

DRAFT

South Platte River Restoration Master Plan

Prepared for:
City of Evans, Colorado

Prepared by:
CDM Smith

May 2015

Appendix A

Draft



Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Map Reaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM Smith

- Project Reach
- Stream
- Canal/Ditch
- Railroad
- Highway
- Diversion Structures
- Private Parcels



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

Appendix A - Figure A-1: South Platte River Reaches
Map Index Page 1



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources

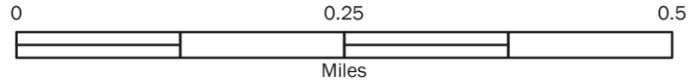




Document Path: \\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Map Reaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM Smith



- Project Reach
- Stream
- Canal/Ditch
- Railroad
- Highway
- Diversion Structures
- Private Parcels



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

Appendix A - Figure A-2: South Platte River Reaches
Map Index Page 2



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: \\SouthPlatte\Rehab\GIS\W\Map\MapReaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM Smith



- Project Reach
- Stream
- Canal/Ditch
- Railroad
- Highway
- Diversion Structures
- Private Parcels



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

Appendix A - Figure A-3: South Platte River Reaches
Map Index Page 3

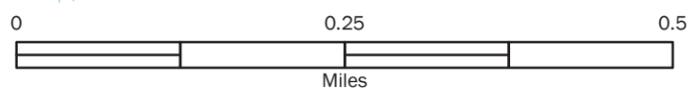
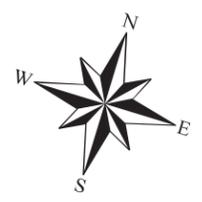


COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





- | | | | |
|---------------|----------|----------------------|--|
| Project Reach | Railroad | Diversion Structures | Parcel Ownership |
| Stream | Highway | Private Parcels | Evans Fire Protection District |
| Canal/Ditch | | | Additional Land Use Information |
| | | | State Wildlife Areas |



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

Appendix A - Figure A-5: South Platte River Reaches
Map Index Page 5

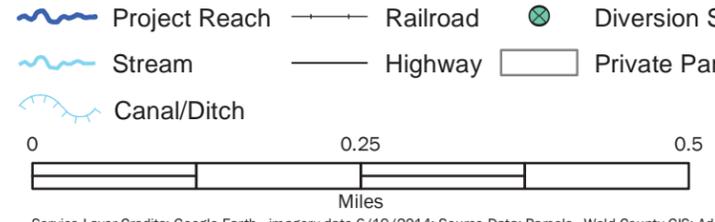
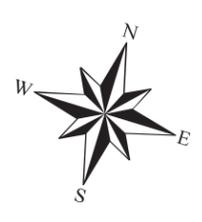


COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: \\SouthPlatte\Rehab\GIS\WAD\FinalReport\Map - Map Reaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



- | | | | |
|---------------|----------|----------------------|-----------------------------------|
| Project Reach | Railroad | Diversion Structures | Parcel Ownership |
| Stream | Highway | Private Parcels | Department of Transportation |
| Canal/Ditch | | | Evans Fire Protection District |
| | | | La Salle Fire Protection District |

South Platte River Restoration Master Plan

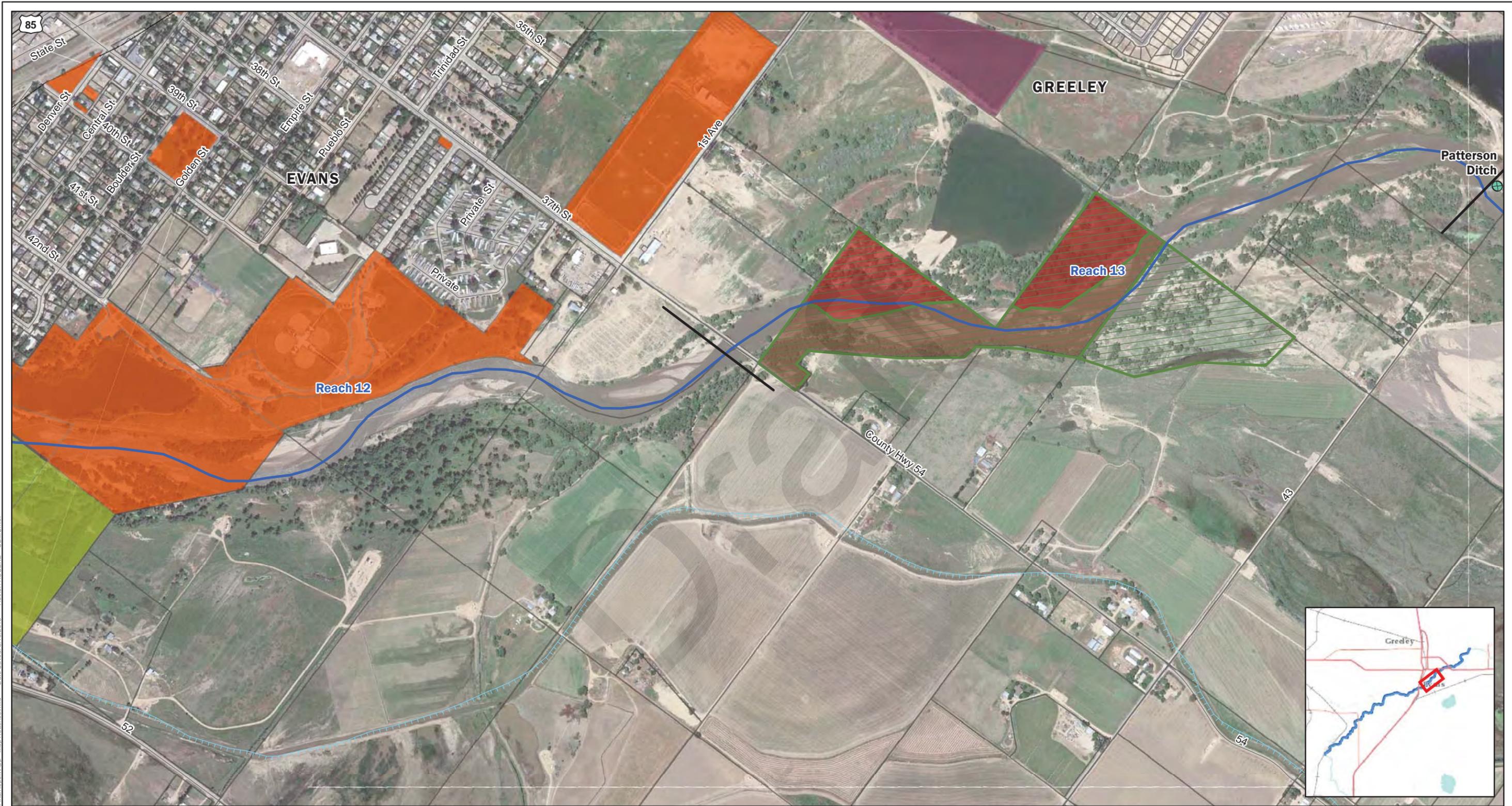
Appendix A - Figure A-6: South Platte River Reaches

Map Index Page 6

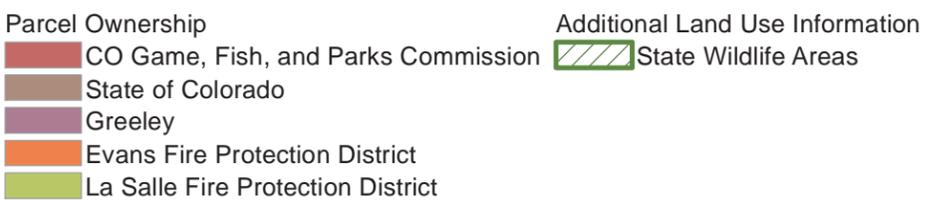
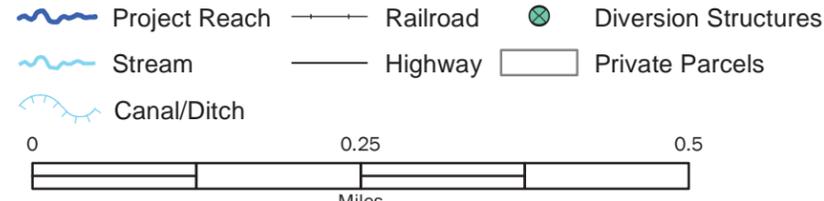


COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: J:\SouthPlatte\Relat\GIS\WAD\FinalReport\Map - Map Reaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

Appendix A - Figure A-7: South Platte River Reaches
Map Index Page 7





- Project Reach
- Stream
- Canal/Ditch
- Railroad
- Highway
- Diversion Structures
- Private Parcels
- Parcel Ownership
CO State Department of Highways



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

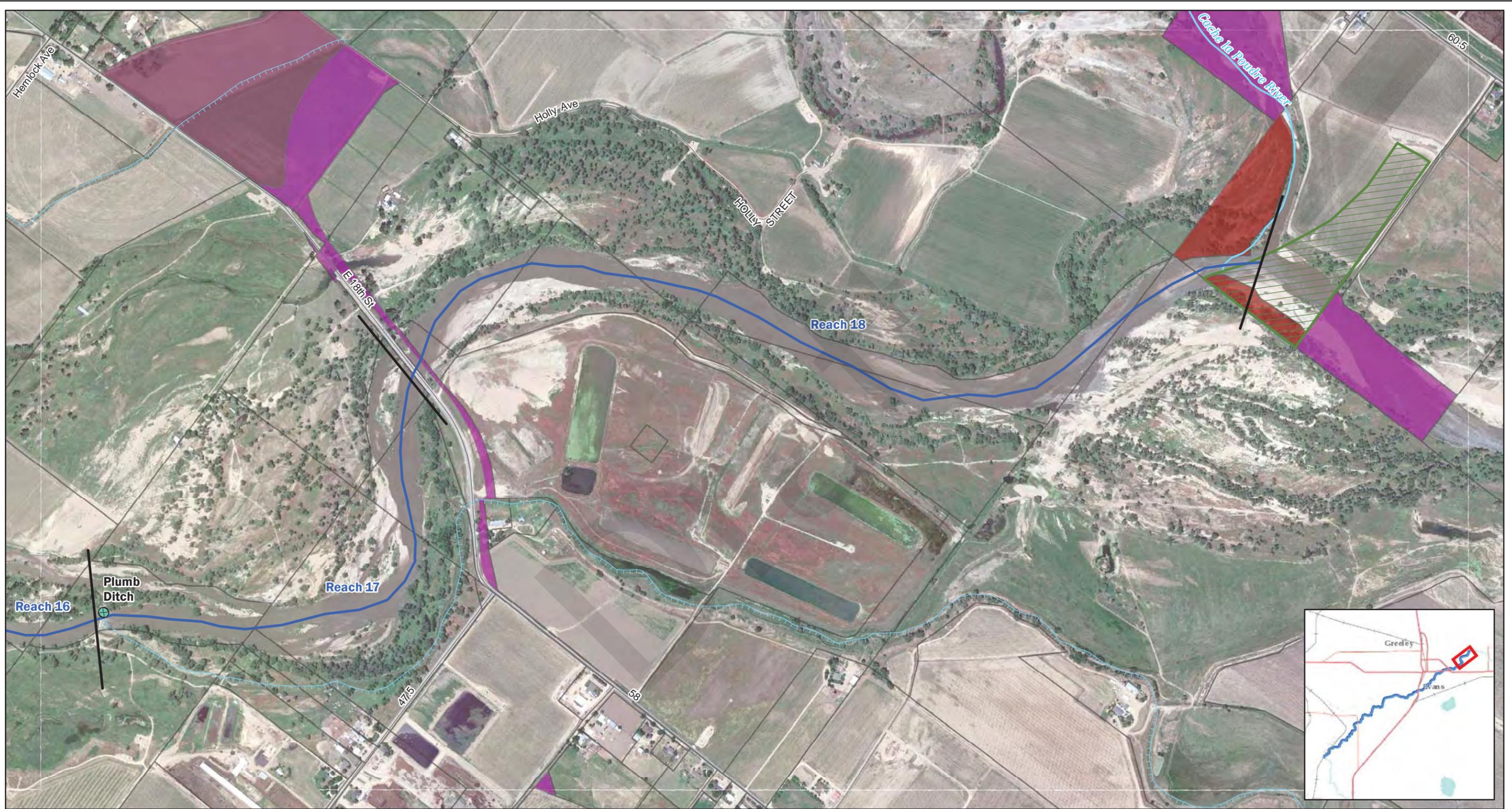
Appendix A - Figure A-8: South Platte River Reaches
Map Index Page 8



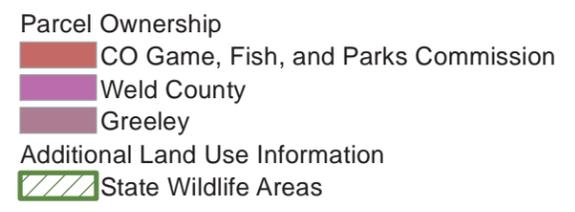
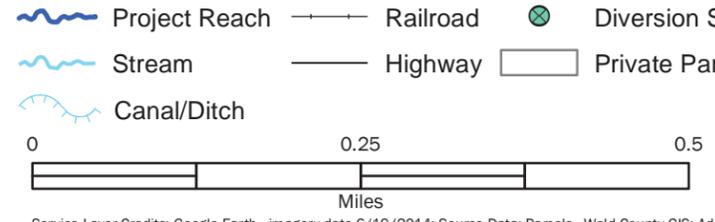
COLORADO
Colorado Water
Conservation Board
Department of Natural Resources



Document Path: \\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Map Reaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM Smith



Document Path: J:\SouthPlatte\Relat\GIS\W\MapReaches.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



Service Layer Credits: Google Earth - imagery date 6/19/2014; Source Data: Parcels - Weld County GIS; Additional Land Use Information - Ducks Unlimited

South Platte River Restoration Master Plan

Appendix A - Figure A-9: South Platte River Reaches
Map Index Page 9



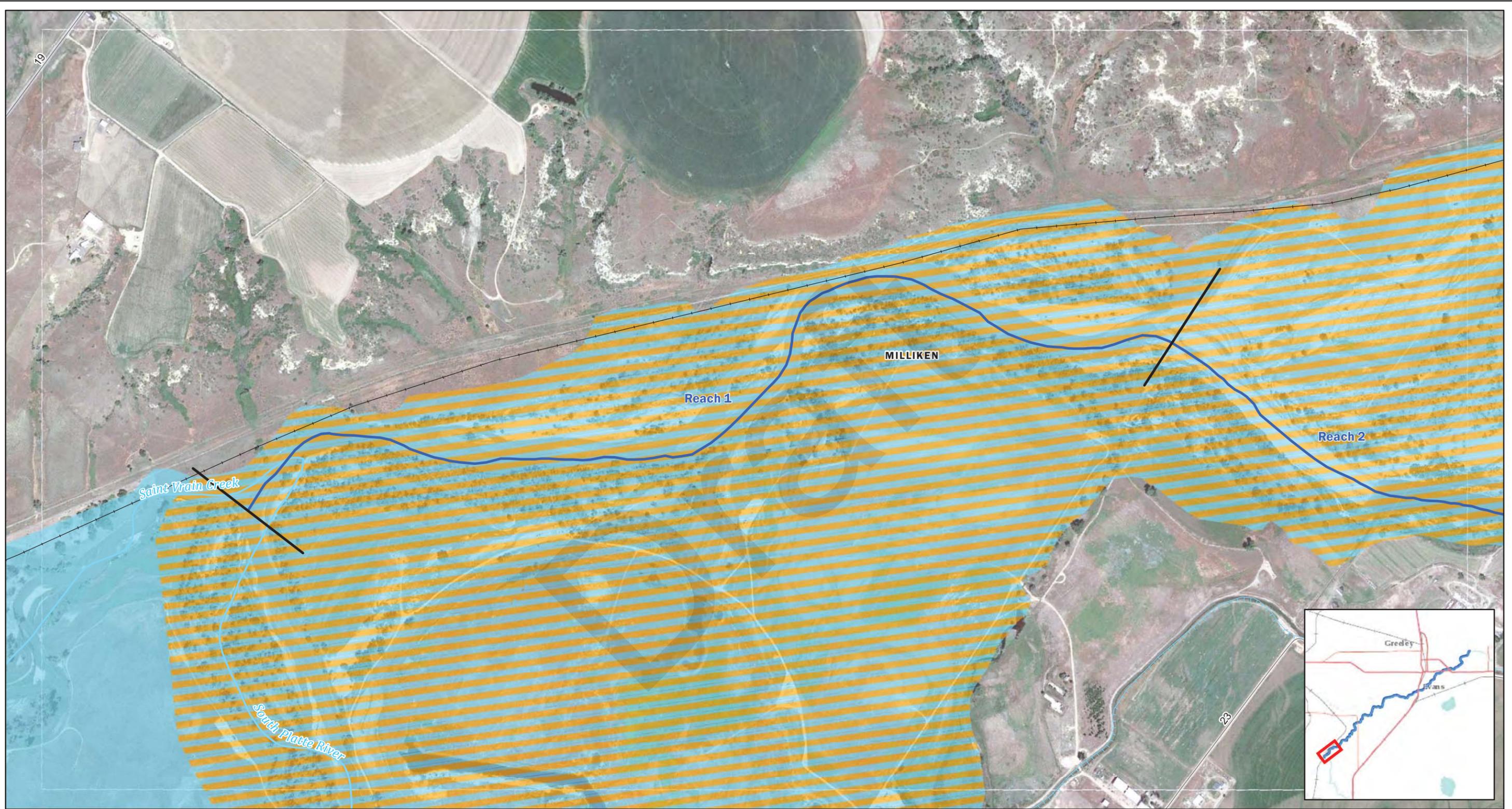
COLORADO
Colorado Water Conservation Board
Department of Natural Resources



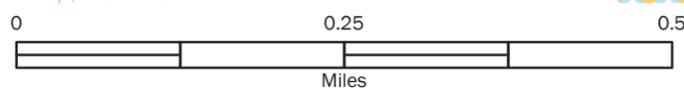
Appendix B

Draft

Document Path: J:\SouthPlatteRehab\GIS\WMD\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



- | | | | |
|---------------|----------------------|------------------------------|----------------|
| Project Reach | Railroad | FEMA Preliminary Flood Zones | |
| Stream | Highway | Approximate | Detailed Study |
| Canal/Ditch | Diversion Structures | | |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan

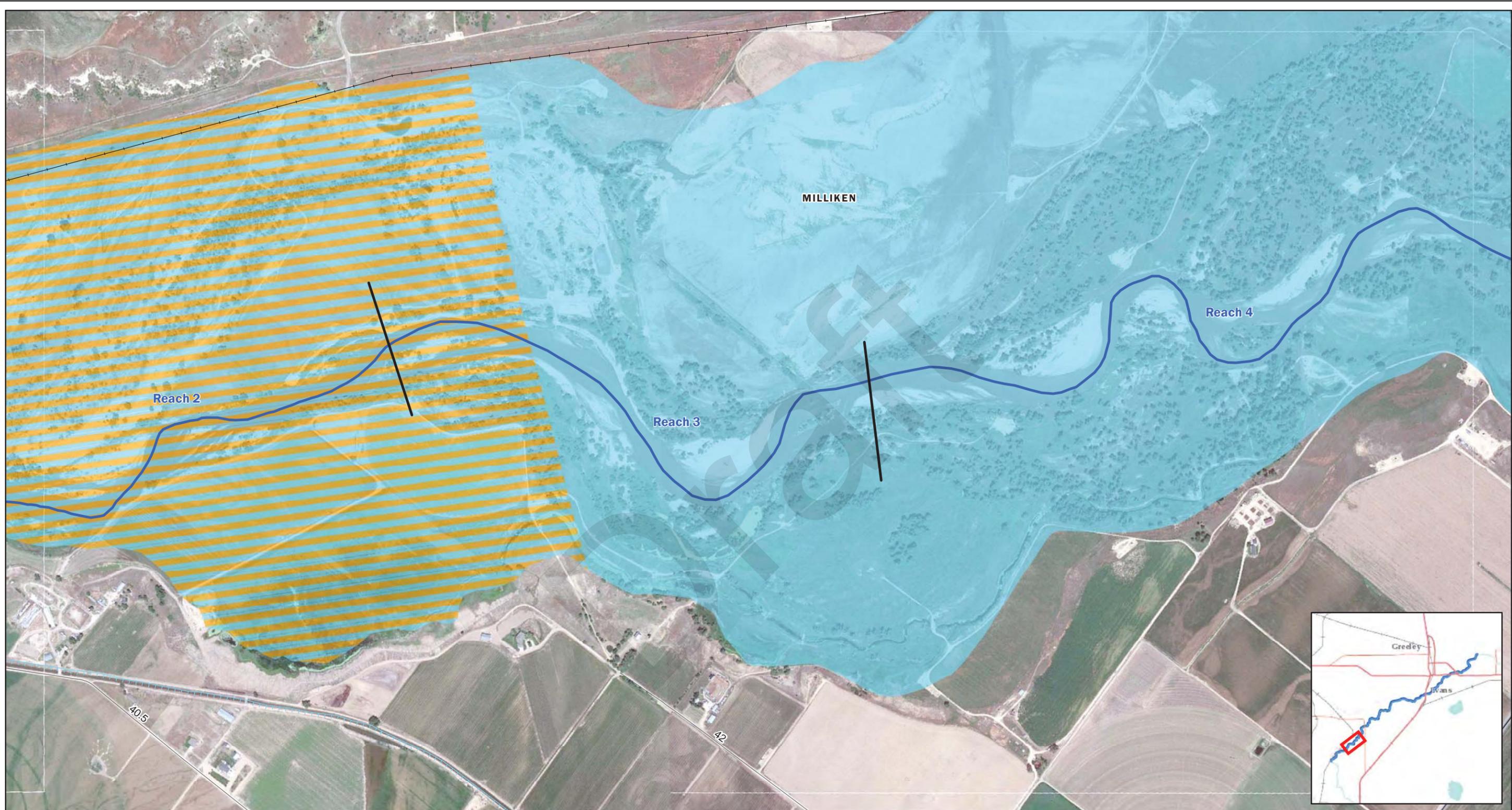
Appendix B - Figure B-1: FEMA Floodplain
Map Index Page 1



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources



Document Path: J:\SouthPlatteRehab\GIS\MapDocs\FEMA Floodplain\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



	Project Reach		Railroad	FEMA Preliminary Flood Zones	
	Stream		Highway		Approximate
	Canal/Ditch		Diversion Structures		Detailed Study

0 0.25 0.5
Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014;

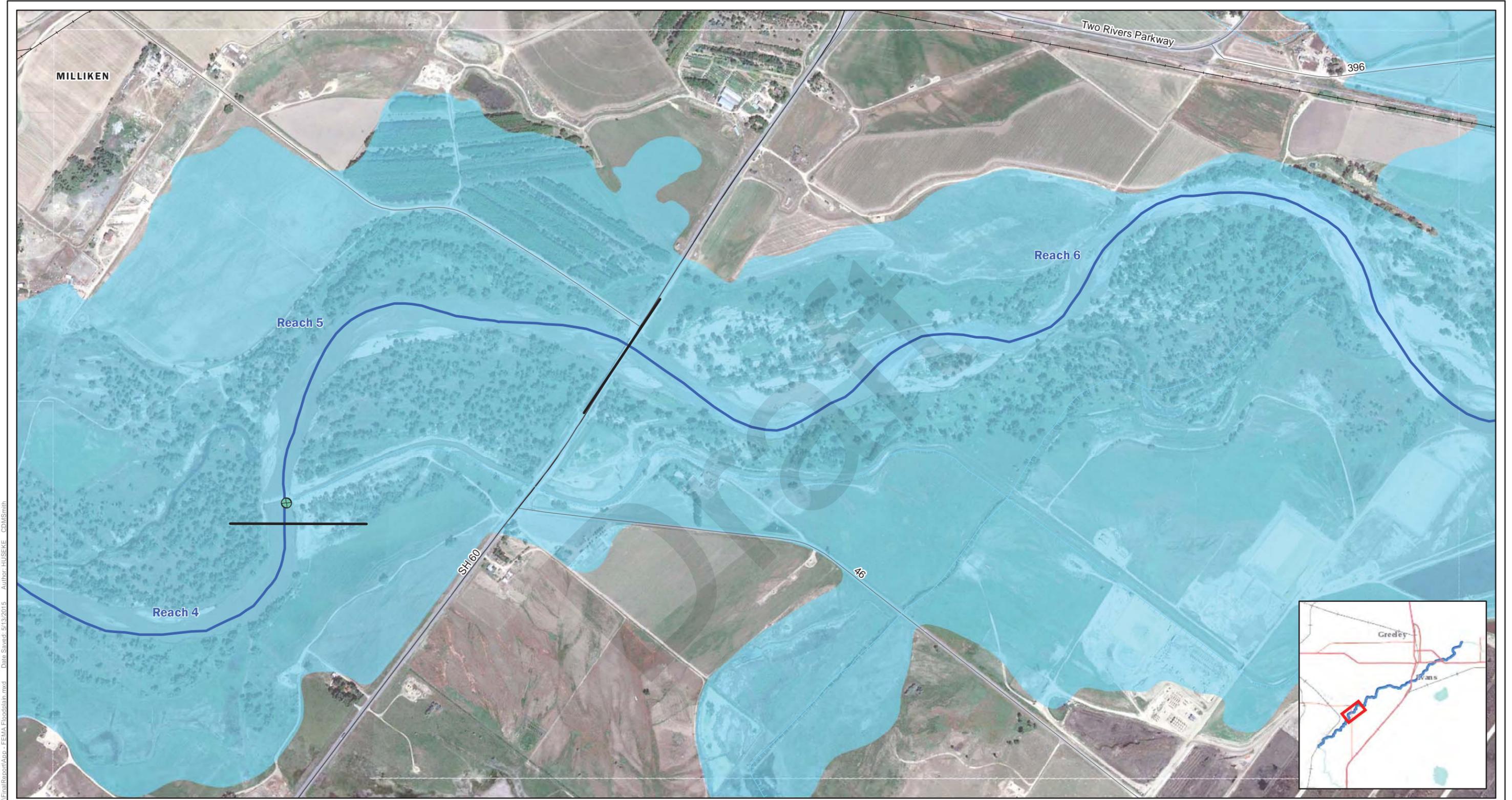
South Platte River Restoration Master Plan

Appendix B - Figure B-2: FEMA Floodplain
Map Index Page 2



COLORADO
Colorado Water Conservation Board
Department of Natural Resources





Document Path: J:\SouthPlatteRehab\GIS\WQD\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE - CDM\Smith



- | | | | |
|---------------|----------------------|------------------------------|----------------|
| Project Reach | Railroad | FEMA Preliminary Flood Zones | |
| Stream | Highway | Approximate | Detailed Study |
| Canal/Ditch | Diversion Structures | | |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan

Appendix B - Figure B-3: FEMA Floodplain
Map Index Page 3



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: \\SouthPlatte\Rehab\GIS\WAD\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM\Smith



- | | | | |
|---------------|----------------------|------------------------------|----------------|
| Project Reach | Railroad | FEMA Preliminary Flood Zones | |
| Stream | Highway | Approximate | Detailed Study |
| Canal/Ditch | Diversion Structures | | |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

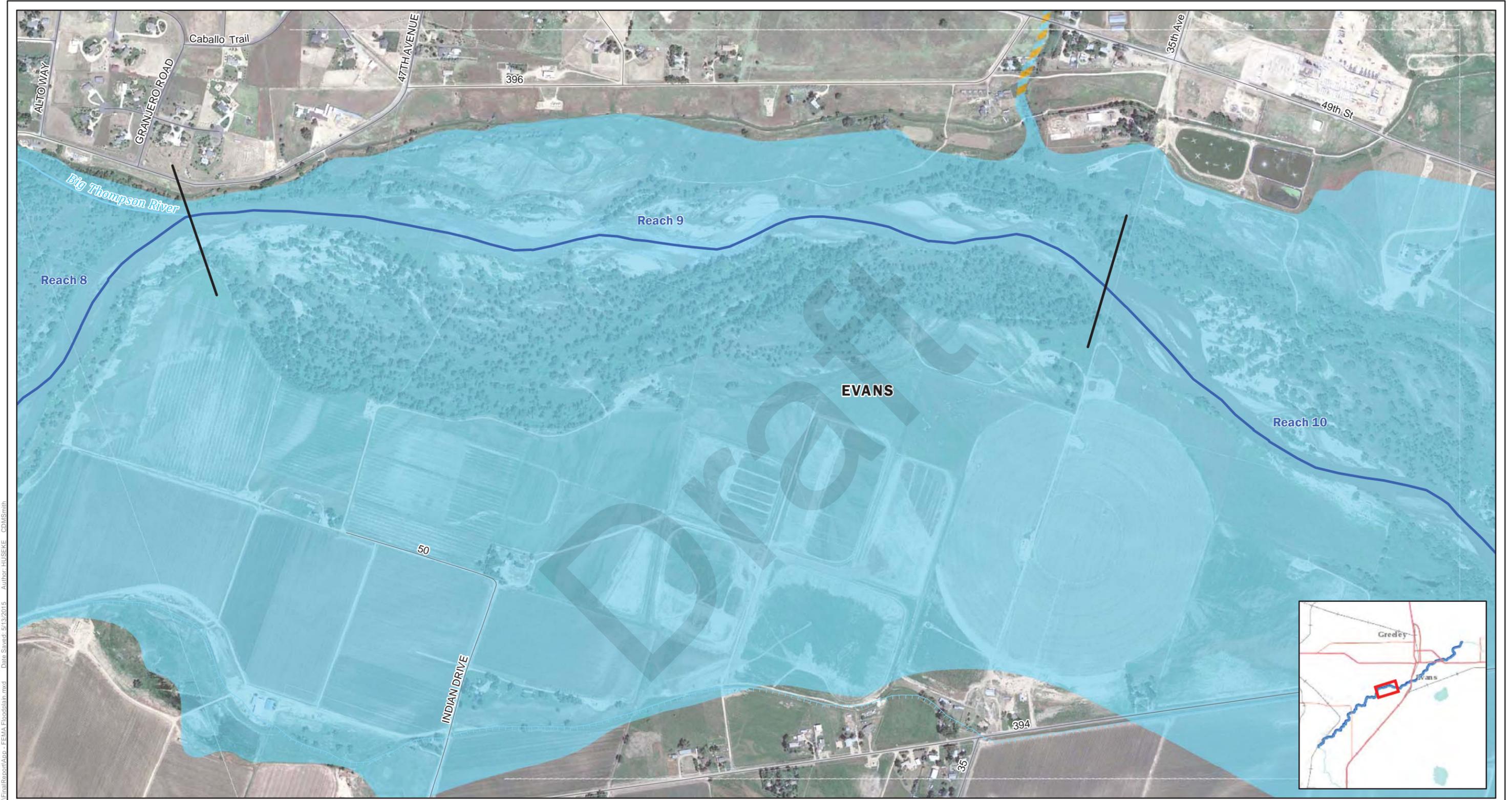
South Platte River Restoration Master Plan

Appendix B - Figure B-4: FEMA Floodplain
Map Index Page 4



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE - CDM\Smith

South Platte River Restoration Master Plan

Appendix B - Figure B-5: FEMA Floodplain
Map Index Page 5



COLORADO
Colorado Water Conservation Board
Department of Natural Resources



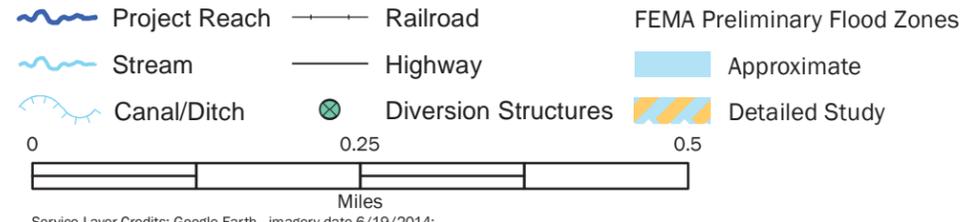
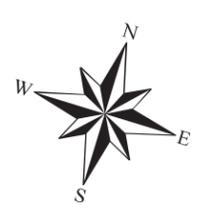
	Project Reach		Railroad	FEMA Preliminary Flood Zones	
	Stream		Highway		Approximate
	Canal/Ditch		Diversion Structures		Detailed Study

0 0.25 0.5
Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014;



Document Path: \\SouthPlatte\Rehab\GIS\WAD\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM\Smith



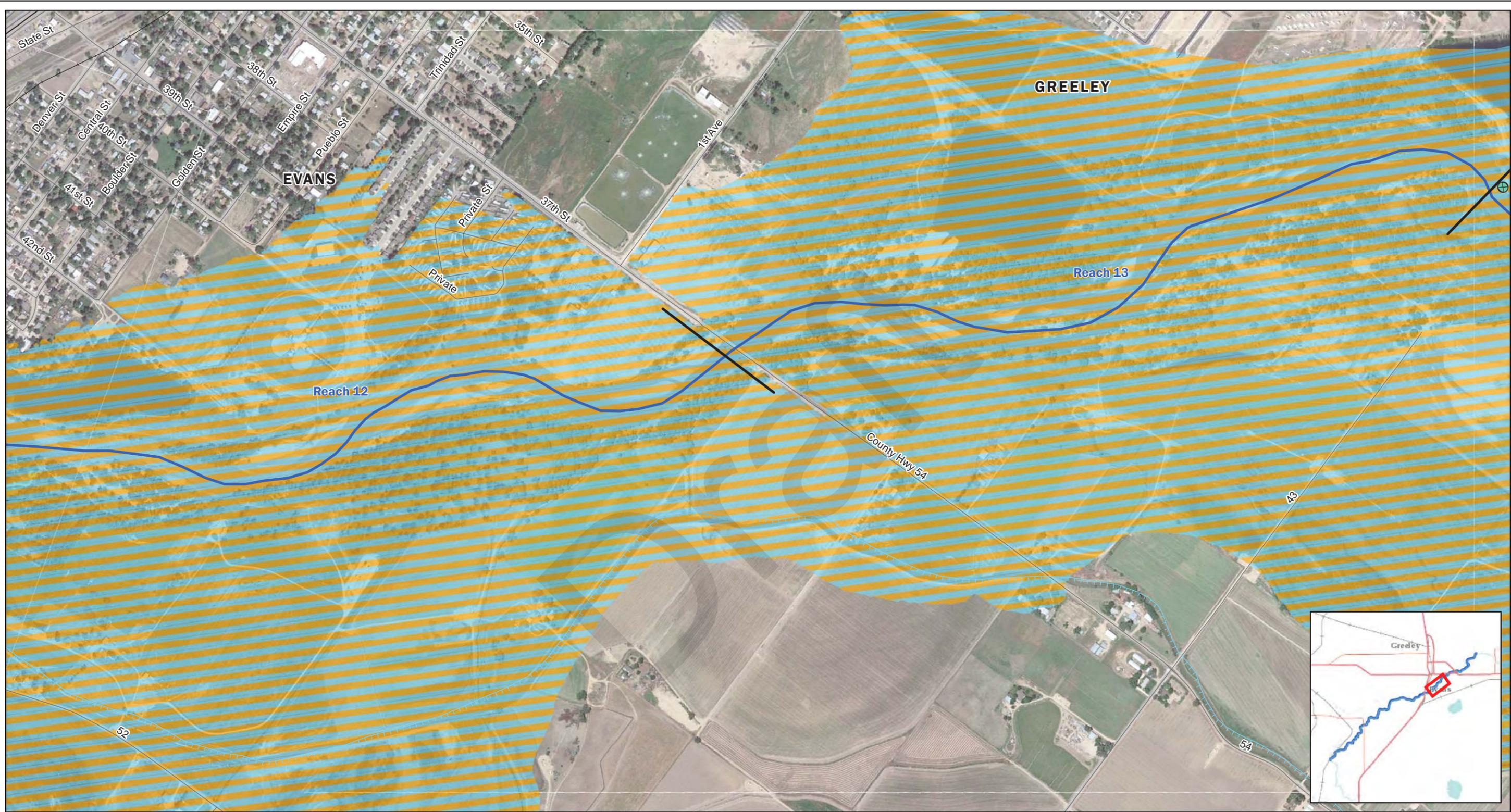
South Platte River Restoration Master Plan

Appendix B - Figure B-6: FEMA Floodplain
Map Index Page 6



COLORADO
Colorado Water Conservation Board
Department of Natural Resources





Document Path: J:\SouthPlatteRehab\GIS\WAD\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith

	Project Reach		Railroad	FEMA Preliminary Flood Zones	
	Stream		Highway		Approximate
	Canal/Ditch		Diversion Structures		Detailed Study

0 0.25 0.5 Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan

Appendix B - Figure B-7: FEMA Floodplain
Map Index Page 7



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: J:\SouthPlatteRch\GIS\W\Map\FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



- | | | | |
|---------------|----------------------|------------------------------|----------------|
| Project Reach | Railroad | FEMA Preliminary Flood Zones | |
| Stream | Highway | Approximate | Detailed Study |
| Canal/Ditch | Diversion Structures | | |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

