.58	525.71	0.003787	4.63	332.84	320.27	0.39
Creek	16575	EX50yr	1970.00	517.00	526.25	523.20	526.62	0.003853	4.91	401.37	376.20	0.39
Creek	16575	EX100yr	2350.00	517.00	526.94	523.69	527.34	0.003870	5.11	459.93	432.91	0.39
Creek	16575	EX500yr	3015.00	517.00	528.05	524.45	528.49	0.003865	5.36	562.82	541.66	0.39
Creek	16575	ULT2yr	835.00	517.00	523.53	521.26	523.78	0.003564	4.00	209.01	207.79	0.38
Creek	16575	ULT5yr	1225.00	517.00	524.65	522.04	524.95	0.003678	4.36	280.67	265.71	0.38
Creek	16575	ULT10yr	1470.00	517.00	525.22	522.47	525.55	0.003767	4.57	321.44	303.08	0.39
Creek	16575	ULT25yr	1895.00	517.00	526.11	523.09	526.47	0.003845	4.86	389.64	368.96	0.39
Creek	16575	ULT50yr	2380.00	517.00	526.99	523.72	527.40	0.003871	5.12	464.51	437.02	0.39
Creek	16575	ULT100yr	2695.00	517.00	527.53	524.10	527.96	0.003883	5.25	513.12	486.93	0.39
Creek	16575	ULT500yr	3390.00	517.00	528.64	524.83	529.10	0.003826	5.45	622.34	678.24	0.39
Creek	16420	EX0.5yr	405.00	517.00	521.29	519.68	521.48	0.003510	3.53	114.77	157.35	0.38
Creek	16420	EX1yr	560.00	517.00	521.94	520.15	522.18	0.003790	3.86	144.95	234.73	0.39
Creek	16420	EX2yr	740.00	517.00	522.60	520.61	522.87	0.003959	4.15	178.41	271.46	0.40
Creek	16420	EX5yr	1055.00	517.00	523.55	521.29	523.87	0.004152	4.53	232.70	307.88	0.41
Creek	16420	EX10yr	1275.00	517.00	524.10	521.70	524.46	0.004268	4.76	267.76	327.59	0.41
Creek	16420	EX25yr	1540.00	517.00	524.67	522.15	525.07	0.004481	5.03	306.23	351.25	0.42
Creek	16420	EX50yr	1970.00	517.00	525.51	522.78	525.96	0.004735	5.35	368.32	390.10	0.43
Creek	16420	EX100yr	2350.00	517.00	526.19	523.28	526.67	0.004817	5.55	423.65	428.27	0.44
Creek	16420	EX500yr	3015.00	517.00	527.31	524.04	527.83	0.004740	5.74	525.22	510.03	0.43
Creek	16420	ULT2yr	835.00	517.00	522.91	520.82	523.19	0.004025	4.28	195.30	283.75	0.40
Creek	16420	ULT5yr	1225.00	517.00	523.99	521.60	524.33	0.004233	4.71	260.22	322.89	0.41
Creek	16420	ULT10yr	1470.00	517.00	524.53	522.03	524.91	0.004418	4.96	296.20	345.20	0.42
Creek	16420	ULT25yr	1895.00	517.00	525.37	522.67	525.81	0.004708	5.30	357.46	383.23	0.43
Creek	16420	ULT50yr	2380.00	517.00	526.24	523.31	526.72	0.004822	5.56	428.05	431.79	0.44
Creek	16420	ULT100yr	2695.00	517.00	526.78	523.68	527.28	0.004812	5.67	475.46	469.62	0.44
Creek	16420	ULT500yr	3390.00	517.00	527.92	524.43	528.44	0.004622	5.79	585.87	557.82	0.43
Creek	16260	EX0.5yr	405.00	517.00	520.86	519.15	521.02	0.002357	3.15	128.62	152.07	0.34
Creek	16260	EX1yr	560.00	517.00	521.46	519.59	521.66	0.002704	3.51	159.74	285.05	0.36
Creek	16260	EX2yr	740.00	517.00	522.09	520.01	522.31	0.002918	3.79	195.23	326.12	0.37
Creek	16260	EX5yr	1055.00	517.00	523.01	520.63	523.28	0.003154	4.16	253.30	371.45	0.38
Creek	16260	EX10yr	1275.00	517.00	523.54	521.03	523.84	0.003299	4.39	290.58	396.56	0.38
Creek	16260	EX25yr	1540.00	517.00	524.08	521.44	524.42	0.003515	4.66	330.40	441.01	0.40
Creek	16260	EX50yr	1970.00	517.00	524.89	522.04	525.27	0.003705	4.99	394.81	479.98	0.40
Creek	16260	EX100yr	2350.00	517.00	525.56	522.49	525.98	0.003747	5.19	452.81	514.27	0.41
Creek	16260	EX500yr	3015.00	517.00	526.70	523.24	527.15	0.003625	5.38	560.02	558.18	0.40
Creek	16260	ULT2yr	835.00	517.00	522.39	520.22	522.62	0.003003	3.92	213.25	341.43	0.37
Creek	16260	ULT5yr	1225.00	517.00	523.43	520.94	523.72	0.003256	4.33	282.72	391.39	0.38
Creek	16260	ULT10yr	1470.00	517.00	523.94	521.33	524.27	0.003462	4.59	320.10	427.56	0.39
Creek	16260	ULT25yr	1895.00	517.00	524.75	521.94	525.13	0.003686	4.94	383.47	473.79	0.40
Creek	16260	ULT50yr	2380.00	517.00	525.61	522.55	526.03	0.003748	5.20	457.42	516.84	0.41

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	16260	ULT100yr	2695.00	517.00	526.15	522.91	526.59	0.003710	5.31	507.35	540.48	0.40
Creek	16260	ULT500yr	3390.00	517.00	527.33	523.61	527.78	0.003488	5.43	624.00	586.69	0.39
Creek	16122	EX0.5yr	405.00	516.74	520.51	518.88	520.67	0.002736	3.19	126.93	154.35	0.35
Creek	16122	EX1yr	560.00	516.74	521.05	519.30	521.25	0.003206	3.62	154.66	167.05	0.38
Creek	16122	EX2yr	740.00	516.74	521.63	519.71	521.87	0.003470	3.95	187.49	220.87	0.39
Creek	16122	EX5yr	1055.00	516.74	522.51	520.33	522.80	0.003755	4.36	241.71	246.27	0.40
Creek	16122	EX10yr	1275.00	516.74	523.01	520.72	523.34	0.003923	4.62	276.17	259.48	0.41
Creek	16122	EX25yr	1540.00	516.74	523.50	521.13	523.88	0.004240	4.95	311.34	272.44	0.42
Creek	16122	EX50yr	1970.00	516.74	524.27	521.72	524.71	0.004480	5.32	370.18	292.78	0.44
Creek	16122	EX100yr	2350.00	516.74	524.93	522.20	525.41	0.004487	5.53	425.23	310.58	0.44
Creek	16122	EX500yr	3015.00	516.74	526.10	522.91	526.61	0.004203	5.68	531.03	360.06	0.42
Creek	16122	ULT2yr	835.00	516.74	521.91	519.92	522.17	0.003574	4.09	204.25	230.01	0.39
Creek	16122	ULT5yr	1225.00	516.74	522.91	520.64	523.23	0.003864	4.55	269.15	256.85	0.41
Creek	16122	ULT10yr	1470.00	516.74	523.38	521.02	523.75	0.004162	4.86	302.27	269.15	0.42
Creek	16122	ULT25yr	1895.00	516.74	524.14	521.62	524.57	0.004460	5.27	359.61	289.26	0.44
Creek	16122	ULT50yr	2380.00	516.74	524.98	522.22	525.46	0.004482	5.54	429.65	311.95	0.44
Creek	16122	ULT100yr	2695.00	516.74	525.54	522.58	526.03	0.004375	5.63	478.57	326.77	0.43
Creek	16122	ULT500yr	3390.00	516.74	526.77	523.28	527.27	0.003966	5.69	595.65	405.69	0.41
Creek	15979	EX0.5yr	405.00	516.50	518.97	518.97	519.72	0.025718	6.95	58.24	161.92	0.99
Creek	15979	EX1yr	560.00	516.50	519.76	519.36	520.35	0.014938	6.18	90.62	183.44	0.76
Creek	15979	EX2yr	740.00	516.50	520.41	519.75	520.99	0.012209	6.13	120.79	204.19	0.69
Creek	15979	EX5yr	1055.00	516.50	521.31	520.36	521.93	0.010497	6.29	167.65	236.13	0.64
Creek	15979	EX10yr	1275.00	516.50	521.78	520.74	522.45	0.010419	6.56	194.30	248.64	0.64
Creek	15979	EX25yr	1540.00	516.50	522.00	521.14	522.86	0.012755	7.41	207.79	258.62	0.70
Creek	15979	EX50yr	1970.00	516.50	522.66	521.74	523.63	0.013159	7.92	248.81	270.78	0.72
Creek	15979	EX100yr	2350.00	516.50	523.48	522.20	524.40	0.011132	7.68	305.85	286.87	0.66
Creek	15979	EX500yr	3015.00	516.50	524.98	522.94	525.76	0.008055	7.11	424.16	336.30	0.56
Creek	15979	ULT2yr	835.00	516.50	520.70	519.95	521.29	0.011523	6.17	135.35	213.67	0.67
Creek	15979	ULT5yr	1225.00	516.50	521.71	520.66	522.36	0.010125	6.43	190.52	247.00	0.63
Creek	15979	ULT10yr	1470.00	516.50	521.96	521.03	522.76	0.012024	7.17	205.10	253.25	0.68
Creek	15979	ULT25yr	1895.00	516.50	522.50	521.64	523.48	0.013559	7.94	238.58	267.75	0.73
Creek	15979	ULT50yr	2380.00	516.50	523.55	522.24	524.46	0.010992	7.66	310.55	288.11	0.66
Creek	15979	ULT100yr	2695.00	516.50	524.26	522.57	525.11	0.009392	7.38	365.10	310.09	0.61
Creek	15979	ULT500yr	3390.00	516.50	525.79	523.33	526.51	0.006846	6.83	496.30	381.57	0.52
Creek	15860	EX0.5yr	405.00	515.08	517.82	517.82	518.65	0.003310	7.27	55.69	159.29	0.99
Creek	15860	EX1yr	560.00	515.08	518.27	518.27	519.21	0.005687	7.80	71.83	174.24	1.00
Creek	15860	EX2yr	740.00	515.08	518.70	518.70	519.77	0.006935	8.31	89.02	186.68	1.00
Creek	15860	EX5yr	1055.00	515.08	519.33	519.33	520.61	0.008540	9.08	116.23	203.74	1.00
Creek	15860	EX10yr	1275.00	515.08	519.79	519.72	521.11	0.008838	9.24	137.94	212.32	0.97
Creek	15860	EX25yr	1540.00	515.08	520.67	520.16	521.77	0.006176	8.39	184.01	230.39	0.79
Creek	15860	EX50yr	1970.00	515.08	521.93	520.70	522.88	0.003604	7.86	256.64	259.40	0.63
Creek	15860	EX100yr	2350.00	515.08	522.92	521.15	523.82	0.002680	7.68	321.31	283.36	0.56
Creek	15860	EX500yr	3015.00	515.08	524.47	521.91	525.33	0.001902	7.59	437.59	331.92	0.49
Creek	15860	ULT2yr	835.00	515.08	518.91	518.91	520.04	0.007474	8.56	97.57	191.32	1.00
Creek	15860	ULT5yr	1225.00	515.08	519.64	519.64	521.00	0.009107	9.37	130.71	209.42	1.00
Creek	15860	ULT10yr	1470.00	515.08	520.45	520.04	521.59	0.007014	8.55	172.00	225.80	0.83
Creek	15860	ULT25yr	1895.00	515.08	521.72	520.59	522.69	0.003878	7.91	243.99	254.67	0.65
Creek	15860	ULT50yr	2380.00	515.08	522.99	521.20	523.89	0.002629	7.67	326.45	284.76	0.56
Creek	15860	ULT100yr	2695.00	515.08	523.75	521.57	524.63	0.002199	7.61	381.13	304.21	0.52
Creek	15860	ULT500yr	3390.00	515.08	525.27	522.31	526.12	0.001654	7.58	505.97	374.34	0.47
Creek	15858		Inl Struct									
Creek	15857	EX0.5yr	405.00	513.28	516.08	515.78	516.76	0.001349	6.62	61.18	123.80	0.82
Creek	15857	EX1yr	560.00	513.28	516.77	516.28	517.47	0.001097	6.73	83.16	144.08	0.76
Creek	15857	EX2yr	740.00	513.28	517.65	516.77	518.29	0.000778	6.41	115.40	164.35	0.66
Creek	15857	EX5yr	1055.00	513.28	518.97	517.50	519.56	0.000535	6.14	171.81	196.49	0.56
Creek	15857	EX10yr	1275.00	513.28	519.78	517.95	520.34	0.000445	6.03	211.41	214.02	0.52
Creek	15857	EX25yr	1540.00	513.28	520.67	518.44	521.22	0.000348	5.96	259.80	232.46	0.48
Creek	15857	EX50yr	1970.00	513.28	521.92	519.12	522.49	0.000264	6.05	334.58	259.96	0.43
Creek	15857	EX100yr	2350.00	513.28	522.91	519.66	523.50	0.000228	6.20	400.38	282.84	0.41
Creek	15857	EX500yr	3015.00	513.28	524.46	520.45	525.10	0.000191	6.48	519.27	330.86	0.39
Creek	15857	ULT2yr	835.00	513.28	518.07	517.01	518.69	0.000683	6.32	132.20	174.01	0.62
Creek	15857	ULT5yr	1225.00	513.28	519.60	517.85	520.17	0.000463	6.05	202.37	210.15	0.53
Creek	15857	ULT10yr	1470.00	513.28	520.44	518.31	521.00	0.000372	5.97	247.18	228.41	0.49
Creek	15857	ULT25yr	1895.00	513.28	521.72	519.01	522.28	0.000275	6.03	321.66	255.17	0.44
Creek	15857	ULT50yr	2380.00	513.28	522.98	519.70	523.58	0.000225	6.21	405.64	284.06	0.41
Creek	15857	ULT100yr	2695.00	513.28	523.74	520.12	524.36	0.000206	6.34	461.56	303.35	0.40
Creek	15857	ULT500yr	3390.00	513.28	525.26	520.84	525.93	0.000178	6.64	588.67	374.52	0.38
Creek	15837	EX0.5yr	405.00	513.21	516.12	515.61	516.67	0.001004	5.93	68.31	135.55	0.71
Creek	15837	EX1yr	560.00	513.21	516.81	516.09	517.39	0.000852	6.14	91.22	150.61	0.67
Creek	15837	EX2yr	740.00	513.21	517.68	516.59	518.23	0.000631	5.97	124.03	170.20	0.60
Creek	15837	EX5yr	1055.00	513.21	518.99	517.30	519.52	0.000458	5.84	180.80	197.46	0.52
Creek	15837	EX10yr	1275.00	513.21	519.79	517.74	520.31	0.000391	5.79	220.38	214.14	0.49
Creek	15837	EX25yr	1540.00	513.21	520.68	518.23	521.19	0.000312	5.76	269.47	233.79	0.45
Creek	15837	EX50yr	1970.00	513.21	521.93	518.93	522.47	0.000242	5.88	347.35	260.57	0.41
Creek	15837	EX100yr	2350.00	513.21	522.92	519.49	523.48	0.000211	6.05	415.38	284.66	0.39

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	15837	EX500yr	3015.00	513.21	524.47	520.30	525.08	0.000179	6.34	536.23	335.05	0.38
Creek	15837	ULT2yr	835.00	513.21	518.09	516.82	518.64	0.000566	5.92	140.99	179.80	0.57
Creek	15837	ULT5yr	1225.00	513.21	519.61	517.65	520.14	0.000404	5.80	211.34	210.36	0.50
Creek	15837	ULT10yr	1470.00	513.21	520.45	518.10	520.97	0.000331	5.76	256.55	229.34	0.46
Creek	15837	ULT25yr	1895.00	513.21	521.73	518.81	522.26	0.000251	5.86	333.85	255.77	0.42
Creek	15837	ULT50yr	2380.00	513.21	522.99	519.52	523.56	0.000209	6.06	420.78	286.50	0.39
Creek	15837	ULT100yr	2695.00	513.21	523.75	519.93	524.34	0.000192	6.20	477.82	308.26	0.38
Creek	15837	ULT500yr	3390.00	513.21	525.27	520.68	525.91	0.000168	6.51	606.59	381.85	0.37
Creek	15825	EX0.5yr	405.00	511.16	516.17	514.81	516.60	0.000521	5.36	89.52	132.09	0.49
Creek	15825	EX1yr	560.00	511.16	516.80	515.39	517.38	0.000578	6.26	111.13	143.43	0.52
Creek	15825	EX2yr	740.00	511.16	517.42	515.99	518.17	0.000633	7.15	134.13	156.91	0.56
Creek	15825	EX5yr	1055.00	511.16	518.35	516.90	519.36	0.000702	8.42	171.86	178.59	0.61
Creek	15825	EX10yr	1275.00	511.16	518.92	517.49	520.10	0.000738	9.18	197.36	191.84	0.63
Creek	15825	EX25yr	1540.00	511.16	519.55	518.09	520.93	0.000770	9.96	227.79	206.27	0.66
Creek	15825	EX50yr	1970.00	511.16	520.43	519.05	522.12	0.000819	11.11	274.61	228.48	0.69
Creek	15825	EX100yr	2350.00	511.16	521.11	519.81	523.06	0.000865	12.05	313.23	244.39	0.72
Creek	15825	EX500yr	3015.00	511.16	522.13	520.96	524.54	0.000941	13.53	377.63	268.37	0.76
Creek	15825	ULT2yr	835.00	511.16	517.72	516.29	518.55	0.000657	7.56	145.74	163.64	0.58
Creek	15825	ULT5yr	1225.00	511.16	518.79	517.35	519.94	0.000731	9.01	191.57	189.07	0.63
Creek	15825	ULT10yr	1470.00	511.16	519.39	517.94	520.72	0.000761	9.76	219.89	202.61	0.65
Creek	15825	ULT25yr	1895.00	511.16	520.29	518.89	521.92	0.000809	10.91	266.79	225.12	0.68
Creek	15825	ULT50yr	2380.00	511.16	521.16	519.87	523.13	0.000869	12.12	316.18	245.56	0.72
Creek	15825	ULT100yr	2695.00	511.16	521.66	520.42	523.85	0.000906	12.84	347.06	257.33	0.74
Creek	15825	ULT500yr	3390.00	511.16	522.65	521.59	525.31	0.000977	14.27	413.25	281.32	0.78
Creek	15822		Inl Struct									
Creek	15820	EX0.5yr	405.00	509.10	516.17	512.55	516.25	0.000511	2.40	174.43	138.27	0.19
Creek	15820	EX1yr	560.00	509.10	516.80	513.06	516.93	0.000647	2.93	200.47	147.95	0.22
Creek	15820	EX2yr	740.00	509.10	517.42	513.55	517.60	0.000784	3.45	227.19	158.51	0.24
Creek	15820	EX5yr	1055.00	509.10	518.34	514.31	518.60	0.000977	4.22	269.25	178.68	0.28
Creek	15820	EX10yr	1275.00	509.10	518.91	514.76	519.23	0.001084	4.67	296.54	191.28	0.29
Creek	15820	EX25yr	1540.00	509.10	519.54	515.26	519.92	0.001191	5.16	328.14	207.80	0.31
Creek	15820	EX50yr	1970.00	509.10	520.43	516.01	520.92	0.001350	5.87	376.08	229.10	0.34
Creek	15820	EX100yr	2350.00	509.10	521.10	516.63	521.69	0.001477	6.43	415.85	243.76	0.36
Creek	15820	EX500yr	3015.00	509.10	522.13	517.60	522.86	0.001665	7.29	482.21	267.08	0.39
Creek	15820	ULT2yr	835.00	509.10	517.71	513.81	517.92	0.000847	3.70	240.40	164.98	0.25
Creek	15820	ULT5yr	1225.00	509.10	518.78	514.65	519.09	0.001061	4.57	290.42	188.43	0.29
Creek	15820	ULT10yr	1470.00	509.10	519.38	515.13	519.75	0.001162	5.03	320.02	203.75	0.31
Creek	15820	ULT25yr	1895.00	509.10	520.28	515.90	520.76	0.001322	5.75	368.05	226.00	0.33
Creek	15820	ULT50yr	2380.00	509.10	521.15	516.67	521.74	0.001486	6.47	418.90	244.83	0.36
Creek	15820	ULT100yr	2695.00	509.10	521.65	517.14	522.32	0.001579	6.89	450.72	256.20	0.37
Creek	15820	ULT500yr	3390.00	509.10	522.65	518.10	523.46	0.001749	7.70	518.76	280.12	0.40
Creek	15806	EX0.5yr	405.00	510.66	516.14	513.29	516.24	0.000769	2.61	157.86	134.27	0.22
Creek	15806	EX1yr	560.00	510.66	516.76	513.75	516.91	0.000911	3.12	184.96	143.92	0.25
Creek	15806	EX2yr	740.00	510.66	517.38	514.21	517.58	0.001048	3.62	212.93	152.77	0.27
Creek	15806	EX5yr	1055.00	510.66	518.30	514.87	518.58	0.001227	4.35	257.36	165.79	0.30
Creek	15806	EX10yr	1275.00	510.66	518.87	515.30	519.21	0.001319	4.78	286.48	177.36	0.32
Creek	15806	EX25yr	1540.00	510.66	519.50	515.77	519.90	0.001405	5.23	320.44	206.16	0.34
Creek	15806	EX50yr	1970.00	510.66	520.39	516.48	520.90	0.001527	5.87	371.99	229.86	0.36
Creek	15806	EX100yr	2350.00	510.66	521.07	517.06	521.66	0.001632	6.39	413.83	241.28	0.37
Creek	15806	EX500yr	3015.00	510.66	522.10	517.95	522.84	0.001798	7.21	482.53	261.46	0.40
Creek	15806	ULT2yr	835.00	510.66	517.67	514.43	517.90	0.001108	3.86	226.83	156.74	0.28
Creek	15806	ULT5yr	1225.00	510.66	518.74	515.22	519.07	0.001301	4.69	279.93	174.07	0.32
Creek	15806	ULT10yr	1470.00	510.66	519.34	515.66	519.73	0.001383	5.11	311.68	197.63	0.33
Creek	15806	ULT25yr	1895.00	510.66	520.25	516.37	520.74	0.001505	5.76	363.44	227.44	0.35
Creek	15806	ULT50yr	2380.00	510.66	521.12	517.09	521.72	0.001641	6.43	417.00	242.21	0.37
Creek	15806	ULT100yr	2695.00	510.66	521.63	517.54	522.29	0.001723	6.83	450.00	251.89	0.39
Creek	15806	ULT500yr	3390.00	510.66	522.62	518.43	523.44	0.001876	7.61	519.93	273.30	0.41
Creek	15748	EX0.5yr	405.00	511.00	515.88	514.31	516.16	0.001965	4.25	100.06	129.44	0.40
Creek	15748	EX1yr	560.00	511.00	516.43	514.78	516.81	0.002240	5.00	119.94	137.96	0.44
Creek	15748	EX2yr	740.00	511.00	516.97	515.31	517.46	0.002512	5.75	140.54	146.26	0.47
Creek	15748	EX5yr	1055.00	511.00	517.76	516.09	518.44	0.002850	6.81	173.89	158.35	0.52
Creek	15748	EX10yr	1275.00	511.00	518.26	516.58	519.05	0.003007	7.42	196.38	166.01	0.54
Creek	15748	EX25yr	1540.00	511.00	518.83	517.12	519.74	0.003102	8.01	223.71	174.49	0.56
Creek	15748	EX50yr	1970.00	511.00	519.63	517.89	520.72	0.003247	8.86	265.10	186.46	0.58
Creek	15748	EX100yr	2350.00	511.00	520.20	518.56	521.46	0.003445	9.60	297.09	195.90	0.60
Creek	15748	EX500yr	3015.00	511.00	521.05	519.53	522.61	0.003806	10.81	347.74	222.43	0.65
Creek	15748	ULT2yr	835.00	511.00	517.22	515.56	517.77	0.002629	6.10	150.88	150.27	0.49
Creek	15748	ULT5yr	1225.00	511.00	518.15	516.48	518.92	0.002978	7.29	191.24	164.29	0.53
Creek	15748	ULT10yr	1470.00	511.00	518.68	516.98	519.56	0.003077	7.86	216.65	172.36	0.55
Creek	15748	ULT25yr	1895.00	511.00	519.50	517.77	520.56	0.003212	8.71	258.40	184.58	0.57
Creek	15748	ULT50yr	2380.00	511.00	520.24	518.60	521.52	0.003463	9.66	299.46	196.65	0.61
Creek	15748	ULT100yr	2695.00	511.00	520.66	519.08	522.08	0.003633	10.24	324.07	207.20	0.63
Creek	15748	ULT500yr	3390.00	511.00	521.45	520.00	523.19	0.004031	11.47	373.71	244.14	0.67
Creek	15659	EX0.5yr	405.00	511.75	515.47	514.54	515.89	0.004265	5.24	77.84	113.08	0.56
Creek	15659	EX1yr	560.00	511.75	515.92	515.05	516.51	0.004806	6.17	92.83	120.19	0.61

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	15659	EX2yr	740.00	511.75	516.33	515.55	517.11	0.005511	7.16	107.37	126.61	0.67
Creek	15659	EX5yr	1055.00	511.75	516.88	516.33	518.02	0.006691	8.69	129.01	135.04	0.75
Creek	15659	EX10yr	1275.00	511.75	517.16	516.83	518.58	0.007689	9.74	140.79	141.32	0.82
Creek	15659	EX25yr	1540.00	511.75	517.51	517.38	519.23	0.008522	10.77	155.82	150.46	0.87
Creek	15659	EX50yr	1970.00	511.75	518.14	518.14	520.18	0.008695	11.84	185.94	173.98	0.90
Creek	15659	EX100yr	2350.00	511.75	518.75	518.75	520.92	0.008225	12.36	217.16	192.77	0.89
Creek	15659	EX500yr	3015.00	511.75	519.67	519.67	522.06	0.007700	13.16	269.72	221.39	0.88
Creek	15659	ULT2yr	835.00	511.75	516.51	515.79	517.40	0.005859	7.64	114.43	129.47	0.69
Creek	15659	ULT5yr	1225.00	511.75	517.11	516.73	518.46	0.007441	9.50	138.38	139.52	0.80
Creek	15659	ULT10yr	1470.00	511.75	517.41	517.23	519.06	0.008350	10.53	151.68	148.35	0.86
Creek	15659	ULT25yr	1895.00	511.75	518.02	518.02	520.02	0.008793	11.72	179.82	169.78	0.90
Creek	15659	ULT50yr	2380.00	511.75	518.80	518.80	520.98	0.008182	12.39	219.72	194.20	0.89
Creek	15659	ULT100yr	2695.00	511.75	519.25	519.25	521.53	0.007914	12.79	244.78	207.61	0.88
Creek	15659	ULT500yr	3390.00	511.75	520.13	520.13	522.64	0.007539	13.59	297.83	236.84	0.88
Creek	15546	EX0.5yr	405.00	512.00	514.22	514.22	515.02	0.015689	7.19	56.33	128.75	1.00
Creek	15546	EX1yr	560.00	512.00	514.65	514.65	515.58	0.015033	7.75	72.27	142.77	1.00
Creek	15546	EX2yr	740.00	512.00	515.07	515.07	516.13	0.014081	8.29	89.34	156.08	0.99
Creek	15546	EX5yr	1055.00	512.00	515.66	515.66	516.98	0.012683	9.24	115.52	175.53	0.98
Creek	15546	EX10yr	1275.00	512.00	516.05	516.05	517.51	0.011830	9.75	133.83	189.63	0.97
Creek	15546	EX25yr	1540.00	512.00	516.46	516.46	518.09	0.011199	10.31	154.74	205.86	0.96
Creek	15546	EX50yr	1970.00	512.00	517.10	517.10	518.94	0.010278	11.02	188.87	233.11	0.95
Creek	15546	EX100yr	2350.00	512.00	517.63	517.63	519.62	0.009560	11.51	219.73	270.09	0.93
Creek	15546	EX500yr	3015.00	512.00	518.45	518.45	520.66	0.008800	12.28	271.67	292.12	0.92
Creek	15546	ULT2yr	835.00	512.00	515.25	515.25	516.40	0.013641	8.62	97.24	161.57	0.99
Creek	15546	ULT5yr	1225.00	512.00	515.96	515.96	517.39	0.011995	9.64	129.73	185.96	0.97
Creek	15546	ULT10yr	1470.00	512.00	516.36	516.36	517.94	0.011316	10.16	149.42	201.79	0.96
Creek	15546	ULT25yr	1895.00	512.00	517.00	517.00	518.80	0.010354	10.89	183.32	226.51	0.95
Creek	15546	ULT50yr	2380.00	512.00	517.67	517.67	519.67	0.009541	11.56	221.90	270.75	0.93
Creek	15546	ULT100yr	2695.00	512.00	518.07	518.07	520.18	0.009136	11.93	246.73	277.99	0.93
Creek	15546	ULT500yr	3390.00	512.00	518.88	518.88	521.19	0.008439	12.64	300.88	310.39	0.91
Creek	15432	EX0.5yr	400.00	511.00	513.01	513.01	513.22	0.001403	4.99	166.66	133.19	0.78
Creek	15432	EX1yr	560.00	511.00	513.02	513.02	513.42	0.002705	6.96	167.66	133.78	1.08
Creek	15432	EX2yr	745.00	511.00	513.02	513.02	513.73	0.004788	9.26	167.66	133.78	1.44
Creek	15432	EX5yr	1110.00	511.00	513.52	513.52	514.36	0.003659	10.08	239.13	146.48	1.33
Creek	15432	EX10yr	1350.00	511.00	513.77	513.77	514.71	0.003456	10.69	276.09	149.38	1.32
Creek	15432	EX25yr	1605.00	511.00	514.01	514.01	515.05	0.003300	11.26	313.03	151.84	1.31
Creek	15432	EX50yr	1915.00	511.00	514.48	514.28	515.47	0.002484	11.05	383.98	155.85	1.17
Creek	15432	EX100yr	2225.00	511.00	515.23	514.52	516.02	0.001455	9.94	504.07	163.34	0.94
Creek	15432	EX500yr	2945.00	511.00	516.45	515.05	517.16	0.000905	9.56	710.42	175.95	0.78
Creek	15432	ULT2yr	845.00	511.00	513.04	513.04	513.93	0.005807	10.33	171.25	135.89	1.59
Creek	15432	ULT5yr	1250.00	511.00	513.67	513.67	514.57	0.003509	10.42	261.58	148.40	1.32
Creek	15432	ULT10yr	1505.00	511.00	513.92	513.92	514.92	0.003349	11.04	298.97	150.92	1.31
Creek	15432	ULT25yr	1835.00	511.00	514.22	514.22	515.35	0.003222	11.77	343.67	153.57	1.32
Creek	15432	ULT50yr	2165.00	511.00	515.11	514.48	515.92	0.001559	10.04	483.99	162.05	0.96
Creek	15432	ULT100yr	2485.00	511.00	515.70	514.73	516.45	0.001168	9.69	582.81	168.27	0.86
Creek	15432	ULT500yr	3230.00	511.00	516.86	515.28	517.58	0.000810	9.57	784.54	180.08	0.74
Creek	15338	EX0.5yr	400.00	507.04	510.73		511.11	0.000551	5.01	79.92	29.73	0.54
Creek	15338	EX1yr	560.00	507.04	511.36		511.85	0.000578	5.63	99.55	32.00	0.56
Creek	15338	EX2yr	745.00	507.04	511.88		512.52	0.000655	6.38	116.76	34.01	0.61
Creek	15338	EX5yr	1110.00	507.04	512.36	511.61	513.44	0.000951	8.32	137.11	54.80	0.75
Creek	15338	EX10yr	1350.00	507.04	512.58	512.11	513.99	0.001165	9.55	150.42	66.63	0.83
Creek	15338	EX25yr	1605.00	507.04	512.74	512.70	514.57	0.001447	10.91	161.27	74.92	0.93
Creek	15338	EX50yr	1915.00	507.04	513.37	513.37	515.22	0.001241	11.08	216.61	94.76	0.88
Creek	15338	EX100yr	2225.00	507.04	513.84	513.84	515.78	0.001177	11.47	263.12	102.09	0.87
Creek	15338	EX500yr	2945.00	507.04	515.19	514.79	516.97	0.000850	11.34	419.95	128.97	0.77
Creek	15338	ULT2yr	845.00	507.04	512.04		512.78	0.000740	6.92	122.19	37.31	0.65
Creek	15338	ULT5yr	1250.00	507.04	512.50	511.91	513.76	0.001067	9.02	145.38	62.40	0.79
Creek	15338	ULT10yr	1505.00	507.04	512.68	512.48	514.34	0.001332	10.37	157.23	71.94	0.89
Creek	15338	ULT25yr	1835.00	507.04	513.23	513.23	515.06	0.001269	10.99	203.76	92.69	0.89
Creek	15338	ULT50yr	2165.00	507.04	513.76	513.76	515.68	0.001179	11.37	255.15	100.86	0.87
Creek	15338	ULT100yr	2485.00	507.04	514.33	514.15	516.23	0.001045	11.47	315.62	112.23	0.84
Creek	15338	ULT500yr	3230.00	507.04	515.59	515.09	517.39	0.000812	11.51	472.63	137.37	0.76
Creek	15302	EX0.5yr	400.00	506.74	510.75		511.08	0.000422	4.59	87.22	29.81	0.47
Creek	15302	EX1yr	560.00	506.74	511.39		511.82	0.000467	5.24	106.95	32.14	0.51
Creek	15302	EX2yr	745.00	506.74	511.92		512.47	0.000542	5.99	124.40	34.06	0.55
Creek	15302	EX5yr	1110.00	506.74	512.42		513.37	0.000788	7.83	145.73	53.63	0.68
Creek	15302	EX10yr	1350.00	506.74	512.66	511.89	513.91	0.000956	8.96	160.26	65.05	0.76
Creek	15302	EX25yr	1605.00	506.74	512.86	512.44	514.45	0.001163	10.17	173.56	74.24	0.84
Creek	15302	EX50yr	1915.00	506.74	513.12	513.12	515.10	0.001353	11.39	194.67	83.40	0.91
Creek	15302	EX100yr	2225.00	506.74	513.66	513.66	515.70	0.001231	11.66	243.33	95.66	0.89
Creek	15302	EX500yr	2945.00	506.74	514.68	514.68	516.89	0.001106	12.41	352.18	118.80	0.87
Creek	15302	ULT2yr	845.00	506.74	512.08		512.73	0.000612	6.51	129.99	37.95	0.59
Creek	15302	ULT5yr	1250.00	506.74	512.57	511.71	513.69	0.000881	8.48	154.57	60.74	0.72
Creek	15302	ULT10yr	1505.00	506.74	512.79	512.22	514.24	0.001077	9.69	168.76	71.06	0.81
Creek	15302	ULT25yr	1835.00	506.74	512.95	512.94	514.94	0.001415	11.37	180.71	78.73	0.93
Creek	15302	ULT50yr	2165.00	506.74	513.56	513.56	515.59	0.001248	11.60	234.20	93.67	0.89
Creek	15302	ULT100yr	2485.00	506.74	514.04	514.04	516.16	0.001188	11.98	280.70	103.53	0.88

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	15302	ULT500yr	3230.00	506.74	515.04	515.04	517.31	0.001072	12.67	396.22	126.74	0.86
Creek	15204	EX0.5yr	400.00	504.11	510.70		510.99	0.002399	4.30	92.94	27.91	0.42
Creek	15204	EX1yr	560.00	504.11	511.32		511.71	0.002776	5.03	113.45	44.50	0.46
Creek	15204	EX2yr	745.00	504.11	511.86		512.35	0.003006	5.71	143.86	69.37	0.49
Creek	15204	EX5yr	1110.00	504.11	512.43		513.15	0.003898	7.08	190.38	89.84	0.57
Creek	15204	EX10yr	1350.00	504.11	512.80		513.60	0.004103	7.62	224.93	98.22	0.59
Creek	15204	EX25yr	1605.00	504.11	513.19		514.03	0.004091	7.98	264.53	105.73	0.59
Creek	15204	EX50yr	1915.00	504.11	513.63		514.50	0.004001	8.30	312.82	114.05	0.59
Creek	15204	EX100yr	2225.00	504.11	514.00	513.39	514.91	0.003997	8.63	356.82	121.38	0.60
Creek	15204	EX500yr	2945.00	504.11	514.75	514.01	515.73	0.003992	9.28	453.21	135.86	0.61
Creek	15204	ULT2yr	845.00	504.11	512.02		512.59	0.003315	6.16	156.07	76.78	0.51
Creek	15204	ULT5yr	1250.00	504.11	512.65		513.42	0.004029	7.41	210.74	95.38	0.58
Creek	15204	ULT10yr	1505.00	504.11	513.04		513.87	0.004103	7.85	249.03	102.86	0.59
Creek	15204	ULT25yr	1835.00	504.11	513.51		514.38	0.004040	8.24	299.99	111.97	0.60
Creek	15204	ULT50yr	2165.00	504.11	513.95	513.31	514.84	0.003934	8.52	350.68	120.12	0.59
Creek	15204	ULT100yr	2485.00	504.11	514.30	513.68	515.23	0.003973	8.87	394.35	128.61	0.60
Creek	15204	ULT500yr	3230.00	504.11	515.00	514.33	516.01	0.004014	9.52	487.31	139.40	0.62
Creek	15090	EX0.5yr	400.00	504.67	510.40		510.72	0.002226	4.56	91.96	43.55	0.40
Creek	15090	EX1yr	560.00	504.67	511.00		511.41	0.002469	5.27	124.45	63.47	0.43
Creek	15090	EX2yr	745.00	504.67	511.56		512.03	0.002560	5.80	164.18	78.54	0.45
Creek	15090	EX5yr	1110.00	504.67	511.98		512.71	0.003862	7.50	199.10	89.82	0.56
Creek	15090	EX10yr	1350.00	504.67	512.23	511.80	513.11	0.004516	8.35	222.36	94.36	0.61
Creek	15090	EX25yr	1605.00	504.67	512.45	512.24	513.49	0.005216	9.20	243.45	97.55	0.66
Creek	15090	EX50yr	1915.00	504.67	512.68	512.61	513.92	0.006050	10.16	266.42	101.08	0.71
Creek	15090	EX100yr	2225.00	504.67	512.96	512.96	514.31	0.006438	10.79	295.17	105.32	0.74
Creek	15090	EX500yr	2945.00	504.67	513.60	513.60	515.11	0.006773	11.77	365.40	114.94	0.77
Creek	15090	ULT2yr	845.00	504.67	511.69		512.23	0.002919	6.29	174.47	82.01	0.48
Creek	15090	ULT5yr	1250.00	504.67	512.14		512.96	0.004230	7.99	213.54	93.01	0.59
Creek	15090	ULT10yr	1505.00	504.67	512.37	512.10	513.35	0.004949	8.88	235.33	96.31	0.64
Creek	15090	ULT25yr	1835.00	504.67	512.63	512.52	513.81	0.005824	9.91	260.99	100.25	0.70
Creek	15090	ULT50yr	2165.00	504.67	512.87	512.87	514.24	0.006562	10.79	285.99	103.99	0.75
Creek	15090	ULT100yr	2485.00	504.67	513.16	513.16	514.62	0.006837	11.33	315.99	108.30	0.77
Creek	15090	ULT500yr	3230.00	504.67	513.85	513.85	515.39	0.006720	12.00	395.07	118.32	0.78
Creek	15006	EX0.5yr	400.00	505.31	510.00		510.45	0.004506	5.43	77.81	36.44	0.56
Creek	15006	EX1yr	560.00	505.31	510.56		511.12	0.004738	6.13	100.26	43.28	0.59
Creek	15006	EX2yr	745.00	505.31	511.28	510.28	511.77	0.003636	6.01	166.26	129.02	0.53
Creek	15006	EX5yr	1110.00	505.31	511.64	511.51	512.33	0.004966	7.45	213.90	135.12	0.63
Creek	15006	EX10yr	1350.00	505.31	511.96	511.80	512.66	0.004859	7.73	258.10	140.19	0.63
Creek	15006	EX25yr	1605.00	505.31	512.23	512.00	512.96	0.005006	8.14	295.77	145.41	0.65
Creek	15006	EX50yr	1915.00	505.31	512.54		513.30	0.004987	8.47	342.48	151.36	0.65
Creek	15006	EX100yr	2225.00	505.31	512.87		513.63	0.004770	8.62	392.96	158.06	0.65
Creek	15006	EX500yr	2945.00	505.31	513.57		514.31	0.004245	8.80	507.58	168.89	0.62
Creek	15006	ULT2yr	845.00	505.31	511.20	510.56	511.89	0.005229	7.11	155.70	127.42	0.64
Creek	15006	ULT5yr	1250.00	505.31	511.85	511.68	512.53	0.004773	7.54	243.05	138.49	0.62
Creek	15006	ULT10yr	1505.00	505.31	512.12	511.96	512.85	0.004987	8.00	280.45	143.24	0.64
Creek	15006	ULT25yr	1835.00	505.31	512.47		513.22	0.004958	8.36	331.60	149.91	0.65
Creek	15006	ULT50yr	2165.00	505.31	512.81		513.57	0.004795	8.58	383.78	156.86	0.65
Creek	15006	ULT100yr	2485.00	505.31	513.14		513.89	0.004544	8.68	435.97	162.75	0.63
Creek	15006	ULT500yr	3230.00	505.31	513.81		514.56	0.004124	8.90	548.09	171.08	0.62
Creek	14918	EX0.5yr	400.00	504.91	509.62	508.39	510.06	0.004200	5.35	74.81	25.35	0.55
Creek	14918	EX1yr	560.00	504.91	509.88	509.02	510.61	0.006538	6.86	81.61	26.47	0.69
Creek	14918	EX2yr	745.00	504.91	510.03	509.61	511.20	0.010169	8.71	87.18	95.66	0.86
Creek	14918	EX5yr	1110.00	504.91	510.96	510.96	511.83	0.006334	8.17	186.72	115.15	0.71
Creek	14918	EX10yr	1350.00	504.91	511.28	511.24	512.17	0.006198	8.50	224.87	122.01	0.71
Creek	14918	EX25yr	1605.00	504.91	511.69	511.52	512.51	0.005436	8.44	277.03	135.49	0.68
Creek	14918	EX50yr	1915.00	504.91	512.13		512.89	0.004785	8.39	339.54	149.35	0.64
Creek	14918	EX100yr	2225.00	504.91	512.51		513.23	0.004345	8.37	397.34	157.15	0.62
Creek	14918	EX500yr	2945.00	504.91	513.27		513.97	0.003705	8.42	522.00	166.94	0.59
Creek	14918	ULT2yr	845.00	504.91	510.58	510.58	511.39	0.006190	7.57	144.05	108.28	0.69
Creek	14918	ULT5yr	1250.00	504.91	511.13	511.13	512.03	0.006444	8.47	206.48	118.68	0.72
Creek	14918	ULT10yr	1505.00	504.91	511.54	511.39	512.38	0.005685	8.45	256.85	129.97	0.69
Creek	14918	ULT25yr	1835.00	504.91	512.01		512.80	0.005004	8.45	322.17	146.93	0.66
Creek	14918	ULT50yr	2165.00	504.91	512.44		513.17	0.004385	8.35	387.49	155.84	0.62
Creek	14918	ULT100yr	2485.00	504.91	512.81		513.51	0.004021	8.34	445.80	161.61	0.60
Creek	14918	ULT500yr	3230.00	504.91	513.52		514.22	0.003630	8.54	562.97	169.63	0.58
Creek	14799	EX0.5yr	400.00	504.00	509.70	507.91	509.79	0.000799	2.78	200.55	112.35	0.25
Creek	14799	EX1yr	560.00	504.00	510.07	508.29	510.19	0.001103	3.46	245.53	139.23	0.29
Creek	14799	EX2yr	745.00	504.00	510.46	508.65	510.60	0.001235	3.88	303.46	161.20	0.31
Creek	14799	EX5yr	1110.00	504.00	511.15	509.22	511.30	0.001251	4.28	429.23	187.34	0.32
Creek	14799	EX10yr	1350.00	504.00	511.56	509.64	511.71	0.001138	4.28	507.14	189.17	0.31
Creek	14799	EX25yr	1605.00	504.00	511.94	509.93	512.10	0.001084	4.36	579.05	190.93	0.31
Creek	14799	EX50yr	1915.00	504.00	512.34	510.00	512.51	0.001059	4.49	655.90	192.80	0.31
Creek	14799	EX100yr	2225.00	504.00	512.70	510.48	512.87	0.001056	4.65	724.61	194.43	0.31
Creek	14799	EX500yr	2945.00	504.00	513.43	511.26	513.64	0.001061	4.98	868.84	198.09	0.32
Creek	14799	ULT2yr	845.00	504.00	510.66	508.82	510.82	0.001409	4.26	337.65	183.57	0.34
Creek	14799	ULT5yr	1250.00	504.00	511.39	509.48	511.55	0.001181	4.28	475.27	188.42	0.32

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	14799	ULT10yr	1505.00	504.00	511.80	509.86	511.95	0.001100	4.32	551.85	190.25	0.31
Creek	14799	ULT25yr	1835.00	504.00	512.24	510.00	512.41	0.001064	4.46	636.83	192.35	0.31
Creek	14799	ULT50yr	2165.00	504.00	512.64	510.48	512.81	0.001051	4.61	712.77	194.15	0.31
Creek	14799	ULT100yr	2485.00	504.00	512.98	510.48	513.17	0.001049	4.76	780.54	195.84	0.31
Creek	14799	ULT500yr	3230.00	504.00	513.67	511.38	513.89	0.001088	5.15	916.53	199.99	0.32
Creek	14676	EX0.5yr	400.00	503.09	509.44		509.65	0.001448	3.87	129.67	71.18	0.33
Creek	14676	EX1yr	560.00	503.09	509.65		509.99	0.002238	4.97	145.56	77.16	0.41
Creek	14676	EX2yr	745.00	503.09	509.85		510.34	0.003184	6.11	161.60	82.76	0.50
Creek	14676	EX5yr	1110.00	503.09	510.15	509.87	510.97	0.005166	8.11	187.13	90.81	0.64
Creek	14676	EX10yr	1350.00	503.09	510.32	510.27	511.36	0.006401	9.23	202.92	95.38	0.72
Creek	14676	EX25yr	1605.00	503.09	510.61	510.61	511.74	0.006720	9.81	231.58	102.33	0.74
Creek	14676	EX50yr	1915.00	503.09	510.94	510.94	512.15	0.006903	10.34	266.51	109.57	0.76
Creek	14676	EX100yr	2225.00	503.09	511.26	511.26	512.52	0.006870	10.70	303.28	116.86	0.76
Creek	14676	EX500yr	2945.00	503.09	511.84	511.84	513.27	0.007258	11.69	376.20	134.06	0.80
Creek	14676	ULT2yr	845.00	503.09	509.95		510.52	0.003713	6.68	169.32	85.32	0.54
Creek	14676	ULT5yr	1250.00	503.09	510.24	510.10	511.20	0.005940	8.80	195.72	93.32	0.69
Creek	14676	ULT10yr	1505.00	503.09	510.51	510.51	511.60	0.006557	9.57	221.29	100.10	0.73
Creek	14676	ULT25yr	1835.00	503.09	510.86	510.86	512.05	0.006857	10.21	257.70	107.78	0.76
Creek	14676	ULT50yr	2165.00	503.09	511.17	511.17	512.45	0.007058	10.74	293.03	114.89	0.77
Creek	14676	ULT100yr	2485.00	503.09	511.45	511.45	512.80	0.007217	11.19	326.19	122.03	0.79
Creek	14676	ULT500yr	3230.00	503.09	512.17	512.07	513.53	0.006695	11.59	421.49	145.47	0.77
Creek	14557	EX0.5yr	400.00	502.50	509.48	505.70	509.51	0.000186	1.57	284.54	135.90	0.15
Creek	14557	EX1yr	560.00	502.50	509.72	506.17	509.78	0.000284	2.02	317.78	142.54	0.18
Creek	14557	EX2yr	745.00	502.50	509.95	506.66	510.04	0.000397	2.49	352.04	149.07	0.22
Creek	14557	EX5yr	1110.00	502.50	510.32	507.42	510.47	0.000616	3.29	408.53	154.58	0.27
Creek	14557	EX10yr	1350.00	502.50	510.54	507.86	510.74	0.000745	3.73	443.27	157.51	0.30
Creek	14557	EX25yr	1605.00	502.50	510.75	508.25	510.99	0.000879	4.18	476.16	160.23	0.33
Creek	14557	EX50yr	1915.00	502.50	510.98	508.69	511.28	0.001032	4.67	513.59	163.28	0.36
Creek	14557	EX100yr	2225.00	502.50	511.19	509.34	511.54	0.001177	5.12	548.28	165.96	0.39
Creek	14557	EX500yr	2945.00	502.50	511.75	509.97	512.20	0.001360	5.88	642.95	173.05	0.43
Creek	14557	ULT2yr	845.00	502.50	510.06	506.87	510.17	0.000458	2.72	368.82	151.15	0.23
Creek	14557	ULT5yr	1250.00	502.50	510.45	507.68	510.63	0.000696	3.56	428.11	156.24	0.29
Creek	14557	ULT10yr	1505.00	502.50	510.67	508.10	510.89	0.000827	4.01	463.55	159.19	0.32
Creek	14557	ULT25yr	1835.00	502.50	510.92	508.57	511.20	0.000995	4.55	503.91	162.50	0.36
Creek	14557	ULT50yr	2165.00	502.50	511.15	509.25	511.49	0.001150	5.03	541.80	165.46	0.39
Creek	14557	ULT100yr	2485.00	502.50	511.36	509.58	511.76	0.001293	5.47	575.87	168.06	0.41
Creek	14557	ULT500yr	3230.00	502.50	512.39	510.18	512.78	0.001073	5.59	755.85	183.21	0.39
Creek	14536		Culvert									
Creek	14515	EX0.5yr	400.00	502.16	506.11	503.48	506.15	0.000051	1.66	240.95	79.57	0.17
Creek	14515	EX1yr	560.00	502.16	506.54	503.80	506.61	0.000067	2.03	276.11	82.68	0.20
Creek	14515	EX2yr	745.00	502.16	506.99	504.13	507.08	0.000082	2.37	314.12	85.58	0.22
Creek	14515	EX5yr	1110.00	502.16	507.91	504.72	508.03	0.000092	2.81	395.29	90.58	0.24
Creek	14515	EX10yr	1350.00	502.16	508.47	505.03	508.62	0.000092	3.02	446.39	91.34	0.24
Creek	14515	EX25yr	1605.00	502.16	509.02	505.33	509.18	0.000093	3.23	496.15	92.08	0.25
Creek	14515	EX50yr	1915.00	502.16	509.50	505.65	509.69	0.000101	3.54	540.97	94.51	0.26
Creek	14515	EX100yr	2225.00	502.16	510.06	505.97	510.28	0.000100	3.75	597.70	128.39	0.26
Creek	14515	EX500yr	2945.00	502.16	511.61	506.62	511.86	0.000084	3.97	804.50	192.56	0.25
Creek	14515	ULT2yr	845.00	502.16	507.16	504.30	507.27	0.000092	2.57	328.63	86.68	0.23
Creek	14515	ULT5yr	1250.00	502.16	508.20	504.91	508.34	0.000095	2.96	421.60	90.97	0.24
Creek	14515	ULT10yr	1505.00	502.16	508.86	505.21	509.01	0.000090	3.12	481.67	91.87	0.24
Creek	14515	ULT25yr	1835.00	502.16	509.45	505.58	509.63	0.000095	3.42	536.39	93.99	0.25
Creek	14515	ULT50yr	2165.00	502.16	509.97	505.91	510.18	0.000100	3.71	587.00	120.90	0.26
Creek	14515	ULT100yr	2485.00	502.16	510.53	506.20	510.77	0.000098	3.90	653.24	149.47	0.26
Creek	14515	ULT500yr	3230.00	502.16	512.40	506.85	512.63	0.000072	3.93	931.60	208.73	0.23
Creek	14463	EX0.5yr	400.00	501.64	506.09	502.99	506.14	0.000029	1.93	263.80	60.20	0.16
Creek	14463	EX1yr	560.00	501.64	506.50	503.32	506.59	0.000043	2.48	288.57	60.27	0.20
Creek	14463	EX2yr	745.00	501.64	506.92	503.66	507.06	0.000058	3.04	313.79	60.34	0.24
Creek	14463	EX5yr	1110.00	501.64	507.72	504.37	507.99	0.000082	4.11	362.63	60.48	0.30
Creek	14463	EX10yr	1350.00	501.64	508.21	504.77	508.55	0.000096	4.70	391.81	60.56	0.33
Creek	14463	EX25yr	1605.00	501.64	508.67	505.16	509.09	0.000109	5.24	419.62	60.64	0.35
Creek	14463	EX50yr	1915.00	501.64	509.08	505.53	509.59	0.000130	5.75	444.66	60.71	0.37
Creek	14463	EX100yr	2225.00	501.64	509.54	505.93	510.15	0.000146	6.29	472.65	60.79	0.40
Creek	14463	EX500yr	2945.00	501.64	510.88	506.84	511.68	0.000158	7.19	554.05	61.02	0.42
Creek	14463	ULT2yr	845.00	501.64	507.08	503.81	507.24	0.000068	3.26	323.45	60.36	0.25
Creek	14463	ULT5yr	1250.00	501.64	507.98	504.57	508.28	0.000092	4.43	377.86	60.52	0.31
Creek	14463	ULT10yr	1505.00	501.64	508.53	505.05	508.93	0.000102	5.08	411.27	60.61	0.34
Creek	14463	ULT25yr	1835.00	501.64	509.03	505.48	509.53	0.000122	5.68	441.57	60.70	0.37
Creek	14463	ULT50yr	2165.00	501.64	509.46	505.87	510.06	0.000143	6.20	467.76	60.77	0.39
Creek	14463	ULT100yr	2485.00	501.64	509.92	506.27	510.62	0.000158	6.73	495.64	60.85	0.42
Creek	14463	ULT500yr	3230.00	501.64	511.58	507.25	512.44	0.000152	7.45	596.85	61.14	0.42
Creek	14399 Carrier Parkway		Culvert									
Creek	14336	EX0.5yr	510.00	501.32	506.05	502.70	506.10	0.000440	1.76	289.33	63.06	0.15
Creek	14336	EX1yr	715.00	501.32	506.44	503.03	506.52	0.000669	2.28	313.81	63.15	0.18
Creek	14336	EX2yr	955.00	501.32	506.83	503.37	506.95	0.000943	2.82	338.24	63.24	0.22

