Jacob's Ladder
Stream Restoration Monitoring Report
DMS Project # 95023
DMS Contract # 003983
Monitoring Year 03

Submitted to:

NCDEQ-DMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Construction Completed: January 2014
Data Collection: 2016
Submitted: December 2016

Design and Monitoring Firm

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Project No: 20110669

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Jacob's Ladder Stream Restoration Site is a full-delivery project that was developed for the North Carolina Division of Mitigation Services (DMS). Construction was completed in January 2014. The site restored a total of 4,971 linear feet and enhanced 446 linear feet along three tributaries to Irish Buffalo Creek in the Yadkin-Pee Dee River Basin. The project is located west of China Grove and north of Kannapolis off of Saw Road in Rowan County (Figure 1, Appendix A). This project will expand aquatic and terrestrial habitat in the Rocky River Watershed (03040105). The project is within the 03040105020040 Irish Buffalo Creek Local Watershed Unit (14-digit HUC) (NCDENR, EEP 2009). In the North Carolina Division of Mitigation Services' (DMS) most recent publication of excluded and Targeted Local Watersheds/Hydrologic Units, the 03040105020040 14-digit HUC has been identified as a Targeted Local Watershed. The project is located in the Piedmont Physiographic Province and the project streams initiate as headwater systems out of moderately-sloped, forested hills before reaching the floodplain of Irish Buffalo Creek. The site's 1.07-square mile project watershed is comprised predominantly of pasture and mixed hardwoods, with an area of rural residential development in the northeastern corner. Prior to construction, the site was actively used for timber and cattle production for over five generations.

The project goals and objectives are listed below.

Project Goals

- Restore a diverse riparian corridor that connects forested stream systems upstream and downstream of the project.
- Reduce the sediment supply entering Irish Buffalo Creek.

Project Objectives

- Restore stable channel planforms to streams that have been straightened and modified.
- Reshape and stabilize eroding stream banks.
- Plant the site with native trees to help reestablish a diverse riparian corridor.
- Install exclusion fencing and alternative watering options to keep livestock out of the project streams.

Vegetation success is based on the criteria established in the USACE Stream Mitigation Guidelines (2003). This document states that vegetation monitoring results should have the following planted stem density minimums in the corresponding monitoring years: 320 stems/acre through Year Three, 288 stems/acre in Year Four, and 260 stems/acre in Year Five. The third-year vegetation monitoring was based on the Level 2 CVS-EEP vegetation monitoring protocol. The site's average density for this monitoring period is 536 planted stems/acre, with none of the plots having live stakes in them. Thirteen of the sixteen plots had greater than 320 planted stems/acre. There are three monitoring plots that have calculated planted stem densities less than 320 stems/acre (Plots 8, 11, and 15). This is not seen as problematic given the high potential for desirable volunteers to become established in the plots and across the site. Like natural vegetative communities, some areas will have slightly higher densities than others, but the data from the vegetation monitoring plots reveal that the site has an adequate average stem density. To ensure continued vegetative success, some parts of the site received supplemental planting in early 2015. Including volunteers, the monitoring plots averaged 908 total stems/acre. The overall vegetation assessment found the site to be on track to meeting the vegetative success criterion.

Third-year monitoring found the Jacob's Ladder streams to be stable, with only minor changes from the as-built conditions. No areas show signs of serious bank erosion. The monitoring components were installed in February/March 2014. An automatic recording gauge has been installed on both T1 and T2. Both gauges recorded bankfull events in 2016. Additionally, during the end of year site visit, many clear signs of a recent bankfull event were observed. The monitoring plan for each tributary is as follows: T1 has a 1,500 foot longitudinal profile, 3

riffle cross-sections and 2 pool cross-sections; T2 has a 1,500 foot longitudinal profile, 4 riffle cross-sections and 1 pool cross-section; T1A is being monitored visually since it is small, partially intermittent, and a mix of mitigation types. Pebble counts were conducted at all ten cross-sections. Nine permanent photo points have been established with a total of nineteen photos to be taken annually. Monitoring year 3 found both T1 and T2 functioning as designed with little change from the baseline conditions.

On March 9, 2015, a utility line that crosses reach T1 near stationing 34+00 was identified, and it was determined that 49 linear feet of channel are impacted by this, resulting in a reduction of 25 credits from what was reported in previous reports. See Table 1 and the CCPV for more information. Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan documents available on the DMS website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

2.0 METHODOLOGY

The survey data were collected with a total station instrument on June 8 and 9, 2016.

The CVS-EEP protocol, Level 2 (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from the site. The vegetation monitoring was completed on November 2, 2016.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

NCDENR, Ecosystem Enhancement Program. 2009. Lower Yadkin Pee-Dee River Basin Priorities 2009. Raleigh, NC. http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Appendix A

Project Vicinity Map and Background Tables

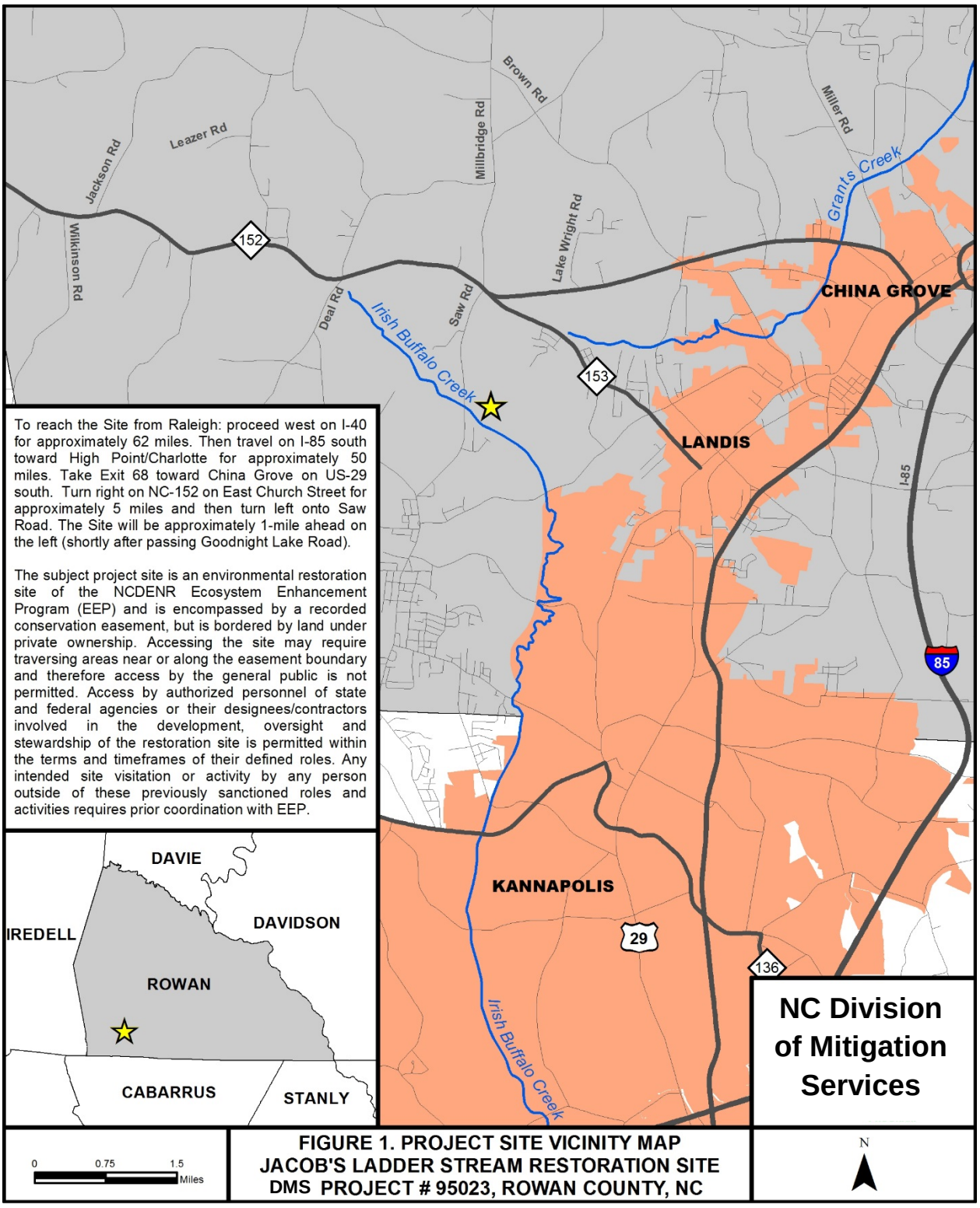


FIGURE 1. PROJECT SITE VICINITY MAP
JACOB'S LADDER STREAM RESTORATION SITE
DMS PROJECT # 95023, ROWAN COUNTY, NC

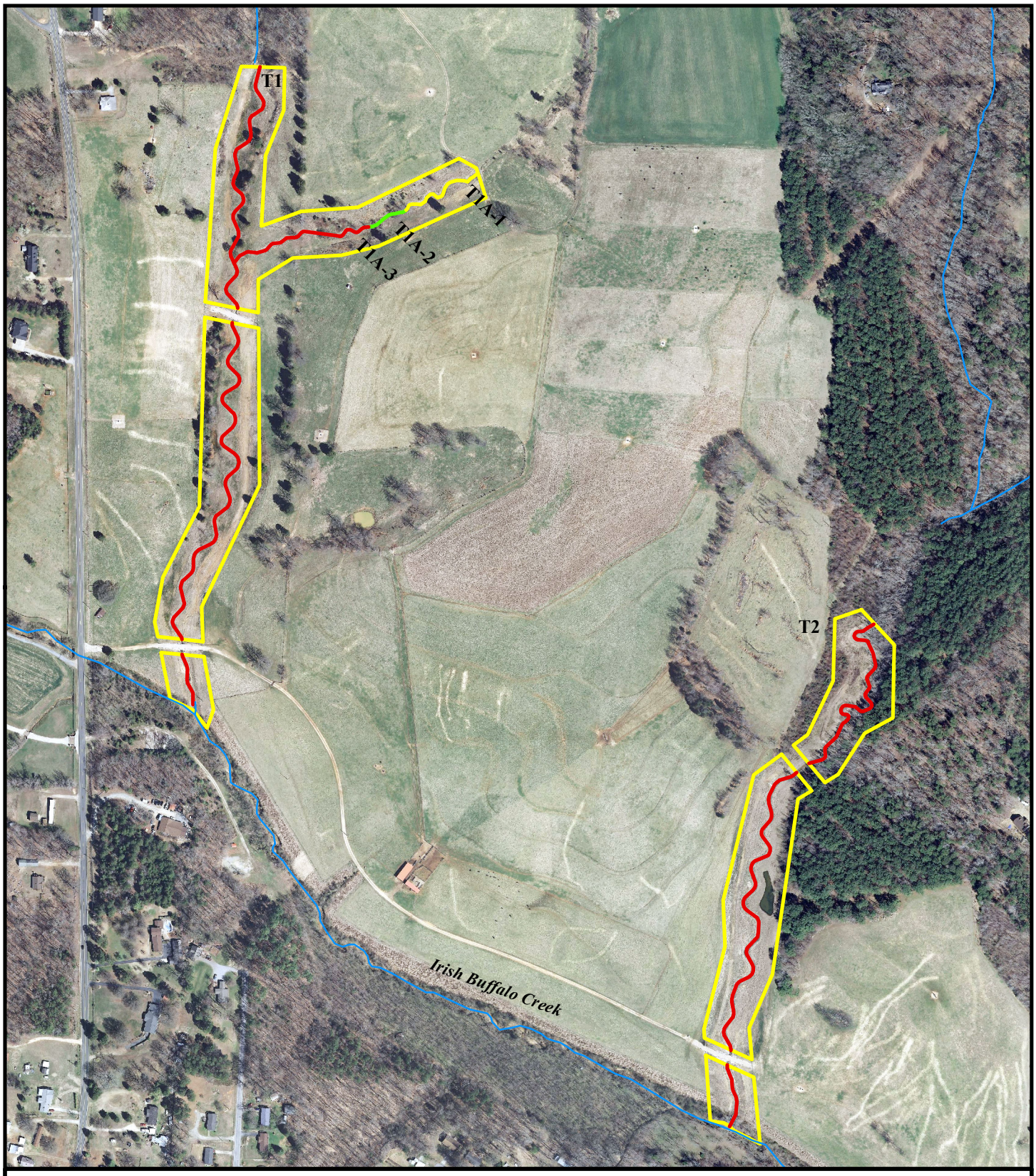


Figure 2. Site Asset Map

KCI

- Restoration
- Enhancement I
- Enhancement II
- Other Streams
- Conservation Easement

1:5,400
1 inch = 450 feet

N

440 220 0 440 Feet

Image Source: NC State Orthoimagery, 2014

Table 1. Project Components and Mitigation Credits
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Mitigation Credits							
	Stream			Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset
Type	R	EI	EII				
Length	4,971	306	140				
Credits	4,946	204	56				
TOTAL CREDITS	5,206						

Project Components						
Project Component -or- Reach ID	Design Stationing/ Location	Existing Footage	Approach (P1, P2 etc.)	Restoration -or- Restoration Equivalent	Restoration Footage	Mitigation Ratio
T1	10+00-34+89*	1,809	P1	Restoration	2,389*	1:1
T1A-1	50+00-53+06	306	-	Enhancement I	306	1:1.5
T1A-2	53+06-54+46	140	-	Enhancement II	140	1:2.5
T1A-3	54+46-59+44	470	P1	Restoration	498	1:1
T2	99+75-121+60*	1,246	P1	Restoration	2,084*	1:1

Component Summation		
Restoration Level	Stream (linear feet)	Mitigation Units (SMU)
Restoration	4,971	4,971
Enhancement I	306	204
Enhancement II	140	56

*Mitigation units have been calculated to exclude the easement exceptions and utility crossings.
There were no BMP elements included in this project.

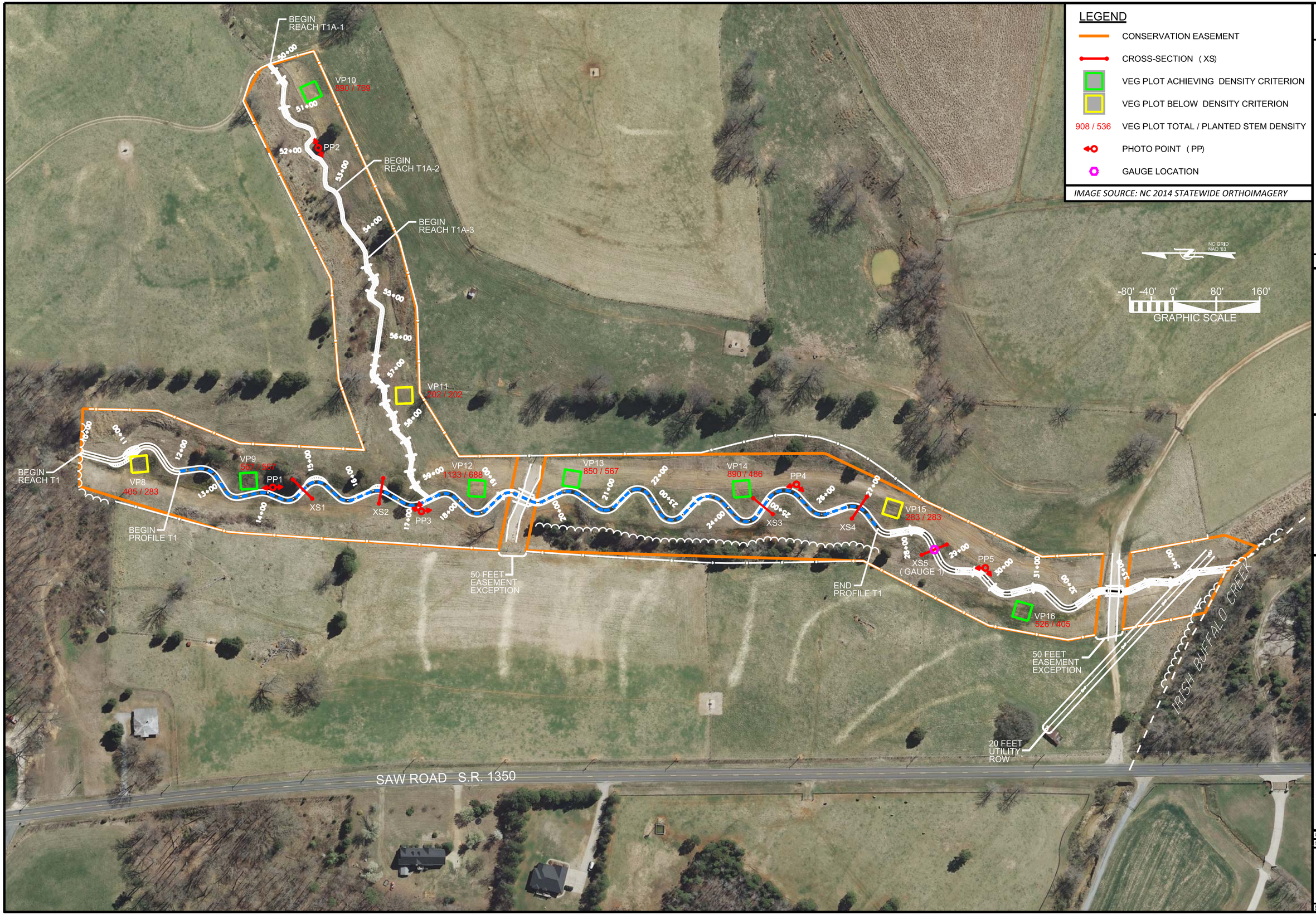
Table 2. Project Activity & Reporting History Jacob's Ladder Stream Restoration Site, DMS Project # 95023		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Sept 12
Final Design - Construction Plans		Dec 12
Construction		Aug 13
Planting		Jan 14
Baseline Monitoring/Report	Feb/March 14	April 14
Year 1 Monitoring	Nov 14	Jan 15
Supplemental Planting		March 15
Year 2 Monitoring	August 15	Dec 15
Year 3 Monitoring	Nov 16	Dec 16