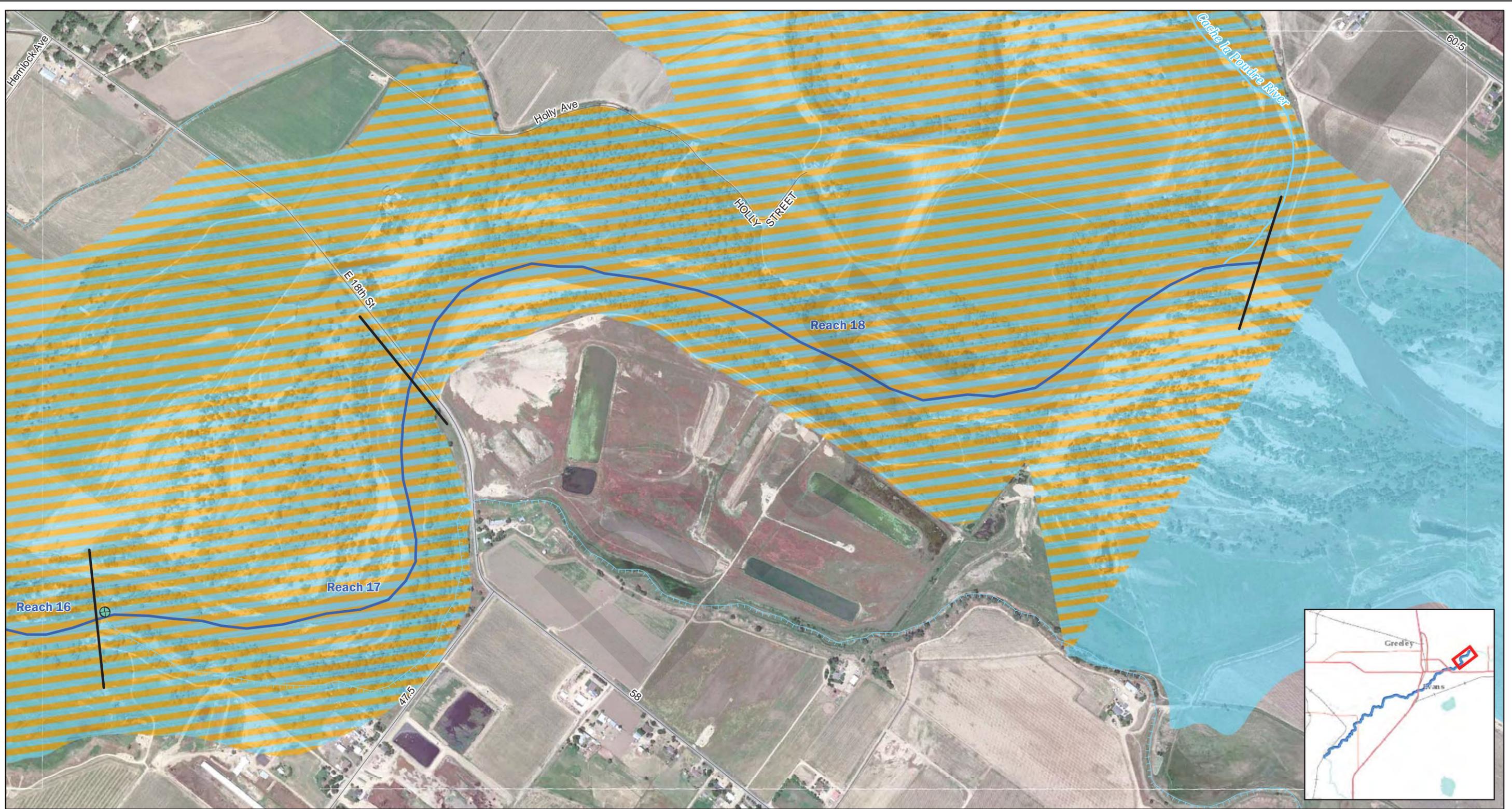
South Platte River Restoration Master Plan

Appendix B - Figure B-8: FEMA Floodplain
Map Index Page 8



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources

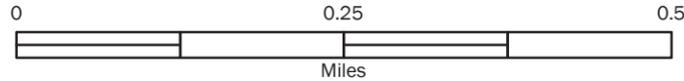




Document Path: J:\SouthPlatteRehab\GIS\MapDocs\FinalReport\Map - FEMA Floodplain.mxd Date Saved: 5/13/2015 Author: HUSEKE CDM/Smith



- | | | | |
|---------------|----------------------|------------------------------|----------------|
| Project Reach | Railroad | FEMA Preliminary Flood Zones | |
| Stream | Highway | Approximate | Detailed Study |
| Canal/Ditch | Diversion Structures | | |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan

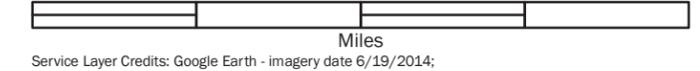
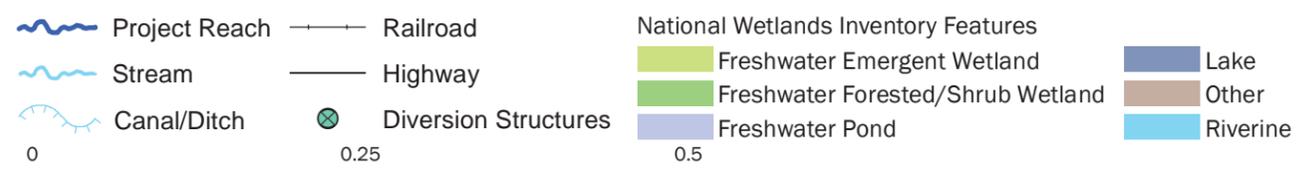
Appendix B - Figure B-9: FEMA Floodplain
Map Index Page 9



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources



Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CD/Smith



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
Appendix B - Figure B-10: Wetlands | Map Index Page 1

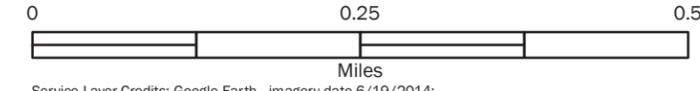




Document Path: J:\SouthPlatte\Rehab\GIS\WQD\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CD/Smith



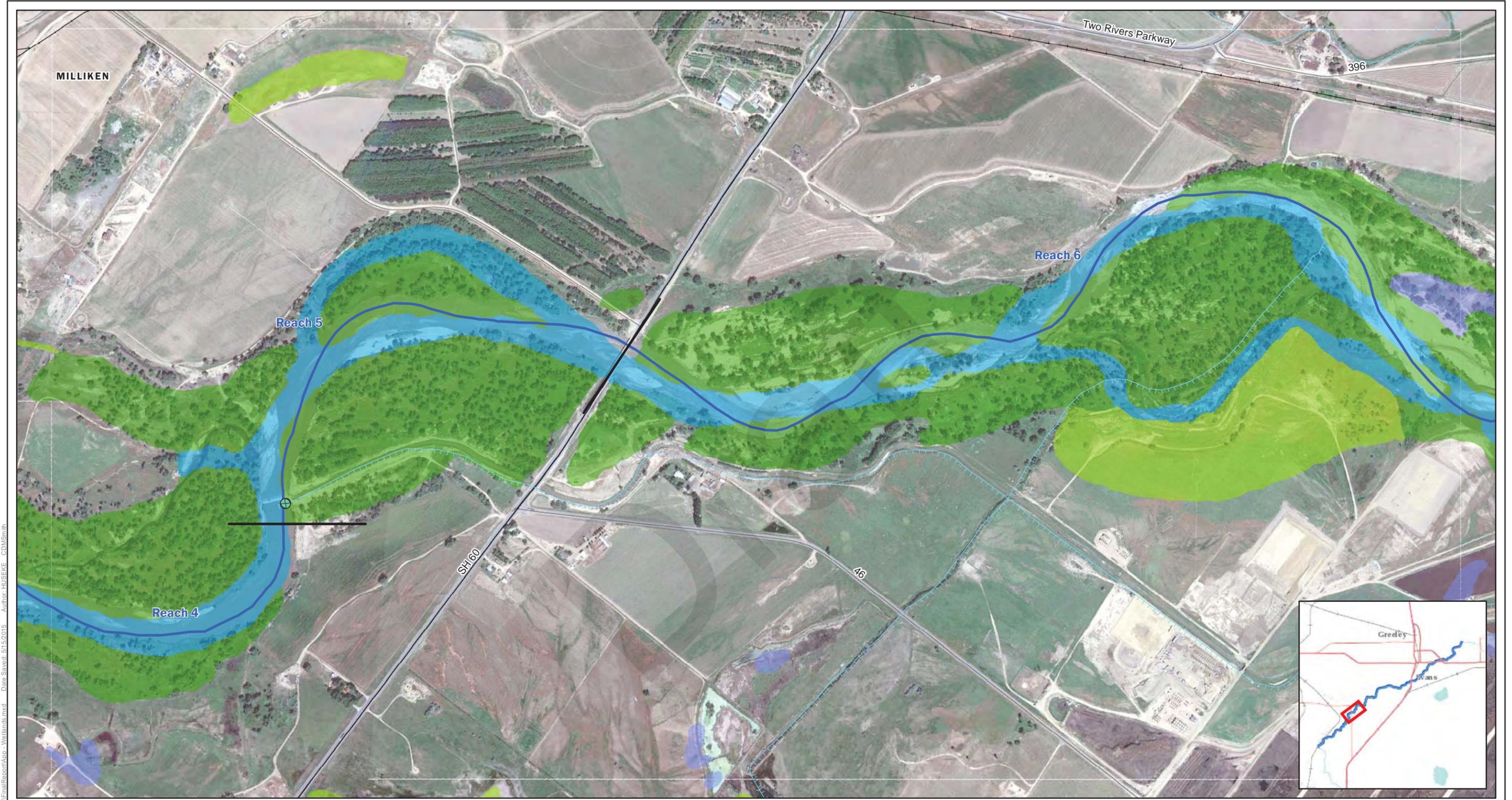
- | | | | |
|---------------|----------------------|--------------------------------------|----------|
| Project Reach | Railroad | National Wetlands Inventory Features | |
| Stream | Highway | Freshwater Emergent Wetland | Lake |
| Canal/Ditch | Diversion Structures | Freshwater Forested/Shrub Wetland | Other |
| | | Freshwater Pond | Riverine |



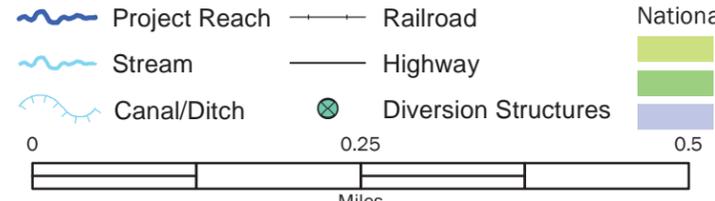
Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
 Appendix B - Figure B-11: Wetlands | Map Index Page 2





Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HJSEKE CD/MSmith



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
 Appendix B - Figure B-12: Wetlands | Map Index Page 3

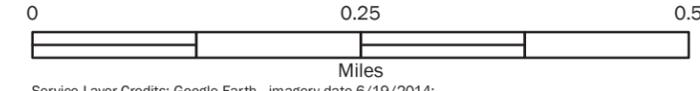




Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CDM/Smith



- | | | | |
|---------------|----------------------|--------------------------------------|----------|
| Project Reach | Railroad | National Wetlands Inventory Features | |
| Stream | Highway | Freshwater Emergent Wetland | Lake |
| Canal/Ditch | Diversion Structures | Freshwater Forested/Shrub Wetland | Other |
| | | Freshwater Pond | Riverine |



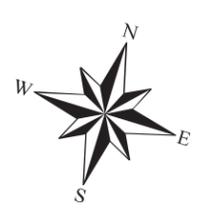
Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
 Appendix B - Figure B-13: Wetlands | Map Index Page 4





Document Path: J:\SouthPlatte\Rehab\GIS\WQD\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CD/Smith



- | | | | |
|---------------|----------------------|-----------------------------------|----------|
| Project Reach | Railroad | Freshwater Emergent Wetland | Lake |
| Stream | Highway | Freshwater Forested/Shrub Wetland | Other |
| Canal/Ditch | Diversion Structures | Freshwater Pond | Riverine |

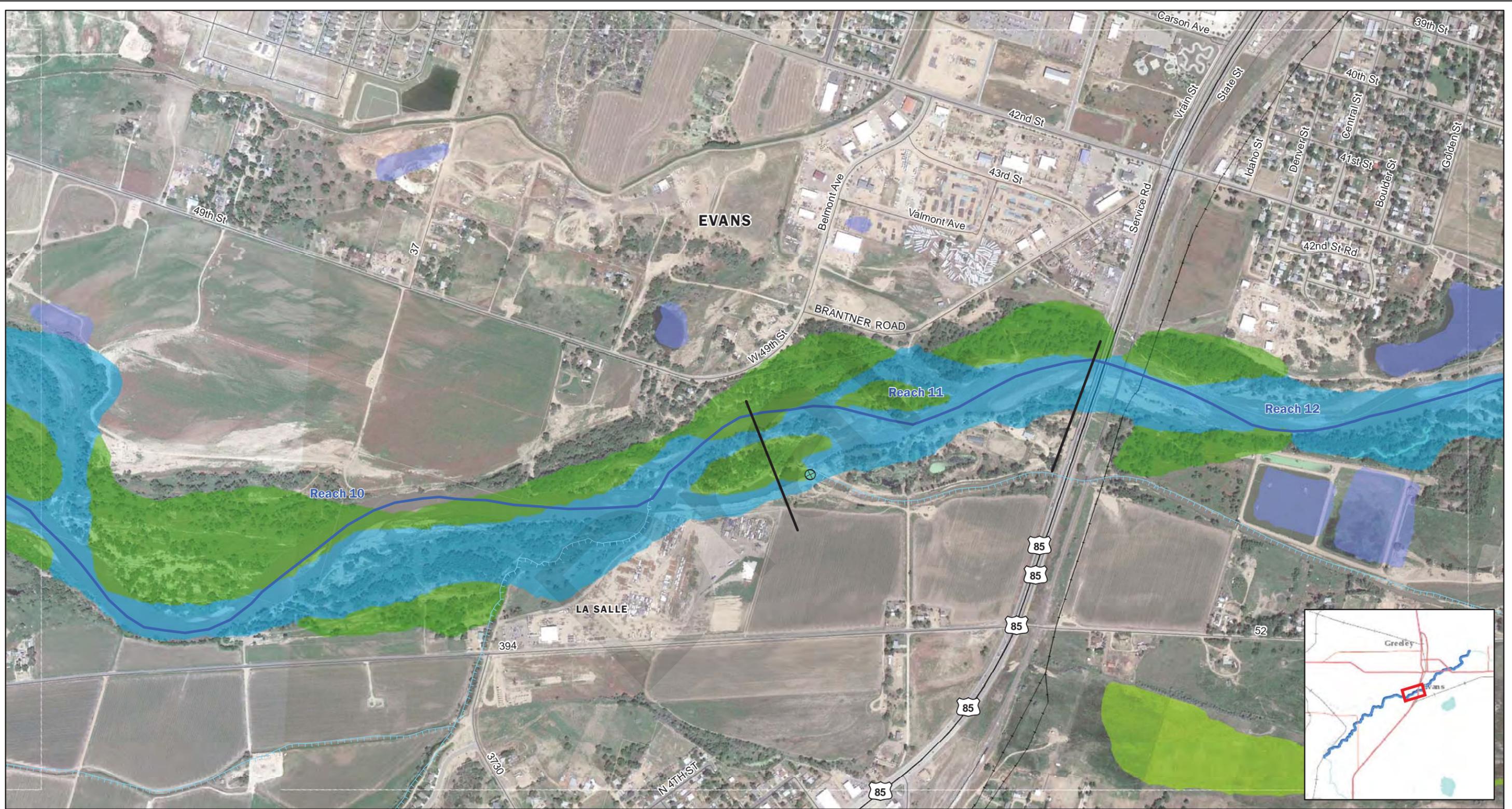


Service Layer Credits: Google Earth - imagery date 6/19/2014;

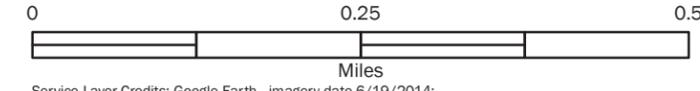
South Platte River Restoration Master Plan
 Appendix B - Figure B-14: Wetlands | Map Index Page 5



Document Path: \\SouthPlatte\Rehab\GIS\WQD\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CDM/Smith



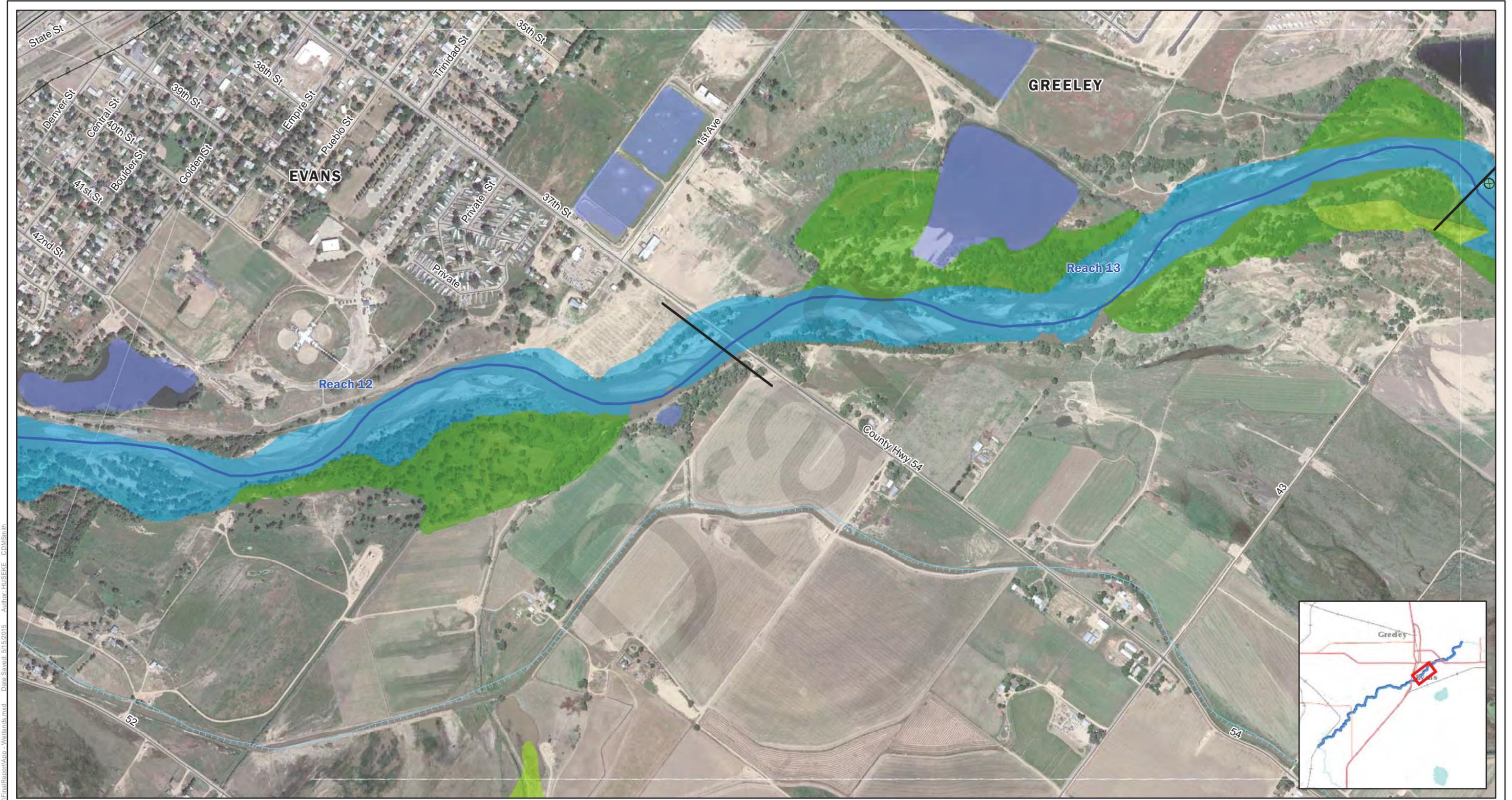
- | | | | |
|---------------|----------------------|--------------------------------------|----------|
| Project Reach | Railroad | National Wetlands Inventory Features | |
| Stream | Highway | Freshwater Emergent Wetland | Lake |
| Canal/Ditch | Diversion Structures | Freshwater Forested/Shrub Wetland | Other |
| | | Freshwater Pond | Riverine |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
Appendix B - Figure B-15: Wetlands | Map Index Page 6

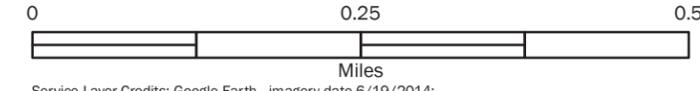




Document Path: J:\SouthPlatte\Rehab\GIS\WQD\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CD/Smith



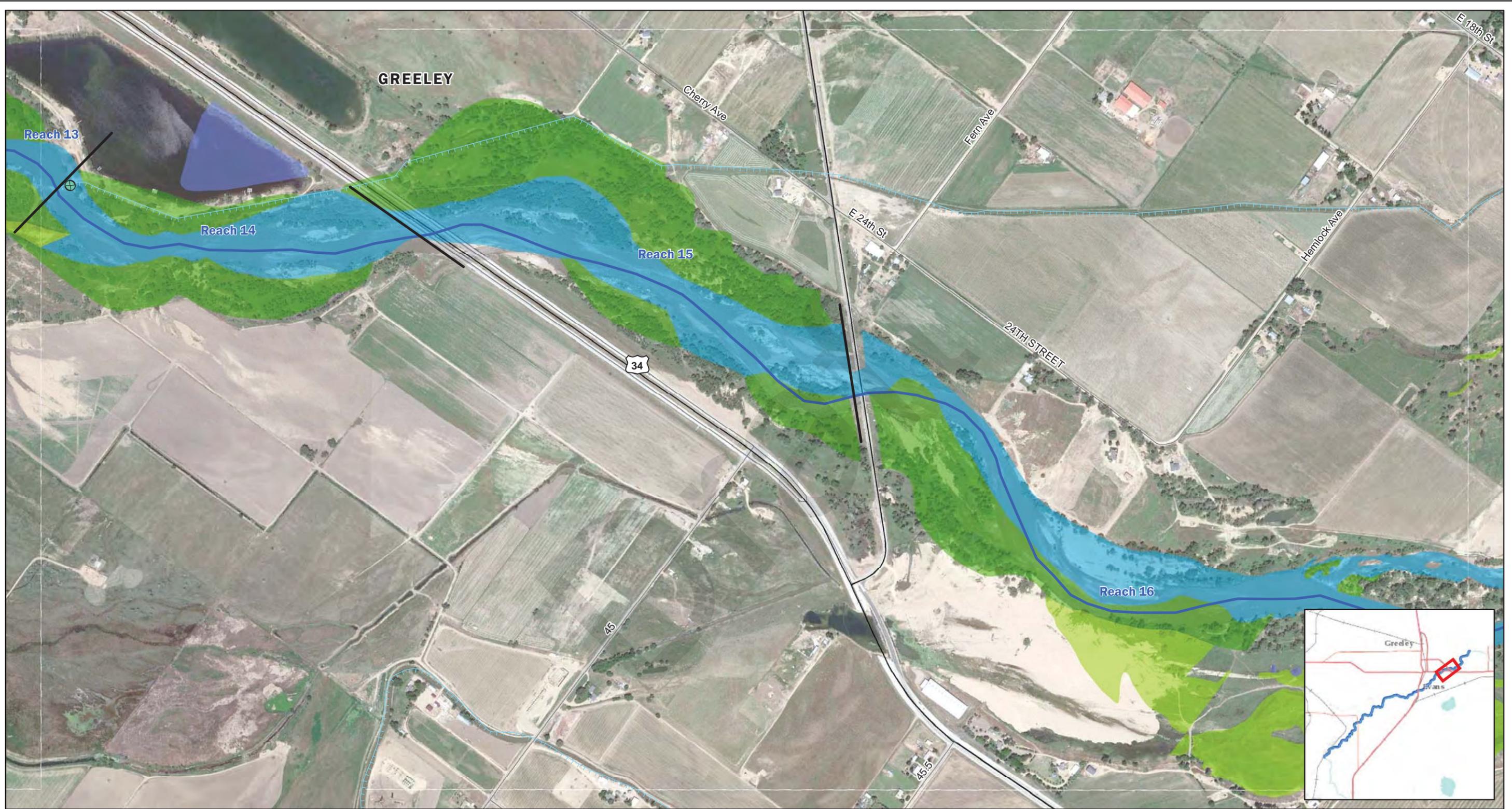
- | | | | | |
|---------------|----------------------|--------------------------------------|-----------------------------------|-------|
| Project Reach | Railroad | National Wetlands Inventory Features | | Lake |
| Stream | Highway | Freshwater Emergent Wetland | Freshwater Forested/Shrub Wetland | Other |
| Canal/Ditch | Diversion Structures | Freshwater Pond | Riverine | |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
 Appendix B - Figure B-16: Wetlands | Map Index Page 7

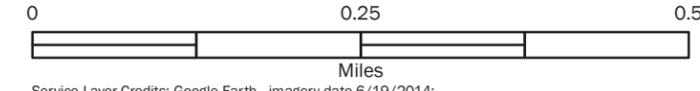




Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 1:15:20 PM Author: HJ/SEKE CDM/Smith



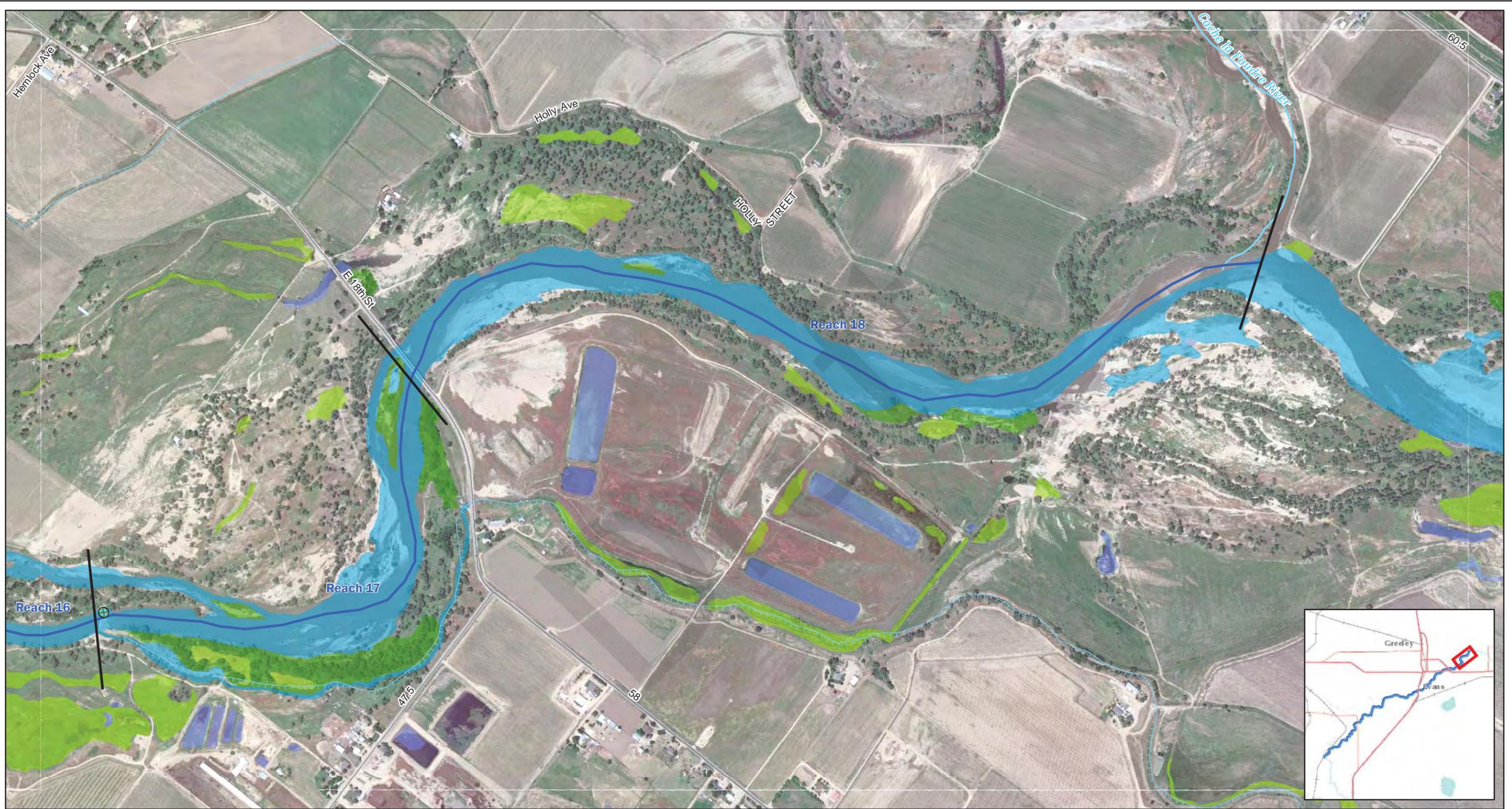
- | | | | |
|---------------|----------------------|-----------------------------------|----------|
| Project Reach | Railroad | Freshwater Emergent Wetland | Lake |
| Stream | Highway | Freshwater Forested/Shrub Wetland | Other |
| Canal/Ditch | Diversion Structures | Freshwater Pond | Riverine |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
 Appendix B - Figure B-17: Wetlands | Map Index Page 8

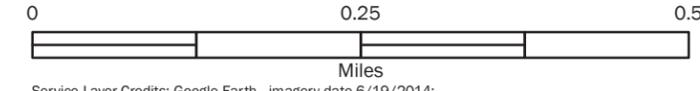




Document Path: J:\SouthPlatte\Rehab\GIS\WQD\FinalReport\Map - Wetlands.mxd Date Saved: 8/15/2015 Author: HUSEKE CDM/Smith



- | | | | |
|---------------|----------------------|-----------------------------------|----------|
| Project Reach | Railroad | Freshwater Emergent Wetland | Lake |
| Stream | Highway | Freshwater Forested/Shrub Wetland | Other |
| Canal/Ditch | Diversion Structures | Freshwater Pond | Riverine |



Service Layer Credits: Google Earth - imagery date 6/19/2014;

South Platte River Restoration Master Plan
 Appendix B - Figure B-18: Wetlands | Map Index Page 9





Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Fish_Passage.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM Smith

 Stream  Railroad
 Canal/Ditch  Highway
 Diversion Structures

0 1.25 2.5
 Miles
 Service Layer Credits: Google Earth - imagery date 6/19/2014

Native Fish Passage Priorities

- Priority 1 - Stream reaches with multiple native species currently present and historically high biodiversity
- Priority 2 - Stream reaches with a single native species currently present or historically high biodiversity
- Priority 3 - Stream reaches with a single native species historically present
- Priority 4 - All other streams

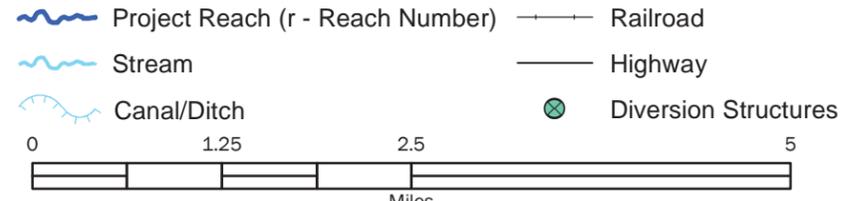
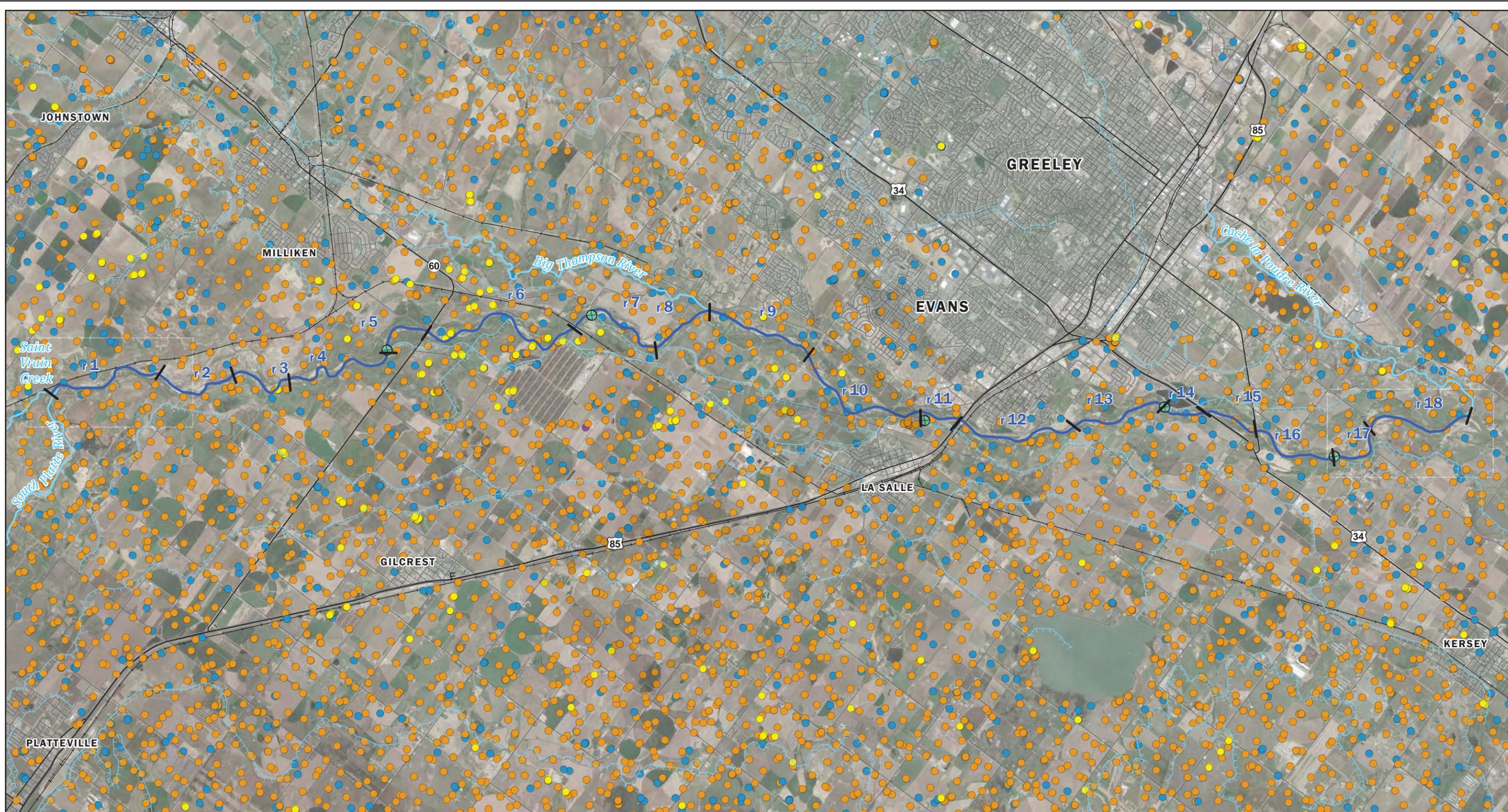
Native Fish Passage Priorities Source: Aquatic Research Section, Colorado Parks and Wildlife, Released 1/10/2014

South Platte River Restoration Master Plan

Appendix B - Figure B-19: Fish Passage Priorities



Document Path: J:\SouthPlatteRehab\GIS\MapDocs\FinalReport\Map - Oil and Gas.mxd Date Saved: 5/15/2015 1:53:00 PM Author: HUSEKE CDM/Smith



- Oil and Gas Wells - Facility Status**
- Abandoned/Inactive
 - Permitted/In Progress
 - Active
 - Domestic Well

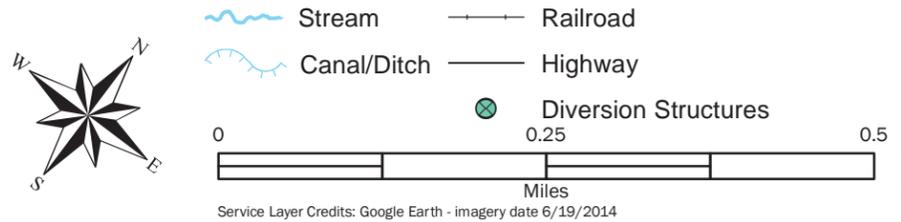
South Platte River Restoration Master Plan
 Appendix B - Figure B-20: Oil and Gas Wells



Service Layer Credits: Google Earth - imagery date 6/19/2014;

