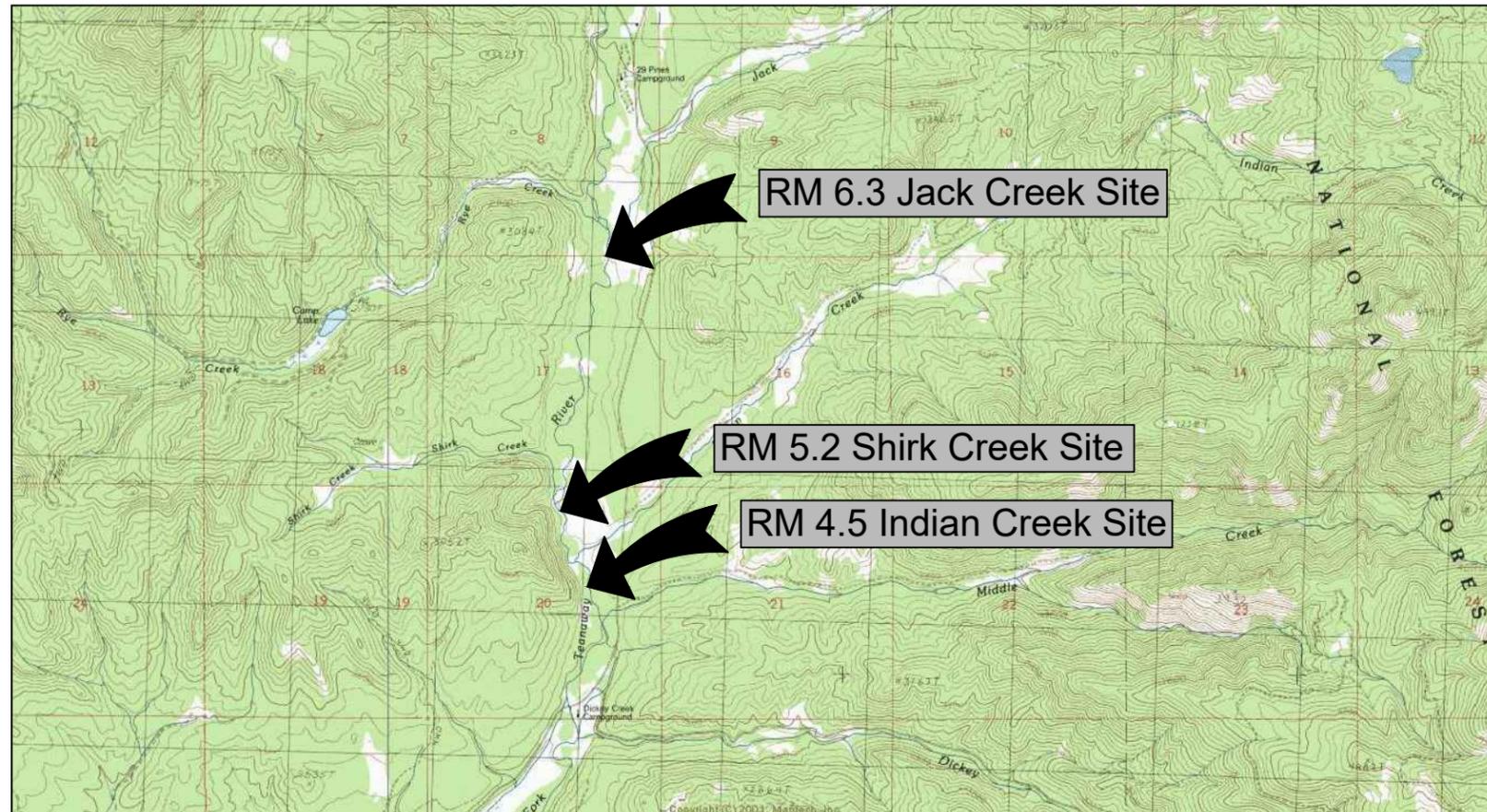


90% Design Drawings

North Fork Teanaway LWD Trapping

Project Number 17-1177



VICINITY MAP
NOT TO SCALE



DRAWING INDEX:

1. Cover Sheet
2. Legend
3. Overall Site Plan
4. RM 4.5 Indian Creek – Site Plan
5. RM 5.2 Shirk Creek – Site Plan
6. RM 6.3 Jack Creek – Site Plan
7. RM 4.5 Indian Creek – Profile/Sections
8. RM 5.2 Shirk Creek – Profile/Sections
9. RM 6.3 Jack Creek – Profile/Sections
10. LWD Bar Structures – Details
11. LWD Bank Structures – Details
12. Anchor Details
13. Details
14. Assembly Details



North Fork Teanaway
LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN BY:
Waterfall Engineering

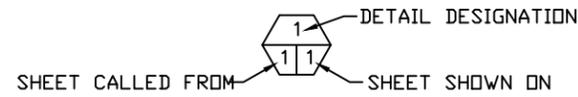
DRAWN BY:

DATE:
4/29/19

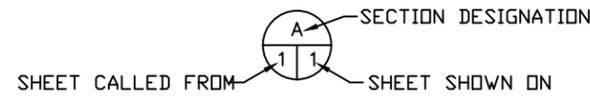
Cover Sheet

1 14
SHEET OF

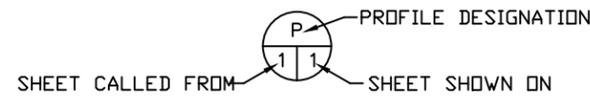
SHEET SYMBOLS



DETAIL CALLOUT

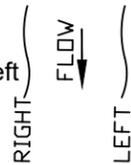


SECTION CALLOUT



PROFILE CALLOUT

References to Right and Left as viewed downstream



- " - INCHES
- ' - FEET
- APPROX. - APPROXIMATELY
- B&B - BALLED AND BURLAPPED
- BM - BENCH MARK
- CL - CENTERLINE
- CAL. - CALIPER
- CFS - CUBIC FEET PER SECOND
- CLR. - CLEARANCE
- CMP - CORRUGATED METAL PIPE
- CONC. - CONCRETE
- DIA. - DIAMETER
- ELEV. - ELEVATION
- EQ. - EQUAL
- FTG. - FOOTING
- HDPE - HIGH DENSITY POLYETHYLENE
- HT. - HEIGHT
- GAL. - GALLON
- I.D. - INSIDE DIAMETER
- I.E. - INVERT ELEVATION
- LBS. - POUNDS
- LWD - LARGE WOODY DEBRIS
- MAX. - MAXIMUM
- MFG. - MANUFACTURER'S
- MHW - MEAN HIGH WATER
- MHHW - MEAN HIGHER HIGH WATER
- MIN. - MINIMUM
- MISC. - MISCELLANEOUS

ABBREVIATIONS

- MISC. - MISCELLANEOUS
- MPH - MILES PER HOUR
- O.C. - ON CENTER
- O.D. - OUTSIDE DIAMETER
- OHW - ORDINARY HIGH WATER
- PK - PARKER-KALON
- R.O.W. - RIGHT OF WAY
- REQ'D - REQUIRED
- SEC. - SECTION
- S.F. - SQUARE FEET
- SHT. - SHEET
- SPEC'S. - PROJECT SPECIFICATIONS
- STA. - STATION
- SS - STAINLESS STEEL
- TEMP. - TEMPORARY
- TYP. - TYPICAL
- W.S. - WATER SURFACE
- WSDOT - WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
- WSEL - WATER SURFACE ELEVATION

LEGEND

- PROPERTY LINE
- RIGHT OF WAY LINE
- CENTERLINE
- EXISTING FENCE
- BUILDING LINE
- INDEX CONTOUR LINE
- UNDERGROUND POWER
- EXISTING WATER LINE
- EXISTING CALLOUT
- NEW CALLOUT
- SURVEY POINT
-
- PROJECT BENCH MARK
- BORING LOCATIONS
- SANDBAGS
- NOTE CALLOUT
- STATION CALLOUT
- PHOTO CALLOUT
- FOUND SURVEY MONUMENT
- SET CONTROL POINT
- POWER POLE
- MANHOLE
- UTILITY CABINET
- LIGHT POST
- TREE
- WATER VALVE
- OWNERSHIP REFERENCE
- CONCRETE
- FILL
- ROCK/GRAVEL
- UNDISTURBED GRADE
- WETLAND DELINEATION
- DEMO
- ELEVATION MARKER
- TREE TO BE REMOVED
- TREE TO REMAIN

Original Benchmarks Established by Mountain 2 Coast Survey. Other Control Points by Waterfall Engineering

Control Points - RM 4.5 Indian Creek

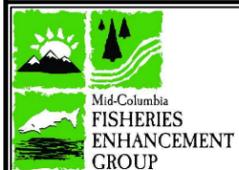
POINT	EASTING	NORTHING	ELEV	Description
BM7	1551663.02	717034.82	2437.19	Rebar w/M2C Cap
BM8	1551787.40	716685.23	2430.75	Rebar w/M2C Cap
WF1	1551450.33	716725.22	2432.15	2x2 Wood Stake