Table 3. Project Contacts Jacob's Ladder Stream Restoration Site, DMS Project # 95023	
Design Firm	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	Wright Contracting, LLC 160 Walker Road Lawndale, NC 28090 Contact: Mr. Stephen James Phone: (704) 692-4633
Planting Contractor	Forestree Management Co. 1280 Maudis Road Bailey, NC 27807 Contact: Mr. Tony Cortez Phone: (252) 243-2513
Monitoring Performers	
MY00- MY03	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Information **Jacob's Ladder Stream Restoration Site, DMS Project # 95023**			
Project Name	Jacob's Ladder Stream Restoration Site		
County	Rowan County		
Project Area (acres)	17.2 acres		
Project Coordinates (lat. and long.)	35.552956 N, 80.653116 W		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Yadkin-Pee Dee		
USGS Hydrologic Unit 8-digit	03040105	USGS Hydrologic Unit 14-digit	03040105020040
DWQ Sub-basin	13-17-09		
Project Drainage Area	682 acres/1.06 square miles		
Project Drainage Area Percentage of Impervious Area	1.1%/8 acres		
CGIA Land Use Classification	15.8% Cultivated, 35.1% Managed Herbaceous Cover, 41.6% Mixed Upland Hardwoods, 6.9% Mixed Hardwoods/Conifers, and 0.5% Southern Yellow Pine		
Reach Summary Information (Post-Restoration)			
Parameters	**T1**	**T1A-1, T1A-2, T1A-3**	**T2**
Length of reach (linear feet)	2,389	944	2,084
Valley classification	VIII	VIII	VIII
Drainage area (acres)	231.6 acres	34.5 acres	450.1 acres
NCDWQ Water Quality Classification	Class C, WSIII	Class C, WSIII	Class C, WSIII
Morphological Description (stream type)	C4	B4c/C4	C4
Evolutionary trend	Stage II (Constructed)	Stage II (Constructed)	Stage II (Constructed)
Mapped Soil Series	Chewacla loam	Pacolet sandy loam	Pacolet sandy loam & Chewacla loam
Drainage class	Poorly drained	Well drained	Well drained
Soil Hydric status	Non hydric	Non hydric	Non hydric
Slope	0-2%	0-2%	0-2%
FEMA classification	AE (portion in backwater of Irish Buffalo Creek only)	N/A	AE (portion in backwater of Irish Buffalo Creek only)
Native vegetation community	Piedmont Alluvial Forest	Mesic Mixed Hardwood Forest & Piedmont Alluvial Forest	Piedmont Alluvial Forest
Percent composition of exotic invasive vegetation	0%	0%	0%
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes, received 404 permit	N/A
Waters of the United States – Section 401	Yes	Yes, received 401 permit	N/A
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Floodplain development permit completed through Rowan County	N/A
Essential Fisheries Habitat	No	N/A	N/A

Appendix B

Visual Assessment Data



DATE
DESCRIPTION
REVISIONS
CHK

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS PLANNERS• SCIENTISTS
4505 FALLS OF NEUSE ROAD
RALEIGH, NORTH CAROLINA 27609

JACOB'S LADDER
STREAM MITIGATION PROJECT
MONITORING YEAR 3
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA
REACH T1

DATE: DEC 2016
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

LEGEND

- CONSERVATION EASEMENT
- CROSS-SECTION (XS)
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- 908 / 536 — VEG PLOT TOTAL / PLANTED STEM DENSITY
- PHOTO POINT (PP)
- GAUGE LOCATION

IMAGE SOURCE: NC 2014 STATEWIDE ORTHOIMAGERY

NC GRID NAD '83

–80′ –40′ 0′ 80′ 160′

GRAPHIC SCALE

BEGIN REACH T2

BEGIN PROFILE T2

END PROFILE T2

50 FEET EASEMENT EXCEPTION

50 FEET EASEMENT EXCEPTION

XS6 · XS7 · XS8 · XS9 · XS10 (GAUGE 2)

PP6 · PP7 · PP8 · PP9

VP1 1578 / 526

VP2 1781 / 607

VP3 1859 / 809

VP4 1174 / 647

VP5 1052 / 567

VP6 890 / 526

VP7 647 / 647

IRISH BUFFALO CREEK

REVISIONS			
SYM.	DESCRIPTION	DATE	

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ENGINEERS • PLANNERS • SCIENTISTS
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RALEIGH, NORTH CAROLINA 27609

JACOB'S LADDER STREAM MITIGATION PROJECT MONITORING YEAR 3

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T2

DATE: DEC 2016

SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 2 OF 2

Table 5. Visual Stream Morphology Stability Assessment
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Assessed Length 2,389 **Reach - T1**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	19	22			86%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	14	21			67%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	14	21			67%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	11	11			100%
		2. Thalweg centering at downstream of meander (Glide)	11	11			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	9	9			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	9			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	2	2			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A

Table 5. Visual Stream Morphology Stability Assessment
Jacob's Ladder Stream Restoration Site, DMS Project # 95023
Assessed Length 2,084 **Reach - T2**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	20	20			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	11	11			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	11	11			100%
	4.**Thalweg Position**[+]	1. Thalweg centering at upstream of meander bend (Run)	10	10			N/A
		2. Thalweg centering at downstream of meander (Glide)	10	10			N/A
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	6	6			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	6			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			N/A
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	3	3			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A

Table 6. Vegetation Condition Assessment
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Planted Acreage 15.9 **Easement Acreage 17.2**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acre	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acre	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acre	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Reference Points

PP1U – MY-00 – 3/11/14

PP1U – MY03 – 11/15/16

PP1D – MY-00 – 3/11/14

PP1D – MY03 – 11/15/16

PP2U – MY-00 – 3/11/14

PP2U – MY03 – 11/15/16

PP2D – MY-00 – 3/11/14

PP2D – MY03 – 11/15/16

PP3 Tributary – MY-00 – 3/11/14

PP3 Tributary – MY03 – 11/15/16

PP3U – MY-00 – 3/11/14

PP3U – MY03 – 11/15/16

PP3D – MY-00 – 3/11/14

PP3D – MY03 – 11/15/16

PP4U – MY-00 – 3/11/14

PP4U – MY03 – 11/15/16

PP4D – MY-00 – 3/11/14

PP4D – MY03 – 11/15/16

PP5U – MY-00 – 3/11/14

PP5U – MY03 – 11/15/16

PP5D – MY-00 – 3/11/14

PP5D – MY03 – 11/15/16

PP6U – MY-00 – 3/11/14

PP6U – MY03 – 11/15/16

PP6D – MY-00 – 3/11/14

PP6D – MY03 – 11/15/16

PP7U – MY-00 – 3/11/14

PP7U – MY03 – 11/15/16

PP7D – MY-00 – 3/11/14

PP7D – MY03 – 11/15/16

PP8U – MY-00 – 3/11/14

PP8U – MY03 – 11/15/16

PP8D – MY-00 – 3/11/14

PP8D – MY03 – 11/15/16

PP9U – MY-00 – 3/11/14

PP9U – MY03 – 11/15/16

PP9D – MY-00 – 3/11/14

PP9D – MY03 – 11/15/16

Vegetation Monitoring Plot Photos

Plot 1 Photo: 11/2/16 – MY03

Plot 2 Photo: 11/2/16 – MY03

Plot 3 Photo: 11/2/16 – MY03

Plot 4 Photo: 11/2/16 – MY03

Plot 5 Photo: 11/2/16 – MY03

Plot 6 Photo: 11/2/16 – MY03

Plot 7 Photo: 11/2/16 – MY03

Plot 8 Photo: 11/2/16 – MY03

Plot 9 Photo: 9/1/16 – MY03

Plot 10 Photo: 9/1/16 – MY03

Plot 11 Photo: 9/1/16 – MY03

Plot 12 Photo: 9/1/16 – MY03

Plot 13 Photo: 9/1/16 – MY03

Plot 14 Photo: 9/1/16 – MY03

Plot 15 Photo: 9/1/16 – MY03

Plot 16 Photo: 9/1/16 – MY03

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Jacob's Ladder Stream Restoration Site, DMS Project # 95023			
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Monitoring Year 03 Planted Stem Density (stems/acre)**	**Monitoring Year 03 Total Stem Density (stems/acre)**
1	Yes	526	1,578
2	Yes	607	1,781
3	Yes	809	1,659
4	Yes	647	1,174
5	Yes	567	1,052
6	Yes	526	890
7	Yes	647	647
8	No	283	405
9	Yes	567	567
10	Yes	769	890
11	No	202	202
12	Yes	688	1,133
13	Yes	567	850
14	Yes	486	890
15	No	283	283
16	Yes	405	526

Report Prepared By	Tommy Seelinger
Date Prepared	12/22/2016 12:40
database name	KCI-2015-J.mdb
database location	M:\2011\20110669-Jacobs Ladder\Monitoring\Vegetaton CVS Database
computer name	12-927DM12
file size	62529536
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95023
project Name	Jacobs Ladder
Description	Stream Restoration Site
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	16

Table 9. DMS Project Code 95023. Project Name: Jacobs Ladder			Current Plot Data MY3 (2016)																								
			95023-01-0001			95023-01-0002			95023-01-0003			95023-01-0004			95023-01-0005			95023-01-0006			95023-01-0007			95023-01-0008			95023-01-0009		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree						1						1														
Acer rubrum	red maple	Tree																										
Alnus incana	gray alder										4																	
Alnus serrulata	hazel alder	Shrub				1	1	1							1	1	1										2	2	2
Baccharis halimifolia	eastern baccharis	Shrub						4																				
Betula nigra	river birch	Tree				7	7	7	7	7	9				2	2	3	10	10	16	1	1	1	2	2	2	2	2	2
Callicarpa americana	American beautyberry	Shrub										2	2	2							1	1	1				1	1	1
Diospyros virginiana	common persimmon	Tree			3																							
Fraxinus pennsylvanica	green ash	Tree	5	5	5				5	5	5	10	10	10	3	3	4				8	8	8	5	5	5	6	6	6
Juglans nigra	black walnut	Tree									1																	
Juniperus virginiana	eastern redcedar	Tree																										
Liquidambar styraciflua	sweetgum	Tree			19			1			2			10												1			
Liriodendron tulipifera	tuliptree	Tree	3	3	4	2	2	2	4	4	6	2	2	2	3	3	3												
Nyssa biflora	swamp tupelo	Tree																2	2	2									
Pinus taeda	loblolly pine	Tree			1			3			1																		
Platanus occidentalis	American sycamore	Tree						1	1	1	1	1	1	1							1	1	1				1	1	1
Populus deltoides	eastern cottonwood	Tree						1									1				2	2	2						
Quercus	oak	Tree																											
Quercus alba	white oak	Tree																											
Quercus michauxii	swamp chestnut oak	Tree																											
Quercus nigra	water oak	Tree																											
Quercus palustris	pin oak	Tree																											
Quercus phellos	willow oak	Tree	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1										1	1	1
Quercus rubra	northern red oak	Tree																									1	1	1
Salix nigra	black willow	Tree			2	3	3	21	2	2	11			2	4	4	13			1	3	3	3			2			
Sambucus canadensis	Common Elderberry	Shrub				1	1	1										1	1	1									
Ulmus americana	American elm	Tree																		2									
Unknown		Shrub or Tree																											
	Stem count		13	13	39	15	15	44	20	20	41	16	16	29	14	14	26	13	13	22	16	16	16	7	7	10	14	14	14
	size (ares)		1			1			1			1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		3	3	7	6	6	12	6	6	10	5	5	8	6	6	7	3	3	5	6	6	6	2	2	4	7	7	7
	Stems per ACRE		526	526	1578	607	607	1781	809	809	1659	647	647	1174	567	567	1052	526	526	890	647	647	647	283	283	405	567	567	567

Table 9. DMS Project Code 95023. Project Name: Jacobs Ladder			Current Plot Data MY3 (2016)																				
			95023-01-0010			95023-01-0011			95023-01-0012			95023-01-0013			95023-01-0014			95023-01-0015			95023-01-0016		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree												1									3
Acer rubrum	red maple	Tree																					
Alnus incana	gray alder																						
Alnus serrulata	hazel alder	Shrub							5	5	5												
Baccharis halimifolia	eastern baccharis	Shrub									1												
Betula nigra	river birch	Tree													1	1	1						
Callicarpa americana	American beautyberry	Shrub										8	8	8									
Diospyros virginiana	common persimmon	Tree	5	5	5																		
Fraxinus pennsylvanica	green ash	Tree	3	3	3	5	5	5	6	6	9	4	4	4	4	4	5	5	5	5	6	6	6
Juglans nigra	black walnut	Tree																					
Juniperus virginiana	eastern redcedar	Tree			1									1									
Liquidambar styraciflua	sweetgum	Tree			1						6			5			6						
Liriodendron tulipifera	tuliptree	Tree										1	1	1									
Nyssa biflora	swamp tupelo	Tree																			2	2	2
Pinus taeda	loblolly pine	Tree			1																		
Platanus occidentalis	American sycamore	Tree										1	1	1	5	5	5				2	2	2
Populus deltoides	eastern cottonwood	Tree															1						
Quercus	oak	Tree															1						
Quercus alba	white oak	Tree	1	1	1										1	1	1						
Quercus michauxii	swamp chestnut oak	Tree																1	1	1			
Quercus nigra	water oak	Tree																					
Quercus palustris	pin oak	Tree	10	10	10																		
Quercus phellos	willow oak	Tree							6	6	7				1	1	1	1	1	1			
Quercus rubra	northern red oak	Tree																					
Salix nigra	black willow	Tree															1						
Sambucus canadensis	Common Elderberry	Shrub																					
Ulmus americana	American elm	Tree																					
Unknown		Shrub or Tree																					
		Stem count	19	19	22	5	5	5	17	17	28	14	14	21	12	12	22	7	7	7	10	10	13
		size (ares)	1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	7	1	1	1	3	3	5	4	4	7	5	5	9	3	3	3	3	3	4
		Stems per ACRE	769	769	890	202	202	202	688	688	1133	567	567	850	486	486	890	283	283	283	405	405	526