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	14336	EX5yr	1490.00	501.32	507.55	504.04	507.79	0.001540	3.88	384.35	63.41	0.28
Creek	14336	EX10yr	1840.00	501.32	507.96	504.43	508.28	0.001915	4.48	410.44	63.51	0.31
Creek	14336	EX25yr	2200.00	501.32	508.35	504.81	508.75	0.002285	5.06	435.09	63.60	0.34
Creek	14336	EX50yr	2555.00	501.32	508.69	505.17	509.17	0.002659	5.60	456.41	63.68	0.37
Creek	14336	EX100yr	2975.00	501.32	509.05	505.55	509.65	0.003098	6.21	479.41	63.77	0.40
Creek	14336	EX500yr	3985.00	501.32	509.81	506.46	510.69	0.004136	7.55	528.00	63.95	0.46
Creek	14336	ULT2yr	1055.00	501.32	506.97	503.50	507.11	0.001058	3.04	347.48	63.28	0.23
Creek	14336	ULT5yr	1675.00	501.32	507.78	504.25	508.05	0.001740	4.20	398.40	63.47	0.30
Creek	14336	ULT10yr	2090.00	501.32	508.24	504.70	508.61	0.002173	4.89	427.75	63.58	0.33
Creek	14336	ULT25yr	2510.00	501.32	508.65	505.12	509.12	0.002611	5.53	453.82	63.67	0.37
Creek	14336	ULT50yr	2900.00	501.32	508.99	505.49	509.56	0.003020	6.10	475.46	63.75	0.39
Creek	14336	ULT100yr	3335.00	501.32	509.33	505.88	510.03	0.003476	6.70	497.49	63.84	0.42
Creek	14336	ULT500yr	4445.00	501.32	510.11	506.84	511.14	0.004612	8.12	547.33	64.02	0.49
Creek	14305	EX0.5yr	510.00	501.46	506.05	502.86	506.08	0.000251	1.27	410.51	156.98	0.11
Creek	14305	EX1yr	715.00	501.46	506.44	503.11	506.48	0.000354	1.61	458.16	182.08	0.14
Creek	14305	EX2yr	955.00	501.46	506.84	503.39	506.90	0.000466	1.95	507.44	248.91	0.16
Creek	14305	EX5yr	1490.00	501.46	507.59	503.93	507.69	0.000674	2.60	601.99	336.96	0.20
Creek	14305	EX10yr	1840.00	501.46	508.02	504.25	508.15	0.000788	2.96	656.11	340.99	0.22
Creek	14305	EX25yr	2200.00	501.46	508.43	504.55	508.59	0.000891	3.29	707.68	345.55	0.23
Creek	14305	EX50yr	2555.00	501.46	508.79	504.83	508.98	0.000989	3.60	752.85	349.15	0.25
Creek	14305	EX100yr	2975.00	501.46	509.18	505.14	509.41	0.001098	3.94	802.15	353.14	0.26
Creek	14305	EX500yr	3985.00	501.46	510.02	505.82	510.35	0.001328	4.67	908.47	363.77	0.29
Creek	14305	ULT2yr	1055.00	501.46	506.99	503.49	507.05	0.000509	2.09	526.29	305.84	0.17
Creek	14305	ULT5yr	1675.00	501.46	507.82	504.11	507.94	0.000737	2.79	631.08	339.13	0.21
Creek	14305	ULT10yr	2090.00	501.46	508.31	504.46	508.46	0.000861	3.19	692.28	343.71	0.23
Creek	14305	ULT25yr	2510.00	501.46	508.74	504.81	508.93	0.000977	3.56	747.34	348.75	0.25
Creek	14305	ULT50yr	2900.00	501.46	509.11	505.08	509.34	0.001079	3.88	793.64	352.40	0.26
Creek	14305	ULT100yr	3335.00	501.46	509.49	505.39	509.75	0.001187	4.22	841.41	356.89	0.27
Creek	14305	ULT500yr	4445.00	501.46	510.37	506.10	510.73	0.001424	4.98	951.84	370.84	0.31
Creek	14239	EX0.5yr	510.00	503.00	505.96	504.35	506.04	0.001412	2.28	240.80	227.57	0.25
Creek	14239	EX1yr	715.00	503.00	506.32	504.65	506.43	0.001702	2.73	297.23	280.10	0.29
Creek	14239	EX2yr	955.00	503.00	506.69	504.95	506.83	0.001932	3.16	356.15	285.94	0.31
Creek	14239	EX5yr	1490.00	503.00	507.40	505.59	507.61	0.002217	3.86	470.38	299.23	0.34
Creek	14239	EX10yr	1840.00	503.00	507.81	505.91	508.06	0.002322	4.22	536.71	308.02	0.36
Creek	14239	EX25yr	2200.00	503.00	508.21	506.27	508.49	0.002392	4.54	600.60	316.68	0.37
Creek	14239	EX50yr	2555.00	503.00	508.55	506.54	508.87	0.002480	4.85	656.29	325.92	0.38
Creek	14239	EX100yr	2975.00	503.00	508.93	506.81	509.29	0.002575	5.18	717.28	336.07	0.39
Creek	14239	EX500yr	3985.00	503.00	509.75	507.39	510.21	0.002754	5.89	849.85	359.76	0.41
Creek	14239	ULT2yr	1055.00	503.00	506.83	505.07	506.99	0.002008	3.31	378.65	288.21	0.32
Creek	14239	ULT5yr	1675.00	503.00	507.62	505.76	507.85	0.002280	4.06	505.93	303.97	0.35
Creek	14239	ULT10yr	2090.00	503.00	508.09	506.16	508.36	0.002374	4.45	581.45	313.92	0.36
Creek	14239	ULT25yr	2510.00	503.00	508.51	506.51	508.82	0.002469	4.81	649.50	324.79	0.38
Creek	14239	ULT50yr	2900.00	503.00	508.87	506.77	509.22	0.002559	5.12	706.74	334.32	0.39
Creek	14239	ULT100yr	3335.00	503.00	509.23	507.03	509.63	0.002652	5.45	765.95	346.51	0.40
Creek	14239	ULT500yr	4445.00	503.00	510.09	507.63	510.59	0.002830	6.18	904.13	366.63	0.42
Creek	14134	EX0.5yr	510.00	501.00	505.47		505.76	0.006749	4.91	187.51	209.48	0.54
Creek	14134	EX1yr	715.00	501.00	505.94		506.17	0.005103	4.78	294.80	246.79	0.49
Creek	14134	EX2yr	955.00	501.00	506.38		506.58	0.004133	4.72	407.24	253.63	0.45
Creek	14134	EX5yr	1490.00	501.00	507.18		507.37	0.003315	4.85	613.91	263.12	0.41
Creek	14134	EX10yr	1840.00	501.00	507.62		507.81	0.003087	5.00	731.23	268.98	0.41
Creek	14134	EX25yr	2200.00	501.00	508.05		508.24	0.002896	5.13	846.56	274.10	0.40
Creek	14134	EX50yr	2555.00	501.00	508.42		508.62	0.002814	5.30	947.79	278.59	0.40
Creek	14134	EX100yr	2975.00	501.00	508.82		509.03	0.002750	5.49	1060.37	283.49	0.40
Creek	14134	EX500yr	3985.00	501.00	509.69		509.92	0.002668	5.93	1318.87	313.96	0.40
Creek	14134	ULT2yr	1055.00	501.00	506.55		506.74	0.003916	4.73	448.56	255.41	0.44
Creek	14134	ULT5yr	1675.00	501.00	507.42		507.61	0.003190	4.94	676.42	266.26	0.41
Creek	14134	ULT10yr	2090.00	501.00	507.92		508.11	0.002951	5.09	811.80	272.61	0.40
Creek	14134	ULT25yr	2510.00	501.00	508.37		508.57	0.002822	5.28	935.39	278.04	0.40
Creek	14134	ULT50yr	2900.00	501.00	508.75		508.96	0.002760	5.46	1040.76	282.64	0.40
Creek	14134	ULT100yr	3335.00	501.00	509.14		509.36	0.002716	5.65	1151.87	291.26	0.40
Creek	14134	ULT500yr	4445.00	501.00	510.03		510.29	0.002820	6.30	1428.33	325.22	0.42
Creek	14069	EX0.5yr	510.00	500.79	505.19		505.47	0.003656	4.64	185.59	174.76	0.43
Creek	14069	EX1yr	715.00	500.79	505.61		505.92	0.003896	5.14	260.53	185.26	0.45
Creek	14069	EX2yr	955.00	500.79	506.03		506.36	0.003945	5.53	342.66	198.86	0.46
Creek	14069	EX5yr	1490.00	500.79	506.84		507.18	0.003847	6.09	513.29	225.49	0.47
Creek	14069	EX10yr	1840.00	500.79	507.30		507.64	0.003667	6.29	619.28	233.97	0.46
Creek	14069	EX25yr	2200.00	500.79	507.73		508.07	0.003592	6.53	722.31	247.48	0.46
Creek	14069	EX50yr	2555.00	500.79	508.09		508.45	0.003572	6.76	815.54	258.06	0.46
Creek	14069	EX100yr	2975.00	500.79	508.50		508.87	0.003497	6.96	922.91	266.07	0.46
Creek	14069	EX500yr	3985.00	500.79	509.40		509.78	0.003320	7.35	1168.17	281.19	0.46
Creek	14069	ULT2yr	1055.00	500.79	506.20		506.53	0.003920	5.65	375.50	202.21	0.46
Creek	14069	ULT5yr	1675.00	500.79	507.08		507.42	0.003757	6.20	569.49	230.05	0.46
Creek	14069	ULT10yr	2090.00	500.79	507.60		507.94	0.003605	6.45	691.18	242.67	0.46
Creek	14069	ULT25yr	2510.00	500.79	508.05		508.40	0.003580	6.74	803.78	257.15	0.46
Creek	14069	ULT50yr	2900.00	500.79	508.43		508.80	0.003506	6.93	904.28	264.55	0.46
Creek	14069	ULT100yr	3335.00	500.79	508.83		509.20	0.003456	7.14	1010.60	272.69	0.46
Creek	14069	ULT500yr	4445.00	500.79	509.75		510.14	0.003293	7.54	1268.18	286.46	0.46

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	13959	EX0.5yr	510.00	501.00	504.69		504.95	0.007412	4.86	175.65	133.96	0.57
Creek	13959	EX1yr	715.00	501.00	505.16		505.41	0.006314	5.07	239.29	140.85	0.54
Creek	13959	EX2yr	955.00	501.00	505.61		505.88	0.005795	5.37	304.00	147.58	0.53
Creek	13959	EX5yr	1490.00	501.00	506.41		506.74	0.005427	6.04	428.24	160.94	0.53
Creek	13959	EX10yr	1840.00	501.00	506.86		507.22	0.005346	6.43	501.64	169.00	0.54
Creek	13959	EX25yr	2200.00	501.00	507.27		507.66	0.005280	6.78	572.62	175.59	0.54
Creek	13959	EX50yr	2555.00	501.00	507.60		508.04	0.005406	7.17	632.38	181.11	0.55
Creek	13959	EX100yr	2975.00	501.00	507.98		508.45	0.005514	7.58	701.09	187.58	0.57
Creek	13959	EX500yr	3985.00	501.00	508.77		509.36	0.005848	8.54	860.10	221.32	0.60
Creek	13959	ULT2yr	1055.00	501.00	505.77		506.06	0.005679	5.50	328.85	150.21	0.53
Creek	13959	ULT5yr	1675.00	501.00	506.65		507.00	0.005381	6.25	467.51	165.30	0.53
Creek	13959	ULT10yr	2090.00	501.00	507.15		507.53	0.005302	6.68	551.16	173.62	0.54
Creek	13959	ULT25yr	2510.00	501.00	507.56		507.99	0.005392	7.12	624.88	180.41	0.55
Creek	13959	ULT50yr	2900.00	501.00	507.91		508.38	0.005494	7.51	689.14	186.46	0.56
Creek	13959	ULT100yr	3335.00	501.00	508.27		508.78	0.005608	7.92	757.35	193.01	0.58
Creek	13959	ULT500yr	4445.00	501.00	509.10		509.72	0.005842	8.83	935.19	228.73	0.60
Creek	13807	EX0.5yr	510.00	499.00	504.16		504.31	0.002830	3.75	241.49	136.54	0.36
Creek	13807	EX1yr	715.00	499.00	504.64		504.81	0.002968	4.20	309.56	147.50	0.38
Creek	13807	EX2yr	955.00	499.00	505.09		505.29	0.003113	4.64	377.96	154.40	0.40
Creek	13807	EX5yr	1490.00	499.00	505.89		506.14	0.003391	5.43	505.01	162.69	0.43
Creek	13807	EX10yr	1840.00	499.00	506.33		506.61	0.003555	5.88	577.00	167.33	0.44
Creek	13807	EX25yr	2200.00	499.00	506.73		507.05	0.003709	6.29	645.29	171.98	0.46
Creek	13807	EX50yr	2555.00	499.00	507.03		507.40	0.004010	6.76	697.72	175.32	0.48
Creek	13807	EX100yr	2975.00	499.00	507.38		507.79	0.004289	7.25	758.47	178.94	0.50
Creek	13807	EX500yr	3985.00	499.00	508.11		508.63	0.004886	8.30	892.41	189.74	0.54
Creek	13807	ULT2yr	1055.00	499.00	505.26		505.46	0.003170	4.80	403.86	156.39	0.40
Creek	13807	ULT5yr	1675.00	499.00	506.13		506.40	0.003480	5.67	543.76	165.06	0.43
Creek	13807	ULT10yr	2090.00	499.00	506.61		506.92	0.003670	6.17	624.59	170.61	0.45
Creek	13807	ULT25yr	2510.00	499.00	507.00		507.35	0.003978	6.71	691.05	174.97	0.48
Creek	13807	ULT50yr	2900.00	499.00	507.32		507.72	0.004239	7.17	747.94	178.26	0.50
Creek	13807	ULT100yr	3335.00	499.00	507.65		508.10	0.004523	7.65	807.20	182.05	0.52
Creek	13807	ULT500yr	4445.00	499.00	508.42		508.99	0.005086	8.71	952.06	195.13	0.56
Creek	13659	EX0.5yr	510.00	497.00	503.43		503.73	0.006785	4.69	142.75	111.96	0.53
Creek	13659	EX1yr	715.00	497.00	503.94		504.26	0.005952	4.98	205.23	130.99	0.51
Creek	13659	EX2yr	955.00	497.00	504.40		504.75	0.005655	5.34	269.42	144.58	0.51
Creek	13659	EX5yr	1490.00	497.00	505.16		505.59	0.005682	6.13	385.84	159.11	0.53
Creek	13659	EX10yr	1840.00	497.00	505.58		506.05	0.005735	6.56	453.58	166.51	0.54
Creek	13659	EX25yr	2200.00	497.00	505.96		506.47	0.005833	6.97	517.91	173.67	0.55
Creek	13659	EX50yr	2555.00	497.00	506.15		506.75	0.006671	7.64	551.00	175.99	0.59
Creek	13659	EX100yr	2975.00	497.00	506.39		507.09	0.007370	8.28	594.25	178.53	0.63
Creek	13659	EX500yr	3985.00	497.00	506.85		507.80	0.009282	9.81	676.50	183.31	0.71
Creek	13659	ULT2yr	1055.00	497.00	504.56		504.92	0.005655	5.51	292.63	147.58	0.51
Creek	13659	ULT5yr	1675.00	497.00	505.39		505.83	0.005712	6.36	422.12	163.05	0.53
Creek	13659	ULT10yr	2090.00	497.00	505.84		506.34	0.005832	6.86	497.72	171.45	0.55
Creek	13659	ULT25yr	2510.00	497.00	506.12		506.72	0.006588	7.57	546.30	175.72	0.59
Creek	13659	ULT50yr	2900.00	497.00	506.35		507.03	0.007239	8.17	587.05	178.11	0.62
Creek	13659	ULT100yr	3335.00	497.00	506.56		507.35	0.008071	8.85	624.97	180.22	0.66
Creek	13659	ULT500yr	4445.00	497.00	507.05		508.11	0.009957	10.39	714.43	185.92	0.74
Creek	13545	EX0.5yr	510.00	497.14	503.19	501.58	503.33	0.001961	3.44	223.63	124.94	0.31
Creek	13545	EX1yr	715.00	497.14	503.73	502.41	503.88	0.001957	3.75	293.96	135.75	0.31
Creek	13545	EX2yr	955.00	497.14	504.20	502.75	504.37	0.002070	4.12	358.92	145.29	0.33
Creek	13545	EX5yr	1490.00	497.14	504.96	503.42	505.18	0.002334	4.82	476.73	162.76	0.36
Creek	13545	EX10yr	1840.00	497.14	505.38	503.73	505.63	0.002451	5.18	548.48	181.09	0.37
Creek	13545	EX25yr	2200.00	497.14	505.77	504.06	506.04	0.002526	5.48	622.14	200.46	0.38
Creek	13545	EX50yr	2555.00	497.14	506.07	504.30	506.29	0.002235	5.31	831.73	449.69	0.36
Creek	13545	EX100yr	2975.00	497.14	506.40	504.57	506.61	0.002045	5.24	981.78	457.47	0.35
Creek	13545	EX500yr	3985.00	497.14	507.05	505.13	507.25	0.001778	5.19	1286.46	470.88	0.33
Creek	13545	ULT2yr	1055.00	497.14	504.35	502.89	504.53	0.002133	4.27	382.11	148.89	0.33
Creek	13545	ULT5yr	1675.00	497.14	505.19	503.58	505.42	0.002407	5.02	514.26	172.25	0.36
Creek	13545	ULT10yr	2090.00	497.14	505.64	503.93	505.91	0.002522	5.40	598.16	193.39	0.38
Creek	13545	ULT25yr	2510.00	497.14	506.03	504.27	506.26	0.002251	5.31	815.94	448.82	0.36
Creek	13545	ULT50yr	2900.00	497.14	506.34	504.52	506.55	0.002073	5.25	956.55	456.27	0.35
Creek	13545	ULT100yr	3335.00	497.14	506.64	504.79	506.84	0.001948	5.23	1093.55	463.81	0.34
Creek	13545	ULT500yr	4445.00	497.14	507.35	505.42	507.54	0.001641	5.11	1426.63	475.03	0.32
Creek	13288	EX0.5yr	510.00	496.27	500.86	500.77	502.04	0.021410	8.75	60.47	28.81	0.93
Creek	13288	EX1yr	715.00	496.27	502.02	502.02	502.85	0.010654	7.71	135.52	113.33	0.69
Creek	13288	EX2yr	955.00	496.27	502.49	502.49	503.32	0.010309	8.18	192.58	132.61	0.69
Creek	13288	EX5yr	1490.00	496.27	503.20	503.20	504.08	0.010312	9.06	295.36	154.09	0.71
Creek	13288	EX10yr	1840.00	496.27	503.49	503.49	504.46	0.011102	9.76	341.99	159.11	0.75
Creek	13288	EX25yr	2200.00	496.27	503.75	503.75	504.82	0.011970	10.46	383.54	163.44	0.78
Creek	13288	EX50yr	2555.00	496.27	504.02	504.02	505.15	0.012310	10.95	428.44	169.56	0.80
Creek	13288	EX100yr	2975.00	496.27	504.28	504.28	505.51	0.012984	11.58	473.68	175.28	0.83
Creek	13288	EX500yr	3985.00	496.27	505.08	504.85	506.29	0.011703	11.92	618.52	191.15	0.80
Creek	13288	ULT2yr	1055.00	496.27	502.66	502.66	503.49	0.009990	8.27	217.02	139.34	0.69
Creek	13288	ULT5yr	1675.00	496.27	503.37	503.37	504.29	0.010636	9.40	322.00	157.02	0.73
Creek	13288	ULT10yr	2090.00	496.27	503.70	503.70	504.72	0.011454	10.17	374.56	162.45	0.76

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	13288	ULT25yr	2510.00	496.27	503.98	503.98	505.11	0.012344	10.92	421.88	168.71	0.80
Creek	13288	ULT50yr	2900.00	496.27	504.23	504.23	505.45	0.012945	11.50	464.71	174.16	0.82
Creek	13288	ULT100yr	3335.00	496.27	504.57	504.50	505.80	0.012547	11.74	524.93	181.04	0.82
Creek	13288	ULT500yr	4445.00	496.27	505.40	505.03	506.63	0.011562	12.22	682.49	203.83	0.80
Creek	13167	EX0.5yr	510.00	495.00	500.96		501.11	0.002274	3.46	229.53	129.96	0.33
Creek	13167	EX1yr	715.00	495.00	501.52		501.68	0.002390	3.71	305.09	138.84	0.34
Creek	13167	EX2yr	955.00	495.00	501.89		502.09	0.002919	4.22	357.74	144.52	0.38
Creek	13167	EX5yr	1490.00	495.00	502.55		502.83	0.003665	5.21	458.92	163.68	0.44
Creek	13167	EX10yr	1840.00	495.00	502.91		503.25	0.004033	5.75	520.23	175.50	0.46
Creek	13167	EX25yr	2200.00	495.00	503.26		503.65	0.004324	6.24	583.24	187.66	0.48
Creek	13167	EX50yr	2555.00	495.00	503.57		504.01	0.004572	6.68	643.46	198.54	0.50
Creek	13167	EX100yr	2975.00	495.00	503.91		504.40	0.004814	7.13	713.04	210.28	0.52
Creek	13167	EX500yr	3985.00	495.00	504.65		505.24	0.005131	7.97	876.35	230.72	0.55
Creek	13167	ULT2yr	1055.00	495.00	502.03		502.24	0.003098	4.41	378.12	147.17	0.39
Creek	13167	ULT5yr	1675.00	495.00	502.75		503.06	0.003863	5.50	491.70	169.94	0.45
Creek	13167	ULT10yr	2090.00	495.00	503.16		503.53	0.004240	6.10	564.09	183.93	0.48
Creek	13167	ULT25yr	2510.00	495.00	503.54		503.97	0.004542	6.62	636.00	197.24	0.50
Creek	13167	ULT50yr	2900.00	495.00	503.85		504.33	0.004775	7.05	700.69	208.25	0.52
Creek	13167	ULT100yr	3335.00	495.00	504.19		504.71	0.004962	7.47	771.98	218.38	0.53
Creek	13167	ULT500yr	4445.00	495.00	504.96		505.58	0.005197	8.28	949.52	239.04	0.56
Creek	13076	EX0.5yr	510.00	495.25	500.42		500.75	0.007613	5.51	158.91	122.03	0.56
Creek	13076	EX1yr	715.00	495.25	501.09	499.67	501.36	0.005473	5.35	273.32	194.10	0.50
Creek	13076	EX2yr	955.00	495.25	501.43		501.73	0.005865	5.88	339.81	203.95	0.52
Creek	13076	EX5yr	1490.00	495.25	502.11		502.43	0.005855	6.53	485.28	223.16	0.53
Creek	13076	EX10yr	1840.00	495.25	502.49		502.83	0.005801	6.86	573.88	235.08	0.54
Creek	13076	EX25yr	2200.00	495.25	502.86		503.21	0.005738	7.14	660.90	245.90	0.54
Creek	13076	EX50yr	2555.00	495.25	503.19		503.55	0.005641	7.37	743.27	253.71	0.54
Creek	13076	EX100yr	2975.00	495.25	503.55		503.92	0.005518	7.59	836.51	260.64	0.54
Creek	13076	EX500yr	3985.00	495.25	504.33		504.73	0.005341	8.09	1045.96	276.80	0.54
Creek	13076	ULT2yr	1055.00	495.25	501.56		501.87	0.005895	6.03	367.98	207.88	0.52
Creek	13076	ULT5yr	1675.00	495.25	502.32		502.65	0.005824	6.71	532.72	229.52	0.54
Creek	13076	ULT10yr	2090.00	495.25	502.75		503.10	0.005758	7.06	634.67	242.71	0.54
Creek	13076	ULT25yr	2510.00	495.25	503.15		503.51	0.005653	7.34	733.14	252.95	0.54
Creek	13076	ULT50yr	2900.00	495.25	503.49		503.86	0.005537	7.55	820.19	259.44	0.54
Creek	13076	ULT100yr	3335.00	495.25	503.84		504.22	0.005455	7.78	912.84	266.83	0.54
Creek	13076	ULT500yr	4445.00	495.25	504.65		505.07	0.005291	8.31	1137.00	284.52	0.55
Creek	12955	EX0.5yr	510.00	495.00	499.78		499.95	0.004706	4.03	177.18	124.25	0.45
Creek	12955	EX1yr	715.00	495.00	500.23		500.54	0.007433	5.50	254.66	208.70	0.57
Creek	12955	EX2yr	955.00	495.00	500.67		500.94	0.005972	5.43	348.85	216.90	0.53
Creek	12955	EX5yr	1490.00	495.00	501.42		501.68	0.005059	5.73	516.89	233.55	0.50
Creek	12955	EX10yr	1840.00	495.00	501.83		502.10	0.004836	5.96	613.35	244.72	0.50
Creek	12955	EX25yr	2200.00	495.00	502.20		502.48	0.004694	6.20	706.41	254.81	0.50
Creek	12955	EX50yr	2555.00	495.00	502.54		502.83	0.004593	6.41	793.79	263.44	0.50
Creek	12955	EX100yr	2975.00	495.00	502.90		503.22	0.004529	6.67	892.31	273.31	0.50
Creek	12955	EX500yr	3985.00	495.00	503.70		504.04	0.004335	7.14	1117.38	289.87	0.50
Creek	12955	ULT2yr	1055.00	495.00	500.83		501.09	0.005667	5.46	383.58	219.84	0.52
Creek	12955	ULT5yr	1675.00	495.00	501.64		501.91	0.004922	5.85	568.94	239.54	0.50
Creek	12955	ULT10yr	2090.00	495.00	502.09		502.37	0.004734	6.13	678.44	251.99	0.50
Creek	12955	ULT25yr	2510.00	495.00	502.50		502.79	0.004601	6.39	783.17	262.40	0.50
Creek	12955	ULT50yr	2900.00	495.00	502.84		503.15	0.004538	6.62	875.04	271.58	0.50
Creek	12955	ULT100yr	3335.00	495.00	503.20		503.52	0.004465	6.85	973.97	280.08	0.50
Creek	12955	ULT500yr	4445.00	495.00	504.03		504.39	0.004270	7.33	1214.42	296.27	0.50
Creek	12873	EX0.5yr	510.00	494.00	499.72		499.82	0.001004	2.65	280.13	178.58	0.22
Creek	12873	EX1yr	715.00	494.00	500.19		500.32	0.001319	3.25	371.76	218.78	0.26
Creek	12873	EX2yr	955.00	494.00	500.59		500.75	0.001511	3.68	462.23	225.58	0.28
Creek	12873	EX5yr	1490.00	494.00	501.31		501.52	0.001834	4.41	629.31	238.45	0.32
Creek	12873	EX10yr	1840.00	494.00	501.71		501.94	0.001990	4.80	724.68	245.17	0.34
Creek	12873	EX25yr	2200.00	494.00	502.07		502.33	0.002124	5.15	815.30	251.46	0.35
Creek	12873	EX50yr	2555.00	494.00	502.41		502.68	0.002235	5.45	899.90	257.99	0.36
Creek	12873	EX100yr	2975.00	494.00	502.77		503.07	0.002351	5.78	994.47	265.44	0.37
Creek	12873	EX500yr	3985.00	494.00	503.55		503.90	0.002517	6.40	1207.73	276.23	0.39
Creek	12873	ULT2yr	1055.00	494.00	500.74		500.91	0.001582	3.83	496.24	228.34	0.29
Creek	12873	ULT5yr	1675.00	494.00	501.53		501.75	0.001919	4.62	680.97	242.12	0.33
Creek	12873	ULT10yr	2090.00	494.00	501.96		502.21	0.002086	5.05	788.19	249.52	0.35
Creek	12873	ULT25yr	2510.00	494.00	502.36		502.64	0.002222	5.42	889.39	257.15	0.36
Creek	12873	ULT50yr	2900.00	494.00	502.70		503.00	0.002332	5.73	977.93	264.15	0.37
Creek	12873	ULT100yr	3335.00	494.00	503.06		503.38	0.002421	6.02	1072.67	269.60	0.38
Creek	12873	ULT500yr	4445.00	494.00	503.88		504.25	0.002580	6.65	1298.22	281.28	0.40
Creek	12673	EX0.5yr	510.00	493.00	499.07	497.93	499.39	0.007444	4.68	131.11	155.56	0.54
Creek	12673	EX1yr	715.00	493.00	499.53		499.86	0.006453	4.92	206.03	167.82	0.52
Creek	12673	EX2yr	955.00	493.00	499.95		500.29	0.005928	5.19	279.70	178.21	0.51
Creek	12673	EX5yr	1490.00	493.00	500.68		501.06	0.005561	5.77	415.42	195.98	0.51
Creek	12673	EX10yr	1840.00	493.00	501.07		501.48	0.005462	6.09	494.44	205.65	0.52
Creek	12673	EX25yr	2200.00	493.00	501.43		501.87	0.005409	6.40	570.45	214.54	0.52
Creek	12673	EX50yr	2555.00	493.00	501.77		502.22	0.005352	6.66	642.95	222.59	0.53
Creek	12673	EX100yr	2975.00	493.00	502.13		502.61	0.005261	6.93	725.54	228.47	0.53

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	12673	EX500yr	3985.00	493.00	502.93		503.46	0.005100	7.48	912.03	241.62	0.53
Creek	12673	ULT2yr	1055.00	493.00	500.11		500.45	0.005822	5.31	307.07	181.77	0.51
Creek	12673	ULT5yr	1675.00	493.00	500.90		501.29	0.005486	5.94	458.39	201.30	0.52
Creek	12673	ULT10yr	2090.00	493.00	501.33		501.75	0.005427	6.31	547.49	211.89	0.52
Creek	12673	ULT25yr	2510.00	493.00	501.73		502.18	0.005360	6.63	633.86	221.68	0.53
Creek	12673	ULT50yr	2900.00	493.00	502.07		502.54	0.005276	6.88	711.09	227.49	0.53
Creek	12673	ULT100yr	3335.00	493.00	502.43		502.92	0.005195	7.13	793.69	233.27	0.53
Creek	12673	ULT500yr	4445.00	493.00	503.25		503.80	0.005064	7.71	991.25	247.15	0.53
Creek	12570	EX0.5yr	510.00	492.00	498.35		498.69	0.006562	4.69	122.65	97.64	0.52
Creek	12570	EX1yr	715.00	492.00	498.86		499.24	0.006175	5.14	183.04	132.42	0.52
Creek	12570	EX2yr	955.00	492.00	499.26		499.69	0.006399	5.68	240.30	148.62	0.54
Creek	12570	EX5yr	1490.00	492.00	499.81		500.42	0.007960	6.99	325.35	159.28	0.61
Creek	12570	EX10yr	1840.00	492.00	500.14		500.83	0.008484	7.60	378.28	164.42	0.64
Creek	12570	EX25yr	2200.00	492.00	500.34		501.18	0.009835	8.44	412.00	167.14	0.70
Creek	12570	EX50yr	2555.00	492.00	500.54	500.23	501.50	0.010896	9.14	445.80	169.83	0.74
Creek	12570	EX100yr	2975.00	492.00	500.77	500.52	501.86	0.011930	9.87	485.05	172.85	0.78
Creek	12570	EX500yr	3985.00	492.00	501.31	501.13	502.68	0.013527	11.26	581.15	182.52	0.84
Creek	12570	ULT2yr	1055.00	492.00	499.38		499.85	0.006728	5.95	257.75	151.10	0.55
Creek	12570	ULT5yr	1675.00	492.00	500.02		500.66	0.007983	7.24	358.92	162.83	0.62
Creek	12570	ULT10yr	2090.00	492.00	500.28		501.07	0.009437	8.19	401.90	166.33	0.68
Creek	12570	ULT25yr	2510.00	492.00	500.52		501.46	0.010763	9.05	441.68	169.50	0.73
Creek	12570	ULT50yr	2900.00	492.00	500.73	500.47	501.80	0.011766	9.75	478.01	172.32	0.77
Creek	12570	ULT100yr	3335.00	492.00	500.96	500.75	502.16	0.012673	10.43	518.10	175.65	0.81
Creek	12570	ULT500yr	4445.00	492.00	501.56	501.33	503.02	0.013841	11.73	627.47	187.26	0.86
Creek	12500	EX0.5yr	510.00	492.00	498.21		498.38	0.002408	3.41	176.63	148.32	0.33
Creek	12500	EX1yr	715.00	492.00	498.74		498.94	0.002432	3.78	267.58	187.93	0.34
Creek	12500	EX2yr	955.00	492.00	499.16		499.39	0.002658	4.23	351.48	225.56	0.36
Creek	12500	EX5yr	1490.00	492.00	499.73		500.04	0.003374	5.18	496.00	268.58	0.41
Creek	12500	EX10yr	1840.00	492.00	500.09		500.42	0.003457	5.50	596.32	277.88	0.42
Creek	12500	EX25yr	2200.00	492.00	500.33		500.71	0.003871	5.99	662.24	281.31	0.45
Creek	12500	EX50yr	2555.00	492.00	500.57		500.98	0.004124	6.37	730.50	285.36	0.47
Creek	12500	EX100yr	2975.00	492.00	500.86		501.30	0.004284	6.70	812.97	289.34	0.48
Creek	12500	EX500yr	3985.00	492.00	501.55		502.03	0.004280	7.21	1018.20	298.33	0.49
Creek	12500	ULT2yr	1055.00	492.00	499.27		499.53	0.002846	4.45	377.96	240.28	0.37
Creek	12500	ULT5yr	1675.00	492.00	499.96		500.28	0.003294	5.28	560.27	275.46	0.41
Creek	12500	ULT10yr	2090.00	492.00	500.25		500.62	0.003773	5.86	640.96	280.14	0.44
Creek	12500	ULT25yr	2510.00	492.00	500.54		500.95	0.004095	6.32	722.03	284.86	0.47
Creek	12500	ULT50yr	2900.00	492.00	500.80		501.24	0.004266	6.65	798.05	288.67	0.48
Creek	12500	ULT100yr	3335.00	492.00	501.10		501.56	0.004346	6.93	883.99	292.53	0.49
Creek	12500	ULT500yr	4445.00	492.00	501.87		502.35	0.004180	7.35	1113.02	301.27	0.49
Creek	12427	EX0.5yr	510.00	491.14	497.57	495.78	498.07	0.007353	5.78	109.73	95.24	0.54
Creek	12427	EX1yr	715.00	491.14	497.86	497.37	498.58	0.010207	7.12	140.45	114.54	0.64
Creek	12427	EX2yr	955.00	491.14	498.40	498.40	499.05	0.008951	7.25	240.88	217.75	0.61
Creek	12427	EX5yr	1490.00	491.14	498.91	498.87	499.65	0.010286	8.38	354.40	222.50	0.67
Creek	12427	EX10yr	1840.00	491.14	499.28	499.28	500.04	0.010319	8.82	449.56	272.36	0.68
Creek	12427	EX25yr	2200.00	491.14	499.69		500.35	0.008910	8.61	564.61	292.08	0.64
Creek	12427	EX50yr	2555.00	491.14	500.06		500.64	0.007885	8.45	674.98	306.84	0.61
Creek	12427	EX100yr	2975.00	491.14	500.46		500.98	0.007001	8.32	799.13	318.56	0.58
Creek	12427	EX500yr	3985.00	491.14	501.30		501.75	0.005745	8.18	1076.07	339.50	0.54
Creek	12427	ULT2yr	1055.00	491.14	498.53	498.53	499.18	0.008939	7.39	269.79	218.97	0.62
Creek	12427	ULT5yr	1675.00	491.14	499.16	499.16	499.90	0.010070	8.57	416.15	266.46	0.67
Creek	12427	ULT10yr	2090.00	491.14	499.60		500.26	0.009001	8.56	537.24	287.62	0.64
Creek	12427	ULT25yr	2510.00	491.14	500.02		500.61	0.007996	8.47	661.52	305.55	0.61
Creek	12427	ULT50yr	2900.00	491.14	500.39		500.92	0.007128	8.33	777.67	316.57	0.58
Creek	12427	ULT100yr	3335.00	491.14	500.77		501.26	0.006450	8.24	900.75	326.61	0.56
Creek	12427	ULT500yr	4445.00	491.14	501.64		502.08	0.005385	8.17	1195.21	348.09	0.52
Creek	12291	EX0.5yr	510.00	490.00	495.81	495.17	496.65	0.015286	7.37	70.83	41.24	0.78
Creek	12291	EX1yr	715.00	490.00	496.78		497.25	0.008519	5.98	188.60	160.55	0.60
Creek	12291	EX2yr	955.00	490.00	497.61		497.88	0.004413	5.04	338.61	206.26	0.45
Creek	12291	EX5yr	1490.00	490.00	498.62		498.84	0.003146	4.96	592.65	278.19	0.39
Creek	12291	EX10yr	1840.00	490.00	499.03		499.25	0.003068	5.17	706.90	282.27	0.40
Creek	12291	EX25yr	2200.00	490.00	499.43		499.66	0.002970	5.34	820.46	288.72	0.39
Creek	12291	EX50yr	2555.00	490.00	499.78		500.02	0.002922	5.51	923.75	295.52	0.39
Creek	12291	EX100yr	2975.00	490.00	500.17		500.41	0.002870	5.69	1039.90	301.65	0.39
Creek	12291	EX500yr	3985.00	490.00	501.00		501.27	0.002782	6.08	1296.02	312.15	0.40
Creek	12291	ULT2yr	1055.00	490.00	497.89		498.13	0.003755	4.87	397.37	219.97	0.42
Creek	12291	ULT5yr	1675.00	490.00	498.83		499.06	0.003120	5.09	652.71	279.82	0.40
Creek	12291	ULT10yr	2090.00	490.00	499.35		499.57	0.002886	5.21	797.86	287.31	0.39
Creek	12291	ULT25yr	2510.00	490.00	499.74		499.97	0.002924	5.49	911.39	294.73	0.39
Creek	12291	ULT50yr	2900.00	490.00	500.10		500.34	0.002878	5.66	1019.79	300.89	0.39
Creek	12291	ULT100yr	3335.00	490.00	500.48		500.73	0.002830	5.83	1134.57	305.24	0.40
Creek	12291	ULT500yr	4445.00	490.00	501.35		501.62	0.002757	6.24	1404.79	316.82	0.40
Creek	12112	EX0.5yr	510.00	488.00	494.21	492.56	494.80	0.006960	6.12	83.31	20.82	0.54
Creek	12112	EX1yr	715.00	488.00	495.08	493.41	495.84	0.007881	7.00	102.21	22.70	0.58
Creek	12112	EX2yr	955.00	488.00	495.90	494.25	496.86	0.008850	7.86	122.12	69.70	0.62
Creek	12112	EX5yr	1490.00	488.00	497.24	497.05	498.13	0.007088	8.20	298.21	256.41	0.58

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	12112	EX10yr	1840.00	488.00	497.92	497.48	498.66	0.005780	7.93	415.39	261.76	0.53
Creek	12112	EX25yr	2200.00	488.00	498.34	497.81	499.09	0.005770	8.25	489.15	265.16	0.54
Creek	12112	EX50yr	2555.00	488.00	498.67	498.10	499.46	0.005988	8.65	547.05	267.85	0.55
Creek	12112	EX100yr	2975.00	488.00	499.04	498.41	499.86	0.006152	9.05	612.54	270.85	0.56
Creek	12112	EX500yr	3985.00	488.00	499.82	499.03	500.73	0.006486	9.89	752.62	277.32	0.59
Creek	12112	ULT2yr	1055.00	488.00	496.25	494.56	497.22	0.008444	7.98	155.23	198.00	0.61
Creek	12112	ULT5yr	1675.00	488.00	497.59	497.29	498.41	0.006434	8.10	358.67	259.21	0.56
Creek	12112	ULT10yr	2090.00	488.00	498.43	497.72	499.06	0.004860	7.63	504.06	265.86	0.49
Creek	12112	ULT25yr	2510.00	488.00	498.64	498.07	499.41	0.005924	8.58	541.41	267.59	0.55
Creek	12112	ULT50yr	2900.00	488.00	498.98	498.36	499.79	0.006114	8.98	601.66	270.34	0.56
Creek	12112	ULT100yr	3335.00	488.00	499.34	498.65	500.19	0.006275	9.36	665.10	273.31	0.57
Creek	12112	ULT500yr	4445.00	488.00	500.14	499.28	501.09	0.006624	10.23	810.22	280.04	0.60
Creek	12056	EX0.5yr	510.00	488.00	493.94	492.00	494.42	0.005472	5.59	91.25	32.95	0.49
Creek	12056	EX1yr	715.00	488.00	494.76	492.82	495.41	0.006467	6.49	110.15	50.70	0.53
Creek	12056	EX2yr	955.00	488.00	495.52	493.64	496.37	0.007527	7.40	129.10	139.36	0.58
Creek	12056	EX5yr	1490.00	488.00	496.92	495.15	497.76	0.006467	7.83	302.62	287.31	0.56
Creek	12056	EX10yr	1840.00	488.00	497.76	497.10	498.36	0.004570	7.17	460.59	293.49	0.48
Creek	12056	EX25yr	2200.00	488.00	498.19	497.45	498.80	0.004547	7.45	542.96	295.78	0.48
Creek	12056	EX50yr	2555.00	488.00	498.52	497.74	499.16	0.004743	7.83	605.66	297.89	0.50
Creek	12056	EX100yr	2975.00	488.00	498.89	498.04	499.57	0.004891	8.20	677.05	302.42	0.51
Creek	12056	EX500yr	3985.00	488.00	499.68	498.65	500.43	0.005190	8.99	829.38	312.57	0.53
Creek	12056	ULT2yr	1055.00	488.00	495.83	493.95	496.75	0.007854	7.69	137.19	160.09	0.60
Creek	12056	ULT5yr	1675.00	488.00	497.38	495.60	498.07	0.005329	7.46	388.26	291.20	0.51
Creek	12056	ULT10yr	2090.00	488.00	498.32	497.36	498.82	0.003721	6.81	566.37	296.40	0.44
Creek	12056	ULT25yr	2510.00	488.00	498.49	497.71	499.12	0.004684	7.76	599.91	297.67	0.49
Creek	12056	ULT50yr	2900.00	488.00	498.83	497.99	499.50	0.004855	8.13	665.29	301.64	0.51
Creek	12056	ULT100yr	3335.00	488.00	499.19	498.28	499.89	0.005000	8.50	734.30	307.10	0.52
Creek	12056	ULT500yr	4445.00	488.00	499.99	498.89	500.78	0.005313	9.31	891.85	316.29	0.54
Creek	11921	EX0.5yr	510.00	488.97	492.63	492.01	493.35	0.011935	6.79	75.07	27.02	0.72
Creek	11921	EX1yr	715.00	488.97	493.51	492.64	494.29	0.010770	7.08	100.99	33.26	0.70
Creek	11921	EX2yr	955.00	488.97	494.38	493.35	495.22	0.009593	7.36	129.84	70.72	0.67
Creek	11921	EX5yr	1490.00	488.97	495.30	494.54	496.58	0.012461	9.07	164.83	209.73	0.78
Creek	11921	EX10yr	1840.00	488.97	495.52	495.21	497.27	0.016235	10.62	175.06	223.68	0.90
Creek	11921	EX25yr	2200.00	488.97	496.60	496.60	497.94	0.010149	9.56	306.24	290.93	0.73
Creek	11921	EX50yr	2555.00	488.97	497.03	497.03	498.34	0.009404	9.70	385.35	299.93	0.72
Creek	11921	EX100yr	2975.00	488.97	497.38	497.38	498.74	0.009452	10.12	451.18	304.42	0.73
Creek	11921	EX500yr	3985.00	488.97	498.06	498.06	499.59	0.009942	11.14	578.99	313.03	0.76
Creek	11921	ULT2yr	1055.00	488.97	494.71	493.58	495.57	0.009403	7.45	141.61	114.10	0.67
Creek	11921	ULT5yr	1675.00	488.97	495.43	494.92	496.95	0.014345	9.88	170.74	217.97	0.84
Creek	11921	ULT10yr	2090.00	488.97	495.65	495.65	497.78	0.019169	11.71	181.36	233.48	0.98
Creek	11921	ULT25yr	2510.00	488.97	496.96	496.96	498.29	0.009633	9.74	372.55	298.72	0.72
Creek	11921	ULT50yr	2900.00	488.97	497.32	497.32	498.67	0.009479	10.06	439.09	303.60	0.72
Creek	11921	ULT100yr	3335.00	488.97	497.64	497.64	499.06	0.009633	10.51	499.51	307.70	0.74
Creek	11921	ULT500yr	4445.00	488.97	498.32	498.32	499.93	0.010211	11.58	628.85	315.78	0.77
Creek	11855	EX0.5yr	510.00	487.33	492.53	490.61	492.83	0.003580	4.34	117.59	32.84	0.40
Creek	11855	EX1yr	715.00	487.33	493.42	491.23	493.78	0.003635	4.85	147.42	78.52	0.41
Creek	11855	EX2yr	955.00	487.33	494.28	491.86	494.73	0.003749	5.36	178.28	218.34	0.43
Creek	11855	EX5yr	1490.00	487.33	495.22	492.99	495.90	0.005039	6.72	280.61	300.39	0.50
Creek	11855	EX10yr	1840.00	487.33	495.58	493.62	496.37	0.005818	7.45	342.20	302.92	0.54
Creek	11855	EX25yr	2200.00	487.33	495.92	494.23	496.80	0.006307	8.01	402.99	305.45	0.57
Creek	11855	EX50yr	2555.00	487.33	496.20	495.75	497.17	0.006802	8.57	451.47	307.34	0.60
Creek	11855	EX100yr	2975.00	487.33	496.53	496.11	497.58	0.007158	9.09	508.88	309.53	0.62
Creek	11855	EX500yr	3985.00	487.33	497.07	496.82	498.41	0.008701	10.55	603.63	313.58	0.69
Creek	11855	ULT2yr	1055.00	487.33	494.60	492.09	495.08	0.003819	5.55	190.33	240.38	0.43
Creek	11855	ULT5yr	1675.00	487.33	495.41	493.33	496.15	0.005501	7.14	313.12	301.73	0.53
Creek	11855	ULT10yr	2090.00	487.33	495.81	494.03	496.67	0.006242	7.87	383.11	304.59	0.57
Creek	11855	ULT25yr	2510.00	487.33	496.17	495.71	497.13	0.006753	8.50	445.23	307.11	0.60
Creek	11855	ULT50yr	2900.00	487.33	496.46	496.05	497.51	0.007150	9.02	497.31	309.05	0.62
Creek	11855	ULT100yr	3335.00	487.33	496.77	496.38	497.90	0.007513	9.53	551.64	311.37	0.64
Creek	11855	ULT500yr	4445.00	487.33	497.34	497.08	498.76	0.009004	10.99	651.68	315.53	0.71
Creek	11651	EX0.5yr	510.00	487.13	490.46	490.16	491.38	0.017311	7.67	66.47	26.05	0.85
Creek	11651	EX1yr	715.00	487.13	490.90	490.81	492.20	0.021302	9.15	78.16	27.33	0.95
Creek	11651	EX2yr	955.00	487.13	491.45	491.45	493.07	0.022596	10.19	93.71	33.26	1.00
Creek	11651	EX5yr	1490.00	487.13	493.50	493.50	494.51	0.009734	8.38	232.00	177.57	0.69
Creek	11651	EX10yr	1840.00	487.13	493.91	493.91	494.94	0.009492	8.77	293.35	188.55	0.69
Creek	11651	EX25yr	2200.00	487.13	494.21	494.21	495.31	0.009884	9.31	339.81	206.07	0.71
Creek	11651	EX50yr	2555.00	487.13	494.50	494.50	495.65	0.009974	9.69	385.82	216.24	0.72
Creek	11651	EX100yr	2975.00	487.13	494.77	494.77	496.01	0.010463	10.25	429.08	224.58	0.75
Creek	11651	EX500yr	3985.00	487.13	495.57	495.37	496.79	0.009439	10.60	561.52	241.21	0.73
Creek	11651	ULT2yr	1055.00	487.13	491.70	491.70	493.40	0.022386	10.47	100.81	35.99	1.00
Creek	11651	ULT5yr	1675.00	487.13	493.74	493.74	494.74	0.009454	8.55	267.65	183.71	0.69
Creek	11651	ULT10yr	2090.00	487.13	494.14	494.14	495.20	0.009598	9.09	328.80	205.16	0.70
Creek	11651	ULT25yr	2510.00	487.13	494.47	494.47	495.61	0.009935	9.63	380.68	215.29	0.72
Creek	11651	ULT50yr	2900.00	487.13	494.74	494.74	495.95	0.010276	10.11	423.34	224.04	0.74
Creek	11651	ULT100yr	3335.00	487.13	495.00	495.00	496.30	0.010677	10.62	466.47	228.12	0.76
Creek	11651	ULT500yr	4445.00	487.13	496.00	495.62	497.18	0.008564	10.53	640.34	271.54	0.70