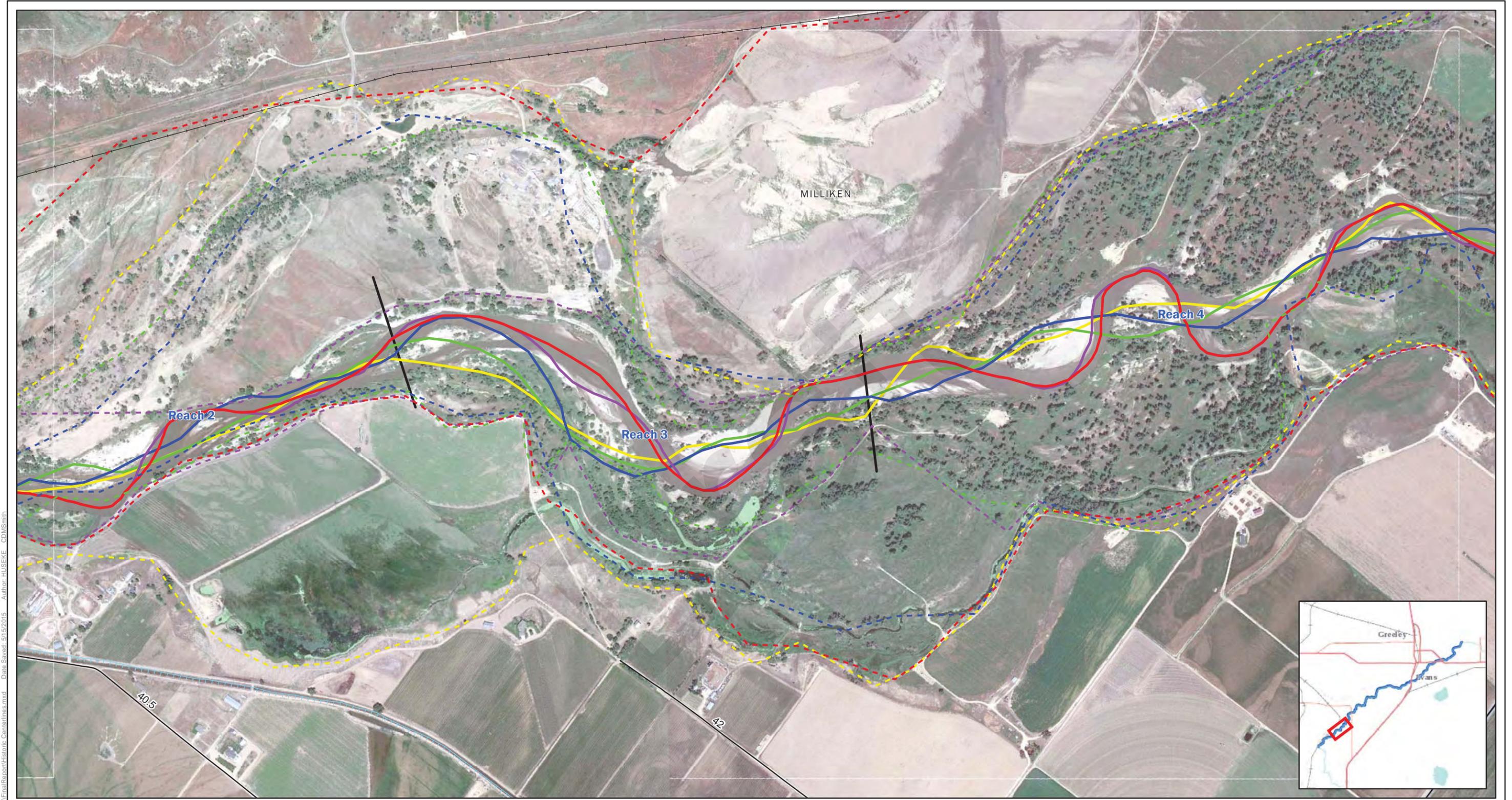


Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic Centerlines.mxd Date Saved: 5/15/2015 Author: HUSKKE CDM\Smith

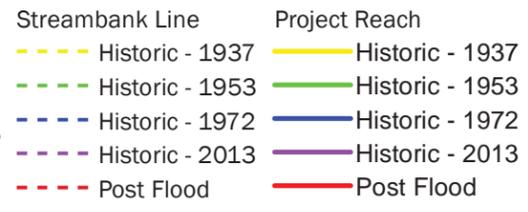
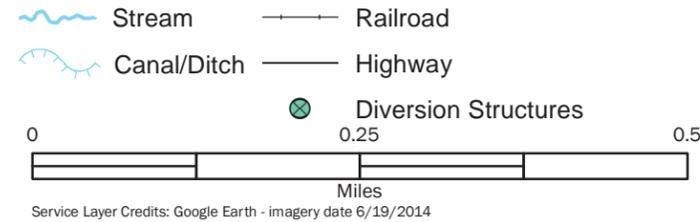


South Platte River Restoration Master Plan
 Appendix B - Figure B-21: Historic Streamlines | Map Index Page 1





Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSPKE CDMSmith

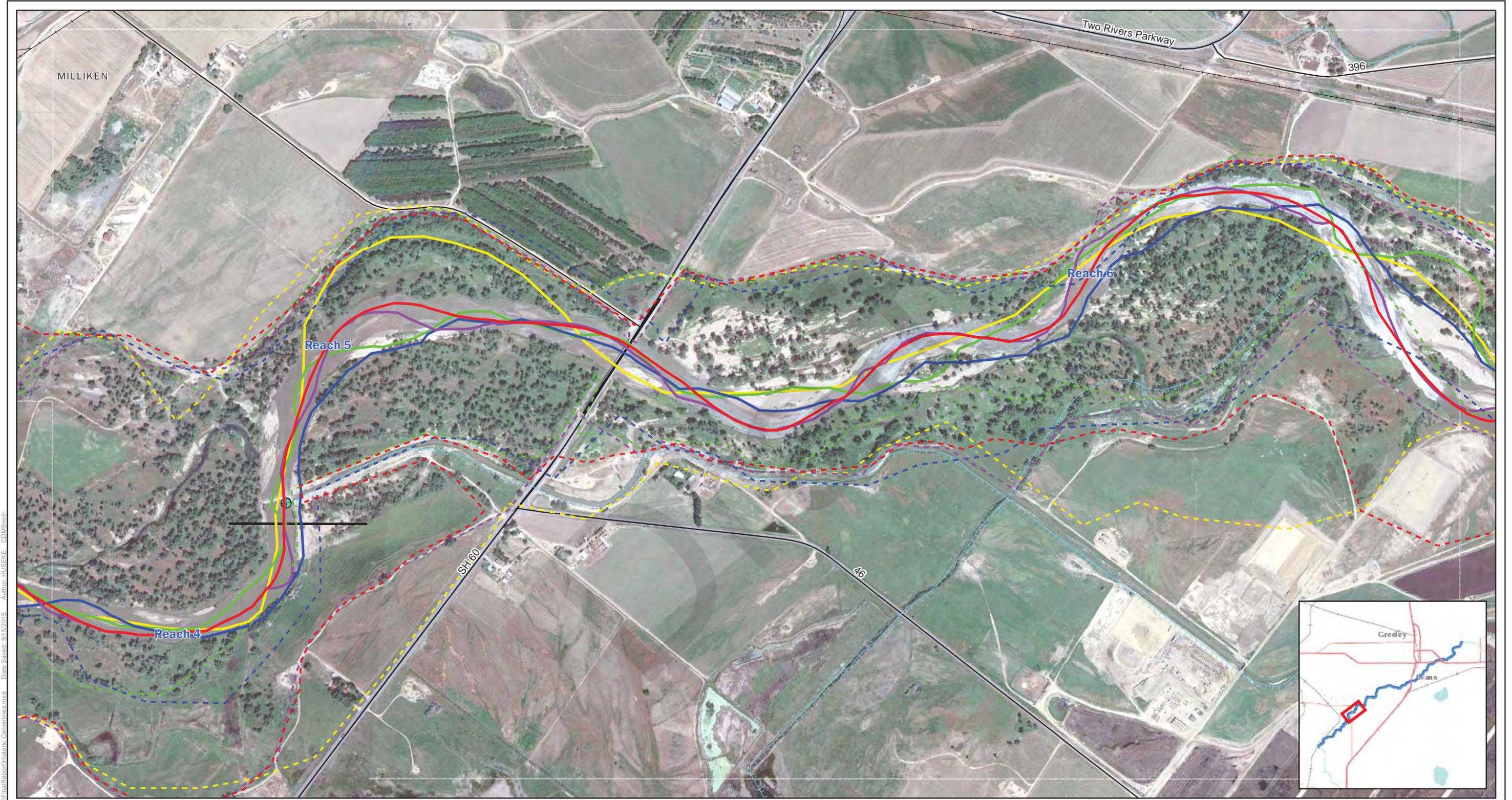


South Platte River Restoration Master Plan
 Appendix B - Figure B-22: Historic Streamlines | Map Index Page 2

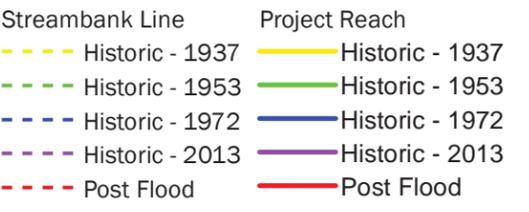
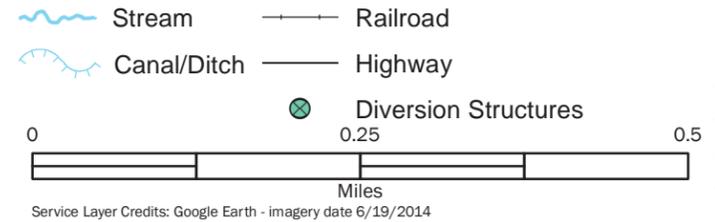


COLORADO
 Colorado Water
 Conservation Board
 Department of Natural Resources



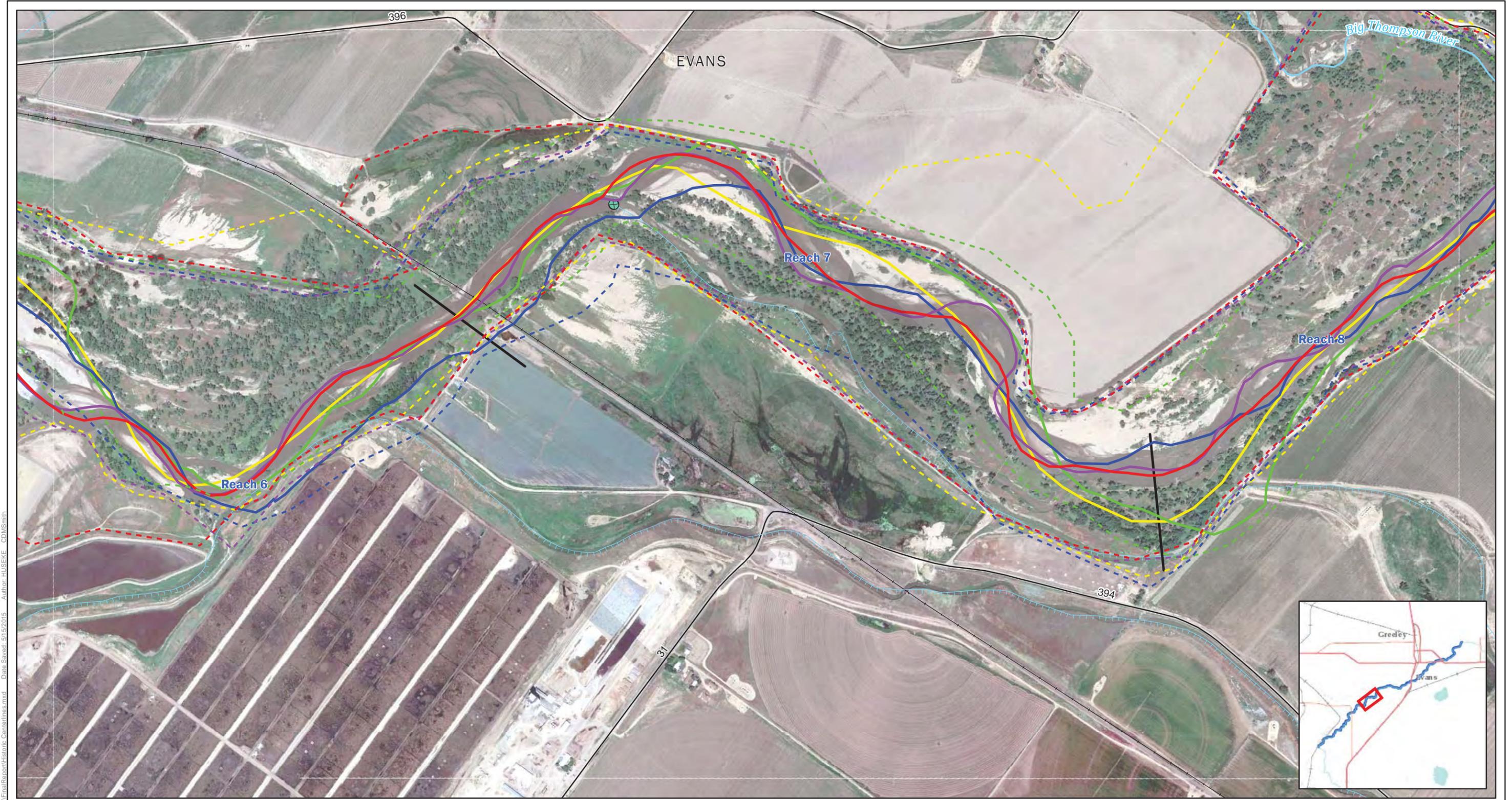


Document Path: J:\SouthPlatte\Rehab\GIS\W\Map\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSKKE CDM\Smith



South Platte River Restoration Master Plan
 Appendix B - Figure B-23: Historic Streamlines | Map Index Page 3





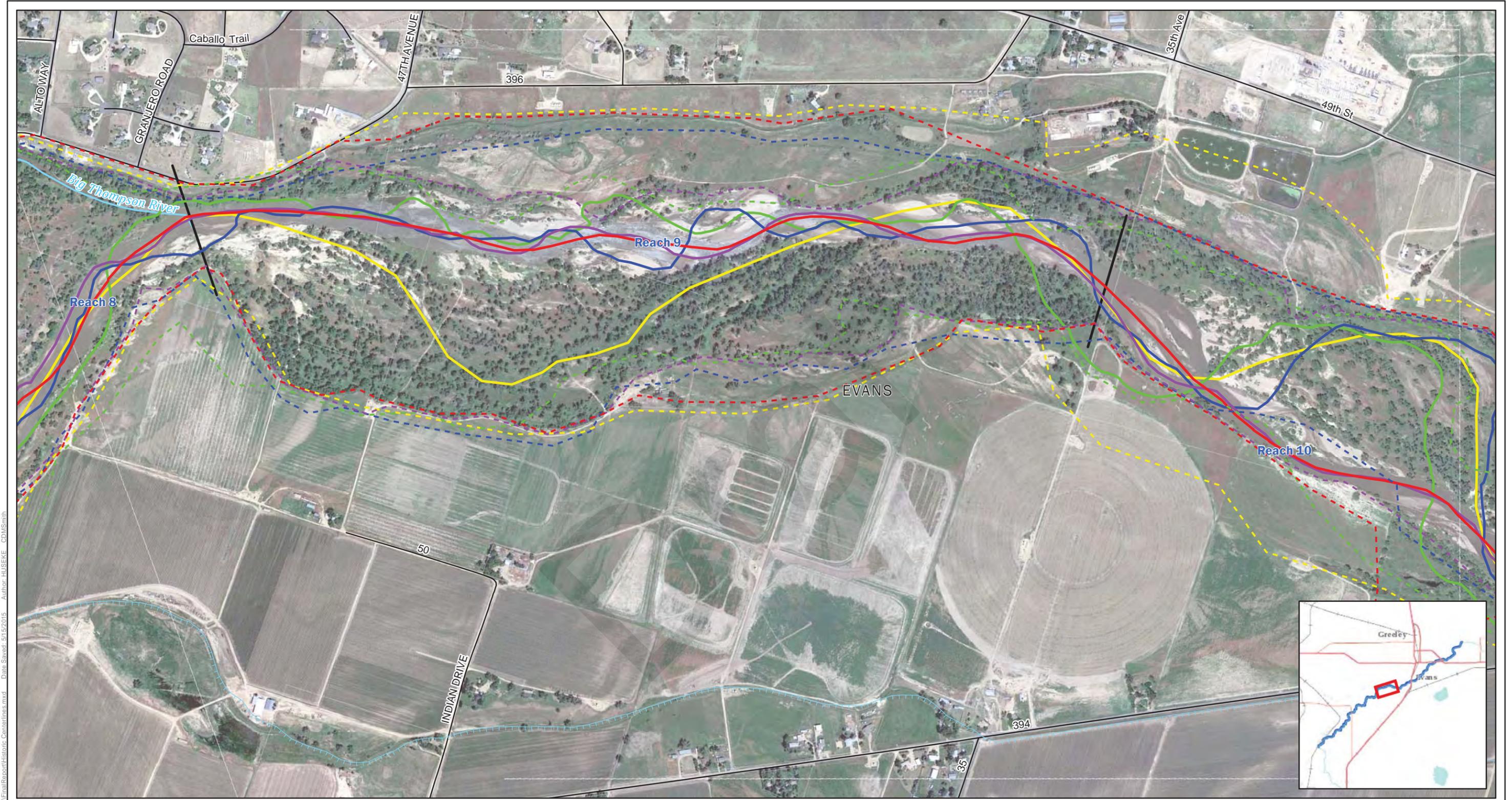
Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSKKE CDM\Smith

 Stream	 Railroad	 Streambank Line	 Project Reach
 Canal/Ditch	 Highway	 Historic - 1937	 Historic - 1937
	 Diversion Structures	 Historic - 1953	 Historic - 1953
		 Historic - 1972	 Historic - 1972
		 Historic - 2013	 Historic - 2013
		 Post Flood	 Post Flood

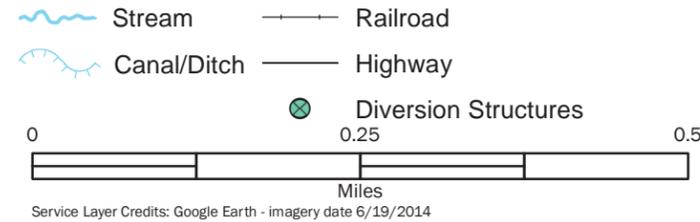
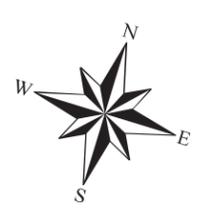
South Platte River Restoration Master Plan
 Appendix B - Figure B-24: Historic Streamlines | Map Index Page 4



Service Layer Credits: Google Earth - imagery date 6/19/2014



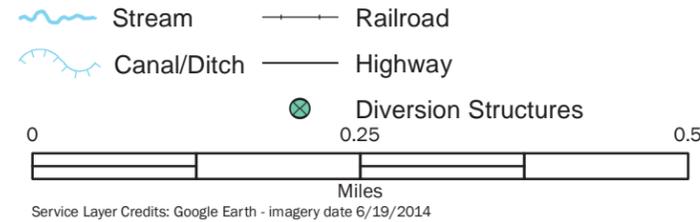
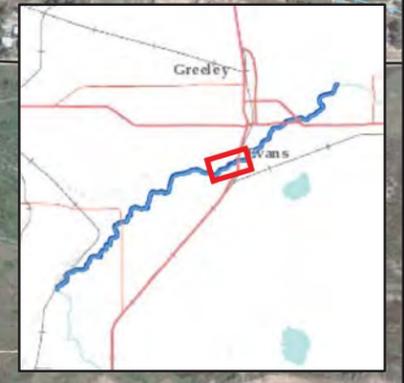
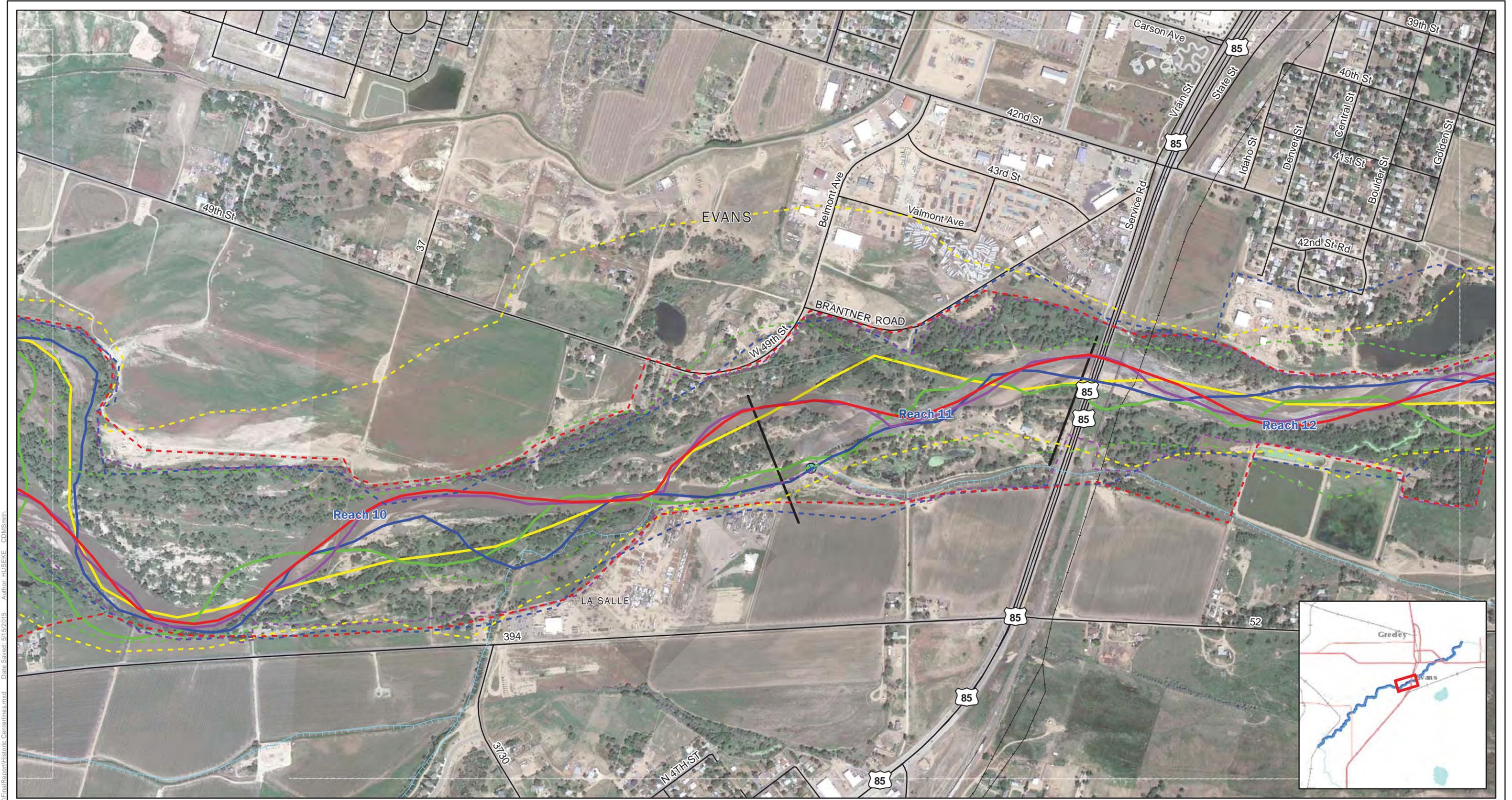
Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSPKE CDMSmith



- | | | | |
|----------------------|----------|-----------------|-----------------|
| Stream | Railroad | Streambank Line | Project Reach |
| Canal/Ditch | Highway | Historic - 1937 | Historic - 1937 |
| Diversion Structures | | Historic - 1953 | Historic - 1953 |
| | | Historic - 1972 | Historic - 1972 |
| | | Historic - 2013 | Historic - 2013 |
| | | Post Flood | Post Flood |

South Platte River Restoration Master Plan
 Appendix B - Figure B-25: Historic Streamlines | Map Index Page 5





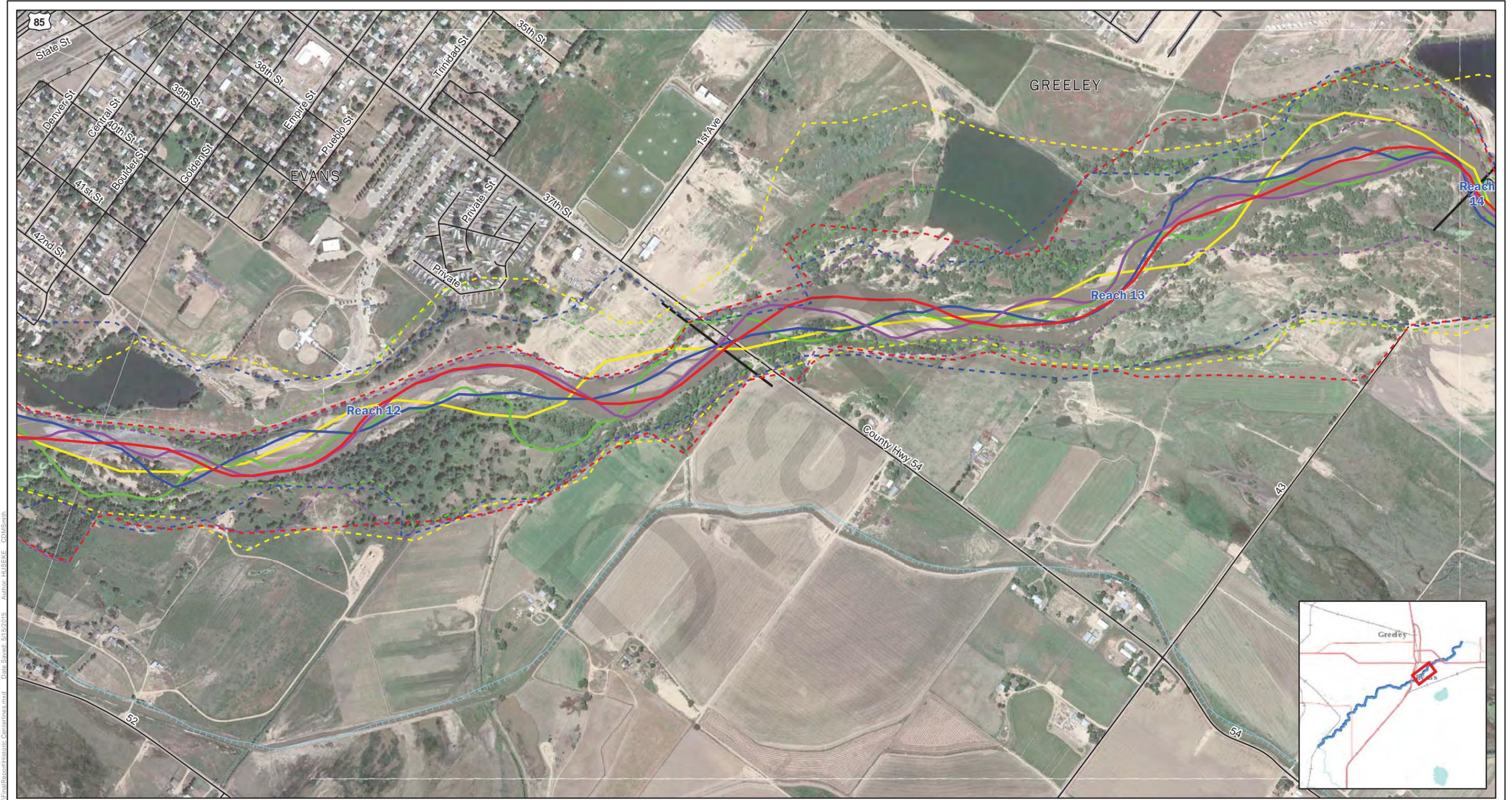
- | | | | |
|----------------------|----------|-----------------|-----------------|
| Stream | Railroad | Streambank Line | Project Reach |
| Canal/Ditch | Highway | Historic - 1937 | Historic - 1937 |
| Diversion Structures | | Historic - 1953 | Historic - 1953 |
| | | Historic - 1972 | Historic - 1972 |
| | | Historic - 2013 | Historic - 2013 |
| | | Post Flood | Post Flood |

South Platte River Restoration Master Plan
 Appendix B - Figure B-26: Historic Streamlines | Map Index Page 6

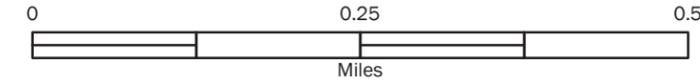


Document Path: J:\SouthPlatteRer\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSPKE CDMSmith

Service Layer Credits: Google Earth - imagery date 6/19/2014



- | | | | |
|----------------------|----------|-----------------|-----------------|
| Stream | Railroad | Streambank Line | Project Reach |
| Canal/Ditch | Highway | Historic - 1937 | Historic - 1937 |
| Diversion Structures | | Historic - 1953 | Historic - 1953 |
| | | Historic - 1972 | Historic - 1972 |
| | | Historic - 2013 | Historic - 2013 |
| | | Post Flood | Post Flood |

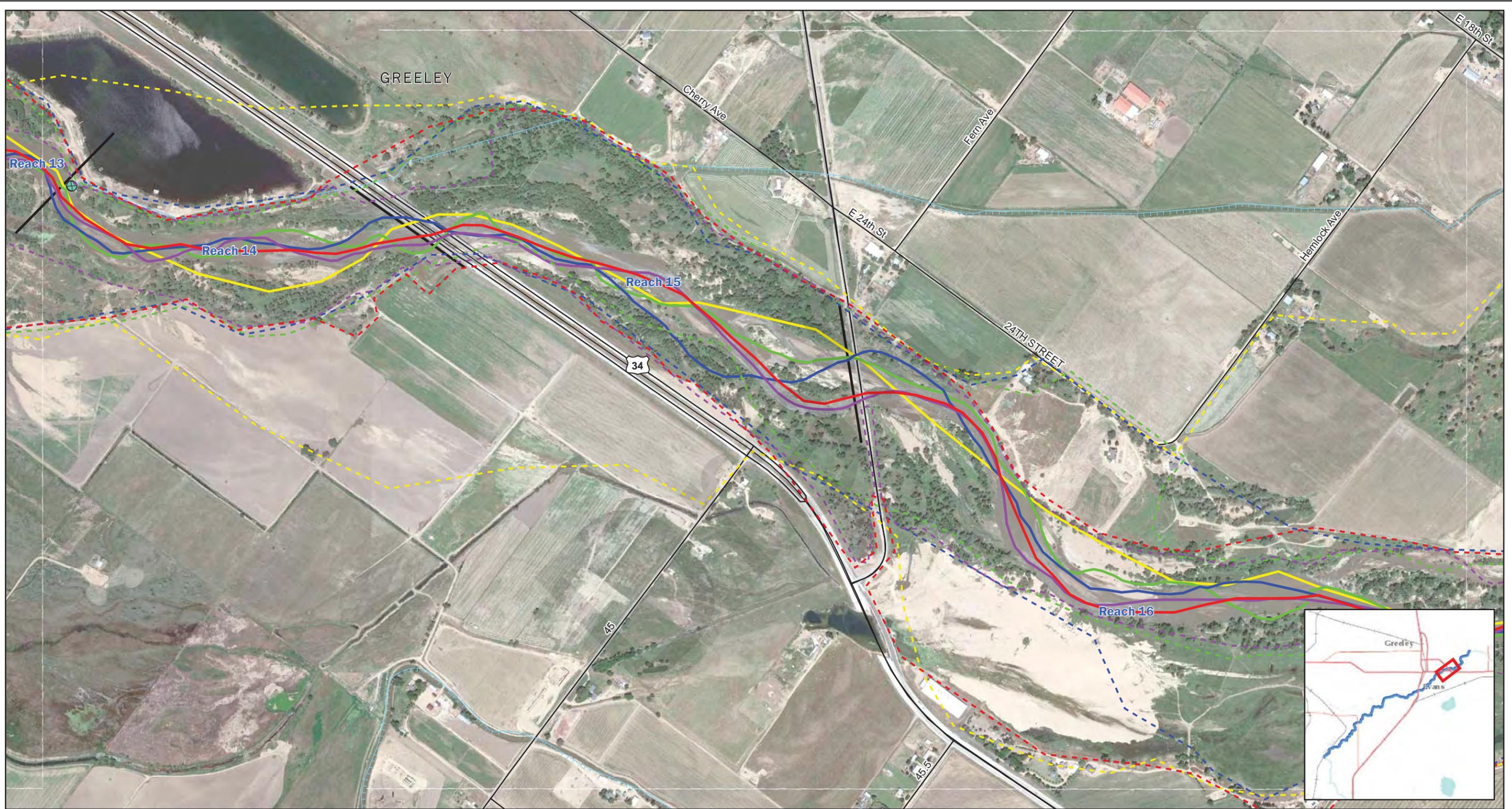


Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan
 Appendix B - Figure B-27: Historic Streamlines | Map Index Page 7



Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSKKE CDMSmith



- | | | | |
|----------------------|----------|-----------------|-----------------|
| Stream | Railroad | Streambank Line | Project Reach |
| Canal/Ditch | Highway | Historic - 1937 | Historic - 1937 |
| Diversion Structures | | Historic - 1953 | Historic - 1953 |
| | | Historic - 1972 | Historic - 1972 |
| | | Historic - 2013 | Historic - 2013 |
| | | Post Flood | Post Flood |

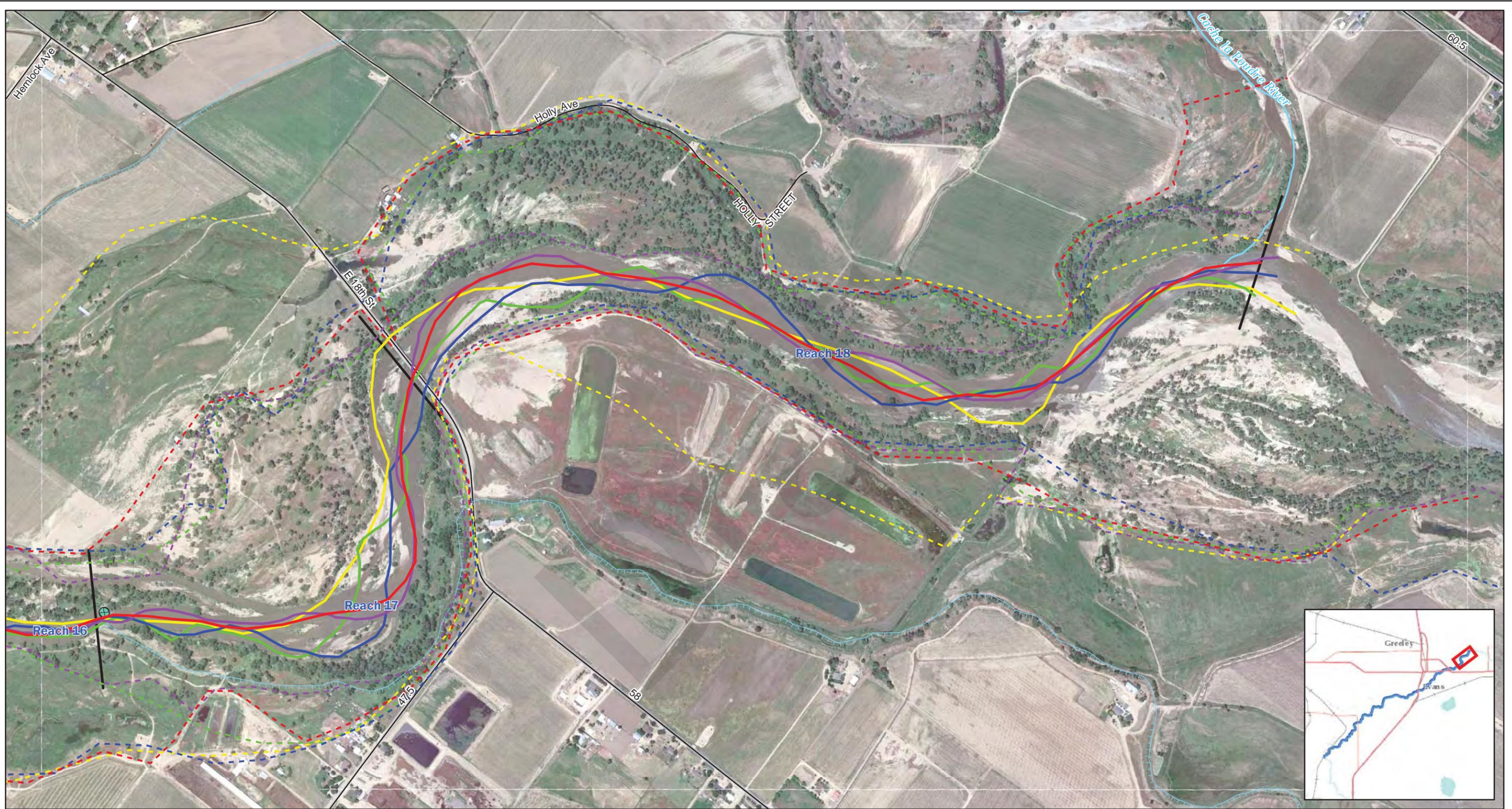


Service Layer Credits: Google Earth - imagery date 6/19/2014

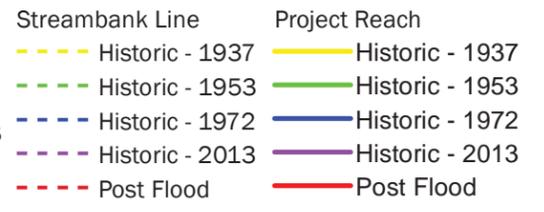
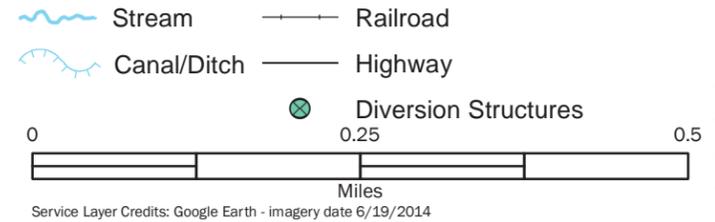
South Platte River Restoration Master Plan
 Appendix B - Figure B-28: Historic Streamlines | Map Index Page 8



Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSPKE CDM\Smith



Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Historic_Centerlines.mxd Date Saved: 5/15/2015 Author: HUSKKE CDMSmith



South Platte River Restoration Master Plan
 Appendix B - Figure B-29: Historic Streamlines | Map Index Page 9



Appendix C

Draft

Appendix C – Effective Discharge Calculations

C.1 Introduction

Effective discharge is commonly defined as the discharge that transports the largest portion of the annual sediment yield over a period of years (Andrews 1980). CDM Smith performed an effective discharge calculation for the South Platte River near the City of Evans to predict the impact of alteration of watershed conditions with respect to sediment loads and hydrology on channel stability.