Table 9. DMS Project Code 95023. Project Name: Jacobs Ladder			Annual Means											
			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree			6			6	1	1	2			
Acer rubrum	red maple	Tree						1			1			
Alnus incana	gray alder				4									
Alnus serrulata	hazel alder	Shrub	9	9	9	9	9	9	7	7	7			
Baccharis halimifolia	eastern baccharis	Shrub			5			2						
Betula nigra	river birch	Tree	32	32	41	23	23	23	17	17	24	39	39	39
Callicarpa americana	American beautyberry	Shrub	12	12	12	11	11	11	9	9	9			
Diospyros virginiana	common persimmon	Tree	5	5	8	6	6	12	6	6	8	1	1	1
Fraxinus pennsylvanica	green ash	Tree	75	75	80	66	66	66	32	32	32			
Juglans nigra	black walnut	Tree			1									
Juniperus virginiana	eastern redcedar	Tree			2									
Liquidambar styraciflua	sweetgum	Tree			51			20			7			
Liriodendron tulipifera	tuliptree	Tree	15	15	18	26	26	26	15	15	15	40	40	40
Nyssa biflora	swamp tupelo	Tree	4	4	4									
Pinus taeda	loblolly pine	Tree			6			2						
Platanus occidentalis	American sycamore	Tree	12	12	13	12	12	13	15	15	17	62	62	62
Populus deltoides	eastern cottonwood	Tree	2	2	5	2	2	4	2	2	8			
Quercus	oak	Tree			1				1	1	1	2	2	2
Quercus alba	white oak	Tree	2	2	2	2	2	3			1			
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1						
Quercus nigra	water oak	Tree										1	1	1
Quercus palustris	pin oak	Tree	10	10	10	10	10	10	7	7	7			
Quercus phellos	willow oak	Tree	18	18	19	19	19	19	17	17	17	24	24	24
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	1	1	1			
Salix nigra	black willow	Tree	12	12	56	12	12	54	14	14	26	13	13	13
Sambucus canadensis	Common Elderberry	Shrub	2	2	2	1	1	2			2			
Ulmus americana	American elm	Tree			2									
Unknown		Shrub or Tree				1	1	1	6	6	6	51	51	51
	Stem count		212	212	359	202	202	286	150	150	191	233	233	233
	size (ares)		16			16			16			16		
	size (ACRES)		0.40			0.40			0.40			0.40		
	Species count		16	16	25	16	16	21	15	15	19	9	9	9
	Stems per ACRE		536	536	908	511	511	723	379	379	483	589	589	589

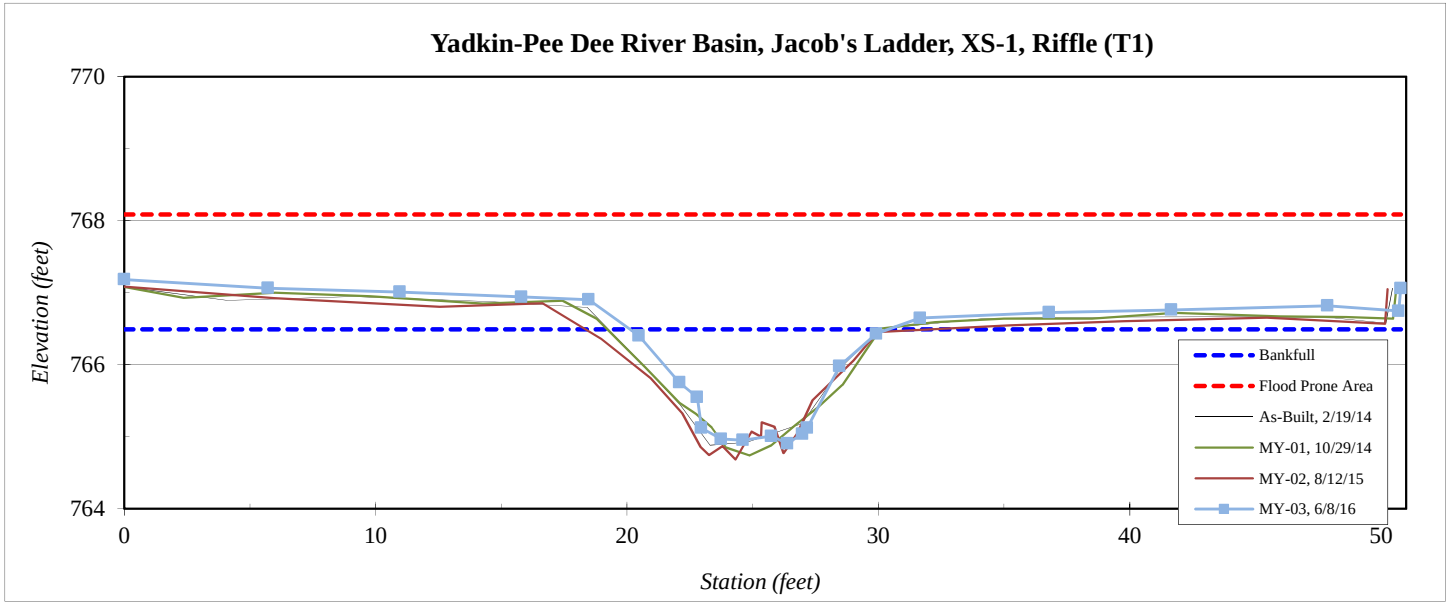
Appendix D

Stream Survey Data

River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-1, Riffle (T1)
Drainage Area (sq mi):	0.21
Date:	6/8/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	767.2
5.7	767.1
11.0	767.0
15.8	766.9
18.5	766.9
20.5	766.4
22.1	765.8
22.8	765.5
23.0	765.1
23.7	765.0
24.6	765.0
25.7	765.0
26.4	764.9
27.0	765.0
27.2	765.1
28.5	766.0
29.9	766.4
31.7	766.6
36.8	766.7
41.7	766.8
47.9	766.8
50.7	766.7
50.8	767.1

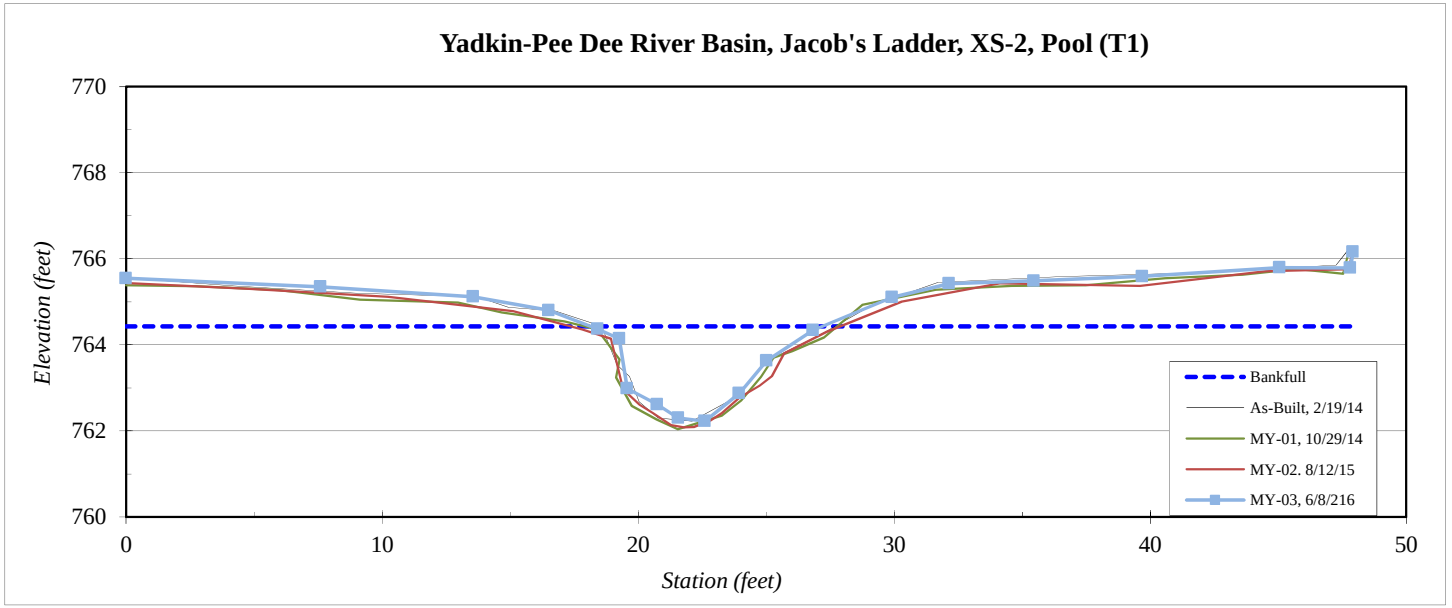
SUMMARY DATA	
Bankfull Elevation (ft):	766.5
Bankfull Cross-Sectional Area (ft^2):	9.5
Bankfull Width (ft):	10.3
Flood Prone Area Elevation (ft):	768.1
Flood Prone Width (ft):	>51
Max Depth at Bankfull (ft):	1.6
Mean Depth at Bankfull (ft):	0.9
W / D Ratio:	11.1
Entrenchment Ratio:	4.9
Bank Height Ratio:	1.0



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-2, Pool (T1)
Drainage Area (sq mi):	0.21
Date:	6/8/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	765.5
7.6	765.3
13.6	765.1
16.5	764.8
18.4	764.4
19.3	764.1
19.6	763.0
20.7	762.6
21.6	762.3
22.6	762.2
23.9	762.9
25.0	763.6
26.8	764.3
29.9	765.1
32.1	765.4
35.5	765.5
39.7	765.6
45.0	765.8
47.8	765.8
47.9	766.2

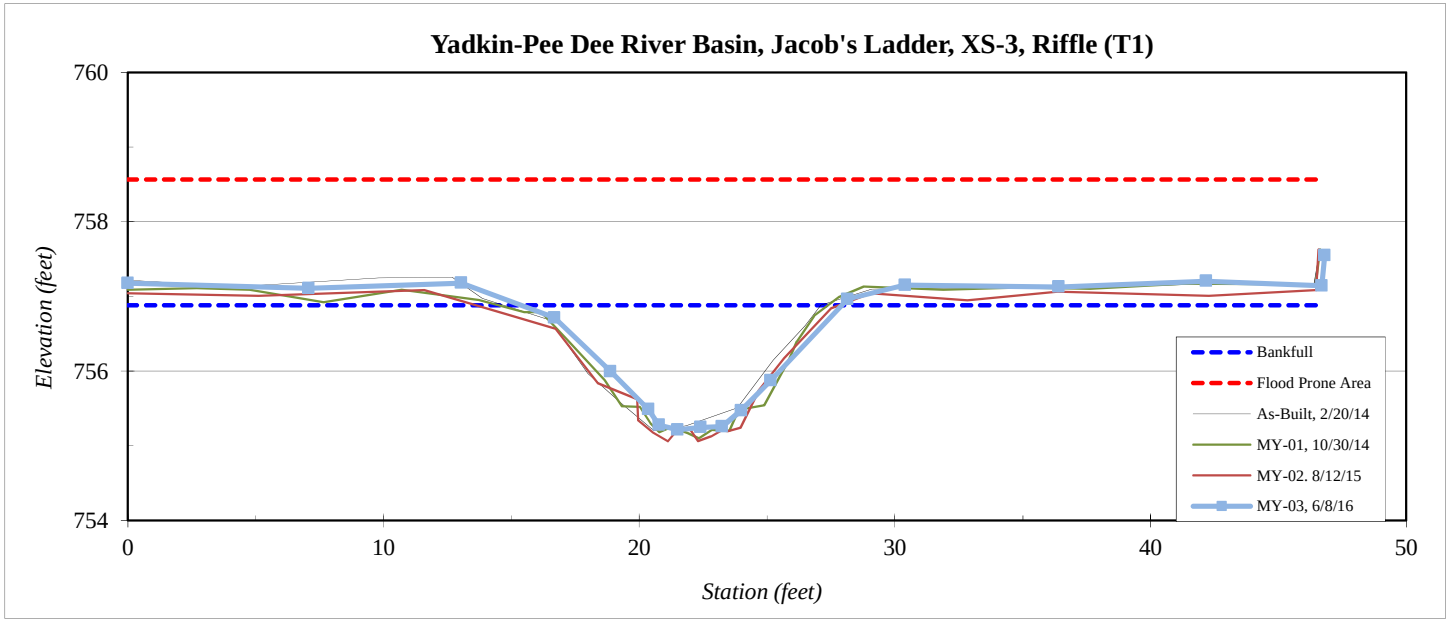
SUMMARY DATA	
Bankfull Elevation (ft):	764.4
Bankfull Cross-Sectional Area (ft^2):	10.5
Bankfull Width (ft):	8.7
Flood Prone Area Elevation (ft):	-
Flood Prone Width (ft):	-
Max Depth at Bankfull (ft):	2.2
Mean Depth at Bankfull (ft):	1.2
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-3, Riffle (T1)
Drainage Area (sq mi):	0.36
Date:	6/8/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	757.2
7.1	757.1
13.0	757.2
16.7	756.7
18.9	756.0
20.4	755.5
20.8	755.3
21.5	755.2
22.4	755.2
23.2	755.3
24.0	755.5
25.1	755.9
28.2	757.0
30.4	757.2
36.4	757.1
42.2	757.2
46.7	757.1
46.8	757.5

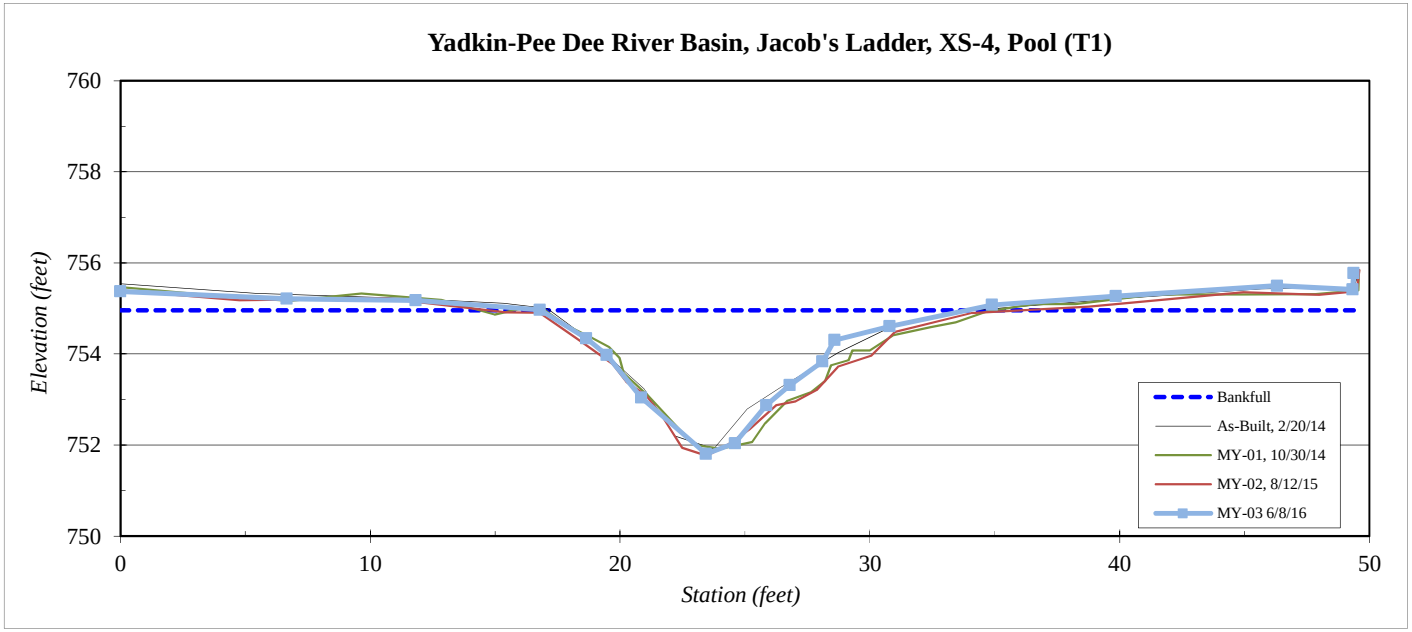
SUMMARY DATA	
Bankfull Elevation (ft):	756.9
Bankfull Cross-Sectional Area (ft^2):	11.8
Bankfull Width (ft):	12.6
Flood Prone Area Elevation (ft):	758.6
Flood Prone Width (ft):	>47
Max Depth at Bankfull (ft):	1.7
Mean Depth at Bankfull (ft):	0.9
W / D Ratio:	13.6
Entrenchment Ratio:	3.7
Bank Height Ratio:	1.0



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-4, Pool (T1)
Drainage Area (sq mi):	0.36
Date:	6/8/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	755.4
6.7	755.2
11.8	755.2
16.8	755.0
18.7	754.3
19.5	754.0
20.9	753.0
23.4	751.8
24.6	752.0
25.9	752.9
26.8	753.3
28.1	753.8
28.6	754.3
30.8	754.6
34.9	755.1
39.8	755.3
46.3	755.5
49.3	755.4
49.4	755.8