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	11568	EX0.5yr	510.00	486.25	490.60	488.71	490.74	0.002177	3.16	169.52	59.09	0.32
Creek	11568	EX1yr	715.00	486.25	491.22	489.14	491.41	0.002421	3.63	207.81	63.96	0.34
Creek	11568	EX2yr	955.00	486.25	491.84	489.59	492.08	0.002639	4.07	248.96	79.07	0.37
Creek	11568	EX5yr	1490.00	486.25	492.92	490.43	493.21	0.002527	4.65	362.88	150.30	0.37
Creek	11568	EX10yr	1840.00	486.25	493.44	490.91	493.76	0.002475	4.93	440.05	186.93	0.37
Creek	11568	EX25yr	2200.00	486.25	493.92	491.35	494.26	0.002407	5.14	517.58	203.30	0.37
Creek	11568	EX50yr	2555.00	486.25	494.35	491.74	494.70	0.002319	5.29	593.20	214.06	0.37
Creek	11568	EX100yr	2975.00	486.25	494.82	492.48	495.18	0.002244	5.46	675.06	218.74	0.37
Creek	11568	EX500yr	3985.00	486.25	495.82	493.41	496.21	0.002096	5.78	855.66	229.44	0.37
Creek	11568	ULT2yr	1055.00	486.25	492.06	489.76	492.31	0.002718	4.24	266.29	116.94	0.37
Creek	11568	ULT5yr	1675.00	486.25	493.21	490.68	493.52	0.002500	4.81	403.83	177.05	0.37
Creek	11568	ULT10yr	2090.00	486.25	493.78	491.21	494.11	0.002430	5.08	494.01	198.80	0.37
Creek	11568	ULT25yr	2510.00	486.25	494.30	491.69	494.65	0.002330	5.27	583.91	213.52	0.37
Creek	11568	ULT50yr	2900.00	486.25	494.74	492.41	495.10	0.002257	5.43	660.79	217.93	0.37
Creek	11568	ULT100yr	3335.00	486.25	495.19	492.74	495.56	0.002186	5.58	741.56	222.49	0.37
Creek	11568	ULT500yr	4445.00	486.25	496.22	493.70	496.63	0.002061	5.93	929.74	234.98	0.37
Creek	11480	EX0.5yr	510.00	487.00	490.34		490.52	0.003236	3.57	149.93	66.33	0.38
Creek	11480	EX1yr	715.00	487.00	490.96		491.18	0.003187	3.99	194.87	79.86	0.39
Creek	11480	EX2yr	955.00	487.00	491.57		491.84	0.003169	4.46	252.55	100.97	0.40
Creek	11480	EX5yr	1490.00	487.00	492.72		493.00	0.002545	4.76	389.07	143.57	0.38
Creek	11480	EX10yr	1840.00	487.00	493.26		493.56	0.002411	4.96	472.48	163.29	0.37
Creek	11480	EX25yr	2200.00	487.00	493.75		494.05	0.002312	5.14	556.04	179.25	0.37
Creek	11480	EX50yr	2555.00	487.00	494.20		494.50	0.002220	5.28	639.48	195.10	0.37
Creek	11480	EX100yr	2975.00	487.00	494.67		494.98	0.002131	5.42	734.92	207.75	0.36
Creek	11480	EX500yr	3985.00	487.00	495.70		496.02	0.001955	5.69	961.94	233.87	0.36
Creek	11480	ULT2yr	1055.00	487.00	491.81		492.07	0.003047	4.55	276.53	105.87	0.40
Creek	11480	ULT5yr	1675.00	487.00	493.02		493.31	0.002469	4.87	433.71	155.46	0.37
Creek	11480	ULT10yr	2090.00	487.00	493.61		493.91	0.002340	5.09	530.51	174.28	0.37
Creek	11480	ULT25yr	2510.00	487.00	494.14		494.45	0.002233	5.26	628.94	193.65	0.37
Creek	11480	ULT50yr	2900.00	487.00	494.59		494.90	0.002146	5.40	717.95	205.57	0.36
Creek	11480	ULT100yr	3335.00	487.00	495.05		495.37	0.002067	5.53	815.84	218.47	0.36
Creek	11480	ULT500yr	4445.00	487.00	496.11		496.44	0.001907	5.81	1060.21	244.00	0.35
Creek	11418	EX0.5yr	510.00	486.43	490.21		490.36	0.001997	3.10	164.76	66.23	0.34
Creek	11418	EX1yr	715.00	486.43	490.83		491.02	0.001948	3.50	207.54	71.77	0.35
Creek	11418	EX2yr	955.00	486.43	491.45		491.68	0.001905	3.88	255.83	87.79	0.35
Creek	11418	EX5yr	1490.00	486.43	492.56		492.87	0.001849	4.54	377.40	143.52	0.36
Creek	11418	EX10yr	1840.00	486.43	493.06		493.42	0.001937	4.96	454.78	170.90	0.38
Creek	11418	EX25yr	2200.00	486.43	493.52		493.91	0.001972	5.28	535.52	178.55	0.38
Creek	11418	EX50yr	2555.00	486.43	493.94		494.36	0.001985	5.55	611.81	184.36	0.39
Creek	11418	EX100yr	2975.00	486.43	494.38		494.84	0.002011	5.85	695.24	190.10	0.40
Creek	11418	EX500yr	3985.00	486.43	495.35		495.88	0.002034	6.43	885.83	203.60	0.41
Creek	11418	ULT2yr	1055.00	486.43	491.68		491.92	0.001896	4.03	276.65	95.19	0.35
Creek	11418	ULT5yr	1675.00	486.43	492.84		493.17	0.001892	4.76	418.32	154.83	0.37
Creek	11418	ULT10yr	2090.00	486.43	493.38		493.77	0.001964	5.19	511.21	176.64	0.38
Creek	11418	ULT25yr	2510.00	486.43	493.89		494.31	0.001984	5.52	602.38	183.78	0.39
Creek	11418	ULT50yr	2900.00	486.43	494.31		494.76	0.002008	5.80	680.57	189.11	0.40
Creek	11418	ULT100yr	3335.00	486.43	494.74		495.23	0.002025	6.07	764.30	194.67	0.40
Creek	11418	ULT500yr	4445.00	486.43	495.74		496.30	0.002056	6.68	965.83	209.92	0.41
Creek	11289	EX0.5yr	510.00	486.00	489.45		489.93	0.005410	5.52	92.31	38.15	0.63
Creek	11289	EX1yr	715.00	486.00	489.87		490.54	0.006951	6.56	108.92	41.92	0.72
Creek	11289	EX2yr	955.00	486.00	490.27		491.15	0.008912	7.54	126.68	47.83	0.82
Creek	11289	EX5yr	1490.00	486.00	490.86	490.81	492.25	0.013071	9.47	157.26	56.31	1.00
Creek	11289	EX10yr	1840.00	486.00	491.47	491.47	492.83	0.010239	9.40	206.99	93.81	0.91
Creek	11289	EX25yr	2200.00	486.00	491.88	491.88	493.32	0.009533	9.80	246.61	100.54	0.90
Creek	11289	EX50yr	2555.00	486.00	492.21	492.21	493.77	0.009316	10.26	280.75	105.86	0.90
Creek	11289	EX100yr	2975.00	486.00	492.61	492.61	494.25	0.008784	10.61	324.82	112.99	0.89
Creek	11289	EX500yr	3985.00	486.00	493.39	493.39	495.27	0.008434	11.57	418.14	128.91	0.89
Creek	11289	ULT2yr	1055.00	486.00	490.41		491.38	0.009631	7.90	133.56	49.86	0.85
Creek	11289	ULT5yr	1675.00	486.00	491.23	491.23	492.58	0.011156	9.33	184.68	89.58	0.94
Creek	11289	ULT10yr	2090.00	486.00	491.77	491.77	493.18	0.009653	9.66	235.36	98.86	0.90
Creek	11289	ULT25yr	2510.00	486.00	492.17	492.17	493.71	0.009349	10.21	276.37	105.12	0.90
Creek	11289	ULT50yr	2900.00	486.00	492.55	492.55	494.17	0.008853	10.54	317.24	111.84	0.89
Creek	11289	ULT100yr	3335.00	486.00	492.91	492.91	494.63	0.008564	10.94	359.57	117.55	0.88
Creek	11289	ULT500yr	4445.00	486.00	493.72	493.72	495.69	0.008245	11.92	461.99	138.28	0.89
Creek	11162	EX0.5yr	510.00	485.01	489.09		489.33	0.003281	3.99	128.98	69.87	0.48
Creek	11162	EX1yr	715.00	485.01	489.53		489.85	0.003334	4.56	162.87	84.00	0.50
Creek	11162	EX2yr	955.00	485.01	489.98		490.36	0.003245	5.02	204.12	97.39	0.51
Creek	11162	EX5yr	1490.00	485.01	490.81		491.27	0.003048	5.71	294.97	123.10	0.51
Creek	11162	EX10yr	1840.00	485.01	491.22		491.73	0.003002	6.07	347.76	130.67	0.52
Creek	11162	EX25yr	2200.00	485.01	491.53		492.11	0.003150	6.51	388.75	133.70	0.54
Creek	11162	EX50yr	2555.00	485.01	491.83		492.46	0.003213	6.86	429.24	136.62	0.55
Creek	11162	EX100yr	2975.00	485.01	492.16		492.85	0.003261	7.23	475.01	139.56	0.56
Creek	11162	EX500yr	3985.00	485.01	492.87		493.70	0.003335	7.96	576.45	145.12	0.58
Creek	11162	ULT2yr	1055.00	485.01	490.16		490.56	0.003174	5.16	222.16	103.11	0.51
Creek	11162	ULT5yr	1675.00	485.01	491.03		491.52	0.003036	5.92	323.28	128.77	0.52
Creek	11162	ULT10yr	2090.00	485.01	491.44		491.99	0.003119	6.39	376.06	132.77	0.53
Creek	11162	ULT25yr	2510.00	485.01	491.79		492.42	0.003209	6.82	424.10	136.25	0.55

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	11162	ULT50yr	2900.00	485.01	492.10		492.78	0.003261	7.17	466.66	139.09	0.56
Creek	11162	ULT100yr	3335.00	485.01	492.42		493.17	0.003300	7.51	511.93	141.60	0.57
Creek	11162	ULT500yr	4445.00	485.01	493.17		494.06	0.003359	8.25	619.67	147.44	0.58
Creek	11028	EX0.5yr	510.00	485.19	488.40	487.84	488.77	0.005304	4.92	108.39	66.83	0.61
Creek	11028	EX1yr	715.00	485.19	488.65	488.27	489.20	0.006885	6.05	125.61	72.63	0.71
Creek	11028	EX2yr	955.00	485.19	488.88	488.69	489.65	0.008533	7.20	143.43	78.57	0.80
Creek	11028	EX5yr	1490.00	485.19	489.45	489.45	490.53	0.009529	8.71	192.38	94.51	0.88
Creek	11028	EX10yr	1840.00	485.19	489.84	489.84	491.01	0.008970	9.15	231.54	105.13	0.87
Creek	11028	EX25yr	2200.00	485.19	490.35	490.35	491.43	0.007209	8.99	293.43	202.22	0.79
Creek	11028	EX50yr	2555.00	485.19	490.60	490.60	491.77	0.007376	9.46	324.60	209.19	0.81
Creek	11028	EX100yr	2975.00	485.19	490.86	490.86	492.14	0.007577	9.98	358.18	215.16	0.83
Creek	11028	EX500yr	3985.00	485.19	491.43	491.43	492.95	0.007840	11.00	433.20	227.05	0.86
Creek	11028	ULT2yr	1055.00	485.19	488.96	488.85	489.83	0.009264	7.66	149.76	80.57	0.84
Creek	11028	ULT5yr	1675.00	485.19	489.67	489.67	490.79	0.009190	8.95	213.38	100.34	0.87
Creek	11028	ULT10yr	2090.00	485.19	490.27	490.27	491.32	0.007211	8.86	282.33	199.58	0.79
Creek	11028	ULT25yr	2510.00	485.19	490.57	490.57	491.72	0.007337	9.40	321.08	208.46	0.81
Creek	11028	ULT50yr	2900.00	485.19	490.82	490.82	492.07	0.007501	9.87	353.06	214.24	0.83
Creek	11028	ULT100yr	3335.00	485.19	491.07	491.07	492.44	0.007641	10.35	386.73	221.23	0.84
Creek	11028	ULT500yr	4445.00	485.19	491.67	491.67	493.30	0.007865	11.37	466.08	230.90	0.87
Creek	10945	EX0.5yr	510.00	485.46	487.77	487.77	488.19	0.009172	5.90	116.80	128.17	0.78
Creek	10945	EX1yr	715.00	485.46	487.99	487.99	488.50	0.009810	6.62	146.86	133.86	0.83
Creek	10945	EX2yr	955.00	485.46	488.23	488.23	488.82	0.010158	7.25	179.05	139.98	0.86
Creek	10945	EX5yr	1490.00	485.46	488.72	488.67	489.41	0.009559	8.04	250.70	152.63	0.86
Creek	10945	EX10yr	1840.00	485.46	489.02	488.91	489.75	0.008838	8.29	298.25	179.20	0.84
Creek	10945	EX25yr	2200.00	485.46	489.29	489.14	490.06	0.008473	8.60	342.55	194.72	0.84
Creek	10945	EX50yr	2555.00	485.46	489.53	489.34	490.35	0.008246	8.89	382.97	207.37	0.83
Creek	10945	EX100yr	2975.00	485.46	489.82	489.58	490.67	0.007764	9.09	433.90	222.66	0.82
Creek	10945	EX500yr	3985.00	485.46	490.39	490.26	491.22	0.006974	9.46	601.96	263.27	0.80
Creek	10945	ULT2yr	1055.00	485.46	488.32	488.32	488.94	0.010231	7.48	191.74	142.05	0.87
Creek	10945	ULT5yr	1675.00	485.46	488.88	488.79	489.59	0.009128	8.17	276.31	157.00	0.85
Creek	10945	ULT10yr	2090.00	485.46	489.21	489.07	489.97	0.008585	8.51	329.14	190.21	0.84
Creek	10945	ULT25yr	2510.00	485.46	489.50	489.33	490.31	0.008284	8.86	377.75	205.75	0.83
Creek	10945	ULT50yr	2900.00	485.46	489.78	489.54	490.62	0.007758	9.02	426.49	220.58	0.82
Creek	10945	ULT100yr	3335.00	485.46	489.92	489.76	490.90	0.008700	9.78	451.31	227.52	0.87
Creek	10945	ULT500yr	4445.00	485.46	490.80	490.41	491.51	0.005312	8.76	711.64	271.75	0.70
Creek	10824	EX0.5yr	510.00	486.00	487.67	486.81	487.74	0.000930	2.02	261.73	188.91	0.29
Creek	10824	EX1yr	715.00	486.00	487.96	486.99	488.05	0.001012	2.36	317.28	195.94	0.31
Creek	10824	EX2yr	955.00	486.00	488.25	487.17	488.36	0.001086	2.70	374.81	203.18	0.33
Creek	10824	EX5yr	1490.00	486.00	488.80	487.54	488.96	0.001183	3.28	489.77	220.31	0.35
Creek	10824	EX10yr	1840.00	486.00	489.11	487.74	489.29	0.001226	3.59	557.75	254.27	0.37
Creek	10824	EX25yr	2200.00	486.00	489.38	487.94	489.60	0.001272	3.88	621.04	267.50	0.38
Creek	10824	EX50yr	2555.00	486.00	489.63	488.11	489.88	0.001320	4.15	678.43	278.98	0.39
Creek	10824	EX100yr	2975.00	486.00	489.93	488.32	490.21	0.001331	4.40	749.77	292.47	0.40
Creek	10824	EX500yr	3985.00	486.00	490.45	488.76	490.79	0.001437	4.98	947.96	314.67	0.42
Creek	10824	ULT2yr	1055.00	486.00	488.36	487.24	488.48	0.001107	2.82	397.74	206.06	0.33
Creek	10824	ULT5yr	1675.00	486.00	488.96	487.64	489.14	0.001208	3.45	526.25	235.49	0.36
Creek	10824	ULT10yr	2090.00	486.00	489.30	487.88	489.51	0.001259	3.79	602.04	263.57	0.38
Creek	10824	ULT25yr	2510.00	486.00	489.60	488.09	489.85	0.001315	4.12	671.07	277.57	0.39
Creek	10824	ULT50yr	2900.00	486.00	489.89	488.28	490.16	0.001322	4.35	738.57	290.37	0.40
Creek	10824	ULT100yr	3335.00	486.00	490.06	488.49	490.38	0.001460	4.72	828.73	310.08	0.42
Creek	10824	ULT500yr	4445.00	486.00	490.83	488.95	491.16	0.001268	4.95	1069.99	318.46	0.40
Creek	10777	EX0.5yr	510.00	486.00	487.25	487.20	487.61	0.008697	4.90	115.93	146.31	0.83
Creek	10777	EX1yr	715.00	486.00	487.53	487.43	487.92	0.007434	5.20	157.60	152.75	0.79
Creek	10777	EX2yr	955.00	486.00	487.79	487.64	488.23	0.006945	5.62	197.20	158.21	0.79
Creek	10777	EX5yr	1490.00	486.00	488.26	488.05	488.81	0.006394	6.41	274.57	181.19	0.79
Creek	10777	EX10yr	1840.00	486.00	488.52	488.27	489.14	0.006198	6.84	321.09	197.42	0.79
Creek	10777	EX25yr	2200.00	486.00	488.73	488.51	489.44	0.006396	7.36	359.62	210.22	0.81
Creek	10777	EX50yr	2555.00	486.00	488.82	488.72	489.70	0.007631	8.21	375.34	215.31	0.89
Creek	10777	EX100yr	2975.00	486.00	489.13	488.96	490.03	0.006821	8.38	438.64	249.07	0.86
Creek	10777	EX500yr	3985.00	486.00	489.98	489.52	490.66	0.003925	7.53	681.74	269.23	0.68
Creek	10777	ULT2yr	1055.00	486.00	487.89	487.72	488.35	0.006647	5.74	214.09	160.28	0.78
Creek	10777	ULT5yr	1675.00	486.00	488.40	488.16	488.99	0.006301	6.65	299.16	189.90	0.79
Creek	10777	ULT10yr	2090.00	486.00	488.67	488.44	489.35	0.006363	7.22	347.62	206.29	0.81
Creek	10777	ULT25yr	2510.00	486.00	488.78	488.69	489.66	0.007714	8.19	369.31	213.36	0.90
Creek	10777	ULT50yr	2900.00	486.00	489.07	488.91	489.98	0.007008	8.38	426.23	244.53	0.87
Creek	10777	ULT100yr	3335.00	486.00	489.48	488.96	490.22	0.005090	7.80	548.96	260.72	0.76
Creek	10777	ULT500yr	4445.00	486.00	490.49	489.69	491.06	0.002834	6.96	822.16	277.97	0.59
Creek	10716	EX0.5yr	510.00	484.14	486.51	486.51	486.99	0.010860	6.21	105.67	108.72	0.77
Creek	10716	EX1yr	715.00	484.14	486.78	486.78	487.33	0.011198	6.85	136.19	120.62	0.79
Creek	10716	EX2yr	955.00	484.14	487.04	487.04	487.65	0.011286	7.38	168.75	130.14	0.81
Creek	10716	EX5yr	1490.00	484.14	487.50	487.50	488.25	0.011480	8.31	232.58	147.35	0.84
Creek	10716	EX10yr	1840.00	484.14	487.74	487.74	488.59	0.011676	8.82	269.46	156.15	0.86
Creek	10716	EX25yr	2200.00	484.14	487.99	487.99	488.90	0.011304	9.12	309.83	164.39	0.86
Creek	10716	EX50yr	2555.00	484.14	488.34	488.20	489.19	0.009355	8.84	368.61	174.99	0.79
Creek	10716	EX100yr	2975.00	484.14	488.80	488.42	489.55	0.007023	8.25	452.52	186.42	0.70
Creek	10716	EX500yr	3985.00	484.14	489.76	488.90	490.38	0.004627	7.66	657.89	228.13	0.59

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	10716	ULT2yr	1055.00	484.14	487.12	487.12	487.77	0.011572	7.63	179.64	132.22	0.83
Creek	10716	ULT5yr	1675.00	484.14	487.63	487.63	488.44	0.011546	8.58	252.90	152.63	0.85
Creek	10716	ULT10yr	2090.00	484.14	487.92	487.92	488.80	0.011370	9.02	298.04	162.04	0.86
Creek	10716	ULT25yr	2510.00	484.14	488.29	488.18	489.15	0.009672	8.90	359.69	173.42	0.80
Creek	10716	ULT50yr	2900.00	484.14	488.72	488.38	489.49	0.007352	8.34	437.85	184.84	0.71
Creek	10716	ULT100yr	3335.00	484.14	489.17	488.63	489.87	0.006317	8.27	526.66	216.58	0.67
Creek	10716	ULT500yr	4445.00	484.14	490.34	489.26	490.86	0.003262	6.89	792.82	237.19	0.50
Creek	10705		Inl Struct									
Creek	10695	EX0.5yr	510.00	481.84	484.94	484.94	485.53	0.019884	6.41	87.00	78.72	0.92
Creek	10695	EX1yr	715.00	481.84	485.29	485.29	485.94	0.017205	6.83	117.18	92.37	0.88
Creek	10695	EX2yr	955.00	481.84	485.63	485.63	486.33	0.015287	7.19	151.80	110.83	0.85
Creek	10695	EX5yr	1490.00	481.84	486.80		487.20	0.005576	5.76	312.63	150.92	0.55
Creek	10695	EX10yr	1840.00	481.84	487.36		487.73	0.004081	5.47	400.10	157.55	0.49
Creek	10695	EX25yr	2200.00	481.84	487.89		488.24	0.003277	5.33	484.30	163.02	0.44
Creek	10695	EX50yr	2555.00	481.84	488.33		488.68	0.002890	5.33	558.10	170.07	0.42
Creek	10695	EX100yr	2975.00	481.84	488.80		489.15	0.002621	5.39	638.56	177.43	0.41
Creek	10695	EX500yr	3985.00	481.84	489.75		490.15	0.002274	5.60	815.93	192.69	0.39
Creek	10695	ULT2yr	1055.00	481.84	485.90		486.49	0.011407	6.70	182.99	124.32	0.75
Creek	10695	ULT5yr	1675.00	481.84	487.10		487.48	0.004700	5.60	358.50	154.78	0.52
Creek	10695	ULT10yr	2090.00	481.84	487.74		488.09	0.003466	5.35	459.56	161.43	0.45
Creek	10695	ULT25yr	2510.00	481.84	488.28		488.63	0.002923	5.32	549.41	169.25	0.43
Creek	10695	ULT50yr	2900.00	481.84	488.72		489.07	0.002661	5.38	624.58	176.18	0.41
Creek	10695	ULT100yr	3335.00	481.84	489.16		489.53	0.002452	5.45	705.17	183.31	0.40
Creek	10695	ULT500yr	4445.00	481.84	490.33		490.71	0.001923	5.46	930.41	201.92	0.37
Creek	10665	EX0.5yr	510.00	481.00	484.54		484.76	0.002482	3.79	135.18	60.89	0.42
Creek	10665	EX1yr	715.00	481.00	485.10		485.38	0.002580	4.22	176.25	81.08	0.43
Creek	10665	EX2yr	955.00	481.00	485.68		485.98	0.002328	4.52	226.41	91.96	0.43
Creek	10665	EX5yr	1490.00	481.00	486.72		487.08	0.002011	5.00	331.85	111.33	0.41
Creek	10665	EX10yr	1840.00	481.00	487.25		487.63	0.001951	5.29	392.49	120.54	0.41
Creek	10665	EX25yr	2200.00	481.00	487.71		488.13	0.001926	5.58	451.08	130.20	0.42
Creek	10665	EX50yr	2555.00	481.00	488.12		488.58	0.001920	5.84	506.08	139.07	0.42
Creek	10665	EX100yr	2975.00	481.00	488.56		489.05	0.001898	6.09	568.45	145.79	0.42
Creek	10665	EX500yr	3985.00	481.00	489.47		490.03	0.001875	6.61	707.28	160.24	0.43
Creek	10665	ULT2yr	1055.00	481.00	485.90		486.21	0.002233	4.61	247.19	95.32	0.42
Creek	10665	ULT5yr	1675.00	481.00	487.01		487.38	0.001973	5.16	364.51	116.41	0.41
Creek	10665	ULT10yr	2090.00	481.00	487.58		487.99	0.001931	5.49	433.38	127.04	0.42
Creek	10665	ULT25yr	2510.00	481.00	488.07		488.52	0.001920	5.81	499.43	138.29	0.42
Creek	10665	ULT50yr	2900.00	481.00	488.49		488.96	0.001902	6.04	557.53	144.73	0.42
Creek	10665	ULT100yr	3335.00	481.00	488.91		489.42	0.001879	6.27	620.27	151.18	0.43
Creek	10665	ULT500yr	4445.00	481.00	490.07		490.60	0.001634	6.50	806.20	170.08	0.41
Creek	10633	EX0.5yr	510.00	481.34	483.76	483.76	484.56	0.009924	7.82	80.54	51.95	0.97
Creek	10633	EX1yr	715.00	481.34	484.18	484.18	485.16	0.009549	8.73	103.52	56.06	0.99
Creek	10633	EX2yr	955.00	481.34	484.62	484.62	485.77	0.009129	9.54	129.31	60.46	0.99
Creek	10633	EX5yr	1490.00	481.34	485.53	485.53	486.87	0.007750	10.56	190.11	76.31	0.96
Creek	10633	EX10yr	1840.00	481.34	486.06	486.06	487.43	0.006943	10.89	233.01	87.19	0.93
Creek	10633	EX25yr	2200.00	481.34	486.46	486.46	487.93	0.006733	11.40	270.20	95.09	0.93
Creek	10633	EX50yr	2555.00	481.34	486.86	486.86	488.37	0.006380	11.71	309.68	103.29	0.91
Creek	10633	EX100yr	2975.00	481.34	487.26	487.26	488.84	0.006219	12.15	351.64	110.15	0.91
Creek	10633	EX500yr	3985.00	481.34	488.40	488.03	489.85	0.004731	12.02	488.38	129.51	0.82
Creek	10633	ULT2yr	1055.00	481.34	484.80	484.80	486.00	0.008924	9.81	140.05	62.20	0.99
Creek	10633	ULT5yr	1675.00	481.34	485.86	485.86	487.18	0.007022	10.62	216.09	83.47	0.92
Creek	10633	ULT10yr	2090.00	481.34	486.35	486.35	487.78	0.006772	11.24	259.19	92.70	0.92
Creek	10633	ULT25yr	2510.00	481.34	486.80	486.80	488.32	0.006485	11.72	303.52	102.04	0.92
Creek	10633	ULT50yr	2900.00	481.34	487.19	487.19	488.76	0.006242	12.07	344.30	108.98	0.91
Creek	10633	ULT100yr	3335.00	481.34	487.55	487.55	489.21	0.006179	12.54	384.86	115.28	0.92
Creek	10633	ULT500yr	4445.00	481.34	489.39		490.48	0.003088	10.65	626.73	149.11	0.68
Creek	10600	EX0.5yr	510.00	480.00	483.40		483.73	0.002577	4.74	122.92	65.83	0.52
Creek	10600	EX1yr	715.00	480.00	483.85		484.28	0.002808	5.49	153.11	69.53	0.55
Creek	10600	EX2yr	955.00	480.00	484.24		484.80	0.003186	6.34	180.63	71.96	0.60
Creek	10600	EX5yr	1490.00	480.00	485.08		485.85	0.003422	7.59	244.25	79.82	0.65
Creek	10600	EX10yr	1840.00	480.00	485.59		486.45	0.003346	8.10	286.67	85.15	0.65
Creek	10600	EX25yr	2200.00	480.00	486.14		487.05	0.003113	8.40	335.20	90.43	0.64
Creek	10600	EX50yr	2555.00	480.00	486.55		487.55	0.003134	8.85	373.13	94.68	0.65
Creek	10600	EX100yr	2975.00	480.00	487.05		488.11	0.003048	9.23	421.85	100.36	0.65
Creek	10600	EX500yr	3985.00	480.00	488.63		489.60	0.002188	9.08	598.49	124.36	0.57
Creek	10600	ULT2yr	1055.00	480.00	484.40		485.01	0.003263	6.61	192.51	73.07	0.61
Creek	10600	ULT5yr	1675.00	480.00	485.38		486.19	0.003301	7.81	269.13	83.00	0.64
Creek	10600	ULT10yr	2090.00	480.00	485.96		486.87	0.003214	8.34	319.11	88.59	0.65
Creek	10600	ULT25yr	2510.00	480.00	486.58		487.53	0.002964	8.64	375.92	94.97	0.63
Creek	10600	ULT50yr	2900.00	480.00	487.07		488.07	0.002862	8.96	423.72	100.61	0.63
Creek	10600	ULT100yr	3335.00	480.00	487.63		488.66	0.002688	9.19	482.02	108.38	0.62
Creek	10600	ULT500yr	4445.00	480.00	489.47		490.34	0.001762	8.72	708.91	139.85	0.52
Creek	10587	EX0.5yr	510.00	479.34	483.42	482.55	483.66	0.003344	3.93	129.63	65.91	0.49
Creek	10587	EX1yr	715.00	479.34	483.89	482.93	484.20	0.003363	4.41	164.49	78.92	0.51
Creek	10587	EX2yr	955.00	479.34	484.32	483.31	484.69	0.003485	4.94	198.55	81.39	0.53

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	10587	EX5yr	1490.00	479.34	485.24	484.03	485.72	0.003253	5.63	275.81	86.74	0.53
Creek	10587	EX10yr	1840.00	479.34	485.78	484.41	486.31	0.003120	5.96	323.40	91.67	0.53
Creek	10587	EX25yr	2200.00	479.34	486.34	484.77	486.91	0.002884	6.15	378.27	102.33	0.52
Creek	10587	EX50yr	2555.00	479.34	486.78	485.09	487.39	0.002818	6.44	424.02	108.09	0.52
Creek	10587	EX100yr	2975.00	479.34	487.30	485.45	487.95	0.002666	6.67	481.91	115.06	0.51
Creek	10587	EX500yr	3985.00	479.34	488.84	486.26	489.47	0.001915	6.62	658.55	134.58	0.44
Creek	10587	ULT2yr	1055.00	479.34	484.50	483.46	484.90	0.003457	5.10	213.22	82.43	0.53
Creek	10587	ULT5yr	1675.00	479.34	485.55	484.24	486.06	0.003112	5.77	303.39	88.58	0.52
Creek	10587	ULT10yr	2090.00	479.34	486.16	484.67	486.72	0.002982	6.12	359.97	98.95	0.52
Creek	10587	ULT25yr	2510.00	479.34	486.79	485.05	487.38	0.002689	6.30	425.72	108.30	0.50
Creek	10587	ULT50yr	2900.00	479.34	487.30	485.38	487.92	0.002532	6.50	482.01	115.07	0.50
Creek	10587	ULT100yr	3335.00	479.34	487.87	485.72	488.51	0.002332	6.64	546.28	122.40	0.48
Creek	10587	ULT500yr	4445.00	479.34	489.64	486.60	490.23	0.001605	6.49	751.02	144.42	0.41
Creek	10557	EX0.5yr	505.00	479.38	483.46	481.70	483.54	0.000813	2.33	217.06	97.24	0.24
Creek	10557	EX1yr	725.00	479.38	483.93	481.99	484.06	0.001015	2.87	252.52	100.59	0.28
Creek	10557	EX2yr	970.00	479.38	484.36	482.30	484.54	0.001221	3.41	284.68	103.32	0.31
Creek	10557	EX5yr	1550.00	479.38	485.27	482.93	485.57	0.001533	4.40	352.53	108.73	0.36
Creek	10557	EX10yr	1935.00	479.38	485.79	483.31	486.17	0.001682	4.94	391.77	111.86	0.38
Creek	10557	EX25yr	2345.00	479.38	486.33	483.68	486.79	0.001779	5.42	432.46	115.10	0.40
Creek	10557	EX50yr	2685.00	479.38	486.76	483.98	487.28	0.001838	5.78	464.55	117.66	0.41
Creek	10557	EX100yr	3090.00	479.38	487.27	484.32	487.85	0.001874	6.15	502.63	120.69	0.42
Creek	10557	EX500yr	4155.00	479.38	488.66	485.13	489.39	0.001804	6.84	607.47	134.77	0.42
Creek	10557	ULT2yr	1080.00	479.38	484.54	482.43	484.74	0.001301	3.62	297.94	104.38	0.32
Creek	10557	ULT5yr	1770.00	479.38	485.57	483.15	485.91	0.001625	4.72	375.20	110.54	0.37
Creek	10557	ULT10yr	2220.00	479.38	486.16	483.57	486.59	0.001766	5.29	419.40	114.06	0.39
Creek	10557	ULT25yr	2690.00	479.38	486.76	483.99	487.28	0.001842	5.79	464.81	117.68	0.41
Creek	10557	ULT50yr	3080.00	479.38	487.25	484.30	487.84	0.001874	6.14	501.64	120.62	0.42
Creek	10557	ULT100yr	3500.00	479.38	487.80	484.64	488.45	0.001864	6.45	542.58	124.86	0.42
Creek	10557	ULT500yr	4665.00	479.38	489.35	485.50	490.13	0.001732	7.08	659.22	139.37	0.42
Creek	10516 Polo Road		Culvert									
Creek	10474	EX0.5yr	505.00	480.76	483.30	482.53	483.51	0.004135	3.71	136.00	102.48	0.47
Creek	10474	EX1yr	725.00	480.76	483.71	482.85	484.01	0.004503	4.40	164.70	111.55	0.51
Creek	10474	EX2yr	970.00	480.76	484.06	483.17	484.47	0.005091	5.13	189.04	113.75	0.55
Creek	10474	EX5yr	1550.00	480.76	484.75	483.83	485.41	0.006054	6.52	237.74	119.04	0.62
Creek	10474	EX10yr	1935.00	480.76	485.13	484.23	485.96	0.006661	7.33	263.91	122.20	0.67
Creek	10474	EX25yr	2345.00	480.76	485.49	484.62	486.51	0.007225	8.11	289.03	125.28	0.70
Creek	10474	EX50yr	2685.00	480.76	485.75	484.93	486.93	0.007701	8.73	307.55	127.54	0.73
Creek	10474	EX100yr	3090.00	480.76	486.04	485.29	487.42	0.008267	9.43	327.56	129.99	0.77
Creek	10474	EX500yr	4155.00	480.76	486.69	486.15	488.61	0.009688	11.14	373.07	133.84	0.85
Creek	10474	ULT2yr	1080.00	480.76	484.20	483.31	484.65	0.005338	5.43	198.77	114.65	0.57
Creek	10474	ULT5yr	1770.00	480.76	484.97	484.07	485.73	0.006420	7.00	252.95	120.87	0.65
Creek	10474	ULT10yr	2220.00	480.76	485.38	484.51	486.34	0.007052	7.88	281.73	124.38	0.69
Creek	10474	ULT25yr	2690.00	480.76	485.75	484.93	486.94	0.007719	8.74	307.68	127.56	0.73
Creek	10474	ULT50yr	3080.00	480.76	486.03	485.27	487.41	0.008248	9.41	327.15	129.94	0.77
Creek	10474	ULT100yr	3500.00	480.76	486.31	485.63	487.89	0.008761	10.09	346.89	131.87	0.80
Creek	10474	ULT500yr	4665.00	480.76	486.93	486.51	489.15	0.010516	11.96	390.19	135.16	0.89
Creek	10432	EX0.5yr	505.00	481.00	483.17	482.32	483.32	0.003490	3.06	165.06	148.48	0.42
Creek	10432	EX1yr	725.00	481.00	483.59	482.62	483.78	0.003838	3.46	209.59	175.38	0.45
Creek	10432	EX2yr	970.00	481.00	483.96	482.90	484.19	0.003788	3.84	254.39	228.51	0.46
Creek	10432	EX5yr	1550.00	481.00	484.73	483.53	485.05	0.003509	4.51	349.46	233.56	0.46
Creek	10432	EX10yr	1935.00	481.00	485.16	483.84	485.53	0.003469	4.91	402.46	235.90	0.47
Creek	10432	EX25yr	2345.00	481.00	485.58	484.13	486.01	0.003434	5.28	454.80	237.74	0.48
Creek	10432	EX50yr	2685.00	481.00	485.89	484.35	486.37	0.003436	5.57	494.54	239.19	0.48
Creek	10432	EX100yr	3090.00	481.00	486.24	484.60	486.78	0.003451	5.90	538.82	240.65	0.49
Creek	10432	EX500yr	4155.00	481.00	487.08	485.21	487.75	0.003482	6.64	644.88	243.73	0.51
Creek	10432	ULT2yr	1080.00	481.00	484.11	483.03	484.36	0.003767	4.00	272.89	229.51	0.46
Creek	10432	ULT5yr	1770.00	481.00	484.98	483.72	485.33	0.003491	4.75	380.07	235.08	0.47
Creek	10432	ULT10yr	2220.00	481.00	485.45	484.05	485.87	0.003439	5.17	439.42	237.20	0.48
Creek	10432	ULT25yr	2690.00	481.00	485.90	484.35	486.37	0.003441	5.58	494.87	239.21	0.48
Creek	10432	ULT50yr	3080.00	481.00	486.24	484.60	486.77	0.003448	5.89	537.87	240.62	0.49
Creek	10432	ULT100yr	3500.00	481.00	486.59	484.83	487.17	0.003439	6.18	582.56	241.93	0.50
Creek	10432	ULT500yr	4665.00	481.00	487.43	485.48	488.17	0.003531	6.98	689.33	245.03	0.52
Creek	10399	EX0.5yr	505.00	480.56	483.04	482.31	483.20	0.003945	3.27	182.95	190.75	0.45
Creek	10399	EX1yr	725.00	480.56	483.49	482.61	483.66	0.003214	3.46	271.10	199.20	0.42
Creek	10399	EX2yr	970.00	480.56	483.88	482.91	484.07	0.002964	3.72	350.37	204.62	0.41
Creek	10399	EX5yr	1550.00	480.56	484.70	483.07	484.92	0.002525	4.15	521.81	212.23	0.40
Creek	10399	EX10yr	1935.00	480.56	485.15	483.07	485.40	0.002419	4.42	618.38	215.72	0.40
Creek	10399	EX25yr	2345.00	480.56	485.60	484.01	485.86	0.002327	4.67	715.09	218.86	0.40
Creek	10399	EX50yr	2685.00	480.56	485.93	484.21	486.22	0.002285	4.87	789.03	221.20	0.40
Creek	10399	EX100yr	3090.00	480.56	486.31	484.42	486.62	0.002249	5.09	872.09	223.42	0.40
Creek	10399	EX500yr	4155.00	480.56	487.20	484.93	487.57	0.002188	5.61	1074.24	229.77	0.41
Creek	10399	ULT2yr	1080.00	480.56	484.04	483.07	484.24	0.002887	3.83	383.37	206.54	0.41
Creek	10399	ULT5yr	1770.00	480.56	484.96	483.07	485.20	0.002466	4.31	577.45	214.35	0.40
Creek	10399	ULT10yr	2220.00	480.56	485.47	483.94	485.73	0.002349	4.60	686.61	217.94	0.40
Creek	10399	ULT25yr	2690.00	480.56	485.94	484.20	486.22	0.002288	4.88	789.67	221.22	0.40
Creek	10399	ULT50yr	3080.00	480.56	486.30	484.41	486.61	0.002248	5.09	870.32	223.37	0.40

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	10399	ULT100yr	3500.00	480.56	486.68	484.62	487.00	0.002204	5.29	954.62	225.63	0.40
Creek	10399	ULT500yr	4665.00	480.56	487.58	485.15	487.97	0.002194	5.86	1161.60	233.98	0.41
Creek	10348	EX0.5yr	505.00	478.16	482.79		482.99	0.003821	3.66	157.74	125.43	0.44
Creek	10348	EX1yr	725.00	478.16	483.21		483.45	0.004078	4.15	222.11	167.11	0.46
Creek	10348	EX2yr	970.00	478.16	483.59		483.87	0.003982	4.51	287.56	171.79	0.47
Creek	10348	EX5yr	1550.00	478.16	484.43		484.74	0.003492	5.01	435.27	181.41	0.46
Creek	10348	EX10yr	1935.00	478.16	484.88		485.22	0.003404	5.34	517.46	186.45	0.46
Creek	10348	EX25yr	2345.00	478.16	485.32		485.69	0.003300	5.63	601.32	191.14	0.46
Creek	10348	EX50yr	2685.00	478.16	485.65		486.05	0.003254	5.86	665.51	194.24	0.47
Creek	10348	EX100yr	3090.00	478.16	486.02		486.45	0.003218	6.11	737.83	197.68	0.47
Creek	10348	EX500yr	4155.00	478.16	486.91		487.40	0.003129	6.68	916.69	205.48	0.47
Creek	10348	ULT2yr	1080.00	478.16	483.75		484.04	0.003940	4.65	314.90	173.70	0.47
Creek	10348	ULT5yr	1770.00	478.16	484.69		485.02	0.003449	5.21	482.39	184.24	0.46
Creek	10348	ULT10yr	2220.00	478.16	485.19		485.56	0.003326	5.54	576.57	189.96	0.46
Creek	10348	ULT25yr	2690.00	478.16	485.66		486.05	0.003260	5.86	665.94	194.26	0.47
Creek	10348	ULT50yr	3080.00	478.16	486.02		486.44	0.003216	6.10	736.33	197.61	0.47
Creek	10348	ULT100yr	3500.00	478.16	486.39		486.84	0.003157	6.33	810.82	201.09	0.47
Creek	10348	ULT500yr	4665.00	478.16	487.28		487.81	0.003123	6.94	993.87	208.48	0.48
Creek	10193	EX0.5yr	505.00	478.53	481.47	480.99	481.97	0.012442	6.57	131.02	114.03	0.81
Creek	10193	EX1yr	725.00	478.53	481.87	480.99	482.41	0.011656	7.16	177.19	118.77	0.81
Creek	10193	EX2yr	970.00	478.53	482.23	482.02	482.84	0.011475	7.78	220.79	123.03	0.82
Creek	10193	EX5yr	1550.00	478.53	482.63	482.63	483.64	0.016570	10.22	271.16	127.72	1.00
Creek	10193	EX10yr	1935.00	478.53	482.97	482.97	484.11	0.016990	11.06	314.89	131.85	1.03
Creek	10193	EX25yr	2345.00	478.53	483.28	483.28	484.58	0.017574	11.91	357.32	137.04	1.07
Creek	10193	EX50yr	2685.00	478.53	483.56	483.56	484.94	0.017431	12.41	395.63	142.00	1.07
Creek	10193	EX100yr	3090.00	478.53	483.87	483.87	485.34	0.017243	12.95	440.20	147.55	1.08
Creek	10193	EX500yr	4155.00	478.53	484.58	484.58	486.30	0.017107	14.24	551.01	162.53	1.10
Creek	10193	ULT2yr	1080.00	478.53	482.38	482.16	483.01	0.011431	8.03	239.00	124.76	0.82
Creek	10193	ULT5yr	1770.00	478.53	482.83	482.83	483.91	0.016667	10.68	297.49	130.06	1.02
Creek	10193	ULT10yr	2220.00	478.53	483.18	483.18	484.44	0.017550	11.69	343.50	135.20	1.06
Creek	10193	ULT25yr	2690.00	478.53	483.57	483.57	484.94	0.017297	12.39	397.29	142.21	1.07
Creek	10193	ULT50yr	3080.00	478.53	483.86	483.86	485.33	0.017285	12.95	438.76	147.38	1.08
Creek	10193	ULT100yr	3500.00	478.53	484.12	484.12	485.73	0.017749	13.62	477.63	152.50	1.11
Creek	10193	ULT500yr	4665.00	478.53	484.91	484.91	486.70	0.016823	14.71	604.66	169.13	1.11
Creek	10138	EX0.5yr	505.00	476.27	481.29	480.53	481.51	0.004598	4.31	162.69	170.20	0.46
Creek	10138	EX1yr	725.00	476.27	481.58	480.93	481.92	0.006107	5.32	193.60	189.32	0.53
Creek	10138	EX2yr	970.00	476.27	481.88	481.28	482.32	0.007307	6.19	226.79	208.03	0.59
Creek	10138	EX5yr	1550.00	476.27	482.60	482.03	482.95	0.005625	6.18	458.59	246.27	0.54
Creek	10138	EX10yr	1935.00	476.27	482.99	482.35	483.34	0.005309	6.37	555.53	257.86	0.53
Creek	10138	EX25yr	2345.00	476.27	483.36	482.59	483.71	0.004993	6.52	653.83	265.58	0.52
Creek	10138	EX50yr	2685.00	476.27	483.64	482.76	484.00	0.004843	6.66	727.94	270.29	0.52
Creek	10138	EX100yr	3090.00	476.27	483.87	482.94	484.26	0.005079	7.02	789.75	273.33	0.53
Creek	10138	EX500yr	4155.00	476.27	484.53	483.39	484.97	0.004984	7.52	975.03	282.26	0.54
Creek	10138	ULT2yr	1080.00	476.27	482.01	481.43	482.49	0.007645	6.49	242.32	216.14	0.61
Creek	10138	ULT5yr	1770.00	476.27	482.84	482.22	483.18	0.005341	6.25	518.03	253.44	0.53
Creek	10138	ULT10yr	2220.00	476.27	483.25	482.53	483.60	0.005071	6.47	624.85	263.37	0.52
Creek	10138	ULT25yr	2690.00	476.27	483.64	482.76	484.00	0.004863	6.68	727.84	270.28	0.52
Creek	10138	ULT50yr	3080.00	476.27	483.91	482.94	484.29	0.004821	6.88	802.41	273.95	0.52
Creek	10138	ULT100yr	3500.00	476.27	484.20	483.15	484.59	0.004751	7.07	881.00	277.77	0.52
Creek	10138	ULT500yr	4665.00	476.27	484.90	483.60	485.33	0.004677	7.57	1078.27	286.98	0.53
Creek	10074	EX0.5yr	525.00	478.00	481.09		481.21	0.003332	3.47	238.84	172.90	0.39
Creek	10074	EX1yr	750.00	478.00	481.36		481.52	0.004062	4.10	286.58	181.47	0.43
Creek	10074	EX2yr	1005.00	478.00	481.66		481.85	0.004370	4.56	342.48	191.08	0.46
Creek	10074	EX5yr	1640.00	478.00	482.31		482.56	0.004470	5.24	473.04	207.94	0.48
Creek	10074	EX10yr	2070.00	478.00	482.68		482.96	0.004492	5.59	551.69	216.91	0.49
Creek	10074	EX25yr	2535.00	478.00	483.04		483.35	0.004468	5.91	632.15	225.31	0.49
Creek	10074	EX50yr	2925.00	478.00	483.31		483.65	0.004467	6.14	692.73	229.05	0.50
Creek	10074	EX100yr	3290.00	478.00	483.53		483.89	0.004530	6.37	743.52	232.18	0.51
Creek	10074	EX500yr	4375.00	478.00	484.19		484.61	0.004412	6.84	900.01	241.78	0.51
Creek	10074	ULT2yr	1125.00	478.00	481.80		482.00	0.004379	4.70	369.94	195.63	0.46
Creek	10074	ULT5yr	1900.00	478.00	482.54		482.80	0.004497	5.47	520.83	213.42	0.48
Creek	10074	ULT10yr	2395.00	478.00	482.94		483.24	0.004493	5.83	607.97	223.13	0.49
Creek	10074	ULT25yr	2925.00	478.00	483.31		483.65	0.004467	6.14	692.73	229.05	0.50
Creek	10074	ULT50yr	3355.00	478.00	483.57		483.94	0.004531	6.41	752.81	232.76	0.51
Creek	10074	ULT100yr	3805.00	478.00	483.85		484.24	0.004500	6.62	817.84	236.74	0.51
Creek	10074	ULT500yr	4980.00	478.00	484.54		484.99	0.004307	7.03	985.68	247.01	0.51
Creek	10011	EX0.5yr	525.00	477.96	480.51	480.48	480.82	0.011245	5.46	151.34	183.35	0.68
Creek	10011	EX1yr	750.00	477.96	480.86		481.13	0.008560	5.30	216.89	192.27	0.61
Creek	10011	EX2yr	1005.00	477.96	481.27		481.50	0.006123	5.00	297.73	201.62	0.53
Creek	10011	EX5yr	1640.00	477.96	481.99		482.24	0.004855	5.20	450.24	224.41	0.49
Creek	10011	EX10yr	2070.00	477.96	482.38		482.65	0.004476	5.36	538.78	228.67	0.48
Creek	10011	EX25yr	2535.00	477.96	482.76		483.05	0.004245	5.56	625.55	232.80	0.48
Creek	10011	EX50yr	2925.00	477.96	483.02		483.34	0.004213	5.77	688.15	235.69	0.48
Creek	10011	EX100yr	3290.00	477.96	483.24		483.59	0.004267	5.99	739.05	237.63	0.49
Creek	10011	EX500yr	4375.00	477.96	483.91		484.32	0.004037	6.37	900.26	242.04	0.48
Creek	10011	ULT2yr	1125.00	477.96	481.45		481.67	0.005450	4.92	334.07	205.39	0.51

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	10011	ULT5yr	1900.00	477.96	482.23		482.49	0.004611	5.30	504.44	227.01	0.49
Creek	10011	ULT10yr	2395.00	477.96	482.64		482.93	0.004317	5.50	599.58	231.57	0.48
Creek	10011	ULT25yr	2925.00	477.96	483.02		483.34	0.004213	5.77	688.15	235.69	0.48
Creek	10011	ULT50yr	3355.00	477.96	483.28		483.63	0.004264	6.02	748.54	237.99	0.49
Creek	10011	ULT100yr	3805.00	477.96	483.56		483.94	0.004176	6.19	815.74	239.76	0.49
Creek	10011	ULT500yr	4980.00	477.96	484.27		484.71	0.003909	6.54	987.22	244.77	0.48
Creek	9892	EX0.5yr	525.00	476.00	480.09		480.24	0.003700	4.26	240.20	222.45	0.42
Creek	9892	EX1yr	750.00	476.00	480.65		480.75	0.002277	3.73	369.33	235.60	0.34
Creek	9892	EX2yr	1005.00	476.00	481.13		481.22	0.001851	3.64	484.20	246.96	0.31
Creek	9892	EX5yr	1640.00	476.00	481.89		482.00	0.001750	3.95	674.18	254.75	0.31
Creek	9892	EX10yr	2070.00	476.00	482.29		482.41	0.001775	4.19	776.79	257.91	0.32
Creek	9892	EX25yr	2535.00	476.00	482.67		482.82	0.001811	4.43	876.41	260.95	0.32
Creek	9892	EX50yr	2925.00	476.00	482.94		483.11	0.001884	4.66	947.18	263.29	0.33
Creek	9892	EX100yr	3290.00	476.00	483.16		483.34	0.001981	4.89	1004.45	265.38	0.34
Creek	9892	EX500yr	4375.00	476.00	483.84		484.07	0.002060	5.34	1188.74	272.01	0.36
Creek	9892	ULT2yr	1125.00	476.00	481.33		481.42	0.001718	3.61	533.33	249.05	0.30
Creek	9892	ULT5yr	1900.00	476.00	482.13		482.25	0.001769	4.10	736.98	256.69	0.32
Creek	9892	ULT10yr	2395.00	476.00	482.56		482.70	0.001805	4.36	846.62	260.05	0.32
Creek	9892	ULT25yr	2925.00	476.00	482.94		483.11	0.001884	4.66	947.18	263.29	0.33
Creek	9892	ULT50yr	3355.00	476.00	483.20		483.39	0.001992	4.92	1015.17	265.78	0.35
Creek	9892	ULT100yr	3805.00	476.00	483.48		483.69	0.002038	5.13	1091.70	268.59	0.35
Creek	9892	ULT500yr	4980.00	476.00	484.21		484.46	0.002062	5.53	1289.05	274.88	0.36
Creek	9839	EX0.5yr	525.00	476.00	479.87		479.96	0.002241	2.94	233.44	175.46	0.31
Creek	9839	EX1yr	750.00	476.00	480.49		480.56	0.001536	2.79	358.27	211.80	0.27
Creek	9839	EX2yr	1005.00	476.00	480.98		481.06	0.001336	2.86	464.41	220.95	0.26
Creek	9839	EX5yr	1640.00	476.00	481.72		481.83	0.001431	3.33	632.17	230.62	0.27
Creek	9839	EX10yr	2070.00	476.00	482.11		482.24	0.001517	3.61	721.58	233.65	0.29
Creek	9839	EX25yr	2535.00	476.00	482.47		482.64	0.001600	3.89	808.25	236.33	0.30
Creek	9839	EX50yr	2925.00	476.00	482.73		482.91	0.001705	4.15	868.32	238.09	0.31
Creek	9839	EX100yr	3290.00	476.00	482.92		483.14	0.001830	4.40	915.44	239.45	0.32
Creek	9839	EX500yr	4375.00	476.00	483.58		483.85	0.001969	4.90	1073.96	244.17	0.34
Creek	9839	ULT2yr	1125.00	476.00	481.18		481.26	0.001278	2.89	509.59	224.00	0.25
Creek	9839	ULT5yr	1900.00	476.00	481.96		482.08	0.001489	3.51	686.74	232.52	0.28
Creek	9839	ULT10yr	2395.00	476.00	482.36		482.52	0.001581	3.82	782.17	235.53	0.29
Creek	9839	ULT25yr	2925.00	476.00	482.73		482.91	0.001705	4.15	868.32	238.09	0.31
Creek	9839	ULT50yr	3355.00	476.00	482.96		483.18	0.001846	4.43	924.46	239.70	0.32
Creek	9839	ULT100yr	3805.00	476.00	483.23		483.48	0.001919	4.66	989.94	241.64	0.33
Creek	9839	ULT500yr	4980.00	476.00	483.94		484.24	0.002002	5.12	1161.22	246.83	0.35
Creek	9701	EX0.5yr	525.00	474.53	479.80		479.85	0.001234	2.44	313.47	207.38	0.23
Creek	9701	EX1yr	750.00	474.53	480.45		480.50	0.000849	2.28	474.86	270.30	0.20
Creek	9701	EX2yr	1005.00	474.53	480.95		481.00	0.000759	2.33	613.41	283.40	0.19
Creek	9701	EX5yr	1640.00	474.53	481.70		481.77	0.000851	2.73	831.13	299.35	0.21
Creek	9701	EX10yr	2070.00	474.53	482.09		482.17	0.000924	2.99	949.08	309.56	0.22
Creek	9701	EX25yr	2535.00	474.53	482.46		482.56	0.000988	3.23	1066.62	320.98	0.23
Creek	9701	EX50yr	2925.00	474.53	482.71		482.84	0.001060	3.43	1149.93	329.75	0.24
Creek	9701	EX100yr	3290.00	474.53	482.91		483.05	0.001135	3.63	1216.21	331.92	0.25
Creek	9701	EX500yr	4375.00	474.53	483.59		483.75	0.001207	4.00	1441.00	338.73	0.26
Creek	9701	ULT2yr	1125.00	474.53	481.16		481.21	0.000735	2.36	672.34	287.98	0.19
Creek	9701	ULT5yr	1900.00	474.53	481.93		482.02	0.000898	2.89	902.78	304.31	0.22
Creek	9701	ULT10yr	2395.00	474.53	482.35		482.45	0.000974	3.16	1030.88	317.56	0.23
Creek	9701	ULT25yr	2925.00	474.53	482.71		482.84	0.001060	3.43	1149.93	329.75	0.24
Creek	9701	ULT50yr	3355.00	474.53	482.95		483.09	0.001145	3.66	1228.96	332.34	0.25
Creek	9701	ULT100yr	3805.00	474.53	483.23		483.38	0.001184	3.83	1321.69	335.20	0.26
Creek	9701	ULT500yr	4980.00	474.53	483.95		484.13	0.001216	4.15	1564.98	341.61	0.27
Creek	9535	EX0.5yr	525.00	475.00	478.31	478.23	479.32	0.019731	8.10	67.84	42.15	0.92
Creek	9535	EX1yr	750.00	475.00	478.92	478.92	480.08	0.018977	8.82	100.21	63.76	0.92
Creek	9535	EX2yr	1005.00	475.00	479.66	479.66	480.66	0.013229	8.55	169.46	113.79	0.80
Creek	9535	EX5yr	1640.00	475.00	480.66	480.66	481.48	0.009609	8.59	334.37	196.31	0.71
Creek	9535	EX10yr	2070.00	475.00	480.96	480.96	481.86	0.010420	9.33	394.56	203.65	0.75
Creek	9535	EX25yr	2535.00	475.00	481.24	481.24	482.24	0.011243	10.06	452.62	214.68	0.78
Creek	9535	EX50yr	2925.00	475.00	481.57	481.57	482.52	0.010370	10.08	529.75	238.38	0.76
Creek	9535	EX100yr	3290.00	475.00	481.93		482.75	0.008752	9.66	616.81	243.37	0.71
Creek	9535	EX500yr	4375.00	475.00	482.83		483.50	0.006404	9.10	841.46	253.81	0.62
Creek	9535	ULT2yr	1125.00	475.00	479.90	479.90	480.89	0.012367	8.63	198.08	126.12	0.78
Creek	9535	ULT5yr	1900.00	475.00	480.87	480.87	481.72	0.009847	8.96	375.97	201.40	0.72
Creek	9535	ULT10yr	2395.00	475.00	481.17	481.17	482.13	0.010836	9.79	438.21	211.01	0.77
Creek	9535	ULT25yr	2925.00	475.00	481.57	481.57	482.52	0.010370	10.08	529.75	238.38	0.76
Creek	9535	ULT50yr	3355.00	475.00	481.99		482.80	0.008507	9.60	632.16	244.10	0.70
Creek	9535	ULT100yr	3805.00	475.00	482.39		483.11	0.007274	9.27	731.14	248.77	0.65
Creek	9535	ULT500yr	4980.00	475.00	483.25		483.90	0.005829	9.04	948.53	258.76	0.60
Creek	9393	EX0.5yr	525.00	473.46	478.57		478.62	0.001261	2.32	376.19	206.89	0.24
Creek	9393	EX1yr	750.00	473.46	479.07		479.13	0.001275	2.59	481.14	213.09	0.25
Creek	9393	EX2yr	1005.00	473.46	479.52		479.59	0.001321	2.87	579.75	220.52	0.26
Creek	9393	EX5yr	1640.00	473.46	480.41		480.51	0.001452	3.45	781.16	233.77	0.28
Creek	9393	EX10yr	2070.00	473.46	480.90		481.01	0.001518	3.77	897.60	241.33	0.29
Creek	9393	EX25yr	2535.00	473.46	481.37		481.50	0.001571	4.06	1012.72	248.39	0.30