Control Points - RM 5.2 Shirk Creek

POINT	EASTING	NORTHING	ELEV	Description
BM5	1551313.04	719075.32	2463.89	Rebar w/M2C Cap
BM6	1551342.35	718521.98	2455.23	Rebar w/M2C Cap
WF2	1550968.15	719172.54	2464.28	Rebar w/WF Cap

Control Points - RM 4.5 Indian Creek

POINT	EASTING	NORTHING	ELEV	Description
BM1	1552302.47	723433.94	2531.76	Rebar w/M2C Cap
BM2	1552113.77	723752.42	2533.35	Rebar w/M2C Cap
WF3	1552056.97	723620.11	2525.50	Rebar w/WF Cap
WF4	1552163.60	723428.40	2528.53	Rebar



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION: 1" = 100'

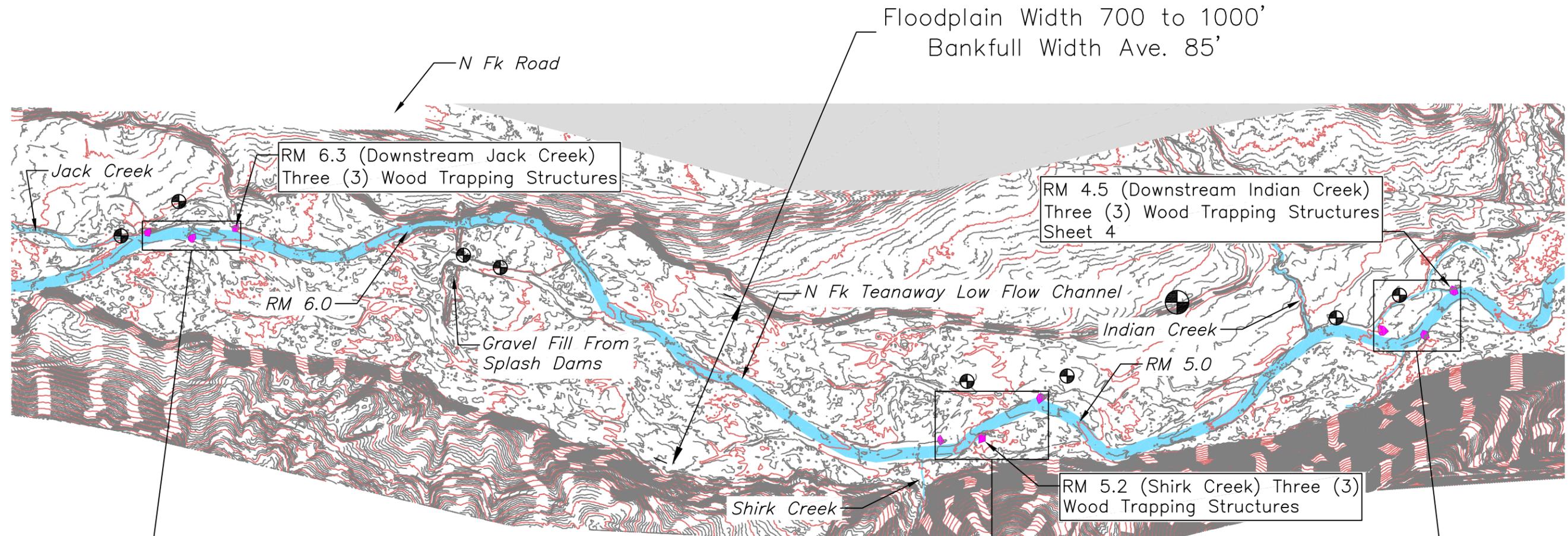
DESIGN BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

Legend

2 SHEET OF 14



RM 6.3 – Jack Creek
 Easting: 1552037.04
 Northing: 723633.41
 Elev. 2525

Site Plan - Rotated 90 Degrees

SCALE: 1" = 600'

FLOW →

⊕ Benchmarks

⬠ Denotes LWD Trapping Structure
 (Approx Size 40' x 40')



RM 4.5 – Indian Creek
 Easting: 1551479.29
 Northing: 716827.81
 Elev. 2425

RM 5.2 – Shirk Creek
 Easting: 1550882.63
 Northing: 719251.31
 Elev. 2457



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

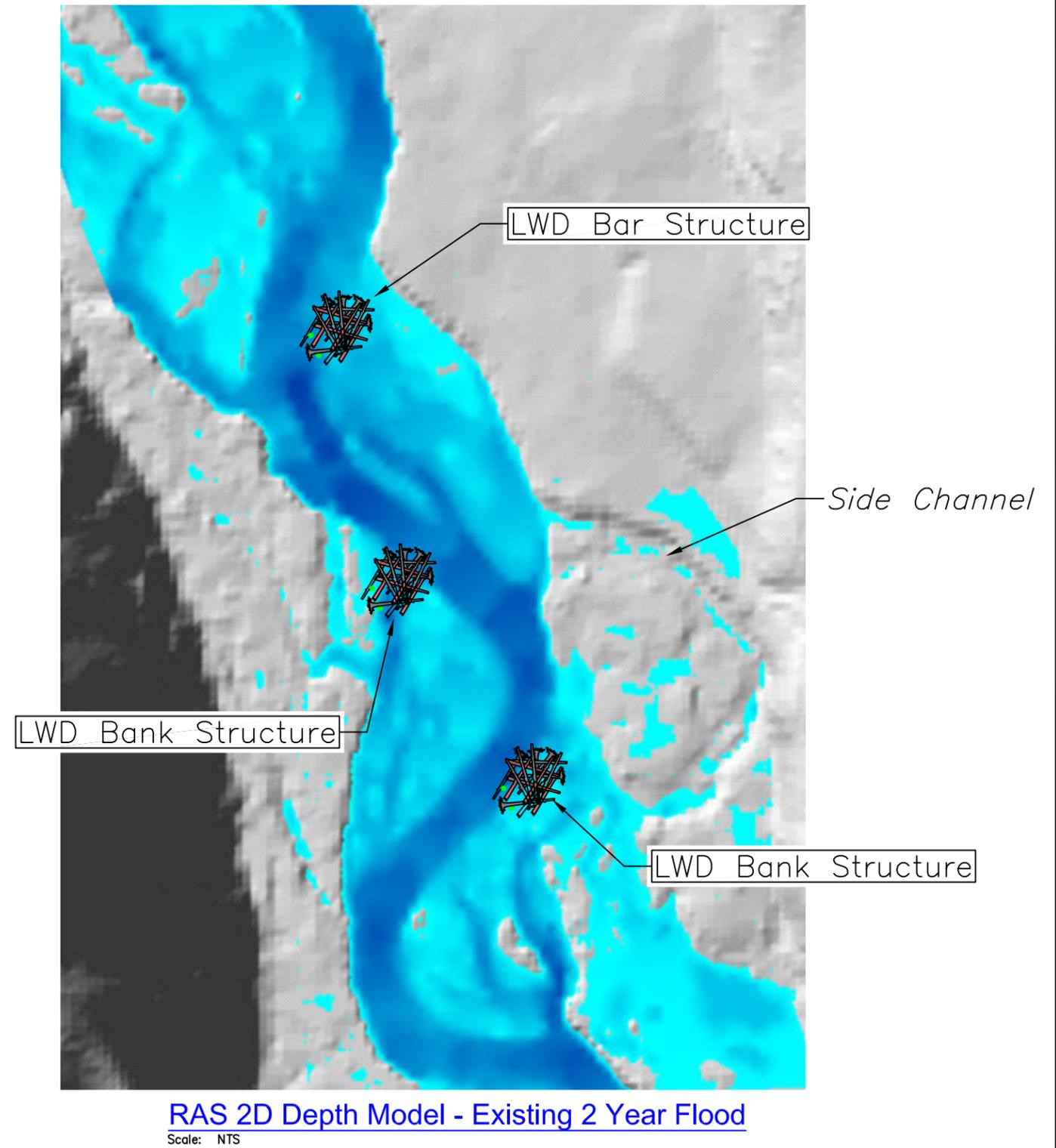
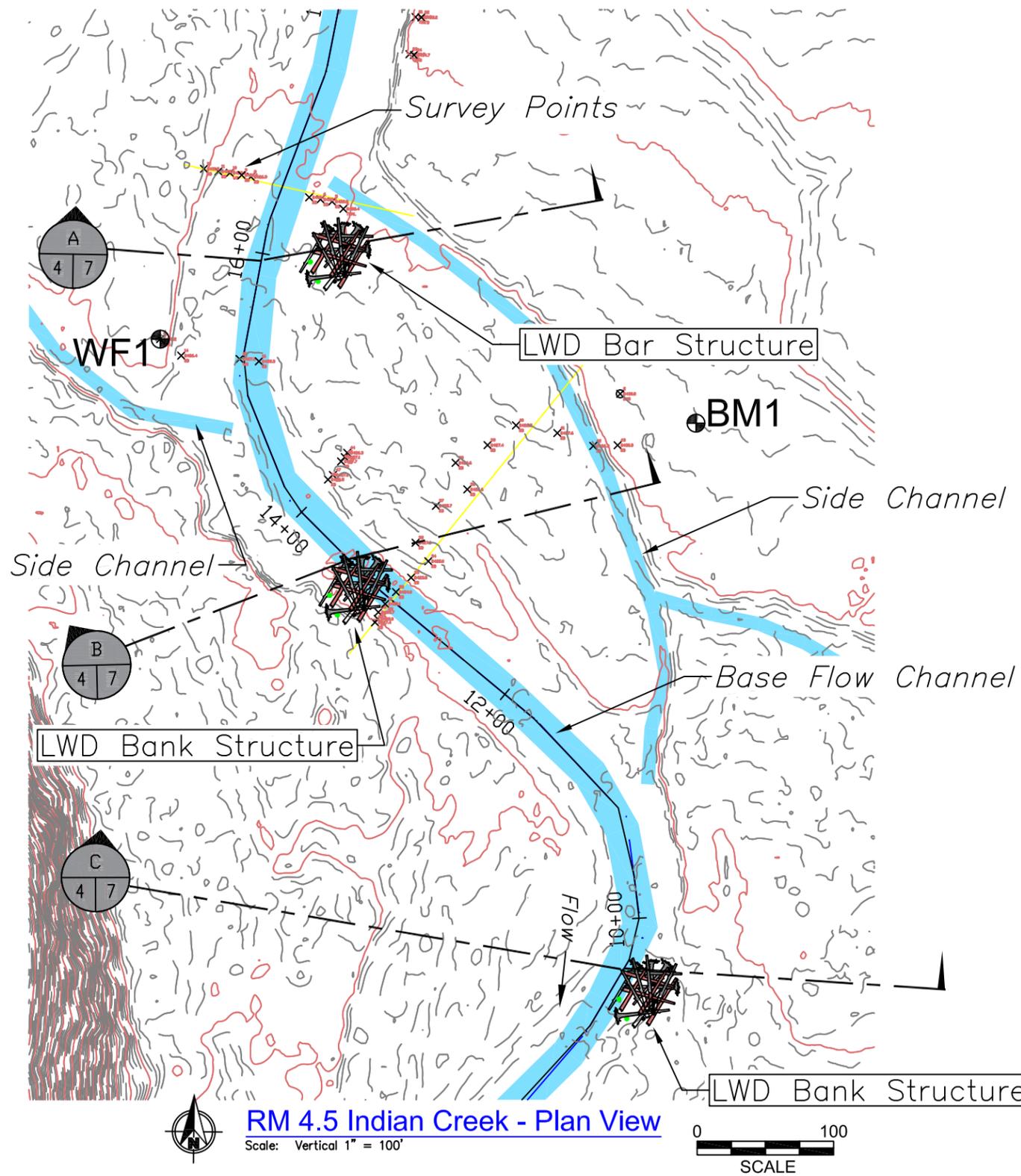
SCALE VERIFICATION
 BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DESIGN BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