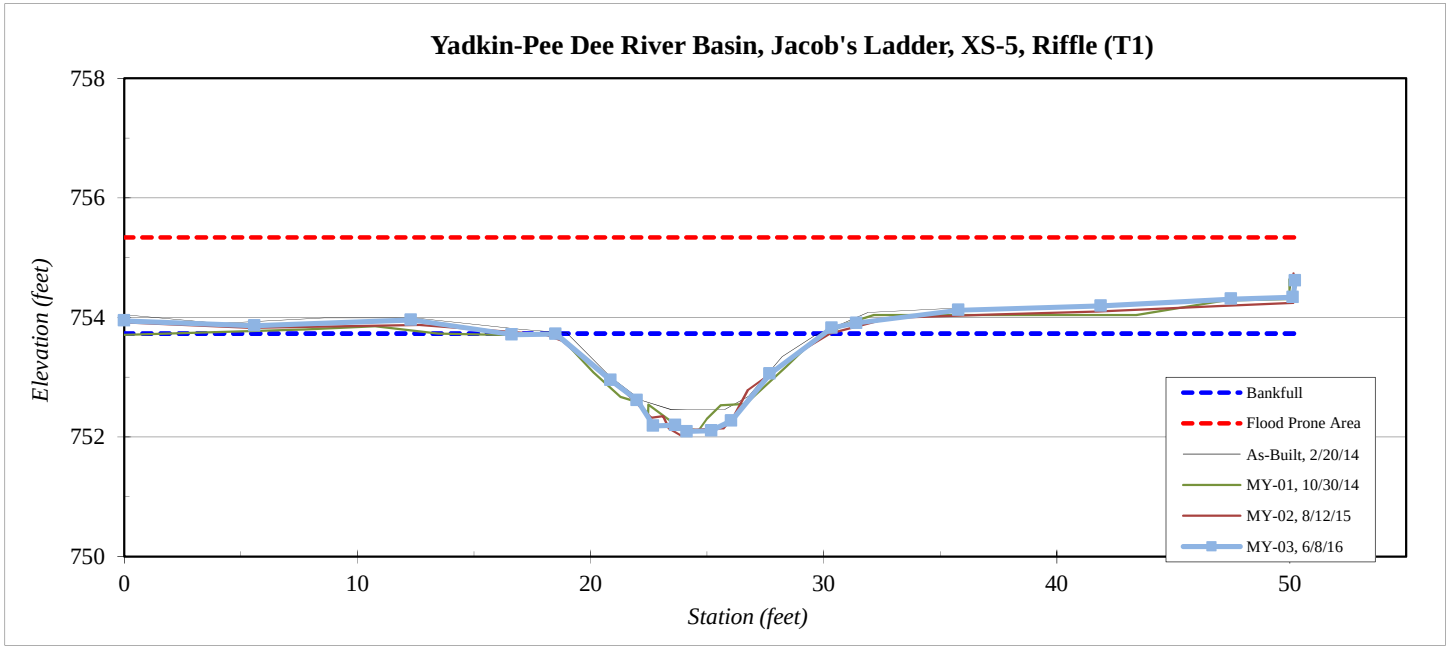
SUMMARY DATA	
Bankfull Elevation (ft):	755.0
Bankfull Cross-Sectional Area (ft^2):	22.81
Bankfull Width (ft):	17.82
Flood Prone Area Elevation (ft):	-
Flood Prone Width (ft):	-
Max Depth at Bankfull (ft):	3.19
Mean Depth at Bankfull (ft):	1.28
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-5, Riffle (T1)
Drainage Area (sq mi):	0.36
Date:	6/8/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	753.9
5.6	753.9
12.3	754.0
16.6	753.7
18.5	753.7
20.9	752.9
22.0	752.6
22.7	752.2
23.6	752.2
24.1	752.1
25.2	752.1
26.0	752.3
27.7	753.1
30.4	753.8
31.4	753.9
35.8	754.1
41.9	754.2
47.5	754.3
50.1	754.3
50.2	754.6

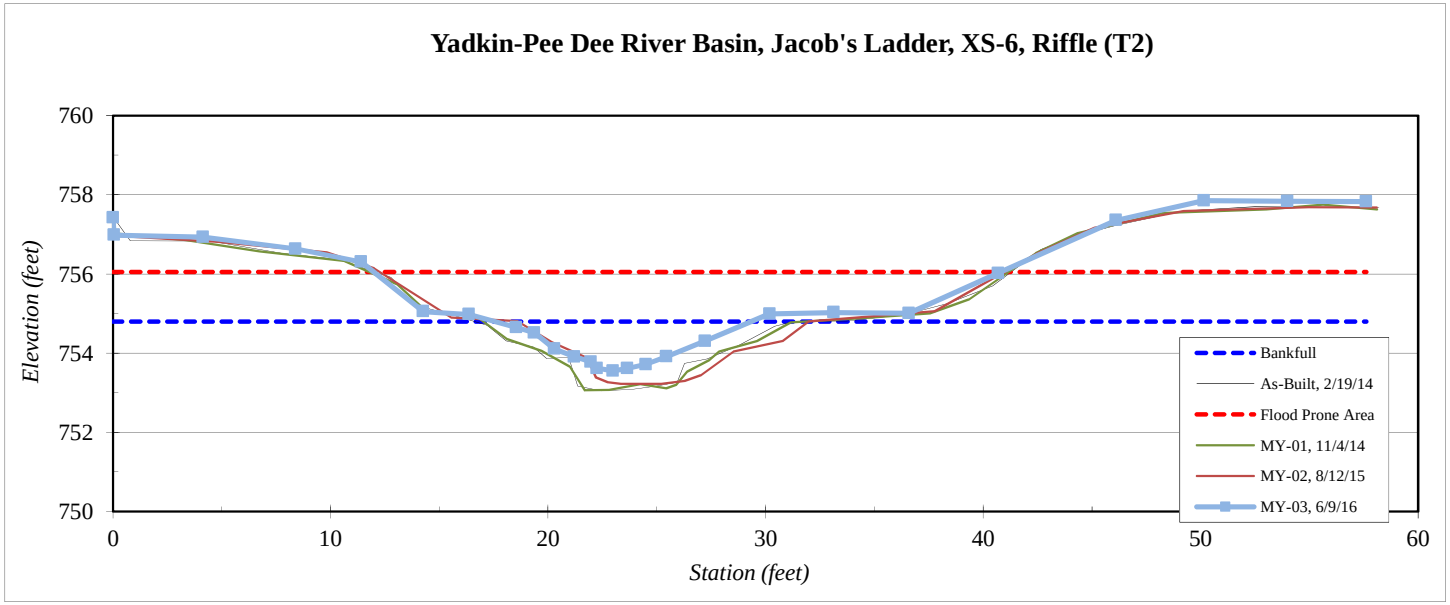
SUMMARY DATA	
Bankfull Elevation (ft):	753.7
Bankfull Cross-Sectional Area (ft^2):	10.41
Bankfull Width (ft):	11.29
Flood Prone Area Elevation (ft):	755.34
Flood Prone Width (ft):	>50
Max Depth at Bankfull (ft):	1.61
Mean Depth at Bankfull (ft):	0.92
W / D Ratio:	12.24
Entrenchment Ratio:	4.45
Bank Height Ratio:	1.00



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-6, Riffle (T2)
Drainage Area (sq mi):	0.67
Date:	6/9/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	757.4
0.1	757.0
4.1	756.9
8.4	756.6
11.4	756.3
14.3	755.1
16.4	755.0
18.5	754.6
19.4	754.5
20.3	754.1
21.2	753.9
22.0	753.8
22.2	753.6
23.0	753.6
23.6	753.6
24.5	753.7
25.4	753.9
27.2	754.3
30.2	755.0
33.1	755.0
36.6	755.0
40.7	756.0
46.1	757.4
50.2	757.9
54.0	757.8
57.6	757.8

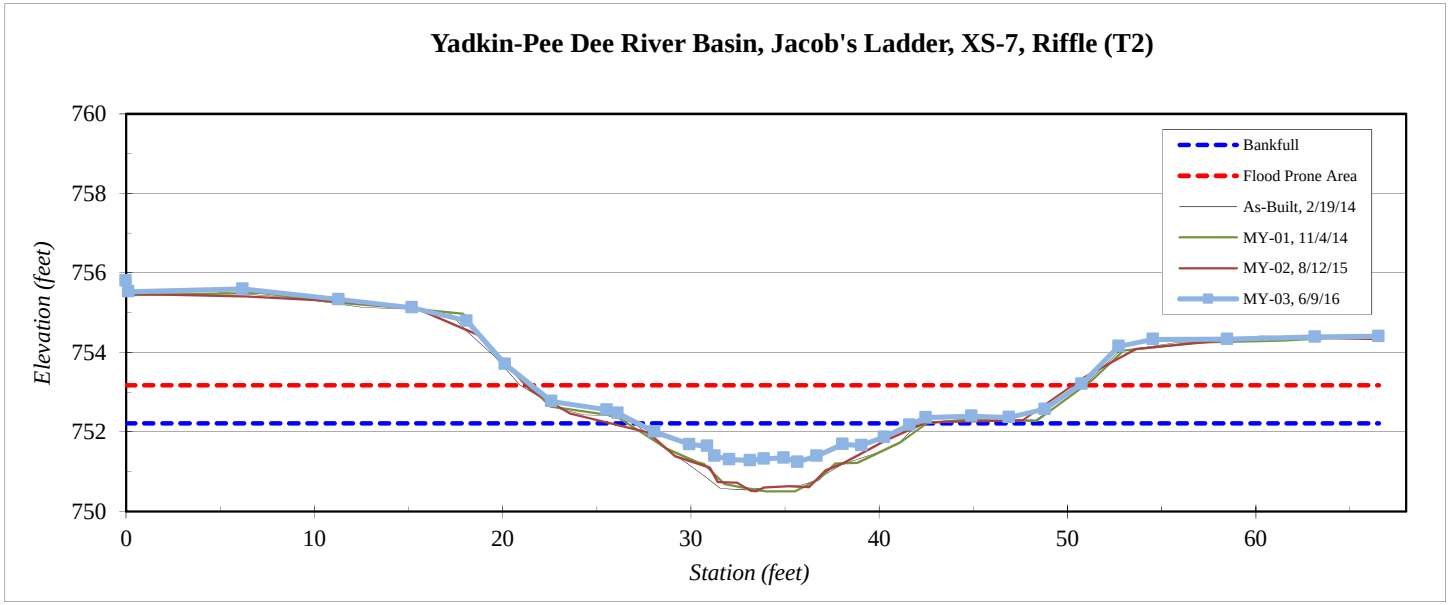
SUMMARY DATA	
Bankfull Elevation (ft):	754.8
Bankfull Cross-Sectional Area (ft^2):	7.83
Bankfull Width (ft):	11.70
Flood Prone Area Elevation (ft):	756.05
Flood Prone Width (ft):	28.78
Max Depth at Bankfull (ft):	1.25
Mean Depth at Bankfull (ft):	0.67
W / D Ratio:	17.50
Entrenchment Ratio:	2.46
Bank Height Ratio:	1.00



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-7, Riffle (T2)
Drainage Area (sq mi):	0.67
Date:	6/9/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	755.8
0.1	755.5
6.2	755.6
11.3	755.3
15.2	755.1
18.1	754.8
20.1	753.7
22.6	752.8
25.5	752.6
26.1	752.5
28.1	752.0
29.9	751.7
30.9	751.6
31.3	751.4
32.1	751.3
33.2	751.3
33.9	751.3
34.9	751.4
35.7	751.2
36.7	751.4
38.1	751.7
39.1	751.7
40.3	751.9
41.6	752.2
42.5	752.4
44.9	752.4
46.9	752.4
48.8	752.6
50.8	753.2
52.7	754.2
54.6	754.3
58.5	754.3
63.2	754.4
66.5	754.4

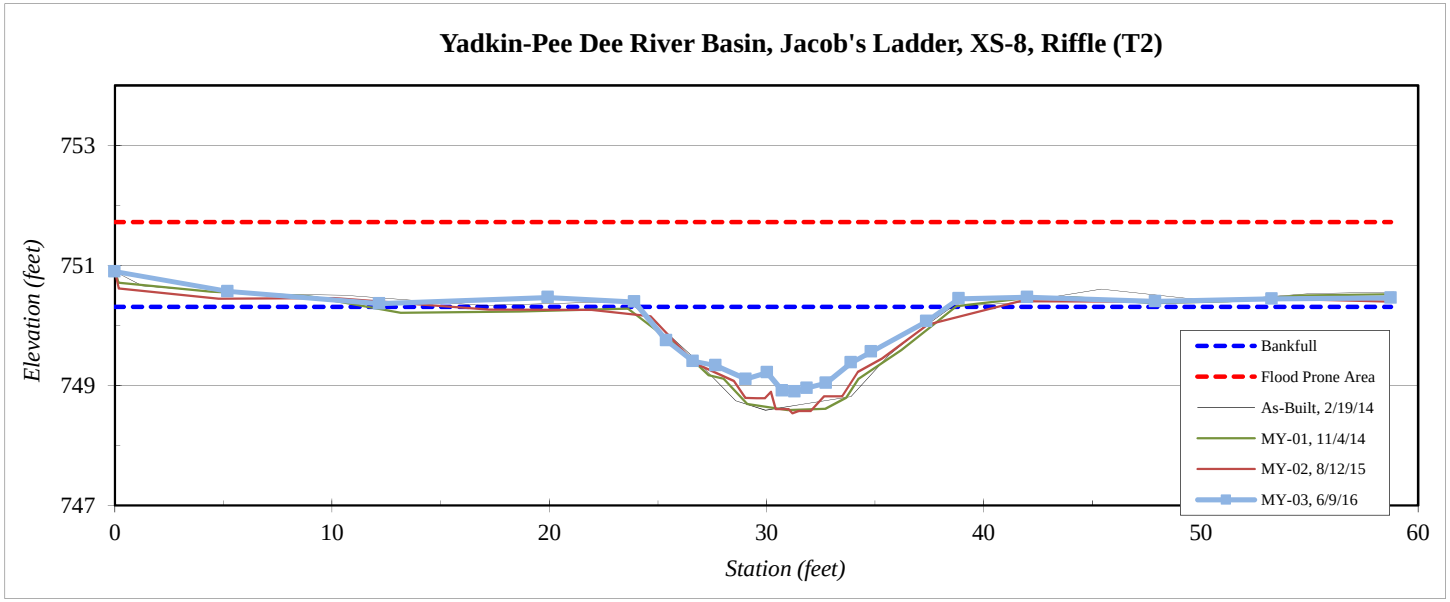
SUMMARY DATA	
Bankfull Elevation (ft):	752.2
Bankfull Cross-Sectional Area (ft^2):	8.46
Bankfull Width (ft):	14.38
Flood Prone Area Elevation (ft):	753.17
Flood Prone Width (ft):	28.95
Max Depth at Bankfull (ft):	0.95
Mean Depth at Bankfull (ft):	0.59
W / D Ratio:	24.43
Entrenchment Ratio:	2.01
Bank Height Ratio:	1.00



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-8, Riffle (T2)
Drainage Area (sq mi):	0.70
Date:	6/9/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	750.9
5.2	750.6
12.2	750.4
19.9	750.5
23.9	750.4
25.4	749.8
26.6	749.4
27.7	749.3
29.1	749.1
30.0	749.2
30.7	748.9
31.3	748.9
31.9	749.0
32.7	749.0
33.9	749.4
34.8	749.6
37.4	750.1
38.9	750.4
42.0	750.5
47.9	750.4
53.3	750.4
58.7	750.5