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	9393	EX50yr	2925.00	473.46	481.72		481.86	0.001619	4.29	1100.09	252.61	0.31
Creek	9393	EX100yr	3290.00	473.46	482.02		482.18	0.001661	4.49	1176.86	256.28	0.31
Creek	9393	EX500yr	4375.00	473.46	482.81		483.01	0.001776	5.02	1384.10	265.64	0.33
Creek	9393	ULT2yr	1125.00	473.46	479.71		479.79	0.001347	2.99	621.62	223.22	0.26
Creek	9393	ULT5yr	1900.00	473.46	480.71		480.82	0.001495	3.65	853.00	238.46	0.29
Creek	9393	ULT10yr	2395.00	473.46	481.23		481.36	0.001554	3.98	979.49	246.51	0.30
Creek	9393	ULT25yr	2925.00	473.46	481.72		481.86	0.001619	4.29	1100.08	252.61	0.31
Creek	9393	ULT50yr	3355.00	473.46	482.07		482.23	0.001669	4.52	1190.00	256.90	0.32
Creek	9393	ULT100yr	3805.00	473.46	482.41		482.59	0.001719	4.75	1278.42	261.05	0.32
Creek	9393	ULT500yr	4980.00	473.46	483.21		483.43	0.001833	5.29	1489.29	269.87	0.34
Creek	9300	EX0.5yr	525.00	474.00	478.46		478.51	0.001519	2.72	375.42	202.37	0.27
Creek	9300	EX1yr	750.00	474.00	478.96		479.02	0.001514	2.99	478.96	209.36	0.27
Creek	9300	EX2yr	1005.00	474.00	479.41		479.49	0.001548	3.27	575.83	217.70	0.28
Creek	9300	EX5yr	1640.00	474.00	480.30		480.39	0.001653	3.84	774.79	231.76	0.30
Creek	9300	EX10yr	2070.00	474.00	480.78		480.90	0.001713	4.16	889.01	237.22	0.31
Creek	9300	EX25yr	2535.00	474.00	481.25		481.38	0.001768	4.46	1000.88	241.75	0.32
Creek	9300	EX50yr	2925.00	474.00	481.59		481.74	0.001822	4.70	1084.85	244.64	0.33
Creek	9300	EX100yr	3290.00	474.00	481.89		482.05	0.001872	4.91	1158.23	247.24	0.34
Creek	9300	EX500yr	4375.00	474.00	482.68		482.88	0.002005	5.47	1354.63	253.58	0.35
Creek	9300	ULT2yr	1125.00	474.00	479.60		479.68	0.001570	3.39	617.03	221.19	0.29
Creek	9300	ULT5yr	1900.00	474.00	480.60		480.71	0.001690	4.03	845.40	235.15	0.31
Creek	9300	ULT10yr	2395.00	474.00	481.12		481.24	0.001750	4.37	968.78	240.64	0.32
Creek	9300	ULT25yr	2925.00	474.00	481.59		481.74	0.001822	4.70	1084.84	244.63	0.33
Creek	9300	ULT50yr	3355.00	474.00	481.94		482.11	0.001881	4.95	1170.75	247.68	0.34
Creek	9300	ULT100yr	3805.00	474.00	482.28		482.46	0.001938	5.19	1254.79	250.39	0.35
Creek	9300	ULT500yr	4980.00	474.00	483.06		483.29	0.002073	5.76	1453.54	256.73	0.36
Creek	9195	EX0.5yr	525.00	474.00	478.01		478.25	0.004131	4.24	173.91	137.13	0.44
Creek	9195	EX1yr	750.00	474.00	478.47		478.76	0.004308	4.78	241.87	151.08	0.46
Creek	9195	EX2yr	1005.00	474.00	478.89		479.21	0.004451	5.25	306.83	158.40	0.48
Creek	9195	EX5yr	1640.00	474.00	479.69		480.10	0.004827	6.22	439.10	173.11	0.51
Creek	9195	EX10yr	2070.00	474.00	480.13		480.59	0.005027	6.75	517.00	181.92	0.53
Creek	9195	EX25yr	2535.00	474.00	480.53		481.06	0.005337	7.32	592.90	194.37	0.55
Creek	9195	EX50yr	2925.00	474.00	480.83		481.41	0.005570	7.75	651.77	202.85	0.57
Creek	9195	EX100yr	3290.00	474.00	481.09		481.71	0.005737	8.10	705.37	209.77	0.58
Creek	9195	EX500yr	4375.00	474.00	481.79		482.51	0.006036	8.94	856.77	225.16	0.61
Creek	9195	ULT2yr	1125.00	474.00	479.06		479.40	0.004532	5.46	334.10	161.41	0.48
Creek	9195	ULT5yr	1900.00	474.00	479.97		480.40	0.004942	6.54	487.30	178.44	0.52
Creek	9195	ULT10yr	2395.00	474.00	480.42		480.93	0.005254	7.16	570.66	191.07	0.55
Creek	9195	ULT25yr	2925.00	474.00	480.83		481.41	0.005571	7.75	651.76	202.85	0.57
Creek	9195	ULT50yr	3355.00	474.00	481.13		481.76	0.005759	8.15	714.76	210.72	0.59
Creek	9195	ULT100yr	3805.00	474.00	481.43		482.10	0.005894	8.52	778.79	217.34	0.60
Creek	9195	ULT500yr	4980.00	474.00	482.14		482.91	0.006095	9.30	938.31	232.60	0.62
Creek	9118	EX0.5yr	525.00	473.00	477.53		477.87	0.005541	4.96	146.78	131.88	0.51
Creek	9118	EX1yr	750.00	473.00	478.01		478.38	0.005364	5.40	212.19	138.81	0.51
Creek	9118	EX2yr	1005.00	473.00	478.40		478.82	0.005631	5.94	268.13	145.85	0.53
Creek	9118	EX5yr	1640.00	473.00	479.09		479.65	0.006667	7.20	372.71	161.71	0.59
Creek	9118	EX10yr	2070.00	473.00	479.47		480.11	0.007160	7.88	438.31	181.65	0.62
Creek	9118	EX25yr	2535.00	473.00	479.83		480.55	0.007600	8.50	507.52	204.50	0.65
Creek	9118	EX50yr	2925.00	473.00	480.11		480.88	0.007809	8.92	565.59	211.05	0.67
Creek	9118	EX100yr	3290.00	473.00	480.37		481.17	0.007917	9.25	619.51	217.04	0.67
Creek	9118	EX500yr	4375.00	473.00	481.08		481.95	0.007878	9.97	780.92	234.72	0.69
Creek	9118	ULT2yr	1125.00	473.00	478.55		478.99	0.005849	6.20	289.96	148.51	0.55
Creek	9118	ULT5yr	1900.00	473.00	479.33		479.93	0.006979	7.62	412.63	174.20	0.61
Creek	9118	ULT10yr	2395.00	473.00	479.73		480.42	0.007475	8.33	486.74	198.06	0.64
Creek	9118	ULT25yr	2925.00	473.00	480.11		480.88	0.007811	8.92	565.53	211.05	0.67
Creek	9118	ULT50yr	3355.00	473.00	480.41		481.22	0.007931	9.30	628.99	218.08	0.68
Creek	9118	ULT100yr	3805.00	473.00	480.71		481.55	0.007949	9.63	695.87	225.36	0.68
Creek	9118	ULT500yr	4980.00	473.00	481.48		482.37	0.007556	10.16	877.90	244.85	0.68
Creek	8982	EX0.5yr	525.00	472.47	476.89		477.18	0.005349	5.07	178.17	125.19	0.50
Creek	8982	EX1yr	750.00	472.47	477.24		477.65	0.007041	6.23	229.95	160.34	0.59
Creek	8982	EX2yr	1005.00	472.47	477.59		478.07	0.007722	6.95	289.54	181.07	0.62
Creek	8982	EX5yr	1640.00	472.47	478.32		478.86	0.008086	7.98	432.92	212.13	0.66
Creek	8982	EX10yr	2070.00	472.47	478.72		479.30	0.008105	8.46	522.68	226.57	0.67
Creek	8982	EX25yr	2535.00	472.47	479.12		479.72	0.008080	8.88	613.81	238.53	0.67
Creek	8982	EX50yr	2925.00	472.47	479.44		480.05	0.007855	9.10	691.75	246.34	0.67
Creek	8982	EX100yr	3290.00	472.47	479.73		480.34	0.007591	9.25	765.37	253.13	0.66
Creek	8982	EX500yr	4375.00	472.47	480.58		481.17	0.006670	9.46	987.37	270.86	0.64
Creek	8982	ULT2yr	1125.00	472.47	477.74		478.24	0.007840	7.19	317.39	186.93	0.63
Creek	8982	ULT5yr	1900.00	472.47	478.57		479.13	0.008101	8.28	487.75	221.01	0.66
Creek	8982	ULT10yr	2395.00	472.47	479.00		479.60	0.008141	8.78	586.05	235.81	0.67
Creek	8982	ULT25yr	2925.00	472.47	479.44		480.04	0.007862	9.10	691.52	246.31	0.67
Creek	8982	ULT50yr	3355.00	472.47	479.78		480.39	0.007553	9.27	778.08	254.26	0.66
Creek	8982	ULT100yr	3805.00	472.47	480.14		480.74	0.007184	9.40	870.08	261.98	0.65
Creek	8982	ULT500yr	4980.00	472.47	481.07		481.63	0.005923	9.34	1123.71	280.58	0.61
Creek	8885	EX0.5yr	525.00	472.00	476.25	475.88	476.63	0.007532	6.17	186.68	163.01	0.63
Creek	8885	EX1yr	750.00	472.00	476.63	476.40	477.02	0.007602	6.72	250.10	171.76	0.65

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	8885	EX2yr	1005.00	472.00	476.97	476.67	477.40	0.007990	7.34	309.42	181.27	0.67
Creek	8885	EX5yr	1640.00	472.00	477.54		478.13	0.010011	9.04	420.26	207.58	0.77
Creek	8885	EX10yr	2070.00	472.00	478.05		478.62	0.008867	9.18	533.53	231.84	0.74
Creek	8885	EX25yr	2535.00	472.00	478.52		479.06	0.008008	9.28	643.62	241.92	0.71
Creek	8885	EX50yr	2925.00	472.00	478.89		479.42	0.007414	9.35	735.10	250.06	0.69
Creek	8885	EX100yr	3290.00	472.00	479.23		479.74	0.006921	9.39	820.41	256.91	0.68
Creek	8885	EX500yr	4375.00	472.00	480.16		480.66	0.005838	9.50	1069.39	275.37	0.64
Creek	8885	ULT2yr	1125.00	472.00	477.10	476.78	477.55	0.008322	7.66	333.20	186.33	0.69
Creek	8885	ULT5yr	1900.00	472.00	477.87		478.44	0.009241	9.12	490.57	224.48	0.75
Creek	8885	ULT10yr	2395.00	472.00	478.38		478.93	0.008248	9.25	610.61	238.93	0.72
Creek	8885	ULT25yr	2925.00	472.00	478.89		479.42	0.007428	9.35	734.60	250.01	0.70
Creek	8885	ULT50yr	3355.00	472.00	479.28		479.80	0.006860	9.40	834.64	258.00	0.68
Creek	8885	ULT100yr	3805.00	472.00	479.68		480.19	0.006348	9.44	939.21	265.88	0.66
Creek	8885	ULT500yr	4980.00	472.00	480.72		481.18	0.005066	9.32	1225.12	285.30	0.60
Creek	8812	EX0.5yr	525.00	472.00	475.54	475.54	476.02	0.010522	6.19	142.92	158.45	0.74
Creek	8812	EX1yr	750.00	472.00	475.81	475.81	476.39	0.012095	7.03	189.47	174.77	0.81
Creek	8812	EX2yr	1005.00	472.00	476.11	476.11	476.75	0.012330	7.68	243.83	190.24	0.83
Creek	8812	EX5yr	1640.00	472.00	477.08		477.57	0.007340	7.31	437.68	210.70	0.68
Creek	8812	EX10yr	2070.00	472.00	477.73		478.15	0.005432	7.03	577.83	219.98	0.60
Creek	8812	EX25yr	2535.00	472.00	478.23		478.65	0.004884	7.17	692.21	244.26	0.58
Creek	8812	EX50yr	2925.00	472.00	478.63		479.04	0.004458	7.23	791.97	255.22	0.56
Creek	8812	EX100yr	3290.00	472.00	478.99		479.39	0.004108	7.26	885.63	264.12	0.55
Creek	8812	EX500yr	4375.00	472.00	479.98		480.37	0.003342	7.31	1158.11	285.94	0.51
Creek	8812	ULT2yr	1125.00	472.00	476.23	476.23	476.89	0.012447	7.95	266.45	193.78	0.84
Creek	8812	ULT5yr	1900.00	472.00	477.53		477.95	0.005723	6.98	532.96	216.12	0.61
Creek	8812	ULT10yr	2395.00	472.00	478.08		478.50	0.005049	7.14	656.46	240.29	0.59
Creek	8812	ULT25yr	2925.00	472.00	478.63		479.04	0.004470	7.24	791.27	255.12	0.56
Creek	8812	ULT50yr	3355.00	472.00	479.05		479.45	0.004066	7.27	901.05	265.44	0.54
Creek	8812	ULT100yr	3805.00	472.00	479.47		479.87	0.003704	7.29	1015.79	275.06	0.52
Creek	8812	ULT500yr	4980.00	472.00	480.56		480.93	0.002893	7.20	1328.26	297.86	0.48
Creek	8759	EX0.5yr	525.00	470.00	475.42		475.48	0.000908	2.30	407.59	244.20	0.21
Creek	8759	EX1yr	750.00	470.00	475.90		475.96	0.000978	2.58	531.10	267.59	0.22
Creek	8759	EX2yr	1005.00	470.00	476.34		476.41	0.001016	2.81	649.59	270.11	0.23
Creek	8759	EX5yr	1640.00	470.00	477.27		477.35	0.001079	3.26	905.40	286.28	0.24
Creek	8759	EX10yr	2070.00	470.00	477.88		477.97	0.001026	3.40	1082.65	292.86	0.24
Creek	8759	EX25yr	2535.00	470.00	478.37		478.47	0.001058	3.64	1227.97	300.51	0.25
Creek	8759	EX50yr	2925.00	470.00	478.76		478.87	0.001067	3.79	1347.45	306.88	0.25
Creek	8759	EX100yr	3290.00	470.00	479.12		479.23	0.001067	3.92	1457.13	313.00	0.25
Creek	8759	EX500yr	4375.00	470.00	480.09		480.22	0.001051	4.22	1771.62	331.53	0.25
Creek	8759	ULT2yr	1125.00	470.00	476.52		476.60	0.001033	2.91	699.44	270.81	0.23
Creek	8759	ULT5yr	1900.00	470.00	477.68		477.76	0.001016	3.32	1023.53	290.44	0.24
Creek	8759	ULT10yr	2395.00	470.00	478.22		478.32	0.001053	3.57	1184.44	298.10	0.24
Creek	8759	ULT25yr	2925.00	470.00	478.76		478.87	0.001068	3.79	1346.69	306.84	0.25
Creek	8759	ULT50yr	3355.00	470.00	479.17		479.29	0.001070	3.94	1475.19	314.10	0.25
Creek	8759	ULT100yr	3805.00	470.00	479.59		479.71	0.001063	4.07	1608.10	322.01	0.25
Creek	8759	ULT500yr	4980.00	470.00	480.66		480.80	0.000999	4.29	1964.63	342.68	0.25
Creek	8654	EX0.5yr	525.00	469.66	475.09		475.32	0.003026	4.24	213.63	180.10	0.38
Creek	8654	EX1yr	750.00	469.66	475.56		475.80	0.003098	4.63	301.87	196.82	0.39
Creek	8654	EX2yr	1005.00	469.66	476.00		476.25	0.003134	4.97	391.98	216.10	0.40
Creek	8654	EX5yr	1640.00	469.66	476.97		477.20	0.002728	5.25	610.00	235.81	0.39
Creek	8654	EX10yr	2070.00	469.66	477.62		477.83	0.002321	5.21	770.50	254.37	0.36
Creek	8654	EX25yr	2535.00	469.66	478.12		478.34	0.002268	5.42	898.54	263.14	0.37
Creek	8654	EX50yr	2925.00	469.66	478.52		478.74	0.002192	5.53	1005.05	268.86	0.36
Creek	8654	EX100yr	3290.00	469.66	478.88		479.10	0.002120	5.62	1103.01	274.72	0.36
Creek	8654	EX500yr	4375.00	469.66	479.87		480.10	0.001933	5.82	1383.62	290.89	0.35
Creek	8654	ULT2yr	1125.00	469.66	476.19		476.44	0.003078	5.06	433.57	219.46	0.40
Creek	8654	ULT5yr	1900.00	469.66	477.42		477.63	0.002364	5.15	718.45	248.65	0.37
Creek	8654	ULT10yr	2395.00	469.66	477.97		478.19	0.002292	5.37	859.88	260.90	0.37
Creek	8654	ULT25yr	2925.00	469.66	478.51		478.74	0.002197	5.54	1004.24	268.81	0.36
Creek	8654	ULT50yr	3355.00	469.66	478.94		479.16	0.002115	5.64	1118.95	275.67	0.36
Creek	8654	ULT100yr	3805.00	469.66	479.36		479.59	0.002028	5.73	1237.79	282.60	0.35
Creek	8654	ULT500yr	4980.00	469.66	480.46		480.69	0.001767	5.82	1557.75	300.86	0.34
Creek	8635	EX0.5yr	525.00	470.00	475.11		475.25	0.002096	3.58	285.51	213.52	0.32
Creek	8635	EX1yr	750.00	470.00	475.58		475.72	0.002110	3.87	391.50	233.33	0.32
Creek	8635	EX2yr	1005.00	470.00	476.02		476.17	0.002111	4.12	498.04	250.31	0.33
Creek	8635	EX5yr	1640.00	470.00	476.99		477.13	0.001852	4.36	752.62	274.11	0.32
Creek	8635	EX10yr	2070.00	470.00	477.64		477.78	0.001590	4.34	935.33	285.64	0.30
Creek	8635	EX25yr	2535.00	470.00	478.14		478.28	0.001575	4.53	1078.65	293.76	0.30
Creek	8635	EX50yr	2925.00	470.00	478.54		478.68	0.001540	4.65	1197.30	299.36	0.30
Creek	8635	EX100yr	3290.00	470.00	478.90		479.05	0.001504	4.75	1306.07	304.40	0.30
Creek	8635	EX500yr	4375.00	470.00	479.89		480.05	0.001408	4.98	1615.32	319.26	0.30
Creek	8635	ULT2yr	1125.00	470.00	476.21		476.36	0.002084	4.20	546.27	256.23	0.33
Creek	8635	ULT5yr	1900.00	470.00	477.44		477.57	0.001614	4.28	876.62	282.00	0.30
Creek	8635	ULT10yr	2395.00	470.00	477.99		478.13	0.001585	4.48	1035.50	291.72	0.30
Creek	8635	ULT25yr	2925.00	470.00	478.54		478.68	0.001544	4.66	1196.41	299.32	0.30
Creek	8635	ULT50yr	3355.00	470.00	478.96		479.11	0.001503	4.77	1323.73	305.21	0.30
Creek	8635	ULT100yr	3805.00	470.00	479.38		479.54	0.001457	4.86	1454.94	311.59	0.30

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	8635	ULT500yr	4980.00	470.00	480.48		480.64	0.001303	5.00	1805.64	327.96	0.29
Creek	8539	EX0.5yr	525.00	470.44	475.00		475.07	0.001503	2.95	341.05	199.40	0.27
Creek	8539	EX1yr	750.00	470.44	475.46		475.55	0.001628	3.33	436.42	212.55	0.29
Creek	8539	EX2yr	1005.00	470.44	475.89		475.99	0.001747	3.68	529.89	223.18	0.30
Creek	8539	EX5yr	1640.00	470.44	476.85		476.97	0.001773	4.21	753.43	242.96	0.32
Creek	8539	EX10yr	2070.00	470.44	477.51		477.64	0.001599	4.32	918.84	256.29	0.31
Creek	8539	EX25yr	2535.00	470.44	478.00		478.14	0.001648	4.61	1046.45	266.84	0.32
Creek	8539	EX50yr	2925.00	470.44	478.40		478.54	0.001652	4.80	1153.46	272.95	0.32
Creek	8539	EX100yr	3290.00	470.44	478.76		478.91	0.001642	4.95	1252.06	278.42	0.32
Creek	8539	EX500yr	4375.00	470.44	479.75		479.92	0.001583	5.28	1533.74	289.39	0.32
Creek	8539	ULT2yr	1125.00	470.44	476.08		476.18	0.001782	3.82	571.80	227.19	0.31
Creek	8539	ULT5yr	1900.00	470.44	477.31		477.43	0.001595	4.22	866.62	251.85	0.30
Creek	8539	ULT10yr	2395.00	470.44	477.85		477.99	0.001640	4.53	1007.71	263.67	0.31
Creek	8539	ULT25yr	2925.00	470.44	478.39		478.54	0.001655	4.80	1152.56	272.90	0.32
Creek	8539	ULT50yr	3355.00	470.44	478.81		478.97	0.001645	4.98	1268.02	279.30	0.32
Creek	8539	ULT100yr	3805.00	470.44	479.24		479.40	0.001617	5.12	1387.93	284.47	0.32
Creek	8539	ULT500yr	4980.00	470.44	480.34		480.52	0.001481	5.34	1707.32	295.10	0.31
Creek	8420	EX0.5yr	525.00	472.00	474.60		474.77	0.005193	3.52	204.13	199.96	0.46
Creek	8420	EX1yr	750.00	472.00	475.12		475.27	0.003618	3.48	310.61	205.33	0.40
Creek	8420	EX2yr	1005.00	472.00	475.56		475.72	0.003202	3.68	401.21	209.54	0.39
Creek	8420	EX5yr	1640.00	472.00	476.55		476.73	0.002500	3.98	613.89	219.09	0.36
Creek	8420	EX10yr	2070.00	472.00	477.25		477.43	0.002043	4.03	769.52	225.75	0.34
Creek	8420	EX25yr	2535.00	472.00	477.72		477.92	0.002075	4.35	877.13	230.22	0.34
Creek	8420	EX50yr	2925.00	472.00	478.11		478.33	0.002058	4.55	967.41	233.87	0.35
Creek	8420	EX100yr	3290.00	472.00	478.47		478.70	0.002020	4.71	1050.88	237.20	0.35
Creek	8420	EX500yr	4375.00	472.00	479.45		479.71	0.001918	5.10	1288.39	246.91	0.35
Creek	8420	ULT2yr	1125.00	472.00	475.75		475.91	0.003067	3.76	441.07	211.37	0.39
Creek	8420	ULT5yr	1900.00	472.00	477.05		477.22	0.002063	3.93	723.86	223.82	0.34
Creek	8420	ULT10yr	2395.00	472.00	477.58		477.77	0.002074	4.26	844.46	228.87	0.34
Creek	8420	ULT25yr	2925.00	472.00	478.11		478.33	0.002064	4.56	966.46	233.83	0.35
Creek	8420	ULT50yr	3355.00	472.00	478.52		478.76	0.002022	4.74	1064.08	237.73	0.35
Creek	8420	ULT100yr	3805.00	472.00	478.94		479.19	0.001970	4.91	1165.32	241.73	0.35
Creek	8420	ULT500yr	4980.00	472.00	480.05		480.32	0.001775	5.20	1439.24	253.28	0.34
Creek	8313	EX0.5yr	525.00	469.17	474.30		474.46	0.002039	3.64	216.81	91.78	0.32
Creek	8313	EX1yr	750.00	469.17	474.73		474.96	0.002719	4.50	258.14	99.67	0.38
Creek	8313	EX2yr	1005.00	469.17	475.03		475.37	0.003747	5.51	288.81	110.60	0.45
Creek	8313	EX5yr	1640.00	469.17	475.83		476.36	0.005133	7.15	397.37	163.04	0.53
Creek	8313	EX10yr	2070.00	469.17	476.34		477.06	0.006255	8.37	493.10	204.88	0.60
Creek	8313	EX25yr	2535.00	469.17	476.91		477.58	0.005570	8.39	613.29	213.53	0.57
Creek	8313	EX50yr	2925.00	469.17	477.38		478.00	0.005029	8.35	715.49	219.74	0.55
Creek	8313	EX100yr	3290.00	469.17	477.80		478.39	0.004636	8.32	807.69	224.79	0.53
Creek	8313	EX500yr	4375.00	469.17	478.89		479.44	0.003938	8.39	1059.92	237.67	0.50
Creek	8313	ULT2yr	1125.00	469.17	475.16		475.55	0.004179	5.93	303.62	113.94	0.47
Creek	8313	ULT5yr	1900.00	469.17	476.11		476.84	0.006441	8.28	447.65	194.95	0.60
Creek	8313	ULT10yr	2395.00	469.17	476.74		477.42	0.005800	8.41	575.80	210.88	0.58
Creek	8313	ULT25yr	2925.00	469.17	477.37		478.00	0.005068	8.37	713.33	219.62	0.55
Creek	8313	ULT50yr	3355.00	469.17	477.86		478.45	0.004619	8.35	820.89	225.50	0.53
Creek	8313	ULT100yr	3805.00	469.17	478.34		478.90	0.004249	8.34	930.41	231.15	0.52
Creek	8313	ULT500yr	4980.00	469.17	479.57		480.08	0.003439	8.25	1224.30	246.96	0.48
Creek	8158	EX0.5yr	525.00	470.04	473.31	473.31	473.76	0.013756	5.81	139.78	186.88	0.75
Creek	8158	EX1yr	750.00	470.04	473.57	473.57	474.09	0.014883	6.58	188.78	194.22	0.80
Creek	8158	EX2yr	1005.00	470.04	474.06		474.46	0.009834	6.15	287.48	210.44	0.67
Creek	8158	EX5yr	1640.00	470.04	475.30		475.55	0.004315	5.27	556.82	226.95	0.47
Creek	8158	EX10yr	2070.00	470.04	475.99		476.22	0.003343	5.18	717.36	237.23	0.43
Creek	8158	EX25yr	2535.00	470.04	476.61		476.84	0.002904	5.26	867.22	245.73	0.41
Creek	8158	EX50yr	2925.00	470.04	477.11		477.34	0.002631	5.33	991.48	252.90	0.40
Creek	8158	EX100yr	3290.00	470.04	477.54		477.77	0.002454	5.40	1101.91	258.77	0.39
Creek	8158	EX500yr	4375.00	470.04	478.66		478.91	0.002173	5.69	1399.37	273.27	0.37
Creek	8158	ULT2yr	1125.00	470.04	474.33		474.67	0.007671	5.80	344.40	213.70	0.60
Creek	8158	ULT5yr	1900.00	470.04	475.71		475.95	0.003688	5.22	652.71	233.14	0.45
Creek	8158	ULT10yr	2395.00	470.04	476.42		476.65	0.003036	5.25	820.72	242.96	0.42
Creek	8158	ULT25yr	2925.00	470.04	477.09		477.33	0.002656	5.35	988.28	252.73	0.40
Creek	8158	ULT50yr	3355.00	470.04	477.60		477.83	0.002453	5.44	1116.98	259.56	0.39
Creek	8158	ULT100yr	3805.00	470.04	478.09		478.33	0.002296	5.54	1247.07	266.20	0.38
Creek	8158	ULT500yr	4980.00	470.04	479.36		479.61	0.001928	5.71	1595.65	282.31	0.36
Creek	8047	EX0.5yr	520.00	469.03	472.02	471.13	472.35	0.005867	4.70	120.32	70.65	0.52
Creek	8047	EX1yr	755.00	469.03	472.61	471.64	473.02	0.005748	5.33	163.58	76.56	0.53
Creek	8047	EX2yr	1015.00	469.03	473.16	472.20	473.65	0.005612	5.87	207.26	81.13	0.54
Creek	8047	EX5yr	1685.00	469.03	474.30	473.14	474.96	0.005571	6.99	304.67	91.58	0.56
Creek	8047	EX10yr	2140.00	469.03	474.89	473.66	475.68	0.005829	7.72	361.66	102.04	0.58
Creek	8047	EX25yr	2630.00	469.03	475.44	474.03	476.32	0.005921	8.30	421.81	118.75	0.60
Creek	8047	EX50yr	3055.00	469.03	475.94	474.50	476.85	0.005654	8.55	484.78	133.33	0.59
Creek	8047	EX100yr	3445.00	469.03	476.40	475.19	477.31	0.005274	8.65	551.42	152.76	0.58
Creek	8047	EX500yr	4525.00	469.03	477.78	476.02	478.54	0.003737	8.22	778.59	176.34	0.50
Creek	8047	ULT2yr	1145.00	469.03	473.41	472.41	473.93	0.005565	6.10	227.70	82.95	0.54
Creek	8047	ULT5yr	1955.00	469.03	474.65	473.46	475.39	0.005779	7.46	337.59	97.64	0.58

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	8047	ULT10yr	2475.00	469.03	475.26	473.99	476.12	0.005957	8.16	401.15	112.93	0.60
Creek	8047	ULT25yr	3045.00	469.03	475.92	474.49	476.83	0.005675	8.56	482.78	132.90	0.59
Creek	8047	ULT50yr	3500.00	469.03	476.47	475.17	477.37	0.005203	8.65	561.91	154.93	0.58
Creek	8047	ULT100yr	3975.00	469.03	477.08	475.59	477.92	0.004500	8.50	660.51	170.34	0.54
Creek	8047	ULT500yr	5165.00	469.03	478.63	476.58	479.30	0.002997	7.85	923.01	185.04	0.46
Creek	7989	EX0.5yr	520.00	467.75	471.94	470.34	472.01	0.002503	2.17	239.60	111.82	0.26
Creek	7989	EX1yr	755.00	467.75	472.57	470.68	472.66	0.002236	2.44	311.59	115.67	0.26
Creek	7989	EX2yr	1015.00	467.75	473.16	471.05	473.27	0.002114	2.69	380.71	119.25	0.26
Creek	7989	EX5yr	1685.00	467.75	474.37	471.70	474.53	0.002028	3.24	528.35	126.70	0.27
Creek	7989	EX10yr	2140.00	467.75	475.00	472.04	475.19	0.002085	3.58	607.43	130.66	0.27
Creek	7989	EX25yr	2630.00	467.75	475.56	472.39	475.80	0.002187	3.92	680.04	134.45	0.29
Creek	7989	EX50yr	3055.00	467.75	476.07	472.67	476.33	0.002198	4.16	745.00	137.81	0.29
Creek	7989	EX100yr	3445.00	467.75	476.53	472.91	476.81	0.002176	4.34	805.19	140.89	0.29
Creek	7989	EX500yr	4525.00	467.75	477.84	473.54	478.17	0.001981	4.66	980.86	149.71	0.29
Creek	7989	ULT2yr	1145.00	467.75	473.42	471.17	473.54	0.002082	2.81	412.30	120.85	0.26
Creek	7989	ULT5yr	1955.00	467.75	474.74	471.91	474.92	0.002076	3.45	575.08	129.05	0.27
Creek	7989	ULT10yr	2475.00	467.75	475.38	472.28	475.60	0.002168	3.82	656.63	133.22	0.28
Creek	7989	ULT25yr	3045.00	467.75	476.05	472.66	476.31	0.002202	4.16	743.09	137.71	0.29
Creek	7989	ULT50yr	3500.00	467.75	476.59	472.95	476.88	0.002170	4.36	813.86	141.33	0.29
Creek	7989	ULT100yr	3975.00	467.75	477.17	473.23	477.48	0.002094	4.52	890.68	145.21	0.29
Creek	7989	ULT500yr	5165.00	467.75	478.65	473.89	479.00	0.001815	4.76	1090.59	160.33	0.28
Creek	7922 Bardin Road		Culvert									
Creek	7883	EX0.5yr	520.00	466.68	471.96	468.78	471.99	0.000267	1.40	371.65	114.54	0.12
Creek	7883	EX1yr	755.00	466.68	472.59	469.08	472.63	0.000355	1.77	426.81	117.41	0.14
Creek	7883	EX2yr	1015.00	466.68	473.16	469.37	473.23	0.000441	2.13	477.61	120.05	0.16
Creek	7883	EX5yr	1685.00	466.68	474.29	470.01	474.42	0.000643	2.92	578.03	125.27	0.20
Creek	7883	EX10yr	2140.00	466.68	474.81	470.40	474.99	0.000803	3.43	624.24	127.67	0.23
Creek	7883	EX25yr	2630.00	466.68	475.23	470.78	475.47	0.001002	3.98	661.03	129.58	0.26
Creek	7883	EX50yr	3055.00	466.68	475.56	471.10	475.86	0.001170	4.43	690.29	131.04	0.28
Creek	7883	EX100yr	3445.00	466.68	475.83	471.37	476.19	0.001328	4.82	714.38	132.23	0.30
Creek	7883	EX500yr	4525.00	466.68	476.47	472.09	477.00	0.001775	5.87	771.21	135.11	0.35
Creek	7883	ULT2yr	1145.00	466.68	473.41	469.50	473.49	0.000481	2.29	500.08	121.22	0.17
Creek	7883	ULT5yr	1955.00	466.68	474.61	470.24	474.77	0.000740	3.23	605.90	126.72	0.22
Creek	7883	ULT10yr	2475.00	466.68	475.10	470.66	475.32	0.000941	3.81	649.62	128.99	0.25
Creek	7883	ULT25yr	3045.00	466.68	475.55	471.08	475.85	0.001168	4.42	689.41	131.00	0.28
Creek	7883	ULT50yr	3500.00	466.68	475.87	471.42	476.23	0.001350	4.88	717.64	132.39	0.30
Creek	7883	ULT100yr	3975.00	466.68	476.17	471.74	476.61	0.001540	5.34	744.58	133.72	0.32
Creek	7883	ULT500yr	5165.00	466.68	476.78	472.49	477.43	0.002055	6.46	799.00	137.57	0.38
Creek	7852	EX0.5yr	520.00	466.69	471.95	469.50	471.98	0.000457	1.52	346.92	117.12	0.15
Creek	7852	EX1yr	755.00	466.69	472.57	469.83	472.62	0.000525	1.83	418.75	121.53	0.17
Creek	7852	EX2yr	1015.00	466.69	473.14	470.14	473.21	0.000588	2.13	486.20	125.61	0.18
Creek	7852	EX5yr	1685.00	466.69	474.28	470.75	474.39	0.000734	2.77	621.60	134.56	0.21
Creek	7852	EX10yr	2140.00	466.69	474.80	471.09	474.95	0.000867	3.20	684.13	137.96	0.23
Creek	7852	EX25yr	2630.00	466.69	475.22	471.44	475.42	0.001040	3.66	733.98	141.01	0.25
Creek	7852	EX50yr	3055.00	466.69	475.55	471.73	475.80	0.001180	4.04	773.80	143.67	0.27
Creek	7852	EX100yr	3445.00	466.69	475.82	471.97	476.11	0.001309	4.37	806.67	145.66	0.29
Creek	7852	EX500yr	4525.00	466.69	476.48	472.60	476.89	0.001667	5.22	884.81	151.31	0.33
Creek	7852	ULT2yr	1145.00	466.69	473.40	470.28	473.47	0.000617	2.26	516.28	127.40	0.19
Creek	7852	ULT5yr	1955.00	466.69	474.59	470.95	474.73	0.000816	3.03	659.29	136.62	0.22
Creek	7852	ULT10yr	2475.00	466.69	475.09	471.33	475.27	0.000988	3.52	718.50	139.96	0.25
Creek	7852	ULT25yr	3045.00	466.69	475.54	471.70	475.78	0.001179	4.03	772.59	143.60	0.27
Creek	7852	ULT50yr	3500.00	466.69	475.86	472.00	476.16	0.001327	4.41	811.14	145.93	0.29
Creek	7852	ULT100yr	3975.00	466.69	476.17	472.28	476.52	0.001479	4.79	848.09	148.49	0.31
Creek	7852	ULT500yr	5165.00	466.69	476.80	472.93	477.29	0.001887	5.71	923.38	154.27	0.35
Creek	7786	EX0.5yr	520.00	468.99	471.28	471.00	471.85	0.007349	6.06	85.74	49.62	0.81
Creek	7786	EX1yr	755.00	468.99	471.52	471.52	472.44	0.010814	7.69	98.22	60.46	1.00
Creek	7786	EX2yr	1015.00	468.99	471.99	471.99	473.01	0.010471	8.14	124.75	162.70	1.00
Creek	7786	EX5yr	1685.00	468.99	472.98	472.98	474.17	0.009084	8.76	195.33	255.52	0.97
Creek	7786	EX10yr	2140.00	468.99	473.50	473.50	474.72	0.007550	9.00	261.66	325.92	0.91
Creek	7786	EX25yr	2630.00	468.99	474.03	474.03	475.19	0.006046	8.96	344.37	354.99	0.83
Creek	7786	EX50yr	3055.00	468.99	474.30	474.30	475.55	0.006056	9.41	387.97	364.74	0.84
Creek	7786	EX100yr	3445.00	468.99	474.55	474.55	475.85	0.005927	9.71	429.33	373.83	0.84
Creek	7786	EX500yr	4525.00	468.99	475.19	475.19	476.61	0.005555	10.36	543.29	422.10	0.84
Creek	7786	ULT2yr	1145.00	468.99	472.19	472.19	473.27	0.010315	8.35	137.15	170.14	1.00
Creek	7786	ULT5yr	1955.00	468.99	473.37	473.37	474.51	0.007372	8.65	244.09	312.60	0.89
Creek	7786	ULT10yr	2475.00	468.99	473.91	473.91	475.05	0.006143	8.83	325.34	349.95	0.84
Creek	7786	ULT25yr	3045.00	468.99	474.31	474.31	475.54	0.005951	9.35	389.63	365.11	0.84
Creek	7786	ULT50yr	3500.00	468.99	474.58	474.58	475.89	0.005920	9.76	434.73	375.04	0.84
Creek	7786	ULT100yr	3975.00	468.99	474.84	474.84	476.24	0.005921	10.16	478.40	385.06	0.85
Creek	7786	ULT500yr	5165.00	468.99	475.49	475.49	477.00	0.005544	10.78	603.53	429.44	0.85
Creek	7715	EX0.5yr	520.00	468.00	471.42	470.41	471.44	0.001903	1.97	448.44	366.82	0.27
Creek	7715	EX1yr	755.00	468.00	471.82	470.58	471.85	0.001902	2.14	572.21	411.32	0.28
Creek	7715	EX2yr	1015.00	468.00	472.09	470.74	472.13	0.001903	2.33	745.40	465.08	0.28
Creek	7715	EX5yr	1685.00	468.00	472.71	471.08	472.76	0.001903	2.76	1038.14	476.35	0.29
Creek	7715	EX10yr	2140.00	468.00	473.07	471.25	473.13	0.001901	3.00	1207.64	481.90	0.30

HEC-RAS Plan: MDP River: Cedar Creek Reach: Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Creek	7715	EX25yr	2630.00	468.00	473.41	471.35	473.48	0.001902	3.21	1372.41	484.66	0.30
Creek	7715	EX50yr	3055.00	468.00	473.68	471.57	473.76	0.001902	3.38	1505.49	486.89	0.31
Creek	7715	EX100yr	3445.00	468.00	473.92	471.65	474.00	0.001901	3.52	1620.96	488.53	0.31
Creek	7715	EX500yr	4525.00	468.00	474.52	472.05	474.62	0.001901	3.87	1915.68	492.63	0.32
Creek	7715	ULT2yr	1145.00	468.00	472.23	470.80	472.27	0.001900	2.43	808.54	467.65	0.28
Creek	7715	ULT5yr	1955.00	468.00	472.93	471.18	472.98	0.001901	2.91	1141.06	480.11	0.30
Creek	7715	ULT10yr	2475.00	468.00	473.30	471.31	473.37	0.001902	3.15	1321.73	483.81	0.30
Creek	7715	ULT25yr	3045.00	468.00	473.68	471.57	473.75	0.001902	3.38	1502.44	486.84	0.31
Creek	7715	ULT50yr	3500.00	468.00	473.95	471.67	474.03	0.001901	3.54	1636.79	488.75	0.31
Creek	7715	ULT100yr	3975.00	468.00	474.22	471.82	474.31	0.001903	3.70	1769.14	490.60	0.32
Creek	7715	ULT500yr	5165.00	468.00	474.85	472.21	474.96	0.001900	4.05	2077.47	494.87	0.32

Appendix D

Storm Drain Model Output (StormCAD) for Cedar Creek (Y#0845)

AECOM

Appendix E.1

Cedar Creek Channel Assessment for the City of Grand Prairie

AECOM

Cedar Creek Channel Assessment For The City of Grand Prairie

Submitted to AECOM by:

Peter M. Allen PhD., PG
Jeff Arnold, PhD.
Gary Stinchcomb M.S.

Cedar Cr.: *Executive Summary: Fluvial Geomorphology for Channel Design*

Bed	clay; limestone sand and gravel; D_{50} 4 mm; minor Eagle Ford shale exposed in stream.
Bed Stability	All bed material mobile 2 year; most in 0.5 year recurrence interval; clay/shale will slake upon wetting and drying; numerous tree dams and minor knickpoints indicate downcutting and widening; roads and associated structures are acting as hardpoints, separating channels into 3 distinct reaches; Robinson to Carrier Pkwy., Carrier Pkway. to Polo, Polo to Bardin Rd.
Banks	Alluvial clay-silty clay banks; scour under root zone; slight erosion Type I-IV; moderate scour both banks Type II-III; wedge failures and slumping in Type III sections.
Bank Stability	Presently bank scour; future degradation will cause increased wedge and slump failures and tree loss; tree dams. Critical height around 8 feet for vertical slopes.
Potential Widening	The bankfull channel should widen to about 30 feet an attain a bankfull depth of about 4-5 feet; more if slumping and widening is not halted with drop structures; with uncontrolled downcutting the overall channel downcutting could reach over 16 feet in Reach 2 with entrenched channel top widths up to 65 feet or more. Degradation will be controlled by location of future hardpoints.
Potential Degradation	Maximum in 20 years up to 4.6 feet/1000 feet channel if in alluvium, based on SWAT-DEG runs; degradation could continue beyond 20 years.
Number of Drops@ <3ft.	Up to 11 drops/hard points to stabilize potential down cutting in Type I-II stream sections; still time for installation of drops here; not in Type III,IV.
Meander Migration ft/yr	1-2 feet/year outside if not protected possible; up to 8.7ft. maximum water depth in bend (bend scour)

Table Contents

1.0 ***Introduction: Stream Assessment Cedar Creek*** 4
1.1 Methods of Assessment: ***Alluvial and Threshold Channels*** 5
1.2 Field Channel Survey Approach 8
2.0 ***Watershed Characteristics*** 11
3.0 ***Watershed Flow Regime and Flood Discharges*** 19
4.0 ***Hydraulic Conditions (AECOM)*** 22
5.0 ***Bed and Bank Material Erosion and Armoring Potential*** 23
5.1 Erosion Rates and Movement of Bed Material 23
5.2 Erosion Rates: Alluvial Material 29
5.3 Erosion Rates: Shale 34
6.0 ***Vertical Stability*** 37
6.1 Equilibrium Slope 37
6.2 Field Survey Results 40
6.3 Predicted Rate of Degradation: SWAT-DEG Model 70
6.4 Stream Power and Instability of Cedar Creek 73
6.5 Predicted Channel Dimensions 74
7.0 ***Planform Stability*** 77
7.1 Meanders 77
7.2 Bank Stability 79
7.3 Future Channel Evolution 82
8.0 ***Local Scour*** 85
9.0 *Conclusions* 86
Bibliography 88
Appendix Stable Slope 92
Appendix: Stable Channel Dimension Calculations: Extremal Hypothesis 93

1.0 *Introduction*: *Stream Assessment Cedar Creek*

A stream channel assessment of Cedar Creek Watershed was authorized by AECOM Engineering for the City of Grand Prairie, Texas. Cedar Creek is a tributary of Mountain Creek. This study involves the upper 1.77 square miles of the Cedar Creek watershed within the City of Grand Prairie. The bottom and sides of the stream has been channelized from near its headwaters at Kite Road (approximately 32 38.975N and 97 2.134W) to Robinson Road (32 39.277N and 97 0895W). This survey concentrated on channel stability assessment from Robinson Road to Bardin Road (32 39.515N and 96 59.749W) or a length of approximately 9396 feet of stream channel. The upper channelized portion of the watershed and lower non-channelized portion of the watershed below Bardin Road were visually inspected but are not part of the site specific references given in the following report.

The assessment of the stability of stream channels is driven by the frequency and magnitude of channel discharges, the slope and depth of the water, the amount of sediment being moved, and the size of the sediment . This relationship is the keystone of stream assessment and was given by Lane (1955) amongst others in evaluating rivers of all sizes. The boundary conditions limiting the channel adjustment are the bed and bank materials, the channel vegetation, and the slope and size of the valley in which the stream is positioned. The stream reacts to these variables by adjusting its channel through changes in channel planform, channel depth, and cross section Figure 1. The creek is in effect continuously adjusting so that it will most efficiently carry the sediment downstream given the spectrum of discharges over time. The key in assessing the stability of the channel is to try and quantify the driving variables and then using analytical and empirical techniques, to try and assess what changes the stream will undergo, and what will the stream ultimately look like over a specified period of time.

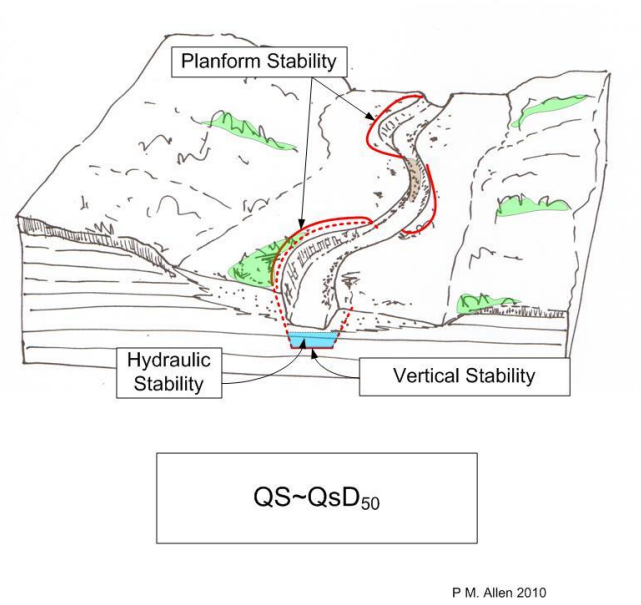


Figure 1. Changes in the fluvial system.

Owing to general increases in magnitude and frequency of floods in urbanized watersheds across the country, work has shown a similarity in the reaction of the stream to increased discharge. The magnitude and speed of changes to the stream are dictated by the local climate, relief and soils, and the history of impacts to the stream over time brought on by changes in land use.

1.1 Methods of Assessment: *Alluvial and Threshold Channels*

Shields et. al. (2003) details the protocol for assessment of channels in which the bed material inflow is negligible and the channel boundary is immobile even at high flows. Much of the theory in channel restoration has evolved in channels in which the channel bed material is mobile and the channel will down cut or aggrade depending on the flow regime and upstream sediment delivery. In the case of the channels in the study area, the channels fall somewhere between alluvial or mobile bed channels and threshold channels. Basically, one must use both types of assessment to adequately design these channels.

The channels in the study area have the following characteristics:

- the bed material is supply limited; it is not present throughout the channel system
- bed material has a wide range in sizes owing to widely varying sources of bed material (local terrace deposits)
- the bottom of the channels range from clay to shale; the shale upon weathering/slaking is removed in cases as fast as the soil material

Channels in the study are fall into the areas of allowable shear stress and tractive power approaches.

Technique	Significant sediment load and movable channel boundaries	Boundary material smaller than sand size	Boundary material larger than sand size	Boundary material does not act as discrete particles	No base flow in channel. Climate cannot support permanent vegetation
Allowable Velocity		**X**			
Allowable Shear Stress			**X**		
Tractive Power				**X**	
Grass Lined Channel					**X**
Alluvial Channel Design	**X**				

From NRCS 2005. Stream restoration Design Handbook.

Table 1. Design Methods for Threshold Channels

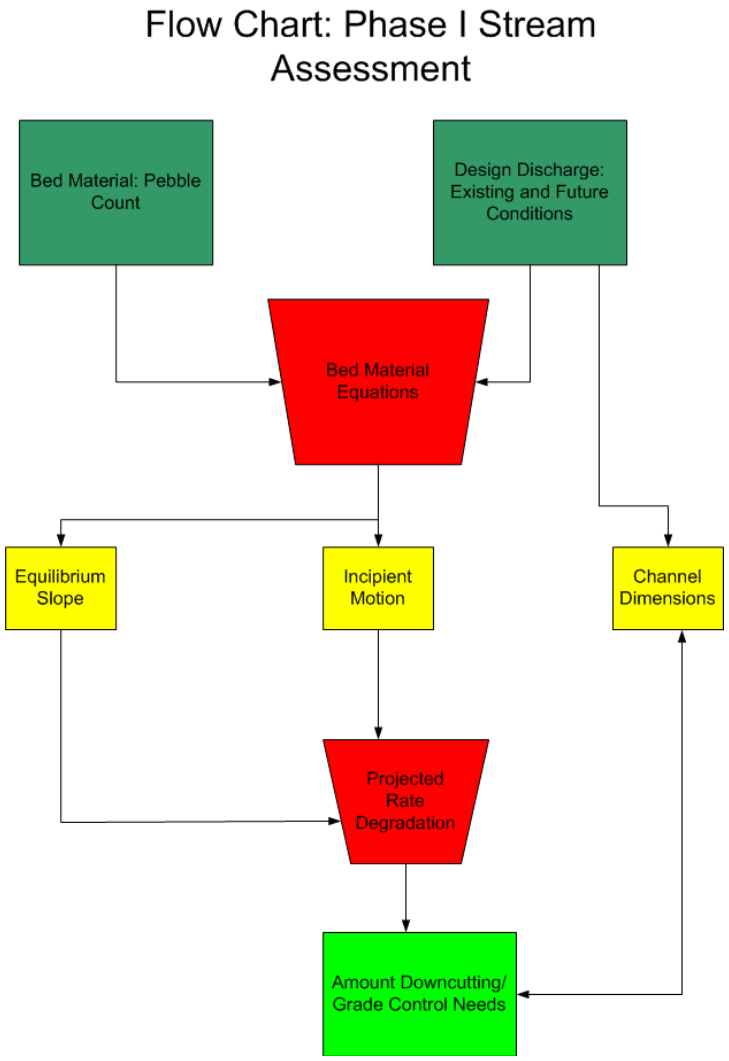


Figure 2. Flow chart of stream assessment for channel stability.

The geomorphic engineering approach used in this study consists of four phases; the general sequence used in analysis is presented in Figure 2. This requires information to be collected to ascertain each of the above so that qualitative and quantitative decisions can be made for the stream detailed below:

1. Involves investigation of the restoration reach using detailed stream reconnaissance techniques. This involves characterizing the channel geometry (bars, pools, riffles, cross sectional characteristics), channel stability status (erosion, slumps, earthflows) , bed and bank materials and riparian vegetation, the configuration of the floodplain, and man-made obstructions. Channel surveys record data in 200 foot sections using field data sheets and digital photography. In addition to field surveys, photographs, and maps are used to detail meander geometry. Samples of bed and bank material are taken in the field surveys to assess the size of bed material and the potential geotechnical characteristics of the

bed and bank material. In this preliminary study, limited bed samples were taken and historical photographs were not analyzed

2. Involves establishing the design or effective discharge for the restoration reach. This is based on the conditions in the approach reach upstream that furnishes the water and sediment and previous studies in the area on the magnitude and frequency of sediment and bed material transport. This discharge is the flow that is responsible for most of the sediment movement over the long term under the proposed land use in the basin.

3. Uses the bed material and design discharge to determine the equilibrium slope for the reach. This is done by substituting the design discharge into bed material formulas and back solving for the slope at which the bed material just begins to move. This slope is assumed to represent the slope of the stream that will be stable under the new flow conditions. This former approach assumes that the design discharge is adequate to predict changes in the channel system over time. Actually, a series of flows are necessary to maintain the channel; the design discharge is a simplified surrogate for this range of channel forming flows. To test the viability of this assumption, we also run a continuous simulation model. The model also gives us an indication of the timing of potential channel change.

4. Involves looking at the results of the stable slope analysis and the field derived geomorphic assessment. The stable slope details how far the stream will down cut from its existing condition. In general, channels have been shown to go through a series of steps as they adjust to newly imposed conditions (such as increased impervious surfaces). This series of changes has been documented as the Channel Evolution Model (CEM) by Schumm and Simons.

1.2 Field Channel Survey Approach

Methods utilized in surveying the channels consisted of assessment of channel hydrology and hydraulics, walking the channel, recording channel dimensions, determining channel processes, and identifying potential structural problems.

Channel hydrology and hydraulics were analyzed (AECOM) using detailed topographic control (2 ft. CI) maps, and HEC-1 and HEC-RAS or HEC-HMS, (U.S. Army Corps Engineers, HEC, 1990a,1990b) hydrology and hydraulics models for assessment of flood heights and channel velocities. General engineering properties of bed and bank materials such as grain size, Atterberg limits, and shear strength were obtained from the literature; and bed load gradation from limited pebble counts.

The channel survey was conducted on 200 foot reaches; this distance was a compromise between survey speed and the accuracy needed for assessment of rapidly changing channel conditions. Distances were measured using a string-line, which was accurate to one foot. For each reach, data for the channel bottom, side slopes, and structural channel

dimensions were compiled on survey sheets. Information of use on the field sheets depends to some extent on the purpose of the survey. Thorne (1998) gives an excellent checklist of information to consider. For purposes of this survey, the following variables were routinely recorded for each 200 foot reach:

- top width, bottom width, active channel width and depth were measured
- bed material, bedload size (field estimate and photograph), bar location
- knickpoints, gullys
- pool and riffle areas
- height of rock in channel bank, rock types, alluvium description
- degree and extent of bank erosion (low, moderate, high) The ratings used in this study were slight, moderate and high. High erosion was noted when greater than 75 percent of the active channel was scoured, the bank was near vertical and greater than 4 feet in height, and the roots of any plants were completely exposed. Moderate erosion was cited when the scour was from 50 to 75 percent of the bank and the bank was over 4 feet in height. Minimum scour was noted when the scour was less than 50 percent of the bank height or the bank was less than 4 feet high.
- mass movement, type, dimensions

Photographs were taken of the channel with a digital camera format. The survey information was compiled by stream and results tabulated for comparison of stream reaches within the study area. Based on the results of the channel survey, as well as previous work in the area (Allen and Narramore, 1985), specific erosion mechanisms were identified based on the type of channel boundary material and its position in the channel cross section.