Site Plan - Existing
2' LiDAR Contours



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

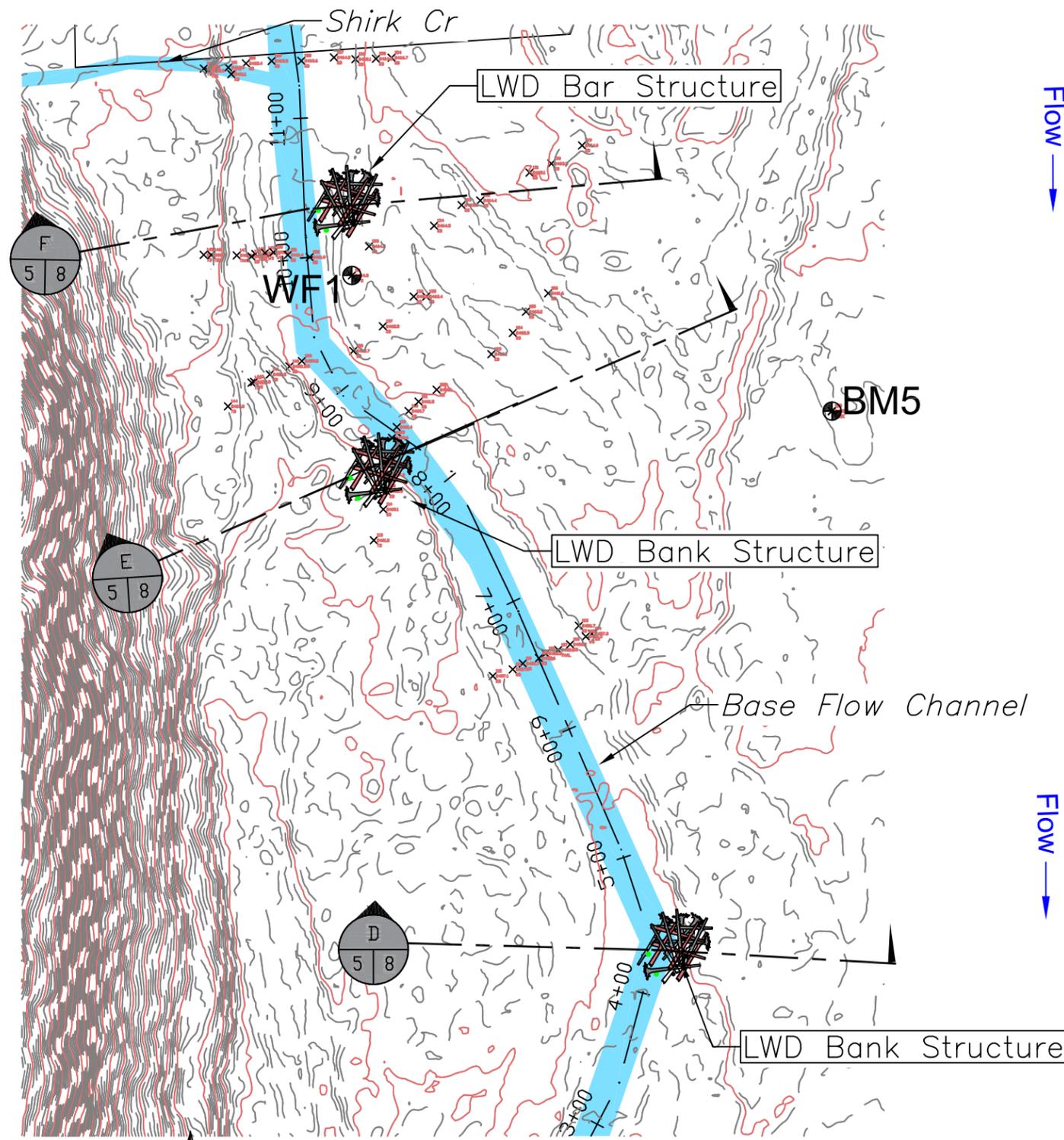
DESIGN BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