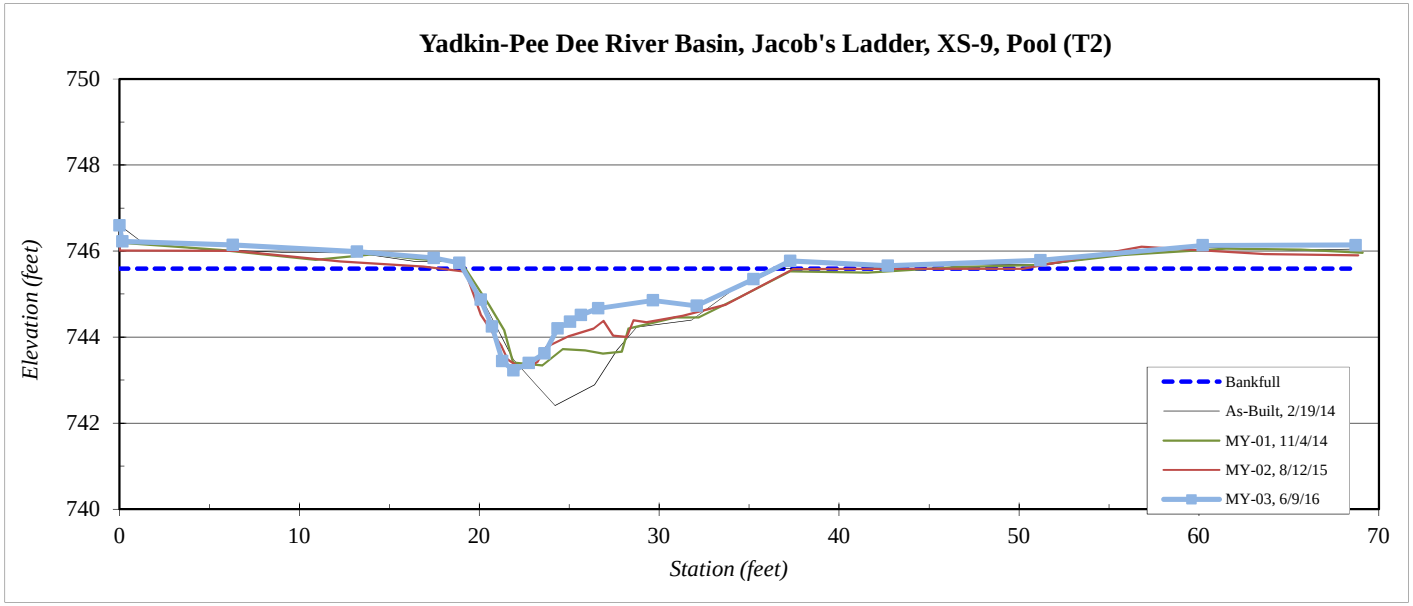
SUMMARY DATA	
Bankfull Elevation (ft):	750.3
Bankfull Cross-Sectional Area (ft^2):	14.6
Bankfull Width (ft):	16.0
Flood Prone Area Elevation (ft):	751.7
Flood Prone Width (ft):	>59
Max Depth at Bankfull (ft):	1.4
Mean Depth at Bankfull (ft):	0.9
W / D Ratio:	17.5
Entrenchment Ratio:	3.8
Bank Height Ratio:	1.0



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-9, Pool (T2)
Drainage Area (sq mi):	0.70
Date:	6/9/2016
Field Crew:	T. Seelinger and S. Jones

Station (ft)	Elevation (ft)
0.0	746.6
0.2	746.2
6.3	746.1
13.2	746.0
17.5	745.8
18.9	745.7
20.1	744.9
20.7	744.2
21.3	743.4
21.9	743.2
22.8	743.4
23.6	743.6
24.4	744.2
25.1	744.4
25.7	744.5
26.6	744.7
29.7	744.9
32.1	744.7
35.2	745.3
37.3	745.8
42.7	745.7
51.2	745.8
60.2	746.1
68.7	746.1

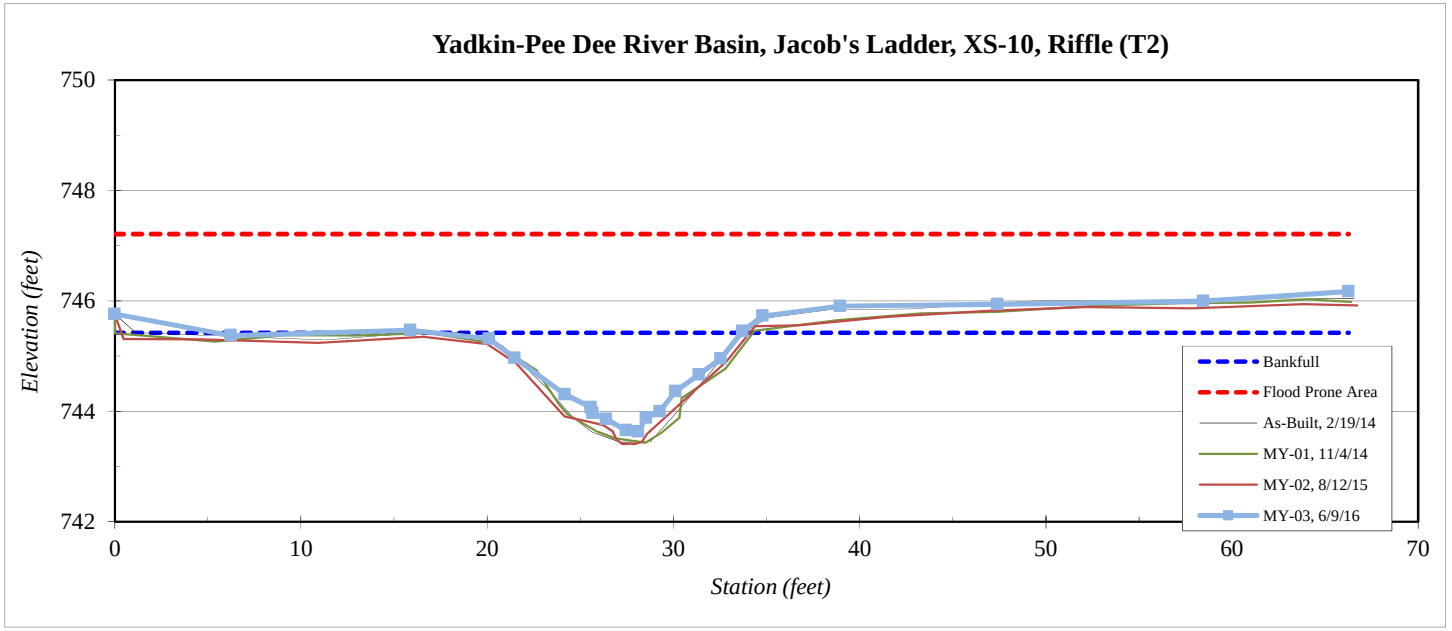
SUMMARY DATA	
Bankfull Elevation (ft):	745.6
Bankfull Cross-Sectional Area (ft^2):	21.9
Bankfull Width (ft):	18.2
Flood Prone Area Elevation (ft):	-
Flood Prone Width (ft):	-
Max Depth at Bankfull (ft):	2.4
Mean Depth at Bankfull (ft):	1.2
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



River Basin:	Yadkin-Pee Dee
Watershed:	Jacob's Ladder
XS ID	XS-10, Riffle (T2)
Drainage Area (sq mi):	0.70
Date:	6/9/2016
Field Crew:	T. Seelinger and S. Jones

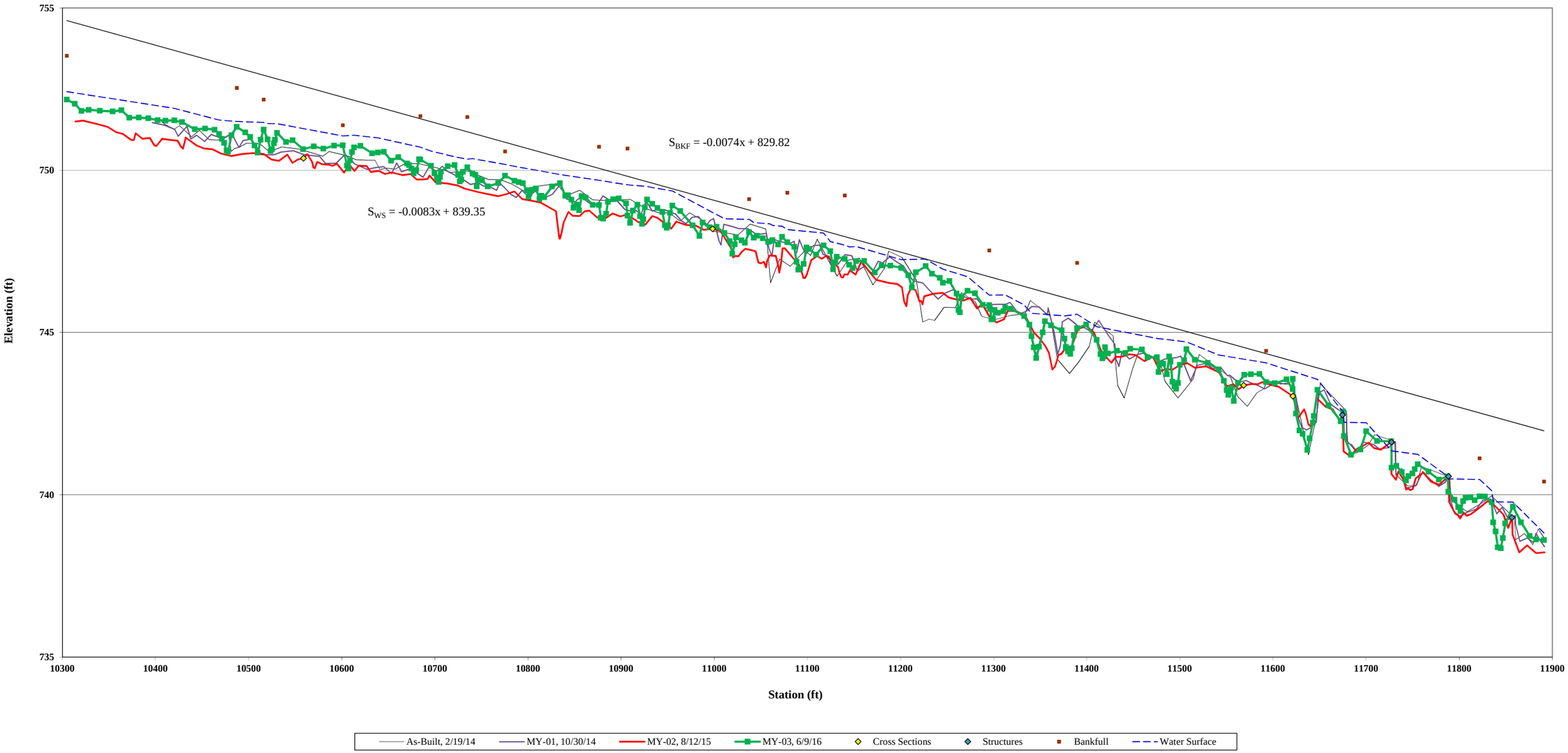
Station (ft)	Elevation (ft)
0.0	745.8
6.2	745.4
15.9	745.5
20.1	745.3
21.5	745.0
24.2	744.3
25.6	744.1
25.7	744.0
26.4	743.9
27.5	743.7
28.1	743.6
28.5	743.9
29.3	744.0
30.1	744.4
31.4	744.7
32.5	745.0
33.7	745.4
34.8	745.7
39.0	745.9
47.4	745.9
58.5	746.0
66.3	746.2

SUMMARY DATA	
Bankfull Elevation (ft):	745.4
Bankfull Cross-Sectional Area (ft^2):	16.9
Bankfull Width (ft):	17.5
Flood Prone Area Elevation (ft):	747.2
Flood Prone Width (ft):	>65
Max Depth at Bankfull (ft):	1.8
Mean Depth at Bankfull (ft):	1.0
W / D Ratio:	18.1
Entrenchment Ratio:	3.8
Bank Height Ratio:	1.0



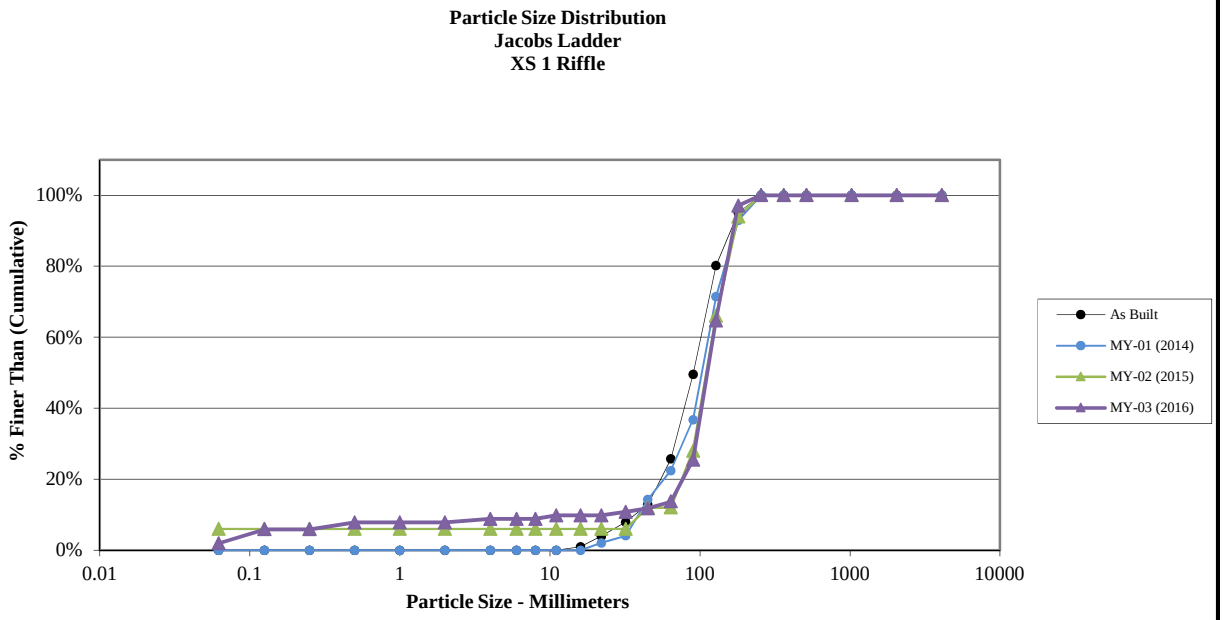
Jacob's Ladder Stream Restoration Site
Longitudinal Profile
T1 MY-03

Jacob's Ladder Stream Restoration Site
Longitudinal Profile
T2 MY-03



Cross-Section 1 Riffle - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	2
Very Fine	.062 - .125	S	4
Fine	.125 - .25	A	
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		1
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		2
Small	64 - 90	C	12
Small	90 - 128	O	40
Large	128 - 180	B	33
Large	180 - 256	L	3
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	102

Note:



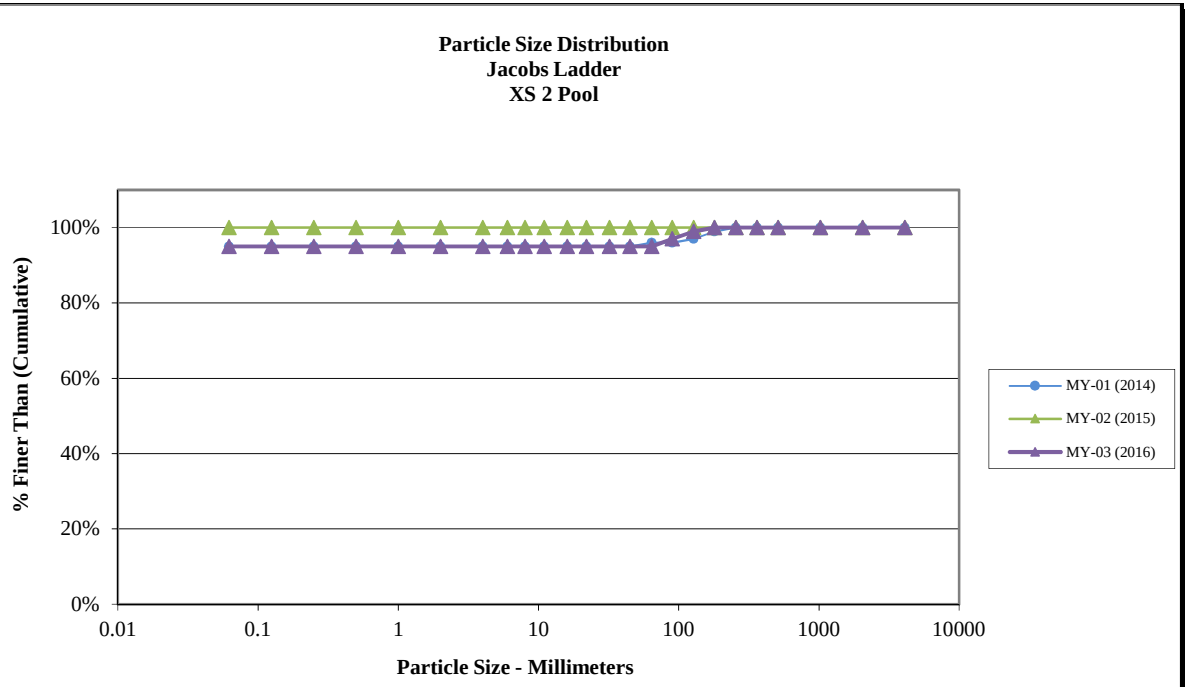
Size (mm)	
D16	48
D35	70
D50	79
D65	90
D84	111
D95	125

Size Distribution	
mean	73.1
dispersion	1.5
skewness	-0.06

Type	
silt/clay	2%
sand	6%
gravel	6%
cobble	86%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 2 Pool - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	95
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	2
Small	90 - 128	O	2
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