C.2 Flow Adjustment

The Kersey gage is located downstream of Evans and below the confluence with the Poudre River. A flow adjustment is necessary to more accurately depict the flows in the South Platte River through Evans. The flows at the Kersey gage were scaled using a ratio of the watershed areas of the Poudre and the South Platte rivers. The total watershed area for the South Platte River at the Kersey gage is 9,659 square miles. The total catchment area of the Poudre River at the Greeley Gage (3 miles upstream of the confluence with the South Platte River) is 1,890 square miles. Subtracting the area of the Poudre River from the total area of the South Platte River at the Kersey gage and then dividing that result by the total watershed area results in a ratio of 0.80. This ratio was applied to all flows in the period of record at the Kersey gage.

C.3 Frequency of Occurrence

To calculate the effective discharge, a curve describing the relationship between frequency of occurrence and discharge was developed. This analysis requires that the curve have only a single peak and a bin analysis was executed to generate this curve. A bin size of 150 CFS produced a curve with a single peak. Smaller bin sizes produced curves with multiple peaks (Figure C-1).

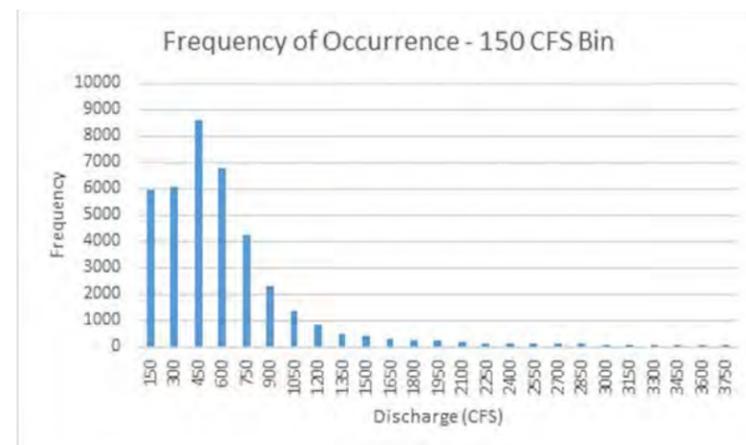


Figure C-1 Frequency of Occurrence

C.4 Transport Rate

Two locations were chosen to calculate the sediment transport rate through the project area: one location upstream of the Highway 85 Bridge and one location downstream of Riverside Park in the City of Evans were chosen. Using the HEC-RAS model developed by FEMA, the cross section selected for a point upstream of US Highway 85 was 4692.511. The cross section selected for downstream of Riverside Park was 2740.38. The Hydraulic Design feature in HEC-RAS was then used for calculating the sediment transport capacity using the Yang equation. This transport rate calculation method requires the user to enter particle size; however, as no site specific particle size data were available, the analysis was performed using gradations for medium sand and coarse sand, which are reasonable approximations of the sediment characteristics in the South Platte River, as defined by the USACE in the manual for the HEC-6 program (Table C-1). This calculation is also sensitive to variations in water temperature and was therefore run using three different temperature scenarios: 55° F, 65° F, and 75° F, which represent typical water temperatures along the South Platte River.

Particle Size	Temperature °F
Medium Sand	55
Coarse Sand	65
	75

The HEC-RAS model was developed to run using the flows determined by the midpoint of each of the bin sizes previously calculated. For example, the flow input incorporated for the 0-150 CFS bin was 75 CFS. Running the HEC-RAS model produced the sediment transport rate at each cross section location under different flow rates. Figure C-2 and Figure C-3 show the results of one sensitivity analysis at each location.

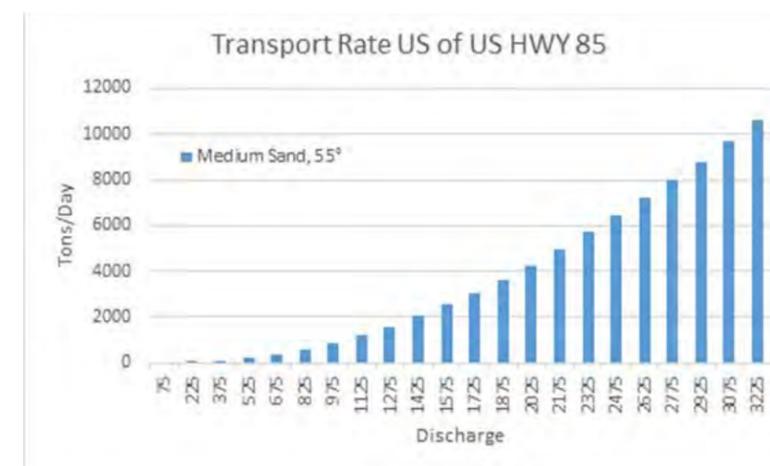


Figure C-2 Transport Rate Upstream of Highway 85

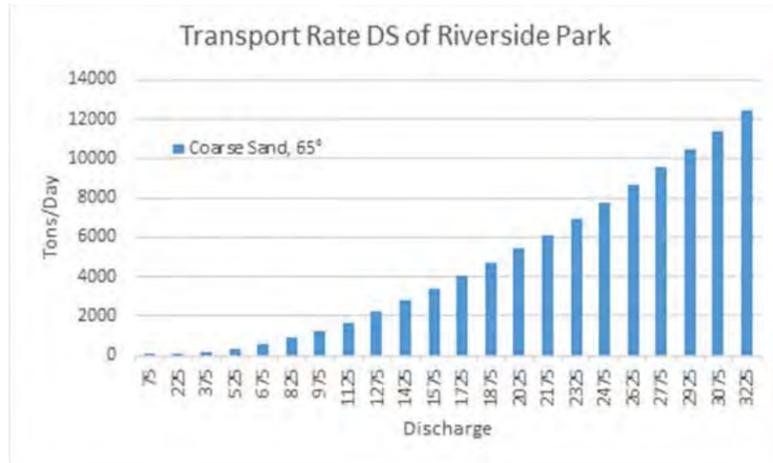


Figure C-3 Transport Rate Downstream of Riverside Park

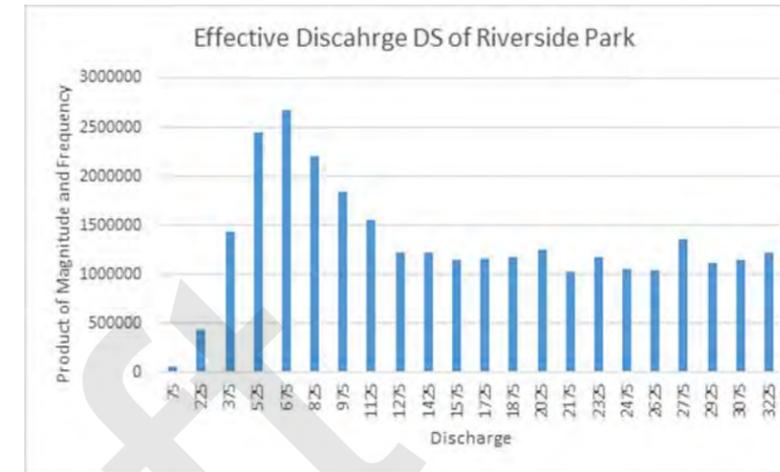


Figure C-5 Effective Discharge Downstream of Riverside Park

C.5 Effective Discharge

Effective discharge is the product of the magnitude of the sediment transport rate and the frequency of discharge. By multiplying the curves described in the previous 2 sections, the effective discharge curve can be plotted. The peak of this curve is the effective discharge. Each curve developed in the sensitivity analysis of the sediment transport rate was tested to see if it changed the effective discharge. In all cases the effective discharge remained the same. The resulting effective discharge calculated at both locations is 675 CFS (Figure C-4 and Figure C-5).

This flow has an AEP of 25 percent (based on flow adjustment at the Kersey Gage), or approximately the 4-year flood. Typical effective discharges are closer to an AEP of 50 percent or the 2-year flood. This means the river moves less sediment now than it probably did pre-Chatfield Dam when the hydrology was not constrained. This change at least partially explains the deposition that occurs in the river.

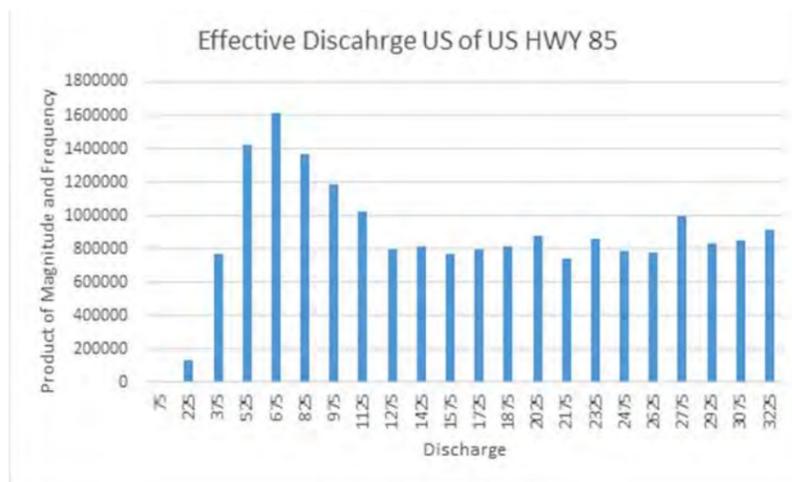
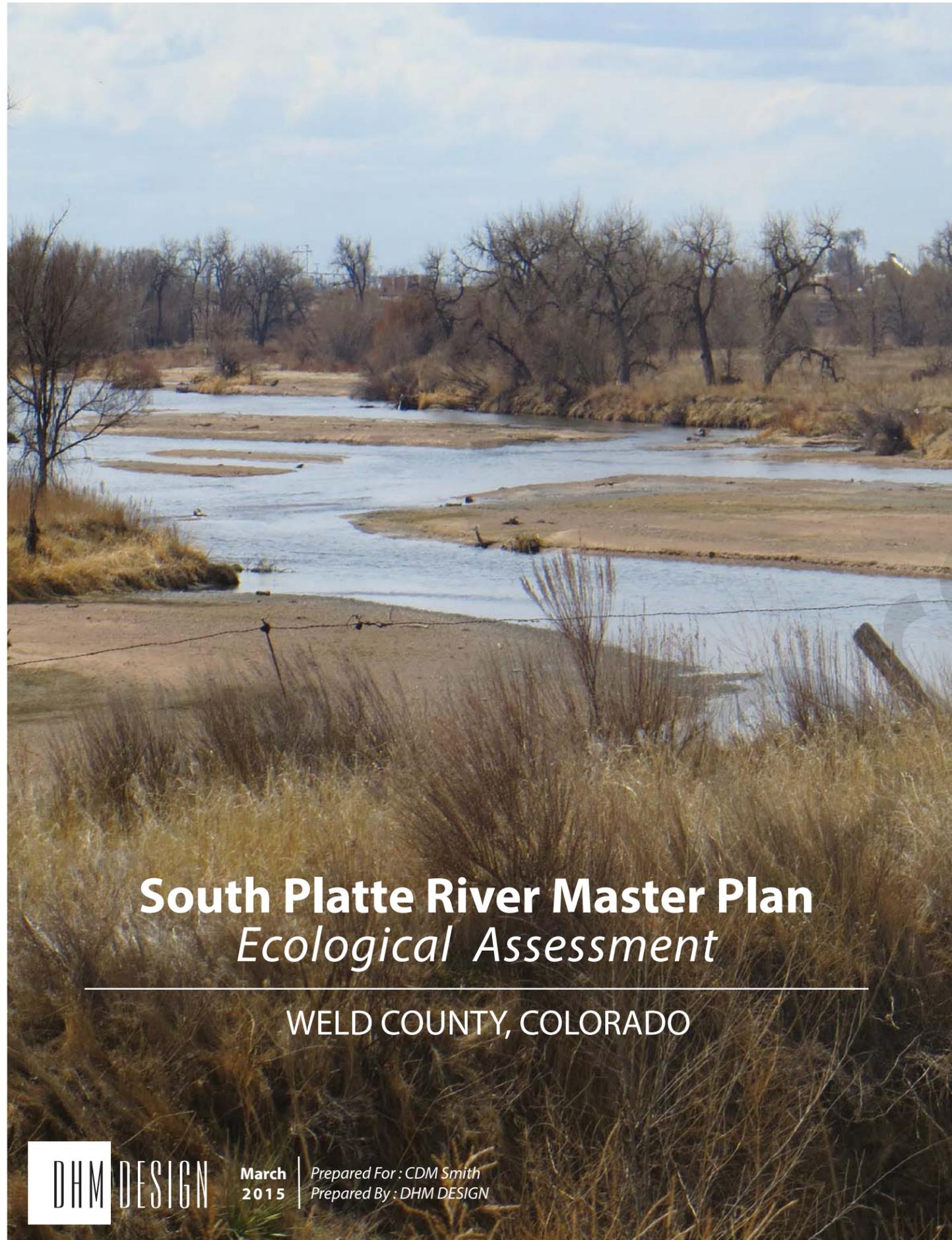


Figure C-4 Effective Discharge Upstream of Highway 85

Draft



South Platte River Master Plan *Ecological Assessment*

WELD COUNTY, COLORADO

DHM DESIGN

March
2015

Prepared For : CDM Smith
Prepared By : DHM DESIGN

Table of Contents

Table of Contents	1
1. INTRODUCTION	3
2. HISTORICAL CONDITION	3
3. CURRENT CONDITION	3
4. METHODS	7
5. RESULTS	9
5.1 Reach Observations	10
5.1.1 Reach 1	10
5.1.2 Reach 2	10
5.1.3 Reach 3	11
5.1.4 Reach 4	11
5.1.5 Reach 5	11
5.1.6 Reach 6	11
5.1.7 Reach 7	12
5.1.8 Reach 8	12
5.1.9 Reach 9	12
5.1.10 Reach 10	13
5.1.11 Reach 11	13
5.1.12 Reach 12	13
5.1.13 Reach 13	13
5.1.14 Reach 14	14
5.1.15 Reach 15	14
5.1.16 Reach 16	15
5.1.17 Reach 17	15
5.1.18 Reach 18	15
6. RECOMMENDATIONS	16
6.1 GENERAL RECOMMENDATIONS	16
6.2 SPECIFIC RECOMMENDATIONS	17
7. CITATIONS	22
APPENDIX 1. Datasheets and Site Photos	25

Reach 1	25
Reach 2	28
Reach 3	32
Reach 4	36
Reach 5	40
Reach 6	44
Reach 7	48
Reach 8	51
Reach 9	55
Reach 10	59
Reach 11	63
Reach 12	67
Reach 13	71
Reach 14	77
Reach 15	81
Reach 16	85
Reach 17	89
Reach 18	92

1. INTRODUCTION

The South Platte River Watershed covers around 24, 300 square miles within Colorado, Wyoming and Nebraska and runs approximately 450 miles from the headwaters, located in the central mountains of Colorado, and continues across the Great Plains to the confluence with the North Platte River (NRCS, 2014). The South Platte River corridor contains a diversity of ecosystems, initially passing through mountain forests before transitioning to the Front Range of Colorado where it continues through urban and industrialized regions and then continues to the agricultural and open range regions of the plains. The study area of this project focuses on the main stem of the South Platte River located in the plains of Colorado, between the confluence of the South Platte River and Saint Vrain Creek, and the confluence of the South Platte River and Cache La Poudre River (Figure 1). Both Saint Vrain Creek and The Cache La Poudre River are major tributaries to the South Platte River. A third major tributary, the Big Thompson River, also joins the South Platte River in this reach. The study area is approximately 20 miles long and divided into 18 reaches, based on structures, geomorphic features, riparian zones and land use (CDM Smith, 2015). This section of the South Platte River is influenced by dense urban centers upstream and mixed urban and agricultural development along the study area. These influences have impacted stream channel development, riparian areas, water quality, and terrestrial and aquatic wildlife within the river corridor. The completion of this ecological assessment of the South Platte River will assist in identifying the ecological risks based on constraints of the system, facilitate in developing project prioritization, and potential locations for stream restoration projects.

2. HISTORICAL CONDITION

Historical conditions of the study area at the turn of the century were drastically different from what the South Platte River is today. The natural vegetation of the plains surrounding the South Platte River was shortgrass prairie with a mix of low sand sage hills and patches of cottonwood and willows with a broad, braided river channel creating a mosaic of braided channels and islands (Mutel and Emerick, 1984). Around 1900, woodland expansion of cottonwood (*Populus deltoides*) began in correlation with development of irrigation canals and reservoirs for water storage. Lower peak flows promoted seed germination of cottonwoods and vegetative growth by willows in areas previously unsuitable due to higher flows. Lack of ice flows reduced mortality of young cottonwood and willows along shorelines. The abrasive action of the ice would prevent seedlings to be established. The alteration in the high-flow and ice-disturbance regime created by the development of water resources formed an imbalance, allowing woodland to replace extensive areas of active channel. By the late 1930s, vegetation had occupied most of the river channel (Kittel et al., 1998). In turn, with more vegetation present, the river channel became narrower. As of 1969 no significant declines in channel area have occurred due to woodland expansion, and by 1986, channel to woodland proportions were relatively uniform throughout the Platte River system (Johnson, 1994). This unique adaptation to lower flows, compared to most western rivers, created a new stable system.

3. CURRENT CONDITION

The dynamic nature of the South Platte River and effects of land uses adjacent to the river have had impacts to the modern river corridor including channel morphology, stream hydrology, water quality, riparian area, and wildlife resources.

Currently the South Platte River, within the study area, contains a highly modified floodplain that is largely disconnected from the river. Large stretches of the river have been channelized through the installation of rip-rap and other structures to armor the banks to prevent further erosion. Armored

banks often increase velocities due to a lack of riparian vegetation, which help dissipate flows, and lead to erosional issues further down the stream.

Changes to hydrology due to diversions, off-channel reservoir development, and transcontinental divide water supplementation have altered a natural flow regime. These changes can affect both aquatic and terrestrial wildlife that depend on riparian zones for refuge, breeding, and rearing of juveniles. *Table 3.1* contains a list of species found in the South Platte study area previous to 1998 and post 1998. Loss of spawning and rearing habitat due to loss of connectivity to the floodplain and restriction of movement due to diversion structures are partially responsible for losses of some of these species in this stretch of river (CPW, 2015).

Table 3.1 Fish Species List

Species	Native/Introduced	Special Status	Pre-1998	Post 1998
orangespotted sunfish	N	State Special Concern Species	X	
suckermouth minnow	N	State Endangered	X	
brassy minnow	N	State Threatened	X	
plains topminnow	N	State Threatened	X	
black bullhead	N		X	
bigmouth shiner	N		X	X
channel catfish	N			X
creek chub	N		X	X
fathead minnow	N		X	X
gizzard shad	N		X	X
longnose sucker	N		X	X
longnose dace	N		X	X
plains killifish	N		X	
red shiner	N		X	X
sand shiner	N		X	X
green sunfish	N		X	X
white sucker	N		X	X
black crappie	I		X	
bluegill	I		X	X
brook stickleback	I		X	X
common carp	I		X	X
largemouth bass	I		X	X
western mosquitofish	I			X
plains killifish	I			X
rainbow trout	I		X	
redside shiner	I		X	
walleye	I		X	
white crappie	I		X	X
yellow perch	I		X	

Upstream water quality is severely degraded as it flows through Denver and the urban industrial corridor to the north. Pollutants are diluted, by several mountain tributaries that enter north of Denver, and then return to concentrated levels below Greeley due to agricultural runoff (Kittle et al. 1998, USGS 1993). The South Platte River through this reach is listed as 303d impaired water, based on the Clean Water Act, due to high selenium levels and is rated as a low priority (CDPHE, 2014).

The lack of an intact riparian area along the South Platte River is detrimental to overall stream health. Retaining riparian vegetation of proper width not only minimizes the impacts of erosion and nonpoint source pollution, but these areas also provide habitat and movement corridors for wildlife as well as benefits to fish populations (Fischer, 2000). The majority of the current riparian area consists of a single generation of cottonwood trees produced from changes in hydrology around the turn of the century with little regeneration. The riparian area appears to be narrowing, due to trees dying on the outer edges of the floodplain and not being replaced by regeneration (Kittel et al. 1998, Johnson 1994). Within time the corridor will become narrower along an increasingly channelized river (Johnson, 1994). Birds that are neotropical migrants, those that migrate south to wintering grounds, use riparian buffers and corridors for breeding and wintering habitat as well as stop-over habitat during spring and fall migration. Eighty-two (82) percent of bird species in Colorado nest in riparian habitats and are riparian obligates, which require the presence of quality riparian habitat for successful reproduction (Fischer, 2000). A list of mammal, bird, reptile and amphibian species are found in Centennial State Wildlife Area, and occupy or use riparian areas are in *Table 3.2*, *Table 3.3*, and *Table 3.4* respectively. Centennial State Wildlife area is approximately 8 miles of the east of reach 18, and species will be relatively similar (CPW, 2015).

Table 3.2 Mammal Species Found Within the South Platte Corridor

Endangered and Declining Species	Non-Endangered Species
Eastern Mole--Scalopus aquaticus	Ord's Kangaroo Rat--Dipodomys ordii luteolus
Eastern Spotted Skunk--Spilogale putorius interrupta	Plains Pocket Mouse--Perognathus flavescens flavescens
Prebles Meadow Jumping Mouse - Zapus hudsonius preblei	Silky Pocket Mouse--Perognathus flavus bunkerii
Swift Fox--Vulpes velox	Eastern Cottontail--Sylvilagus floridanus
	Black-tailed Jackrabbit--Lepus californicus
	Meadow Vole--Microtus pennsylvanicus
	Mule Deer--Odocoileus hemionus
	Little Brown Myotis--Myotis lucifugus
	Silver-haired Bat--Lasiurus noctivagans
	Big Brown Bat--Eptesicus fuscus
	Eastern Red Bat--Lasiurus borealis
	Hoary Bat--Lasiurus cinereus
	White-tailed Deer--Odocoileus virginianus
	Pronghorn--Antilocapra americana
	Red Fox--Vulpes vulpes
	Coyote--Canis latrans

Table 3.3 Bird Species Found Within the South Platte River Corridor

Endangered and Declining Species	Non-Endangered and Stable Species
American Bittern--Botaurus lentiginosus	American Wigeon--Anas americana
American Redstart--Setophaga ruticilla	Blue Grosbeak--Guiraca caerulea
American White Pelican--Pelecanus erythrorhynchos	Blue-winged Teal--Anas discors
Bald Eagle--Haliaeetus leucocephalus	Brewer's Sparrow--Spizella breweri
Baltimore Oriole--Icterus galbula	Canada Goose--Branta canadensis
Bell's Vireo--Vireo bellii	Cinnamon Teal--Anas cyanoptera
Black-billed Cuckoo--Coccyzus erythrophthalmus	Dickcissel--Spiza americana
Black-crowned Night-Heron--Nycticorax nycticorax	Gadwall--Anas strepera
Black-necked Stilt--Himantopus mexicanus	Grasshopper Sparrow--Ammodramus savannarum
Bobolink--Dolichonyx oryzivorus	Green-winged Teal--Anas crecca
Bufflehead--Bucephala albeola	Horned Lark--Eremophila alpestris
Canvasback--Aythya valisineria	Lark Bunting--Calamospiza melanocorys
Chestnut-collared Longspur--Calcarius ornatus	Mallard--Anas platyrhynchos
Chestnut-sided Warbler--Dendroica pensylvanica	Merlin--Falco columbarius
Eared Grebe--Podiceps nigricollis	Merriam's Wild Turkey--Meleagris gallopavo merriami
Eastern Bluebird--Sialia sialis	Northern Bobwhite--Colinus virginianus
Eastern Phoebe--Sayornis phoebe	Northern Shoveler--Anas clypeata
Ferruginous Hawk--Buteo regalis	Northern Pintail--Anas acuta
Field Sparrow--Spizella pusilla	Ring-billed Gull--Larus delawarensis
Forster's Tern--Sterna forsteri	Ring-necked Pheasant--Phasianus colchicus
Great Blue Heron--Ardea herodias	Swainson's Hawk--Buteo swainsoni
Great Egret--Ardea albus	
Greater Sandhill Crane--Grus canadensis tabida	
Green Heron--Butorides virescens	
Interior Piping Plover--Charadrius melodus circumcinctus	
Least Bittern--Ixobrychus exilis	
Least Tern--Sterna antillarum	
Lesser Sandhill Crane--Grus canadensis canadensis	
Long-billed Curlew--Numenius americanus	
Marsh Wren--Cistothorus palustris	
McCown's Longspur--Calcarius mccownii	
Mountain Plover--Charadrius montanus	
Northern Harrier--Circus cyaneus	
Red-headed Woodpecker--Melanerpes erythrocephalus	
Osprey--Pandion haliaetus	
Ovenbird--Seiurus aurocapillus	
Red-eyed Vireo--Vireo olivaceus	
Short-eared Owl--Asio flammeus	
Snowy Egret--Egretta thula	
Upland Sandpiper--Bartramia longicauda	
Western Snowy Plover--Charadrius alexandrinus nivosus	
White-faced Ibis--Plegadis chihi	
Willet--Catoptrophorus semipalmatus inornatus	
Yellow-crowned Night-Heron--Nyctanassa violacea	

Table 3.4 Amphibian and Reptile Species Found Within the South Platte Corridor

Endangered and Declining Species	Non-Endangered Species
Amphibians	
Northern Cricket Frog--Acris crepitans	Great Plains Toad--Bufo cognatus
Northern Leopard Frog--Rana pipiens	Chorus Frog--Pseudacris triseriata
Plains Spadefoot--Spea bombifrons	Tiger Salamander--Ambystoma tigrinum
	Woodhouses Toad--Bufo woodhousii
Reptiles	
Common Garter Snake--Thamnophis sirtalis	Eastern Fence Lizard--Sceloporus undulatus
	Many-lined Skink--Eumeces multivirgatus
	Milk Snake--Lampropeltis triangulum
	Racer--Coluber constrictor
	Short-Horned Lizard--Phrynosoma hernandesi

Riparian areas are of great importance for maintaining water quality and quantity, stabilizing stream banks, and providing habitat for fish and other wildlife species (Hansen et al. 1988). A healthy riparian area can create a transitional zone between the stream channel and the floodplain. Functioning and healthy riparian areas trap sediment, filter and buffer surface runoff, build and maintain stream banks, store floodwater and reduce the energy of floodwater, and maintain biological diversity (Manitoba Water Stewardship Division, 2014). Developing a functional riparian area with a connected floodplain will help to address some of the constraints of the South Platte River including sedimentation, riparian corridor health, wildlife habitat, and water quality.

4. METHODS

An ecological evaluation to assess the overall condition of the stream, riparian area, and instream habitats was completed using the Stream Visual Assessment Protocol Version 2 (SVAP2) developed by the Natural Resource Conservation Service (NRCS, 2009). This protocol is a qualitative assessment tool and is designed to visually assess stream corridor conditions. It was developed to be used as a tool for conservation planning, identifying potential resource concerns, project development, and to assess trends in stream and riparian conditions over time. Due to lack of public access within the project area, alternative data collection methods were utilized to complete the SVAP2 assessment. Alternative data collection methods included site visits, review of data from various agencies including Colorado Parks and Wildlife and Colorado Natural Heritage Program, aerial imagery provided by Google Earth and CDM Smith site photographs provided by CDM Smith, and personal correspondence with Colorado Parks and Wildlife and US Fish and Wildlife biologists. The evaluation was completed to identify the ecological constraints of the stream and riparian area of the South Platte River between the confluence of Saint Vrain Creek and the confluence of the Cache La Poudre River and to identify potential opportunities for riparian restoration. The 18 reaches within the study area were evaluated individually on 13 different elements (Table 4.1).

Table 4.1 SVAP2 Ecological Elements

Element	Element Criteria
Channel Condition	Evaluates the channel relative to the Floodplain
Hydrologic Alteration	Extent of change to streamflow versus a natural flow regime
Bank Condition	Stability of Banks; bank failure versus protected banks
Riparian Area Quantity	Width of riparian area in relation to bankfull width
Riparian Area Quality	Riparian plant diversity; native versus non-native; age-class
Canopy Cover	Percentage of overhanging vegetation over the stream
Water Appearance	Compares turbidity and color
Nutrient Enrichment	Evaluates for excessive algal and aquatic plant growth
Manure or Septic Sources	Sources of manure and human waste
Pools	Number and depth of pools
Barriers to Movement	Prevent movement of aquatic species; seasonally or permanently
Fish Habitat Complexity	Different types of Habitat and quantity of each
Aquatic Invertebrate Habitat	Different types of Habitat and quantity of each

Each individual element was given a score of 1-10. For riparian area quantity and riparian area quality, each side of the river was evaluated separately and the average score was recorded. The ecological element scores were averaged together to produce an ecological condition score for the reach. Data sheets with detailed field notes and photos from each reach are located in *Appendix 1*. Survey reaches were rated as follows after completion of the evaluation:

Severely Degraded – Channel has little or no floodplain connection with steep and failing streambanks, or large portions of the bank are covered with rip-rap; riparian and flood plain rarely inundated, bankfull or higher flows rarely occur, with an altered flow regime; riparian corridor is narrow or not present with large gaps in vegetation and invasive species are wide spread; water appears green and inputs from human activities present; lacks pools and habitat diversity for aquatic species; contains barriers to aquatic species movement.

Poor – Channel is actively incising with little floodplain connection, bank failures are evident, with some natural protection, fabricated structures cover more than half of the bank; riparian and floodplain inundated every 6-10 years with developments present; riparian area is slightly wider with smaller vegetation gaps and invasive plant species are common; lacks pools of significant depth and contains a small quantity of diverse habitat types for aquatic species; contains barriers that restrict aquatic species movement.

Fair – Channel and banks are moderately unstable with some natural protection, fabricated structures are less predominant, with some connectivity to the floodplain; riparian corridor with gaps of vegetation along the reach with invasive plant species present; fairly clear with less algal growth; limited habitat complexity and few pools of significant depth; contains barriers that restrict aquatic species movement.

Good - Channel and banks show signs of instability with some recovery taking place, the active channel and floodplain are connected in most areas and bankfull flows occur every 3-5 years, with little

effect on flow regime from developments in the floodplain; riparian area is wide composed of predominantly native species with few vegetation gaps; clear water with limited algal growth; pools of significant depth, separated by riffles and numerous types of aquatic habitat present; barriers seasonally restrict aquatic species movement.

Excellent - Channel and banks are stable with continuous attachment to the floodplain, bankfull flows occur every 1-2 years; riparian area is wide with diverse vegetation and various age classes; water is clear or appropriate for the system; aquatic habitat types are diverse and numerous with numerous pools; no barriers to aquatic species movement are present.

Ecological risk ratings of low, medium, and high were established from the scores produced during the ecological evaluation. Those reaches that scored 0 to 3.3 represent reaches with a high ecological risk. Reaches that scored 3.4 to 6.6 represent reaches with a medium ecological risk. Reaches that scored 6.7 to 10 represent a low ecological risk.

5. RESULTS

Individual scores for each element, overall score, and ecological risk are in *Table 5.1, Figure 5.1, and Figure 5.2*. Based on the ecological score, each reach was placed into one of the following designations based on the numerical score:

- Severely Degraded: Score of 1 to 2.9
- Poor: Score of 3 to 4.9
- Fair: Score of 5 to 6.9
- Good: Score of 7 to 8.9
- Excellent: Score of 9 to 10

An ecological risk value was designated for each reach based on the score acquired during SVAP2 evaluation and placed into the following categories (see *Table 5.1, Figure 5.1, and Figure 5.2*):

- High: Score of 0 to 3.3
- Medium: Score of 3.4 to 6.6
- Low: Score of 6.7 to 10

Restoration priority was assigned to each reach based on ecological condition, land ownership, and those areas where restoration would be effective in establishing a healthy, functioning ecological system (*Table 6.2*). Each reach was placed into the following categories:

- High: Reaches located on public property that have restoration potential and would benefit from restoration or preservation; or reaches on public property that would provide outstanding ecological benefits.
- Medium: Reaches located on private property that have restoration potential and would benefit from restoration or preservation.
- Low: Reaches located on private property that are degraded and have little restoration potential and would not benefit from restoration.

Table 5.1 SVAP2 Scores, Ecological Risk Level, and Restoration Priority																		
Reach	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Channel Condition	2	2	3	3	3	2	2	4	2	5	2	3	2	5	6	4	2	2
Hydrologic Alteration	3	3	4	3	4	4	2	4	3	5	2	2	5	4	6	5	2	2
Bank Condition	2	2	2	2	3	2	2	2	2	2	3	2	2	4	5	3	2	2
Riparian Quantity	4	3	3	4	7	3	2	2	4	2	4	2	2	3	4	1	2	3
Riparian Quality	4	6	5	4	4	2	3	6	3	4	2	3	2	3	6	2	3	2
Canopy Cover	3	1	2	1	1	2	2	1	1	5	2	2	2	2	3	1	1	1
Water Appearance	5	3	3	3	2	3	2	3	3	2	3	4	2	2	4	3	4	4
Nutrient Enrichment	4	5	4	4	6	3	2	2	2	4	2	5	4	4	5	5	2	2
Manure or Septic	6	6	4	6	6	3	2	2	4	6	2	5	3	6	6	5	2	2
Pools	3	4	2	2	2	4	2	4	2	6	4	3	3	4	6	6	6	6
Barriers to Movement	3	6	5	4	1	6	1	6	6	6	2	6	6	2	6	2	6	6
Fish Habitat Complexity	4	3	4	4	2	2	2	3	3	5	2	2	2	2	4	4	2	2
Aquatic Invertebrate Habitat	4	3	4	4	2	2	2	3	3	5	3	2	2	2	4	4	2	2
SVAP2 Average	3.6	3.6	3.4	3.4	3.3	2.9	2	3.2	2.9	4.4	2.5	2.9	3.3	3.3	5	3.5	2.8	2.8
Ecological Risk	Medium	Medium	Medium	Medium	High	High	High	High	High	Medium	High	High	Medium	Medium	Medium	Medium	High	High



LEGEND

SVAP2 Ecological Score

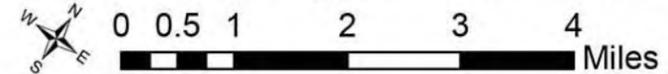
- Excellent
- Good
- Fair
- Poor
- Severely Degraded

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Figure 5.1

SVAP2 Ecological Score





LEGEND

SVAP2 Ecological Score

- Excellent
- Good
- Fair
- Poor
- Severely Degraded

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Figure 5.1

SVAP2 Ecological Score

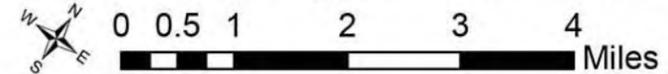




Figure 5.2

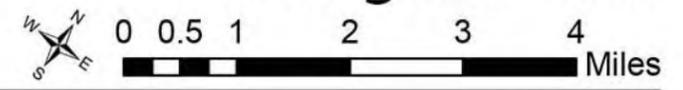
LEGEND
Ecological Risk

- High
- Medium
- Low

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Ecological Risk



The majority of the 18 reaches were rated as severely degraded and poor, with exception of Reach 15 which rated fair (Figure 5.1). Overall, the South Platte River channel is highly modified with large portions of the river bank failing. Steep banks are falling into the stream and widening, which creates point bars and deposition within the active channel. There are very few locations where there is connection to the floodplain. On average, the riparian area is fairly wide; however, there are large gaps in the vegetation along the stream bank, which decreases the riparian quality rating. The overall riparian quality through the study area also rated low due to the lack of cottonwood and willow species regeneration. Additionally, there were significant concentrations of invasive plant species present. Water quality within the study area is negatively impacted by land use practices adjacent to the river. Surface runoff from agriculture and industrial sources promote excessive algal and plant growth. Habitat for aquatic species lack diversity within the study area, and the presence of irrigation diversion structures also impact the movement of aquatic species. Reaches 1, 2, 4, 5, 10, 14, 15, and 16 rated as a medium ecological risk, while reaches 3, 6, 7, 8, 9, 11, 12, 13, 17, and 18 rated as a high ecological risk (Figure 5.2).

5.1 Reach Observations

The following section describes observations made for each reach for the following attributes: channel stability, vegetation, water quality, and aquatic species habitat.

5.1.1 Reach 1

The north bank is heavily manipulated with a highly modified channel, and predominantly gravel substrate lacking cover of any kind. The south bank contains a more intact riparian corridor with a European pasture grass understory, with groupings of sparse and intermittent *P. deltoids* and some intact *Symphoricarpos* understory. There is evidence of past agricultural pasturing activities but not recently. The middle of the reach includes more complex vegetation island systems which have a more intact vegetation complex with a mixed age over story and moderate size class diversity. *S. exigua*, *S. amygdoloides* identified as important back edge species, were found on numerous cut banks. Small off-channel wetland systems were observed in two locations. This reach should be considered important, because of confluence connectivity with Saint Vrain Creek, for potential fisheries spawning and recruitment of individuals.