RM 4.5 Indian Creek

4 14
SHEET OF



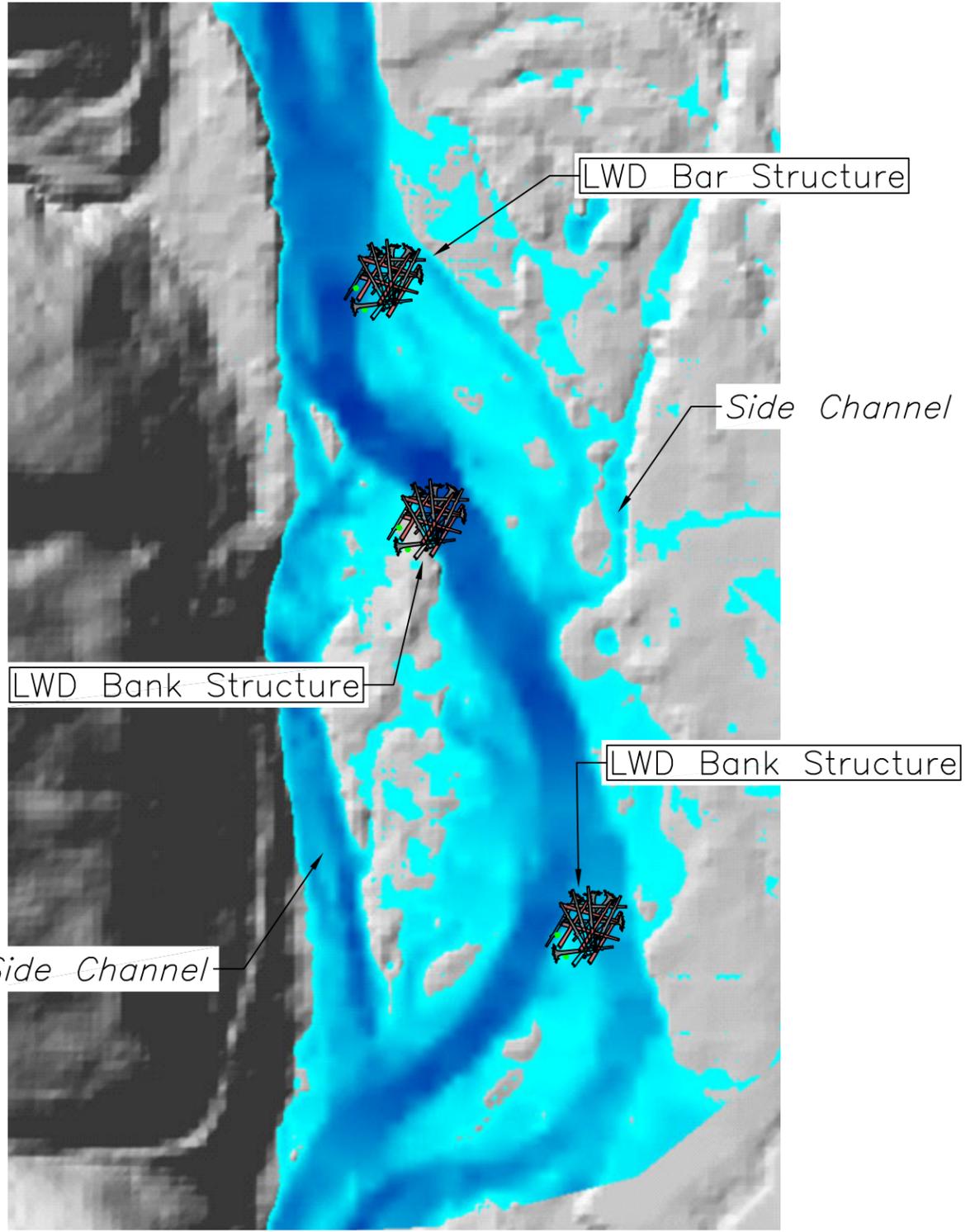
RM 5.2 Shirk Creek - Plan View

Scale: Vertical 1" = 100'



FLOW ↓

FLOW ↓



RAS 2D Depth Model - Existing 2 Year Flood

Scale: NTS



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION
 BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
 IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

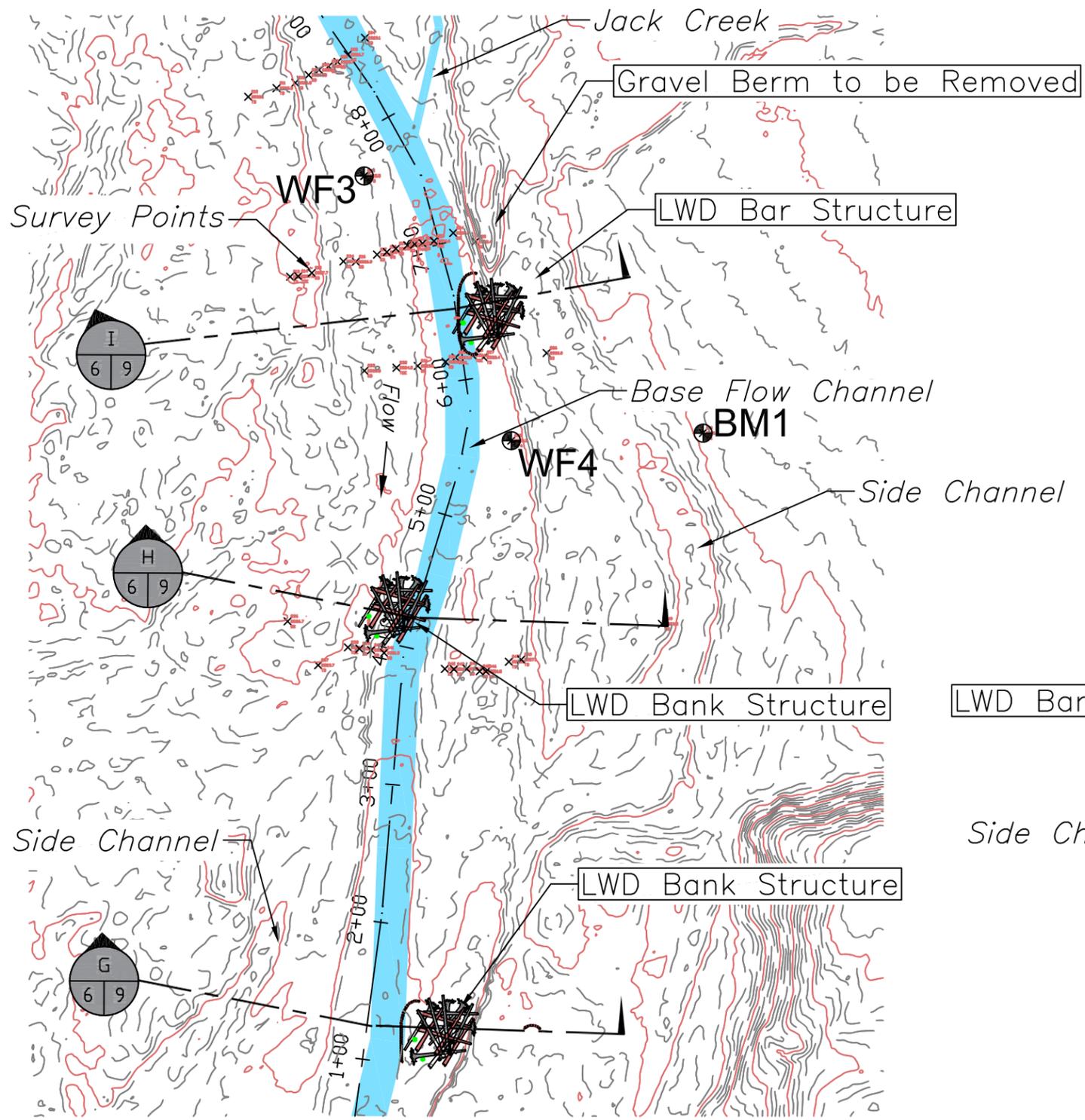
DESIGN BY:
Waterfall Engineering

DRAWN BY:

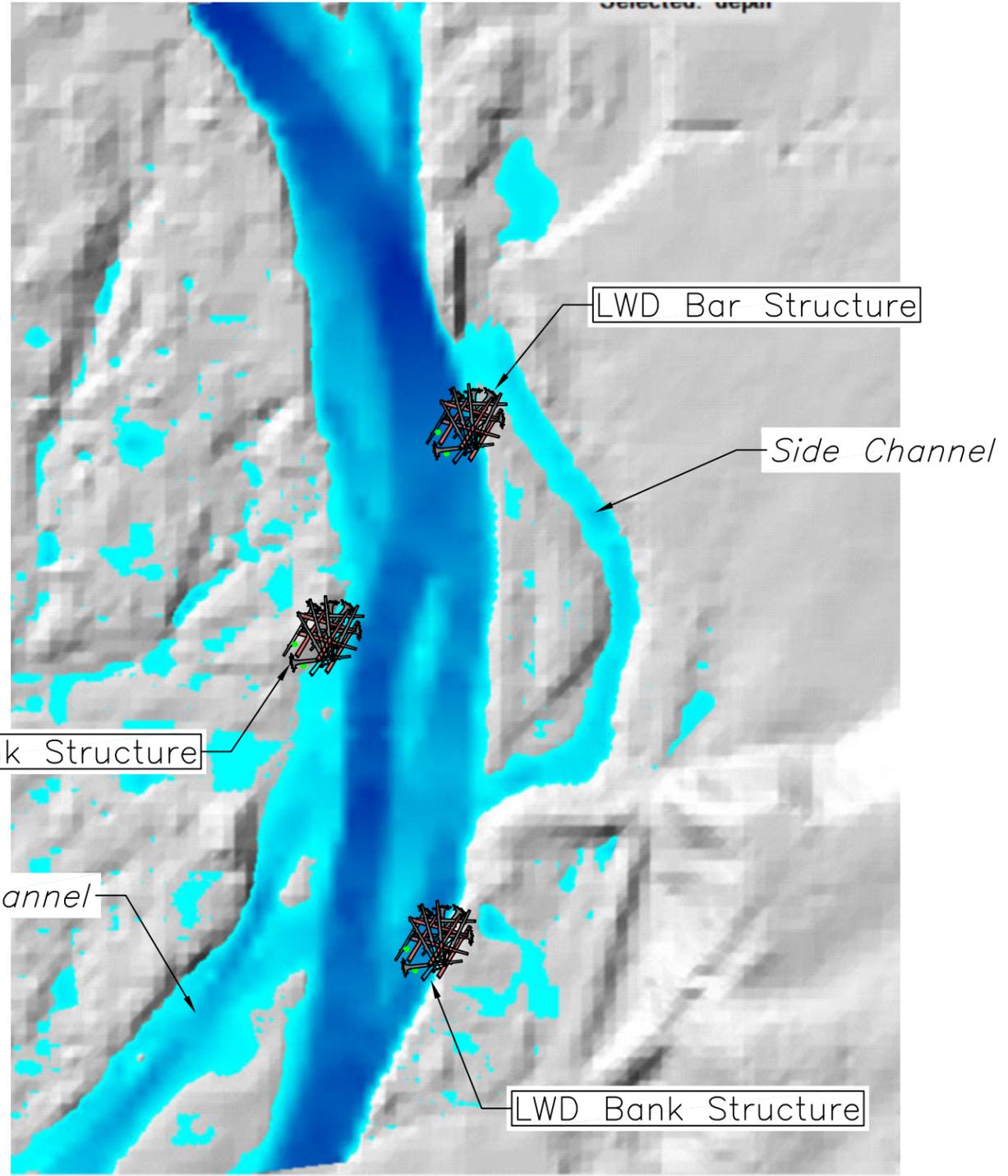
DATE:
4/29/19

RM 5.2 Shirk Creek

5 14
SHEET OF



RM 6.3 Jack Creek - Plan View
 Scale: Vertical 1" = 100'