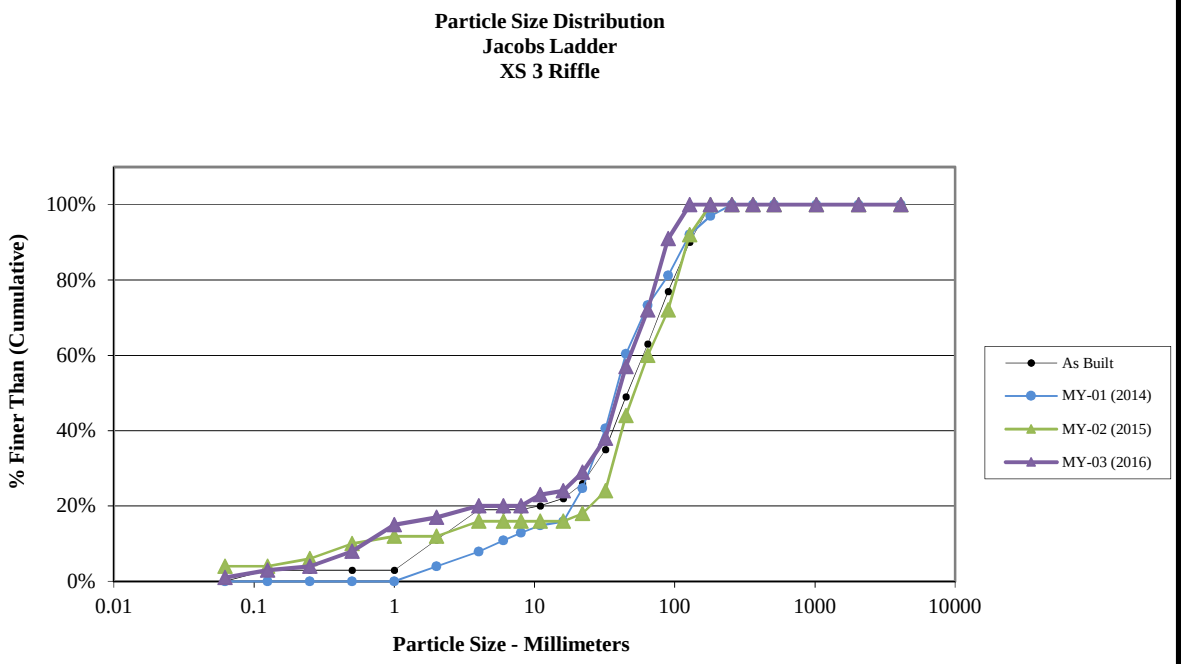
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.062
D95	45

Size Distribution	
mean	0.1
dispersion	1.0
skewness	---

Type	
silt/clay	95%
sand	0%
gravel	0%
cobble	5%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 Riffle - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	1
Medium	.25 - .50	N	4
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		3
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	5
Coarse	22.6 - 32	L	9
Very Coarse	32 - 45	S	19
Very Coarse	45 - 64		15
Small	64 - 90	C	19
Small	90 - 128	O	9
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



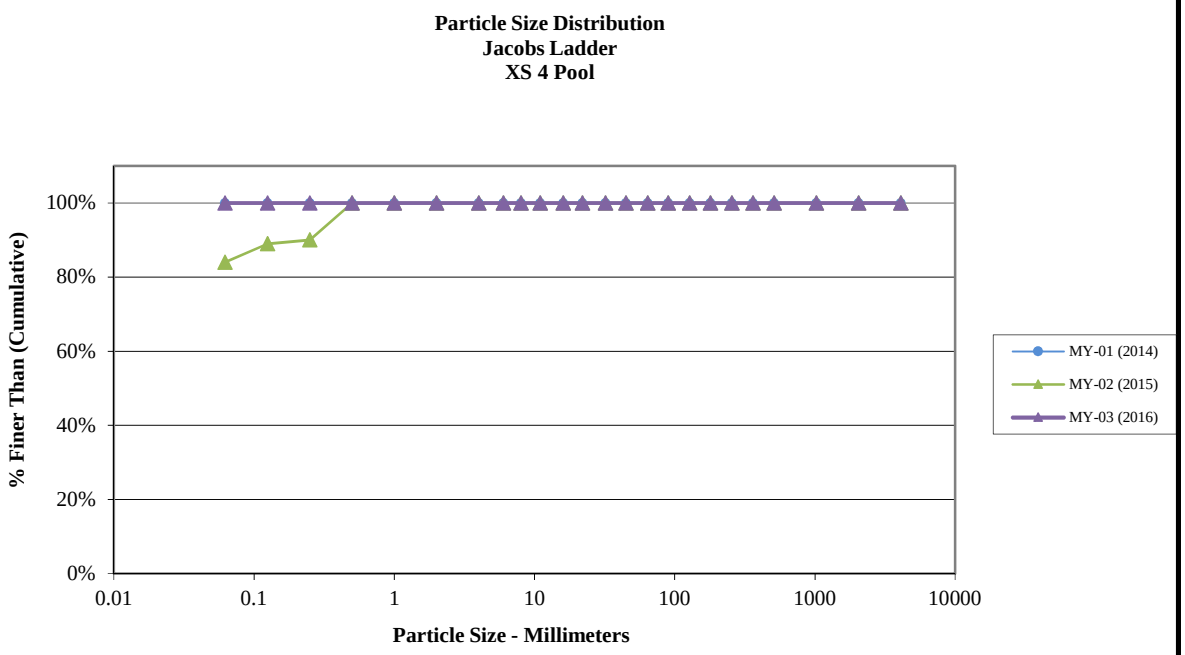
Size (mm)	
D16	1
D35	20
D50	28
D65	38
D84	56
D95	74

Size Distribution	
mean	6.3
dispersion	20.9
skewness	-0.47

Type	
silt/clay	1%
sand	16%
gravel	55%
cobble	28%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 4 Pool - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	100
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



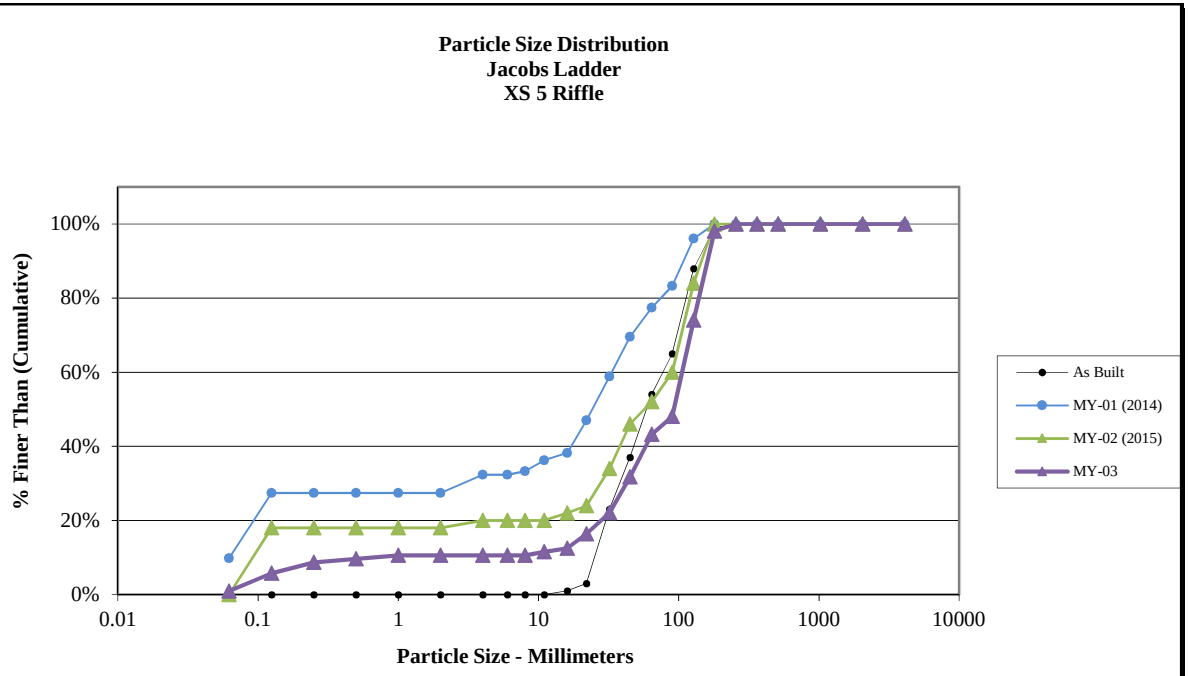
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.062
D95	0.062

Size Distribution	
mean	0.1
dispersion	1.0
skewness	---

Type	
silt/clay	100%
sand	0%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 5 Riffle - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	3
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	10
Very Coarse	45 - 64		12
Small	64 - 90	C	5
Small	90 - 128	O	27
Large	128 - 180	B	25
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	104

Note:



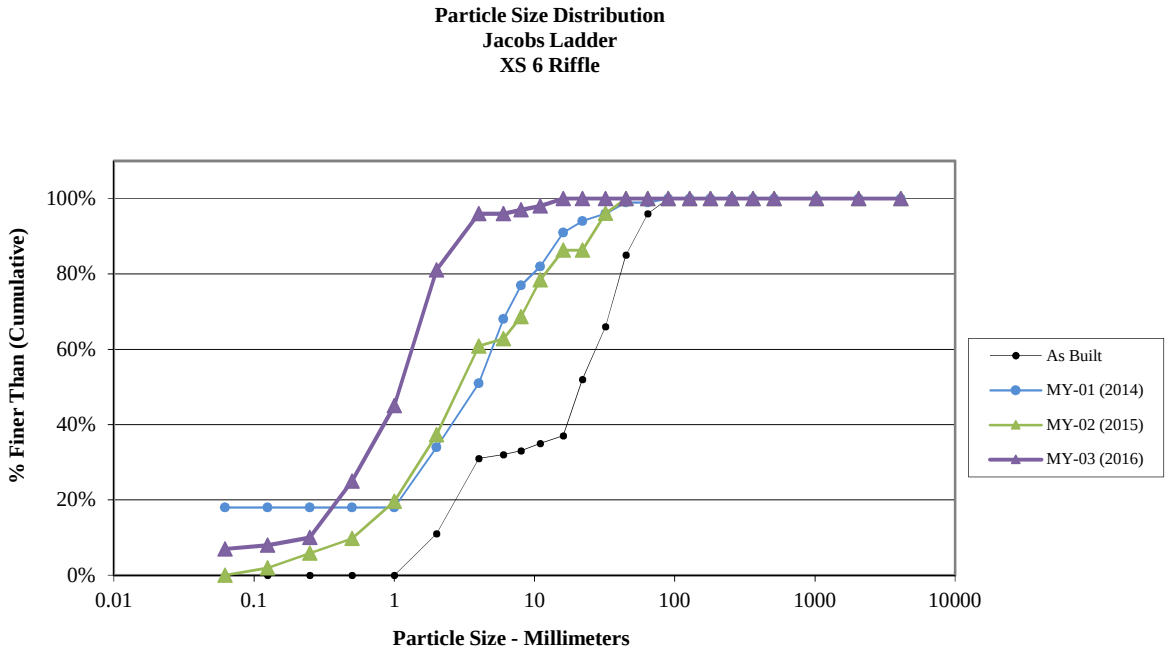
Size (mm)	
D16	16
D35	35
D50	66
D65	80
D84	104
D95	122

Size Distribution	
mean	40.2
dispersion	2.9
skewness	-0.23

Type	
silt/clay	1%
sand	10%
gravel	33%
cobble	57%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6 Riffle -MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	7
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	2
Medium	.25 - .50	N	15
Coarse	.50 - 1	D	20
Very Coarse	1 - 2	S	36
Very Fine	2 - 4		15
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



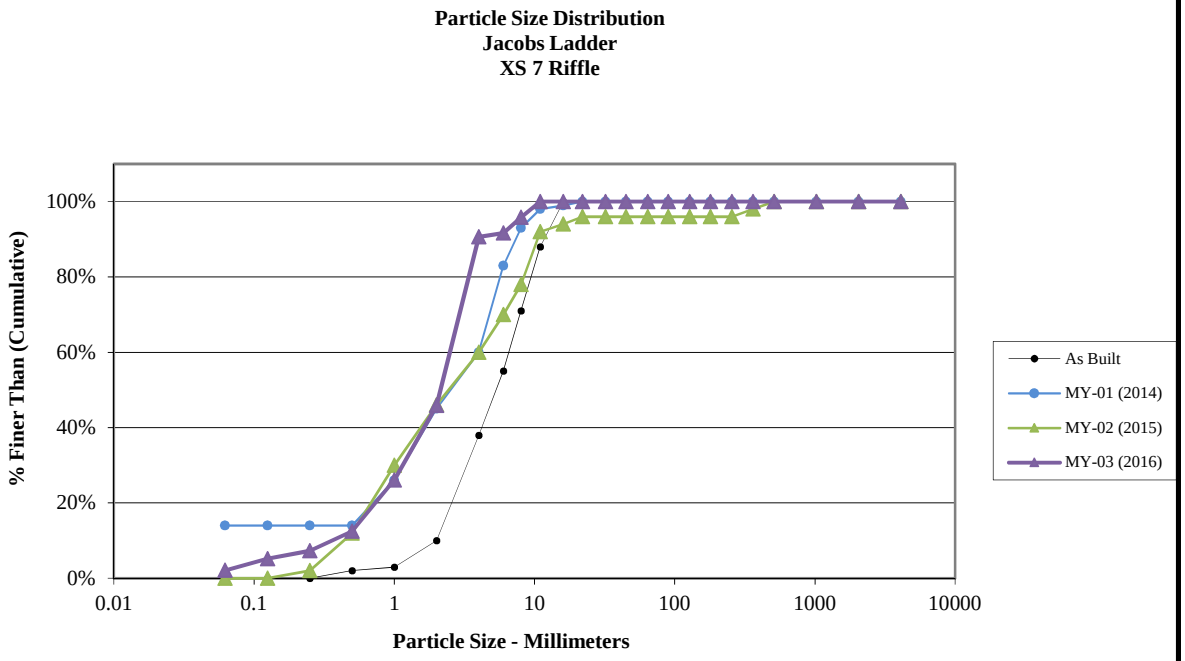
Size (mm)	
D16	0.16
D35	0.35
D50	0.55
D65	0.73
D84	1.1
D95	1.9

Size Distribution	
mean	0.4
dispersion	2.7
skewness	-0.11

Type	
silt/clay	7%
sand	74%
gravel	19%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 7 Riffle - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	2
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	2
Medium	.25 - .50	N	5
Coarse	.50 - 1	D	13
Very Coarse	1 - 2	S	19
Very Fine	2 - 4		43
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	96

Note:



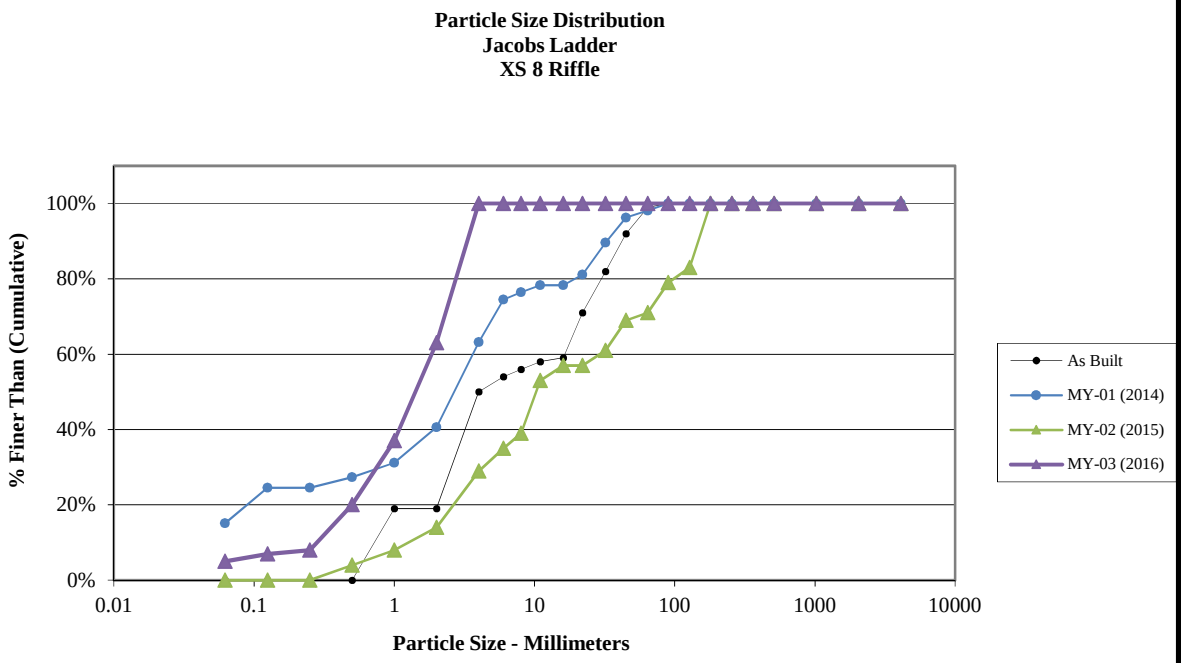
Size (mm)	
D16	0.30
D35	0.68
D50	1.1
D65	1.3
D84	1.8
D95	5.3