In urbanizing watersheds, it is very hard to establish reference reaches or stable reaches owing to the fact that the watersheds are in a constant state of flux and in fact are still in adjustment to agricultural practices which occurred long before urbanization. Therefore, this approach seems to allow the best overall assessment of channels in this area.

In order to assess the channels, various levels of data must be analyzed. Simons and Li (1984) and others have demonstrated that information is best presented and analyzed using the STEPS shown in Figure 3. In general, the flow chart show the information required for channel assessment as well as who is responsible for major inputs. This procedure of presenting information is followed in this report.

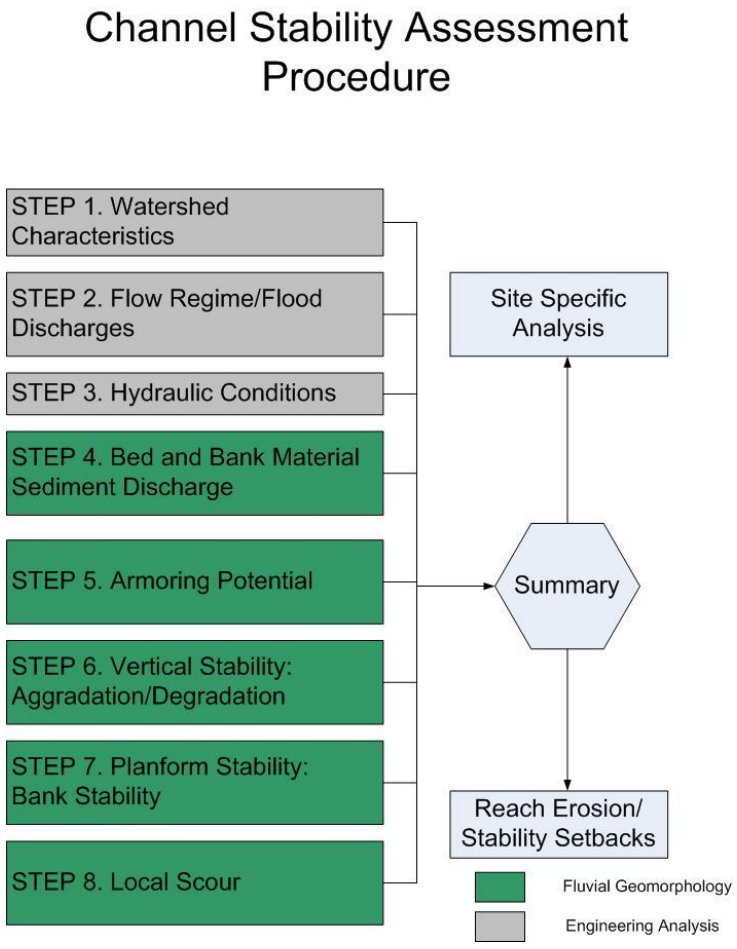


Figure 3. STEPS for Stream Channel Assessment for Engineering after Simons and Li (1984)

2.0 *Watershed Characteristics*

The study area occupies the extreme northern part of the humid subtropical belt which extends inland from the Gulf of Mexico. Average seasonal temperatures range from 46-85 degrees Fahrenheit. Annual precipitation averages 34 inches. Rainfall in the fall and winter is triggered by southward moving continental polar fronts. These fronts produce low intensity long duration storms. The most common storms in April to September are thunderstorms which are responsible for most of the serious flooding (100 year R.I.) in the smaller urban watersheds (1-10 square miles).

A natural basin is defined as a basin with less than 10 percent impervious cover; less than 10 percent of its drainage controlled by reservoirs, and no other human-related factors that would effect peak stream flow (Asquith and Slade, 1999). The two year discharge for natural basins range in this region of Texas ranges from 293 cfs (1 sq. mile) to 1155 cfs (10 sq. miles). Analysis indicates that in a fully developed residential area, flood peaks will be 1.2 to 1.4 times larger than those of a comparable natural area; the annual direct runoff will be about double that of a natural area (Dempster, 1974).

The watershed in this study is classified as a sinuous (sinuosity of 1.4), mixed load, slightly entrenched stream with a low width depth ratio and moderately steep channel slope, (Figure 4.) Cedar Creek would be classified as a E4 to E5 depending upon the bed material using the Rosgen Classification. It is beginning to incise and will be moving toward a G Classification. Major bed material for the stream is furnished from erosion of limestone gravels found in the stream bed and banks. The upstream "supply reach" of the stream is a channelized segment of stream. Minor sediment is assumed to make it downstream into the study area from upstream.

The Blackland Prairie study area is underlain by Cretaceous age shales which dip gently to the southeast at 0.54 degrees, (Allen and Flannigan, 1985), Figure 5. Channel beds vary from clay (Quaternary Alluvium) to shale (Eagle Ford Shale). The alluvial soils, which form the channel banks, consist of silty clay soils mapped as Ovan by the NRCS. The banks contain over 75 percent silt-clay in the banks and are classified as CH soils with high plasticity, Figures 6,7. The stream slope is approximately 20 feet per mile. Slopes fall within the coarse bed alluvial region of Sklar and Dietrich (1998). This is consistent with the highly variable amount of bed load found in the channel bottom. Bed load material consists of sand to cobble size platy limestone, and shale clasts. Shale in the bed material indicates the channel is actively mining the shale bedrock in the bed of the channel.

The watershed has remained in agricultural land use from the late 1800's to about 1972. The upstream portion of the watershed was built up into residential land use sometime between 1958 and 1972. Then, the watershed remained in this state until the late 1990's. Major growth in the lower portion of the watershed has occurred in the last decade, Figures 8-11.

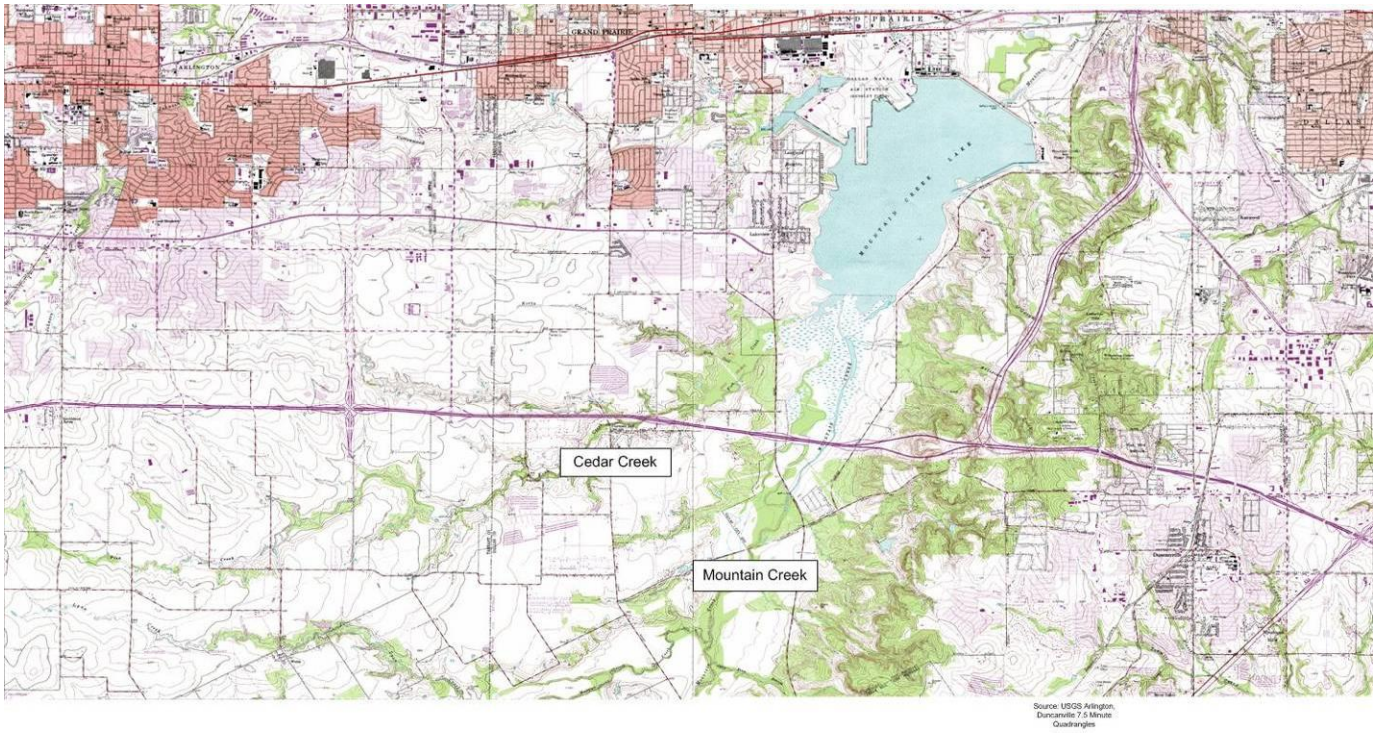
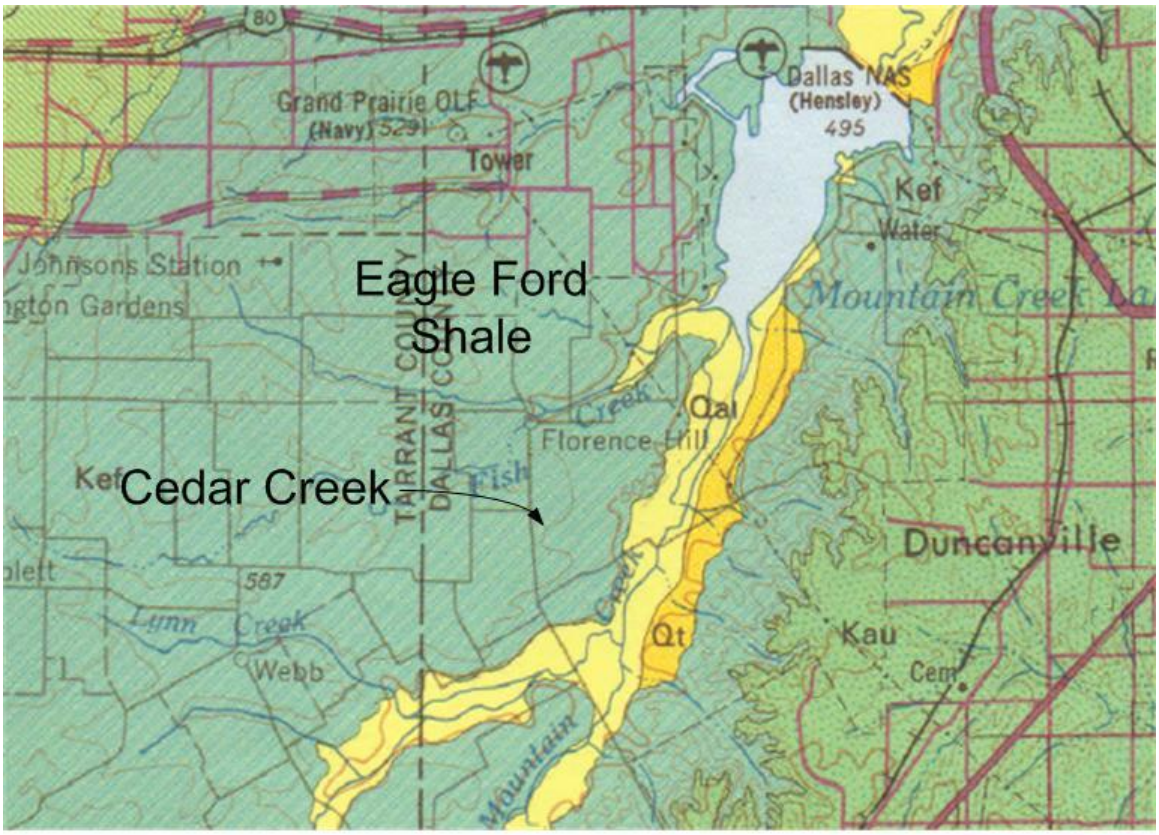


Figure 4. Topography of Cedar Cr. (Source USGS). Note Study reach begins at Robinson Rd. and Ends just downstream of Bardin Road. Cedar Creek flows into Mountain Creek.



Geology Map of Grand Prairie and Cedar Creek

Figure 5. Regional Geology of Cedar Creek. Shown in outcropping area of Eagle Ford Shale. (Bureau of Economic Geology, Dallas Sheet). The stream flows in a north east direction. Dip of the formation is to the southeast at around 50 feet per mile.

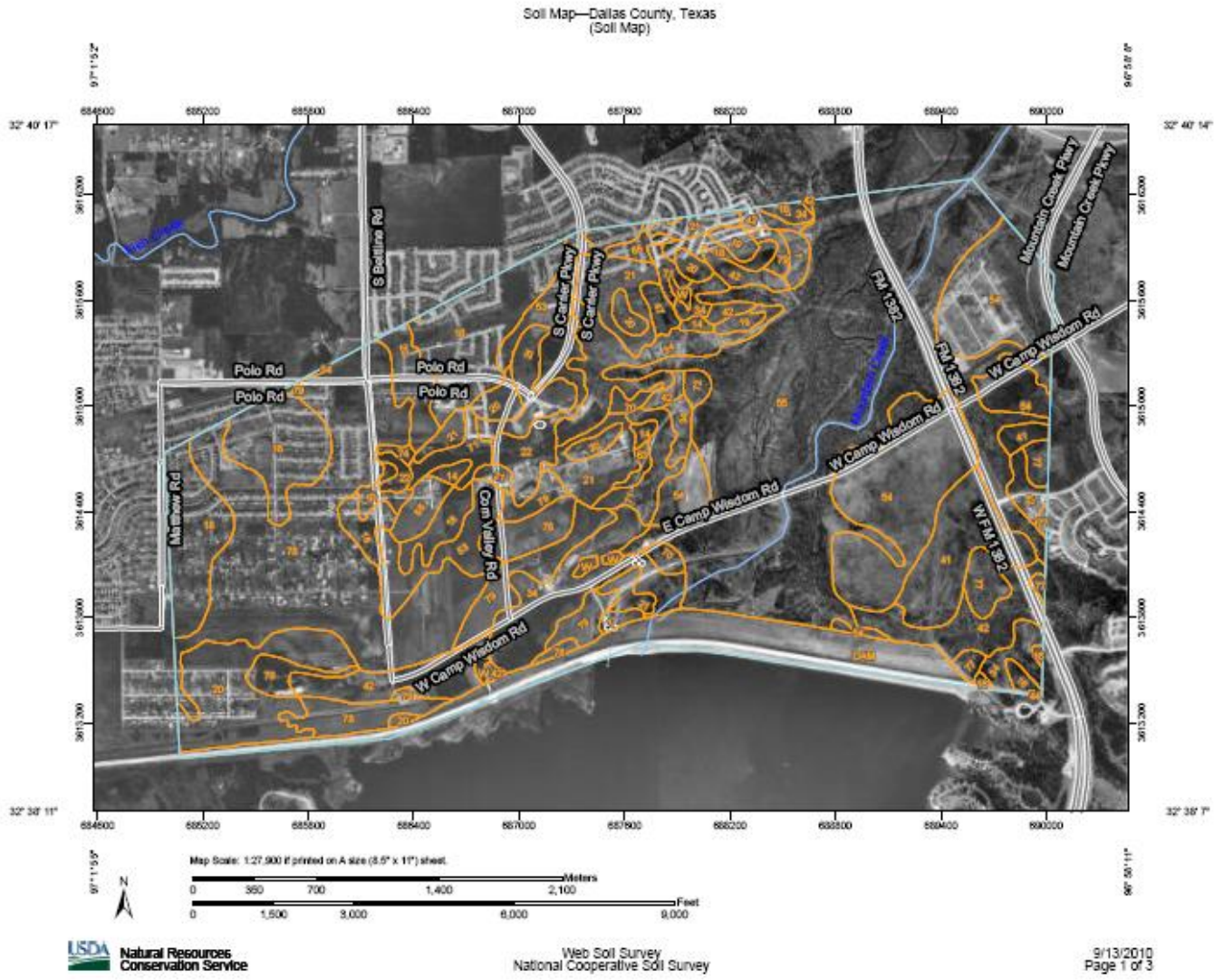


Figure 6. Detailed soil map of study area. Cedar Cr. is within the mapped area. The channel is mapped as 55 (Ovan clay frequently flooded) from Mountain Creek to near Polo. In the vicinity of Polo it is mapped as 34 (Ferris Heiden Clay); from upstream of Polo to Carrier as 22 (Crocket Fine Sandy Loam) and from Carrier upstream to Robinson as 71 (Sunev Clay). (Source: NRCS Web Soil Survey)

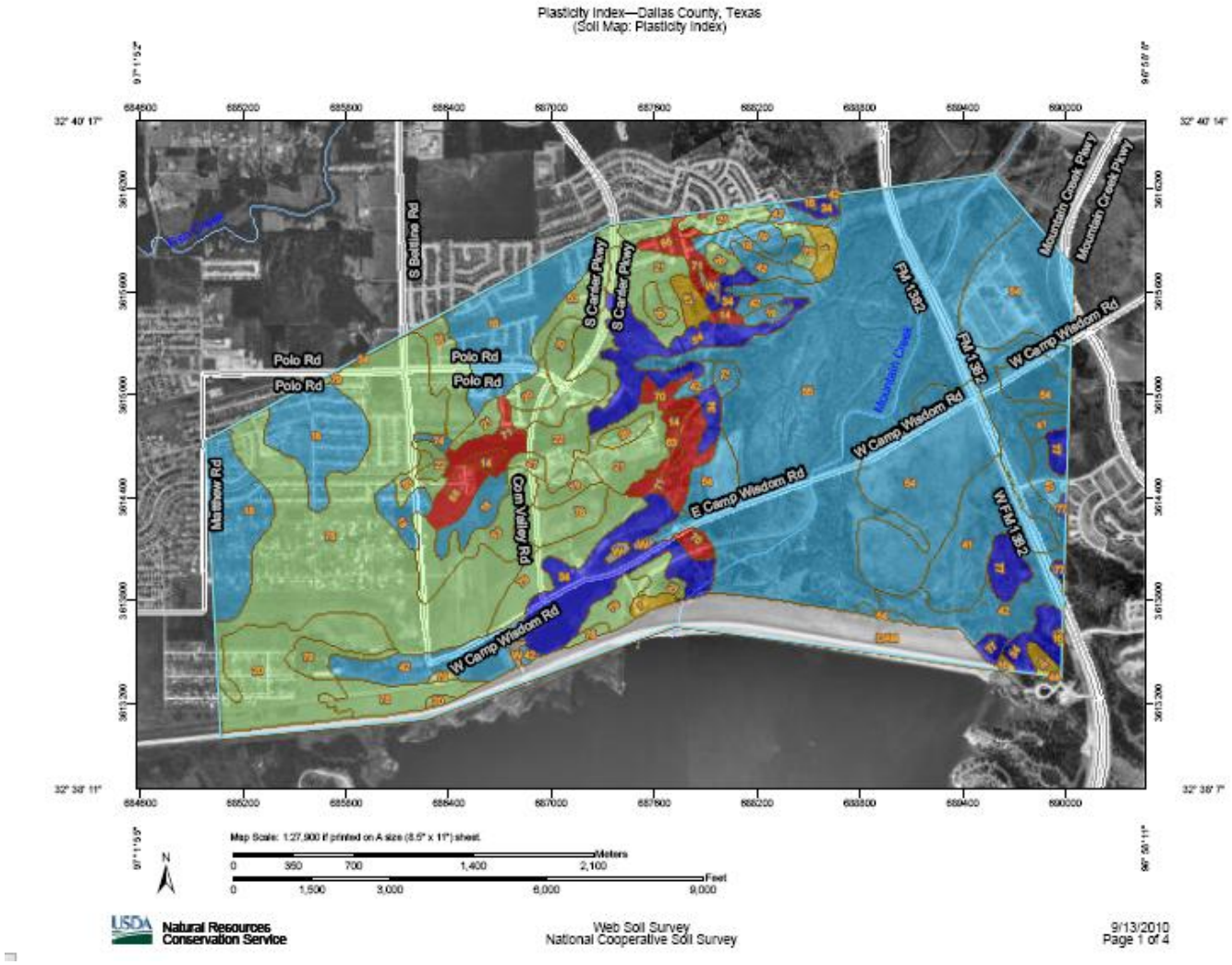
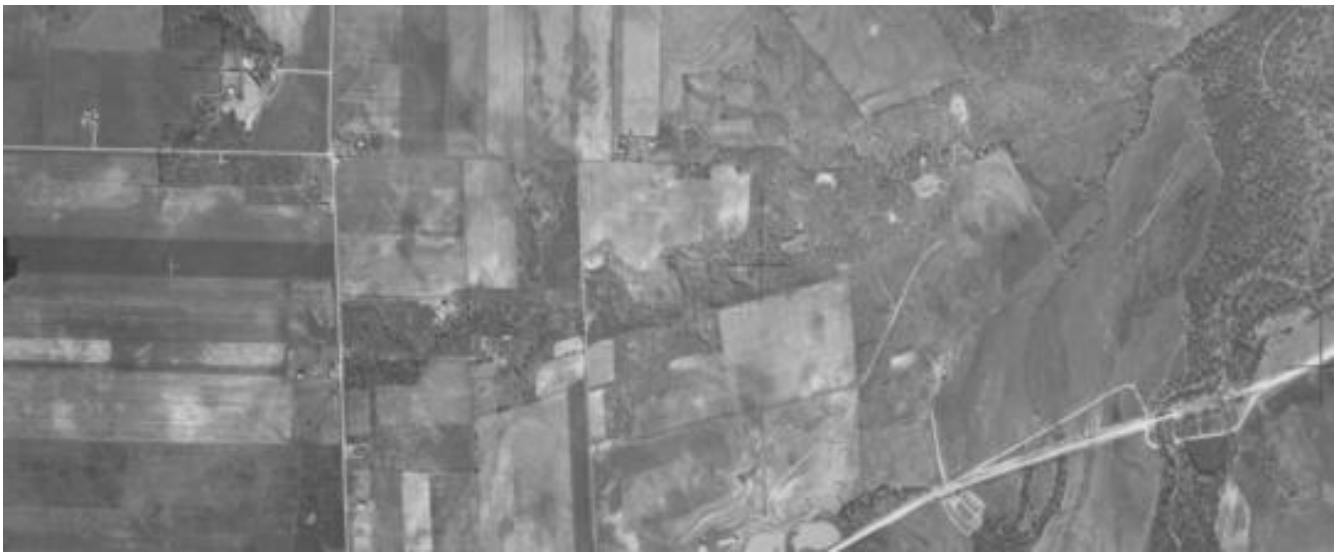


Figure 7. Soil Plasticity Index for Cedar Br. PI ranges from 16-51.1 Proceeding up channel; Ovan Clay (42.7); Heiden Ferris (51.1); Crockett (31.8) and Sunev (16). (Source NRCS Web Soil Survey)

Cedar Creek 1942

Figure 8. Land use in Cedar Creek in 1942. Note the channel was very sinuous, with tight meanders visible. The upland area with the speckled pattern is due to gilgai or microrelief exhibited by the swelling soils. Rill and gully erosion are also visible in the photograph.



Cedar Creek Watershed 1958

Figure 9. Land use in 1958; while the photographic quality is not as good, land use remains the same as in 1972.

Cedar Creek Watershed 1972

Figure 10. The upper watershed is beginning some development while the lower watershed is still in agricultural land use.

Figure 11. Changes in lower watershed from 2001-2009.

3.0 *Watershed Flow Regime and Flood Discharges*

Figure 12. Watershed Sub-basins (Source: AECOM).

The Cedar Creek watershed has been subdivided into subasins based on soil landuse and hydrological conditions. Of major concern in this study is the active channel downstream of Robinson Road. As can be seen in Figure 12, the stream has been channelized upstream of Robinson Road. Channelization is terminated at stream Junction 6.

Subbasin	Area		CN	% Impervious		Lag Time	TC	Stream	
	(ac)	(sq mi)		Existing	Future	(min)	(min)	Length (ft)	Slope (ft/ft)
S-1	137.87	0.2154	80	45	60	18.17	30.28	-	-
S-2	142.71	0.2230	80	62	63	19.62	32.70	2653	0.0014
S-3	65.35	0.1021	80	61	61	13.12	21.87	2131	0.0013
S-4	66.48	0.1039	80	38	39	15.68	26.13	-	-
S-5	83.28	0.1301	80	63	64	14.43	24.05	2566	0.0015
S-6	82.67	0.1292	78	30	32	16.82	28.03	-	-
S-7	183.98	0.2875	79	48	61	14.43	24.05	2440	0.0071
S-8	115.72	0.1808	76	35	49	46.96	78.27	875	0.0061
S-9	79.37	0.1240	80	23	26	15.63	26.05	3779	0.0058
S-10	78.76	0.1231	80	46	62	10.81	18.02	401	0.0032
S-11	26.30	0.0411	75	30	32	22.79	37.98	-	-
S-12	67.23	0.1050	78	48	51	11.90	19.83	2085	0.0047

Table 2. Watershed Characteristics (Source: AECOM); illustrating routing structure and hydrologic properties of the watershed.

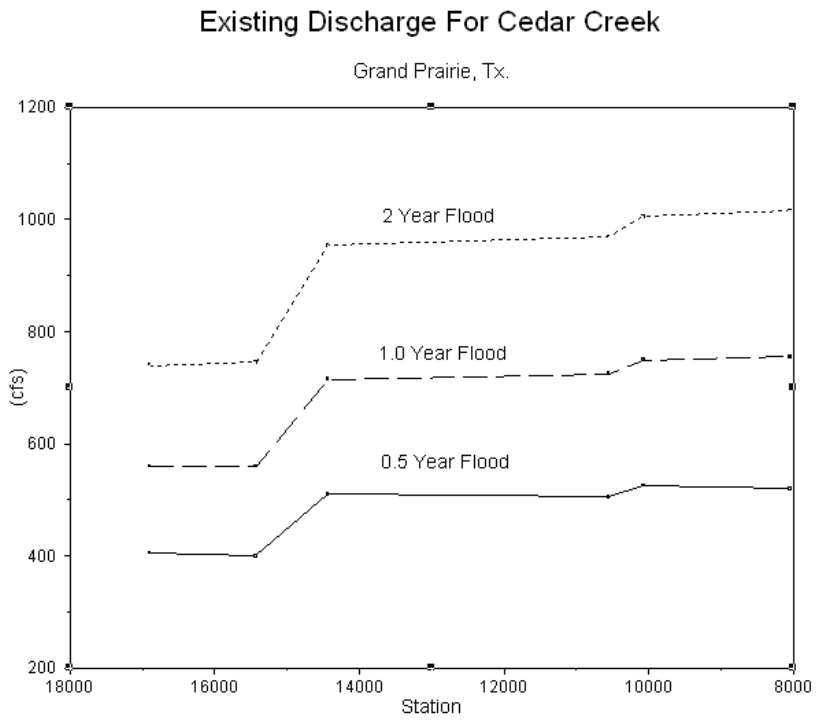


Figure 13. High frequency channel forming flow regime in the watershed. The existing channel still exhibits characteristics (cross sectional area, width, depth) of flow regimes less than the existing 0.5 year flow. There is a lag time between urbanization and channel and geomorphic change. This can be from 5 to 50 years.

Flow Regime	**Carrier Pkwy.**	**Bardin Rd.**
USGS 2 yr. Natural	476	485
AECOM 2yr. Existing	955	1015
AECOM 2yr Ultimate	1055	1145
AECOM 100 yr Existing	2975	3450
AECOM 100 yr Ultimate	3325	3980
Ratio 2year Existing/Natural	2	2.09
Ratio 2year Ultimate/Existing	1.1	1.12
Ratio 100yearUltimate/Existing	1.12	1.16
AECOM Existing 0.5 year Flow	510	525

Table 3. Characteristics of Cedar Creek Flood Discharge and Frequency

In the Metroplex, the geomorphically effective discharge of urbanized watersheds seems to correspond to a recurrence interval slightly less than the 1.25 year frequency flood (Allen, Arnold, and Skipwith, 2002). Dempster's (1974) equations, which include the percent of impervious surfaces in the drainage basin, allow prediction of future discharge under fully urbanized watersheds and are therefore useful in predicting current as well as ultimate active channel dimensions. Dempster's equation is based on extended flood records and has been found to more accurately reflect the flow regime of smaller floods than the HEC modeled events. While the Dempster equation has been shown to be helpful in predicting the effective discharge in local urban basins (Allen, Arnold, and Skipwith, 2003), it is a simple regression model and cannot be used in assessing reach hydrology and hydraulics and the effects of complex channel routing structure. Therefore, analysis of the results indicate that multiplication of the HEC-HMS 1 year flood discharges by 0.6 results in an adequate preliminary design discharge for study watersheds or 0.8 times the 6 month flow, Table 3. The air photographs and results (using the 2 year flow for example) indicate that the major changes in the watershed occurred during the last decade. The agricultural discharge was doubled as land use changed: agricultural to urban. (Note ratios). The ultimate 2 year discharge ranges from 20-30 percent greater than the existing urbanized flows but far less than the past changes in hydrology as the basin was converted from agricultural land uses to urban which doubled discharge. The ratios for both the 2 year and 100 year flows indicate a similar response to future urbanization of the watershed or about 1.1 times greater discharge. Also of note is that the existing 0.5 year flow is comparable to the 2 year "natural " floods in the watershed. The 0.5 year existing flow is expected to change about 20 to 30 percent from current values as the basin reaches ultimate land use conditions. Since the 0.5 year flow is approximately the "bankfull flow" in the channel, it is used to examine channel reach hydraulics.

4.0 *Hydraulic Conditions (AECOM)*

	Velocity (fps)	Hi	Low	Shear (lbs/sq.ft.)	Hi	Low	Froude	Hi	Low	Power (lbs/fts)	Hi	Low
Channel	4.37	8.75	1.27	.7	3.26	.01	.49	1.0	.11	3.91	28.5	.01
Reach 1	4.2	7.27	1.57	.41	2.41	.01	.466	1.0	.15	2.1	16.8	.02
Reach 2	4.55	8.75	1.27	.91	3.26	.01	.457	.99	.11	5.37	28.5	.01
Reach3	4.33	8.1	2.19	.75	2.8	.14	.476	.97	.2	3.96	23	.33

Table 4. Mean, maximum and minimum hydraulic factors by reach for Cedar Cr for 0.5 year frequency. Reach 1 (15837-14336); Reach 2 (14305-10474); Reach 3 (10474-7989).

Average values for the 0.5 year flow indicate velocities of 4.37 fps, moderately high shear, Froude numbers, and stream power. These values are used in subsequent sections for analysis of bed/bank stability. The NRCS Stream Corridor Manual cites work by Brooks who, for limited channels, postulated that stream power can be used as an indicator of channel stability. Channels with stream power over 3.4 are prone to erosion and instability; channels below 1 are prone to deposition and aggradation, and channels are stable in the 2.5 range. Units are in lbs/ft-sec. As can be seen, reaches 2 and three exceed these limits. Simons and Albertson (1963) indicate Froude numbers in excess of .3 to .35 indicate unstable conditions.

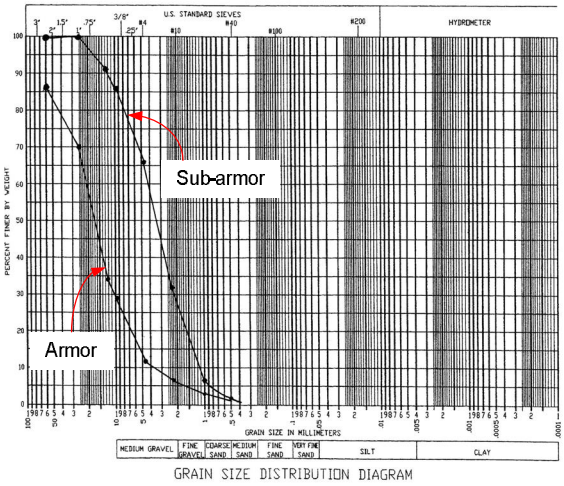
5.0 *Bed and Bank Material Erosion and Armoring Potential*

5.1 Erosion Rates and Movement of Bed Material

Bed material mobility analysis is essential for assessing stream stability. If the bedload is not moved, the stream will not degrade. If there is more bed material supplied to a reach than it can transport, the stream can aggrade. If the stream has excess capacity to move bed material and/or the supply is limited, the stream can degade. Bed material transport has also been linked to abrasion and wearing away of the underlying bedrock.

There was a lot of variability in the bed material in the channel bottom. The bed material was discontinuous along the channel and sources of bed material were from mined alluvial deposits along the channel and minor sourcing from discontinuous limestone flags in the shale. Bed material was sampled in the field and sieved (ASTM methods). Results are given in Figure 14. Bed material consisted of limestone gravel and some pieces of shale bedrock. Studies have shown that the gravel and cobbles made of shale will break down in days of exposure and essentially disintegrate into clay size particles.

In the channel bottom, the potential for movement of the loose bed material was determined from incipient motion assessment. The critical tractive force using Shields relationship is 0.1 (D50) to .41 lbs/ft^2 (D95) .



GRAIN SIZE DISTRIBUTION DIAGRAM

Grain Size	D16	D35	D50	D84	D95
Subarmor	1.5	2.5	3.5	9.0	18
Armor	5.5	12	25	60	62

Figure 14. Representative Sieve Gradation of Bed Material in Cedar Creek.

Several methods were used to assess bed load movement as analysis of movement under the discharge regime of the stream is needed to see if this material can be moved and thus determine if the channel is prone to degradation or aggradation. Figure 15, and thresholds given in Table 5. indicate the critical velocity or shear needed to move the bed material and erode the rock. It is shown that the dominant discharge or approximately the 0.5 year storm will move the bed material. To calculate potential for armoring the following formula is used:

$$Yd = Ya *(1/p - 1)$$

Where: Yd= depth from original streambed to top of armoring layer
Ya= thickness of armor layer (3*Dc)
P= decimal percentage of original bed material larger than armor size (Dc)

Dc= (.00659*Velocity2)*304.8 after Yang (1973)

Results of this assessment indicate that the 0.5 year event would have Dc = 44mm or need an armor layer of about 132mm. This would require degradation of the bed material about 1.05 feet. based on the analysis of the bed material. The 2 year storm, assuming an average velocity of about 6.72 would move all the material with no potential for armoring the channel. Similarly, analysis of the 0.5 year flood in Figure 16 illustrates the shear generated by the 0.5 year flood compared to the mobility of 3 sizes of bed material. Essentially it illustrates the same results as Figure 15 ; the majority of bed material is mobile in very small floods.

This assessment indicates the following when the amount or supply of bed material is taken into account. (1) the channel will coarsen and establish an armor for the smaller flood events (less 0.5 year) which may cause local diversion of the bed and bank scour. (2) the large flood events (2 year or greater) will move the bed material down channel with no potential for armoring (3) the supply of bed material alone from the channel banks and upstream appears low as there are many portions of the channel with little or no gravel making continuous armor of the channel bottom, and (4) this means that the channel can downcut without armoring to its equilibrium slope.

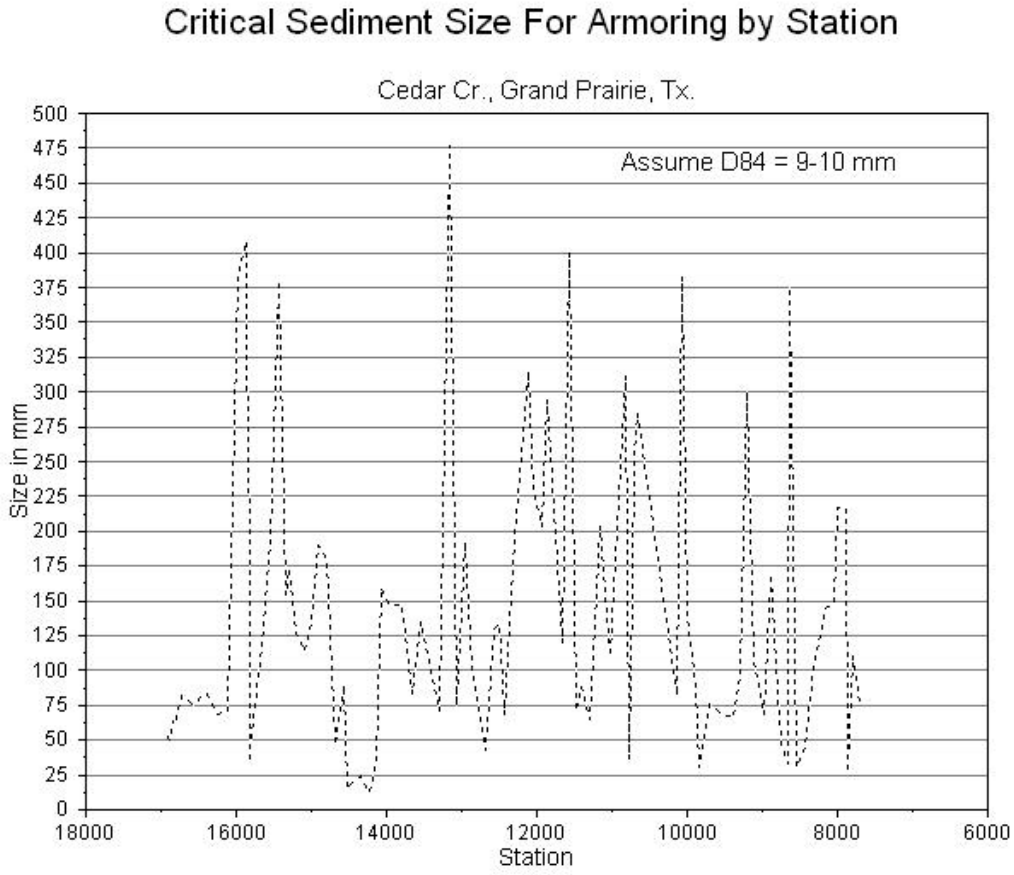


Figure 15. Plot of the Armor size to contain the 0.5 year frequency event indicates that the sampled bed material for the most part will be in motion and armoring will probably be an insignificant factor influencing degradation.

Class name	d_s (in)	ϕ (deg)	τ_c	τ_{cr} (lb/sf)	V_{*c} (ft/s)
Boulder					
Very large	>80	42	0.054	37.4	4.36
Large	>40	42	0.054	18.7	3.08
Medium	>20	42	0.054	9.3	2.20
Small	>10	42	0.054	4.7	1.54
Cobble					
Large	>5	42	0.054	2.3	1.08
Small	>2.5	41	0.052	1.1	0.75
Gravel					
Very coarse	>1.3	40	0.050	0.54	0.52
Coarse	>0.6	38	0.047	0.25	0.36
Medium	>0.3	36	0.044	0.12	0.24
Fine	>0.16	35	0.042	0.06	0.17
Very fine	>0.08	33	0.039	0.03	0.12
Sands					
Very coarse	>0.04	32	0.029	0.01	0.070
Coarse	>0.02	31	0.033	0.006	0.055
Medium	>0.01	30	0.048	0.004	0.045
Fine	>0.005	30	0.072	0.003	0.040
Very fine	>0.003	30	0.109	0.002	0.035
Silts					
Coarse	>0.002	30	0.165	0.001	0.030
Medium	>0.001	30	0.25	0.001	0.025

Table 5. Critical shear table from USACE. This indicates the critical tractive force and critical velocities for moving bed material.

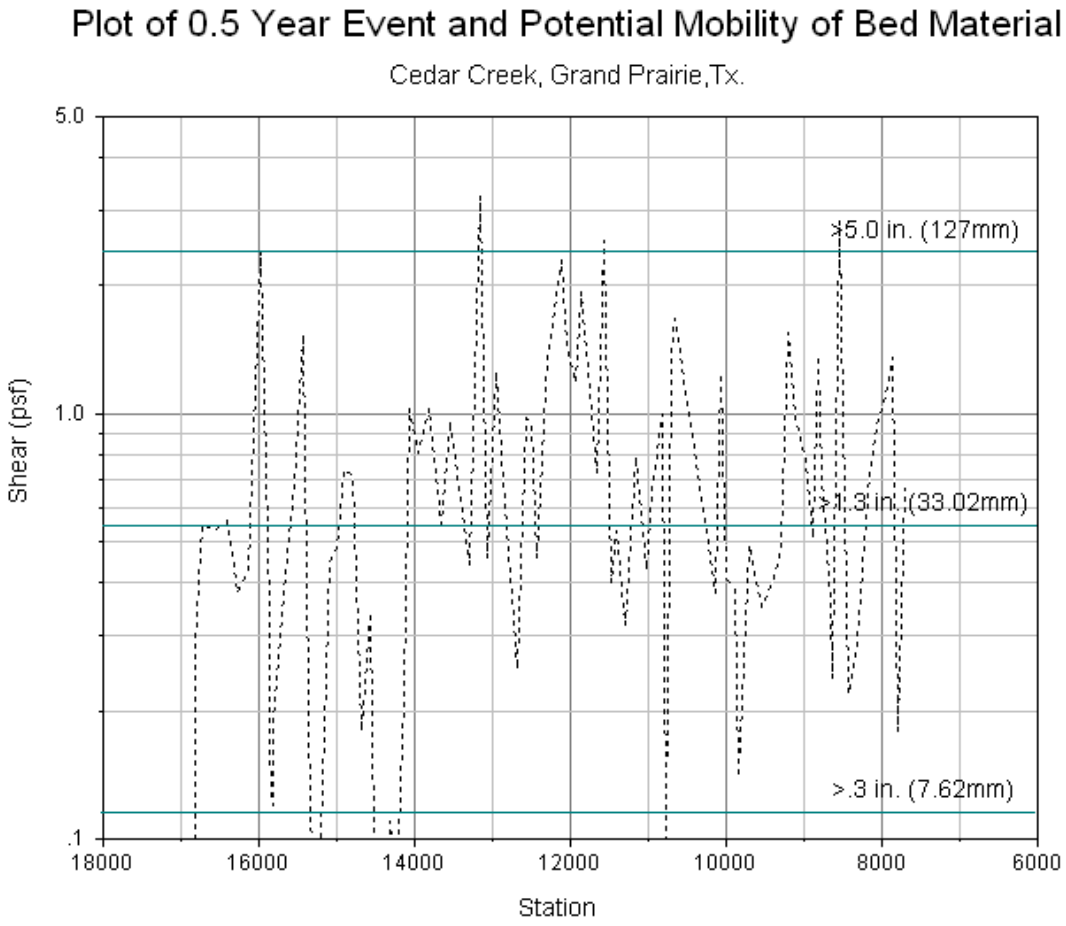


Figure 16. Illustrates the shear for the 0.5 year event compared to the critical shear for various sizes of bed material. It illustrates that most of the bed material will be mobile in the 0.5 year event. The 7.62mm material will be mobile for example, for most of the channel except in the area between stations 14000 and 16000. The largest clasts >5inches will be mobile only in about 3 locations during the 0.5 year event.

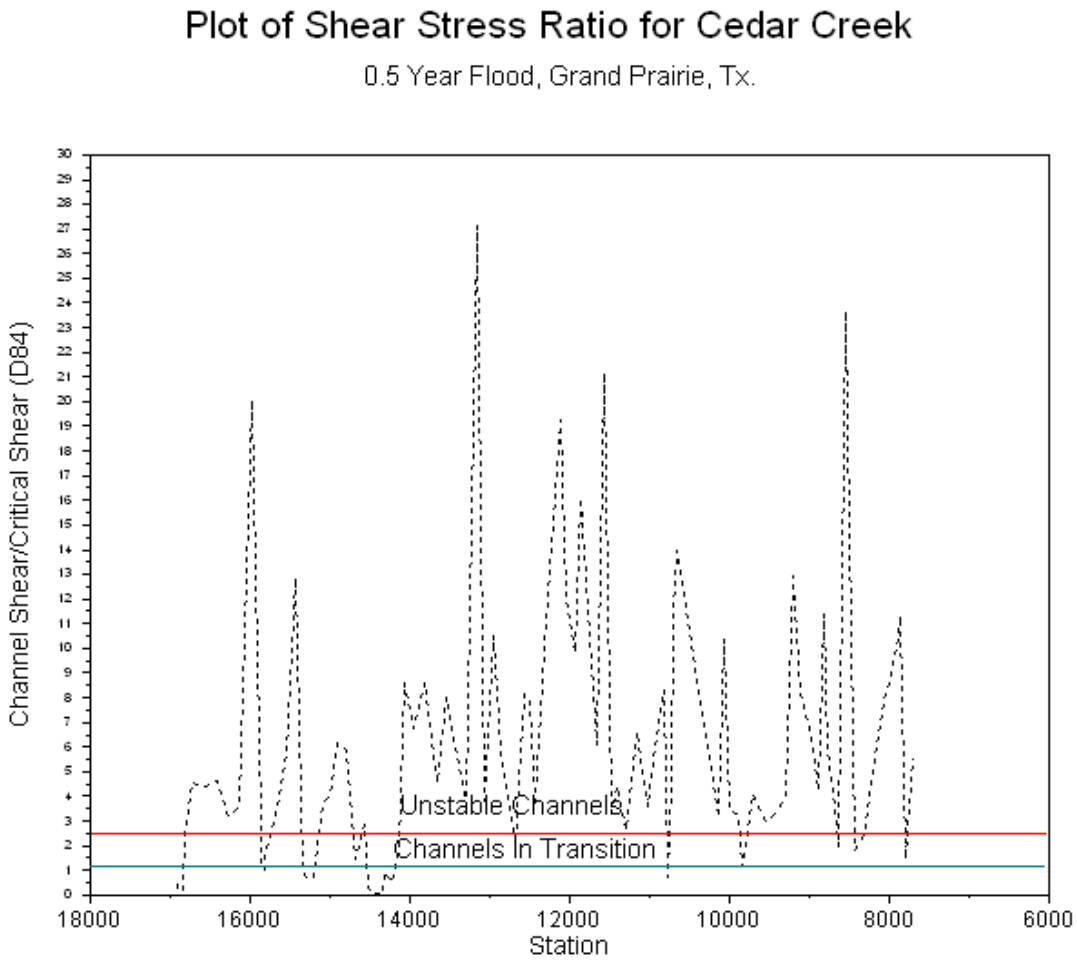


Figure 17. Illustrates Cedar Creek and the Shear Stress Ratio. The SSSR is the ratio of the average boundary shear stress divided by the critical shear stress at which grains move.

Figure 17. is a plot of the shear strength ratio of the stream under various frequency flows. This is constructed by dividing the average boundary shear stress provided by HEC-RAS by the critical shear stress required to move the bed load. The shear stress ratio is used as an indicator of channel stability. A channel is considered stable in form when the shear stress is approximately 20% greater than that required to initiate motion in the center of the channel. This would provide a shear stress ratio of less than 1.2, indicating that stable banks can coexist with low but non zero rates of gravel transport. This would maintain the channel banks while still transporting sediment. When the SSR exceeds 2.5, most of the bed is in motion and this is considered unsuitable or unstable channel conditions. Ratios from 1.2-2.5 indicate transitional channels. Cedar Creek appears to be a channel in transition with trends during most flows plotting in the unstable or transition zones.

5.2 Erosion Rates: Alluvial Material

Erosion rates in the soil/alluvial zone (channel banks or channel bottom) were tested using submerged jet testing (Allen and others,1997,1999, and Hanson, 1990;1991). Tests were made on a representative silty clay/ clay alluvial soils just upstream of section 11000. A sample was collected and laboratory tests were done to determine the engineering properties of the material such as Atterberg limits, and bulk density (Allen and others, 1999). Briaud et. al. (1999) has developed the scour rate in cohesive soils method (SRICOS) to predict scour depth versus time at bridges. His method includes testing samples obtained with shelby tubes in the field in an erosion function apparatus (EFA) as a means to establish erosion rates of materials under given shear stresses. Rates established by this method are comparable in magnitude to those obtained for similar cohesive soils by Allen and others (1999). For cohesive soils with moderate to high plasticity (CH-CL Unified Classification) such as are found in the Dallas/Ft. Worth area, Briaud and others (1999) reports a mean rate of scour of 5.2 in/hr/lbs./ft^2 and a range of scour from 0.94 to 14.1 in/hr/lbs./ft^2 While either method appears suitable for use in the alluvial soil zone, the submerged jet test was done for this study.

Submerged Jet Test Dry Conditions (Wilting Point)	9.9 inches/hr./lbs/ft^2
Submerged Jet Test (Plastic Limit)	0.09 inches/hr./lbs/ft^2

Table 6. Estimated Erosion rates in Cedar Creek.

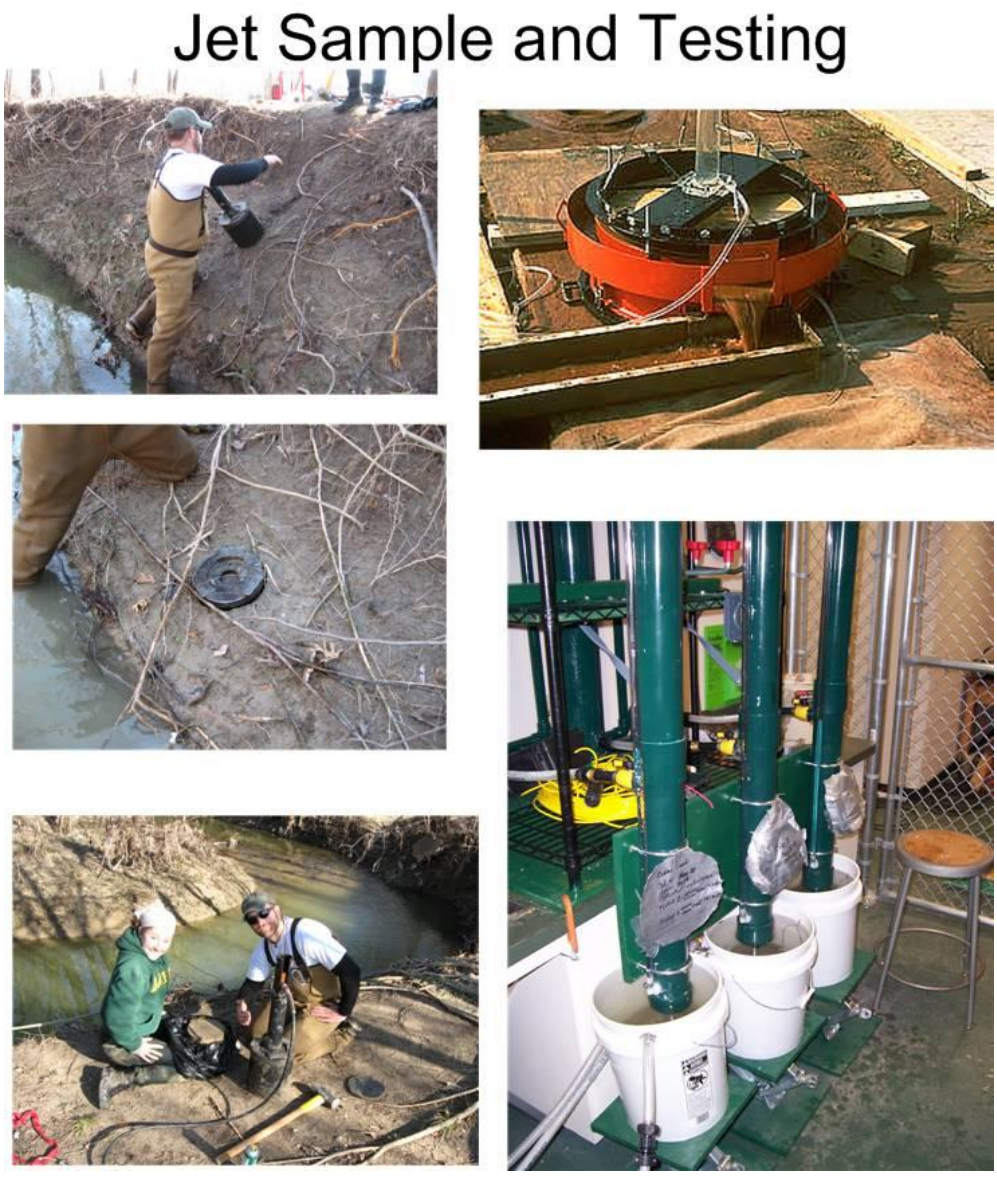


Figure 18. Examples of field sampling procedure, (left) and examples of test equipment for the jet test , (right).

From the simple assessment of the hydraulics, the following relationships are established for shear and velocity in the channel for the 0.5 year flood.