RAS 2D Depth Model - Existing 2 Year Flood
 Scale: NTS



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

SCALE VERIFICATION

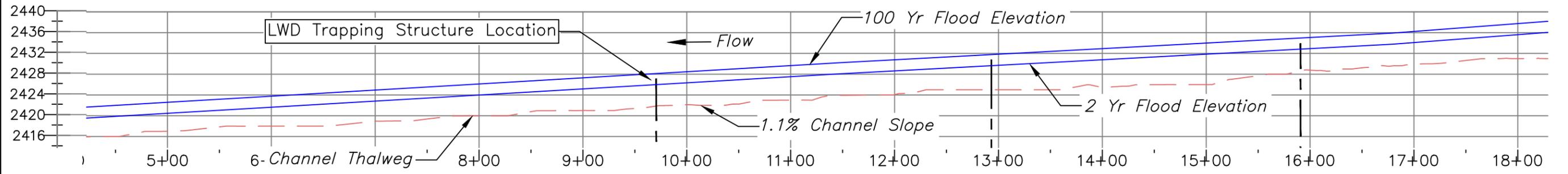
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGN BY:
Waterfall Engineering

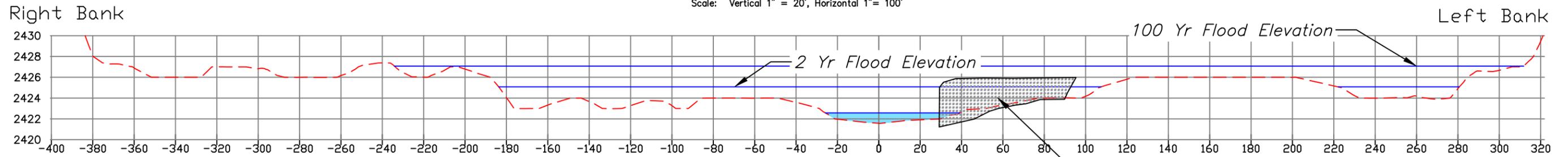
DRAWN BY:

DATE:
4/29/19

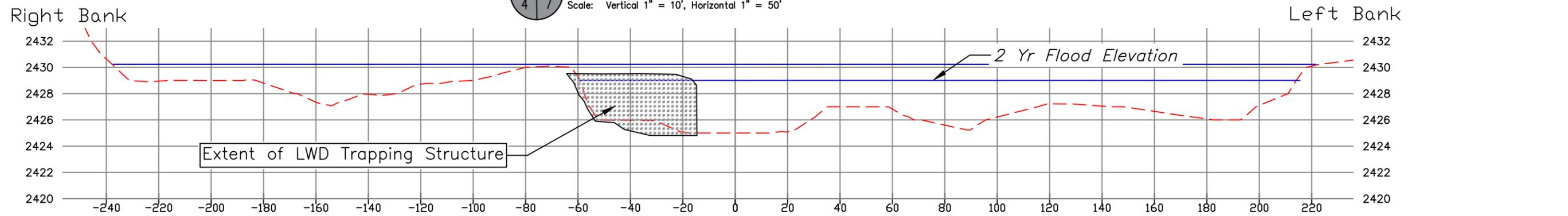
RM 6.3 Jack Creek



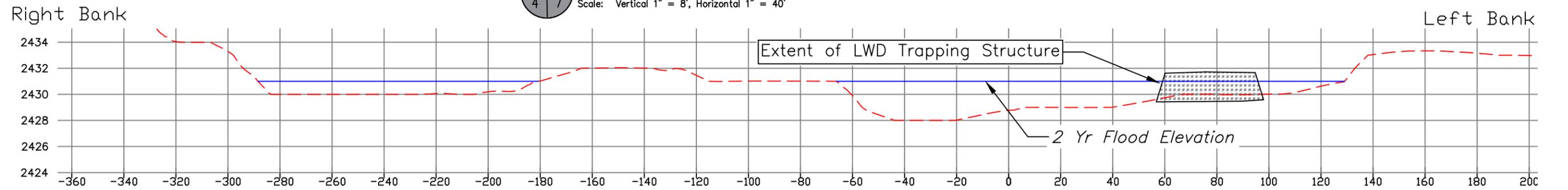
Stream Profile
Scale: Vertical 1" = 20', Horizontal 1" = 100'



Stream Section - STA 9+60 - View Upstream
Scale: Vertical 1" = 10', Horizontal 1" = 50'



Stream Section - STA 13+53 - View Upstream
Scale: Vertical 1" = 8', Horizontal 1" = 40'



Stream Section - STA 15+94 - View Upstream
Scale: Vertical 1" = 8', Horizontal 1" = 40'



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

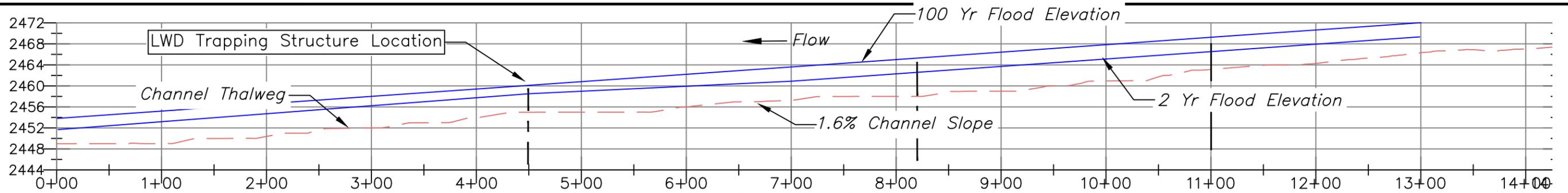
SCALE VERIFICATION: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DESIGN BY:
Waterfall Engineering

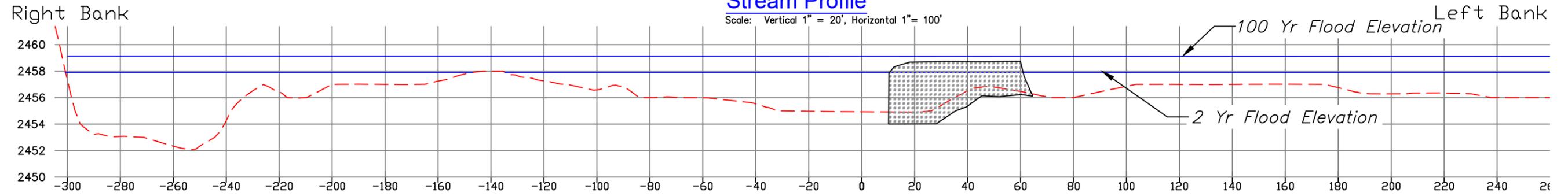
DRAWN BY:

DATE:
4/29/19

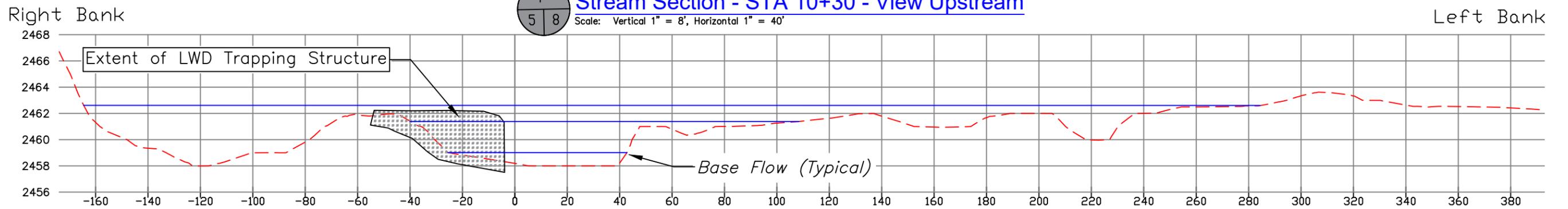
RM 4.5 - Indian Creek



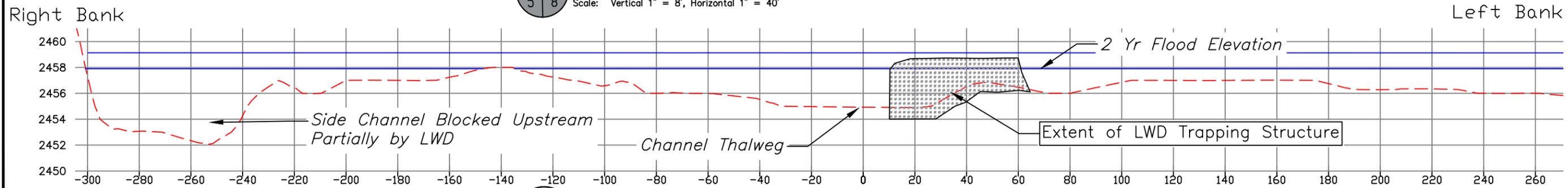
Stream Profile
Scale: Vertical 1" = 20', Horizontal 1" = 100'