Ecological Risk: Medium; Restoration Priority: High

5.1.2 Reach 2

The north bank is highly modified with significant agricultural activities in close proximity to the stream channel with little to no riparian area. The riparian is composed of a *P. deltoides* overstory with mostly declining individuals, lacking regeneration of juvenile *P. deltoides*. There is no significant understory (woody). There are significant mid-channel and side channel sandbar deposition systems that are mostly not vegetated. The south bank consists of more intact riparian corridor with woody debris and other structure found within the corridor and floodplain. Understory in south bank riparian corridor includes an intact *Bromus* grass understory from remnant agricultural applications which creates good cover. The overstory layer consists of moderate age class *P. deltoides* forest with evidence of overall decline from live canopy indicators. Woody understory is 10% of overall actual cover. There are

also significant quantities noxious vegetation within this reach including *U. parvifolia* and *Phyllaris sp.*

Ecological Risk: Medium; Restoration Priority: Low

5.1.3 Reach 3

The north bank is heavily armored throughout the reach with concrete rubble and is detached from the floodplain. The north bank has very thin, if any riparian corridor. Industry and agriculture border right along the edge of the stream. The intermittent *P. deltoides* overstory consists of mostly declining individuals. There is a shrub *S. Exigua* component that is established on some of the sand bars. The South bank riparian is somewhat wider, and contains a side channel area mid-reach with some regeneration and a fair amount of a shrub understory, with intermittent connection to the floodplain. The southern bank provides good habitat and is a potential location to reestablish a regular floodplain connection.

Ecological Risk: Medium; Restoration Priority: Medium

5.1.4 Reach 4

The north bank has a fairly wide riparian zone with an overstory canopy consisting mainly of *P. deltoides* with some parts of the reach exhibiting some regeneration; however, a large portion of the bank is heavily armored with concrete rubble and car beds. Herbaceous cover is growing between the car beds which provides for more bank stability. There is also a backwater channel that begins in Reach 5 and continues upstream into Reach 4. This backwater channel provides excellent habitat opportunities for migratory birds and amphibians. The south bank also contains a wider riparian and consists of a moderate age class *P. deltoides* through most of the corridor however there are large gaps in the overstory. Agricultural and industrial developments are within the floodplain with some adjacent to the actual channel.

Ecological Risk: Medium; Restoration Priority: Medium

5.1.5 Reach 5

The north and south bank include an intact riparian corridor and riparian woodland forest zone with even-aged and over mature *P. deltoides* making up the majority of the overstory. Riparian corridor observed is wide with an understory made up of various *graminoids* and herbaceous vegetation. Riparian corridor and floodplain are disconnected from the river channel and steep banks, especially on the south bank, are common. There is some armoring and channelization observed in mid-reach areas. Ecological conditions are generally observed to be in better condition in this reach, possibly due to the fact that this reach appears to include a large outfitter hunting operation on the north bank. This reach has significant habitat values. The channel is wide with braided channels and lacks connection to the floodplain, limiting forest regeneration.

Ecological Risk: High; Restoration Priority: Medium

5.1.6 Reach 6

This reach includes significant deposition zones with significantly incised banks of up to 15 feet. Industrial and agricultural pressures are present and overall reach is in a declined condition. *P. deltoides* overstory is intermittent on both banks, but significantly wide on north bank. All individuals are over mature and in general decline. There is a high incidence of state and county listed noxious vegetation within reach. This reach has high potential,

especially towards the bottom of the reach along the north bank, for reconnection to the floodplain. This reach is especially affected by the upstream Highway 60 Bridge, which is causing significant deposition of gravel and sediment, and extremely high bed loads. The riparian corridor on south bank is fairly wide at the top of the reach but becomes very thin with developed agriculture directly adjacent to riparian zone.

Ecological Risk: High; Restoration Priority: Medium

5.1.7 Reach 7

This reach is heavily armored with intensive agricultural operations in close proximity. The north bank has little to no riparian corridor until the middle of the reach. Gravel deposition in this reach is almost 200 yards wide in many locations. The south bank has an intact riparian corridor in most locations consisting of a *P. deltoides* overstory with *S. exigua* understory on the river banks and pasture complex grasses located farther back from the river as an understory. Very little recruitment or regeneration of *P. deltoides* was noted within this area. Proximity to high intensity agriculture and significant channel manipulation makes this a low quality habitat and riparian zone for species movement. The downstream portion of the reach is affected by a diversion which creates a wide deposition zone with very little opportunity for upstream fish passage.

Ecological Risk: High; Restoration Priority: Low

5.1.8 Reach 8

This reach consists of an extremely wide river channel with multiple braids, sand bars, cobble bars, and islands, which is a somewhat close equivalent of what the historic South Platte might have looked like. Towards the bottom of the reach, the riparian corridor is functioning at a high level with excellent width on the north bank and good buffering from low density residential uses beyond. The south bank area provides good quality habitat, with quality backwater and instream wetland complexes including ephemeral ponds and channels. The overstory and understory vegetation includes examples of native species, especially a number of native woody shrubs. This reach also includes the confluence of the Big Thompson River and the South Platte River. The location of the confluence includes an excellent riparian corridor and provides for good quality fishery and aquatic systems. This reach would be a high priority for preservation of existing ecological conditions and future restoration potential for many natural resource criteria.

Ecological Risk: High; Restoration Priority: High

5.1.9 Reach 9

This reach includes a river channel that is deeply and drastically incised, which disconnects the riparian corridor from the river. The south bank portion has 12- to 15-foot vertical banks at the river's edge throughout the reach. The riparian corridors on both sides of this reach are currently utilized for agricultural uses including horse pasturing, which limits the height or function of grasses or herbaceous vegetation for wildlife use. There are intermittent stands of *P. deltoides* that are quite tall and large on this reach and creates avian habitat. The riparian forest in this area is mostly over-mature, however, the condition of individual trees is good. A high bedload with significant amounts of fine sediments are found within the channel of this reach. The south bank contains good cover with little bare ground.

Ecological Risk: High; Restoration Priority: Low

5.1.10 Reach 10

This reach includes very high quality riparian areas and areas of good in-stream fish habitat. There are many areas of heavily armored banks, consisting of car bodies and concrete, yet there are many other areas where in stream channel includes backwaters, eddy, woody debris, and other aquatic habitat elements. There is significant terrestrial habitat for amphibians and reptiles within this reach, including observed wetlands, ephemeral wetlands, back-channel stream threads, and off-channel open water. The riparian corridor on this reach, particularly the north-channel, has a very wide riparian corridor with an intact overstory of *P. deltoides* and a number of other tree species (*Fraxinus*, *Acer*, and *Salix*). In many areas of this reach, the understory is in excellent condition with native *graminoids* and herbaceous species. Other areas of this reach are not as intact and include noxious vegetation. This reach has excellent potential for restoration and preservation of in-channel and riparian corridor functions. This reach is adjacent to a state wildlife area which makes management actions and restoration a viable alternative.

Ecological Risk: Medium; Restoration Priority: High

5.1.11 Reach 11

This reach is highly modified by human intervention and includes massive sedimentation, channelization, and floodplain manipulation with multiple styles and densities of rip-rap and armoring. The south bank of this reach has very little to no riparian corridor in multiple locations, with industry directly adjacent to the channel. The north bank has a higher density of riparian forested zones and includes a high density of moderate aged *P. deltoides* individuals and stands. This area also includes significant amounts of debris and general abandoned materials. The condition of this reach is driven by the high density of bridge infrastructure at the downstream boundary. This reach also contains a diversion structure that restricts aquatic species movement.

Ecological Risk: High; Restoration Priority: Low

5.1.12 Reach 12

This reach of the river is dominated by Evans Riverside Park and associated improvements on the north bank of the reach. The reach is also dominated by the downstream sedimentation associated with upstream infrastructure of multiple bridges. The corridor on the north bank is heavily modified with armoring infrastructure and channelization. There is a significant element of non-native overstory within this reach (*U. parvifolia*) and low habitat values. In channel habitat and conditions are low and degraded with very little aquatic or fishery habitat. The south bank portions of the reach have higher ecological values and a more intact riparian corridor associated with a multi-aged and multi-sized overstory dominated by *P. deltoides*. This reach has potential for restoration and management considerations, mostly because it is a publically owned resource. The opportunity for restoration of floodplain connections, riparian corridor quality, and long term management is high.

Ecological Risk: High; Restoration Priority: High

5.1.13 Reach 13

The majority of this reach of the river is heavily channelized and armored. Armoring

includes significant structure such as cars and concrete. The north bank is severely degraded with very low habitat value. Mid reach, the north bank condition improves with better age class diversity of *P. deltoids* and density of stands, as well as width of the riparian corridor. The heavily armored portions of the bank through this reach include areas where there is very little opportunity for connection to the floodplain. In channel zones include significant modification from heavy deposits of sedimentation, downstream from bridge structure. The north bank, for some portions of the reach, has higher ranked ecological values than the south bank, however it is still heavily influenced by adjacent agriculture, oil and gas development, and it is directly adjacent to high density residential and high density temporary housing. There were some back-channel wetlands and newer scoured ephemeral wetlands discovered in the vicinity of Brower State Wildlife Area. The opportunities to utilize this publically owned resource for potential restoration and long term management considerations is an important opportunity. There were many potential modifications noted within this reach that could reconnect the floodplain and achieve some natural hydrologic cycles connected to the historic watershed presence.

Ecological Risk: Medium; Restoration Priority: High

5.1.14 Reach 14

This reach consists of significantly incised banks and is influenced by high intensity agricultural, and industry infrastructure such as roads and facilities. The riparian corridor is intermittent and cover is varied in terms of species height, age class, and species diversity. There are some areas where the riparian width begins to connect to fairly appropriate widths, and other zones where the corridor is quite narrow. The general conditions of the corridor are predominantly better on the north bank with intact *P. deltoides* riparian forests, however, there is very little recruitment or regeneration occurring due to disconnection with the river channel. There is a historic channel on a significant portion of the south bank which has been disconnected from the river, but has good characteristics related to off channel wetlands and potential wildlife habitat. A diversion located at the top of the reach restricts aquatic species passage.

Ecological Risk: Medium; Restoration Priority: Medium

5.1.15 Reach 15

There are many characteristics of this reach of the river that make it one of the higher quality reaches within the study area. There is good connection and accessibility to the floodplain, excellent soil resources, and excellent age class diversity of the dominant overstory which includes active recruitment and dynamic age class systems, good herbaceous cover, good woody shrub understory consisting of *Salix*, *Fraxinus*, *Acer*, and others. This reach of the river has had much less human intervention than the majority of the other reaches. Agricultural activities on the north bank are at an appropriate distance away, and Colorado Department of Transportation managed lands make up the majority of the south channel corridor. Although this is one of the shorter reaches within the study area, it is one of the best examples of both in-channel, floodplain, and riparian health within the study zone. This reach would be a good anchor for restoration activities or for a relatively good baseline reach context for “moderate” condition, as opposed to many of the other reaches that are described as “poor” or “severely degraded.”

Ecological Risk: Medium; Restoration Priority: High

5.1.16 Reach 16

This reach is a transition zone from areas of low modification to areas of very high modification of the channel and river banks. The north bank consists of a riparian corridor with a moderate aged overstory and a very poorly developed understory. Overall, the north bank of this reach extends from areas of fairly intact herbaceous cover to very little intact herbaceous cover and significant noxious vegetation with influences from residential and agricultural areas adjacent to the stream. The south bank has more diversity with a wide stretch of riparian corridor consisting mainly of an overstory of *P. deltoides*. No recruitment or regeneration within this reach was noted. In the middle portions of the reach, the south bank riparian zone transitions to a thin riparian area consisting of mostly bare ground. There are examples within this stretch of good habitat and values. The instream conditions of this reach are varied and include some examples of viable fish habitat in a number of deeper holes backwater areas. There is not a significant amount of habitat, however, in the majority of the channel sections in this reach.

Ecological Risk: Medium; Restoration Priority: Low

5.1.17 Reach 17

This is a highly modified reach with significant deposition within all areas of the reach that defines the lack of significant aquatic habitat. There is evidence of significant channel manipulation and heavy bank stabilization techniques. In addition, both sides of the channel include agricultural infrastructure adjacent to the channel and within the limited riparian corridors. There are some intact and intermittent stands and forest cover types within the reach that consist of primarily *P. deltoides* and *S. amygdolides*. Most of this coverage is broken or segmented.

Ecological Risk: High; Restoration Priority: Low

5.1.18 Reach 18

The final reach of the study area is very similar in condition and context to Reach 17, in that it is highly modified. However, this reach is even more impacted by these activities and includes very thin riparian corridors with large gaps in riparian vegetation. The instream components and channel qualities are low quality habitat with very little pooling, water quality inputs, significant amounts of algae, and very little structure for fish habitat. This reach includes the confluence of the South Platte River and the Cache la Poudre River, which provides unique and important ecological restoration and management considerations. The location of the confluence within this reach has the highest quality areas of riparian forest and in-channel aquatic habitat and has potential for preservation and restoration. Similar to the two other important confluence areas found within the study area. In addition this reach is adjacent to a State Wildlife Area along the north bank, which will allow for more flexibility with management, stewardship, and restoration.

Ecological Risk: High; Restoration Priority: Low

6. RECOMMENDATIONS

The ecological assessment score, ecological risk score, data collected during site visits and visual observations have guided the general and specific recommendations provided in *Table 6.1* and *Table 6.2*. Ecologically, some reaches have a higher potential for preservation and restoration activities; however, land ownership, adjacent land use, and stakeholder interests also influence which areas can effectively be restored. Reach restoration priority level is shown in *Table 6.2* and *Figure 6.1*. Ideal areas within each reach for restoration are those where the riparian corridor is fairly intact, historic side channels and wetlands were previously existed and located on public lands such as Riverside Park, Colorado Parks and Wildlife State Wildlife Areas, and Colorado Department of Transportation Right Of Ways. Areas that are also of interest for restoration are those stretches of the river where there is stakeholder and land owner interest. Restoration efforts of these areas will have positive effects to the hydrology, ecology, and physical character of this reach of stream.

6.1 GENERAL RECOMMENDATIONS

Throughout the study area, the floodplain is disconnected from the stream channel. A river’s floodplain is an integral part of the river’s ecosystem and performs important natural functions, including temporary storage of floodwaters, moderation of peak flows, maintenance of water quality, groundwater recharge, and prevention of erosion. Floodplains also provide habitat for wildlife, recreational opportunities, and aesthetic benefits (CRWP, 2015). Areas that have high potential for restoration efforts are identified in Section 6.2.

Table 6.1 General Recommendations for the South Platte River Study Area

Number	Recommendation
1	Reconnecting the floodplain and reestablishing a healthy robust riparian corridor will address some of the constraints of the South Platte River. Creating a riparian area that is inundated with high flows on a regular and frequent basis will promote regeneration of riparian species and overall riparian health, reduce flow velocity, trap sediment, create habitat opportunities for aquatic species and migratory birds, filter pollutants from surface runoff from surrounding land uses, and overtime the active channel will narrow and increase velocity within the channel to help with bedload transport. Due to the varying degree the channel is incised reattachment of the floodplain will vary in difficulty. Decreasing the grade of the bank and creating wetland benches with natural vegetation at elevations that will see a more regular inundation schedule, will promote regeneration of woody species (<i>Salix</i> and <i>P. deltoides</i>), will create a link between the existing floodplain and channel, protect banks from future high flow events, and increase aquatic habitat diversity. Incorporation of woody debris into this process will also help to create bank stabilization and habitat diversity for aquatic species.

2	There are five diversion structures within the 20 mile study area reach. These are located in Reaches 5, 7, 11, 13, and 16. Each diversion structure presents an obstruction to aquatic species passage and aquatic species movement is restricted between diversion structures. Feasibility studies to determine potential for diversion alteration would help to determine whether or not aquatic species passage can be improved. Diversions could be retrofitted for fish passage (i.e. fish ladder), completely replaced allowing for fish passage, or removed if the diversion structure is no longer needed.
3	There are three confluences with major tributaries within the twenty mile study area; Saint Vrain Creek, the Big Thompson River, and the Cache La Poudre River. These confluence areas are of high ecological value and importance, and provide excellent habitat for fish species as well as avian species. The focus on protecting and restoring these key areas should be considered an essential element in future management objectives.

4	Throughout the study area reach there is an abundance of non-native and noxious vegetation. Noxious vegetation are plants that disrupt native vegetation that have no natural controls and are able to adapt to varied climates (CSU Extension, 2015). An integrated weed management plan should be designed to implement mechanical, chemical, and biological controls if available to manage the noxious vegetation within the study area. Reaches 2, 3, 6, 10, 12, 17, and 18 had a higher incidence of noxious vegetation and should be addressed as higher priority for a noxious vegetation plan.
---	---



Figure 6.1

LEGEND

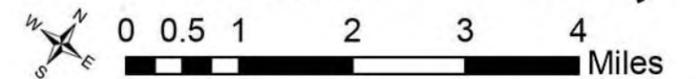
Restoration Priority

- Low
- Medium
- High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Restoration Priority



6.2 SPECIFIC RECOMMENDATIONS

Individual recommendations for each reach are presented in *Table 6.2*. Reaches 1, 8, 10, 12, 13, 15, and 18 are considered to have high potential for restoration efforts

Table 6.2 Individual Reach Recommendations

Reach Number	Recommendations	Priority Level
1	<p>The top of Reach 1 contains the confluence with St. Vrain Creek, making it a high priority reach for restoration particularly the confluence area. The north bank riparian area is thin and lacks vegetation in general and reconnecting the floodplain in the area between the two rivers would benefit wildlife greatly.</p> <p>The lower portion of Reach 1 also is a high priority location because of two pre-existing small off channel wetland systems along the south bank. Based upon the amount of bare ground on the north bank near the bottom of the reach, wetland plantings, and reattachment of the floodplain could help to trap sediment in this area (<i>Figure 6.2.1</i>).</p>	High
2	<p>Reach 2 would benefit from floodplain reconnection through wetland benching particularly along the south bank where the riparian corridor is intact but lacking regeneration of woody species. The present <i>P. deltoides</i> overstory is overall in decline.</p>	Low
3	<p>Mid-Reach 3 maintains a potential site for connection of the floodplain due to existing off channel wetland and side channel areas in place. Promoting the health of these areas and creating a wetland system that is regularly inundated would benefit aquatic and terrestrial wildlife greatly (<i>Figure 6.2.2</i>).</p>	Medium



LEGEND
Restoration Priority Potential Restoration Areas

 Low	 Low
 Medium	 Medium
 High	 High

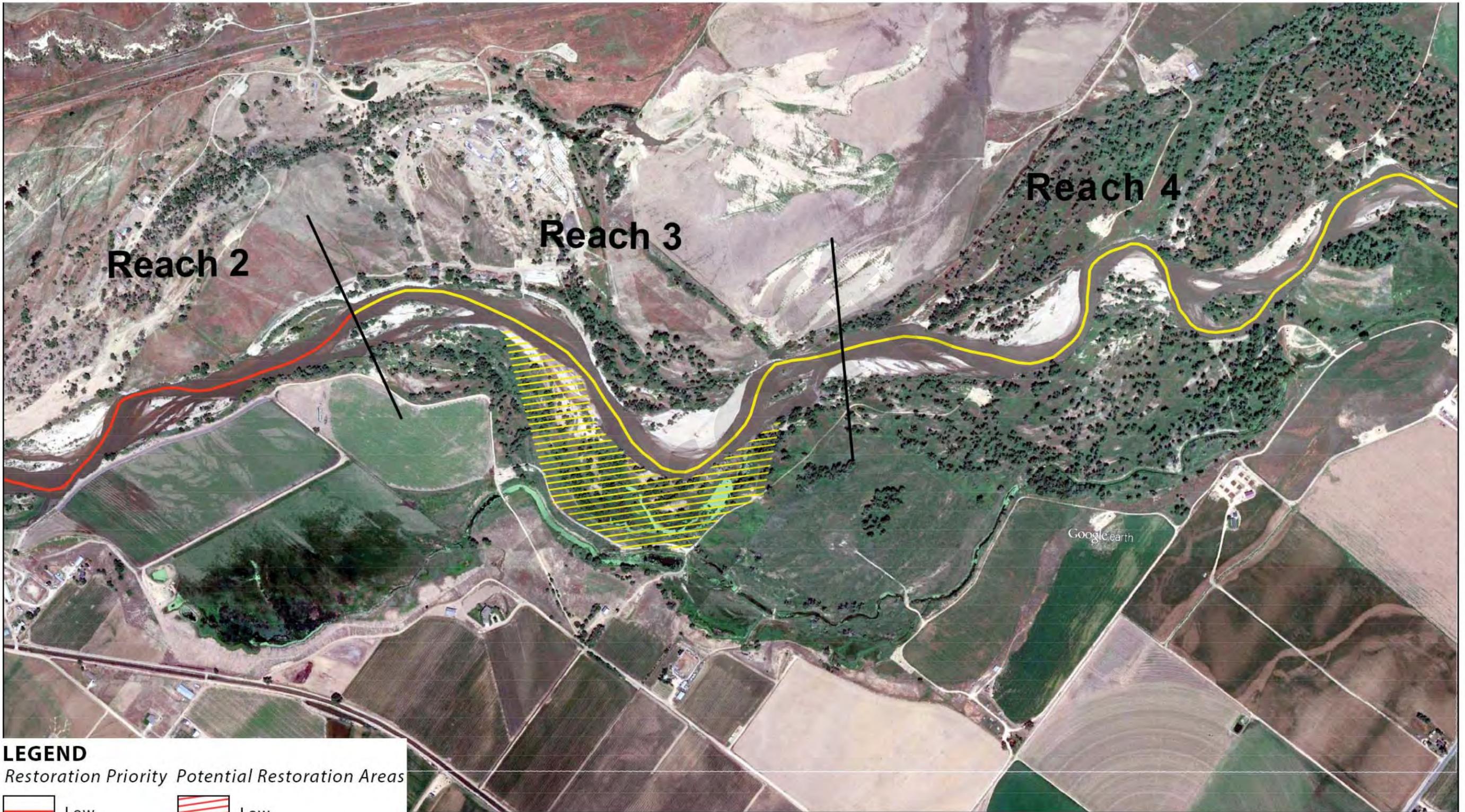
DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Figure 6.2.1



Reach 1 Restoration Areas



LEGEND

Restoration Priority Potential Restoration Areas

 Low	 Low
 Medium	 Medium
 High	 High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Figure 6.2.2



Reaches 2, 3, and 4 Restoration Areas

4	Reach 4 has moderate potential for restoration activities. A fairly long backwater channel that attaches to the river in Reach 5 and runs upstream into Reach 4 is present. A waterfowl hunting outfitter is located along this area of Reach 4 and could be interested in restoration projects.	Medium
	Reach 4 also encompasses a large amount of armored banks that could benefit from wetland planting and benching (Figure 6.2.3).	
5	Reach 5 has a wide riparian corridor which could benefit from reattachment from the floodplain. The riparian area is intact and is in better ecological condition compared to surrounding reaches. Connecting the floodplain to the channel would promote regeneration of the riparian forest, and could help with sediment deposition issues downstream near the Highway 60 Bridge (Figure 6.2.3)	Medium
6	Reach 6 is severely degraded; however, it holds high potential along the north bank for floodplain reattachment to improve the ecological condition of this reach. Challenges in this reach include oil and gas development directly adjacent to the river channel. The south bank also presents opportunities for restoration by improving irrigation return channels and developing off channel wetlands (Figure 6.2.3 and Figure 6.2.4).	Medium
7	The south bank of Reach 7 presents an opportunity to develop riparian vegetation and wetlands with side channels created by irrigation water returns. However, bank armoring, an extremely wide channel, and close proximity to agriculture make this a low priority ecologically for restoration efforts.	Low

8	The bottom of Reach 8 is the confluence with the Big Thompson River and provides another high priority for preservation of current ecological condition. This would be a good location for restoration of riparian and wetland conditions that would benefit aquatic and terrestrial wildlife species (Figure 6.2.4 and Figure 6.2.5).	High
9	This portion of the river is highly incised with collapsing and failing banks adding sediment to the bedload. Riparian benching along these vertical banks would, promote redevelopment of riparian vegetation on the north bank and reduce sediment input along the southern bank, where the majority of the reach has vertical failing banks. The degree of degradation along this reach make it a low priority ecologically.	Low
10	This reach has high potential for restoration of in-channel and riparian corridor functions due to the presence of off-channel ephemeral wetlands, and back-channel stream threads. This reach is also adjacent to Weber State Wildlife Area, which may facilitate making improvements to this reach (Figure 6.2.5 and Figure 6.2.6)	High
11	The degradation of Reach 11 is due to sediment deposition occurring within the channel. The deposition is due to the numerous bridges at the bottom of the reach. The channel is also heavily armored with different types of rip-rap. Creation of wetland benches and riparian planting could promote sediment trapping upstream of the bridges and reduce the amount of in-channel bars above and below the bridges.	Low

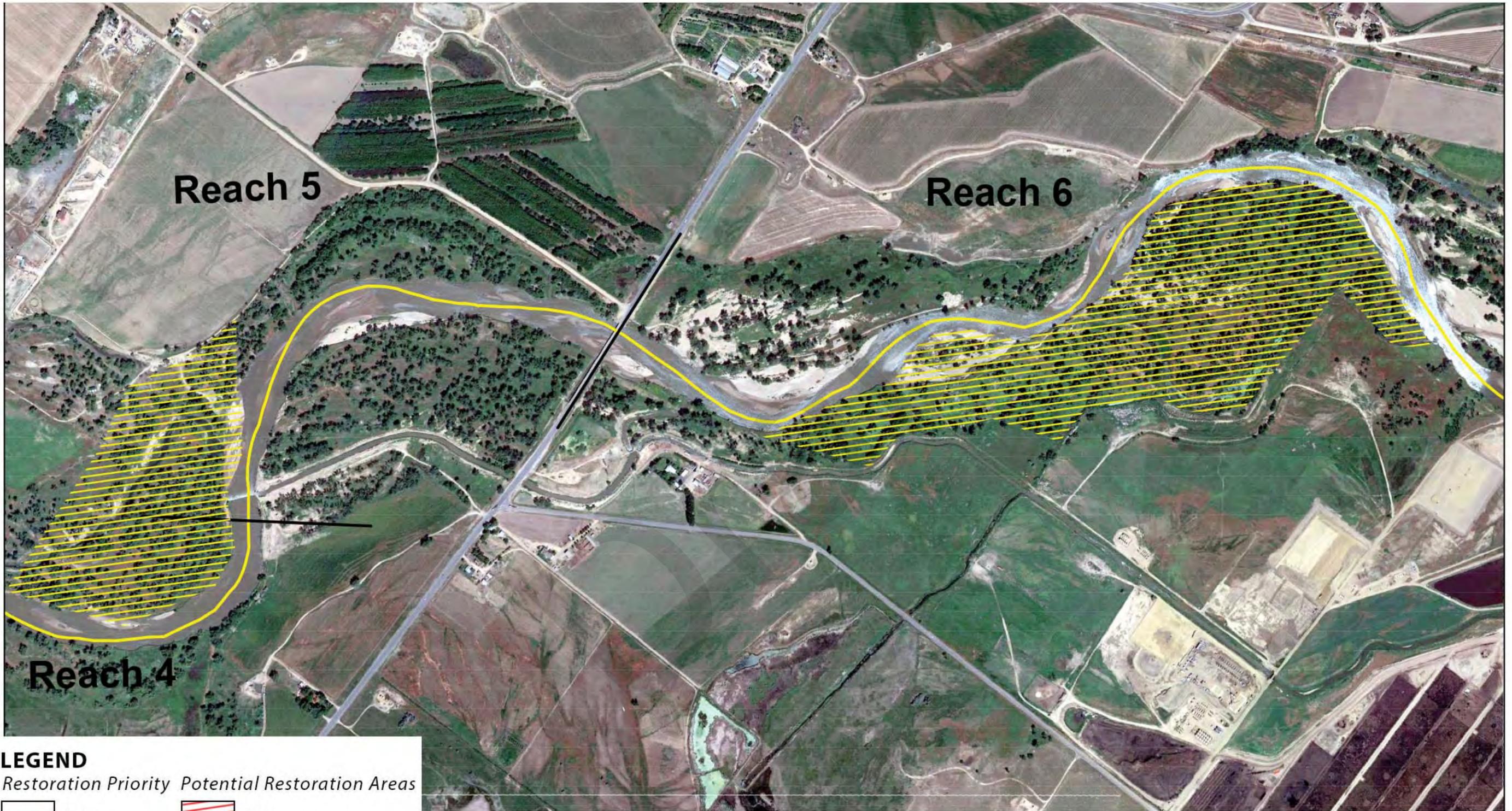


Figure 6.2.3

LEGEND

Restoration Priority Potential Restoration Areas

 Low	 Low
 Medium	 Medium
 High	 High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith



Reaches 4, 5, and 6 Restoration Areas



Figure 6.2.4

LEGEND

Restoration Priority	Potential Restoration Areas
Low	Low
Medium	Medium
High	High

- DATA SOURCES**
1. Google Earth 2014 Aerial Imagery
 2. Hydrography data from National Hydrology Database
 3. CDM Smith



Reaches 6, 7, and 8 Restoration Areas

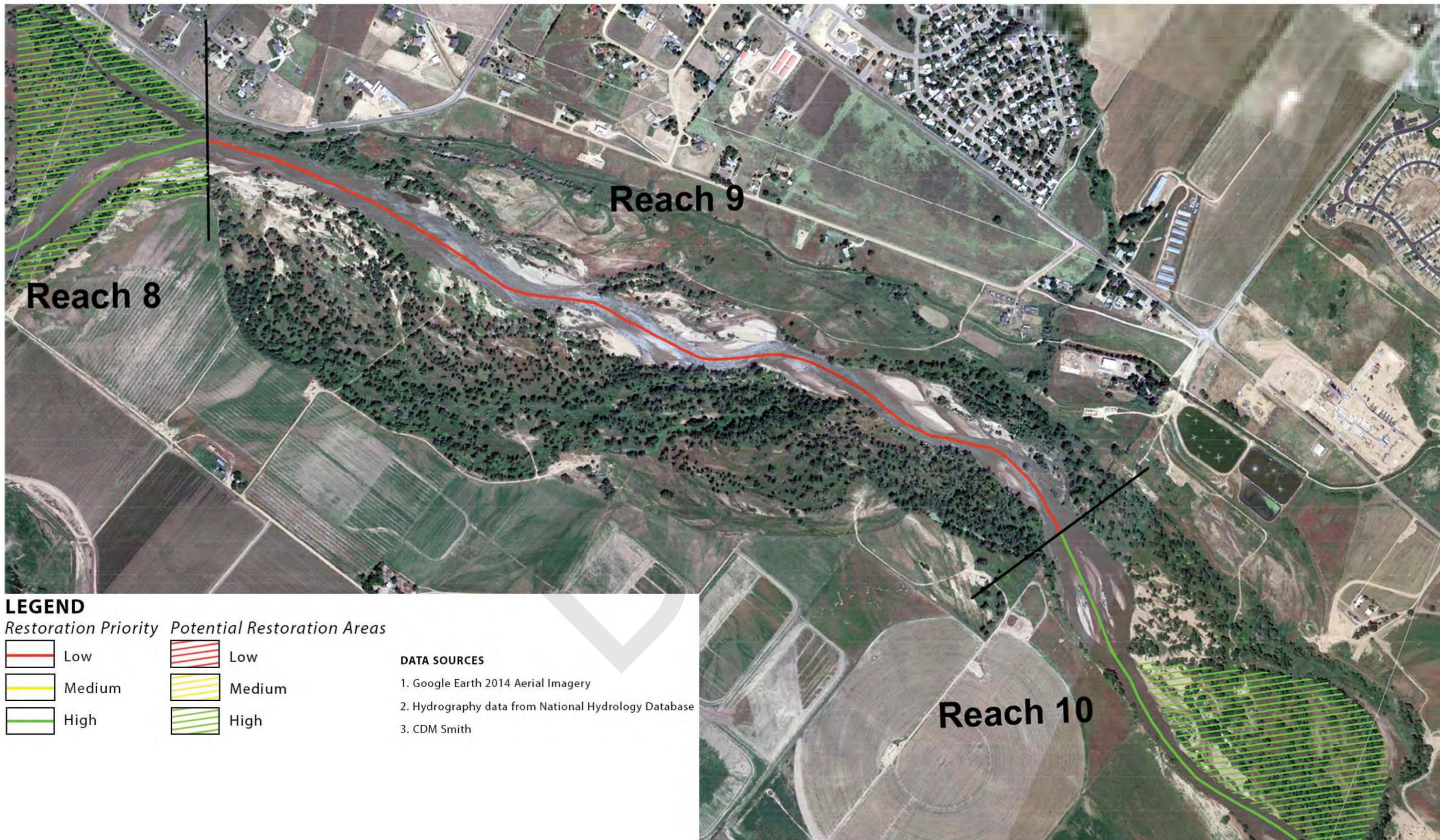


Figure 6.2.5

Reaches 8, 9, and 10 Restoration Areas



Figure 6.2.6

LEGEND

Restoration Priority Potential Restoration Areas

 Low	 Low
 Medium	 Medium
 High	 High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith



Reaches 10, 11, and 12 Restoration Areas

12	<p>Reach 12 is adjacent to Riverside Park, which makes this reach a high priority for restoration. Public land ownership will facilitate access for restoration work along this reach.</p> <p>Decreasing the grade of the river banks and constructing riparian benches with wetland species plantings could provide examples to surrounding land owners of projects that help restore the river.</p> <p>These restoration activities would also improve habitat for aquatic and terrestrial wildlife and reduce sediment deposition near the bottom of the reach at the 37th Street Bridge (<i>Figure 6.2.6 and Figure 6.2.7</i>).</p>	High
13	<p>Reach 13 is adjacent to the Brower State Wildlife Area and presents another high priority reach. Land ownership and existing back channel wetlands and newer scoured wetlands provide excellent opportunities to increase wetland habitat diversity for aquatic and avian wildlife. This could also increase recreational opportunities within the Stare Wildlife Area (<i>Figure 6.2.7</i>).</p>	High
14	<p>Reach 14 has potential for wetland development along the south bank near the end of the reach. An existing historical stream channel could provide for wetland development with floodplain reattachment along the bank (<i>Figure 6.2.8</i>).</p>	Medium
15	<p>Ecologically, Reach 15 was in the best condition and should be preserved to serve as an example of “Moderate” conditions of ecological factors. Reach 15 will be a good anchor point to begin restoration activities. There is no bank armoring and the riparian corridor is wide along both shores. This reach is located on Colorado Department of Transportation lands which also make it a high priority (<i>Figure 6.2.8</i>).</p>	High



LEGEND

Restoration Priority Potential Restoration Areas

	Low		Low
	Medium		Medium
	High		High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Figure 6.2.7



Reaches 12 and 13 Restoration Areas

South Platte River Master Plan Ecological Assessment
2015.03.26



LEGEND

Restoration Priority	Potential Restoration Areas
Low	Low
Medium	Medium
High	High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

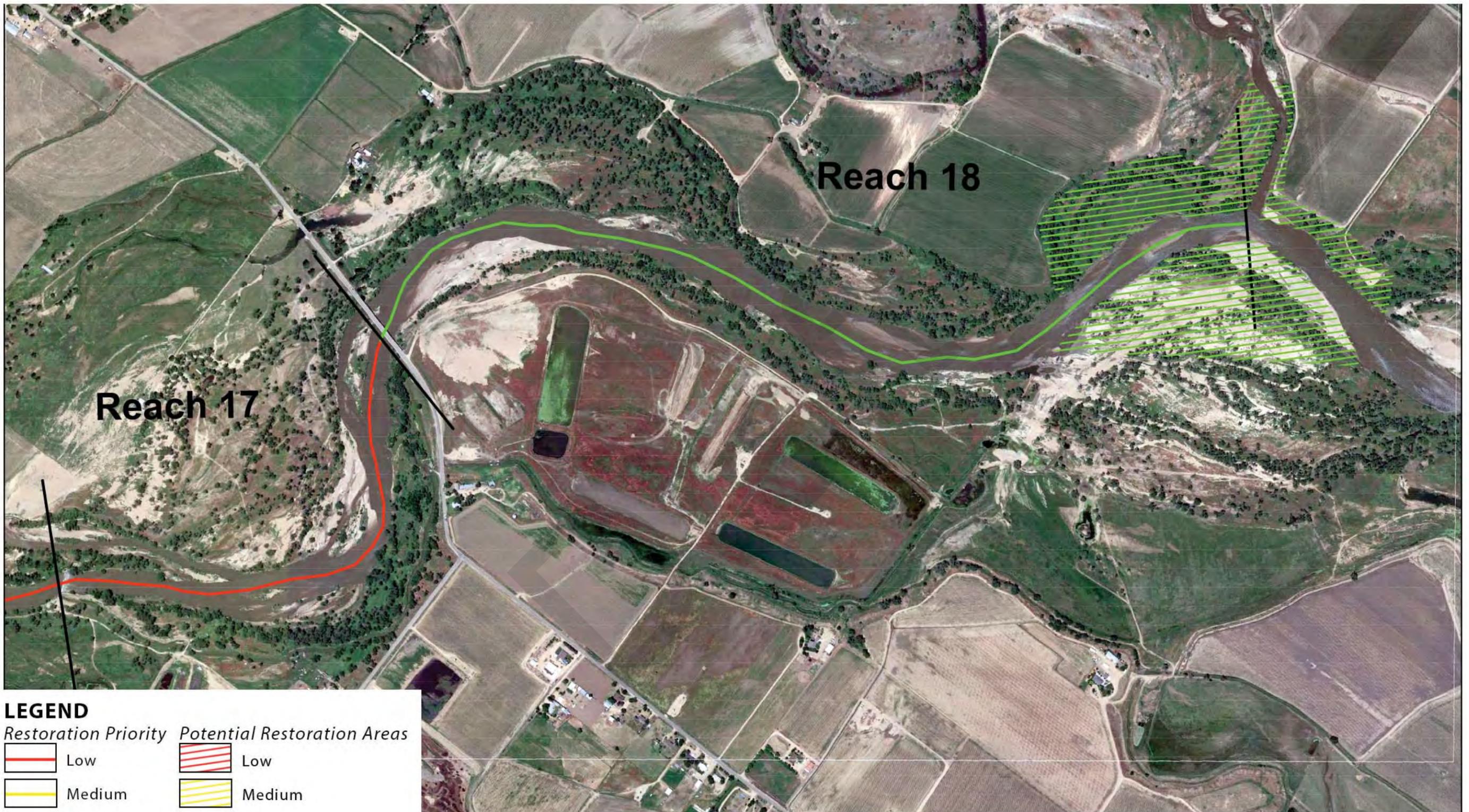
Figure 6.2.8



Reaches 14, 15, and 16 Restoration Areas

16	The riparian corridor of Reach 16 is lacking along both banks. The riparian area is thin in a large percentage of the reach and in there are large vegetation gaps. There is no regeneration or recruitment and without connection to the floodplain the decline in the riparian will continue. This reach could also benefit from some riparian species plantings. Residential and agricultural activities adjacent to the river channel will add to the difficulty of restoration activities .	Low
17	Reach 17 lacks regeneration of woody species and is in a degraded condition. Agriculture and oil and gas activity are directly adjacent to the reach, which makes it a low priority for restoration or preservation. Reestablishing the riparian area along the north bank where the riparian corridor lacks regeneration and vegetation is sparse would be the most beneficial actions.	Low
18	The confluence with the Cache La Poudre River provide an excellent opportunity for ecological restoration and management. This area has the best quality riparian area and has fairly good aquatic species and avian habitat. The location of the Nakagawa State Wildlife area could facilitate access to this reach of river to develop restoration projects (<i>Figure 6.2.9</i>).	High

Draft



LEGEND

<i>Restoration Priority</i>		<i>Potential Restoration Areas</i>	
	Low		Low
	Medium		Medium
	High		High

DATA SOURCES

1. Google Earth 2014 Aerial Imagery
2. Hydrography data from National Hydrology Database
3. CDM Smith

Figure 6.2.9



Reaches 17 and 18 Restoration Areas

/water_info/riparian/riparian_areas.html

7. CITATIONS

CDM Smith. Accessed March 2015. Evans public meeting PowerPoint.