Where: $\text{Shear} = a\ V^{b}$

The average values for estimates of channel shear for the 0.5 year frequency are:

$$\text{Shear (lbs./ft.}^2\text{)} = 0.03\ \text{Velocity(fps)}^{1.83}$$

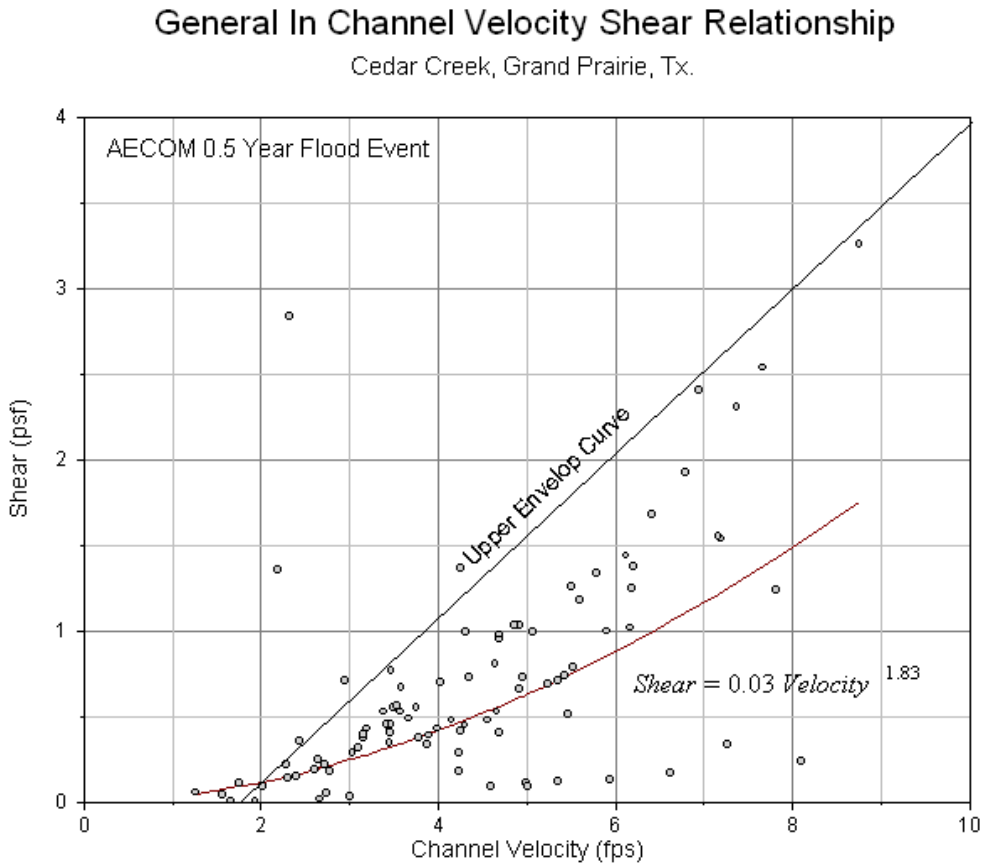


Figure 19. Relationship of in channel shear to channel velocity. The Upper Envelop Curve suggests for small channels in the area; Shear = 0.5Velocity -1.0.

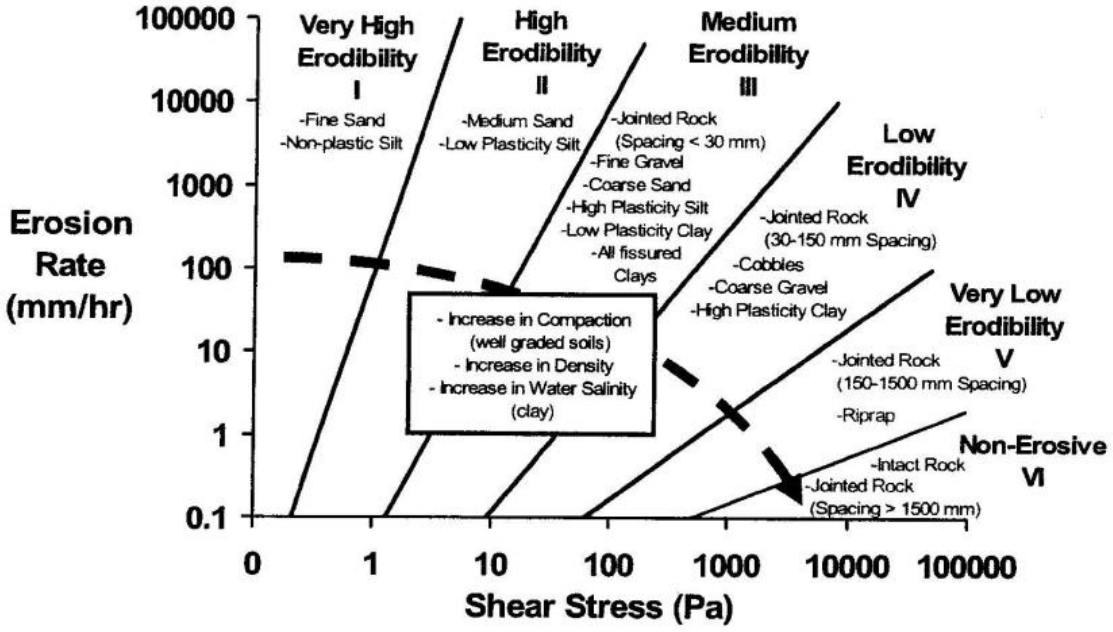


Figure 20. Shows the relationship established by Briaud (2008; J. Geotech. And Geoenvironmental Eng. Vol 134, No. 10)) for the rate of erosion to shear stress. Soil in the watershed would be in Categories III-IV. Note 47.88Pa = 1psf

Figure 19. indicates that the channel during the frequent 0.5 year event will have shear with a mean of 33.5 Pa and a maximum shear of 156 Pa would erode at a rate from around 0.1 to 10 mm/hr. This is consistent with rates indicated below due to submerged jet testing.

Basically, depending on weathering, bare surficial soils (no vegetative cover) will erode at velocities around 2.7 fps (critical shear based on void ratio and Plasticity Index) at a rate of about .09 in/hr/lbs/sq.ft. (based on Submerged jet testing at Cedar Creek). Vegetation or cover has a large effect on erosion rates

The weathered shale will erode at velocities in the range of 12.9 fps. Shale loss may be related to slake durability noted in the next section. Intact, unweathered shale bedrock will erode based on assessment of Tractive Power. Tractive power to erode shale may also be estimated with the following equation:

$$\text{Threshold Power} = 2.93\text{EE-}7\ \text{UCC}^{2.52}$$

Where: TP = lbs/ft-sec
UCC = unconfined compressive strength lbs./sq. ft.

(Arizona Dept. of Water Resources; State Standards, 5-96)

Without local engineering tests, the depth to shale is not known except in areas where it is observed along the channel (as noted in the channel surveys). Unweathered Eagle Ford Shale has an average unconfined compressive strength of 310 psi. with values ranging from 14 to 670. This indicates that the intact shale is non erodible according to the above equation. However, based on field observations, the shale does erode. This is evidenced by the shale clasts found on the channel bars and shale knickzones where the shale is being mined.

Another method used to assess rock erosion thresholds has been put forth by Annandale (1995). Basically, the channel stream power is assessed in kW/m and compared to an erosion threshold based on evaluation of unlined spillways. The erosion factor (Kh) is based on analysis of the following:

$$Kh = Ms * Kb * Kd * Js$$

Where: Ms = material strength number
Kb= Block or particle size number
Kd= Interparticle bond shear strength
Js = Ground structure number

Based on the lowest possible ranges for the Eagle Ford Shale, and assuming no structural control, the values range from about .084 to 2.49 for Kh. These are plotted on the threshold chart below along with the stream power of the 100 year ultimate flow. The lesser flows did not have the necessary stream power to plot. Based on the results, it appears that the 100 year flow can erode the shale when the shale is highly weathered as is discussed in the next section.

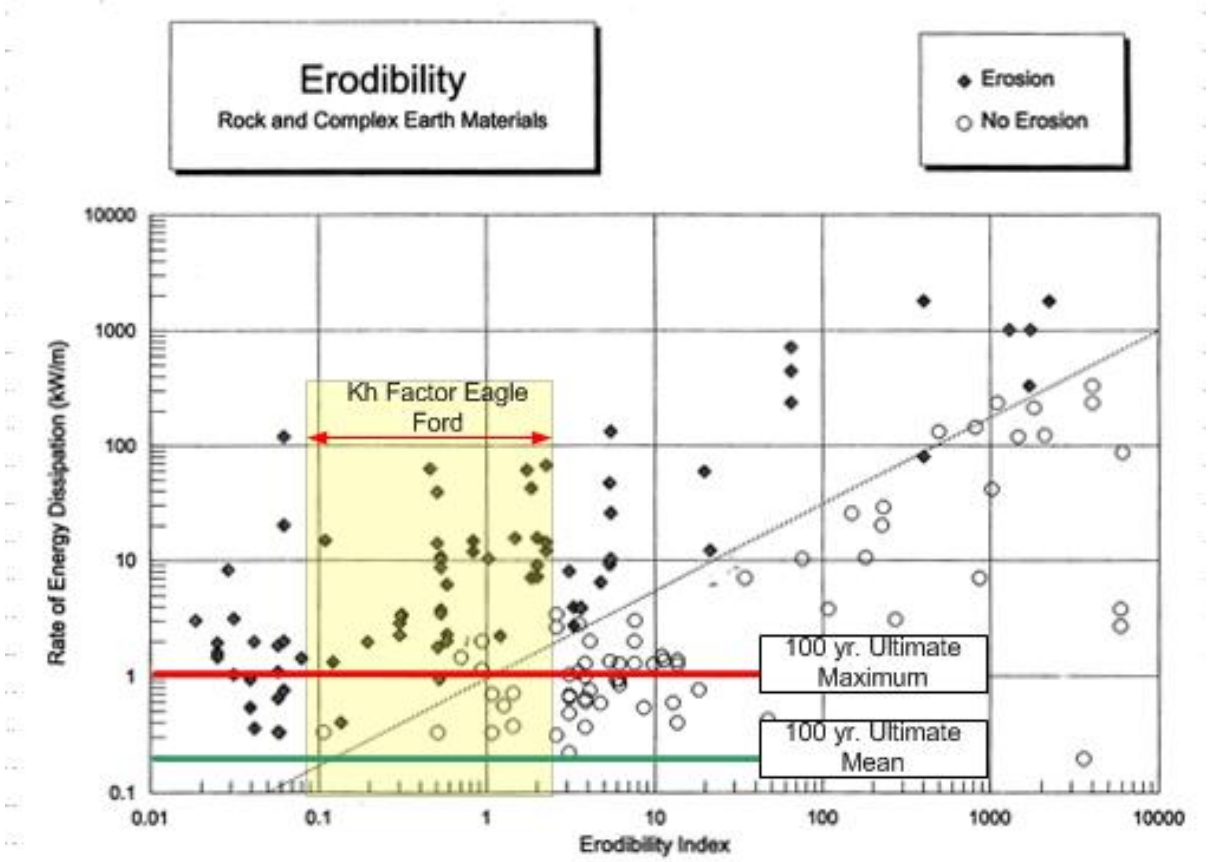


Figure 21. Potential Scour of Bedrock in Cedar Creek. The zone above the threshold line in yellow, bounded by the red and green lines represents the conditions under which bedrock can be eroded in the channel based on Annandale's criterion.

5.3 Erosion Rates: Shale

The erosion rate in the bedrock slake zone (active channel zone) has been assessed in previous studies in both the field and laboratory. The field tests consisted of repeated measurements of stream bank profiles in a shale dominated bedrock channel after flood events (greater than 1 year Return Interval) based on procedures and equipment used by Zonge, Swanson, and Myers (1996). The laboratory tests consisted of performing slake durability tests on the shale bedrock utilizing methods modified from Richardson and Long (1987). The procedure consisted of oven drying the bulk rock samples from the bank (2 x 4 inches) in the oven at 105 C for 12 hours. The samples were then weighed and put in a #12 sieve and immersed in and out of a water bath 200 times in a period of ten minutes. The sample was then oven dried, reweighed and the process repeated for five more cycles. The slake durability index was found by dividing each final dry weight retained on the sieve by the original weight and multiplying the result by 100%. The slope of the plotted relationship between percent loss due to slaking and the number of slake cycles was determined by regression analysis. The average slake rate for the Eagle Ford Shale are given below.

Dry Density	Total Density	2nd Cycle Slake
119 pcf	138 pcf	21 %

Table 6. Slake Durability for Shale

In areas where the channels have down cut into the underlying rock, widening of the channel is accomplished through scour of the alluvial material and weathering (slaking) and removal of the exposed rock material. This zone of exposed rock which extends from the mean flow line of the channel taken as the riffle height to the soil/rock interface is termed the slake zone. In the Dallas/Fort Worth area, the slake zone along the urban channel banks ranges in height from 0-5 feet.

Channel loss rates in this zone range from less than 0.4 to over 2 inches a year depending on the number of wet dry cycles per year and flood frequency. This is based on the following assumptions: (1) This lower portion of the bank is subject to high shear stress and numerous wet and dry cycles (Lawler, 1992;1993, Thorne and others, 1982;1998), and (2) the shale and limestone rock in this zone are subject to repeated cycles of slaking and subsequent removal by flooding.

The slake rate equation derived for this zone is based on repeated site surveys on a shale bedrock channel in North Texas and slake testing done on the bedrock samples. The bank scour process in this zone appears related to both the location of the erosion site on the meander and to the exhaustion of slaked material after numerous flood events. Greater erosion is associated with the downstream portion of the meander. Slake durability test data for the site represents the slake loss for each laboratory slake cycle. The equation derived in this study for predicting ultimate bed and bank loss rates due to slaking and subsequent entrainment is based on: (1) assessment of the number of flood flows in this zone per year, (2) slake rates established by the work of Shakoor and Rodgers (1996), and (3) previous suggestions by Howard and Kerby (1983).

$$SLR = \text{Sum}\,(LR*(e^{at}))$$

where:
SLR = annual slake loss (inches) in the stream channel
LR = maximum annual loss rate (inches) of shale material
a = slake rate (slope of slake durability loss per slake cycle range or -0.4 to -0.65)
t = number of floods in slake zone

With an average second cycle slake durability value one can compute the maximum slake loss rate in inches per year based on Shakoor and Rodgers (1996), where:

LR= 3.91 - .0792*SR (For SR less than 30)

LR = 2.10 – 0.0119*SR (For SR greater than 30)
LR = Maximum rate of loss in in/yr.
SR = 2nd Cycle Slake Durability

For example, for a channel with a second cycle slake durability of 21 percent, up to 3.64 inches could be lost if four floods occurred during that year under worst case conditions. (1.506+1.009+.676+.45) Generally about 3 to 5 inches per year is the observed rate of loss for totally exposed shale channels in the area subject to wetting and drying cycles. Work by Prosser, and others (2000) reinforces these assumptions. They show that erosion can be controlled by subaerial processes such as dessication of clays.

6.0 *Vertical Stability*

6.1 Equilibrium Slope

The bed material gradation combined with the channel forming discharge is used to estimate the equilibrium or "ultimate" stable channel slope. Five methods are used to assess stable slope under boundary conditions imposed within the design reach. The rationale for using this number of methods is due to the fact that the bedload equations on which they are based are not very accurate. Equilibrium slope is given for the stream in Table 8. Most methods of solving for the equilibrium slopes utilize bed load equations and back solve for slopes at incipient motion. These methods assume that there is insufficient coarse material to form an armored layer, the gradation of the bed material is the same down to the depth of degradation, and the bed material depth is greater than the expected degradation limit. While all these assumptions are not met (shale bedrock lies below the bed material at depths of less than the depth of degradation) this analysis gives a reasonable point to which the stream would down cut if new bed material is supplied through erosion of terrace material. In addition, since the critical tractive force of the weathered bed shale is in the range of the tractive force of the bed material, this assumption seems appropriate. Six methods were used to calculate the equilibrium slope; USACE, Meyer Peter Muller, Schoklitsch, Shields, SAMWin, Blackland Regression, and Bledsoe (GBR) . These methods are given in the appendix.

Station	Equilibrium Slope	Actual Slope	Maximum Number Drops @ 3 ft.
15806-14557	.00089	.0065	7ft or 2 drops
14134-10665	.00089	.00576	16.9ft. or 6 drops
10074-7989	.00089	.0049	8.4 ft. or 3 drops

Table 8. Computation of equilibrium channel slope and projected maximum degradation by study reach. The number of drop structures is determined by:
Number =((Actual S –Eq. S)*Length))/3. This assumes a maximum engineered drop height of 3 feet.

Table 8. indicates that in each cited reach of the stream, based on the existing slope of the channel, the bed material, as well as the effective discharge, the channel will try and downcut to achieve quasi equilibrium over time. The conservative estimate indicates that the slope will degrade to 0.0009 feet per foot. This assumes no armoring and sediment supply is continuous. SAM Win gives a higher slope which is less conservative as does the GBR model (appendix). While these models optimize for the equilibrium slope, they assume abundant bed material supply and have no way to control bank vegetative effects. Therefore for design, the lower slope was chosen. SWAT-DEG runs (next section) indicate the amount of time this degradation should take. The 3 foot drop is used as an upper limit of usually accepted drop structure heights. The particle size used to predict equilibrium slope is 3.6 mm. This is approximately D_{50} and is considered a representative

particle size in the stream where the bed material changed from one reach to the next. This is conservative as entering a large particle size will steepen the equilibrium slope.

The Channel Evolution Model (CEM) has been formulated by Schumm et. al. (1984) and later by Simon and Hupp (1986). In this model the fluvial geomorphologists noted that alluvial channels in different environments, when destabilized by human and natural disturbances, pass through a sequence of channel forms through time. These systematic channel adjustments through time have been called the CEM and permit interpretation of past, present and future channel conditions. Figure 21 indicates the simple stages identified in previous work in the Metroplex with references to the original work by Schumm and Simon. When doing field work in the area, the various attributes of the channel are noted. The major disturbances causing changes in channel morphology in this area are related to increased impervious surfaces and runoff, increased storm sewers, modified channel sections (channelization) and hydraulic changes near bridges. The combination of these parameters results in channel disequilibrium and bed and bank erosion. The impact was first summarized by Lane (1955) where:

$$QS \sim Q_s D_{50}$$

Where: Q= discharge
S = slope
Qs = bed material transport
D50 = size of bed material

In general if the other variables are held constant and one increases discharge, the channel will tend to reduce its slope. As it degrades, it will go through a sequence of Stages shown in Figure 21. The channel will downcut in Stage 2; as it reaches the critical slope height based on the engineering characteristics of the bank (cohesion, internal angle of friction, weathering, and water table) it will fail and the channel will begin to widen. As it widens and deepens in Stage III, it will reduce the tractive force and velocity of the water and at a certain point, it will begin to cease downcutting and begin to stabilize through deposition, and restabilized banks with a new lower floodplain and new channel or Stage IV. While channels can also adjust to the greater urban discharge by increasing their length (larger meanders), in this particular terrain, owing to either rock or cohesive soils, the channels are more prone to downcut to reduce the slope, Figure 21..

Channel Evolution Model (CEM)

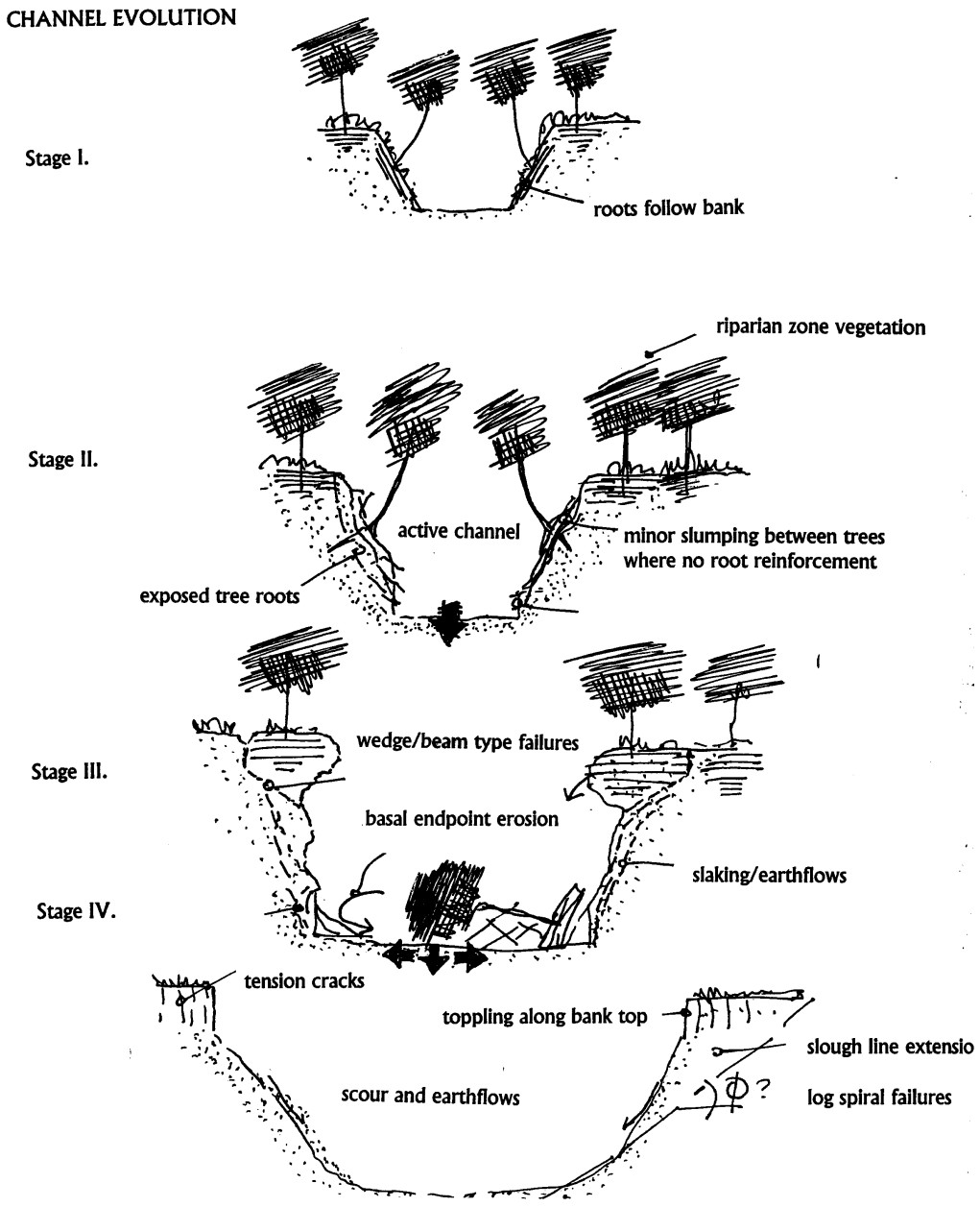
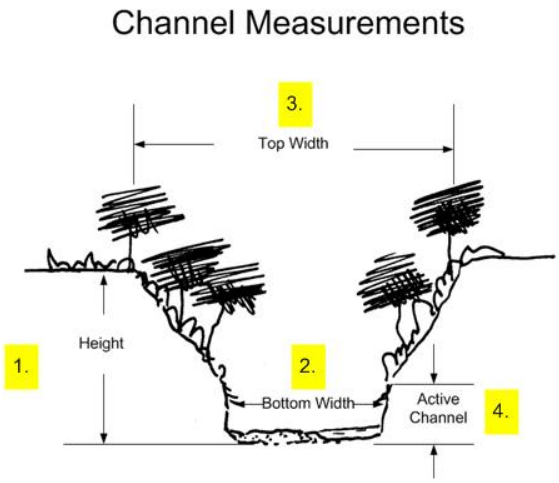


Figure 21. Channel Evolution Model adapted from previous work by Schumm , Simon and others adapted for Metroplex streams.

6.2 Field Survey Results

Survey results are given in Figures 22-59 which illustrate the bed and bank processes and also document each 200 foot survey reach of the channel. Field notes along with GPS locations of all photographs are in the appendix. Figure 22 illustrates the field data collected by survey segment; Figure 23 is a plot of the general trends in field surveyed data, and Figures 24-25 are a summary of the field data in the context of the channel evolution model (CEM). Specific areas of change in the channel and key erosion or sites where changes are taking place in the stream are noted diagrammatically and in photographs in Figures 26-60.



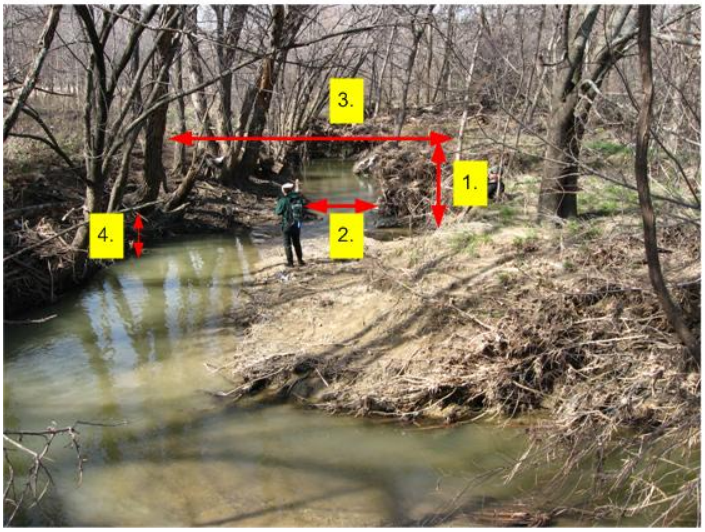


Figure 22. Illustration of typical channel measurements on stream in field survey. The channel characteristics are shown in three ways; (1) by plots of the general existing active channel dimensions, (2) by a plot of the channel thalweg and general divisions of morphological types, and (3) reach summaries with associated photographs.

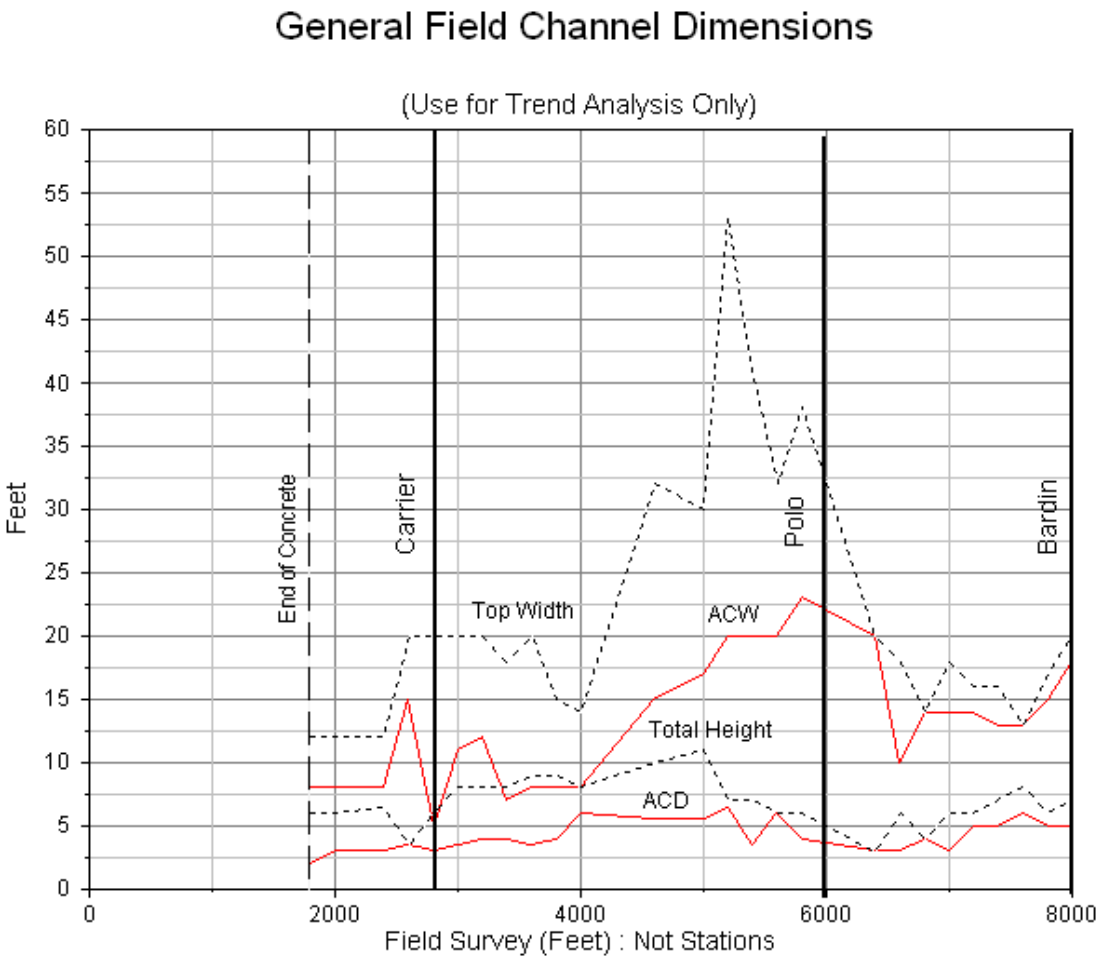


Figure 23. Channel Geometry: Active Channel Width and Depth Cedar Cr.

Field measured dimensions are meant to detail trends in channel dynamics. Moving average values have been found to most accurately reflect general progression of in channel processes in stream evaluation. The following observations can be made from the plots:

- Top Width ranges from 12 -53 feet with a mean of around 21 feet; the channel ranges from 12 feet in the upper channel to around 45 feet in as the stream approaches Polo and then decreases in width to around 20 feet near Bardin.
- Channel Total Height ranges from 3 to 11 feet with a mean depth of 6.8 feet. Maximum height is located just above Polo. This is the approximate location of major channel incision.
- Bottom Active Channel Width ranged from 5 to 23 feet with a mean of 13 feet; width increases in the middle reach and reaches a maximum near Polo; the lower reach decreases in width in the middle of the reach and then increases in width toward Bardin.

- Active Channel Depth ranges from 2 to 6.5 feet with a mean of about 4.2 feet. Active channel width mirrors top width.

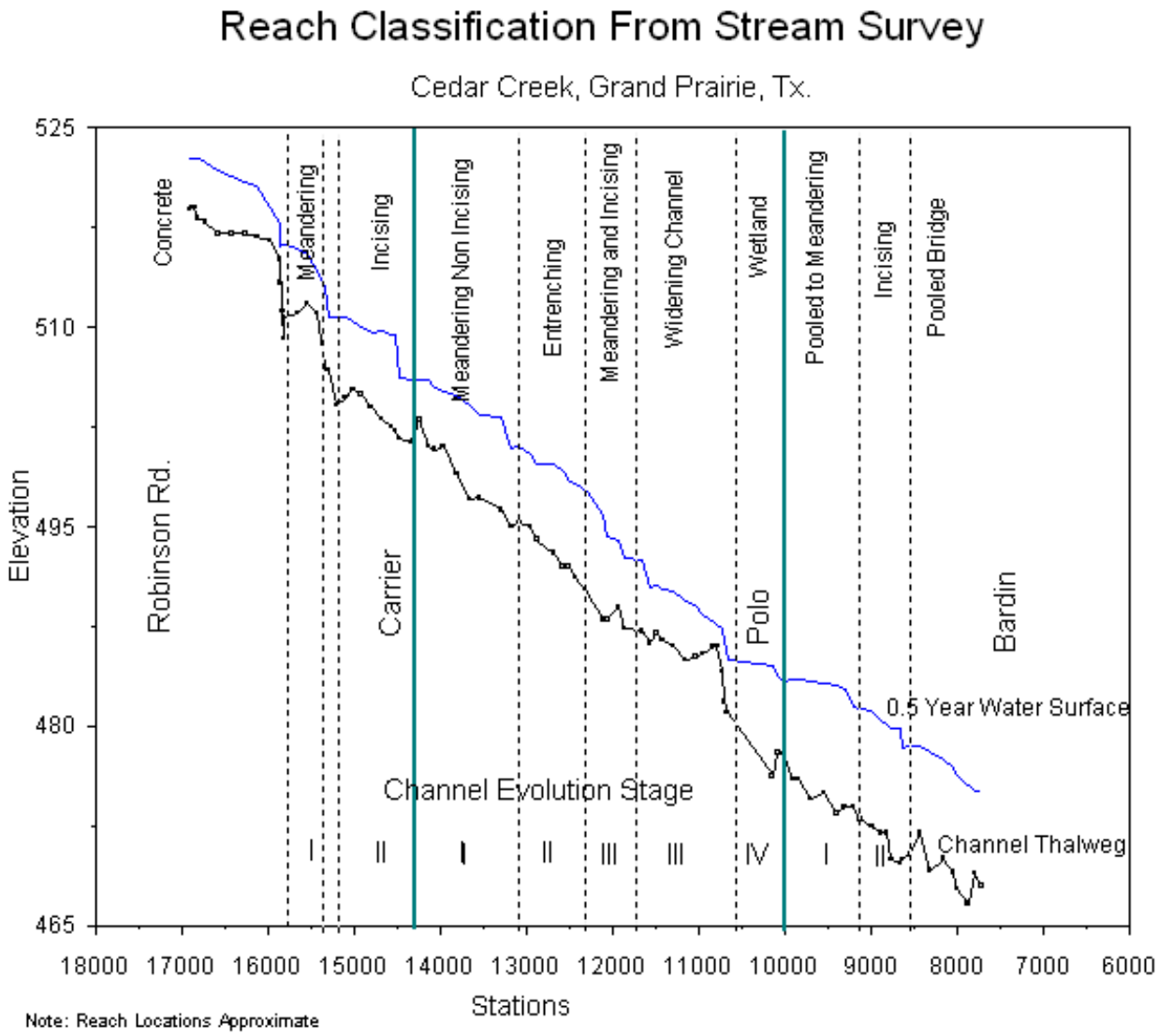


Figure 24. Channel thalweg (minimum elevation), 0.5 year water surface, and classification of channel morphology based on field survey and the Channel Evolution Model (CEM).

Based on the field survey, the channel has been classified into three basic reaches separated by hardpoints at the bridges. These hardpoints will control the channel degradation at the lower end of each reach.

As can be seen in Figures 24 and 25, Cedar Cr. is predominantly in Stage I and II in the Robinson Carrier Reach and the Polo to Bardin Reach; the channel is adjusting to the increased discharge by both increased frequency of overbank flows as noted by the flood studyies as well as in the field by deposition of overbank silts and clays. The middle reach from Carrier to Polo appears to be between states I through IV. At Stage III, it is very costly to control the stream as the channel has already down cut enough to begin to cause massive bank failures. Drop structures are typically advocated for streams entering Stage II to prevent potential degradation.

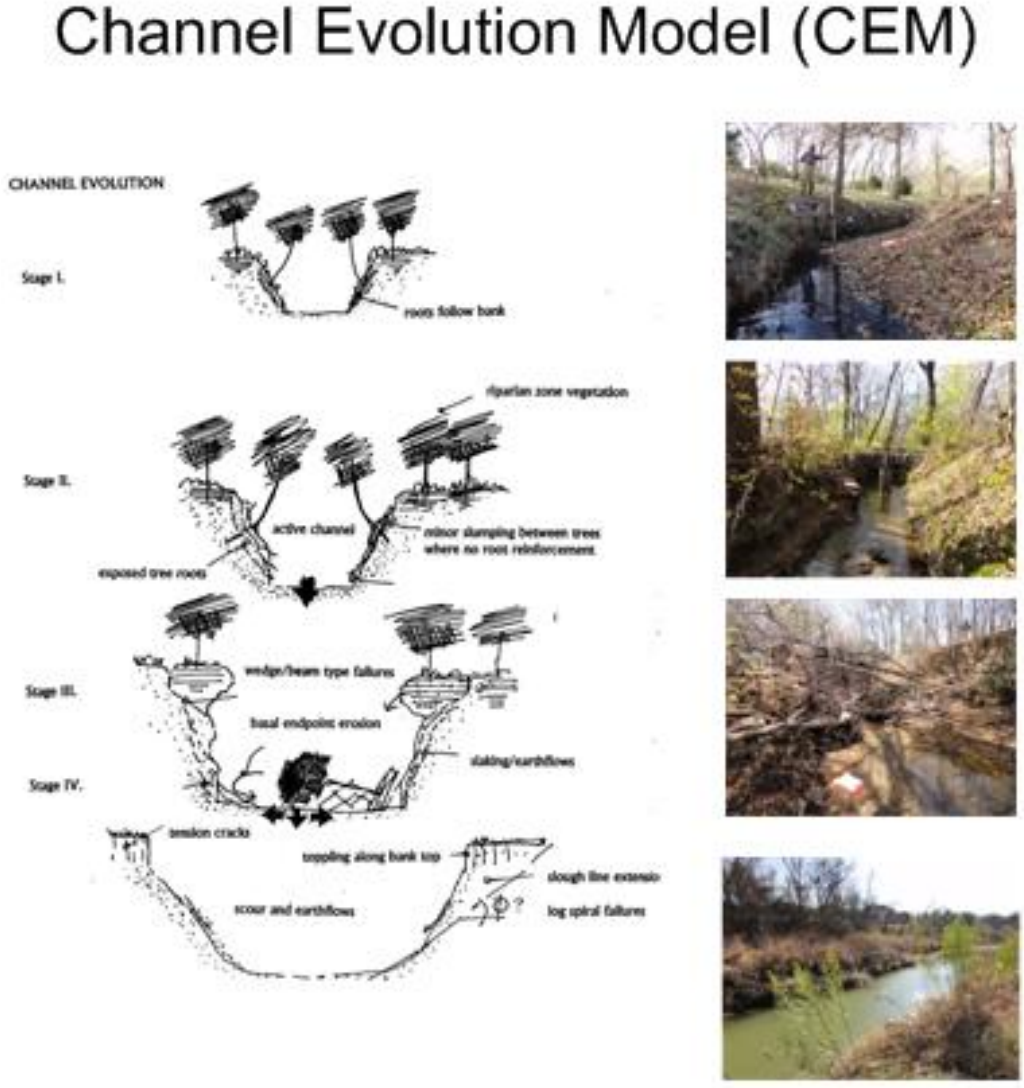


Figure 25 Illustrating the representative channel segments and the CEM model. These photographs are meant to illustrate each step in the Channel Evolution Model for Cedar Creek.

The following diagrams summarize the field survey results. Note that all photographs with GPS locations and site notes are in the appendix.

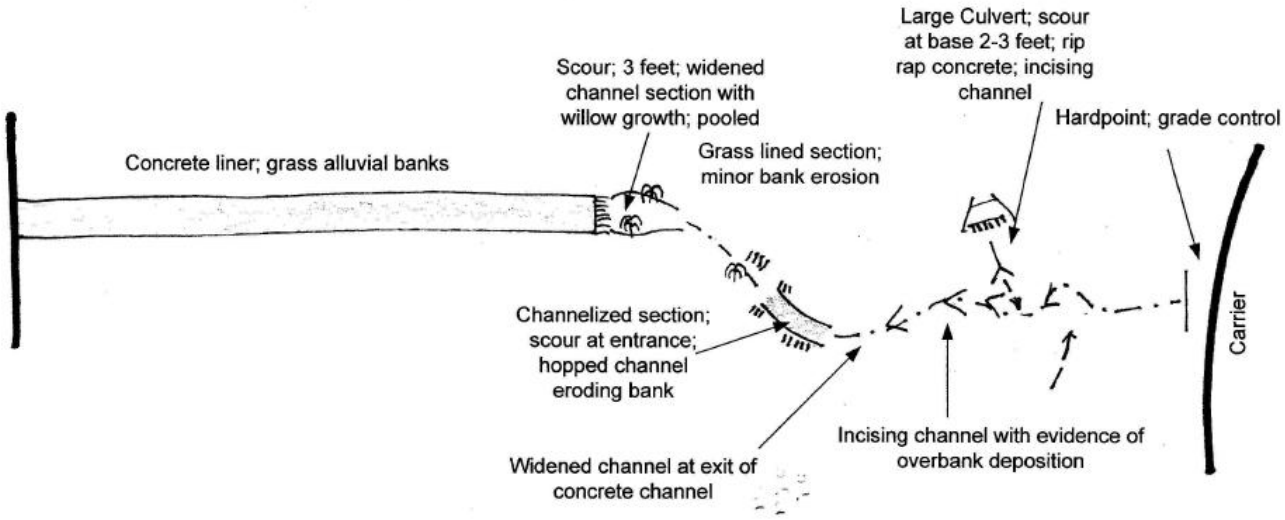


Figure 26. Reach I from Robinson Road to Carrier Parkway.

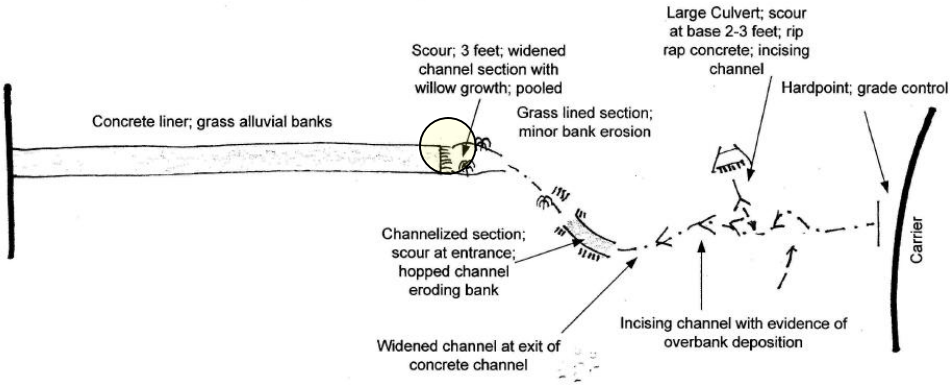


Figure 27. Scour below rip rap at end of channelized section.

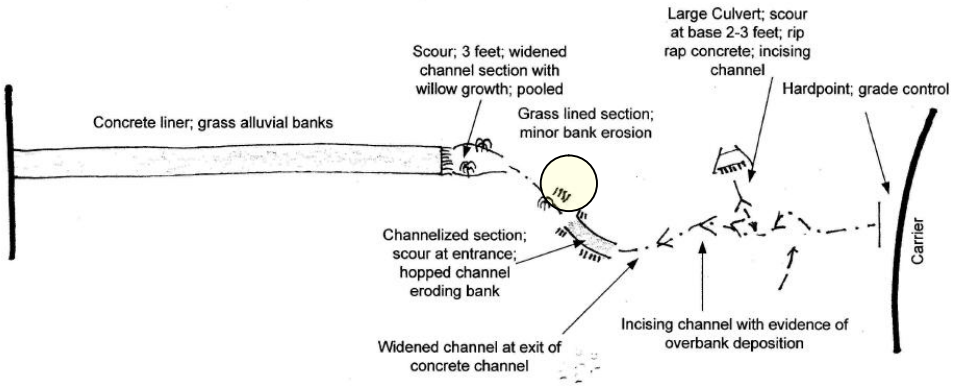


Figure 28. Minor bank scour caused by diversion due to willow growth.

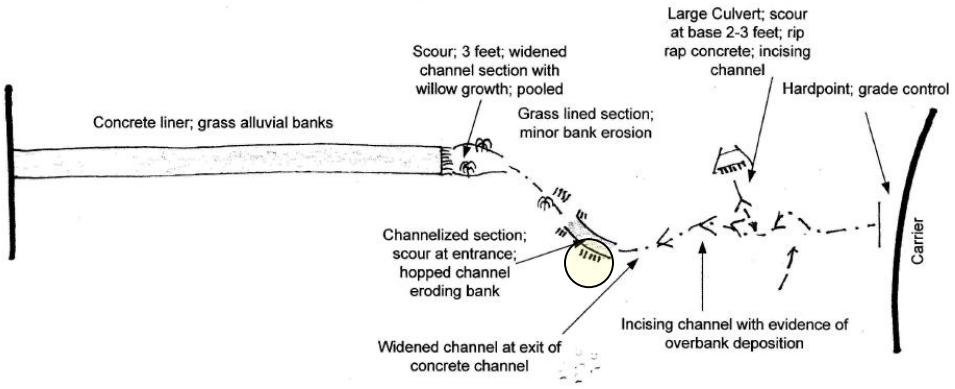


Figure 29. Channel jumps concrete liner and is scouring bank.

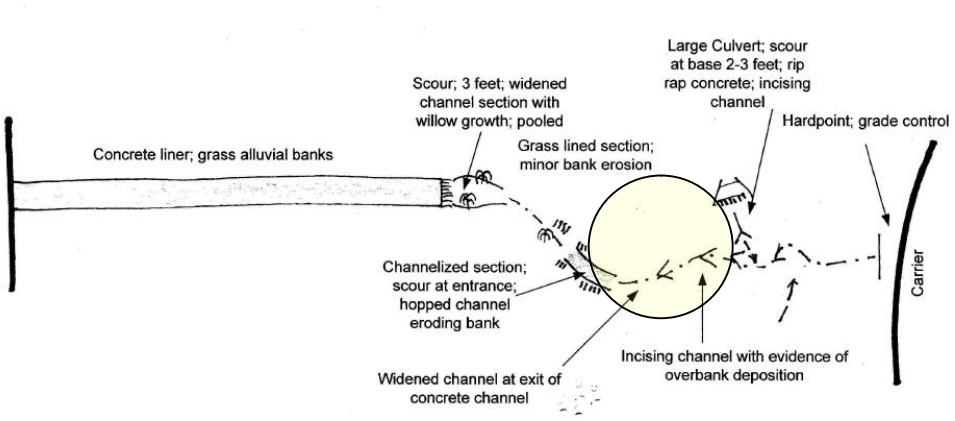


Figure 30. Lower floodplain. Note floodplain deposition "fencepost trees" due to abundant overbank flow in this area.

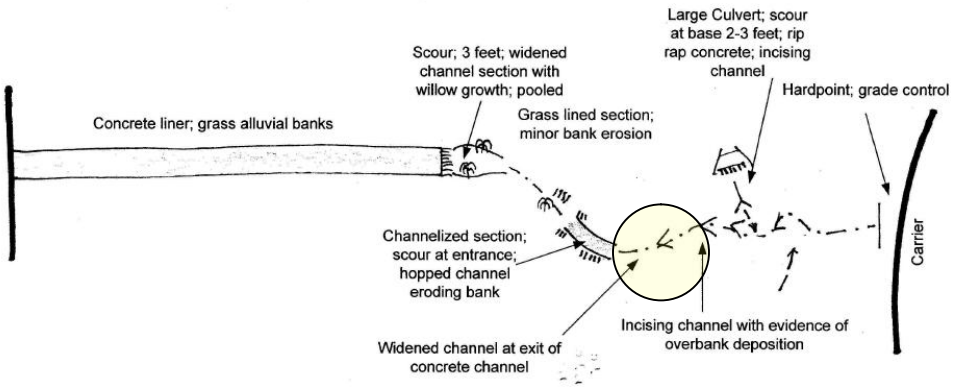


Figure 31. Incising channel downstream of concrete lined channel.

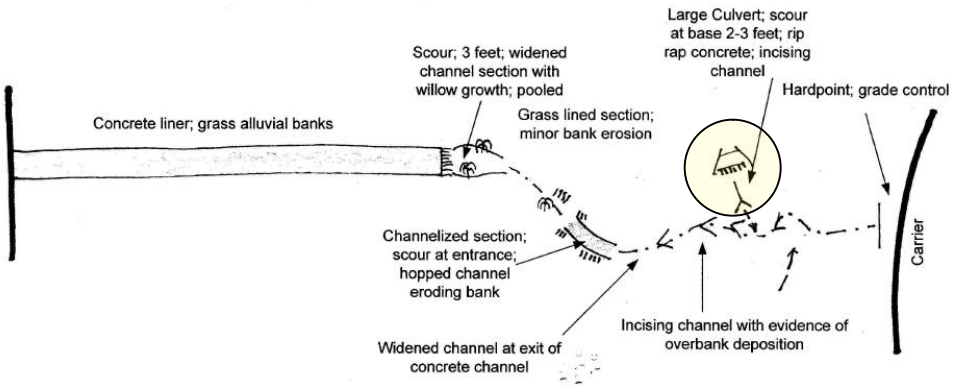


Figure 32. Erosion associated with outfall from large culvert.

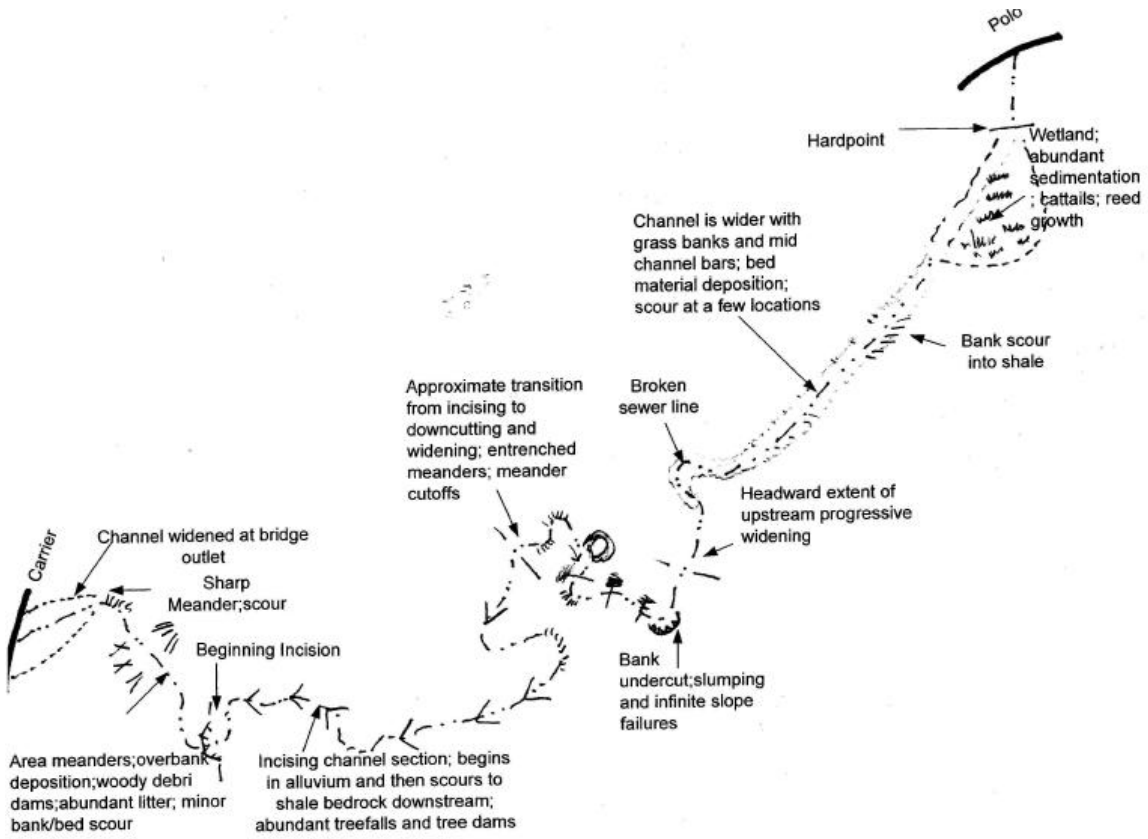


Figure 33. Reach 2 notes from Carrier Parkway to Polo.

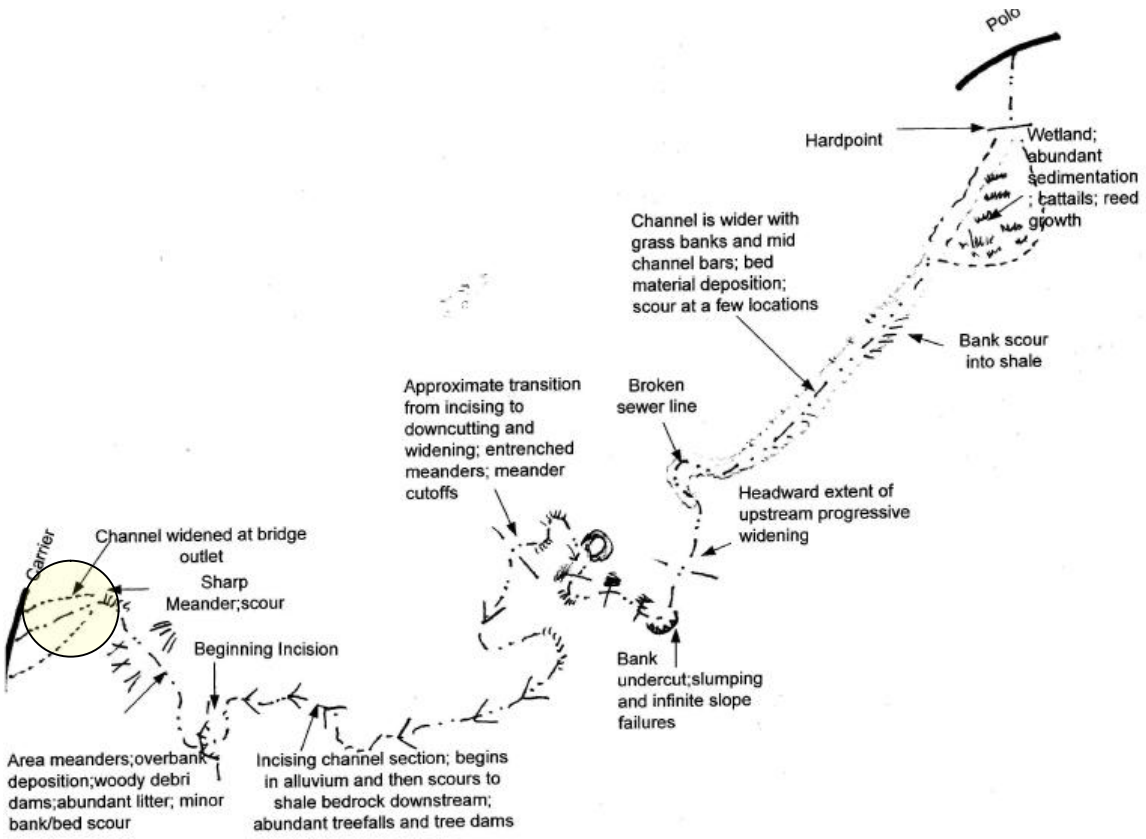


Figure 34. Ponded area and sedimentation (about 1-2feet) downstream of Carrier Parkway.