F
5 | 8
Stream Section - STA 10+30 - View Upstream
Scale: Vertical 1" = 8', Horizontal 1" = 40'



E
5 | 8
Stream Section - STA 8+31 - View Upstream
Scale: Vertical 1" = 8', Horizontal 1" = 40'



D
5 | 8
Stream Section - STA 4+31 - View Upstream
Scale: Vertical 1" = 8', Horizontal 1" = 40'



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

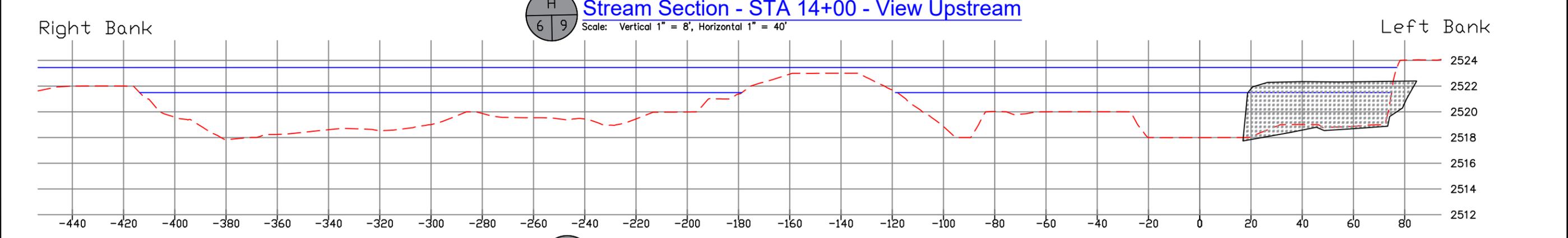
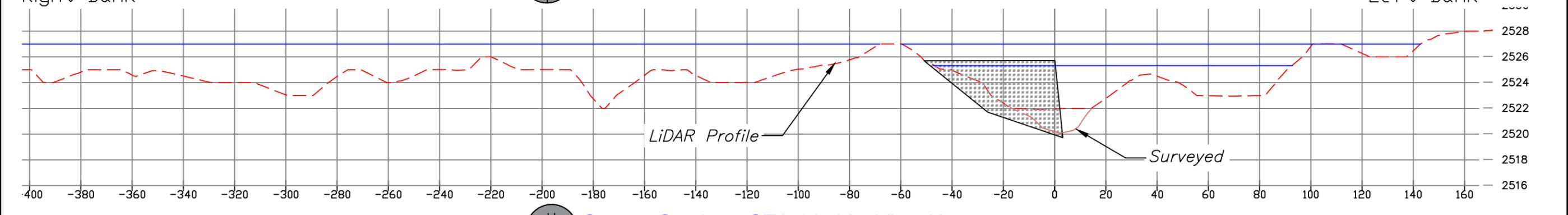
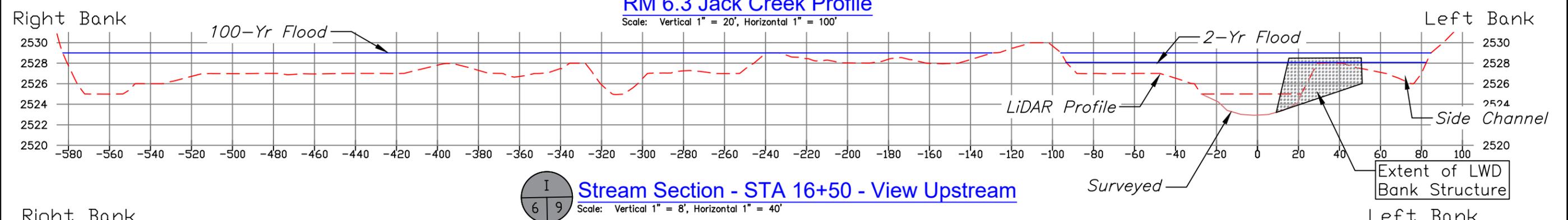
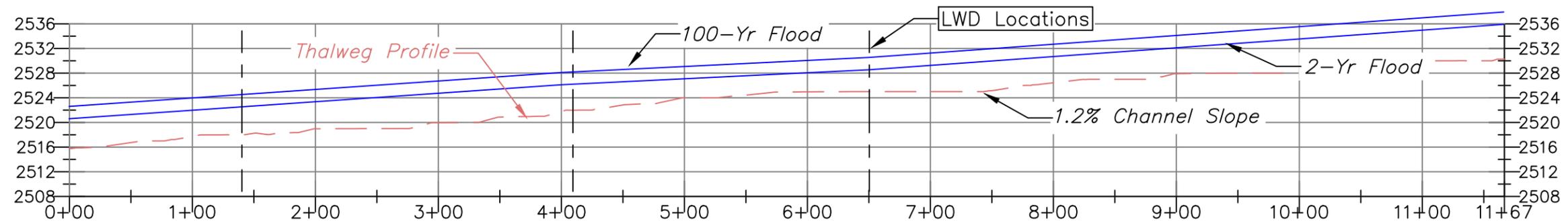
DESIGN BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

RM 5.2 - Shirk Creek

8 **14**
SHEET OF



North Fork Teanaway LWD Trapping



REV	DATE	BY	APPD	DESCRIPTION

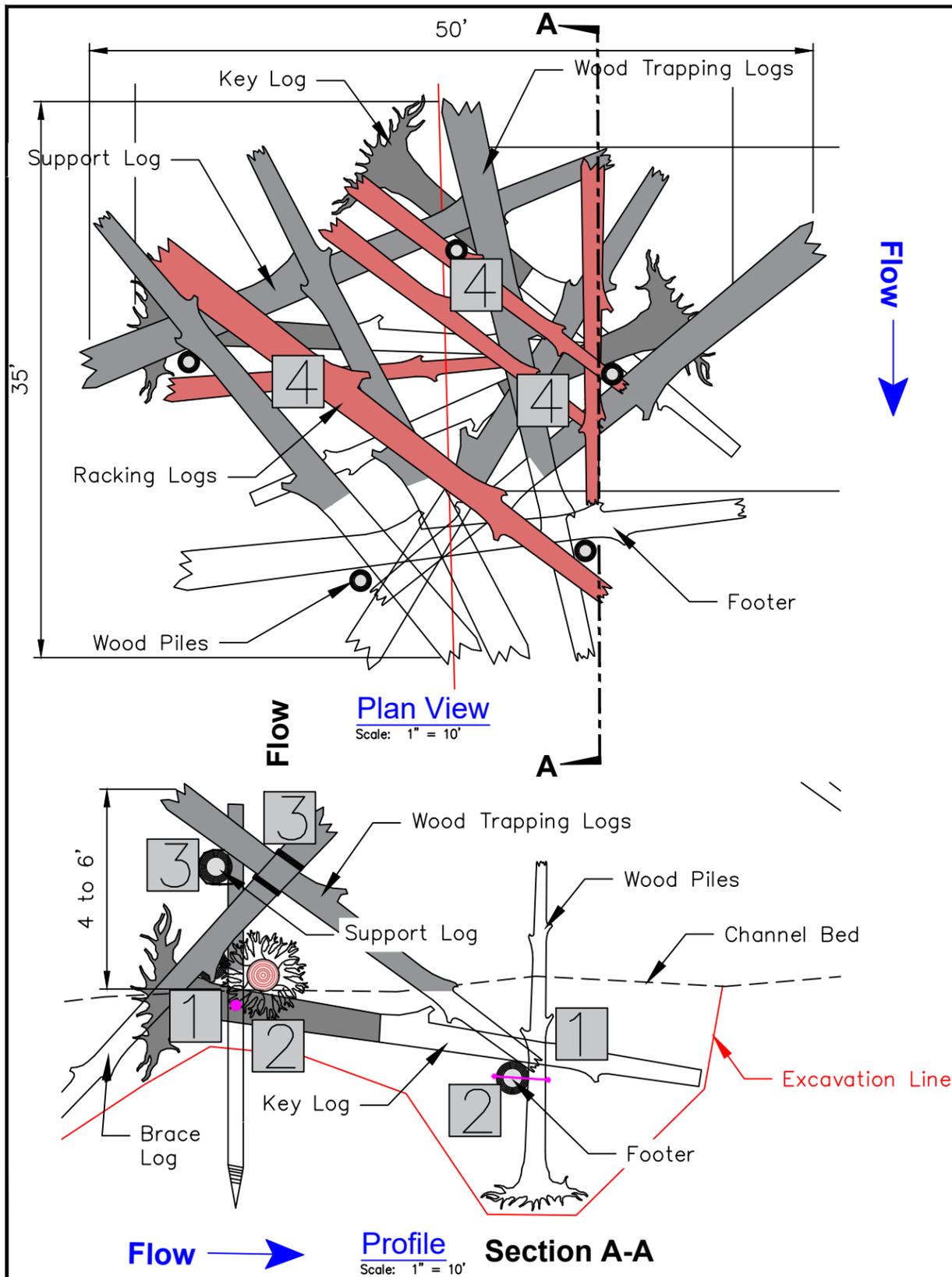
SCALE VERIFICATION: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DESIGN BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