Size Distribution	
mean	0.7
dispersion	2.6
skewness	-0.18

Type	
silt/clay	2%
sand	44%
gravel	54%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 8 Riffle -MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	5
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	1
Medium	.25 - .50	N	12
Coarse	.50 - 1	D	17
Very Coarse	1 - 2	S	26
Very Fine	2 - 4		37
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



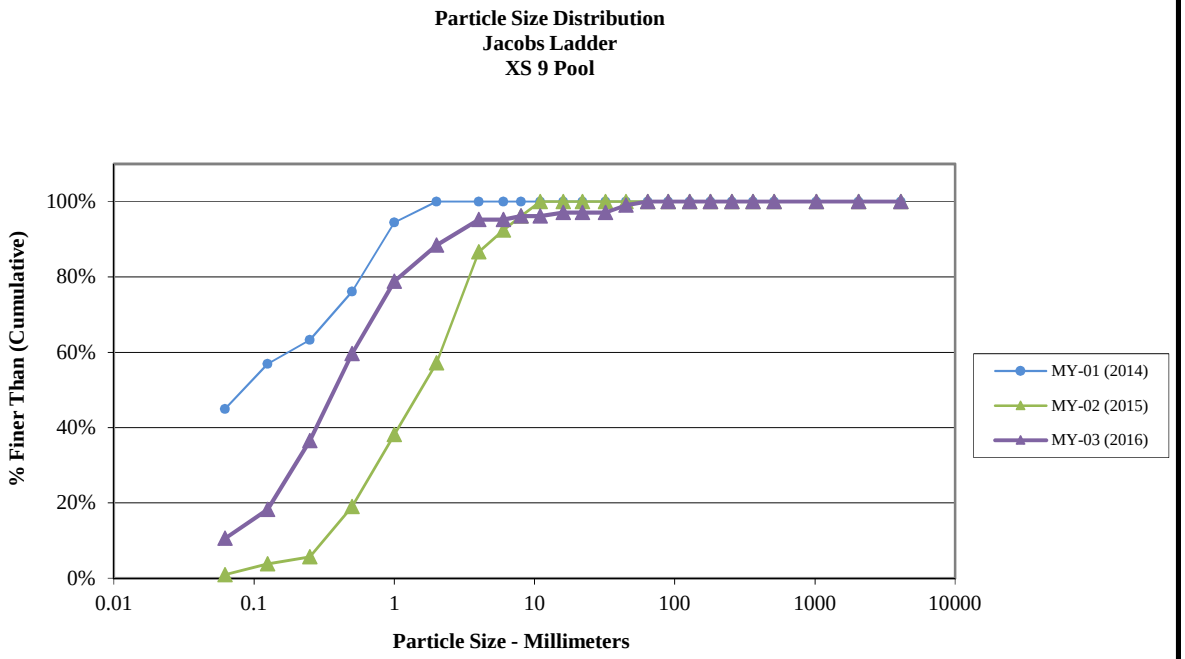
Size (mm)	
D16	0.20
D35	0.46
D50	0.71
D65	1.0
D84	1.5
D95	1.8

Size Distribution	
mean	0.5
dispersion	2.8
skewness	-0.12

Type	
silt/clay	5%
sand	58%
gravel	37%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 9 Pool - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	11
Very Fine	.062 - .125	S	8
Fine	.125 - .25	A	19
Medium	.25 - .50	N	24
Coarse	.50 - 1	D	20
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		7
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		1
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	104

Note:



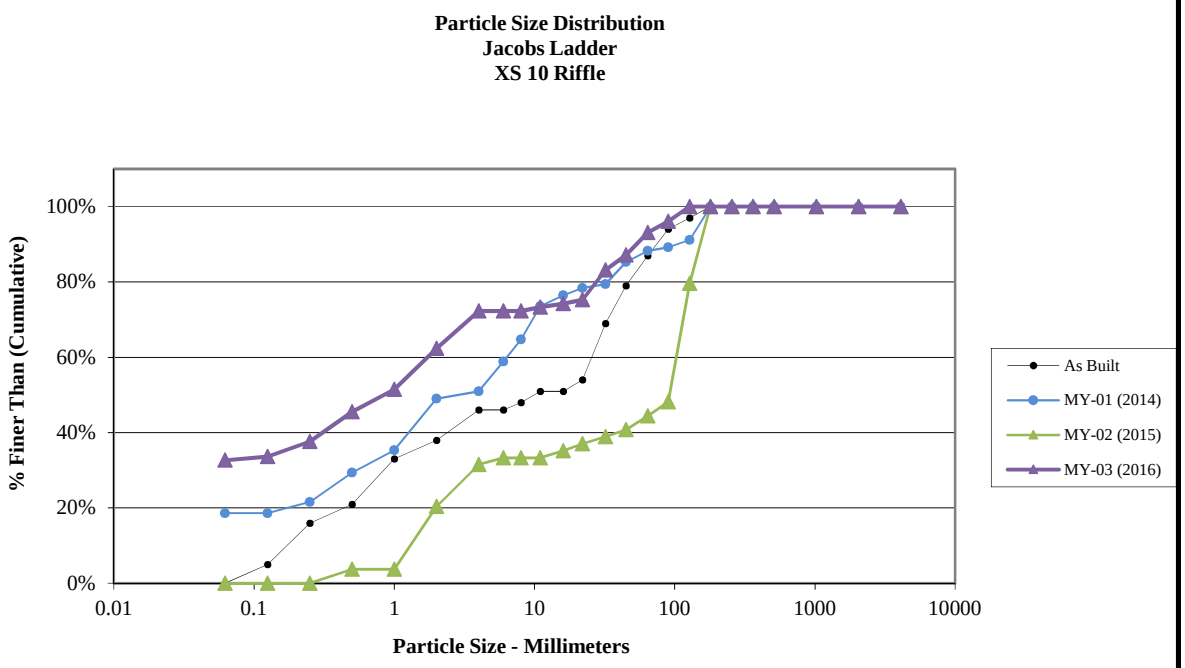
Size (mm)	
D16	0.04
D35	0.12
D50	0.19
D65	0.30
D84	0.72
D95	2.0

Size Distribution	
mean	0.2
dispersion	4.5
skewness	-0.06

Type	
silt/clay	11%
sand	78%
gravel	12%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 10 Riffle - MY-03			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	33
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	4
Medium	.25 - .50	N	8
Coarse	.50 - 1	D	6
Very Coarse	1 - 2	S	11
Very Fine	2 - 4		10
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	8
Very Coarse	32 - 45	S	4
Very Coarse	45 - 64		6
Small	64 - 90	C	3
Small	90 - 128	O	4
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



Size (mm)	
D16	0.06
D35	0.08
D50	0.42
D65	1.2
D84	24
D95	57

Size Distribution	
mean	1.2
dispersion	32.2
skewness	0.29

Type	
silt/clay	33%
sand	30%
gravel	31%
cobble	7%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Table 10a. T1 Baseline Stream Data Summary
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	6.7	8.2		9.6	2	6.9				1	10.3	11.5	10.8	11.3	12.4	3
Floodprone Width (ft)	12	14		16	2	23				1	23	70	>45	>48	>50	3
Bankfull Mean Depth (ft)	1.1	1.3		1.5	2	1.1				1	0.9	1.0	0.8	0.9	1.0	3
Bankfull Max Depth (ft)	1.7	2.1		2.4	2	1.6				1	1.4	1.5	1.3	1.5	1.7	3
Bankfull Cross-Sectional Area (ft^2)	9.8	10.2		10.5	2	7.4				1	9.0	11.0	8.8	10.3	11.6	3
Width/Depth Ratio	4.6	6.7		8.8	2	6.4				1	12.0	12.0	11.2	12.6	13.3	3
Entrenchment Ratio	1.3	1.8		2.2	2	3.4				1	2.2	6.0	3.6	4.3	4.6	3
Bank Height Ratio	2.3	2.8		3.3	2	1.0				1	1.0	1.0	1.0	1.0	1.0	3
Pattern																
Channel Beltwidth (ft)	*					14	26		38	2	25	70	25	48	70	
Radius of Curvature (ft)	*					12	19		25	2	20	45	20	33	45	
Rc:Bankfull width (ft/ft)	*					1.7	2.7		3.6	2	2	4	2	3	4	
Meander Wavelength (ft)	*					43	73		102	2	65	140	65	103	140	
Meander Width Ratio	*					2.0	3.8		5.5	2	2.4	5.8	2.4	4.0	5.8	
Profile																
Riffle Length (ft)													20	31	40	21
Riffle Slope (ft/ft)	0.010			0.035		0.011			0.025	2	0.004	0.017	0.003	0.015	0.022	21
Pool Length (ft)						16			23		12	40	18	28	49	19
Pool Spacing (ft)						28			57		47	95	54	76	95	19
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	0% / 21% / 79% / 0% / 0% / 0%												0% / 4% / 44% / 52% / 0% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	1 / 6 / 8 / 11 / 17 / 22												27 / 49 / 65 / 89/ 123 / 163			
Additional Reach Parameters																
Channel length (ft)	2,179										2,361		2,389			
Drainage Area (SM)	0.36					0.16					0.36		0.36			
Rosgen Classification	G4					E4					C4		C4			
Sinuosity	1.03					1.18					1.14-1.18		1.14-1.18			
Water Surface Slope (ft/ft)	0.011					0.007					0.011		0.008			

*Not a meandering channel and mostly composed of riffles and runs; therefore no pattern data or pool data was shown

Table 10b. T2 Baseline Stream Data Summary
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	10.6	12.6		16.5	3	6.9				1	13.5	13.5	14.6	14.9	15.2	4
Floodprone Width (ft)	16	24		35	3	23				1	30	70	33	34	66	4
Bankfull Mean Depth (ft)	1.2	1.7		2.3	3	1.1				1	1.1	1.1	0.9	1.1	1.1	4
Bankfull Max Depth (ft)	2.1	2.6		3.4	3	1.6				1	1.8	1.8	1.7	1.7	1.8	4
Bankfull Cross-Sectional Area (ft^2)	18.5	21.4		25.0	3	7.4				1	15.3	15.3	13.9	15.4	16.3	4
Width/Depth Ratio	4.7	8.0		13.2	3	6.4				1	12.0	12.0	13.9	14.4	15.5	4
Entrenchment Ratio	1.5	1.8		2.1	3	3.4				1	2.2	5.2	2.2	3.3	4.4	4
Bank Height Ratio	1.9	2.0		2.0	3	1.0				1	1.0	1.0	1.0	1.0	1.0	4
Pattern																
Channel Beltwidth (ft)	20	40		60	3	14	26		38	2	20	70	20	45	70	
Radius of Curvature (ft)	5	10		15	3	12	19		25	2	20	54	20	37	54	
Rc:Bankfull width (ft/ft)	0.5	1.0		1.4	3	1.7	2.7		3.6	2	2	4	2	3	4	
Meander Wavelength (ft)	23	87		150	3	43	73		102	2	58	140	58	99	140	
Meander Width Ratio	1.8	3.8		5.8	3	2.0	3.8		5.5	2	2.2	5.2	2.2	4.0	5.2	
Profile																
Riffle Length (ft)													5	15	23	23
Riffle Slope (ft/ft)	0.004			0.018	3	0.011			0.025	2			0.001	0.011	0.041	23
Pool Length (ft)						16			23				13	26	49	16
Pool Spacing (ft)						28			57				52	69	92	16
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	4% / 21% / 75% / 0% / 0% / 0%												0% / 20% / 76% / 5% / 0% / 0%			
d16 / d35 / d50 / d84 / d95 (mm)	1 / 2 / 3 / 6 / 11 / 19												1 / 5 / 10 / 22 / 36 / 57			
Additional Reach Parameters																
Channel length (ft)	2,083										2,084		2,084			
Drainage Area (SM)	0.70					0.16					0.70		0.70			
Rosgen Classification	G4					E4					C4		C4			
Sinuosity	1.00-1.47					1.18					1.16-1.45		1.16-1.45			
Water Surface Slope (ft/ft)	0.006-0.013					0.007					0.007-0.012		0.008			

Table 10c. T1A-1, T1A-2 Baseline Stream Data Summary
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	12.7				1	7.7	9.3		10.8	2	7.0					
Floodprone Width (ft)	30				1	13	15		16	2	0.9					
Bankfull Mean Depth (ft)	0.4				1	0.7	0.8		0.9	2	0.6					
Bankfull Max Depth (ft)	0.9				1	1.3	1.5		1.7	2	0.9					
Bankfull Cross-Sectional Area (ft^2)	4.5				1	6.1	7.5		8.8	2	3.9					
Width/Depth Ratio	35.8				1	8.5	9.9		11.4	2	12.5					
Entrenchment Ratio	2.4				1	1.6	1.8		2.1	2	2.2					
Bank Height Ratio	1.0				1	1.0				1	1.0					
Pattern																
Channel Beltwidth (ft)	*					22				1	10	30				
Radius of Curvature (ft)	*					11			23	2	12	25				
Rc:Bankfull width (ft/ft)	*					1			3	2	2	4				
Meander Wavelength (ft)	*					49			59	2	55	95				
Meander Width Ratio	*					2			3	2	1.0	4.3				
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)	0.013			0.018	2	0.012			0.028	2	0.006	0.020				
Pool Length (ft)						5			9		7	11				
Pool Spacing (ft)											22	63				
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%						0%, 18%, 82%, 1%, 0%, 0%										
d16 / d35 / d50 / d84 / d95 (mm)						3, 7, 9, 13, 17, 25										
Additional Reach Parameters																
Channel length (ft)	446										446					
Drainage Area (SM)	0.05					0.15					0.05					
Rosgen Classification	C4					B4c					B4c/C4					
Sinuosity	1.11					1.20					1.11					
Water Surface Slope (ft/ft)	0.015					0.012					0.012					

*Not a meandering channel and mostly composed of riffles and runs; therefore no pattern data or pool data was shown

Table 10d. T1A-3 Baseline Stream Data Summary
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	9.3				1	9.0	9.5		10.0	2	6.0					
Floodprone Width (ft)	10				1	13	17		21	2	14					
Bankfull Mean Depth (ft)	0.5				1	1.1	1.1		1.2	2	0.5					
Bankfull Max Depth (ft)	0.7				1	1.3	1.4		1.5	2	0.9					
Bankfull Cross-Sectional Area (ft^2)	4.3				1	10.4	10.5		10.7	2	3.2					
Width/Depth Ratio	20.1				1	8.0	9.0		10.0	2	11.2					
Entrenchment Ratio	1.1				1	1.3	1.8		2.3	2	2.2					
Bank Height Ratio	8.6				1	1.0				1	1.0					
Pattern																
Channel Beltwidth (ft)	*					45				1	15	30				
Radius of Curvature (ft)	*					13			42	2	12	27				
Rc:Bankfull width (ft/ft)	*					1.3			4.4	2	2.0	4.5				
Meander Wavelength (ft)	*					93			136	2	50	80				
Meander Width Ratio	*					4.5			5.0	2	2.5	5.0				
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)						0.013			0.028	2	0.020	0.030				
Pool Length (ft)						3			25	2	6	12				
Pool Spacing (ft)						30			39	2	20	40				
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%																
d16 / d35 / d50 / d84 / d95 (mm)																
Additional Reach Parameters																
Channel length (ft)	470										498					
Drainage Area (SM)	0.05					0.40					0.05					
Rosgen Classification	F4					B4c					B4c/C4					
Sinuosity	1.06					1.20					1.09					
Water Surface Slope (ft/ft)	0.018					0.013					0.017					

*Not a meandering channel and mostly composed of riffles and runs; therefore no pattern data or pool data was shown

Table 11. Cross-Section Morphology Data Tables
Jacob's Ladder Stream Restoration Site, DMS Project # 95023