Chagrin River Watershed Partners (CRWP). 2009. Floodplain Restoration and Storm Management: Guidance and Case Study. Accessed 2015.
http://www.crwp.org/files/floodplain_restoration_sw_management_march_2009.pdf

Colorado Department of Public Health & Environment. Accessed March 2015. Clean Water GIS maps. <https://www.colorado.gov/pacific/cdphe/clean-water-gis-maps>

Colorado Parks and Wildlife. 2015. Personal Communication. Aquatic Conservation Biologist Boyd Wright. March, 13, 2015

Colorado State University Extension. 2015. What are weeds? Accessed March 2015.
<http://www.ext.colostate.edu/sam/weeds.html>

Fischer, R. A. 2000. Width of riparian zones for birds. EMRRP Technical Notes Collection (TN EMRRP-SI-09), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/emrrp

Hansen, P.L., S.W. Chadde, and R.D. Pfister. 1988. Riparian Dominance Types of Montana. Montana Forest and Conservation Experimental Station Miscellaneous Publication No. 49. University of Montana, Missoula, MT.

Johnson, W. C. 1994. Woodland Expansion in the Platte River, Nebraska: Patterns and Causes. Ecological Monographs 64(1):45-84.

Kittel, G., E. VanWie, and M. Damm. Accessed March 2015. A classification of the Riparian Vegetation of the South Platte and Republican River Basins, Colorado 1998 Final Report. CNHP. http://digitool.library.colostate.edu/dtl_publish/16/118700.html

Manitoba Water Stewardship Division. Accessed March 2015. The Role and Importance of Riparian Areas in Manitoba. <http://www.gov.mb.ca/waterstewardship>

Mutel, C. and J. Emerick. 1984. From Grassland to Glacier: The Natural History of Colorado. Johnson Books, Boulder, CO.

Natural Resource Conservation Service. Accessed March 2015. Stream Visual Assessment Protocol Version 2. 2009. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043252.pdf

Natural Resource Conservation Service. Accessed March 2015. National Water Quality Assessment (NAWQA) Program – South Platte River Basin.
<http://co.water.usgs.gov/nawqa/splt/html/spbasinfops.html>

USGS. 1993. National Water Summary 1990-91: Hydrological Events and Stream Water Quality. Compilers R. Paulson, E. Chase, J. Williams, and D. Moody. United States Geological Survey Water-Supply Paper 2400. U.S. Dept. of Interior, Washington, D.C.

USGS. 2014. US Geological Survey National Hydrography Database. Accessed March 2015.
<ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/>

APPENDIX 1. Datasheets and Site Photos

Reach 1

REACH 1 Field Assessment

A. Preliminary Field Data

Date of assessment 03/12/2015 Weather conditions today Sunny 60°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°16'10.93"N/ 104°52'26.90."W

Channel type/classification scheme: III / Channel Evolution Model

Riparian Cover Type(s): Tree 30 % Shrub 15 % Herbaceous 15 % Bare 40 %

Bank Profile: Stratified x Homogeneous Cohesive Soil Noncohesive Soil x

Gradient (V one): Low (0-2%) x Moderate (>2<4%) High (>4%)

Bankfull channel width 252 ft

Average riparian zone width 724 ft Method used (e.g., Range finder): Range Finder

Average height of woody shrubs 60 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder 0 cobble 10 gravel 20 sand 30 fine sediments 40
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
1.1	40°17'03.76"N, 104°51'23.19"W	Riparian Area, looking from south to north
1.2	40°17'03.76"N, 104°51'23.19"W	Island and Backwater on South Bank
1.3	40°17'03.76"N, 104°51'23.19"W	Upstream view
4		
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	5
2. Hydrologic Alteration	3	13. Aquatic Invertebrate Habitat	4
3. Bank Condition	2	A. Sum of all Elements Scored	43.5
4. Riparian Area Quantity	5R3L	B. Number of Elements Scored	13
5. Riparian Area Quality	5R2L	Overall Score A/B:	3.7
6. Canopy Cover	3	0 to 2.9 Severely Degraded	
7. Water Appearance	5	3 to 4.9 Poor	
8. Nutrient Enrichment	4	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	3	9 to 10 Excellent	
11. Barriers to Movement	3		



Photo 1.1 - Bottom of Reach 1, looking across from south to north, *S. Exigua* in the foreground. Bare substrate with a *P. deltoids* overstory on the north bank.



Photo 1.2 – Bottom of Reach 1, south bank looking upstream, side channel with herbaceous vegetation covering the gravel bar. On the north bank, more bare substrate and *P. deltoides* overstory is present.



Photo 1.3 – Bottom of Reach 1, south bank looking upstream, top of side channel along south bank, a good example of aquatic habitat diversity.

Reach 2

REACH 2 Field Assessment

A. Preliminary Field Data

Date of assessment 03/12/2015 Weather conditions today Sunny, 60°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°17'03.76"N/ 104°51'23.19"W

Channel type/classification scheme III /Channel Evolution Model

Riparian Cover Type(s): Tree 60 % Shrub 10 % Herbaceous 10 % Bare 20 %

Bank Profile: Stratified X Homogeneous Cohesive Soil Noncohesive Soil X

Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 216 ft

Average riparian zone width 510 ft Method used (e.g., Range finder): Range Finder

Average height of woody shrubs 60ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder 0 cobble 10 gravel 10 sand 30 fine sediments 50
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
2.1	40°17'03.76"N,104°51'23.19"W	Looking downstream from the top of Reach 2 on the South Bank.
2.2	40°17'03.76"N,104°51'23.19"W	Looking across the stream from the South Bank to the North Bank
2.3	40°17'03.76"N,104°51'23.19"W	Looking downstream from the top of Reach 2 on the South Bank.
2.4	40°17'03.76"N,104°51'23.19"W	Riparian on South Bank mostly declining <i>P. deltoides</i>
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	3
2. Hydrologic Alteration	3	13. Aquatic Invertebrate Habitat	3
3. Bank Condition	2	A. Sum of all Elements Scored	47
4. Riparian Area Quantity	3L3R	B. Number of Elements Scored	13
5. Riparian Area Quality	6L6R	Overall Score A/B:	3.6
6. Canopy Cover	1	0 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	5	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	4	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 2.1 – Top of reach 2 south Bank looking downstream, the south bank with a *P. deltoides* overstory with mostly declining individuals, herbaceous understory



Photo 2.2 – Top of Reach 2 looking across from south to north, depositional sand bar in foreground. The north bank with bare substrate and *P. deltoides* overstory.



Photo 2.3 – Top of Reach 2 looking downstream, south bank with some woody debris, but with steep and failing banks



Photo 2.4 – Top of Reach 2, south bank, intact riparian corridor with a *P. deltoides* overstory and an intact *Bromus* grass understory from remnant agricultural applications which creates good cover.

Reach 3

REACH 3 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°17'32.87"N/104°50'31.61"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 50 % Shrub 10 % Herbaceous 10 % Bare 30 %

Bank Profile: Stratified X Homogeneous Cohesive Soil Noncohesive Soil X

Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 245 ft

Average riparian zone width 750 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 60 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 20 sand 30 fine sediments 50
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
3.1	40°17'40.23"N,104°50'18.82"W	Looking downstream riparian on both shores as well as bank condition
3.2	40°17'40.23"N,104°50'18.82"W	South bank, bank is raw
3.3	40°17'40.23"N,104°50'18.82"W	North bank, willow regeneration
3.4	40°17'40.23"N,104°50'18.82"W	Looking from the south towards the North bank riparian
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	3	12. Fish Habitat Complexity	4
2. Hydrologic Alteration	4	13. Aquatic Invertebrate Habitat	4
3. Bank Condition	2	A. Sum of all Elements Scored	45
4. Riparian Area Quantity	L2R4	B. Number of Elements Scored	13
5. Riparian Area Quality	L3R6	Overall Score A/B:	3.4
6. Canopy Cover	2	0 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	4	5 to 6.9 Fair	
9. Manure or Human Waste	4	7 to 8.9 Good	
10. Pools	2	9 to 10 Excellent	
11. Barriers to Movement	5		



Photo 3.1 – Mid-Reach 3, looking downstream, steep and cut banks on the south bank, with a higher shrub component, *Salix*, on the north bank



Photo 3.2 – Mid-Reach 3, looking toward the south bank, steep failing banks visible with a *P. deltoides* overstory and herbaceous understory with a higher shrub component further downstream.



Photo 3.3 – Mid Reach 3, looking toward the north bank, a large amount of bare ground, less steep banks and some regeneration of woody species present.



Photo 3.4 – Mid-Reach 3 looking toward the north bank. Steep, failing banks are visible with a more dense riparian forest downstream

Reach 4

REACH 4 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F
 Weather conditions over past 2 to 5 days: Similar to today
 Reach location (UTM or Lat./Long.) 40°17'53.05"N/104°49'51.17"W
 Channel type/classification scheme III / Channel Evolution Model
 Riparian Cover Type(s): Tree 50 % Shrub 10 % Herbaceous 20 % Bare 20 %
 Bank Profile: Stratified X Homogeneous Cohesive Soil Noncohesive Soil X
 Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)
 Bankfull channel width 254 ft
 Average riparian zone width 1300 ft Method used (e.g., Range finder): GIS
 Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder
 Dominant substrate (%): boulder cobble gravel 20 sand 30 fine sediments 50
 (> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
4.1	40°17'55.75"N, 104°49'48.50"W	Looking downstream from the top of reach 4
4.2	40°17'55.75"N, 104°49'48.50"W	Looking downstream at riparian
4.3	40°19'29.98"N, 104°49'10.35"W	Auto body Riprap along the North bank
4.4	40°18'31.64"N, 104°49'03.55"W	South bank and riparian area
4.5	40°19'29.98"N, 104°49'10.35"W	South bank concrete rubble rip rap and riparian area above diversion structure
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	3	12. Fish Habitat Complexity	4
2. Hydrologic Alteration	3	13. Aquatic Invertebrate Habitat	4
3. Bank Condition	2	A. Sum of all Elements Scored	43.5
4. Riparian Area Quantity	L5R2	B. Number of Elements Scored	13
5. Riparian Area Quality	4	Overall Score A/B:	3.2
6. Canopy Cover	1	0 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	4	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	2	9 to 10 Excellent	
11. Barriers to Movement	4		



Photo 4.1 – Mid Reach 4, looking downstream, a point bar visible on the south bank and more dense riparian forest on the north bank



Photo 4.2 – Mid-Reach 4, looking downstream, bare substrate on the north bank with a higher percentage of shrub component, *Salix*, in the riparian along both the north and south banks and *P. deltoides* overstory



Photo 4.3 – Mid-Reach 4, looking toward the north bank, auto body bank cover with herbaceous cover in between cars. The bank is stable but very steep and the floodplain is disconnected



Photo 4.4- Mid Reach 4, looking downstream, a point bar is visible along the north bank, with steep banks along the south shore.



Photo 4.5 – Bottom of reach 4, looking toward the south bank, *P. deltoides* overstory, with portions of the bank armored with concrete rubble and other portions bare and failing. Some regeneration is present in this reach.

Reach 5

REACH 5 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°18'45.23"N/104°48'57.61"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 60 % Shrub 10 % Herbaceous 30 % Bare 0 %

Bank Profile: Stratified Homogeneous X Cohesive Soil Noncohesive Soil X

Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 253 ft

Average riparian zone width 1200 ft Method used (e.g., Range finder): GIS Aerial

Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble 10 gravel 10 sand 40 fine sediments 40
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
5.1	40°19'12.38"N,104°48'40.25"W	Looking upstream from bridge at the bottom of Reach5
5.2	40°19'12.38"N,104°48'40.25"W	Looking across the bottom of reach 5 from the North Bank to the South Bank
5.3	40°19'09.64"N,104°49'07.79"W	Riparian area from Weld County Road 46.
5.4	40°19'12.38"N,104°48'40.25"W	Looking across irrigation canal towards riparian area south towards the north
5.5	40°19'12.38"N,104°48'40.25"W	Looking toward the west on the south bank of riparian area
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	3	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	4	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	3	A. Sum of all Elements Scored	43
4. Riparian Area Quantity	L7R7	B. Number of Elements Scored	13
5. Riparian Area Quality	L4R4	Overall Score A/B:	3.3
6. Canopy Cover	1	0 to 2.9 Severely Degraded	
7. Water Appearance	2	3 to 4.9 Poor	
8. Nutrient Enrichment	6	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	2	9 to 10 Excellent	
11. Barriers to Movement	1		



Photo 5.1 – Bottom of Reach 5, from the Highway 60 Bridge looking upstream. Deposition of sediment on the south bank from bridge infrastructure. Wide and dense riparian along both banks.



Photo 5.2 – Bottom of Reach 5, looking towards the south bank from the Highway 60 Bridge, depositional zone of mostly fine sediment, sand, and gravel above bridge.



Photo 5.3 – Mid-Reach 5, north bank riparian area, with even aged and over mature *P. deltoides* making up the majority of the overstory with an understory of herbaceous vegetation.



Photo 5.4 – Mid-Reach 5, looking from the south bank to the north bank, thin riparian area along the south bank, agricultural fields directly adjacent to riparian and stream channel.



Photo 5.5 – Mid-Reach 5, looking from south of the riparian corridor to the northwest. Evidence of industry within the floodplain. Irrigation canal in the foreground with a dense riparian in the background.

Reach 6

REACH 6 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°19'12.38"N / 104°48'40.25"W

Channel type/classification scheme III /Channel Evolution Model

Riparian Cover Type(s): Tree 30 % Shrub 10 % Herbaceous % Bare 30 %

Bank Profile: Stratified Homogeneous X Cohesive Soil Noncohesive Soil X

Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 260 ft

Average riparian zone width 1200 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 70 Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 10 sand 30 fine sediments 60
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
6.1	40°19'12.38"N ,104°48'40.25"W	Looking upstream at the bridge at the top of reach 6
6.2	40°19'12.38"N ,104°48'40.25"W	Looking across and downstream from the top of Reach 6. Aggradation of fine sediment from bridge.
6.3	40°19'12.38"N ,104°48'40.25"W	Riparian area, North of the River
6.4	40°19'12.38"N ,104°48'40.25"W	Downstream Riparian South Bank
6.5	40°19'12.38"N ,104°48'40.25"W	Downstream Riparian
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	4	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	2	A. Sum of all Elements Scored	38
4. Riparian Area Quantity	L2R4	B. Number of Elements Scored	13
5. Riparian Area Quality	2	Overall Score A/B:	2.9
6. Canopy Cover	2	0 to 2.9 Severely Degrade	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	3	5 to 6.9 Fair	
9. Manure or Human Waste	3	7 to 8.9 Good	
10. Pools	4	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 6.1 – Top of Reach 6, looking upstream towards Highway 60 Bridge, sediment deposition along the south bank and mid channel created by bridge infrastructure.



Photo 6.2 – Close to the top of Reach 6, looking from the north bank to south bank, large sediment depositional zone created by the Highway 60 bridge infrastructure. Thin riparian corridor along the south bank.



Photo 6.3 – Close to the top of reach 6, riparian area along north bank, slightly wider with a large proportion of bare ground visible. Mature overstory of *P. deltoides* with little to no regeneration, the floodplain is completely disconnected.



Photo 6.4 – Close to top of Reach 6, looking toward the south bank, steep banks with a thin riparian corridor along the south bank. Some woody debris and habitat diversity for aquatic species along the north bank.



Photo 6.5 – Top of Reach 6, looking downstream, lack of connectivity to floodplain is visible with steep banks separating the channel from the riparian corridor.

Reach 7

REACH 7 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F
 Weather conditions over past 2 to 5 days: Similar to today
 Reach location (UTM or Lat./Long.) 40°20'13.28"N/104°47'01.28"W
 Channel type/classification scheme III /Channel Evolution Model
 Riparian Cover Type(s): Tree 40 % Shrub 10 % Herbaceous 10 % Bare 40 %
 Bank Profile: Stratified Homogeneous X Cohesive Soil Noncohesive Soil X
 Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)
 Bankfull channel width 267 ft
 Average riparian zone width 776 ft Method used (e.g., Range finder): GIS
 Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder
 Dominant substrate (%): boulder cobble gravel 10 sand 30 fine sediments 60
 (> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
7.1	40°20'29.56"N,104°46'57.81W	Looking Downstream from Diversion, Riparian area of both shores
7.2	40°20'29.56"N,104°46'57.81W	Looking Across from the North Shore to the South Shore just downstream from the diversion.
7.3	40°20'29.56"N,104°46'57.81W	Looking upstream from just below the diversion
4		
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	2	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	2	A. Sum of all Elements Scored	26
4. Riparian Area Quantity	L1R3	B. Number of Elements Scored	13
5. Riparian Area Quality	L3R3	Overall Score A/B:	2
6. Canopy Cover	2	0 to 2.9 Severely Degraded	
7. Water Appearance	2	3 to 4.9 Poor	
8. Nutrient Enrichment	2	5 to 6.9 Fair	
9. Manure or Human Waste	2	7 to 8.9 Good	
10. Pools	2	9 to 10 Excellent	
11. Barriers to Movement	1		



Photo 7.1 – Top of Reach 7, looking downstream from the north bank, bare substrate and deposition of sediment below the diversion structure located at the top of the reach. Very thin riparian areas line this reach.



Photo 7.2 – Top of Reach 7, looking from the north bank to south bank, well developed point bar with a *P. deltoids* overstory and a small percent of shrub cover within the very thin riparian corridor.



Photo 7.3 – Top of reach 7, looking upstream towards channel wide diversion structure. This structure and other diversions similar restrict aquatic species movement.

Reach 8

REACH 8 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°20'34.47"N/104°45'55.34"

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 30 % Shrub 10 % Herbaceous 60 % Bare %

Bank Profile: Stratified X Homogeneous Cohesive Soil Noncohesive Soil X

Gradient (√ one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 257 ft

Average riparian zone width 988 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 80 Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 20 sand 40 fine sediments 40

(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
8.1	40°21'16.11"N, 104°45'36.84	Looking upstream from the bottom of reach 8. Big Thompson confluence.
8.2	40°21'16.11"N, 104°45'36.84	Looking upstream from the bottom or reach 8
8.3	40°21'16.11"N, 104°45'36.84	Looking across the river at the bottom of reach 8
8.4	40°21'16.11"N, 104°45'36.84	Looking upstream towards the confluence of the South Platte River and Big Thompson River.
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	4	12. Fish Habitat Complexity	3
2. Hydrologic Alteration	4	13. Aquatic Invertebrate Habitat	3
3. Bank Condition	2	A. Sum of all Elements Scored	41.5
4. Riparian Area Quantity	L1R2	B. Number of Elements Scored	13
5. Riparian Area Quality	RL6R6	Overall Score A/B:	3.2
6. Canopy Cover	1	1 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	2	5 to 6.9 Fair	
9. Manure or Human Waste	2	7 to 8.9 Good	
10. Pools	4	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 8.1 – Bottom of Reach 8, looking upstream from the north bank, the Big Thompson River channel is in the foreground and the riparian area between the South Platte River and the Big Thompson River is beyond. Confluence areas are important sites for restoration and benefit fish and wildlife species.



Photo 8.2 – Bottom of Reach 8, looking upstream from the south bank, a wide channel with meandering braids, possibly what the historic channel looked like.



Photo 8.3 – Bottom of Reach 8, looking from the north bank to south bank, a wide riparian corridor with a good mix of *P. deltoids* overstory and woody understory. Woody debris is also along the bank and could provide future aquatic species habitat.



Photo 8.4 – Bottom of Reach 8, looking upstream from the north bank, confluence with Big Thompson River. Highly functioning riparian area and a high potential area for restoration activities.

Reach 9

REACH 9 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°20'29.56"N/104°45'37.27"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 30 % Shrub 15 % Herbaceous 20 % Bare 15 %

Bank Profile: Stratified ___ Homogeneous X Cohesive Soil ___ Noncohesive Soil X

Gradient (V one): Low (0-2%) X Moderate (>2<4%) ___ High (>4%) ___

Bankfull channel width 270 ft

Average riparian zone width 1600 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder ___ cobble ___ gravel 10 sand 30 fine sediments 60
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
9.1	40°21'22.78"N, 104°45'25.83"W	Riparian area on North side of River.
9.2	40°21'22.78"N, 104°45'25.83"W	Southern Bank, lacking vegetation
9.3	40°21'22.78"N, 104°45'25.83"W	Riparian area looking from North to South
9.4	40°21'22.78"N, 104°45'25.83"W	Riparian Area looking upstream from the North bank
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	3
2. Hydrologic Alteration	3	13. Aquatic Invertebrate Habitat	3
3. Bank Condition	2	A. Sum of all Elements Scored	37.5
4. Riparian Area Quantity	L1R6	B. Number of Elements Scored	13
5. Riparian Area Quality	L3R3	Overall Score A/B:	2.9
6. Canopy Cover	1	1 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	2	5 to 6.9 Fair	
9. Manure or Human Waste	4	7 to 8.9 Good	
10. Pools	2	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 9.1 – Mid-Reach 9, north bank looking towards river channel from edge of riparian, patches of P. deltooides are visible, a very tall tree in the background provides excellent avian habitat.



Photo 9.2 - Mid-Reach 9, north bank looking towards the river channel, irrigation canal in the foreground. South bank in back ground with a steep and bare bank.



Photo 9.3 – Mid-Reach 9, looking from the north bank to south bank, the south bank has a fairly wide riparian corridor with a higher percentage of tree cover.



Photo 9.4 – Mid Reach 9, looking upstream from the north bank, large amounts of substrate present in the channel developing point bars and in-channel islands

Reach 10

REACH 10 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F
 Weather conditions over past 2 to 5 days: Similar to today
 Reach location (UTM or Lat./Long.) 40°21'30.34"N/104°45'25.83"W
 Channel type/classification scheme III / Channel Evolution Model
 Riparian Cover Type(s): Tree 25 % Shrub 10 % Herbaceous 50 % Bare 15 %
 Bank Profile: Stratified Homogeneous Cohesive Soil Noncohesive Soil X
 Gradient (v one): Low (0-2%) X Moderate (>2<4%) High (>4%)
 Bankfull channel width 203 ft
 Average riparian zone width 1160 ft Method used (e.g., Range finder): GIS
 Average height of woody shrubs 70 ft Method used (e.g., Range finder): Range Finder
 Dominant substrate (%): boulder cobble gravel 20 sand 30 fine sediments 50
 (> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)
 Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
10.1	40°21'21.70"N,104°43'22.47"W	Riparian area on North Side of River
10.2	40°21'21.70"N,104°43'22.47"W	Looking upstream from the middle of reach 10
10.3	40°21'21.70"N,104°43'22.47"W	Armored bank on South side of river
10.4	40°21'21.70"N,104°43'22.47"W	Looking upstream and point bar on south side of river.
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	5	12. Fish Habitat Complexity	5
2. Hydrologic Alteration	5	13. Aquatic Invertebrate Habitat	5
3. Bank Condition	2	A. Sum of all Elements Scored	56.5
4. Riparian Area Quantity	L6R1	B. Number of Elements Scored	13
5. Riparian Area Quality	L5R5	Overall Score A/B:	4.3
6. Canopy Cover	2	1 to 2.9 Severely Degraded	
7. Water Appearance	2	3 to 4.9 Poor	
8. Nutrient Enrichment	4	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	6	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 10. 1 – Mid-Reach 10, Riparian forest on the north bank. The riparian area is wide with a *P. deltooides* overstory and a *graminoid* and other native grass understory.



Photo 10.2 – Mid-Reach 10, looking upstream from the north bank, woody debris within the channel providing habitat opportunities for aquatic species. Banks are less incised and covered with herbaceous vegetation.



Photo 10.3 – Mid-Reach 10, looking from the north bank to the south bank, armored banks constructed from auto-bodies. The south bank in this piece of Reach 10 has little to no riparian with dense residential areas adjacent to the river channel along.



Photo 10.4 – Mid-Reach 10, looking upstream from the north bank. Banks are less incised and covered with vegetation, some woody species present, *Salix*, side channels are present along the south bank.

Reach 11

REACH 11 Field Assessment

A. Preliminary Field Data

Date of assessment 3/13/2015 Weather conditions today Sunny, 65°F
 Weather conditions over past 2 to 5 days: Similar to today
 Reach location (UTM or Lat./Long.) 40°21'45.07"N/104°42'19.82W
 Channel type/classification scheme III /Channel Evolution Model
 Riparian Cover Type(s): Tree 25 % Shrub 10 % Herbaceous 50 % Bare 20 %
 Bank Profile: Stratified X Homogeneous ___ Cohesive Soil ___ Noncohesive Soil X ___
 Gradient (√ one): Low (0-2%) X Moderate (>2<4%) ___ High (>4%) ___
 Bankfull channel width 182 ft
 Average riparian zone width 768 ft Method used (e.g., Range finder): GIS
 Average height of woody shrubs 55 ft Method used (e.g., Range finder): Range Finder
 Dominant substrate (%): boulder ___ cobble ___ gravel 10 sand 30 fine sediments 60
 (> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)
 Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
11.1	40°21'57.29"N, 104°41'48.69"W	Algal growth in a puddle next to river
11.2	40°21'57.29"N, 104°41'48.69"W	North Bank Looking upstream from the bottom of reach 11
11.3	40°21'57.29"N, 104°41'48.69"W	Side channels and sedimentation under bridge at the bottom of reach 11 US HWY 85 Bridge
11.4	40°21'57.29"N, 104°41'48.69"W	Riparian on north side of bank
11.5	40°21'57.29"N, 104°41'48.69"W	Point bar and southern bank upstream from the bottom of Reach 11
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	2	13. Aquatic Invertebrate Habitat	3
3. Bank Condition	3	A. Sum of all Elements Scored	32.5
4. Riparian Area Quantity	L6R1	B. Number of Elements Scored	13
5. Riparian Area Quality	L3R1	Overall Score A/B:	2.5
6. Canopy Cover	2	1 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	2	5 to 6.9 Fair	
9. Manure or Human Waste	2	7 to 8.9 Good	
10. Pools	4	9 to 10 Excellent	
11. Barriers to Movement	2		



Photo 11.1 – Bottom of Reach 11, north bank under Highway 85 Bridge, high concentrations of algal growth are present which is an indicator of nutrient enrichment and degraded water quality.



Photo 11.2 – Bottom of Reach 11, looking upstream from the north bank. The north bank riparian corridor is fairly wide with patchy *P. deltoides* and *U. parvifolia* overstory. The south bank has a thin riparian corridor with residential areas interspersed within.



Photo 11.3 – Bottom of Reach 11, north bank under Highway 85 Bridge. Deposition of sediment due to three sets of bridge infrastructure in this area. Pools with algal growth were present within the sediment.



Photo 11.4 – Bottom of Reach 11, looking upstream on the north bank. Riparian forest along the north bank.



Photo 11.5 – Bottom of Reach 11, looking up stream. Steep and failing banks are present along the north bank and a point bar is present on the southern bank.

Reach 12

REACH 12 Field Assessment

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Overcast, 68°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°21'57.29"N/104°41'48.69"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 85 % Shrub 15 % Herbaceous % Bare %

Bank Profile: Stratified X Homogeneous Cohesive Soil Noncohesive Soil X

Gradient (√ one): Low (0-2%) Moderate (>2<4%) High (>4%)

Bankfull channel width 320 ft

Average riparian zone width 900 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 60 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 10 sand 80 fine sediments 10

(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
12.1	40°22'02.55"N,104°41'16.99"W	Looking from North to South of River riparian area and bank
12.2	40°22'02.55"N,104°41'16.99"W	Looking downstream and across at south bank riparian
12.3	40°22'37.76"N,104°40'27.77"W	Shallow side channel with pipes coming into it. Eutrophication of water due to nutrient enrichment at bottom of reach 12.
12.4	40°22'37.76"N,104°40'27.77"W	Looking from the north bank to south bank, armored bank. Sediment deposit above bridge
12.5	40°22'37.76"N,104°40'27.77"W	HWY 34 Bridge
12.6	40°22'37.76"N,104°40'27.77"W	Southern, armored bank
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	3	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	2	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	2	A. Sum of all Elements Scored	40.5
4. Riparian Area Quantity	L1R3	B. Number of Elements Scored	13
5. Riparian Area Quality	L1R4	Overall Score A/B:	3.1
6. Canopy Cover	2	1 to 2.9 Severely Degraded	
7. Water Appearance	4	3 to 4.9 Poor	
8. Nutrient Enrichment	5	5 to 6.9 Fair	
9. Manure or Human Waste	5	7 to 8.9 Good	
10. Pools	3	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 12.1 – Mid-Reach 12, Riverside Park, looking from the north bank to the south bank. The *Salix*, shrub component in the foreground is located on a point bar along the north bank. The south bank contains a riparian forest with a *P. deltoides* overstory and herbaceous understory.



Photo 12.2 – Mid-Reach 12, Riverside Park looking from the north bank to the south bank. The riparian area on the north bank is thin with steep banks present, the channel is disconnected from the flood plain throughout this reach and large deposits of sediment within the channel.



Photo 12.3 – Bottom of Reach 12, north bank, East 37th Street Bridge. Point source of nutrient enrichment and algal growth are present in this portion of the reach.



Photo 12.4 – Bottom of Reach 12 looking from the north bank to south bank. Deposition of sediment due to the East 37th Street Bridge infrastructure.



Photo 12.5 – Bottom of Reach 12 looking downstream towards the East 37th Street Bridge.



Photo 12.6 – Bottom of Reach 12, looking from the north bank to the south bank. This photo is an example of the heavily armored banks throughout this reach and the degree of separation between the floodplain and channel.

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Sunny, 65°F
 Weather conditions over past 2 to 5 days: Similar to Today
 Reach location (UTM or Lat./Long.) 40°22'38.74"N/104°40'25.95"W
 Channel type/classification scheme III /Channel Evolution Model _____
 Riparian Cover Type(s): Tree 60 % Shrub 10 % Herbaceous 30 % Bare 20 %
 Bank Profile: Stratified X Homogeneous _____ Cohesive Soil _____ Noncohesive Soil X
 Gradient (V one): Low (0-2%) X Moderate (>2<4%) _____ High (>4%) _____
 Bankfull channel width 340 ft
 Average riparian zone width 700 ft Method used (e.g., Range finder): GIS
 Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder
 Dominant substrate (%): boulder _____ cobble _____ gravel 20 sand 20 fine sediments 60
 (> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
13.1	40°22'38.74"N,104°40'25.95"W	Looking Downstream from the North Bank
13.2	40°22'38.74"N,104°40'25.95"W	Looking Across from the North Bank to the South Bank and back towards HWY 34 Bridge
13.3	40°22'38.74"N,104°40'25.95"W	South bank riparian area
13.4	40°22'38.74"N,104°40'25.95"W	Point Bar on South bank looking downstream
13.5	40°22'38.74"N,104°40'25.95"W	Looking across from the South bank to the North bank, rip rap and raw bank
13.6	40°22'38.74"N,104°40'25.95"W	Riparian are on the south bank, looking from outside edge towards river.
7		
8		
9		
10		

[Reach 13](#)

REACH 13 Field Assessment

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	2

2. Hydrologic Alteration	5	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	2	A. Sum of all Elements Scored	38
4. Riparian Area Quantity	L2R2	B. Number of Elements Scored	13
5. Riparian Area Quality	L2R2	Overall Score A/B:	2.9
6. Canopy Cover	2	1 to 2.9 Severely Degraded	
7. Water Appearance	2	3 to 4.9 Poor	
8. Nutrient Enrichment	4	5 to 6.9 Fair	
9. Manure or Human Waste	3	7 to 8.9 Good	
10. Pools	3	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 13.1 – Top of Reach 13 looking down stream. The north bank and south bank riparian corridors are thin towards the top of the reach but get wider further down in the reach.



Photo 13.2 – Top of Reach 13, looking from the north bank to the south bank. Deposition of sediment below the East 37th Street Bridge making the channel wide, shallow, and homogenous with little diversity of habitat for aquatic species.



Photo 13.3 – Top of Reach 13, south bank looking downstream on the edge of the riparian. This is located within Brower State Wildlife area and could be a promising location for restoration activities.



Photo 13.4 – Top of Reach 13, looking downstream on the south bank. Large depositional bar of sediment below the East 37th Street Bridge. In the distance there are islands with a healthy mix of herbaceous and woody cover with some regeneration.



Photo 13.5 – Near the top of Reach 13, looking from the south bank to the north bank. Steep and degraded banks are visible with some armoring along the north bank.



Photo 13.6 – Near the top of Reach 13, looking from the south bank out into the riparian corridor. The riparian is very thin with no regeneration of the *P. deltoides* overstory.

Reach 14

REACH 14 Field Assessment

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°22'38.74"N/104°39'35.03"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 50 % Shrub 10 % Herbaceous 30 % Bare 10 %

Bank Profile: Stratified X Homogeneous Cohesive Soil Noncohesive Soil X

Gradient (v one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 198 ft

Average riparian zone width 700 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 45 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 10 sand 20 fine sediments 70

(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
14.1	40°23'30.60"N,104°39'05.27"W	Rip rap of historic edge of riparian on South bank
14.2	40°23'30.60"N,104°39'05.27"W	Looking upstream in riparian habitat on South bank
14.3	40°23'30.60"N,104°39'05.27"W	Looking upstream and riparian zone
14.4	40°23'30.60"N,104°39'05.27"W	Looking upstream at raw steep bank on the south bank
14.5	40°23'30.60"N,104°39'05.27"W	Looking downstream towards US 34 Bridge
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	5	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	4	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	4	A. Sum of all Elements Scored	43
4. Riparian Area Quantity	L1R5	B. Number of Elements Scored	13
5. Riparian Area Quality	L3R3	Overall Score A/B:	3.3
6. Canopy Cover	2	1 to 2.9 Severely Degraded	
7. Water Appearance	2	3 to 4.9 Poor	
8. Nutrient Enrichment	4	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	4	9 to 10 Excellent	
11. Barriers to Movement	2		



Photo 14.1 – Near the bottom of Reach 14 on the south bank, looking downstream. Rip-rap from a historic channel was present in this reach towards the outside of the thin riparian corridor. Possibly a good location for restoration of off channel wetlands.



Photo 14.2 – Near the bottom of Reach 14 on the south bank, looking upstream. The riparian corridor is patchy and thin in this part of the reach, however the north bank riparian corridor is denser.



Photo 14.3 – Near the bottom of Reach 14 on the south bank, looking upstream. This reach contains a wide homogenous channel with little habitat for aquatic species.



Photo 14.4 - Near the bottom of Reach 14 on the south bank, looking upstream. Steep and failing banks are present as well as disconnect from the floodplain.



Photo 14.5 - Bottom of Reach 14 on the south bank, looking downstream. View of Highway 34 Bridge with sediment deposit above the bridge in the middle of the channel.