RM 6.3 - Jack Creek Profile and Sections



LWD Anchor Details:

- 1 [Wood Pile Detail and Attachment Detail](#)
- 2 [Typical Log Pin](#)
- 3 [Log Lashing](#)
- 4 [LWD Ballast Anchor](#)

Note: See Sheet 11 for Detailed Description. Actual layout and alignment will vary as directed in field by the Engineer. LWD Anchors shown are typical and will vary in field.



North Fork Teanaway LWD Trapping



REVISIONS				
REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION: 0 1"

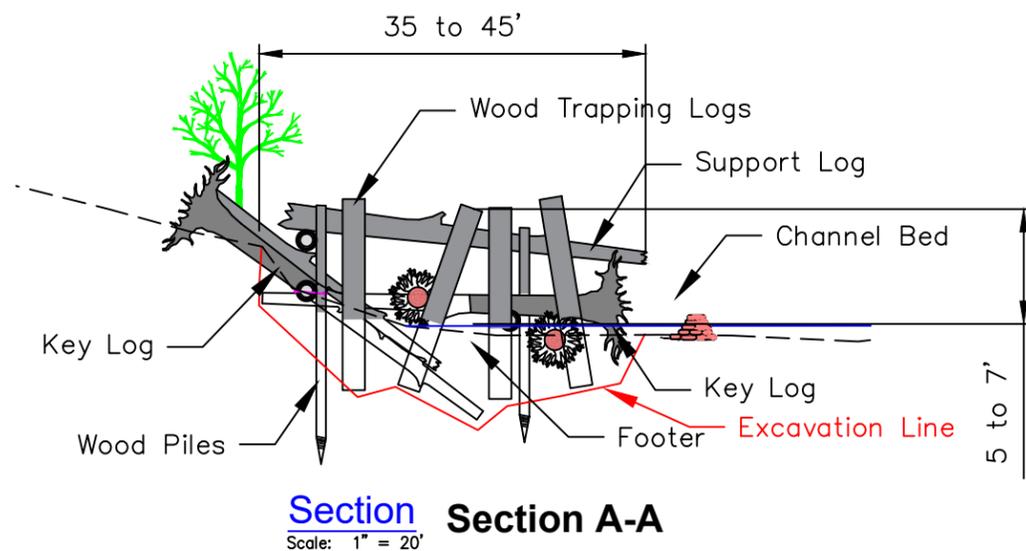
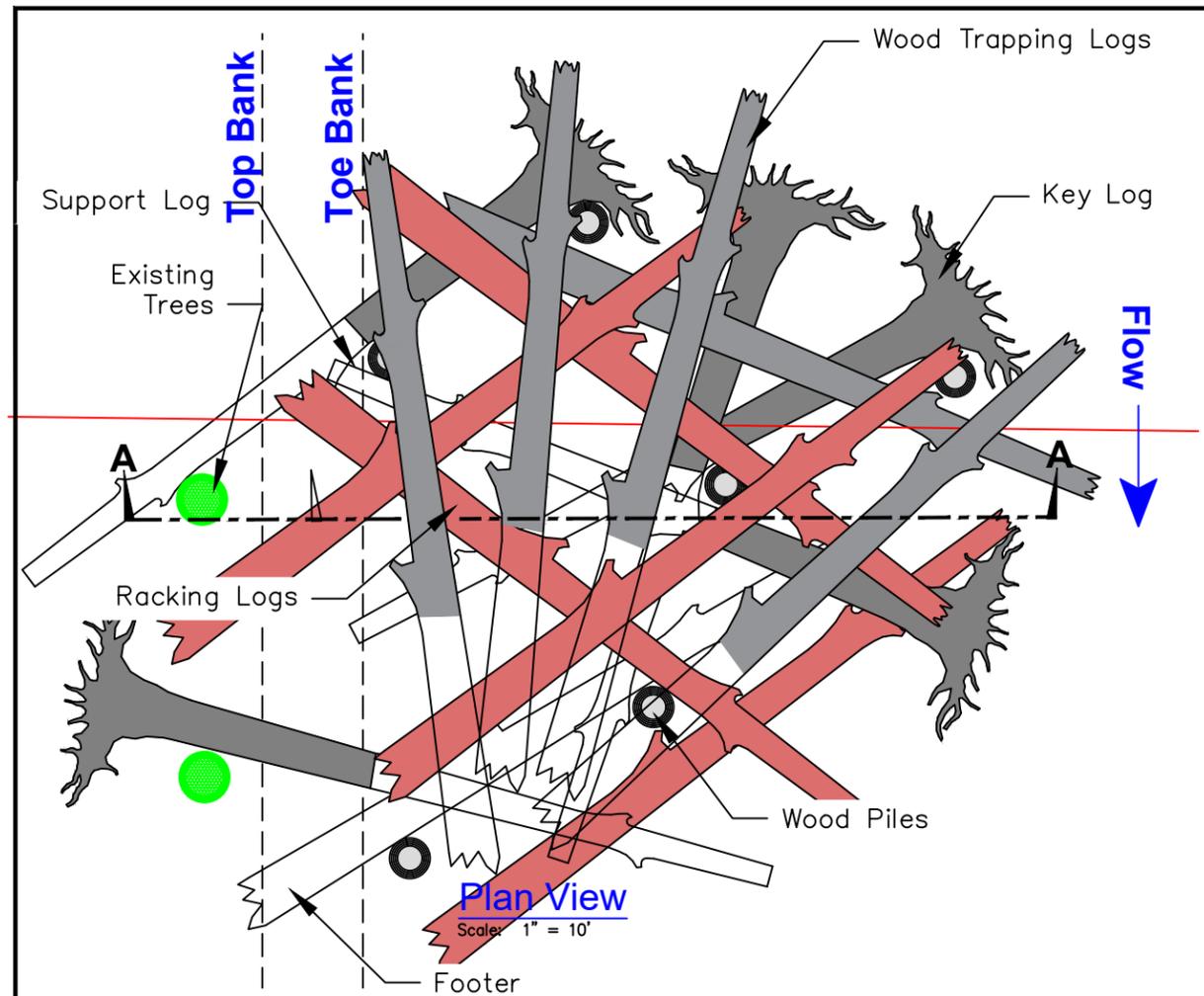
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGNED BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

LWD Details Bar Structure



Wood Piles: Single log 10 to 12 " diameter, 15 to 20' long with end shapened for driving. Optional wood pile formed from 12 to 18" diameter Log with rootwad buried in the streambed. Pile embedment depth equal to 2X exposed height.

Footer Log: Place upstream of downstream wood pile and anchor to wood pile with bolted connection. Backfill excavation if needed so footer log is 2 to 3' below channel bed.

Key Logs: Excavate channel as needed to place 18 to 24" dia. logs with rootwads. Anchor logs to wood piles and footer log. Place under logs to fill gaps.

Support logs: 18 to 24" dia. 30 to 40 ' long. Place lower support log on top of key logs and anchor to piles and key logs. Place upper support log with a bolted connection to wood pile.

Wood Trapping Logs: (18" to 24" diam, 30 to 40' long): Anchor top toe log on downstream end and place on top of support logs. Tip of logs to extent 4 to 6 feet above channel bed.

Brace Logs: (12" to 18" dia. 20 to 25' long): Excavate tip into bed and anchor to wood trapping logs.

Racking Logs: (12" to 18" Dia. 20 to 25' long): Existing on-site logs located above OHW as directed by Project Manager. Place/weave into gaps within structure to block major openings.

Gravel Cobble Backfill: Backfill with excavated material to original channel bed.

Note: Actual layout, position and alignment of logs will vary as directed in field by the Engineer based on site conditions.