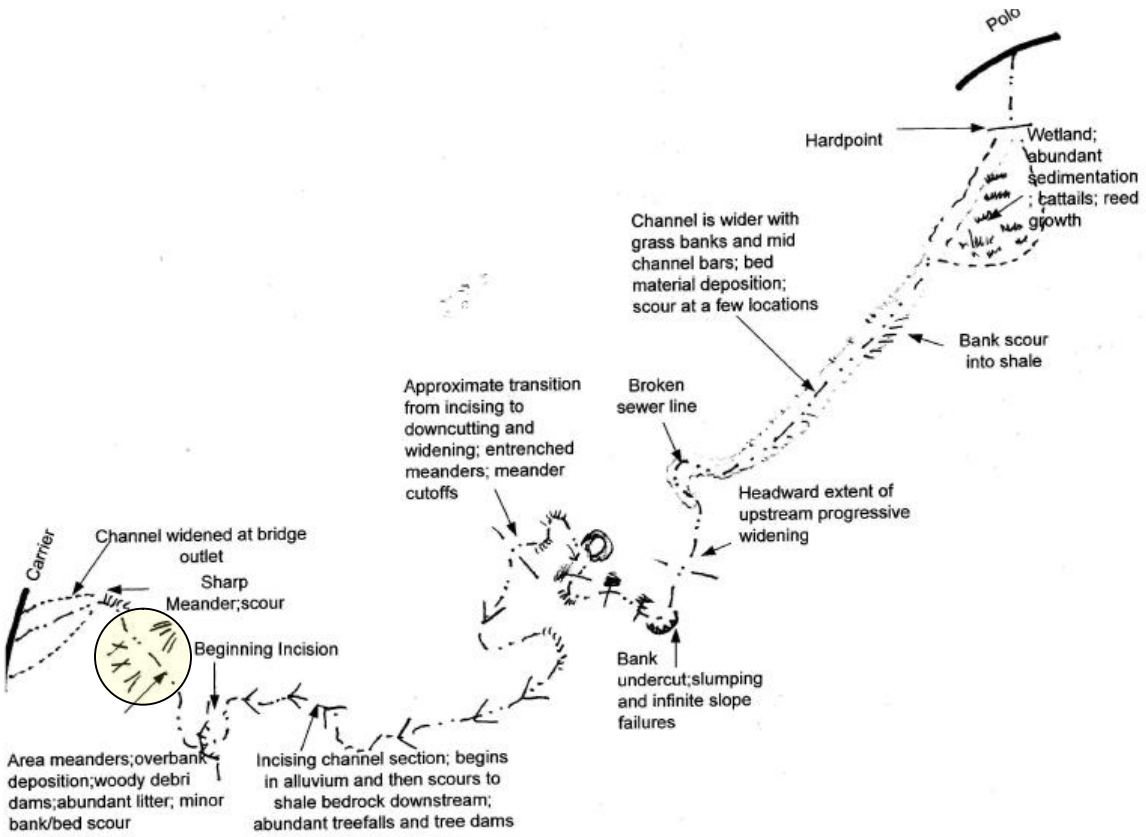


Figure 35. Pooled meandering section downstream from Carrier with abundant litter and debri dams.

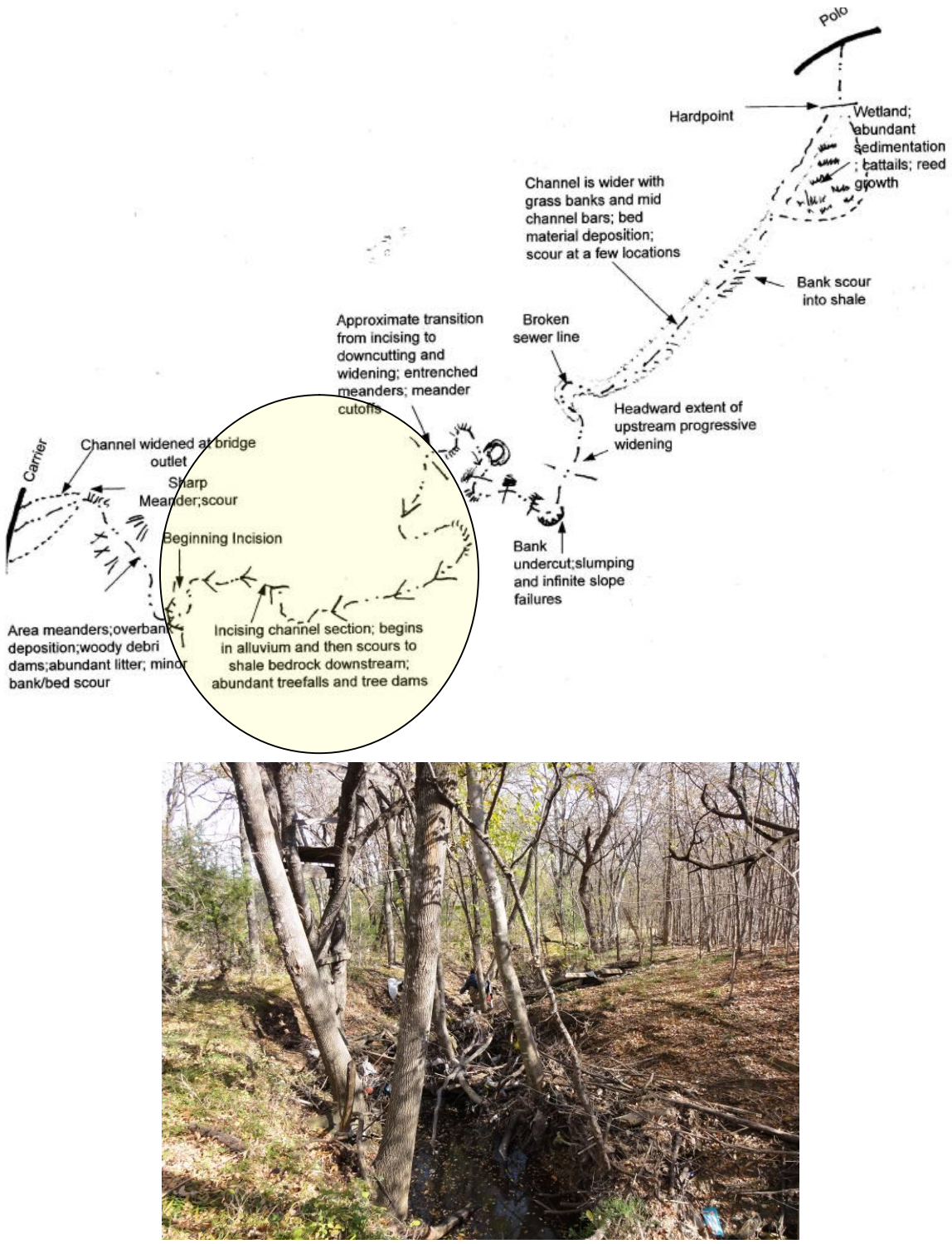


Figure 36. Beginning of channel incision. Scour on both banks, increasing depth, treefalls.

Figure 37. Incising channel and lateral erosion. Bank material silty clay with exposed roots.

Figure 38. Shot of meander in incising reach with fence and structure in the background.

Figure 39. Incising reach. Notebook is on the old channel bottom.

Figure 40. Stream is downcutting into shale. Shale is noted in the bank under the hammer to the left.

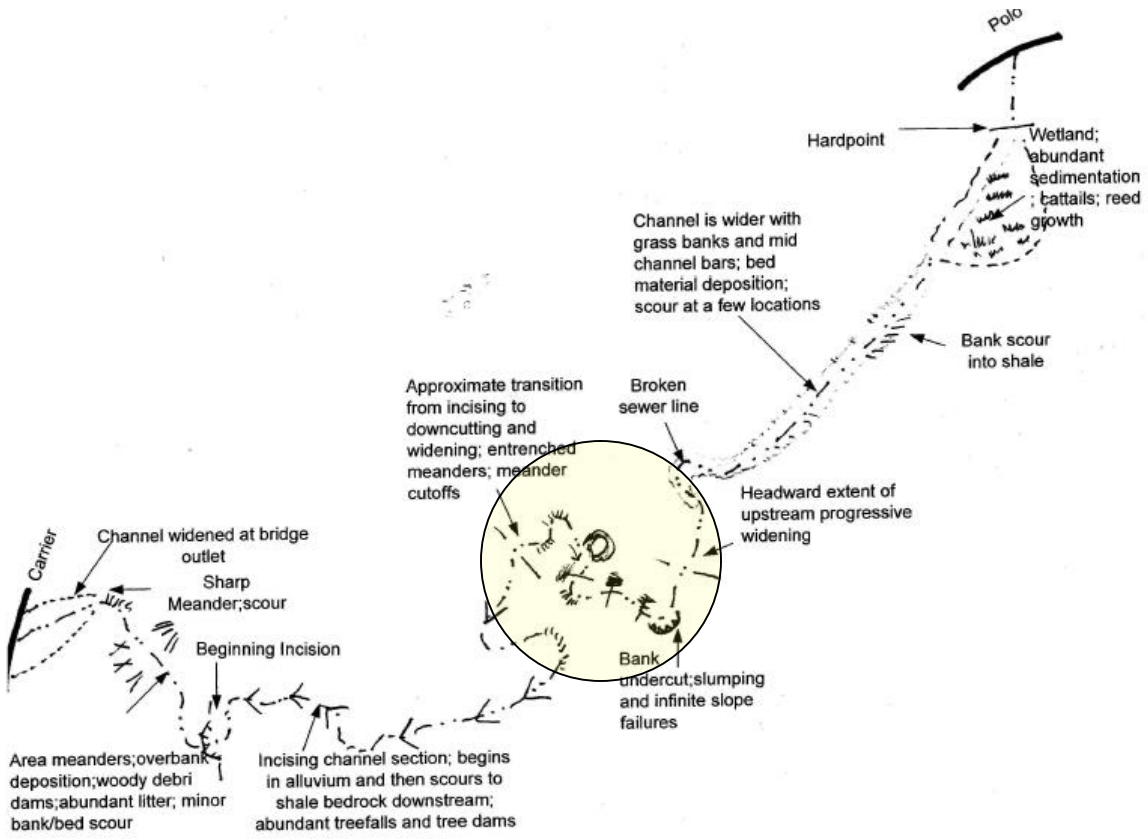


Figure 41. Beginning of the zone where the channel is downcutting and widening. This is a zone of abundant treefalls and undercut banks.

Figure 42. Meander cutoff. Note the level of the old channel to the right compared to the newer channel on the left.

Figure 43. Major tree fall, meander cutbank erosion.

Figure 44. Cutbank erosion, treefalls and a slump. The top of the slump is the area with the grass in the center of the photo.

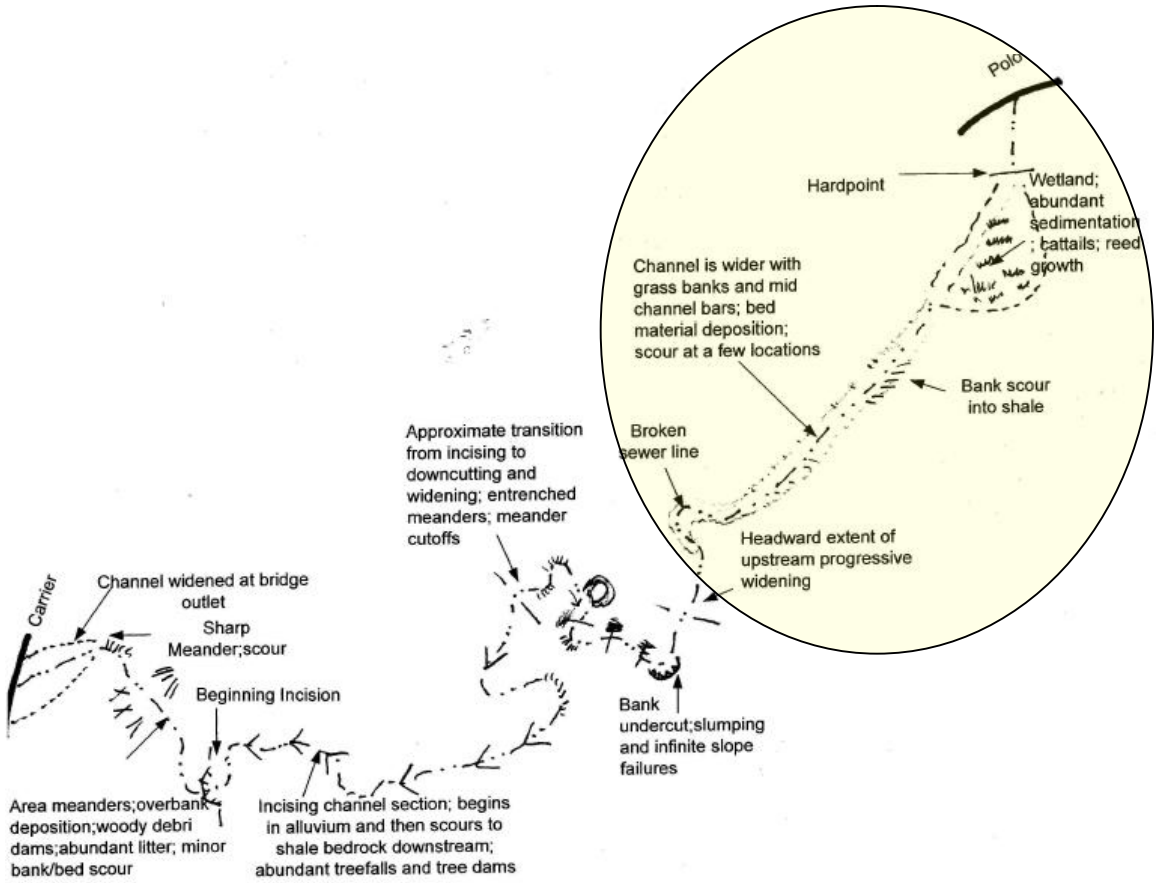


Figure 45. Beginning of the widened area where the channel has degraded and widened and is now depositing sediment.

Figure 46. Cutbank erosion with small wedge failures on bank. The top of the house is visible in the background.

Figure 47. Broken sewer line caused by degradation and widening of the channel.

Figure 48. Zone of deposition and widening of the channel upstream of the drop strucuture.

Figure 49. Stable banks and widened grassed channel above the drop structure.

Figure 50. erosion in the channel bank in shale. Increased erosion could lead to upslope problems in terms of potential slumping and earth failure.

Figure 51. Wetland filling in with sediment with abundant cattails and grasses.

Figure 52. Lower hardpoint on the channel which controls the upstream grade.

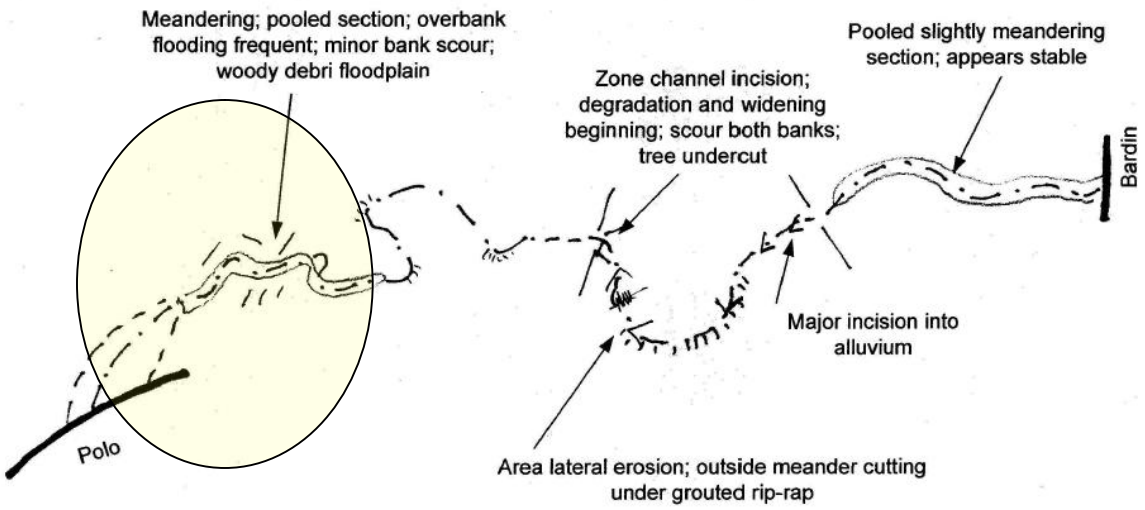


Figure 53. Reach 3 notes from Polo to Bardin Rd.

Figure 54. Pooled section immediately below the rip rapped channel downstream of Polo Rd.

Figure 55. Pooled meandering section with minor erosion.

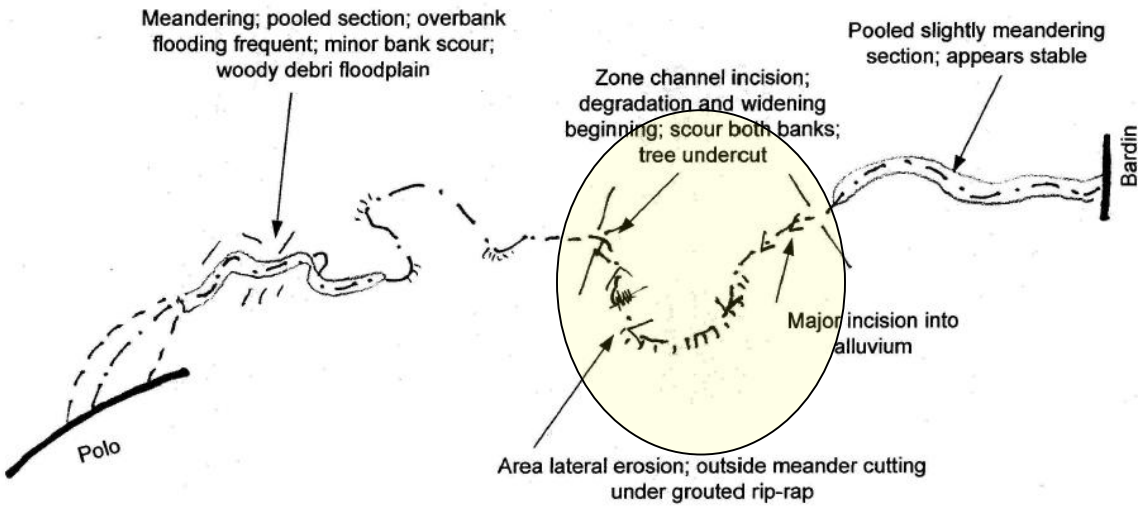


Figure 56. Beginning of channel incision noted by erosion of both banks, deepening of channel and cutting of old bar deposits.

Figure 57. Degrading channel on a meander which is undercutting grouted rip-rap located along Polo Rd.

Figure 58. Deep degradation located just downstream indicated by deep pools, near vertical banks and severe bank scour.

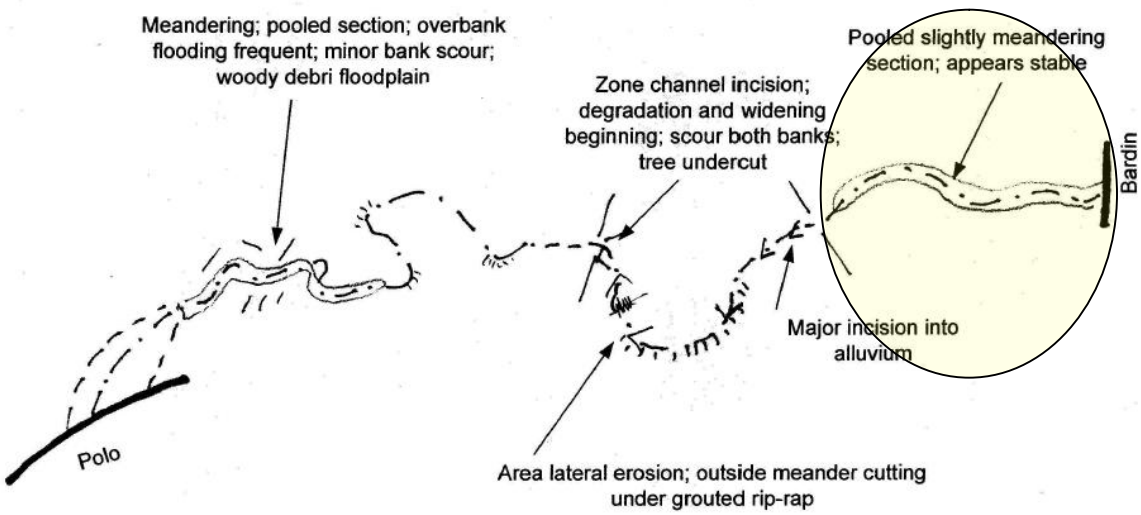


Figure 59. Lower pooled area just upstream of the hardpoint at Bardin. Channel appears stable with little bank or bed scour.

Figure 60. Pooled section above Bardin Rd.

6.3 Predicted Rate of Degradation: SWAT-DEG Model

The rate of bed degradation can be assessed with the Soil Water Assessment Tool (Arnold, et. al., 1993) and a simple degradation component SWAT- DEG, (Allen et. al., 1994;1999). SWAT-DEG is a continuous simulation model , which has been developed to predict time series channel erosion and degradation. Input to this model, besides basic watershed parameters (curve numbers or loss rates, time of concentration, routing structure), are channel dimensions, channel slopes, erodibility of the channel bottoms and width depth ratios of the channel. Erodibility is assessed utilizing the submerged jet technique (Hanson, 1990; Allen et. al., 1999). Bed load is assessed using the appropriate bed load equation after Stevens and Yang (1989). Width-depth ratios and general channel dimensions are based on channel surveys. A W/D of 4 and was used in the SWAT-DEG model for assessing channel degradation and dimensions over time.

This method has the advantage of giving the time rate of potential degradation and can be used to test the effects of varying land-use and climatic conditions on channel erosion. The modeled climate was the daily rainfall and temperature for Grand Prairie, Texas from 1950-1986 . Boundary conditions for design of degradation can utilize the SWAT-DEG results as a general planning tool for assessment of acceptable planning horizons for designing engineering works. Figure 61 illustrates the speed of knickpoint migration up the middle reach of Cedar Creek. This is based on sequential analysis of air photographs. This is the only area where, owing to vegetative cover, the channel could be seen. Average annual knickpoint migration from 2001 to 2009 appears to approach 52 feet.

Figure 61. This figure illustrates the time series degradation and widening upstream of the hardpoint on the middle reach of Cedar Cr. The average rate of movement was about 52 feet a year.

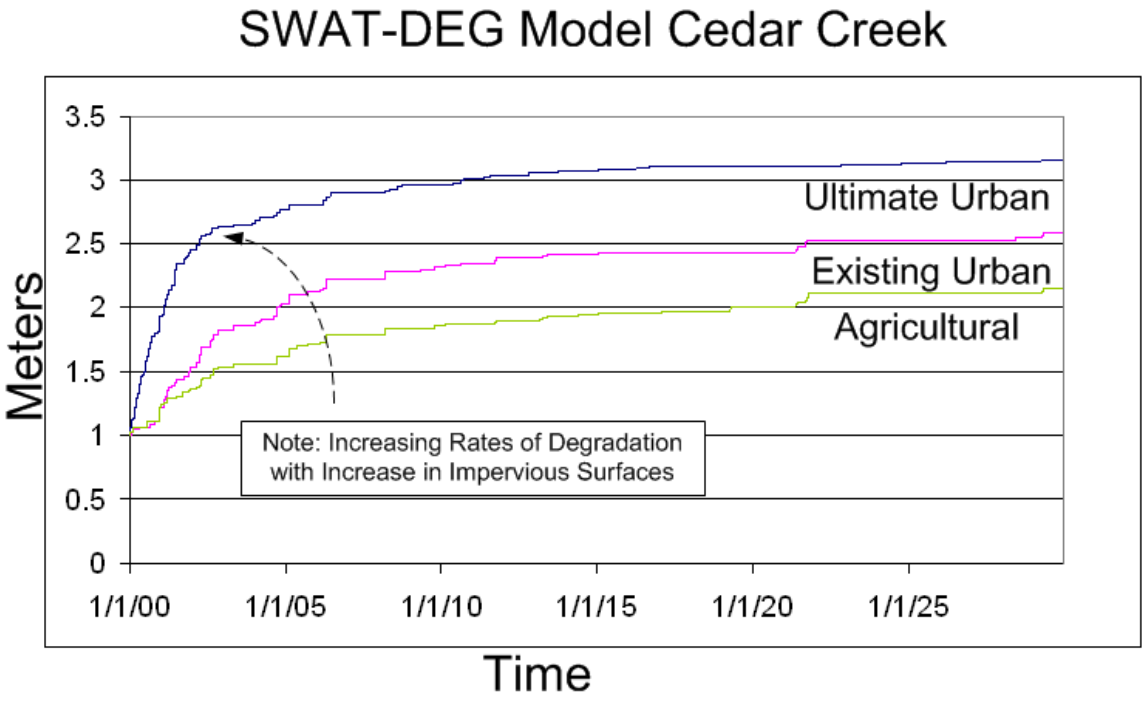


Figure 62. This diagram indicates the potential degradation, and changes possible in a straight reach of the channel over a 30 year time period in Cedar Creek with SWAT-DEG. under 3 different land use conditions.

Results shown in Figure 62 indicate the amount of degradation possible over time. Model results indicate that under *Agricultural Conditions* the channel is slow to change; it is still slowly degrading after 30 years and it never reaches the proposed equilibrium slope over this time. As the basin urbanizes, *Existing Conditions,* more pronounced changes occur in the in basin curve numbers and runoff, and the degradation process speeds up. If we assume that these changes took place over the past decade, then this implies that the basin has not yet adapted to those changes as the channel takes about 21 years to reach equilibrium or it has another decade or more to respond to these changes. Urbanization under the *Ultimate Conditions* infers that these added changes in impervious surfaces will occur more rapidly in perhaps as little as a decade. In summary, there is a lag in watershed response to land use changes. The greater the change in curve number and time of concentration, the more rapid the response of the watershed. This also infers that changes in the channel reflect the entire history of the watershed; that adjustments from one era overlap more recent changes. This infers that the watershed will reach the degradation from the first wave of urbanization in the next decade and continue to degrade in response to future land use changes over the next 20 years.

6.4 Stream Power and Instability of Cedar Creek

Booth (1990) for work in the Pacific Northwest found that improved correlation between flow parameters and observed erosion was found by using the unit stream power or energy expended by the flow per unit time per unit bed area. This author has found that the moving average approach gives a better indication of general trends in stream power and is shown in Figure 63. Comparing this figure with the field data indicates that while this plot illustrates the worst areas, it does fail to pick out the more subtle changes noted in the field in terms of the CEM model and the evolution of the channel. The ultimate 2 year and 100 year power reinforce the same trends. Note how the 2 year ultimate surpasses the threshold in the areas that are currently experiencing problems. This plot reinforces the field data shown in plots 23-25 and coupled with the time rates of degradation aids in prioritizing areas for stream repair and can probably be used as a first order tool in defining problem areas.

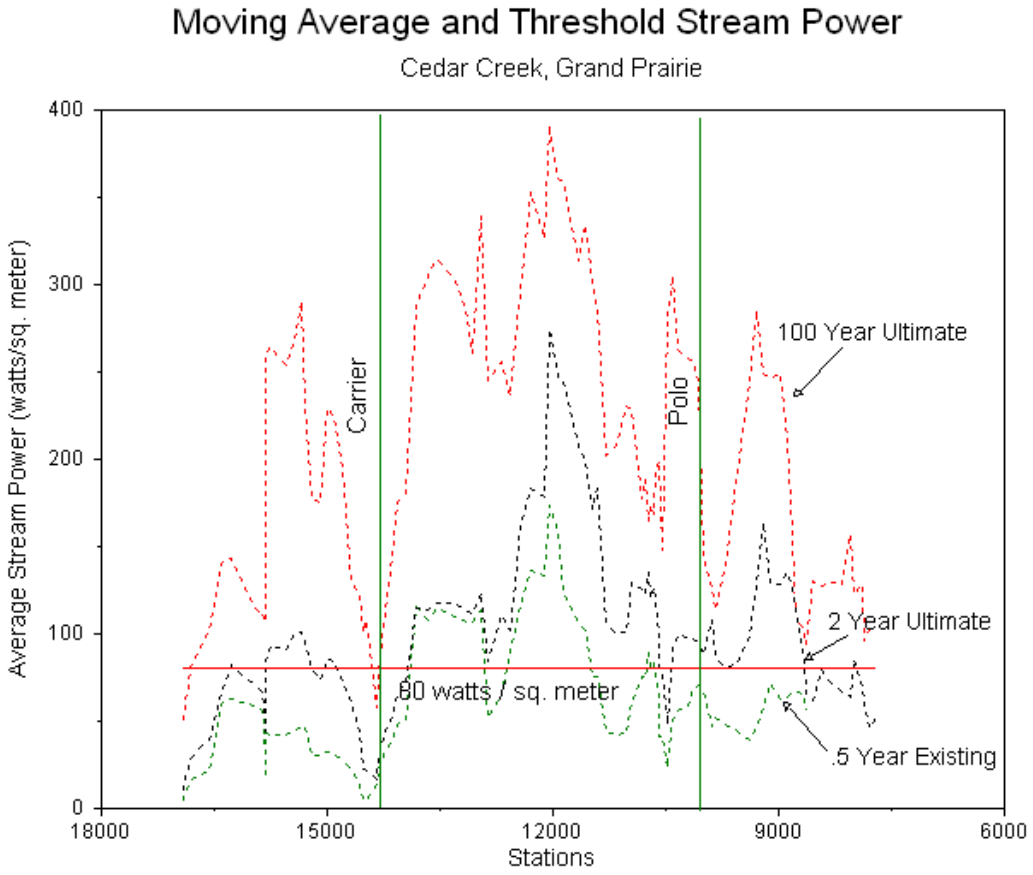


Figure 63. Illustrates the existing 0.5 year stream power in Watts/m-2 and the ultimate 2 and 100 year values for the channel. Note how the major area denoted by the moving average stream power coincides with the area of major channel incision and disturbance.

6.5 Predicted Channel Dimensions

From the effective discharge, work in the Metroplex has shown that the channel dimensions can be predicted within an acceptable error and are comparable to other methods of estimating equilibrium dimensions (Allen, Arnold, and Skipwith, 2002.). The results of SAM model runs (appendix) indicate the channel will be stable at a width of approximately 30 feet and a depth of 4.9 feet with an equilibrium slope of .0032; the GBR (Bledsoe Colorado State Model) results (appendix) using a different transport equation give widths of 65 feet , depths around 2 feet and channel slopes around .001. Both these methods assume that there is an abundant supply of the bed material; this is not the case in this channel. Regional Regime Equations based on field surveys of gaging stations in the Metroplex are shown in Figures 64 and 65. The Simons and Albertson (1963) relationship is based on analysis of regime channels with cohesive beds and banks. The Hey (2006) relationship is given for gravel bed streams and does allow for vegetative factors and a width depth ratio for input. In this case, a ultimate width depth ratio of 6 was used and a cover factor of 0.6 or heavy side slope vegetation.

Station	Q eff.	Width (ft.)	Depth (ft.)
Above 14134 Regional Curve	459 (457)	20	4.5
Simons and Albertson	459	44	5.7
Hey	459	25.7	3.4
Mean		**29.9**	**4.5**
Below 14134 Regional Curve	584 (470)	23	4.9
Simons and Albertsons	584	49.8	6.25
Hey	584	28.5	3.73
Mean		**33.7**	**4.96**

Table 7. Station, Effective Discharge and Channel Dimensions for Cedar Cr.
The above computations are based on the effective channel discharge and are guides to potential change in the active channel. The numbers in parenthesis are the 0.5 year existing x 1.12 urbanization effect x 0.8. The other is the Dempster 1.25 year based on ultimate levels of imperviousness. The higher value was used in this assessment.

Therefore, the existing active channel will widen about 11 feet and deepen about 1 foot. The channel thalweg , due to degradation in the reach can add another 4.6 feet of depth to the channel for each 1000 feet of channel length over the next 20 years. Increase in bank height (reach degradation plus local scour), will increase the channel width due to bank failures and slumping on meanders (@4:1 width depth could be 60 feet top width). Associated riparian tree loss will cause localized tree dams and scour as well as localized backwater conditions.

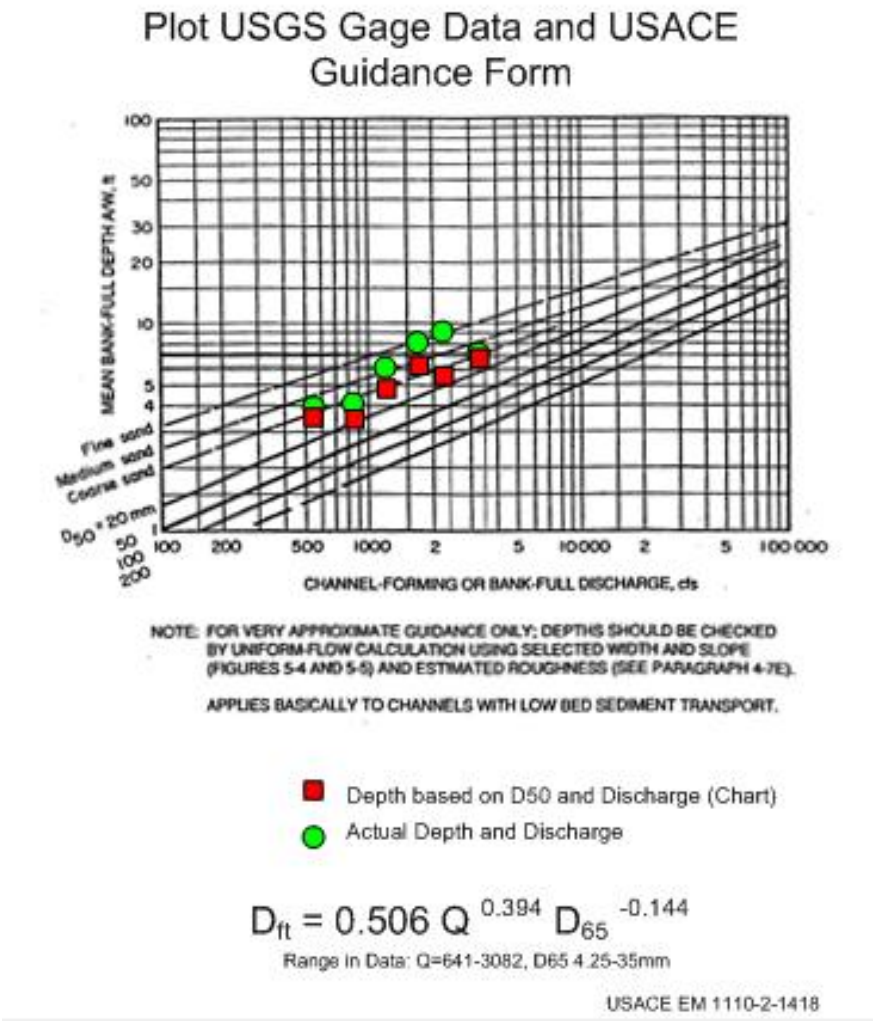


Figure 64. This diagram illustrates the general relationship between channel depth, effective discharge, and bed material size. The colored symbols are for gage site assessments previously done in the Metroplex. With a effective discharge around 500 and a bed material size of 4mm would have a design depth of about 4-5 feet.

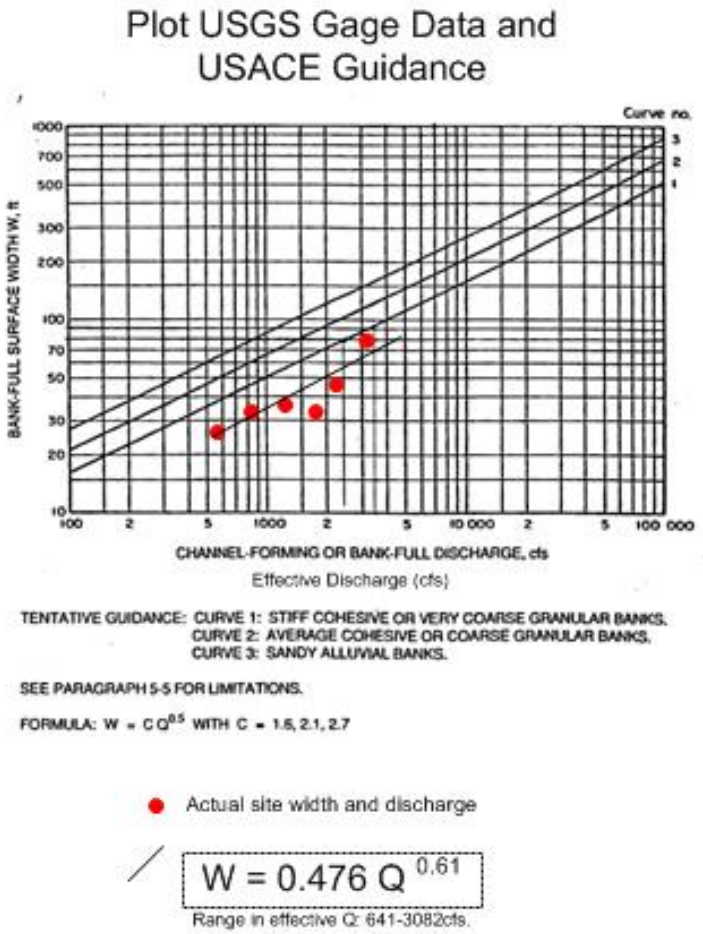


Figure 65. This is a similar chart showing previously surveyed channel widths at Metroplex gage sites and channel width. It can be seen that the USACE relationships indicates larger channel widths. This is because this does not take into account the effects of bank vegetation. In general, the 500 cfs effective discharge will give ultimate widths of around 30-34 feet. the channel could be wider depending on bank vegetation.

7.0 *Planform Stability*

7.1 Meanders

Work by Leopold and Wolman (1957) on rivers in the United States indicates that, based on channel slope, rivers will tend to go from meandering to braided when the channel slope exceeds the threshold slope of :

$$S_t = .06\ Q^{-.44}$$

Where: S_t is in ft/ft. dimensionless
Q is in cfs.

Using this relationship, and the predicted effective discharge of the stream, it appears that the stream is steep enough to trend toward braiding as the actual slope is greater than the predicted threshold for the stream between .0036-.004. This infers that the tendency of the stream will be to widen and straighten to effectively carry the load of the stream. This is a very simplistic representation of stream dynamics but does show the tendency of the stream, eg. for the predicted effective discharge, the slope is very high.

While the SWAT model infers maximum degradation in the channel, it assumes no meanders.

Based on a limited time series photographic assessment of channel migration in the Blackland Prairie and in the Metorplex, the following regression appears appropriate for a first order estimate of potential meander migration rates in small channels.

$$\text{Channel Widths/Year} = 0.1346 - 0.0128\ Rc/W - 0.00115\ Da$$

Where: Rc = radius of curvature in feet
W = channel width in feet
Da = drainage area in sq. miles

So, for a 1.7 square mile drainage area with a channel width of 10-20 feet and a projected mean radius of curvature of 60 feet, the channel bend loss rate could be .1092 widths a year or up to 2 feet/year. This indicates on meanders, some form of bank protection will be needed to arrest lateral migration if structures or other critical facilities are within this zone. The only visible meander in which some time series analysis could be done was in the Polo to Bardin Reach. Here, based on 5 years of photographic data, the channel appears to migrate from 0.8 to 1.2 feet per year or within the limits of the above equation.

For design, the maximum bank shear stress and shear stresses in bends should probably be adjusted as shown below after the USACE.

For straight channel segments: $T_{max} = 1.5\ T$

For Bends: $T_{max} = 2.64\ T(Rc/W)^{-.5}$

Where: T = maximum shear stress HEC-RAS
Rc= radius of curvature
W= channel bankfull width..

From ERDC TN-EMRRP-SR-29 Fischenich (2001)

Bedload per unit channel width		metric units		conversion	English units with grain size in mm		check back to SI	
depth	d	**1.219**	m	3.28	4.0	ft		
slope	S	**0.006**	m/m		0.006	ft/ft		
diameter sediment	d_*	**0.005**	m		5	mm		
gravitational acceleration	g	9.81	m/sec^2	3.28	32.2	ft/sec^2		
density fluid	ρ_f	1000	kg/m^3	0.00194	1.94	$slugs/ft^3$		
density sediment	ρ_*	2650	kg/m^3	0.00194	5.15	$slugs/ft^3$		
relative density	s	2.65	dimensionless		2.65	dimensionless		
shear stress	τ	71.8	N/m^2		1.499	lb_f/ft^2		
dimensionless parameter	Ψ	1.13			1.13			
bed-load transport (Meyer-Peter)	Φ	6.154			6.151			
	q_*	**0.0088**	m^2/s		**0.0942**	ft^2/s	0.008749	m^2/s
bed-load transport ($Einstein_{alt}$)	Φ	1.383			1.383			
	q_*	**0.00197**	m^2/s		**0.02117**	ft^2/s	0.001967	m^2/s
bed-load transport ($Einstein_{std}$)	Φ	6.380			6.378			
	q_*	**0.00908**	m^2/s		**0.09764**	ft^2/s	0.009071	m^2/s
Ackers and White	n	0.021			0.021			
	U	4.16	m/s		13.64	ft/s		
	q_*	**0.00338**	m^2/s		**0.03611**	ft^2/s	0.003356	m^2/s

Source: Williams, G.P., 1986. River meanders and channel size. *Journal of Hydrology*, 88 pp.147-164

Meander Pattern from Bankfull Dimension		meander length			belt width			radius of curvature			length bend		
cross section area													
width	25	146	**239**	395	79	**136**	237	31	**48**	74	99	**162**	267
mean depth													

Table 10. Projected Meander Dimensions and bed material transport relationships for Cedar Cr. (after Mecklenberg, Ohio Department of Natural Resources).

Table 10 indicates that given the design discharge and channel width, the channel, should develop a meandering pattern with dimensions shown in the Table. These are for idealized meanders based on large data sets. These should be used only for a guide, more detailed assessment of the channel in any area of proposed channel alteration must be done to assess the proximity of the bend to hard points, incoming tributaries, depth of shale bedrock, and depth to sewer and water lines. The general dimensions of the radius of curvature will change in relation to the increased discharges and predicted downcutting. In general, it has been found that most channels in the Metroplex will tend

to downcut rather than increase the meander dimensions in an effort to lower overall channel slope. As was shown in the tendency toward braiding given in the beginning of the section.

7.2 Bank Stability

Bank stability is complicated and based on slope geometry, material properties, ground water table and pore water conditions, vegetation, as well as climatic and stream flood cycles. Work in shale terrain has shown several types of failure which are shown in diagrams and pictures for failures found along Cedar Creek.

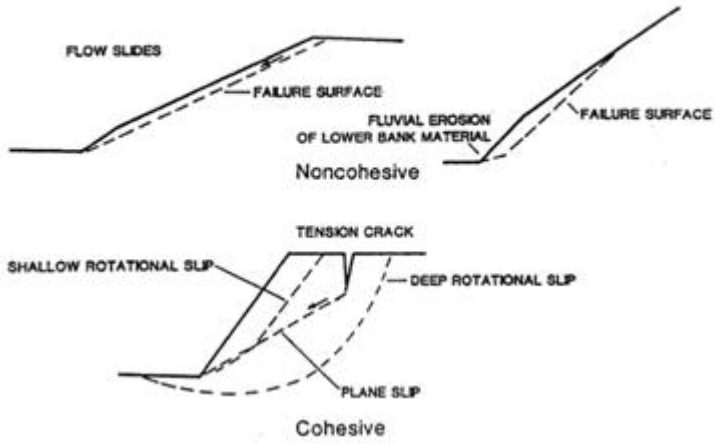


Figure 66. Wedge Failures are common along the outside of meanders or in Type II streams where the channel is incising.

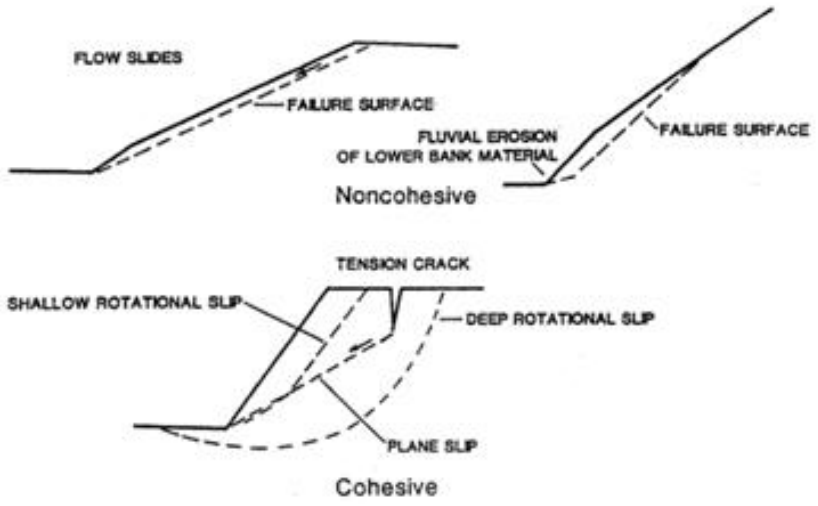


Figure 67. Slump type failure along Cedar Creek (Between Stations 11921 and 12 291). These failures are found where the slopes are typically less than 60 degrees and the stream cuts into an area where the shale is highly weathered or there is soil forming the channel banks. In this case, the slump appears to occur in the upper bank soil material above the shale bedrock. In most cases the failures will "bottom out" on top of the shale at the base of the weathered material.

For wedge failure analysis, a simple method proposed by Thorne (1982) indicates that the maximum stable slope height assuming a tension crack which extends ½ the bank height is:

$$Hc = 2c/g * Tan (45+p/2)$$

Where: Hc = critical height
c = cohesion
g = saturated weight
p = internal angle of friction

If one assumes that the maximum height (Hc) of a stable vertical channel as seen in the field is in the range of 8 feet, and one assumes the internal angle of friction is the fully softened value of 20 degrees, and the saturated weight is 125 pounds per cubic foot, then the computed cohesion active in the field is around 350 psf. This relationship then assumes that if the slope exceeds this height, given these conditions, it will fail. For more rigorous design of wedge failures, one should consult work by Andrew Simon and BSTEM analysis ARS/USDA.http://www.ars.usda.gov/Research/docs.htm?docid=5044) This method allows one to assess progressive failures on streambanks with variable properties as well as vegetative effects, coupled with dominant discharge. This cohesion is well below that predicted by laboratory unconfined compression tests as were used in assessing rock erosion. However, with weathering and moisture, the author has found cohesion from post mortem analysis of slope failures in the area has been consistently in this range.

For slumps, work in the area has shown that the failures along stream channels are highly related to the depth of the top of the shale, weathering of the shale, and height of the shale in the stream bank. The higher the shale is positioned within the channel bank, the more the channel will tend to fail by wedge failures and by erosive scour rather than slumping. The wedge failures in the shale bedrock will tend to occur along fractures, tension cracks, and fault planes. If the soil material extends the whole height of the bank, and the shale is in the channel bottom, scouring of the channel toe can result in slumps. The depth of the bank failure arcs tend to be less than 10 feet and the failures are a result of high pore pressures and are related to floods or intense rain storms which can charge the surficial cracked soil resulting in high pore pressures and failure (Kuhn and Zornberg, 2006). *For any site, geotechnical engineers should be consulted for analysis of the failure when structures are involved.*

ambient soil unit weight	saturated soil unit weight	cohesion	friction angle	bank angle	bank height	design factor of safety		linearly interpolated factor of safety (ambient conditions)	estimated bank angle @ design FS	linearly interpolated factor of safety (saturated conditions)	estimated bank angle @ design FS
15.72	19.64	16.80	20.00	30.00	3.00	1.50		3.32	stable @ 90°	2.32	62.73
15.70	19.60	16.80	20.00	40.00	3.00	1.50		3.00	stable @ 90°	2.06	62.80
15.70	19.60	16.80	20.00	50.00	3.00	1.50		2.68	stable @ 90°	1.80	62.80
15.70	19.60	16.80	20.00	60.00	3.00	1.50		2.40	stable @ 90°	1.57	62.80
15.70	19.60	16.80	20.00	70.00	3.00	1.50		2.11	stable @ 90°	1.33	62.80
15.70	19.60	16.80	20.00	80.00	3.00	1.50		1.85	stable @ 90°	1.08	62.80
15.70	19.60	16.80	20.00	30.00	5.00	1.50		2.57	71.78	1.71	39.34
15.70	19.60	16.80	20.00	40.00	5.00	1.50		2.28	71.78	1.49	39.34
15.70	19.60	16.80	20.00	50.00	5.00	1.50		2.00	71.78	1.26	39.34
15.70	19.60	16.80	20.00	60.00	5.00	1.50		1.77	71.78	1.07	39.34
15.70	19.60	16.80	20.00	70.00	5.00	1.50		1.54	71.78	0.88	39.34
15.70	19.60	16.80	20.00	80.00	5.00	1.50		1.33	71.78	0.65	39.34

Using the REAME program (Soenksen, et. al. 2003), and assuming similar bank properties as in the vertical slope, it can be seen that under saturated bank conditions, the 10 foot tall bank is stable up to about 60 degrees and then falls below the 1.5 design factor of safety. In other words, as the bank is eroded, it would maintain stability until the bank is undercut to about 60 degrees. The 16 foot bank reaches the same level of stability at an angle of about 40 degrees. In other words, the taller the bank, the greater the driving forces and the more the banks will be subject to failure at smaller slope angles. This also

indicates that as the channel degrades, and bank height increases, the streambank will readily fail as the channel degrades.

Infinite slope failures are typically seen along stream banks where there is abundant soil material above weathered shale (.5 to 3 feet). Slope angles can range from near vertical to less than 60 degrees. Here, as in the case of the slumps, the failures are shallow with Length to depth rations of greater than 20 with depths typically less than a meter. The failures parallel the ground surface and if moist can be considered earthflows or mudflows. The depth of infinite slope failures in this area is associated with the depth of surfical soil cracking due to dessication. The process is explained by Kuhn and Zornberg, (2006) and can be related to rainstorm properties of intensity and duration.

7.3 Future Channel Evolution

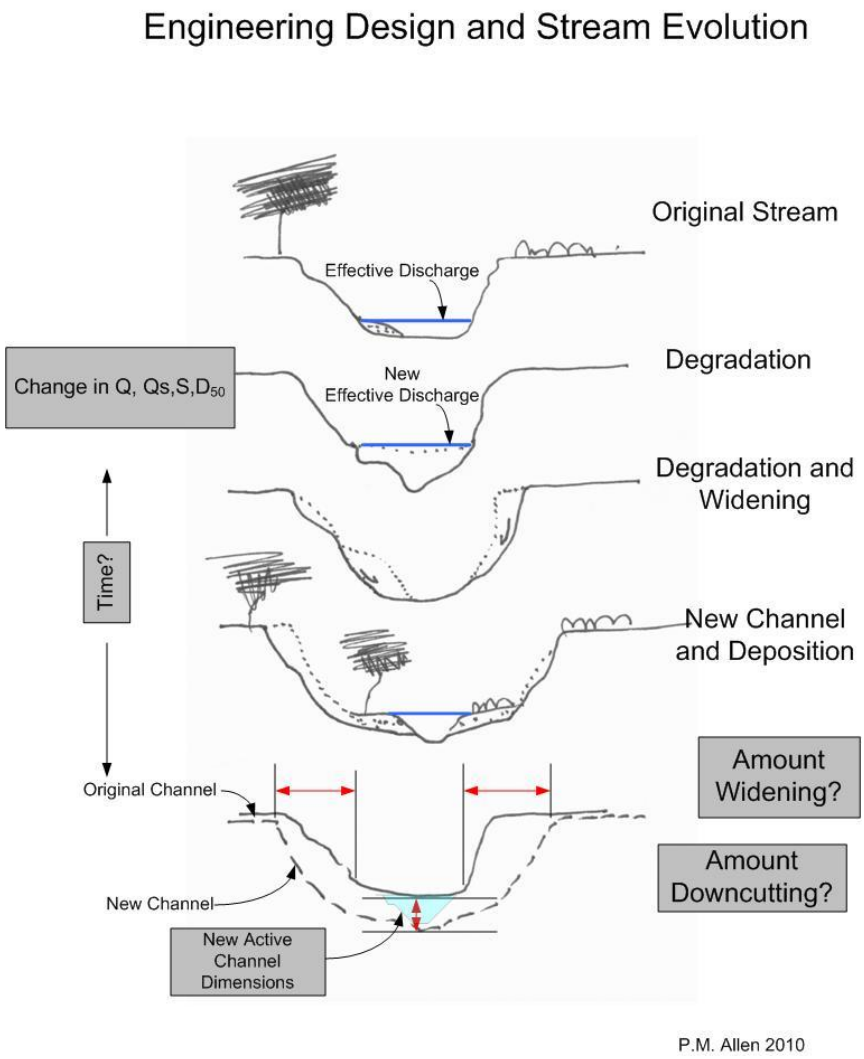
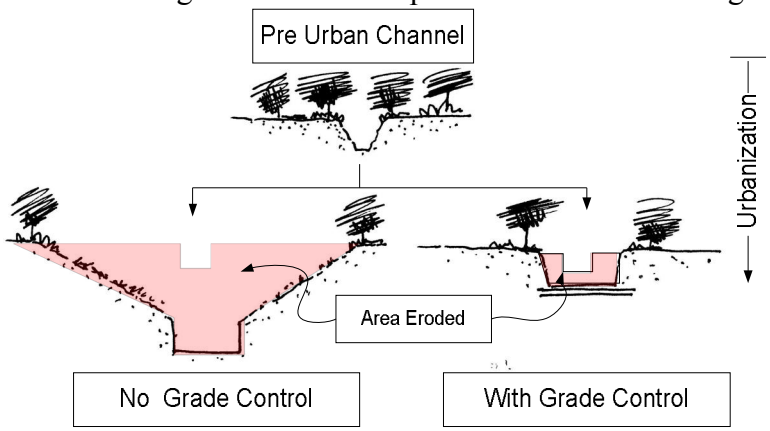


Figure 68. Major Design Questions for Channel Stability Analysis

The following comments and figure are shown to illustrate the potential changes predicted in the channel based on accumulated field evidence and past history of similar streams.

- the channel will continue to downcut and widen over time , perhaps doubling its size following the trends in the channel evolution model over the next 20 years (SWAT-DEG). Widening will not be rapid until the channel has cut down through the tree root zone; when the trees are undercut, the channel will continue to widen and downcut more rapidly. Estimates for channel width and depth are given in Table 7.
- Tree falls will be very active in CEM Stage III and form local low woody debri dams (LWD) which can cause local backwater and or scour problems if not removed.
- Flows less than the 0.5 year flood event will continue to go overbank until the channel degrades and widens to the newer bank full flow (estimated to be around 459-584 cfs); when this new width and depth is reached, the channel will not flow overbank as often, lessening the overbank scour and deposition.
- The channel will continue to downcut to lower the channel slope to reach its projected equilibrium slope (.0009) based on the effects of urbanization and great discharge. This will tend to release large amounts of sediment from the eroded channel. Sediment will pass downstream and deposit in any areas of current ponding or low velocity overbank flow. Downcutting without grade control will be about 4.6 feet/1000 feet of channel (Reach 2 could be 16 feet to thalweg and 60 foot top width).The channel can follow two paths depending on grade control shown below. In both cases the channel will widen; without grade control it will also deepen and ultimately cause a lot larger land loss with potential structural damage.