Reach 15

REACH 15 Field Assessment

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Sunny, 65°F

Weather conditions over past 2 to 5 days: Similar to today

Reach location (UTM or Lat./Long.) 40°23'30.60"N/104°39'03.02"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree % Shrub % Herbaceous % Bare %

Bank Profile: Stratified X Homogeneous Cohesive Soil X Noncohesive Soil

Gradient (v one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 376 ft

Average riparian zone width 1100 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 40 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 10 sand 10 fine sediments 80

(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
15.1	40°23'30.60"N,104°39'03.02"W	Riparian area on North bank, middle age class cottonwoods
15.2	40°23'30.60"N,104°39'03.02"W	Looking from the North bank to the South bank downstream of the US HWY 34 Bridge
15.3	40°23'30.60"N,104°39'03.02"W	Looking downstream from the top of Reach 15
15.4	40°23'48.06"N,104°38'19.45"W	Looking upstream from the South bank at the bottom of Reach 15
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	6	12. Fish Habitat Complexity	4
2. Hydrologic Alteration	6	13. Aquatic Invertebrate Habitat	4
3. Bank Condition	5	A. Sum of all Elements Scored	66
4. Riparian Area Quantity	L6R2	B. Number of Elements Scored	13
5. Riparian Area Quality	L6R6	Overall Score A/B:	5.0
6. Canopy Cover	3	1 to 2.9 Severely Degraded	
7. Water Appearance	4	3 to 4.9 Poor	
8. Nutrient Enrichment	5	5 to 6.9 Fair	
9. Manure or Human Waste	6	7 to 8.9 Good	
10. Pools	6	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 15.1 – Top of Reach 15, looking downstream. Visible in this photo is a good example of the excellent age class diversity of the dominant overstory.

Element	Score	Element	Score
1. Channel Condition	4	12. Fish Habitat Complexity	4
2. Hydrologic Alteration	5	13. Aquatic Invertebrate Habitat	4
3. Bank Condition	3	A. Sum of all Elements Scored	45
4. Riparian Area Quantity	L1R1	B. Number of Elements Scored	13
5. Riparian Area Quality	2	Overall Score A/B:	3.5
6. Canopy Cover	1	1 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	5	5 to 6.9 Fair	
9. Manure or Human Waste	5	7 to 8.9 Good	
10. Pools	6	9 to 10 Excellent	
11. Barriers to Movement	2		



Photo 16.1 – Top of Reach 16 looking downstream. A depositional island is present below the Highway 34 Business Loop Bridge.



Photo 15.2 – Top of Reach 15, looking from the north bank to the south bank. Highway 34 Bridge.



Photo 15.3 – Top of Reach 15, looking downstream along the north bank. The banks in this reach are less steep and generally have better cover than most. The north corridor riparian however is a little thin.

Reach 16

REACH 16 Field Assessment

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Sunny, 65°F
 Weather conditions over past 2 to 5 days: Similar to today
 Reach location (UTM or Lat./Long.) 40°23'48.06"N/104°38'19.45"W
 Channel type/classification scheme III / Channel Evolution Model
 Riparian Cover Type(s): Tree 20 % Shrub 20 % Herbaceous 30 % Bare 30 %
 Bank Profile: Stratified X Homogeneous Cohesive Soil X Noncohesive Soil
 Gradient (v one): Low (0-2%) X Moderate (>2<4%) High (>4%)
 Bankfull channel width 230 ft
 Average riparian zone width 736 ft Method used (e.g., Range finder): GIS
 Average height of woody shrubs 70 ft Method used (e.g., Range finder): Range Finder
 Dominant substrate (%): boulder cobble gravel 20 sand 40 fine sediments 40
 (> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
16.1	40°23'48.06"N,104°38'19.45"W	South bank from top of Reach 16 side channel
16.2	40°23'48.06"N,104°38'19.45"W	South bank Riparian area, cottonwood forest
16.3	40°23'48.06"N,104°38'19.45"W	Looking from the South bank across to the north bank
16.4	40°23'48.06"N,104°38'19.45"W	Vegetation along the North bank, with fish habitat structures in the foreground
16.5	40°23'48.06"N,104°38'19.45"W	Deposition Zone of sediment below the US 34 Business Loop Bridge
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	4	12. Fish Habitat Complexity	4
2. Hydrologic Alteration	5	13. Aquatic Invertebrate Habitat	4
3. Bank Condition	3	A. Sum of all Elements Scored	45
4. Riparian Area Quantity	L1R1	B. Number of Elements Scored	13
5. Riparian Area Quality	2	Overall Score A/B:	3.5
6. Canopy Cover	1	1 to 2.9 Severely Degraded	
7. Water Appearance	3	3 to 4.9 Poor	
8. Nutrient Enrichment	5	5 to 6.9 Fair	
9. Manure or Human Waste	5	7 to 8.9 Good	
10. Pools	6	9 to 10 Excellent	
11. Barriers to Movement	2		



Photo 16.1 – Top of Reach 16 looking downstream. A depositional island is present below the Highway 34 Business Loop Bridge.



Photo 16.1 – Top of Reach 16, looking downstream, along the south bank riparian corridor. The riparian is wider on the south bank and has a mix of declining *P. deltooides* overstory and woody shrub component along the edge of the river.



Photo 16.2 – Near the top of Reach 16, looking downstream along the south bank. This reach contains a better diversity of aquatic species habitat.



Photo 16.3 – Near the top of Reach 16, looking from the south bank to the north bank. More examples of aquatic habitat diversity are in the foreground. In the background the thin and patchy riparian corridor is visible.



Photo 16.4 - Top of Reach 16, looking across from the south bank to the north bank. Highway 34 Business Loop Bridge.

Reach 17

REACH 17 Field Assessment

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Windy, Overcast, 65°F

Weather conditions over past 2 to 5 days: Sunny, 65°F similar to the morning.

Reach location (UTM or Lat./Long.) 40°24'03.91"N/104°37'11.22"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 50 % Shrub 10 % Herbaceous 10 % Bare 30 %

Bank Profile: Stratified Homogeneous Cohesive Soil Noncohesive Soil

Gradient (√ one): Low (0-2%) Moderate (>2<4%) High (>4%)

Bankfull channel width 371 ft

Average riparian zone width 760 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 10 sand 30 fine sediments 60

(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
17.1	40°24'33.33"N,104°37.00.66"W	Looking upstream from bottom of Reach 17
17.2	40°24'33.33"N,104°37.00.66"W	Looking across from South bank to North Bank, construction diversion in foreground
17.3	40°24'33.33"N,104°37.00.66"W	Looking across from South bank to North Bank 18 th St. Bridge Construction
4		
5		
6		
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	2	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	2	A. Sum of all Elements Scored	36
4. Riparian Area Quantity	L1R3	B. Number of Elements Scored	13
5. Riparian Area Quality	L3R3	Overall Score A/B:	2.8
6. Canopy Cover	1	1 to 2.9 Severely Degraded	
7. Water Appearance	4	3 to 4.9 Poor	
8. Nutrient Enrichment	2	5 to 6.9 Fair	
9. Manure or Human Waste	2	7 to 8.9 Good	
10. Pools	6	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 17.1 – Bottom of Reach 17, looking upstream along the south bank. This reach is adjacent to high intensity agriculture and evidence of nutrient enrichment is present. This reach also has a fair amount of bare ground present.



Photo 17.2 – Bottom of Reach 17, looking from the south bank to north bank. The diversion in the foreground is for construction of the new 18th Street Bridge. The riparian along the north bank is visible and is fairly degraded.



Photo 17.3 – Bottom of Reach 17, looking across the new 18th Street Bridge from the south bank to the north bank.

Reach 18

REACH 18 Field Assessment

A. Preliminary Field Data

Date of assessment 3/12/2015 Weather conditions today Windy, Overcast, 65°F

Weather conditions over past 2 to 5 days: Sunny, 65°F similar to the morning

Reach location (UTM or Lat./Long.) 40°24'33.33"N/104°37'00.66"W

Channel type/classification scheme III / Channel Evolution Model

Riparian Cover Type(s): Tree 50 % Shrub 10 % Herbaceous 30 % Bare 10 %

Bank Profile: Stratified Homogeneous X Cohesive Soil Noncohesive Soil X

Gradient (V one): Low (0-2%) X Moderate (>2<4%) High (>4%)

Bankfull channel width 266 ft

Average riparian zone width 1120 ft Method used (e.g., Range finder): GIS

Average height of woody shrubs 80 ft Method used (e.g., Range finder): Range Finder

Dominant substrate (%): boulder cobble gravel 20 sand 30 fine sediments 50
(> 250 mm) (60-250mm) (2-60 mm) (2-.06 mm) (< .06 mm)

Photo Point Locations and Descriptions:

PHOTO POINT #	GPS COORDINATES/WAYPOINTS	DESCRIPTION
18.1	40°24'33.33"N,104°37.00.66"W	Looking downstream from the top of Reach 18
18.2	40°24'33.33"N,104°37.00.66"W	Riparian area on South bank at the top of Reach 18
18.3	40°25'21.21"N,104°35'53.81"W	Looking upstream towards the confluence of the South Platte River and Cache La Poudre River
18.4	40°24'33.33"N,104°37.00.66"W	North bank and riparian area looking upstream from the bottom of reach 18
18.5	40°24'33.33"N,104°37.00.66"W	Looking across from the North bank to the South Bank, with a large point bar in the foreground
18.6	40°24'33.33"N,104°37.00.66"W	Riparian on South bank
7		
8		
9		
10		

B. Element Scores

Element	Score	Element	Score
1. Channel Condition	2	12. Fish Habitat Complexity	2
2. Hydrologic Alteration	2	13. Aquatic Invertebrate Habitat	2
3. Bank Condition	2	A. Sum of all Elements Scored	35.5
4. Riparian Area Quantity	L4R1	B. Number of Elements Scored	13
5. Riparian Area Quality	L2R2	Overall Score A/B:	2.7
6. Canopy Cover	1	1 to 2.9 Severely Degraded	
7. Water Appearance	4	3 to 4.9 Poor	
8. Nutrient Enrichment	2	5 to 6.9 Fair	
9. Manure or Human Waste	2	7 to 8.9 Good	
10. Pools	6	9 to 10 Excellent	
11. Barriers to Movement	6		



Photo 18.1- Top of Reach 18, looking downstream along the south bank. The south bank is mostly bare, due to construction of the new bridge, however the riparian is very thin on the south bank and directly adjacent to agricultural activities. The north bank is somewhat wider however livestock are grazing within the riparian corridor.



Photo 18.2 – Top of Reach 18, looking from the outer edge of the south bank riparian corridor towards the river. The riparian is fairly thin and patchy with little regeneration.



Photo 18.3 – Bottom of Reach 18, looking upstream from the north bank. The confluence with the Cache La Poudre River is on the right side of the photo.



Photo 18.4 - Bottom of Reach 18, looking upstream from the north bank. Steep and failing banks are present at the bottom of the reach, further upstream banks are armored.



Photo 18.5 – Bottom of Reach 18, looking across from the north bank to the south bank. A large point bar is visible. The riparian is in better condition at the bottom of the reach than the top.

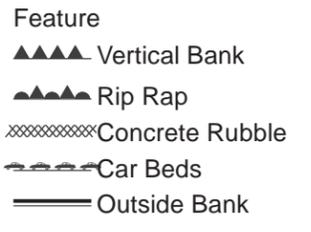
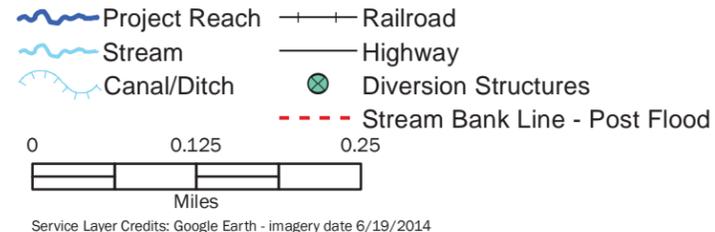


Photo 18.6 – Bottom of Reach 18, looking across from the north bank to the south bank. The area between the two rivers is an important area for ecological preservation and restoration. This will benefit both aquatic and terrestrial wildlife.

Appendix E

Draft

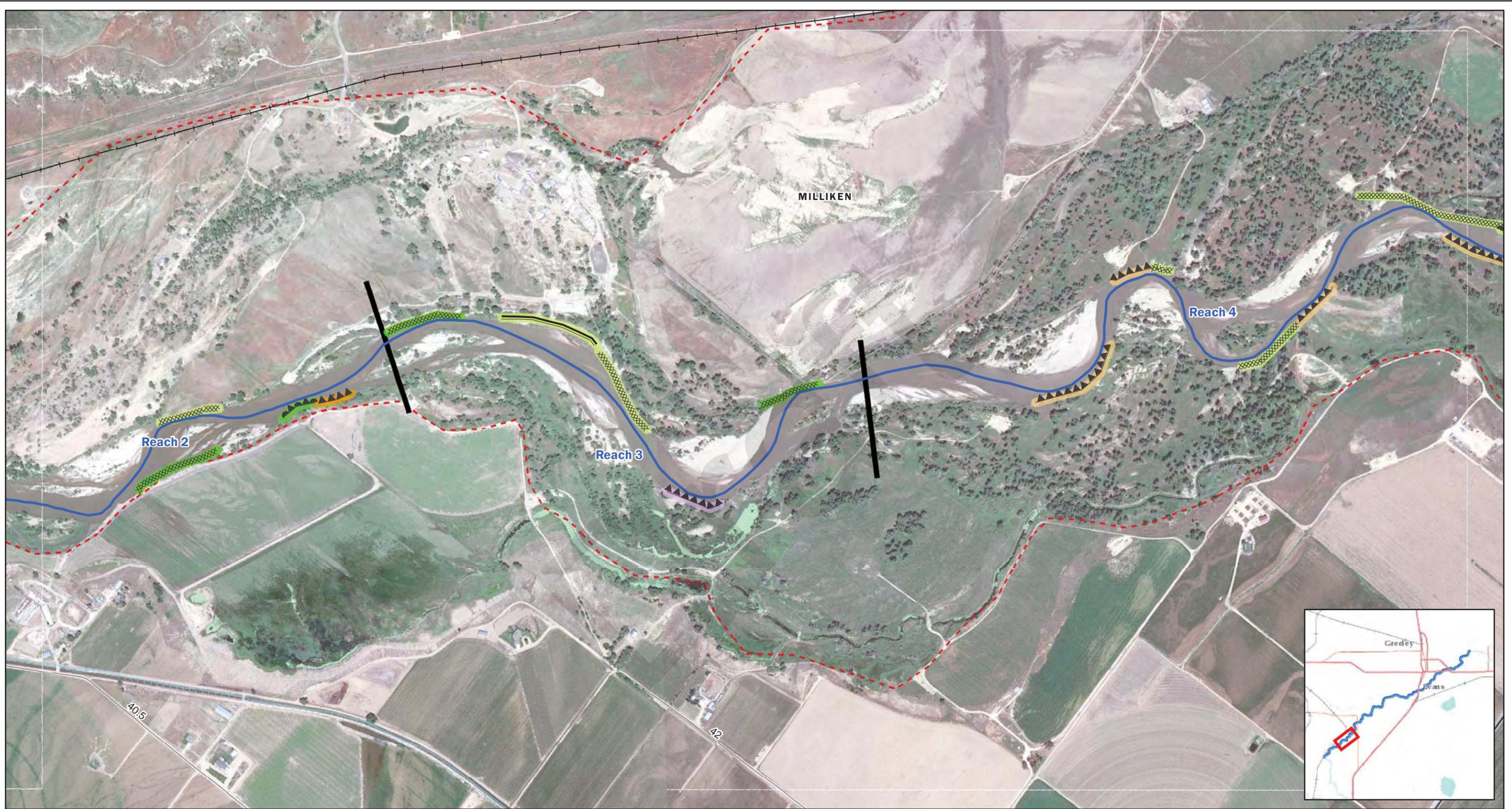
Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM/Smith



South Platte River Restoration Master Plan

Appendix E - Figure E-1: Geomorphic Risk Analysis | Map Index Page 1





Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM\Smith

Project Reach	Railroad
Stream	Highway
Canal/Ditch	Diversion Structures
Stream Bank Line - Post Flood	

0 0.125 0.25
Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014

Feature

- Vertical Bank
- Rip Rap
- Concrete Rubble
- Car Beds
- Outside Bank

Flood Hazard Erosion: Potential and Severity

Low, Low	High, Low
Low, Medium	High, Medium
Low, High	High, High
Medium, Low	
Medium, Medium	
Medium, High	

South Platte River Restoration Master Plan

Appendix E - Figure E-2: Geomorphic Risk Analysis | Map Index Page 2





Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE - CDM\Smith



- | | |
|---------------|-------------------------------|
| Project Reach | Railroad |
| Stream | Highway |
| Canal/Ditch | Diversion Structures |
| | Stream Bank Line - Post Flood |



Service Layer Credits: Google Earth - imagery date 6/19/2014

- | |
|-----------------|
| Feature |
| Vertical Bank |
| Rip Rap |
| Concrete Rubble |
| Car Beds |
| Outside Bank |

- | | |
|---|--------------|
| Flood Hazard Erosion: Potential and Severity | |
| Low, Low | High, Low |
| Low, Medium | High, Medium |
| Low, High | High, High |
| Medium, Low | |
| Medium, Medium | |
| Medium, High | |

South Platte River Restoration Master Plan

Appendix E - Figure E-3: Geomorphic Risk Analysis | Map Index Page 3



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM/Smith



Project Reach	Railroad
Stream	Highway
Canal/Ditch	Diversion Structures
Stream Bank Line - Post Flood	

0 0.125 0.25
Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014

Feature

- Vertical Bank
- Rip Rap
- Concrete Rubble
- Car Beds
- Outside Bank

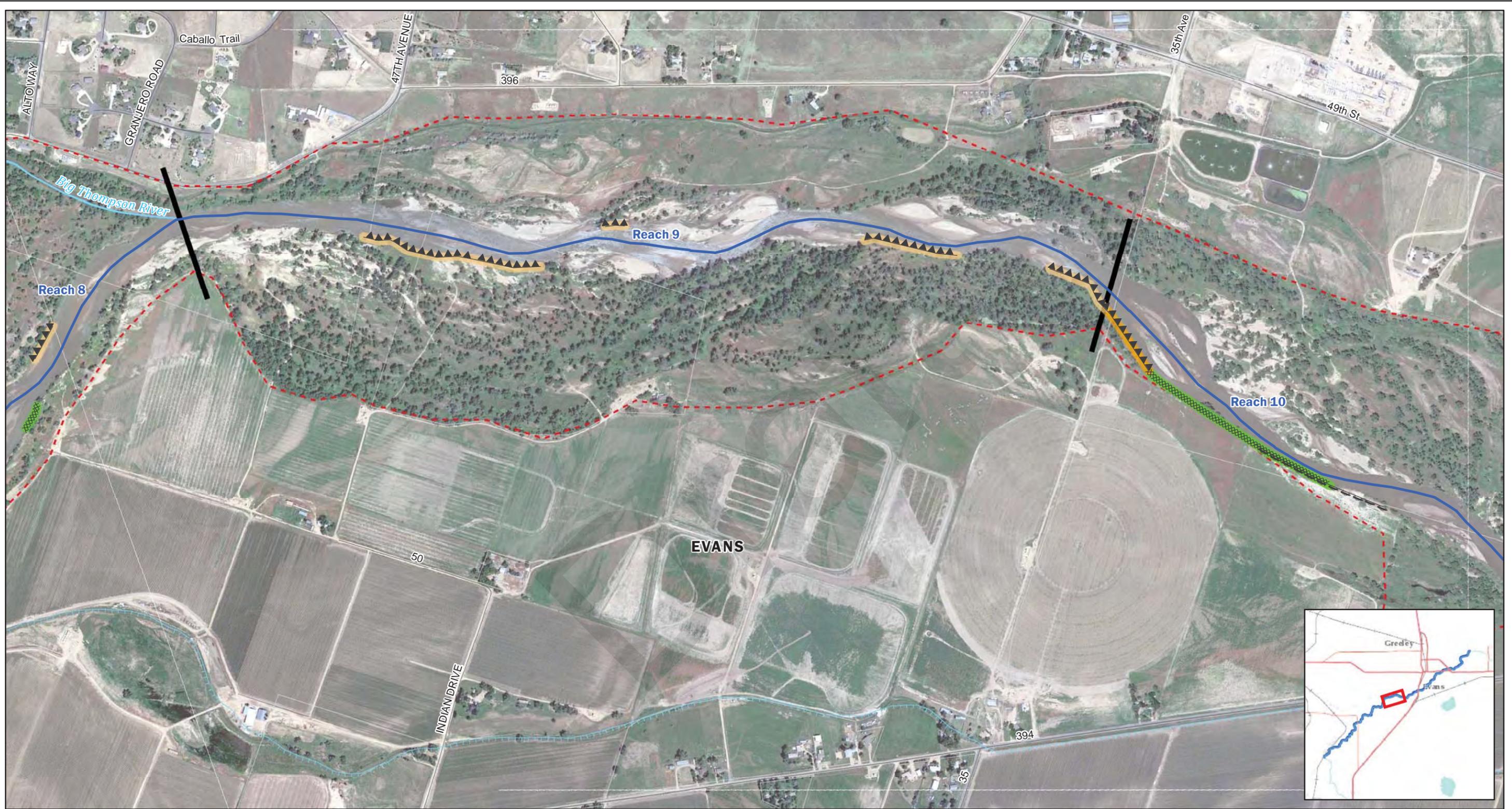
Flood Hazard Erosion: Potential and Severity

Low, Low	High, Low
Low, Medium	High, Medium
Low, High	High, High
Medium, Low	
Medium, Medium	
Medium, High	

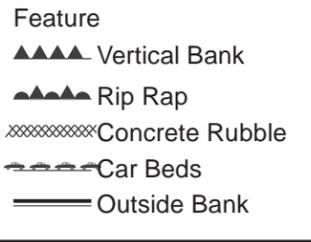
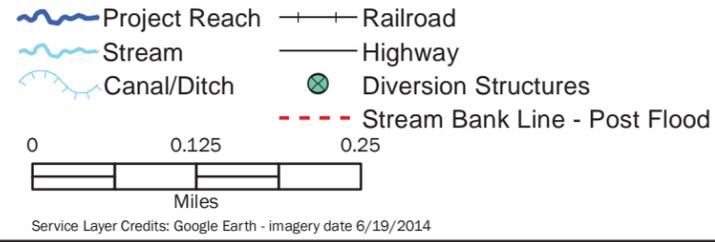
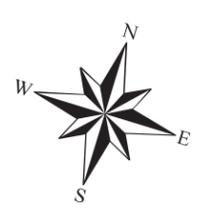
South Platte River Restoration Master Plan

Appendix E - Figure E-4: Geomorphic Risk Analysis | Map Index Page 4





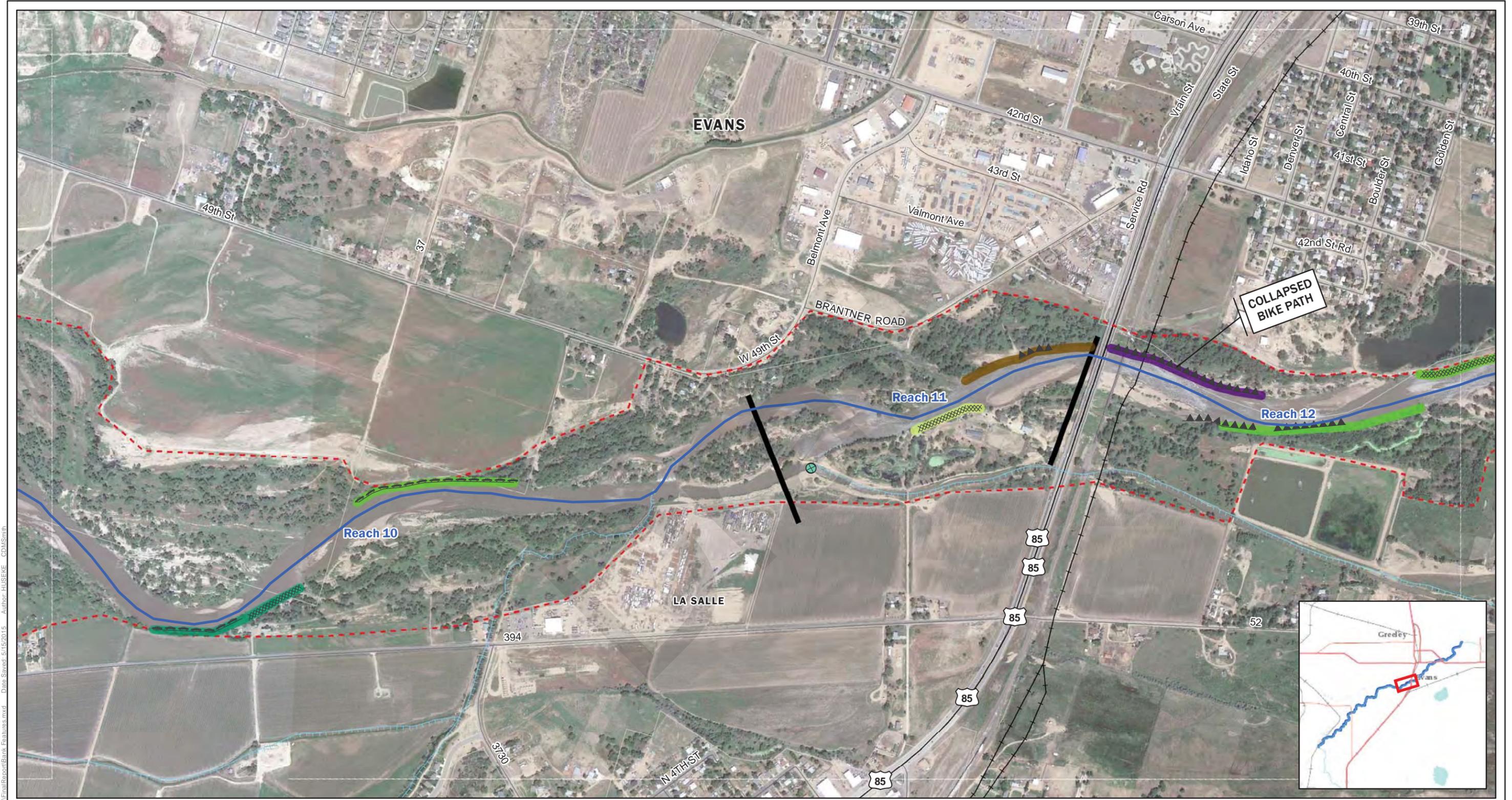
Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM\Smith



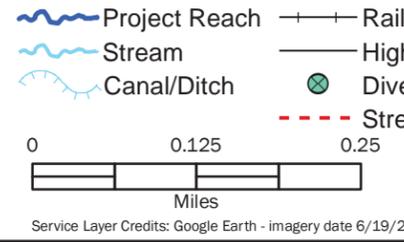
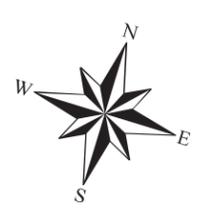
South Platte River Restoration Master Plan

Appendix E - Figure E-5: Geomorphic Risk Analysis | Map Index Page 5





Document Path: J:\SouthPlatte\Rehab\GIS\W\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM/Smith



- Project Reach
- Stream
- Canal/Ditch
- Railroad
- Highway
- Diversion Structures
- Stream Bank Line - Post Flood

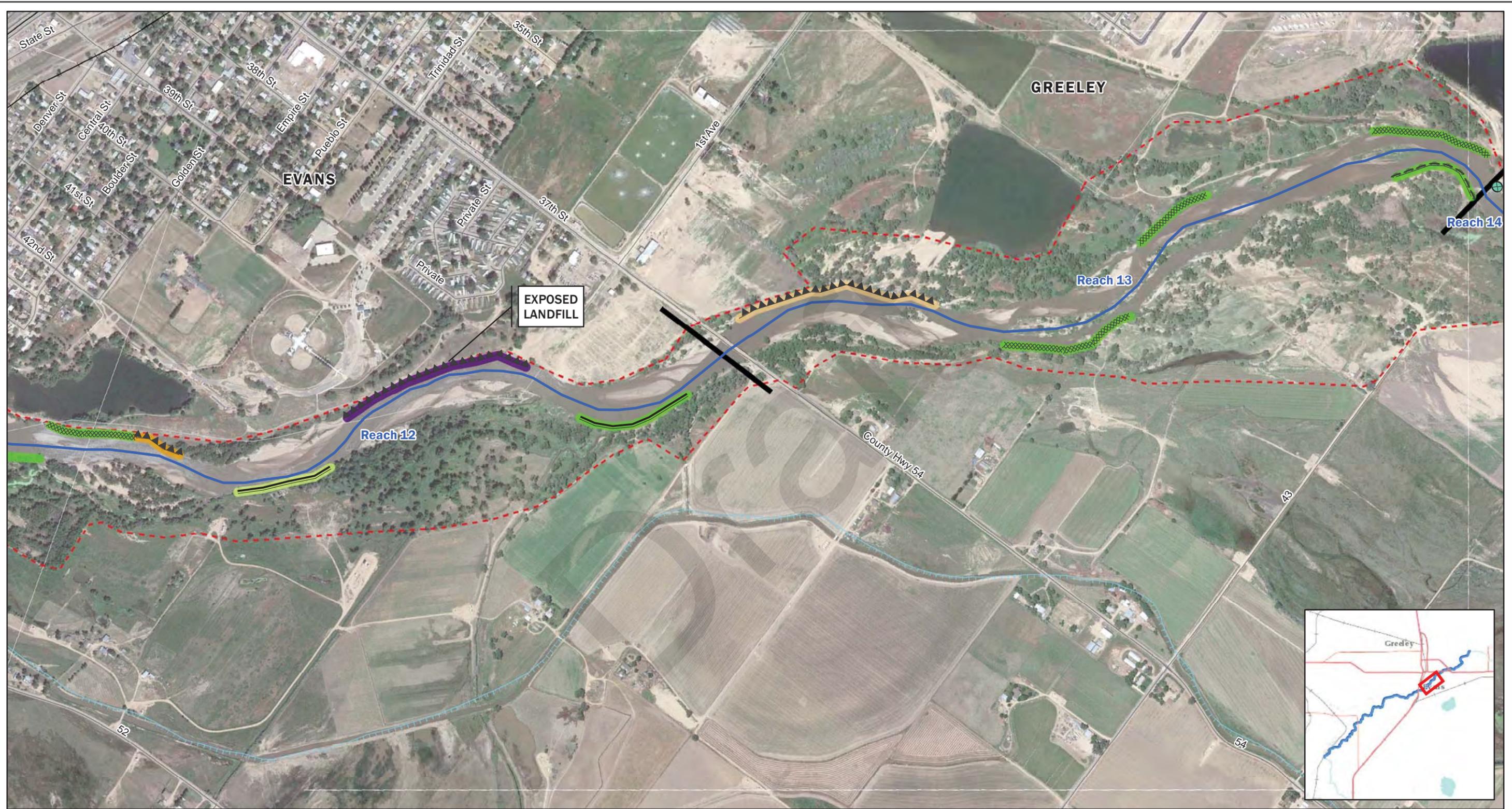
- Feature**
- Vertical Bank
 - Rip Rap
 - Concrete Rubble
 - Car Beds
 - Outside Bank

- Flood Hazard Erosion: Potential and Severity**
- Low, Low
 - Low, Medium
 - Low, High
 - Medium, Low
 - Medium, Medium
 - Medium, High
 - High, Low
 - High, Medium
 - High, High

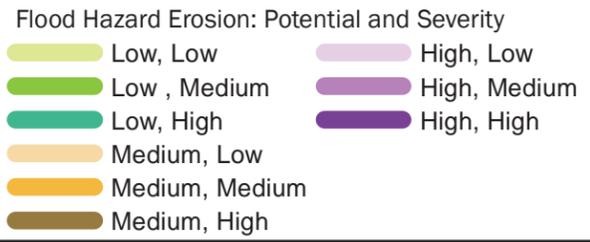
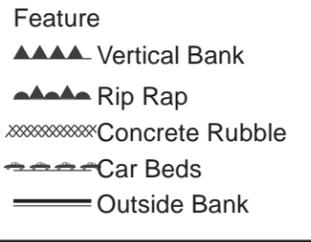
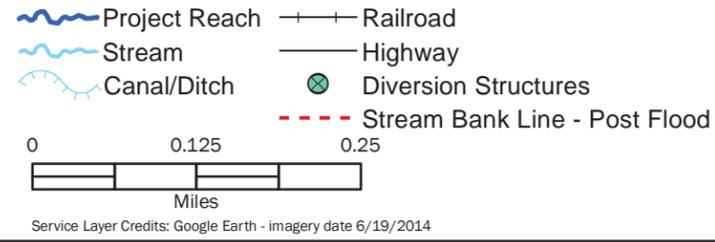
South Platte River Restoration Master Plan

Appendix E - Figure E-6: Geomorphic Risk Analysis | Map Index Page 6





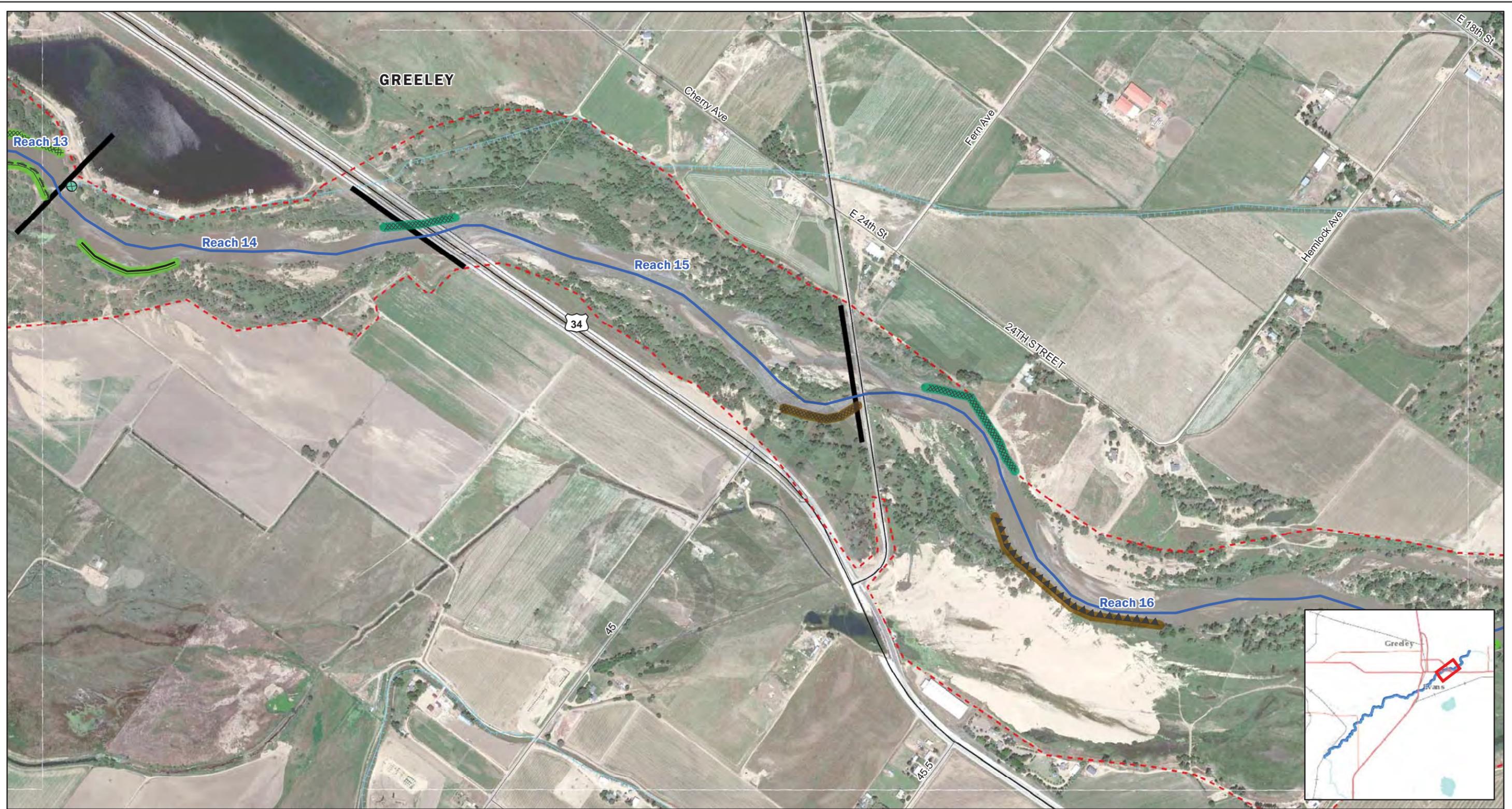
Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank_Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM/Smith



South Platte River Restoration Master Plan

Appendix E - Figure E-7: Geomorphic Risk Analysis | Map Index Page 7





Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM/Smith



Project Reach	Railroad
Stream	Highway
Canal/Ditch	Diversion Structures
Stream Bank Line - Post Flood	