Dimension and Substrate	Cross-Section 1 (T1-Riffle) Station 14+75							Cross-Section 2 (T1-Pool) Station 16+40							Cross-Section 3 (T1-Riffle) Station 24+88							Cross-Section 4 (T1-Pool) Station 26+98							Cross-Section 5 (T1-Riffle) Station 28+75						
Based on fixed baseline elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	10.8	10.9	11.0	10.3				9.1	9.5	10.1	8.7				12.4	13.2	14.4	12.6				17.0	18.7	17.3	17.8				10.8	11.5	11.9	11.3			
Floodprone Width (ft)	>50	>50	>50	>50				-	-	-	-				>45	>45	>45	>45				-	-	-	-				>50	>50	>50	>50			
Bankfull Mean Depth (ft)	1.0	1.0	0.9	0.9				1.3	1.3	1.2	1.2				0.9	1.0	0.9	0.9				1.3	1.3	1.5	1.3				0.8	0.9	0.9	0.9			
Bankfull Max Depth (ft)	1.6	1.8	1.7	1.6				2.2	2.4	2.3	2.2				1.7	1.8	1.8	1.7				3.0	3.1	3.2	3.2				1.3	1.6	1.7	1.6			
Bankfull Cross-Sectional Area (ft^2)	10.4	10.9	12.7	9.5				11.5	12.7	15.0	10.5				11.6	12.7	14.5	11.8				21.4	25.3	22.2	22.8				8.8	10.2	16.1	10.4			
Bankfull Width/Depth Ratio	11.2	10.8	11.8	11.1				-	-	-	-				13.3	13.6	15.7	13.6				-	-	-	-				13.3	13.0	13.6	12.2			
Bankfull Entrenchment Ratio	4.6	4.7	4.6	4.9				-	-	-	-				3.6	3.6	3.3	3.7				-	-	-	-				4.6	4.3	4.2	4.5			
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0				-	-	-	-				1.0	1.0	1.0	1.0				-	-	-	-				1.0	1.0	1.0	1.0			
d50 (mm)	91	100	110	79				-	-	-	-				46	38	51	28				-	-	-	-				59	24	57	66			

	Cross-Section 6 (T2-Riffle) Station 101+73							Cross-Section 7 (T2-Riffle) Station 105+67							Cross-Section 8 (T2-Riffle) Station 110+00							Cross-Section 9 (T2-Pool) Station 115+88							Cross-Section 10 (T2-Riffle) Station 116+28						
Based on fixed baseline elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	14.7	14.3	13.4	11.7				15.2	15.7	16.3	14.4				14.6	15.0	15.8	14.1				17.5	18.1	19.5	17.3				15.0	13.8	14.0	15.5			
Floodprone Width (ft)	35.0	34.9	31.6	28.8				33.0	32.8	33.0	28.9				>60	>60	>60	>60				-	-	-					>66	>65	>65	>65			
Bankfull Mean Depth (ft)	0.9	1.0	0.9	0.7				1.1	1.0	0.9	0.6				1.0	1.0	0.9	0.8				1.5	1.3	1.1	1.0				1.1	1.2	1.2	0.8			
Bankfull Max Depth (ft)	1.8	1.7	1.6	1.2				1.7	1.7	1.7	1.0				1.7	1.7	1.8	1.4				3.2	2.3	2.3	2.4				2.0	2.0	2.0	1.8			
Bankfull Cross-Sectional Area (ft^2)	13.9	14.1	10.2	7.8				16.3	15.8	12.5	8.5				15.2	15.4	13.2	11.8				26.5	23.2	26.1	17.5				16.2	16.1	10.3	13.1			
Bankfull Width/Depth Ratio	15.5	14.5	14.2	17.5				14.2	15.6	17.7	24.4				14.0	14.6	17.2	16.9				-	-	-	-				13.9	11.9	12.2	18.4			
Bankfull Entrenchment Ratio	2.4	2.4	2.4	2.5				2.2	2.1	2.0	2.0				4.1	3.9	3.7	3.8				-	-	-	-				4.4	4.8	4.8	3.9			
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0				-	-	-	-				1.0	1.0	1.0	1.0			
d50 (mm)	21	4	2.9	0.6				5	2.5	2.4	1.1				4	2.7	10	0.7				-	-	-	-				10	2.8	92	0.4			

Table 11b. Stream Reach Morphology Data Tables
Jacob's Ladder Stream Restoration Site, DMS Project # 95023
Reach: T1 (2,389 ft.)

Parameter	MY01 (2014)						MY02 (2015)						MY03 (2016)						MY04 (2017)						MY05 (2018)					
Dimension	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	10.9	11.9	11.5	13.2	1.2	3	11.0	12.4	11.9	14.4	1.8	3	10.3	11.4	11.3	12.6	1.2	3												
Floodprone Width (ft)	46.8	49.1	50.0	50.6	2.0	3	46.9	49.2	50.3	50.4	2.0	3	46.8	49.3	50.3	50.8	2.2	3												
Bankfull Mean Depth (ft)	0.9	1.0	1.0	1.0	0.1	3	0.9	0.9	0.9	0.9	0.0	3	0.9	0.9	0.9	0.9	0.0	3												
Bankfull Max Depth (ft)	1.6	1.7	1.8	1.8	0.1	3	1.7	1.7	1.7	1.8	0.1	3	1.6	1.6	1.6	1.7	0.0	3												
Bankfull Cross-Sectional Area (ft^2)	10.2	11.3	10.9	12.7	1.3	3	10.2	11.2	10.3	13.2	1.7	3	9.5	10.6	10.4	11.8	1.1	3												
Width/Depth Ratio	10.8	12.5	13.0	13.6	1.5	3	11.8	13.7	13.6	15.7	1.9	3	11.1	12.3	12.2	13.6	1.2	3												
Entrenchment Ratio	3.6	4.2	4.3	4.7	0.6	3	3.3	4.0	4.2	4.6	0.7	3	3.7	4.4	4.5	4.9	0.6	3												
Bank Height Ratio	1.0	1.0	1.0	1.0	0	3	1.0	1.0	1.0	1.0	0	3	1.0	1.0	1.0	1.0	0	3												
Pattern																														
Channel Beltwidth (ft)	25	48		70																										
Radius of Curvature (ft)	20	33		45																										
Rad. of Curv. : Bankfull Width (ft/ft)	2	3		4																										
Meander Wavelength (ft)	65	103		140																										
Meander Width Ratio	234.0	4		5.8																										
Profile																														
Riffle Length (ft)	17	34	35	46	7.00	20	6.4	35.7	37.9	56.2	12.2	20	23.4	41.0	39.2	101.1	16.4	18												
Riffle Slope (ft/ft)	0.009	0.02	0.02	0.06	0.01	21	0.006	0.02	0.02	0.02	0.004	20	0.01	0.02	0.02	0.02	0.002	18												
Pool Length (ft)	8.0	28.3	27.1	49.6	10.8	16	4.8	20.2	18.2	49.4	10.8	17	6.7	15.7	14.4	24.8	5.0	14												
Pool Max Depth (ft)	2.4	2.7		3.0		2	2.3	2.8		3.2		2	2.2	2.7		3.2		2												
Pool Spacing (ft)	38.5	50.8	45.5	99.0	14.6	15	54.1	85.7	75.0	175.8	30.8	16	54.3	91.5	72.9	195.1	43.6	13												
Additional Reach Parameters																														
Channel Thalweg Length (ft)	2,389						2,389						2,389																	
Sinuosity	0.36						0.36						0.36																	
Water Surface Slope (ft/ft)	0.0093						0.0093						0.0087																	
Bankfull Slope (ft/ft)	0.0092						0.0082						0.0082																	
Rosgen Classification	C4						C4						C4																	
SC% / Sa% / G% / C% / B% / Be%	41 / 4 / 29 / 26 / 0 / 0						39 / 8 / 18 / 35 / 0 / 0						1 / 10 / 32 / 57 / 0 / 0																	
d16 / d35 / d50 / d84 / d95 (mm)	10 / 19 / 25 / 50 / 64						17 / 34 / 44 / 80 / 100						21 / 42 / 58 / 90/ 107																	
% of Reach with Eroding Banks	0%						0%						0%																	

Table 11c. Stream Reach Morphology Data Tables
Jacob's Ladder Stream Restoration Site, DMS Project # 95023
Reach: T2 (2,084 ft.)

Parameter	MY01 (2014)						MY02 (2015)						MY03 (2016)						MY04 (2017)						MY05 (2018)					
Dimension	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	13.8	14.7	14.7	15.7	0.8	4	13.4	14.9	14.9	16.3	1.4	4	11.7	13.9	14.2	15.5	1.6	4												
Floodprone Width (ft)	32.8	48.3	46.9	66.4	16.9	4	31.6	47.5	45.9	66.7	17.9	4	28.8	42.9	41.3	60.3	16.4	4												
Bankfull Mean Depth (ft)	1.0	1.0	1.0	1.2	0.1	4	0.9	1.0	0.9	1.2	0.1	4	0.6	0.7	0.8	0.8	0.1	4												
Bankfull Max Depth (ft)	1.7	1.8	1.7	2.0	0.1	4	1.6	1.8	1.7	2.0	0.2	4	1.0	1.3	1.3	1.8	0.3	4												
Bankfull Cross-Sectional Area (ft^2)	14.1	15.4	15.6	16.1	0.9	4	12.7	14.6	14.7	16.1	1.4	4	7.8	10.3	10.1	13.1	2.5	4												
Width/Depth Ratio	11.9	14.1	14.5	15.6	1.6	4	12.2	15.3	15.7	17.7	2.6	4	16.9	19.3	17.9	24.4	3.5	4												
Entrenchment Ratio	2.1	3.3	3.2	4.8	1.3	4	2.0	3.2	3.0	4.8	1.3	4	2.0	3.0	3.1	3.9	0.9	4												
Bank Height Ratio	1.0	1.0	1.0	1.0	0	4	1.0	1.0	1.0	1.0	0	4	1.0	1.0	1.0	1.0	0	4												
Pattern																														
Channel Beltwidth (ft)	20	45		70																										
Radius of Curvature (ft)	20	37		54																										
Rad. of Curv. : Bankfull Width (ft/ft)	2	3		4																										
Meander Wavelength (ft)	58	99		140																										
Meander Width Ratio	2.2	4		5.2																										
Profile																														
Riffle Length (ft)	9.1	37.9	31.1	133.6	28.9	20	5.8	25.8	24.7	44.5	12.9	20	3.0	26.8	21.0	163.5	32.1	27												
Riffle Slope (ft/ft)	0.003	0.01	0.01	0.05	0.01	20	0.002	0.02	0.01	0.04	0.01	20	0.00	0.02	0.02	0.04	0.01	27												
Pool Length (ft)	1.7	3.9	0.8	19.3	5.6	14	4.7	8.1	7.1	17.0	3.5	16	3.4002	8.7	6.9	19.1	4.1	29												
Pool Max Depth (ft)	2.3	2.3		2.3		1	1.2	1.2		1.2		1	2.4	2.4		2.4		1												
Pool Spacing (ft)	22.5	44.4	47.3	237.7	74.9	13	16.4	94.7	51.4	279.5	89.0	15	13.5	48.9	42.9	132.6	28.5	28												
Additional Reach Parameters																														
Channel Thalweg Length (ft)	2,084						2,084						2,084																	
Sinuosity	1.16-1.45						1.16-1.45						1.16-1.45																	
Water Surface Slope (ft/ft)	0.0088						0.0083						0.0086																	
Bankfull Slope (ft/ft)	0.0078						0.0074						0.0083																	
Rosgen Classification	C4						C4						C4																	
SC% / Sa% / G% / C% / B% / Be%	22 / 32 / 43 / 3 / 0 / 0						0 / 35 / 47 / 17 / 1 / 0						12 / 51 / 35 / 2 / 0 / 0																	
d16 / d35 / d50 / d84 / d95	0.2 / 1 / 2 / 17 / 46						1.1 / 5 / 22 / 59 / 77						0.2 / 0.4 / 0.7 / 7.2 / 16																	
% of Reach with Eroding Banks	0%						0%						0%																	

Appendix E

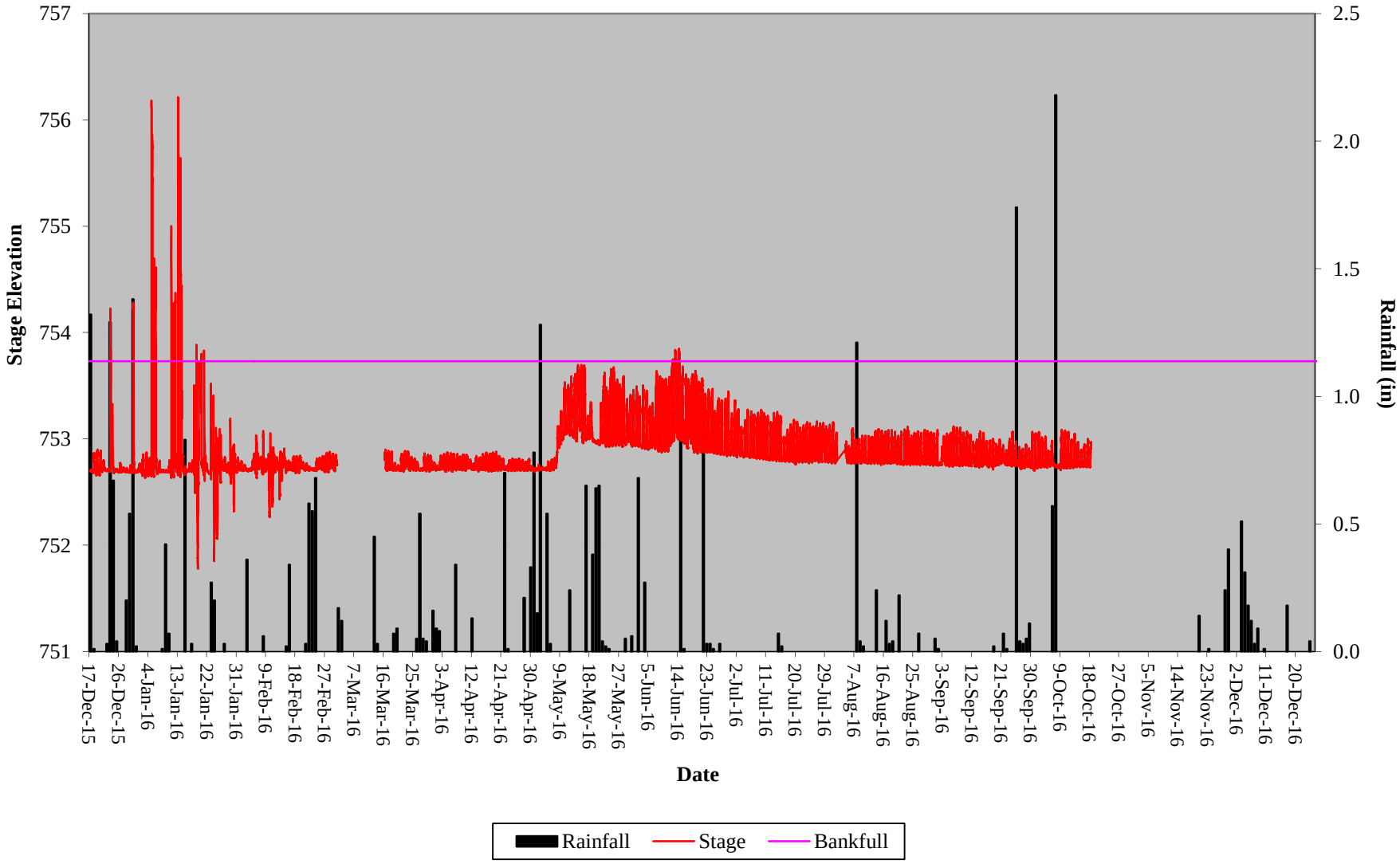
Hydrologic Data

Table 12. Verification of Bankfull Events Jacob's Ladder Stream Restoration Site, DMS Project # 95023			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo Number**
4/20/2015	4/20/2015	Automatic gauge on-site	N/A
12/17/2015	Unknown	Wracklines and flattened vegetation observed at bankfull, stream observed above bankfull	1 - 2
12/23/2015	12/23/2015	Automatic gauge on-site (T1 only)	N/A
12/30/2015	12/30/2015	Automatic gauge on-site	N/A
1/5/2016	1/5/2016	Automatic gauge on-site (T1 only)	N/A
1/14/2016	1/14/2016	Automatic gauge on-site (T1 only)	N/A
1/21/2016	1/21/2016	Automatic gauge on-site (T1 only)	N/A
6/14/2016	6/14/2016	Automatic gauge on-site	N/A

Photo 1. Bankfull indicators along T1, 12/17/15

Photo 2. T2 at bankfull, 12/17/15

Jacob's Ladder Restoration Site
Stage Hydrograph
Stream Gauge 1



Jacob's Ladder Restoration Site
Stage Hydrograph
Stream Gauge 2