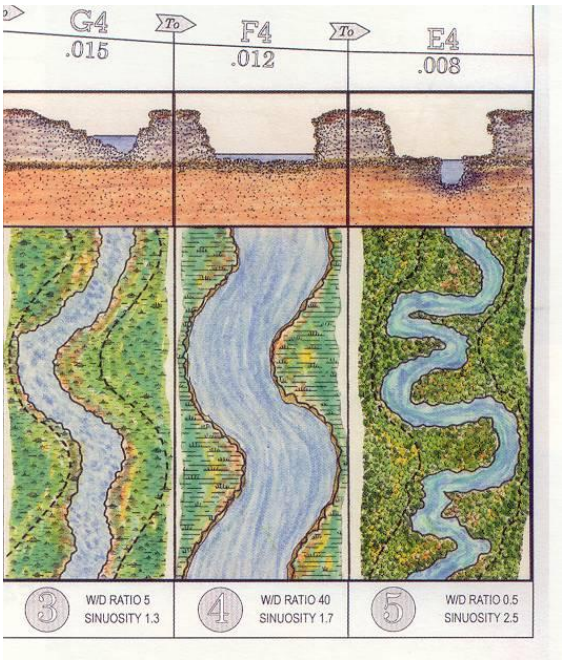


Figure 69 . Illustrates the potential evolution of the current stream according to Rosgen,1996. Basically it shows the current channel downcutting and widening and then aggrading and infilling to form a more sinuous channel in a newly developed lower floodplain.

- The evolutionary sequence (Figure 69) as explained will cause massive tree loss and sedimentation downstream if allowed to progress. The installation of hard points to halt downcutting is advocated.
- The hard points (grade control) spaced as stated will contain the channels downcutting but the channel will still tend to widen. In addition, the sediment caused by widening will be a factor during this period of stream adjustment and some maintenance will be required for localized sediment problems
- The wetland, upstream of Polo will continue to receive sediments as the channel widens and erodes. Plans should be made to assess what the ultimate status of the area will be; pond; wetland, or lowland with cattails and grasses. If left alone, this area will probably be filled with sediment and ultimately grow up in willows and then over time hardwoods.

8.0 *Local Scour*

- In general the major points of this report have dealt with changes in the stream due to changes in regional watershed scale variables of land use, and interpretation of watershed scale impacts. The design parameters indicated do not take into account local scour around culverts, bridge piers, local structures, weirs, trees wads, and scour lengths and depths at meanders. These local scour phenomena can often be of the same or greater magnitude that those associated with more regionally induced degradation or aggradation. For analysis of this type of scour, more detailed engineering is advocated and examples are given in the appendix by the NRCS for scour and grade control (NEH -654 National Engineering Handbook NRCS, Technical Supplement 14G on grade control and 14B on scour calculations. In addition, manuals prepared by the FHWA such as FHWA NHI 01-001 and 003 for evaluating scour at bridges and bridge scour and stream instability countermeasures are excellent.

9.0 Conclusions/Comments

- The channels flow in CH-CL soils and are underlain by Eagle Ford Shale Bedrock in some areas. The shale as well as soil is subject to slope instability owing to high plasticity and low shear strength. Post mortem of failures in the shale have shown strength values approaching residual values or fully softened values.
- The soils are prone to shrink and swell with varying moisture conditions which enhances erodibility of the materials upon drying. Use of allowable velocity approaches in such material are questionable as the dry material cracks and the material is far more erosive. Based on submerged jet testing, rates range from 1-10 mm/hour or from .09 in/hr. per psf tractive force for bare soil. Cover vegetation can reduce these effects dramatically.
- Drying and stress in vertical cut slopes can aid in creation of tension cracks and bank failure, cracks in side slopes can enhance shallow or infinite slope failures on steeper slopes and smaller cantilever failures on small cut-banks. The BSTEM model is applicable for evaluation of local vertical slopes. The toe areas of slopes adjacent to homes should be protected to prevent slumping. Once established slumps will tend to progress upslope toward the structure. Slumps will tend to be in the weathered soil and bottom out on the top of the shale bedrock. The critical slope height for vertical slopes approaches 8 feet.
- The channel bottoms are covered in places with a diverse size range of bed material owing to the location of outcropping limestone ledges and formerly deposited gravel in terraces. More extensive assessment of bed material is advocated prior to any design of channel restoration projects.
- Where the shale is exposed it will be subject to slaking. Slaking will result in easily entrainable particles and erosion. Rates are given in the text and average from 1-3 inches per year.
- The channel banks are predominantly covered with trees and brush except in areas where the channel is entrenched or on steep cut banks; while trees resist lateral erosion, bank vegetation is highly susceptible to degradation as trees can be lost with as little as 2 feet of degradation; once the trees are gone, the bank can erode faster resulting in definable widening and downcutting according to the CEM model and the equilibrium slope.
- Incipient motion assessment using an average bed material sample indicates in the one year event, all D50 material will be in motion, D90 material will be in motion in the 2 year event; armoring is not considered to be a factor in stream evolution.
- Stream Power assessment of future conditions indicates that the channel may exceed simple erosion thresholds set at 80 Watts m-2. This is also seen in the high Froude values(>0.35) and velocities in the reach. Such indicators help point to areas of instability in the channel and are shown in Figure 63.
- Increased runoff and related degradation caused by past land use changes will cause continued headward gully erosion, slumping on steeper shale side slopes, and bank and channel bed erosion with rates approaching 52 feet per year; Figure 61.
- Channels will widen Table 7. from around 10-20 feet to 30 feet.

- Channel degradation, if uncontrolled, could result in downcutting of up to 4.6 feet/1000 feet channel.
- SWAT-DEG runs done indicate the approximate rate of degradation. In this stream, degradation under future conditions can cause degradation over 20 years
- Most channel dimensions and processes are controlled by the frequency and magnitude of discharge, channel bed and bank lithologies, and bank vegetation. Urbanization is shown to increase the 2 year discharge by about 2 times over natural conditions for the study watershed but a little over 1.1 times for future conditions. Channel widths will increase, meander geometry will change, and related pool riffle spacing. It should be noted that the channel is still in transition from the past urbanization and according to the SWAT-DEG runs, the channel will continue to adjust over the next 20 years.
- Previous studies have indicated that a bimodal flow regime may occur as a result of storm sewer systems and surface runoff. This should be considered in future channel design. Often this creates a two stage channel with the smaller inner channel related to high frequency storm sewer discharge and the larger channel to the less frequent bankfull flows.
- Results are based on conditions at the time of the field survey and computed hydrology and hydraulics, changes in the watershed land use and sediment and erosion control practices can alter the rates and magnitude of indicated change in the watershed.
- Grade control is advocated for all three study reaches in order to halt predicted degradation and related bank instability (CEM model). Evaluation indicates (p.43) the approximate number of drop structures needed by reach. In practice, the number of drop structures is related to a number of factors including stream sinuosity, land ownership, access, sewer and water lines, and the state of the stream with regard to the CEM model. Typically, drops are not advocated for CEM Stage III-IV as the stream is already widening and degrading and the cost is often prohibitive. Drops are indicated for Type II streams. Therefore, taking this into account, logical areas for assessment of drops would be around stations 14918 in Reach 1, around stations 13959, (13167-13071) and (12873-12477) in Reach 2, and around stations (9535 or 9839), station 9195 and station 8539 in Reach 3. (See Biedenharn and Hubbard, 2001; ERDC/CHL CHETN-VII-3 Design Considerations for Siting Grade Control Structures USACE). Location of existing sewer and water lines should be considered in placement of structures taking into account the existing depth of the lines and future degradation potential.
- Local scour around structures is not considered in this study but should be evaluated when planning engineering works.
- Meander migration can average about 1-2 feet per year. The only area which requires immediate planform attention is the meander near station 8982. At this point the previously placed rip rap is being undercut. Engineering placement of protection should consider reach degradation from the downstream hard point at 4.6ft./1000 feet, increased tractive force on the outside of the meander and potential scour depths near walls.

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Appendix Stable Slope

Example stable slope formulas.

1. **Meyer Peter Muller Formula**:

S = .19*((n/(d90**1/6))**1.5)dm/R

Where:
Dm = effective size of bed material expressed as a weighted mean diameter or d50 in mm
D90= particle size of bed material at 90 percent finer in mm
R = hydraulic radius, for width depth ratio greater than 40 use water depth in feet
N = manning n factor

2. **Schoklitsch Formula**

S = ((.00021*dm*B/Q)**0.75

Where:
B= Channel width
Q = dominant discharge

3. **Shields/DuBoys**

S = tau-cr /(gma*R)

Where:
Gma = specific weight of water in lbs./cuft.
Tau-cr = critical bed shear stress in lbs/sq. ft. using dm

4. **Regional Regression for North Texas**

S = 0.01576*Q**-.3534

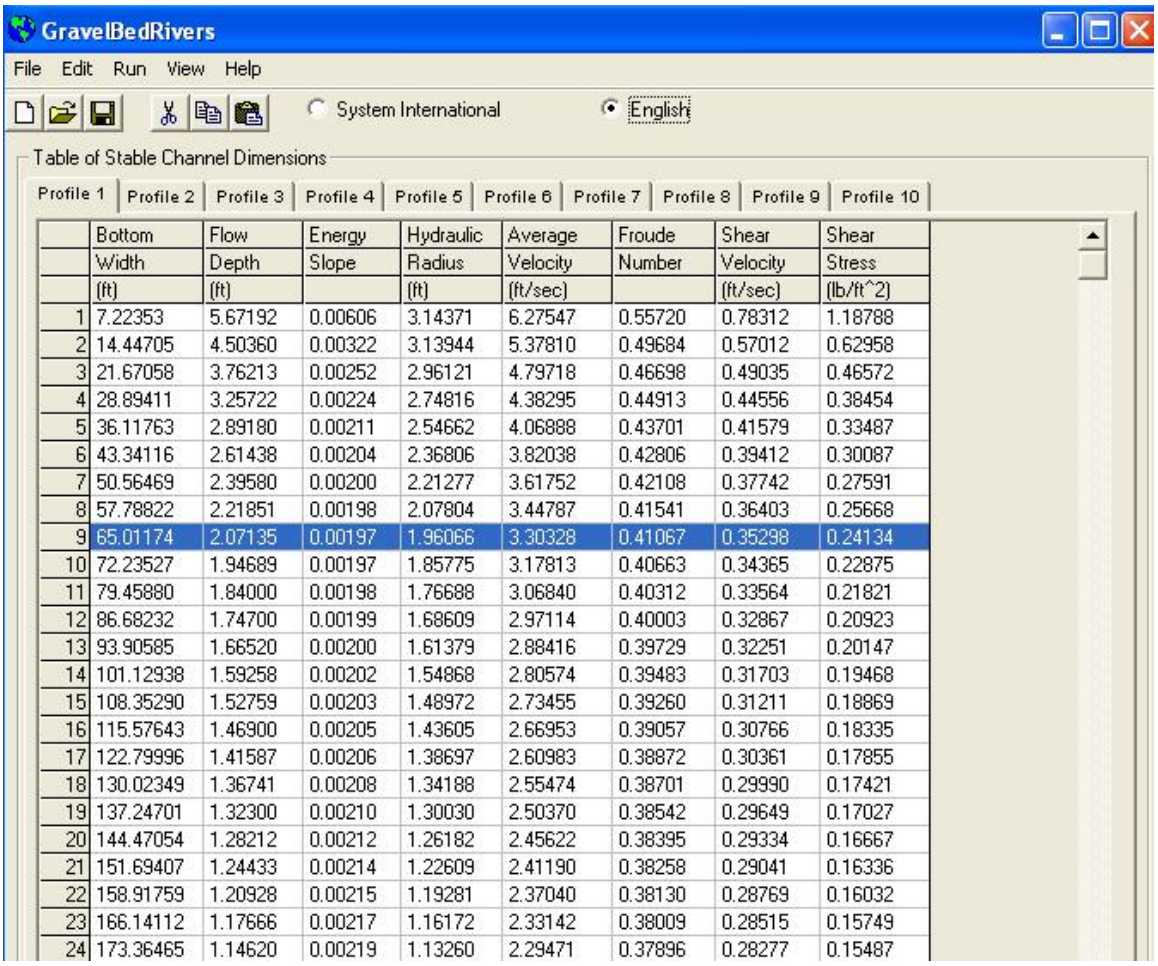
Where:
Q = dominant discharge in cfs.

Represents lower prediction interval for USGS gage sites in Region 7 (North Texas) of channel slope versus discharge.

5. **Beldsoe et. al.**

S = 0.000246*Cs**.559*Q**-.336
Where:
Q = dominant discharge in cfs
Cs = ppm sediment

Appendix: Stable Channel Dimension Calculations: Extremal Hypothesis



	Bottom Width (ft)	Flow Depth (ft)	Energy Slope	Hydraulic Radius (ft)	Average Velocity (ft/sec)	Froude Number	Shear Velocity (ft/sec)	Shear Stress (lb/ft^2)
1	7.22353	5.67192	0.00606	3.14371	6.27547	0.55720	0.78312	1.18788
2	14.44705	4.50360	0.00322	3.13944	5.37810	0.49684	0.57012	0.62958
3	21.67058	3.76213	0.00252	2.96121	4.79718	0.46698	0.49035	0.46572
4	28.89411	3.25722	0.00224	2.74816	4.38295	0.44913	0.44556	0.38454
5	36.11763	2.89180	0.00211	2.54662	4.06888	0.43701	0.41579	0.33487
6	43.34116	2.61438	0.00204	2.36806	3.82038	0.42806	0.39412	0.30087
7	50.56469	2.39580	0.00200	2.21277	3.61752	0.42108	0.37742	0.27591
8	57.78822	2.21851	0.00198	2.07804	3.44787	0.41541	0.36403	0.25668
9	65.01174	2.07135	0.00197	1.96066	3.30328	0.41067	0.35298	0.24134
10	72.23527	1.94689	0.00197	1.85775	3.17813	0.40663	0.34365	0.22875
11	79.45880	1.84000	0.00198	1.76688	3.06840	0.40312	0.33564	0.21821
12	86.68232	1.74700	0.00199	1.68609	2.97114	0.40003	0.32867	0.20923
13	93.90585	1.66520	0.00200	1.61379	2.88416	0.39729	0.32251	0.20147
14	101.12938	1.59258	0.00202	1.54868	2.80574	0.39483	0.31703	0.19468
15	108.35290	1.52759	0.00203	1.48972	2.73455	0.39260	0.31211	0.18869
16	115.57643	1.46900	0.00205	1.43605	2.66953	0.39057	0.30766	0.18335
17	122.79996	1.41587	0.00206	1.38697	2.60983	0.38872	0.30361	0.17855
18	130.02349	1.36741	0.00208	1.34188	2.55474	0.38701	0.29990	0.17421
19	137.24701	1.32300	0.00210	1.30030	2.50370	0.38542	0.29649	0.17027
20	144.47054	1.28212	0.00212	1.26182	2.45622	0.38395	0.29334	0.16667
21	151.69407	1.24433	0.00214	1.22609	2.41190	0.38258	0.29041	0.16336
22	158.91759	1.20928	0.00215	1.19281	2.37040	0.38130	0.28769	0.16032
23	166.14112	1.17666	0.00217	1.16172	2.33142	0.38009	0.28515	0.15749
24	173.36465	1.14620	0.00219	1.13260	2.29471	0.37896	0.28277	0.15487

Equilibrium Dimensions from Meyer Peter Muller Equation for Above Carrier based on Bledsoe GBR model. *No Vegetation effects included.*

Equilibrium Channel Dimensions and Slope from SAM Program Copeland Method.

USING BROWNLIES RESISTANCE & TRANSPORT EQUATIONS

MEDIAN BED SIZE ON BED, MM = 3.54664
GRADATION COEFFICIENT = 6.102
VALLEY SLOPE = 0.00800000

	LEFT BANK	RIGHT BANK
SIDE SLOPE	1.000	1.000
Ks, FT	2.560	2.560
n-VALUE	0.04000	0.04000

TABLE 4-1. STABLE CHANNELS FOR Q= 584.0 C,mgl= 500.0 D50= 3.547

K:	BOTTOM WIDTH : FT	DEPTH : FT	ENERGY SLOPE : FT/FT	CMPOSIT: n-Value:	HYD RADIUS: FT	VEL : FPS	FROUDE: NUMBER:	SHEAR: STRESS: #/SF:	BED * REGIME
1	3.	8.2	0.005754	0.0408	3.50	6.37	0.39	2.94	TL
2	6.	7.6	0.004244	0.0412	3.75	5.67	0.36	2.01	LO
3	9.	6.9	0.003691	0.0415	3.84	5.33	0.36	1.59	LO
4	12.	6.3	0.003432	0.0418	3.84	5.12	0.36	1.34	LO
5	15.	5.7	0.003307	0.0419	3.79	4.96	0.37	1.17	LO
6	18.	5.2	0.003255	0.0420	3.70	4.83	0.37	1.06	LO
7	21.	4.8	0.003246	0.0420	3.58	4.71	0.38	0.97	LO
8	24.	4.4	0.003264	0.0420	3.46	4.62	0.39	0.90	LO
9	27.	4.1	0.003300	0.0420	3.33	4.53	0.39	0.85	LO
10	30.	3.9	0.003348	0.0420	3.20	4.45	0.40	0.81	LO
11	33.	3.6	0.003404	0.0419	3.08	4.38	0.40	0.77	LO
12	36.	3.4	0.003466	0.0419	2.96	4.31	0.41	0.74	LO
13	39.	3.3	0.003531	0.0418	2.85	4.25	0.42	0.72	LO
14	42.	3.1	0.003600	0.0417	2.75	4.19	0.42	0.69	LO
15	45.	2.9	0.003669	0.0416	2.65	4.14	0.43	0.67	LO
16	48.	2.8	0.003740	0.0416	2.55	4.09	0.43	0.66	LO
17	51.	2.7	0.003812	0.0415	2.47	4.04	0.43	0.64	LO
18	54.	2.6	0.003884	0.0414	2.39	3.99	0.44	0.63	LO
19	57.	2.5	0.003955	0.0413	2.31	3.95	0.44	0.61	LO
20	60.	2.4	0.004027	0.0412	2.24	3.91	0.45	0.60	LO
	RESULTS AT MINIMUM STREAM POWER								
21	20.	4.9	0.003245	0.0420	3.61	4.74	0.38	0.99	LO

* REGIMES: LO=LOWER, TL=TRANSITIONAL-LOWER, TU=TRANSITIONAL-UPPER, UP=UPPER.

Stop Notes:

Latitude Longitude	Notes: Field Observations	Photo No.
Begin	Robinson Road.	
32 39.303 97 00.809	Shots of channel	RMG0009
32 39.303 97 00.770	Shots of channel	
32 39.304 97 00.732	Shots of channel; view of gunite rip rap;willows encroaching pooled area downstream channelized area.	RMG0021 22-26
32 39.302 97 00 678	**End of channelized bottom and scour hole 3.5 feet scour** Rip rap/gunite being undercut: tan clay soil	29-31
32 39.286 97 00.634	Sanitary Manhole; erosion slight to moderate due to willows and pushing flow toward opposite bank;house shown up bank	32-35
32 39.297 97 00.648	Appears seepage from either broken sewer line or septic tank?	34
32 39.279 97 00.624	Shots of channel; beginning of concrete channel; 15 foot bottom Width 2 foot side height; minor scour entrance	36-37
32 39.268 97 00.624	**Channel has hopped concrete liner eroding bank; near end of** **Channel liner and beginning of scour widening; 2 feet scour degradation end of structure**	38-40
32 39.271 97 00.568	Shots of channel up and downstream	41-42
32 39.277 97 00.555	Shots of channel; pooled 1-2feet deep; incising; clay banks with roots; gravel/clay bottom; shot of bed material; channel 5 feet deep.	43-46
32 39.287 97 00.538	**Shots of culvert (7.5 feet diameter) Scour below outfall; concrete** **Blocks rip rap; scour around sides outfall. 2 feet scour.; note overbank deposition**	47-51
32 39.287 97 00.538	**Shot of scour at culvert; shots channel downstream; shot of floodplain deposition**	53-56
32 39.271 97 00.499	Shots side channel culvert; shots channel to highway bridge	57-62
End Reach	**Carrier Parkway**	
32 39.200 97 00.422	Shots from bridge and shots of channel; deposition as channel widens below bridge; cattails, grass, mud	63-66
32 39.295 97 00.394	Shots of channel meander scour; tree fall; abundant debri, litter, 2foot pooled section; tight meanders; low incision	67
32 39.279	Shots up and down channel; pooled section with slight bank	68-69

Latitude Longitude	Notes: Field Observations	Photo No.
97 00.381	scour; abundant floodplain debri; litter	
32 39.259 97 00.368	Tree dams; shots up and downstream; abundant overbank debri, wood litter not incised here.	70-72
32 39.251 97 00.368	Floodplain narrows; channel beginning to incise; low wood debri dams **INCISION**	73
32 39.259 97 00.363	Low woody debri dams, shots down channel; channel incising	74-75
32 39.262 97 00.358	Tree fall	76
32 39.261 97 00.333	**Old placed rip rap; not enough to allow for hydraulics; being scoured, not graded; appears poor placement ; predict will be undercut and breached**	77-81
32 39.259 97 00.325	Shots of channel; shot toward meander and fence/structure; pedestrian bridge about ready to fall in due to channel widening	82-84
32 39.247 97 00.316	**Fence about 14 feet from outside of meander**; shots of meander and fence	85-86
32 39.248 97 00.307	Appears concrete in bottom; may be covered sewer or water line; acting as grade control; 12 foot bottom width; 8 feet deep	87-89
32 39.255 97 00.289	Shots of house and low woody debri; channel incising; shale bottom visible; **House about 147 feet from channel; homeowner noted in 1994 not much scour**	90
32 39.255 97 00.270	Appears to be about 3 feet of downcutting and incision here; shots of old bottom and incision into shale; banks undercut when channel hits shale; orange notepad on old bottom.	91-92
32 39.263 97 00.264	Shots of channel; shale in bottom along whole reach here; shale bed material and small limy flags in bars; incised scour both banks	93-95
32 39.267 97 00.260	Bar shot of bed material and tire	96
32 39.269 97 00.250	Shots of knickzone, shale banks; **INCISION SHALE BEDROCK**	97
32 39.276 97 00.243	Shots of exposed shale banks up 12 feet high and treefall	98-99
32 39.200 97 00.247	Shots shale in bank; highly weathered and slaking; shots down channel beyond treefall	100-102
32 39.276 97 00.262	Shots of channel bank; sequence shale bottom channel; alluvial soil above shale being undercut; root wad at base exposed and erosion resistant	103
32 39.278	Shots of shale and gravel bar; **perched tributary channel;**	104-108

Latitude Longitude	Notes: Field Observations	Photo No.
97 00.271	**about 4.5 feet above main channel.**	
32 39.284 97 00.271	Major **KNICKZONE** with channel incising into shale	109-110
32 39.294 97 00.262	More shots of knickzone	111
32 39.316 97 00.255	Manhole	
32 39.318 97 00.249	Meander cutoff shots channel; note change in grade; downcutting; shots bar/gravel	112-113
32 39.309 97 00.233	Shots shale bar bed material	114
32 39.302 97 00.228	Channel shots; tight meanders; shale bars	115
32 39.259 97 00.270	Shot upstream showing channel	116
32 39.289 97 00.204	**Major meander undercutting bank resulting in slump at bend. House visible top of hill about 80 feet away from channel. Needs attention as bank will progressively fail causing upslope problems.**	117-119
32 39.295 97 00.206	Shots channel, tree falls.	120
32 39.306 97 00.195	Change in channel, incising, bottom widening; shale bottom and sideslopes with upper yellow clay terrace material; bars of shale; scour and toppling failures	121-122
32 39.318 97 00.191	Shot of house and bank; House about 140 feet from top of channel; channel is eroding with undercutting and small wedge and slump failures.	123
32 39.328 97 00.202	**Perched gully area; broken sewer line active (approx 12 inch PVC line) broken and about 15 foot section removed by scour. Other section appears filling with clay material downstream.**	124-125
32 39.338 97 00.201	Shots of channel and homes	126
32 39.329 97 00.181	Shots of large bar; tributary coming in from left or head ward eroding gully. **Channel is changing dramatically here from meandering to straighter and wider with grassed banks and limited erosion.**	127
32 39.331 97 00.181	Shots down channel; mid channel bar deposition	128-129
32 39.340 97 00.162	Shots of channel; houses far from active channel	130-131
32 39.360	Shots of houses; long grass channel banks mud/shale bottom	133

Latitude Longitude	Notes: Field Observations	Photo No.
97 00.149		
32 39.380 97 00.129	Scour of shale bank noted about 10 feet high; About 105 feet from active channel to fence.	134-137
32 39.405 97 00.105	Wetland area above the grade control; channel widens, deposition and cattails	138-141
32 39.426 97 00.092	Drop structure and minor scour around structure.	142-147
End Reach	Polo	
32 39.459 97 00 094	Shots from bridge of rip rapw/gunite narrows toward outlet to 8.5 feet at bottom and about 20 top width	148-149
32 39.487 97 00.060	Shot down channel; shot up tributary; pooled channel; no lateral erosion; no scour or major degradation of tributary	150-151
32 39.501 97 00.041	Shot pooled area.	152-156
32 39.495 97 00.033	Shot down channel; small knickzone apparent small bottom width	157
32 39.502 97 00.022	Shots up and downstream and tributary junction	158-159
32 39.490 97 00.009	Shots up and down channel at meander…no erosion	160-161
32 39.495 97 00.005	Old bar to right; dates older urbanization upstream	162
32 39.496 96 59.992	Shot channel cross section with gravel bar	163
32 39.509 97 00.002	Bar shots and channel	164-165
32 39.518 96 59.981	Pooled reach shots of houses about 110 feet to fences.	166
32 39.516 96 59.974	Pooled reach, perched gullys	167
32 39.501 97 59.970	Incising channel; shots of channel with pool riffles	168
32 39.494 96 59.927	Shots cross section; shots down channel	169-171
32 39.482 96 59.922	**Shots scour of southern bank; bank rip rap and gunite. Undercutting rip rap.**	172-174
32 39.480 96 59.902	Knickzone incising channel shots.	175-177
32 39.479 96 59.897	Chute cut off noted across meander; shots	178
32 39.479 96 59.897	Shots down channel	179

Latitude Longitude	Notes: Field Observations	Photo No.
32 39.487 96 59.890	Shots down channel chute cutoff	180
32 39.499 96 59.882	Shots up and down channel	181
32 39.510 96 59.865	Shots up and down channel	182
32 39.521 96 59.840	Shots of fence and homes approximately 100 feet away active channel.	183
32 39.516 96 59.824	Shots of channel and widening of pooled reach. (265 feet bridge) appears to be grade control upstream bridge.	184-187
32 39.516 96 59.760	Shots downstream of bridge.	188

Appendix E.2

Roadway Crossing Evaluation for Cedar Creek (Y#0845)

AECOM

Matthew Road Crossing

The Matthew Road Crossing is approximately 2,700 feet downstream of the storm sewer outfall at Kite Road. The crossing consists of 3-8'x4' box culverts that are in good condition. Based on AECOM's HEC-RAS modeling, the Matthew Road Crossing will be overtopped by the existing conditions 10-year storm event. This portion of Cedar Creek is concrete lined, and there appears to be no major erosive issues near the crossing. Two flumes just upstream of the crossing, on either side of the channel, carry overland flow from the alleys into the channel.

Matthew Rd Crossing: Looking Downstream

Matthew Rd Crossing: Looking Upstream

Matthew Rd Crossing: Downstream Face

Matthew Rd Crossing: Upstream Face

Prairie Road Crossing

The Prairie Road Crossing is approximately 2,200 feet downstream of the Matthew Road crossing. The crossing consists of 4-8'x4' box culverts that are in good condition. Based on AECOM's HEC-RAS modeling, the Prairie Road Crossing will be overtopped by the existing conditions 10-year storm event. This portion of Cedar Creek is concrete lined, and there appears to be no major erosive issues near the crossing. The concrete lined channel widens just downstream of the crossing, and there is a 7'x4' storm drain outfall on the right wing wall just downstream of the crossing.

Prairie Rd Crossing: Looking Downstream

Prairie Rd Crossing: Looking Upstream

Prairie Rd Crossing: Downstream Face

Prairie Rd Crossing: Upstream Face

Robinson Road Crossing

The Robinson Road Crossing is approximately 2,600 feet downstream of the Prairie Road crossing. The crossing consists of 4-9'x5' box culverts that are in good condition. Based on AECOM's HEC-RAS modeling, the Robinson Road Crossing will be overtopped by the existing conditions 50-year storm event. Upstream of the crossing, Cedar Creek is a concrete lined channel. Downstream of the crossing, Cedar Creek transitions to a concrete lined flume approximately 15 feet in width with tall grass/short tree lined banks. Approximately 850 feet upstream of the crossing, Cedar Creek makes a 90-degree turn to the north and runs parallel to Robinson Road before turning back to the east to pass through the culverts under Robinson Road. During the high frequency storm events (100- and 500-year), the creek overflows its right bank and flows eastward over Robinson Road. Just downstream of the crossing on the left bank a 33-inch storm sewer line outfalls into the channel. There appears to be no major erosive issues near the crossing.

Robinson Rd Crossing: Looking Downstream

Robinson Rd Crossing: Looking Upstream

Robinson Rd Crossing: Downstream Face

Robinson Rd Crossing: Upstream Face

Carrier Parkway Crossing

The Carrier Parkway Crossing is approximately 2,550 feet downstream of the Robinson Road crossing. The crossing consists of 5-12'x8' box culverts that are in good condition. Based on AECOM's HEC-RAS modeling, the Carrier Parkway Crossing will be able to pass all frequency storm events for existing and ultimate conditions. The upstream side of the crossing consists of a large concrete apron which captures the flow from the upstream natural channel via a high flow weir and a 24-inch low-flow pipe. The downstream wing walls consist of 2-48" RCP storm sewer outfalls (one on each wing wall) that discharge into Cedar Creek. Ponding appears to be due to accumulation of sediment and debris immediately downstream of the crossing, which is a direct result of the transition from a 5 barrel culvert back to a natural channel.

Carrier Pkwy Crossing: Looking Downstream

Carrier Pkwy Crossing: Looking Upstream

Carrier Pkwy Crossing: Downstream Face

Carrier Pkwy Crossing: Upstream Face

Polo Road Crossing

The Polo Road Crossing is approximately 2,600 feet upstream of the Bardin Road crossing. The crossing consists of 6-10'x8' box culverts that are in good condition; however there is significant build up of silt on the downstream side of the crossing. Based on AECOM's HEC-RAS modeling, the Polo Road Crossing will be able to pass all frequency storm events for existing and ultimate conditions. Approximately 190 feet upstream of the crossing, there is an existing grade control structure. Upstream of this structure, the creek widens and has created a ponding area. The creek has eroded around and under the weir reducing its effectiveness. Initially, the weir was assumed as a protection for a possible sanitary sewer crossing that connected to the existing 18" trunk line that runs along the left bank of the creek in this area; however, based on as-builts there are no crossings in this area.

In the reach between the grade control structure and Polo Road Crossing, the left and right banks are protected by grouted rock rip-rap, and there is deep ponding within the main channel portion of the creek. The ponding is most likely due to the siltation on the downstream side of the crossing, where Cedar Creek makes a 90-degree turn to the east and transitions back into a natural channel. Erosion was observed on the left upstream bank, where the existing sidewalk has been undermined possibly due to sheet flow running down the sidewalk. The header slopes into the creek without an exit flume to transition the flow from the outside edge of the sidewalk to the creek. Both the left and right banks on the downstream side of the Polo Road crossing are lined with large grouted rocks, which are in good condition.

Polo Rd Crossing: Looking Downstream

Polo Rd Crossing: Looking Upstream

Polo Rd Crossing: Downstream Face

Polo Rd Crossing: Upstream Face

Bardin Road Crossing

The Bardin Road crossing is the final crossing along Cedar Creek within the Grand Prairie city limits. The crossing consists of 8-10'x7' concrete box culverts that are in good condition. Based on AECOM's HEC-RAS modeling, the Bardin Road Crossing will be able to pass all frequency storm events for existing and ultimate conditions. Upstream of Bardin Road, the natural channel opens up to transition to the wide crossing under Bardin Road, while immediately downstream of Bardin Road the channel constricts. This sudden increase and following decrease in floodplain width results in the creek dropping its sediment load and suspended solids. As a result, the channel bottom has silted in considerably and has created conditions ideal for vegetation to flourish.

Bardin Rd Crossing: Looking Downstream

Bardin Rd Crossing: Looking Upstream

Bardin Rd Crossing: Downstream Face

Bardin Rd Crossing: Upstream Face

Appendix E.3

Improvement Project Photo Log for Cedar Creek (Y#0845)

AECOM

Improvement Project #2 – Stations 89+00

Looking downstream (east) at right bank undercutting and failed protection. Polo Pkwy to the south.

Improvement Project #4 – Stations 116+60

Looking north/downstream at left bank erosion and exposed/broken sanitary sewer line.

Improvement Project #5 – Stations 125+00 and 123+65

Looking upstream. Notice old channel on left bank

Looking at old channel on left bank.

Improvement Project #8 – Station 158+00

Severe scour; looking upstream at the transition from concrete lined to natural channel.

Improvement Project #9 – Stations 154+60, 153+40, and 153+00

Looking downstream at concrete flume.

Looking downstream at concrete flume.

Improvement Project #9 – Stations 154+60, 153+40, and 153+00

Looking downstream at right bank erosion of concrete flume.

Looking upstream at the end of the concrete flume.

Improvement Project #10 – Stations 149+50

Looking north at 90-inch storm sewer outfall. Headwall/apron scour and failing banks.

Appendix E.4

QA/QC Comments & Responses for Cedar Creek (Y#0845)

AECOM

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Memorandum

Date	September 27, 2010
To	Gabriel Johnson, P.E., CFM
From	Zubin Sukheswalla, P.E., CFM
Subject	Letter of Map Revision – Cedar Creek (FEMA Stream 8C5) – Response to Comments
Distribution	Stephen Crawford, P.E., CFM

This memorandum addresses QA/QC comments, dated September 3, 2010, received from Halff Associates, Inc (Halff) regarding AECOM's Letter of Map Revision – Cedar Creek (FEMA Stream 8C5), submitted for review. The numbering of the responses corresponds to the numbers of the comments, and a brief synopsis of each comment is included.

General Comments – City of Grand Prairie

1. *Please keep in mind that our intent is to submit the final floodplain delineations to FEMA via the CTP funding which is performed in DFIRM format and accordance with their scope and tasks. This will not be submitted as a typical LOMR.*

Response: AECOM has been made aware of this and shall take the necessary steps to address subsequent submittals related to the DFIRM data.

2. *When comparing the 100-yr existing and 100-yr ultimate discharges, there is a significant difference in the upper reach for the concrete channel. Given the highly urbanized basins for S1, S-2, S-3, S-4, and S-5, I would have expected the discharges to be closer. Currently, you are showing ultimate discharges increasing by an average of 37% for the upper reach. Please verify.*

Response: In the upper reaches of the watershed, subbasin S-1 has a large vacant agricultural land, where an overland flow length of 300 feet was used as per the City of Grand Prairie's Stormwater Design Manual. This caused the overland flow travel time to dominate the time of concentration calculations. During ultimate conditions the vacant area was assumed to be fully built out with commercial land use which resulted in a significantly lower overland flow travel times. Subbasins S-2, S-3, S-4, and S-5 have no change in lag time and minimal change in land use from existing to ultimate conditions which implies that the leading cause for the 37% increase in discharge from existing to ultimate conditions are the modeling assumptions used for subbasin S-1 . As per City comment number 5, the existing conditions overland flow path in subbasin S-1 was limited to 100 feet which reduced the lag time and increased the existing conditions flows. Refer to Table 1 below showing the comparison of discharges at Junctions J-1 through J-5 due to the changes in modeling methodology in subbasin S-1 as described above.

Table 1.

Analysis Point	Peak Flows (cfs)		
	Existing	Revised Existing	Ultimate
J-1	635	740	1005
J-2	1310	1465	1670
J-3	1785	2060	2335
J-4	1760	2055	2340
J-5	1985	2325	2700

3. *The floodway delineations look incorrect in some spots. For instance there is a sharp zig-zag between FEMA sections B and C. There are a few other spots that raise flags. Please verify the delineations.*

Response: AECOM would like to defer addressing this comment until these response to comments and the hydrology has been approved by the City.

4. *Please adjust the basin delineations that are adjacent to Fish Creek as per the shapefile I provided in an email on 8/13/2010.*

Response: After review of the basin delineations sent to AECOM by the City, AECOM has some questions/issues regarding the delineations that need to be discussed with the City. An exhibit has been created highlighting each of the problem areas that should be discussed before changes can be made.

5. *Recalculate the lag times using a maximum overland flow length of 100 feet.*

Response: Refer to H&H Comments – Halff Associates item 1.

Report Comments – Halff Associates

1. *A 100-year floodway analysis was performed. Please ensure you include the current effective and revised floodway data table in the report.*

Response: A floodway data table has been created and added to the report as Table 4. This table shall be included in the TSDN submittal.

2. *Flood Profiles — Ensure that channel stationing on profile sheets match cross-section numbering. Refer to current effective flood profiles and note on floodway data table.*

Response: AECOM defers addressing this comment until the hydrology has been approved by the City.

3. *MT-2 forms — Please check "Regulatory Floodway Revision" on Form 1*

Response: MT-2 Form 1 has been updated to reflect this change.

4. *Please include a table, either within Table 2 or after Table 2 showing a comparison between study discharges and current effective FIS discharges, with location denoted.*

Response: The 100-yr effective FIS discharges have been included in Table 2.

5. *Page3—Table2*
   a. *Analysis Points J-5, J-6, J-7, and J-9 do not match the discharges shown in the table versus the discharges shown in HEC-HMS at these nodes.*

Response: This error has been corrected and all table nodes and flows now match the HMS results.

H&H Comments – Halff Associates

1. *Lag times for Basins S-1 and S-8*
    a. *City requirements state that maximum overland flow length can be up to 300'. However, current iSWM standards state that overland flow in urban areas should be no more than 50-100 feet.*
    Response: AECOM has ensured that all time of concentration calculations adhere to the iSWM standards for urban overland flow and has made adjustments accordingly.

    b. *S-1 — Existing conditions overland flow length is 300 feet and ultimate conditions overland flow length is 10 feet. Consider revising existing conditions overland flow length to 100 feet to avoid having the overland flow component dominate the overall time of concentration.*
    Response: The existing overland flow length has been changed to 100 feet and the HMS models have been updated to reflect this change.

    c. *S-8 - Existing conditions overland flow length is 300 feet and ultimate conditions overland flow length is 10 feet. Consider revising existing conditions overland flow length to 100 feet to avoid having the overland flow component dominate the overall time of concentration.*
    Response: The existing overland flow length has been changed to 100 feet and the HMS models have been updated to reflect this change.

2. *HEC-RAS Channel Reach Lengths — Please check reach lengths between the following cross- sections to ensure they are correct:*
    a. *Between Stations 10728 and 10649 (RAS shows 83 feet)*
    b. *Between Stations 10884 and 10868 (RAS shows 17.5 feet)*
    c. *Between Stations 14634 and 14515 (RAS shows 130 feet)*
    Response: In each case listed above the stream centerline is at a slightly different orientation than the culvert or weir and as a result the two do not perfectly match up. These reach lengths found in HEC-RAS were determined based on survey data and are deemed correct. River Stationing shall be updated in the final HEC-RAS model after hydrology is approved.

3. *HEC-RAS Flood profiles above highest ground elevation in cross-section*
    a. *Station 17932 is overtopped by the Existing 500-year and Ultimate 50-, 100-, and 500- year events. This station is located upstream of the lateral weir in the model.*
    Response: The lateral weir has been modified to include station 17932.

    b. *Matthew Road (Culvert Station 21964) is overtopped by Ultimate 500-year. This also causes Station 22010 to be overtopped by this event.*
    c. *Prairie Road (Culvert Station 19757) is overtopped by Existing 100- and 500-year and Ultimate 25-, 50-, 100-, and 500-year events. This also causes Station 19787 to be overtopped by these events.*
    Response: Cross-sections have been extended at both Matthew Road and Prairie Road.

4. *HEC-RAS Horizontal Variation of n-values*
    a. *It appears that n-values were generated from GIS shapefiles. Since some cross-sections have 5 or 6 different horizontal n-value variations along the cross-section, please ensure that these n-values are representative of actual field conditions. Additionally, Half recommends minimizing the number of n-values along a cross-*

section and averaging these out as much as possible for ease of use in future modeling situations.

Response: Manning's n-values were determined by visual observations in the field and the City provided aerials. No changes shall be made to the n-value variations as they are representative of on-ground conditions. Also, averaging n-values is a subjective matter without clear guidelines and therefore in the future it may be detrimental to the model.

b. *Horizontal Variation of n-values should not extend across left and right bank stations. N-value horizontal breaks should be placed at the left and right bank stations, even if the n-value just outside the bank station is the same as the channel n-value.*

Response: Manning's n-values have been updated to reflect this comment.

5. *Channel n-values are 0.013 for the concrete-lined channel upstream of Robinson Road. This n-value is representative of RCP pipe. Please consider using channel n-values of 0.015 to 0.020 for exposed concrete-lined channels.*

Response: AECOM will update its HEC-RAS to reflect this recommendation.

6. *Overbank n-values are 0.035 for the left and right overbanks upstream of Robinson Road. This may be representative for grassed/maintained areas of backyards, but also please consider the effects of fences and other obstructions that could raise these n-values higher.*

Response: In general the Ultimate 500-year floodplain does not encroach into backyards; rather it is contained within the concrete-lined channel and grass-lined overbanks. However, there are areas where it appears the flow will be affected by fences and homes; therefore, in these areas only, the n-values will be changed to 0.090.

7. *<u>HEC-RAS/HEC-HMS Lateral Weir</u>*

Note: The primary goal of this comment is for AECOM to ensure that all floodwater in this area is being accounted for that is leaving the RAS model through the lateral weir and if it needs to also be modeled as a diversion in HEC-HMS.

a. *Lateral weir structure is located in model beginning at Station 17900 and affects Stations 17894 to 17186*
b. *Along the reach between 17894 and 17186, there is a wide variation of discharges at each cross-section. At some cross-sections, discharges for the 2-year to 25-year events are higher than those of the 100-year and 500-year events. This may actually be representative of how the model is working along this reach, but is difficult to tell just by the information provided in the model. Half recommends a short summary of how this was modeled and how it is working in the model.*
c. *No diversion structure was included in the HEC-HMS model at this location. Halff recommends that AECOM provide reasoning why this is not accounted for in the hydrology model or else add the diversion structure and explain how it relates to the hydraulic model lateral weir.*

Response: The above mentioned lateral weir was created to model the overtopping of Robinson Road and the resultant ponding upstream of the road. Cross-sections 17932 to 17219 discharge any overflow into cross-section 17186 which is just upstream of cross-section 17185. A flow change has been placed at cross-section 17185 so as to allow the Robinson Road culverts to see full flow at its upstream face. No flow is actually lost from the system, and the lateral weir is providing the desired ponding effect upstream of the crossing. Typically, a diversion is used in HEC-HMS to transfer flow from one basin to another. In this case, since the HEC-RAS model has been specifically set up to allow the upstream face of Robinson Road to see the full flow from its upstream contributing drainage areas, a diversion is not required in HEC-HMS to model this condition.

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Memorandum

Date	May 12, 2011
To	Gabriel Johnson, P.E., CFM
From	Zubin Sukheswalla, P.E., CFM
Subject	City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek – Response to Draft Report QA/QC Review
Distribution	Stephen Crawford, P.E., CFM

This memorandum addresses QA/QC comments, dated April 4, 2011, received from Halff Associates, Inc (Halff) regarding AECOM's City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek, Draft Report, submitted for review. The numbering of the responses corresponds to the numbers of the comments, and a brief synopsis of each comment is included.

General Comments – City of Grand Prairie

1. *Entire Report – Make report layout consistent with **CWDMP Road Map** and **Joe Pool MDP**.*
Response: AECOM's City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek has been formatted consistent with the *CWDMP Road Map* and *Joe Pool MDP*.

2. *Section 1 – Use standard language from the Joe Pool report to meet the CRS requirements. Specifically the section on "City Ordinances and Development Requirements" (see attached Joe Pool Example).*
Response: AECOM's City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek has incorporated requested standard language.

3. *Page 5 – The date for Grand Prairie's Drainage Design Manual is December 2010.*
Response: This date has been updated throughout the report.

4. *Table 5.2 – The column "Station" should be "Type"*
Response: AECOM has addressed this comment.

5. *Section 6 – If the bypass channel will not work when designed to engage above the ordinary high water mark then remove the bypass channels and all references (report and figures) completely since we are providing protection at those bends. We do not want to get into a 404 permitting issue with the bypass channels.*
Response: AECOM determined that the bypass channels would not work when designed to engage above the ordinary high water mark, and has therefore removed all references to the bypass channels from the report.

6. *Section 6 – Provide a prioritization calculation for all the "Other Improvements" as per the CWDMP Road Map Prioritization calculation.*

Response: Prioritization calculations for all relevant projects have been included.

7. *Section 6 – Include a Robinson Road floodplain reduction alternative.*

Response: This alternative has been included in the report.

8. *Appendix F – On the CD at the end of the report please include all the following:*
    - **a.** *All H&H models*
    - **b.** *All GIS shapefiles and databases*
    - **c.** *All spreadsheets for prioritization, hydrology, hydraulics, etc.*
    - **d.** *All pictures and other digital media*
    - **e.** *A PDF of the complete report*

Response: A CD with all requested data has been included in the back of the report

<u>Comments – Halff Associates</u>

1. *Please use "Drainage Master Plan" instead of "Master Drainage Plan" to be consistent with all other master plans and the Road Map terminology.*

Response: All instances of "Master Drainage Plan" have been changed to "Drainage Master Plan".

2. *Please provide an executive summary at the beginning of the report (see attached Joe Pool example).*

Response: An Executive Summary has been included in the report.

3. *Table 4.4 – Please include a column showing the flood frequency level of protection for each roadway crossing.*

Response: Level of protection for each roadway crossing has been added to table.

4. *Section 6 – Recommended Improvements*
    a. *Include Opinions of Probable Construction Costs with each improvement description.*

    Response: OPCC has been included for each improvement project.

    b. *Try to combine channel erosion protection projects to reduce the total amount of site preparation/access/mobilization for each project. This seems to contribute to the majority of overall costs of the recommended projects*

    Response: All bypass channels and their associated costs have been removed from the proposed improvements, thereby reducing the cost of those projects. Projects can be performed simultaneously to eliminate the need for multiple mobilization costs, thereby reducing the total cost of the projects.

    c. *Ensure that if overflow swales are utilized, that they are located above the OHWM to reduce the amount of 404 permitting. If not beneficial, then remove the overflow swales from the recommended projects.*

    Response: See response to City comment number 5.

    d. *Include cost estimates for recommended projects that are beneficial to improving flood protection of roadway crossings. For example, discussed at the meeting, look into improvements at Robinson Road that would be beneficial for Robinson Road, Prairie Lane, and Matthew Road.*

    Response: All relevant cost estimates have been included in the report and appendices.

5. *Exhibits*
    a. *HEC-RAS profile – For both existing and ultimate conditions, include grid-lines, cross-section labels, and roadway crossing labels. Ensure that the profile has a horizontal and vertical scale. This could be expanded to two sheets if needed.*

    Response: HEC-RAS profiles have been set up in accordance with this comment.

    b. *Plan and Profile exhibits – For any improvement location shown in plan view, please show corresponding improvements locations in profile view.*

    Response: All improvement project locations are now included in both plan and profile views.

6. *Please include the Short Term & Long Term Implementation Plan matrix spreadsheet with the Cedar Creek proposed capital improvement project alternatives, ranked accordingly (see attached Joe Pool example for your use).*

Response: The Short Term & Long Term Implementation Plan matrix spreadsheet has been created for all CIP projects and has been included in the report.

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Memorandum

Date	July, 11 2011
To	Gabriel Johnson, P.E., CFM
From	Zubin Sukheswalla, P.E., CFM
Subject	City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek – Response to Final Report QA/QC Review
Distribution	Stephen Crawford, P.E., CFM

This memorandum addresses QA/QC comments, dated May 19, 2011, received from the City of Grand Prairie (City) regarding AECOM's City of Grand Prairie City-wide Drainage Master Plan for Cedar Creek, Final Report, submitted for review. The numbering of the responses corresponds to the numbers of the comments, and a brief synopsis of each comment is included.

General Comments – City of Grand Prairie

1. *Once the Council has signed the resolution, we need to make sure the signed resolution is the first page(s) of the document.*
Response: Once AECOM receives a signed resolution, it will be placed at the front of the Cedar Creek Drainage Master Plan report.

2. *Add a letter similar to the Joe Pool DMP that has the engineering seal(s). I would not seal the cover since we will be adding to the document in the future.*
Response: A letter, similar to the one found in the Joe Pool DMP, with the appropriate engineering seal(s) will be provided with the final submittal of the Cedar Creek Drainage Master Plan report.

3. *Include a CIP location map and the implementation plan ranking spreadsheet behind the executive summary.*
Response: AECOM has included a CIP Location Map and the Short-Term and Long-Term Implementation Plan spreadsheet after the Executive Summary.

4. *Section I-E – Add a paragraph discussing the Principal Flooding Problems (state is there are or aren't any) and for sections I-E.1 discuss the drainage complaint database and for section I-E.2 discuss the hot spot locations identified in the Roadmap. Please also note that for some of the hotspots the recent Sandra Lane project was completed to address some/most of the issues.*
Response: AECOM has added a paragraph to Section 1-E discussing the principal flooding problems found in the Cedar Creek Watershed. AECOM has also added two sub-sections to Section I-E discussing the City's drainage complaint database and hot spot locations.

5. *Section II-C – Update the existing and future land use to account for the 15 acres in basin S-1 to be assumed as developed for existing and future. Please also add some verbiage in the text noting that the assumption was made based on plan approval for the proposed project.*

Response: After discussions with the City at a meeting on May 25, 2011, it was decided not to pursue changing the land use in the report. Basin S-1 has several single family lots that are currently vacant; therefore, the existing and ultimate conditions flows will still differ from each other. Considering that the 15-acre tract is currently in the design phase, it is technically still vacant at the time of production of the DMP and therefore, it was decided to let the hydrology for basin S-1 remain unchanged.

6. *Section II – Verify the longest flow path for S-1 taking into account the 15 acre tract is already developed.*

Response: As per Response #5, it was mutually decided to not make any changes to the hydrology of basin S-1.

7. *Section II-H – Provide a description of which rainfall distribution method was used in HMS and provide plot or table.*

Response: AECOM has formatted this section as per the Joe Pool DMP and included the requested table.

8. *Section III-A – Add the location of the lateral weir to Figure 6a and add a note to the figure stating, "The lateral weir was modeled as described in Section III-A of the Cedar Creek Drainage Master Plan."*

Response: AECOM has updated Figure 6a as per the City's request.

9. *Section III – Add some verbiage to the text describing how the models were modified to better match Grand Prairie stream gauge data.*

Response: After discussions with the City at a meeting on May 25, 2011 and a subsequent email from the City on June 1, 2011, it was decided not to perform any calibrations on the models based on the gage data available for the Bardin Road gage.

10. *Section IV – Update all the tables based on the changes to the H&H models.*

Response: No changes to hydrology were made; therefore, the tables in the report remain unchanged.

11. *Section V – Add text for the floodplain description similar to what is found in the Joe Pool DMP. Also provide floodplain/floodway maps, or the location of the maps.*

Response: AECOM has added the following text to Section V – Floodplain Mapping as it applies to Cedar Creek:

"As part of the City-Wide Drainage Master Plan for Cedar Creek, AECOM was originally contracted to map Cedar Creek using the City of Grand Prairie 2009 LIDAR data. AECOM prepared a Letter of Map Revision (LOMR) application for submittal dated August 11, 2010; however, during the submittal meeting the City informed AECOM of a pending Cooperating Technical Partner Program (CTP) agreement between the City and FEMA that would cover the remapping effort of Cedar Creek moving forward. At this point, it was decided to abandon the LOMR application and pursue the mapping of Cedar Creek under a separate contract named the Cedar Creek FEMA CTP Mapping (Y#0880). This project includes preparation of hydrology and hydraulic data as well as the preparation of Digital Flood Insurance Rate Maps (DFIRMs). The existing and ultimate 100-year floodplains for Cedar Creek can be found in *Figures 6a and 6b*."

12. *Section VI – Include a map that shows the roadway crossings and denotes what frequency the roads will pass. Use figure VI-1 from the Joe Pool DMP as a go-by*

Response: AECOM has added Figure VI-1 Roadway Crossings to the Cedar Creek Drainage Master Plan report.

13. *Section VI – Include a proposed alternatives table similar to Table VI-2 from the Joe Pool DMP.*

Response: AECOM has created a table similar to Table VI-2 from the Joe Pool DMP and included it in the Cedar Creek Drainage Master Plan report (Section VI).

14. *Section VII – Include a CIP map with the numbered priorities similar to figure VII-1 from the Joe Pool DMP.*

Response: AECOM has added a CIP Map to Section VII.

15. *Section IX – Please look at Section IX from the Joe Pool DMP and incorporate all applicable sections for IX-D, IX-E, IX-F, IX-G, IX-H, IX-I, IX-J, and IX-K.*

Response: AECOM has incorporated all applicable sections and formatted them as per the Joe Pool DMP.

16. *Section X – Include some verbiage as to what was done for this task. There was some fee in the original contract for this task*

Response: AECOM has updated Section X.

17. *Section XI – How much would it cost to perform a storm drain outfall assessment based on the Marshall Lancaster survey and the City's available pictures?*

Response: AECOM has prepared a scope and fee to perform a storm drain outfall assessment for the Cedar Creek project area. The scope and fee will be provided separately.

18. *Appendix A – Ensure that the flood profiles for existing and ultimate conditions are labeled as Figure 7 and Figure 8, respectively.*

Response: Figures for the existing and ultimate conditions flood profiles have been labeled accordingly.

Appendix F

CD-ROM
for Cedar Creek (Y#0845)

AECOM