0 0.125 0.25
Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014

Feature

- Vertical Bank
- Rip Rap
- Concrete Rubble
- Car Beds
- Outside Bank

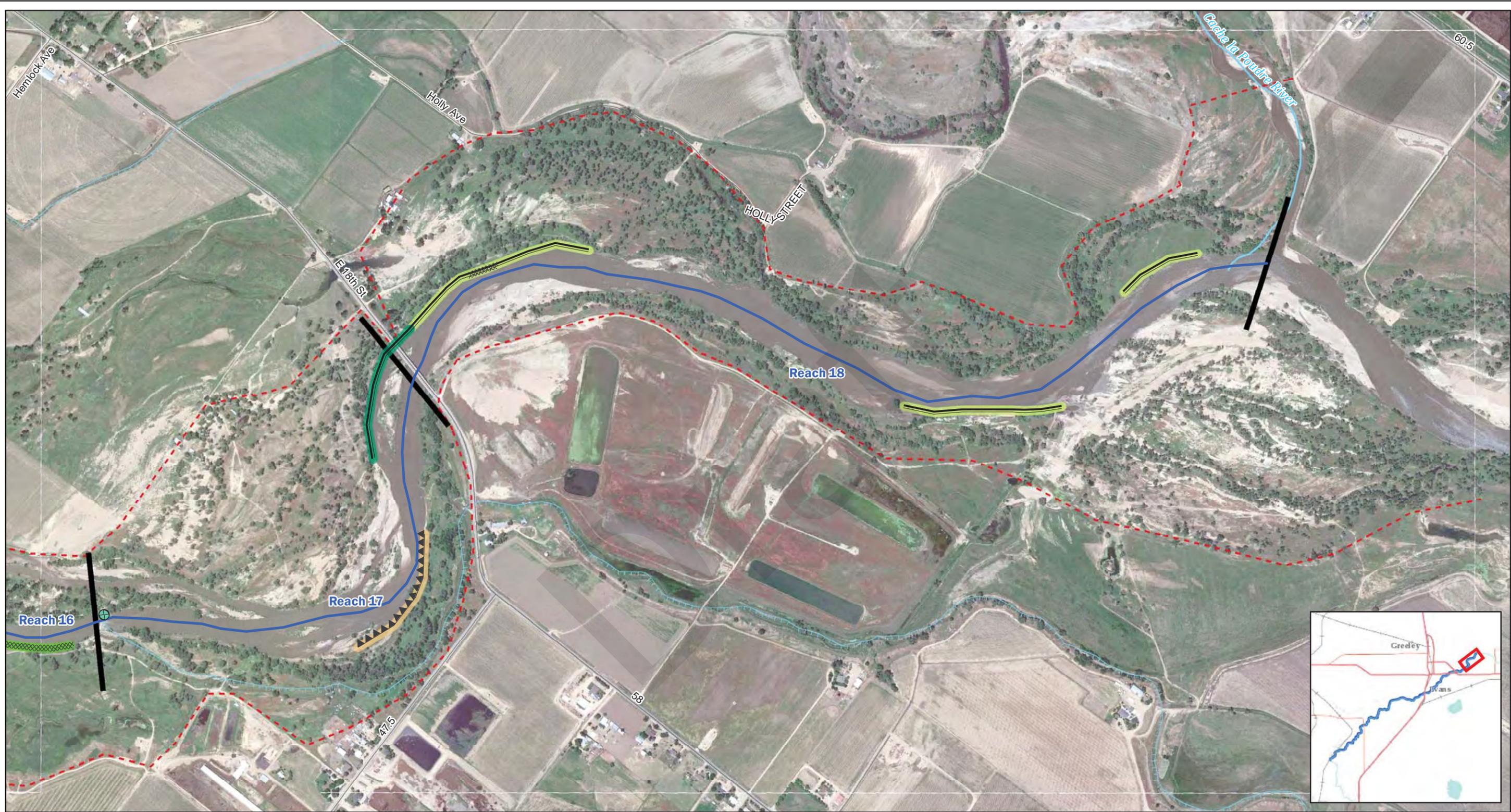
Flood Hazard Erosion: Potential and Severity

Low, Low	High, Low
Low, Medium	High, Medium
Low, High	High, High
Medium, Low	
Medium, Medium	
Medium, High	

South Platte River Restoration Master Plan

Appendix E - Figure E-8: Geomorphic Risk Analysis | Map Index Page 8





- | | |
|-------------------------------|----------------------|
| Project Reach | Railroad |
| Stream | Highway |
| Canal/Ditch | Diversion Structures |
| Stream Bank Line - Post Flood | |

- Feature**
- Vertical Bank
 - Rip Rap
 - Concrete Rubble
 - Car Beds
 - Outside Bank

- Flood Hazard Erosion: Potential and Severity**
- | | |
|----------------|--------------|
| Low, Low | High, Low |
| Low, Medium | High, Medium |
| Low, High | High, High |
| Medium, Low | |
| Medium, Medium | |
| Medium, High | |

South Platte River Restoration Master Plan

Appendix E - Figure E-9: Geomorphic Risk Analysis | Map Index Page 9



Document Path: J:\SouthPlatte\Rehab\GIS\Map\FinalReport\Bank Features.mxd Date Saved: 5/15/2015 Author: HUSEKE CDM/Smith

Service Layer Credits: Google Earth - imagery date 6/19/2014

Appendix F

Draft



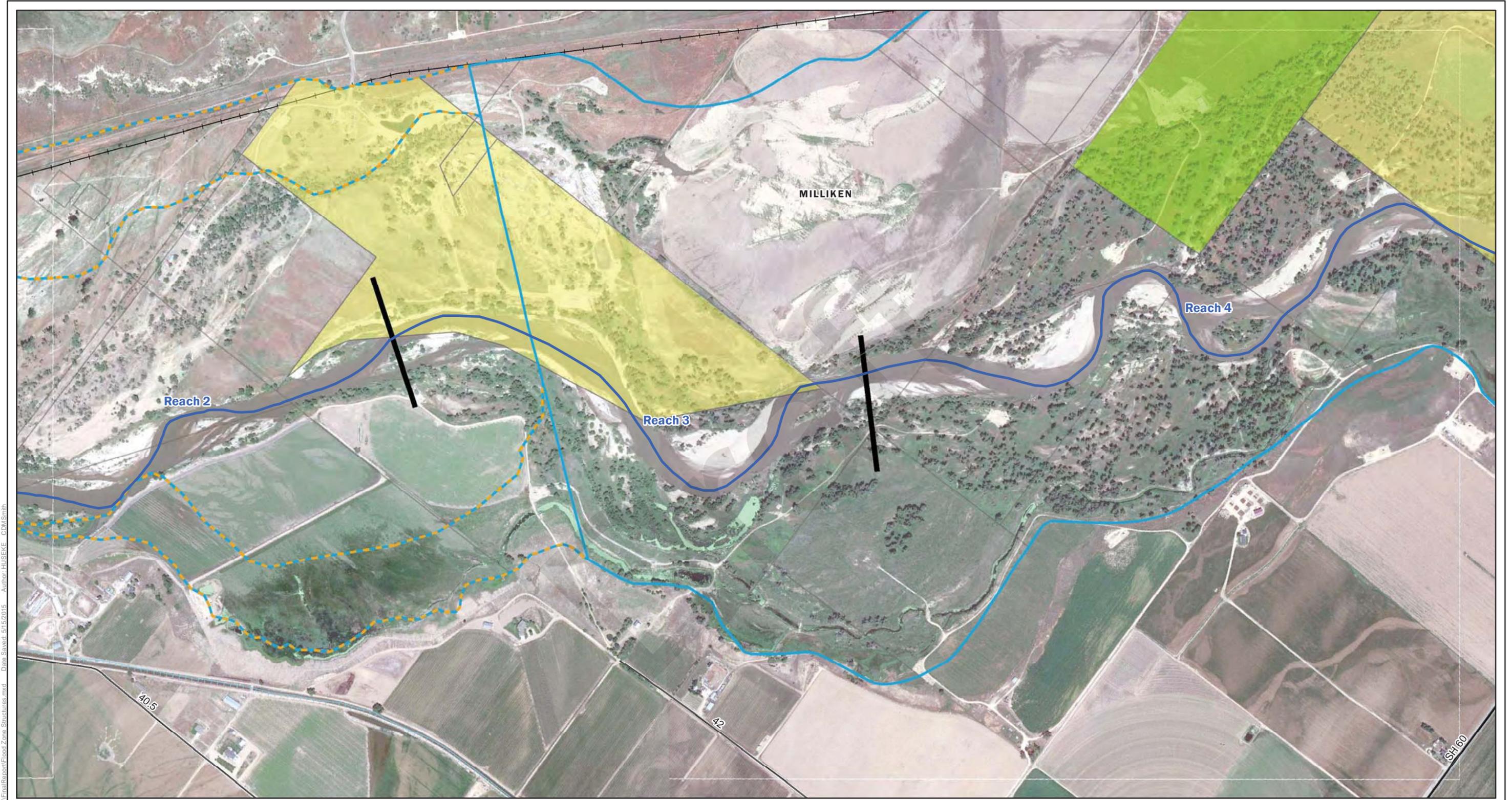
Document Path: J:\SouthPlatte\Rehab\GIS\WIP\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HUSKE CDM5Smith

	Project Reach	Railroad	FEMA Preliminary Flood Zone	Insured Structures per Parcel
	Stream	Highway	Approximate	1 - 2
	Canal/Ditch	Diversion Structures	Detailed Study	2 - 5
				5 - 10
				11 +

Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan
 Appendix F - Figure F-1: Flood Hazard Risk Analysis | Map Index Page 1





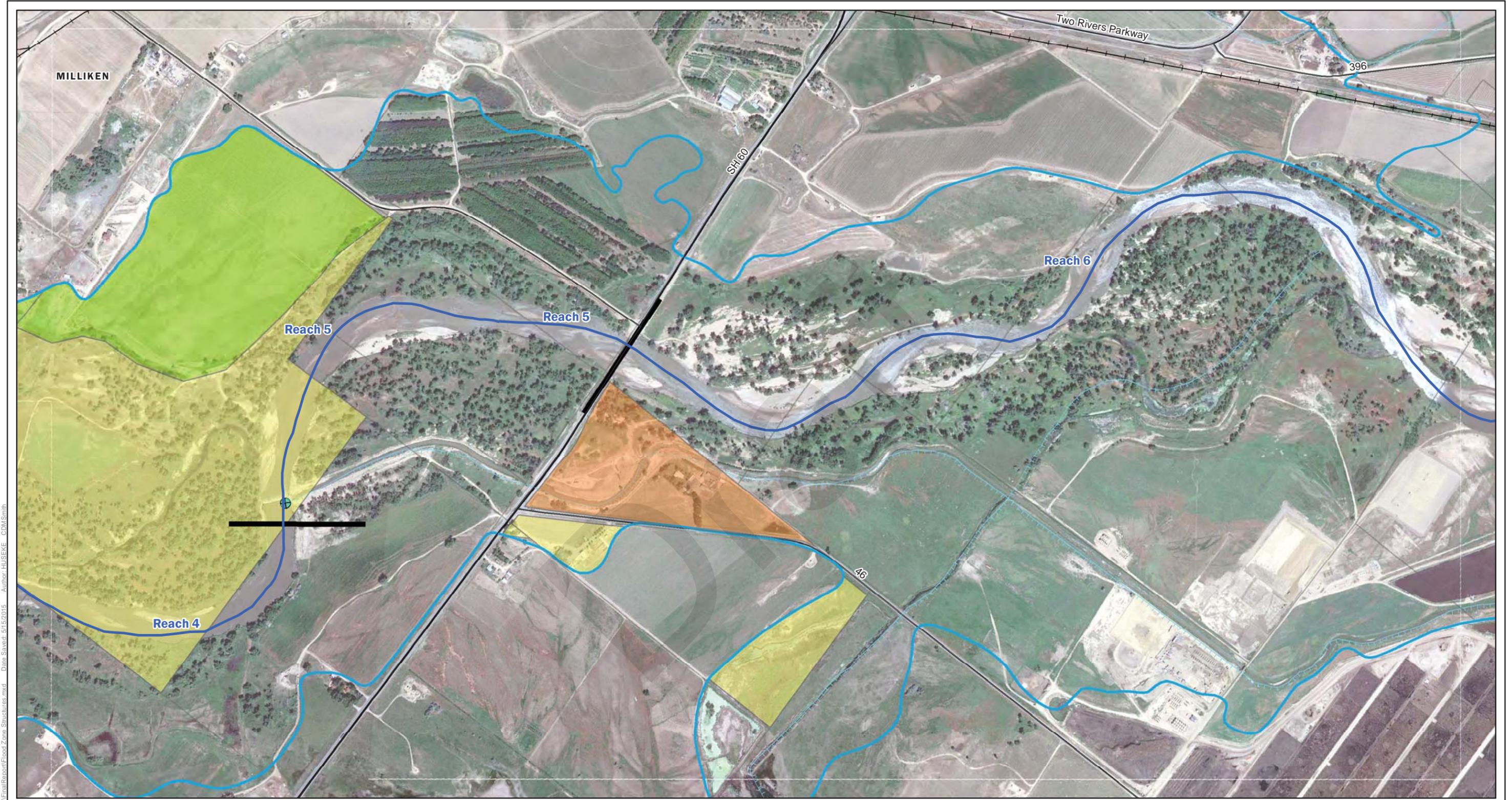
Document Path: J:\SouthPlatte\Rehab\GIS\WQD\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HUSSEKE CDM5Smith

	Project Reach	Railroad	Stream	Highway	Canal/Ditch	Diversion Structures	FEMA Preliminary Flood Zone Approximate Detailed Study	Insured Structures per Parcel 1 - 2 2 - 5 5 - 10 11 +

Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan
 Appendix F - Figure F-2: Flood Hazard Risk Analysis | Map Index Page 2





Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HULSEKE CDM5Smith

	Project Reach	Railroad	FEMA Preliminary Flood Zone	Insured Structures per Parcel
	Stream	Highway	Approximate	1 - 2
	Canal/Ditch	Diversion Structures	Detailed Study	2 - 5
				5 - 10
				11 +

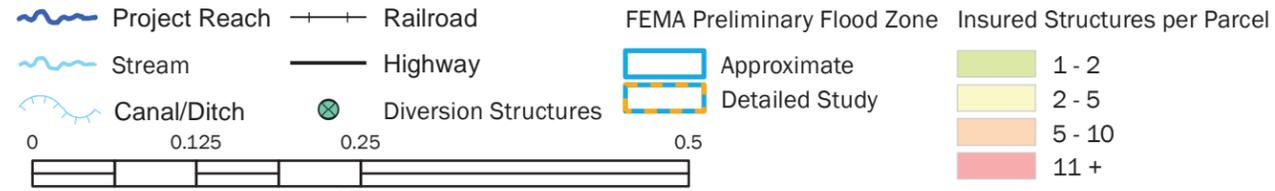
Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan
 Appendix F - Figure F-3: Flood Hazard Risk Analysis | Map Index Page 3





Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HULSEKE CDM5Smith

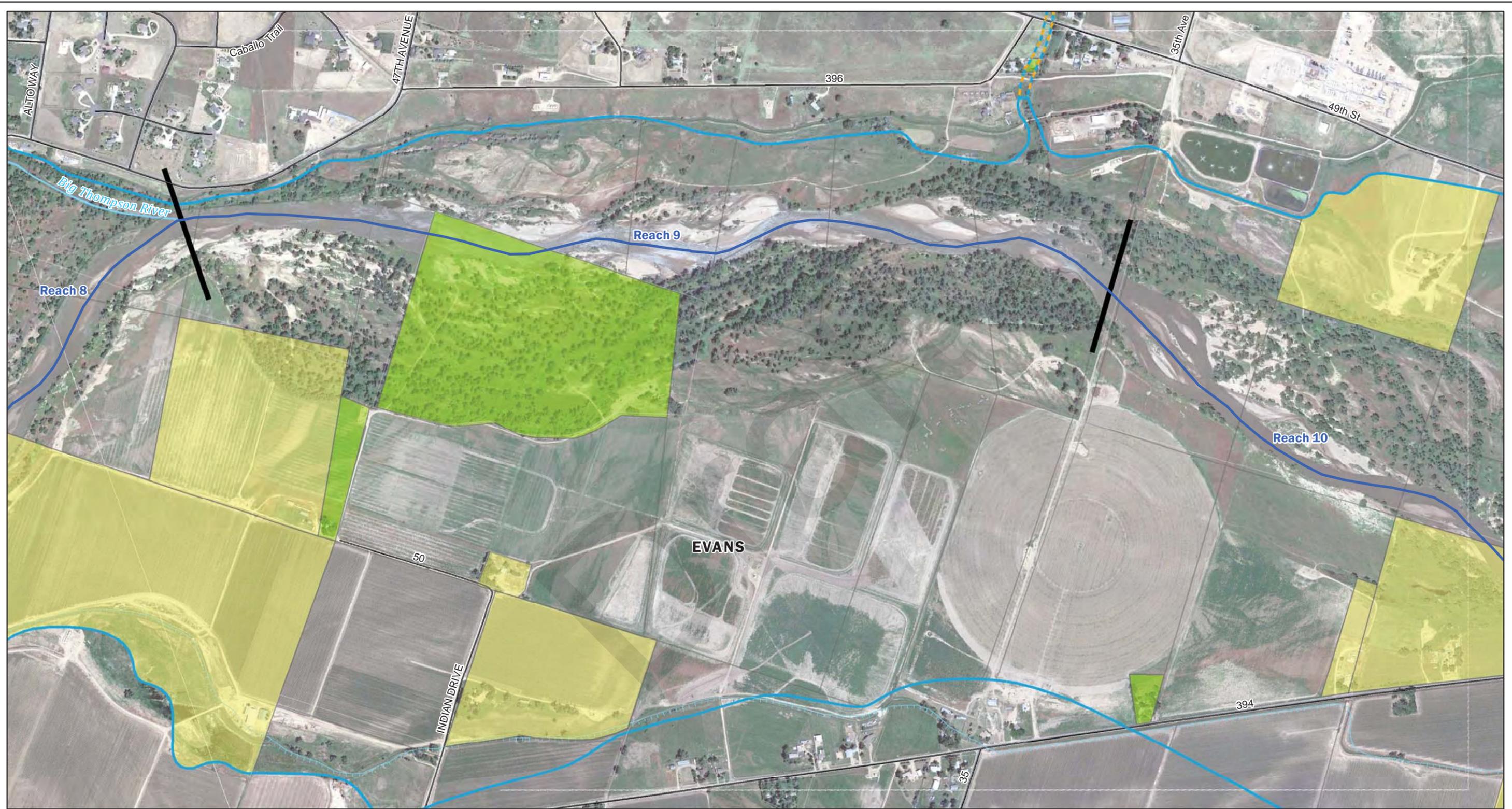


Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan

Appendix F - Figure F-4: Flood Hazard Risk Analysis | Map Index Page 4

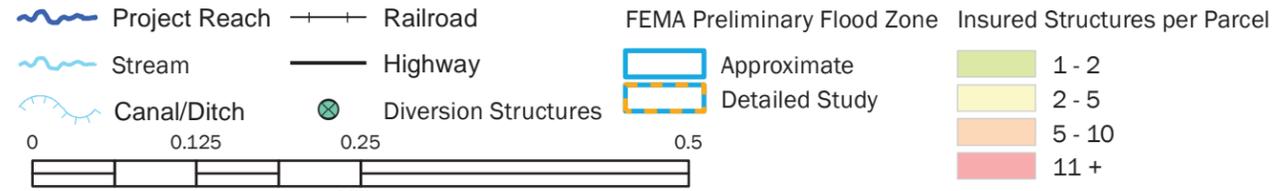
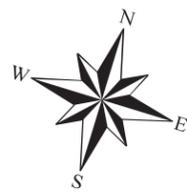




Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HULSEKE CDM5Smith

South Platte River Restoration Master Plan

Appendix F - Figure F-5: Flood Hazard Risk Analysis | Map Index Page 5

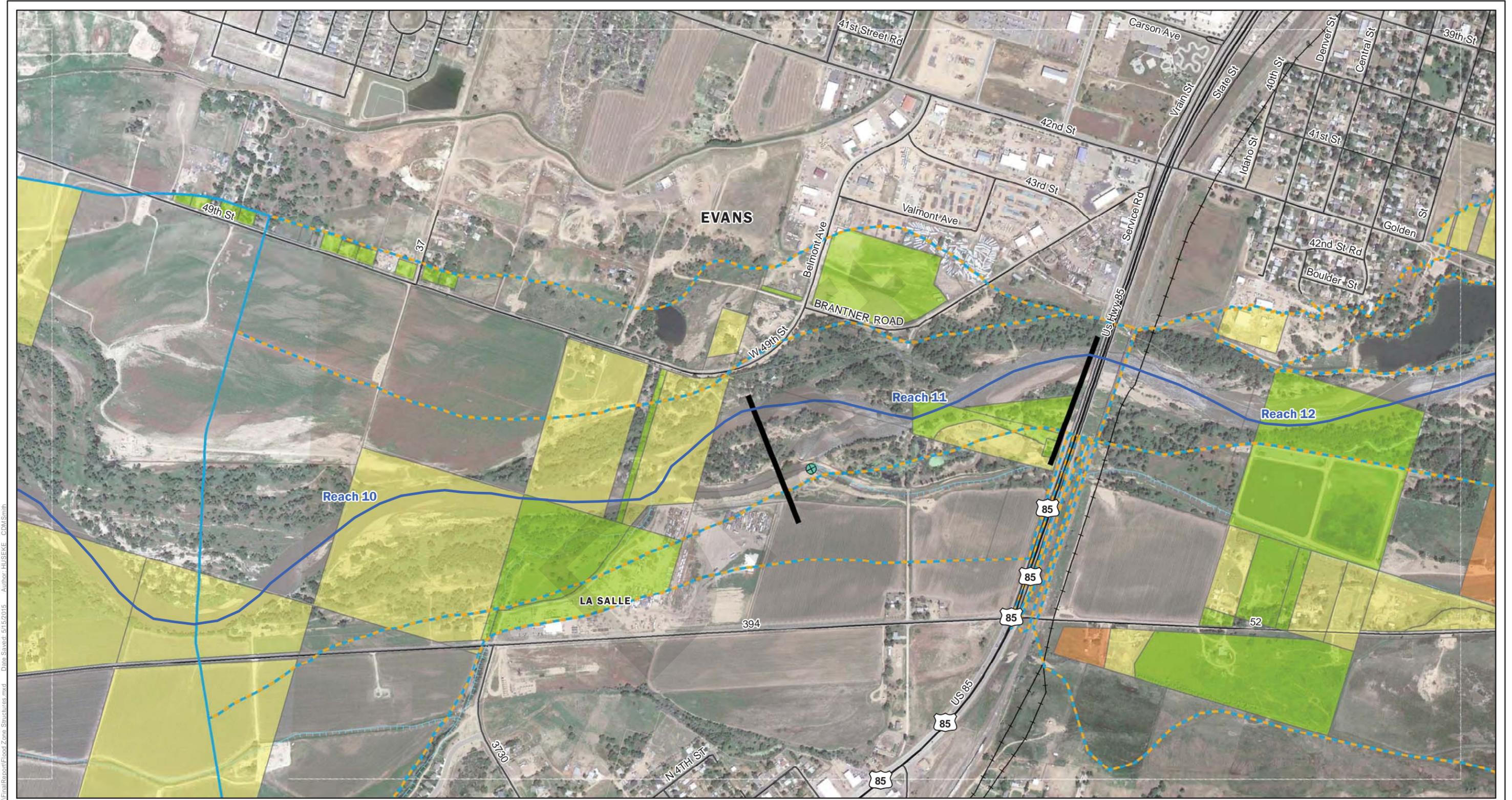


Service Layer Credits: Google Earth - imagery date 6/19/2014



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





Document Path: \\SouthPlatte\Rehab\GIS\WAD\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HJSEKE CDM5Smith



Service Layer Credits: Google Earth - imagery date 6/19/2014

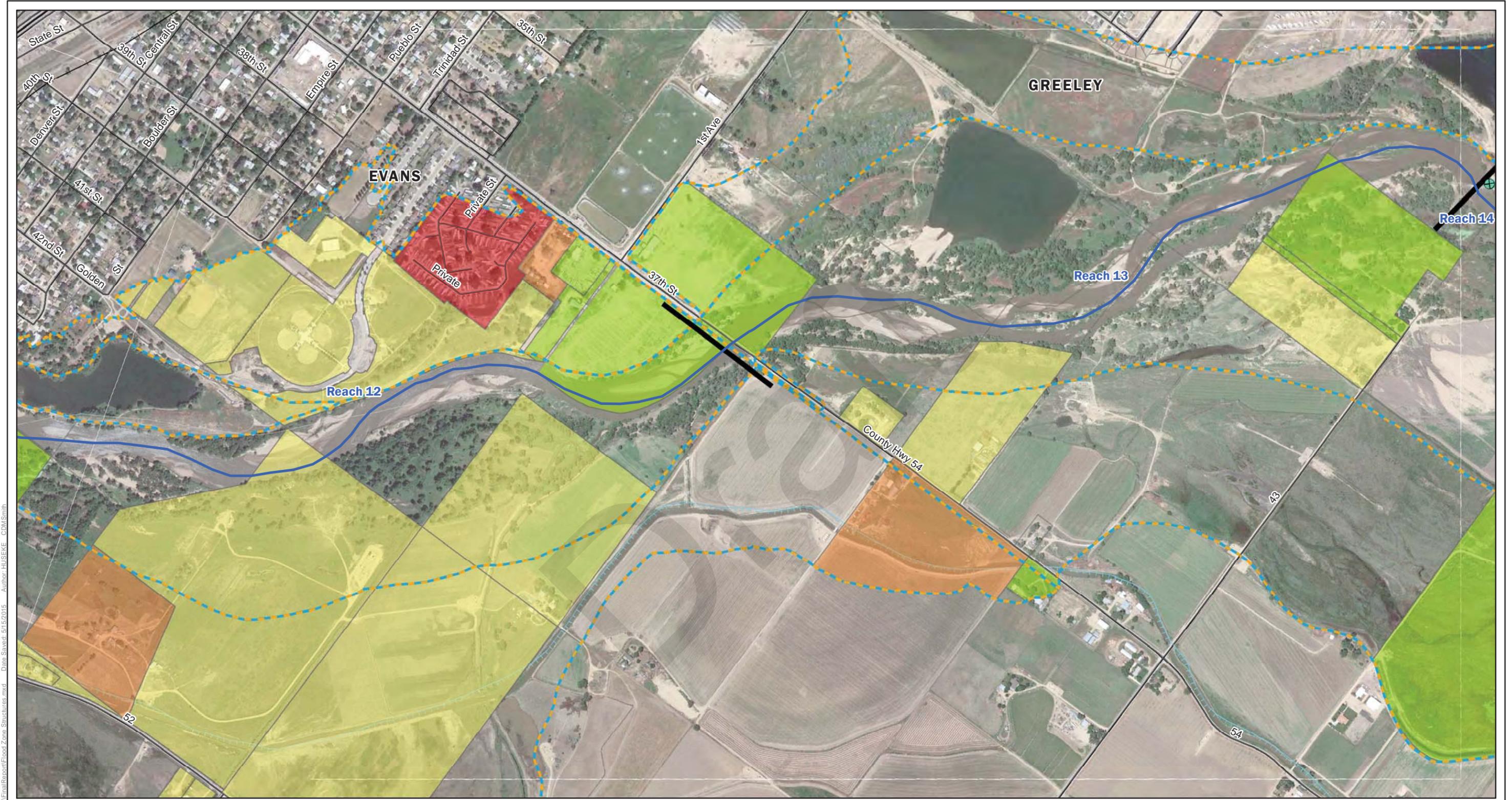
South Platte River Restoration Master Plan

Appendix F - Figure F-6: Flood Hazard Risk Analysis | Map Index Page 6



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources





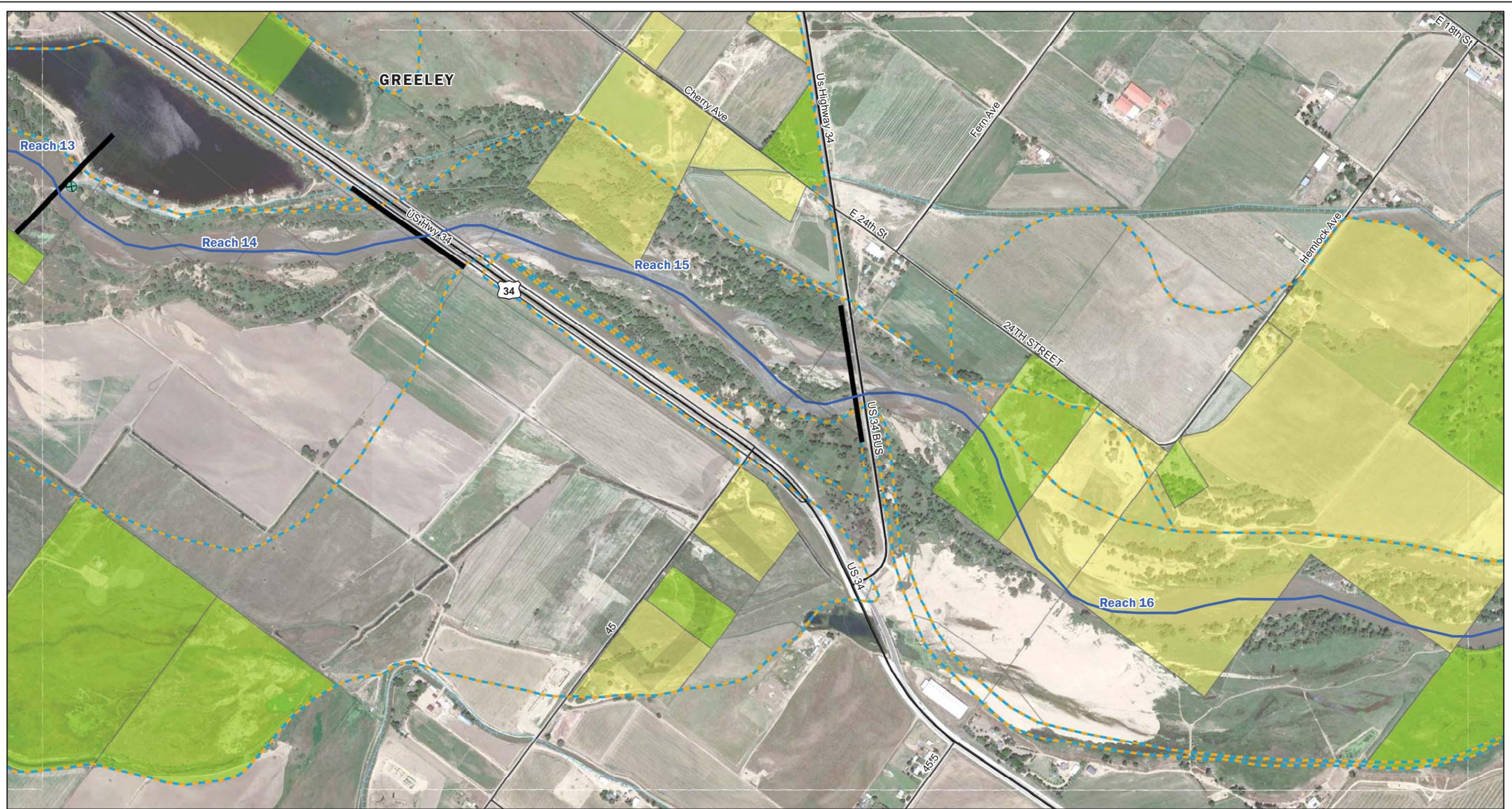
Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HULSEKE CDM5Smith

	Project Reach	Railroad	FEMA Preliminary Flood Zone	Insured Structures per Parcel
	Stream	Highway	Approximate	1 - 2
	Canal/Ditch	Diversion Structures	Detailed Study	2 - 5
	0 0.125 0.25 0.5 Miles			5 - 10
				11 +

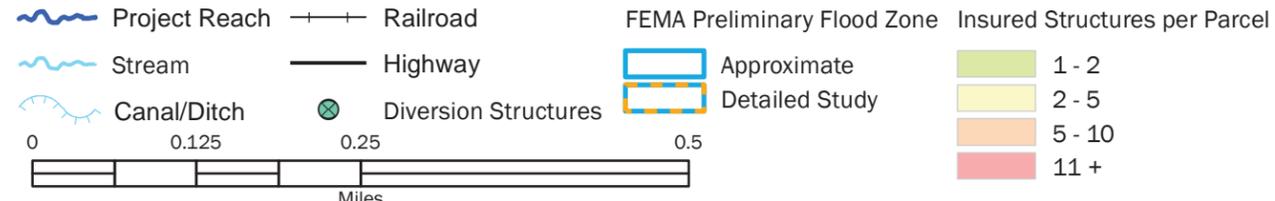
Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan
 Appendix F - Figure F-7: Flood Hazard Risk Analysis | Map Index Page 7





Document Path: J:\SouthPlatte\Rehab\GIS\MapDocs\FinalReport\Flood Zone Structures.mxd Date Saved: 5/15/2015 Author: HJSEKE CDM5Smith



Service Layer Credits: Google Earth - imagery date 6/19/2014

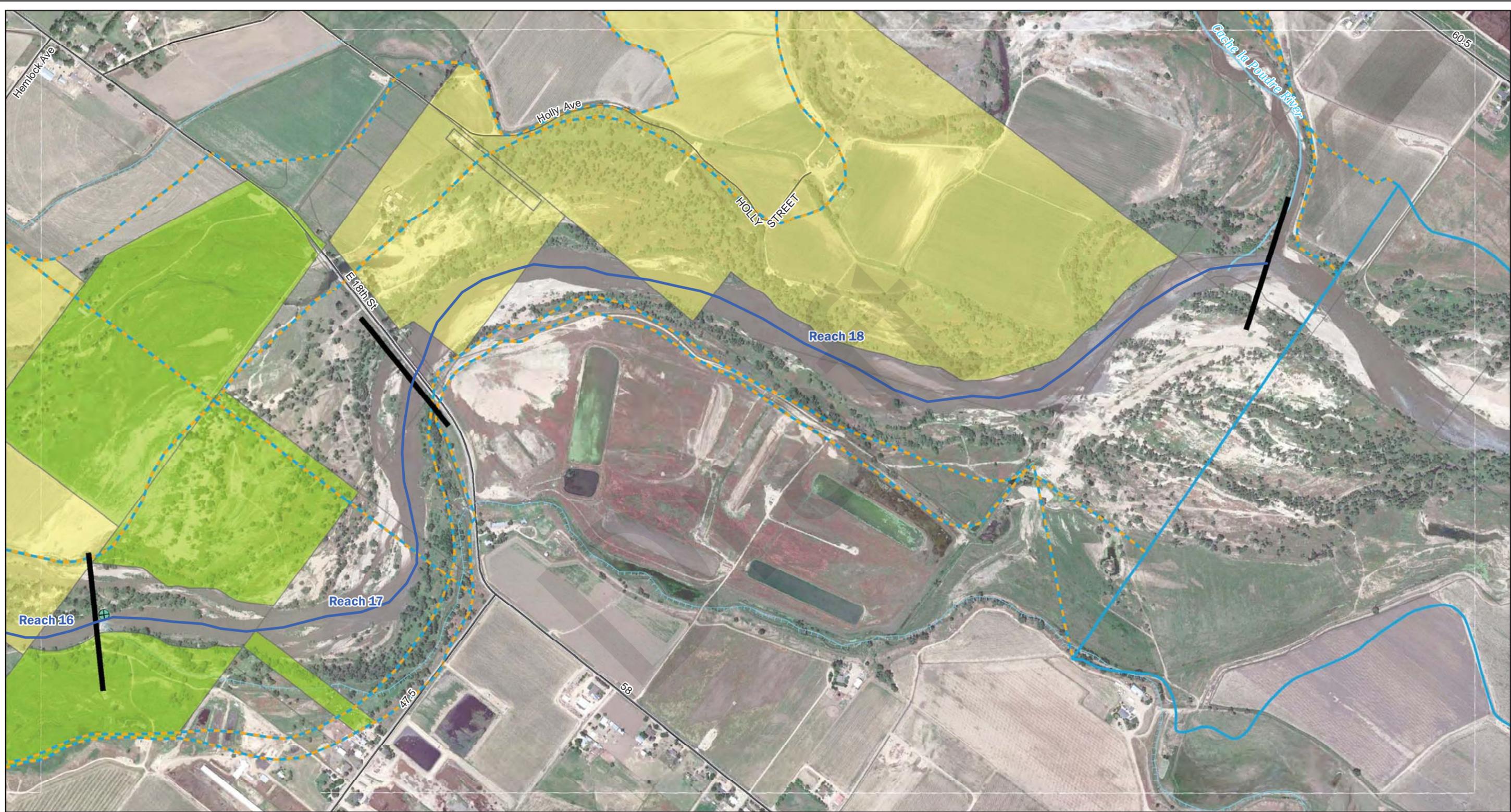
South Platte River Restoration Master Plan

Appendix F - Figure F-8: Flood Hazard Risk Analysis | Map Index Page 8



COLORADO
 Colorado Water Conservation Board
 Department of Natural Resources





Document Path: J:\SouthPlatte\Rehab\GIS\WAD\FinalReport\Flood_Zone_Structures.mxd Date Saved: 5/15/2015 Author: HUSKE CDM5mith

	Project Reach	Railroad	FEMA Preliminary Flood Zone	Insured Structures per Parcel
	Stream	Highway	Approximate Detailed Study	1 - 2 2 - 5 5 - 10 11 +

Canal/Ditch
 Diversion Structures

0 0.125 0.25 0.5
 Miles

Service Layer Credits: Google Earth - imagery date 6/19/2014

South Platte River Restoration Master Plan
 Appendix F - Figure F-9: Flood Hazard Risk Analysis | Map Index Page 9