North Fork Teanaway LWD Trapping

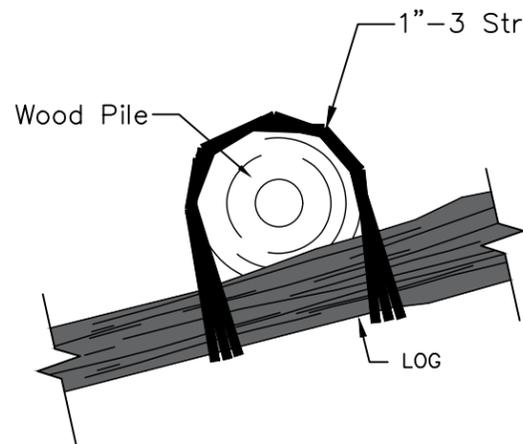


REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

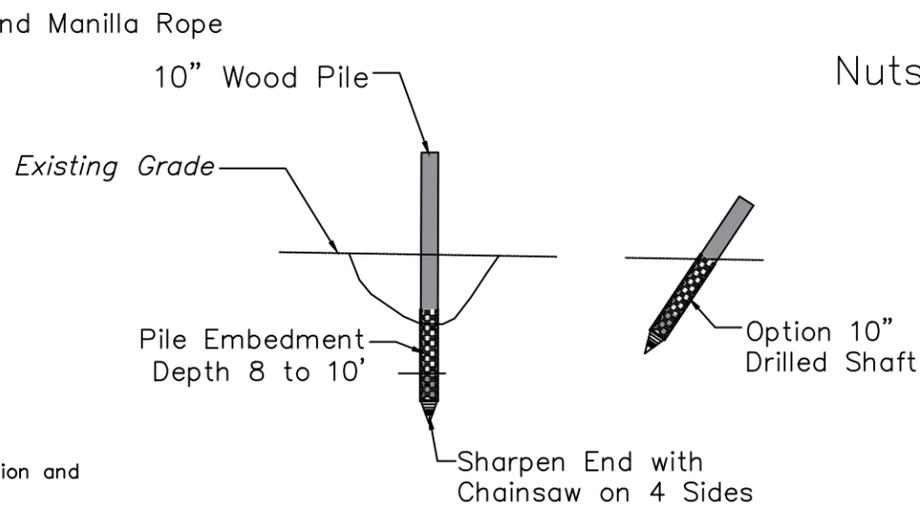
SCALE VERIFICATION: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGNED BY:
Waterfall Engineering
DRAWN BY:
DATE:
4/29/19

**LWD Details
Bank Structure**

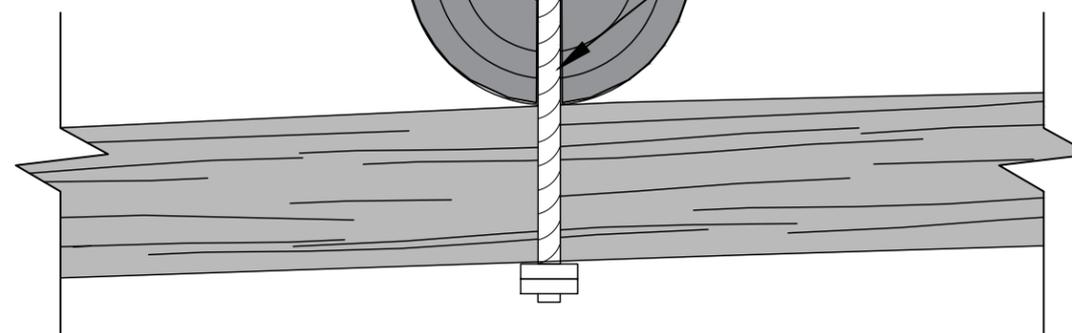


Three wraps of rope around log and pile, tension and secure with double square knot



Washers and 2 Hex Nuts to Match Threaded Rod

1-1/8" Threaded Rod

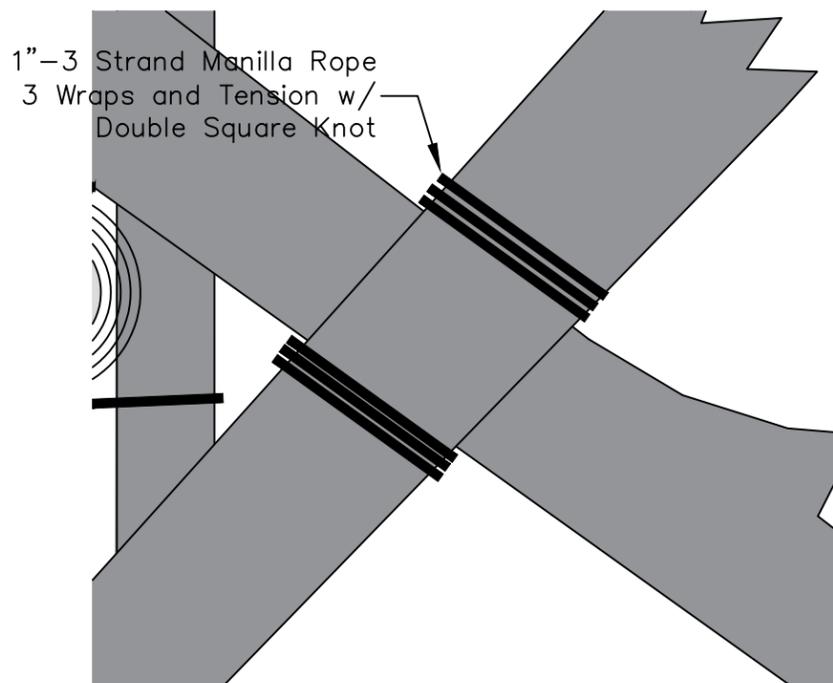


1 Wood Pile Detail and Attachment Detail

NOT TO SCALE

2 Typical Log Pin

Scale 1" = 2'



3 Log Lashing

Scale 1" = 2'

Threaded Rod to Match Chain

Log Diameter 18 to 24"

3/4" Grade 80 Lifting Chain

1" Grade B7 Threaded Rod 18" Long Embedment Depth 14"

1-1/8" Dia Hole 16" Deep Use Epoxy per Manufactures Specifications

Rock Size Varies 48 to 60"

4 LWD Ballast Anchor

Scale 1" = 10'



North Fork Teanaway LWD Trapping



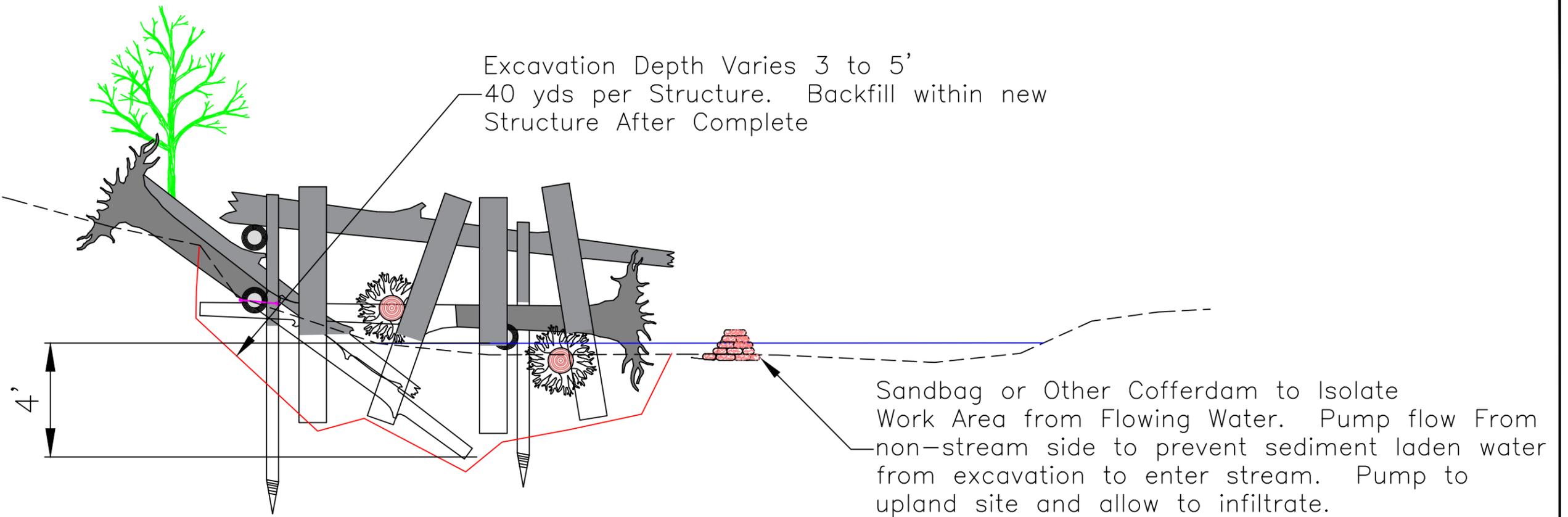
REVISIONS				
REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGNED BY: Waterfall Engineering
 DRAWN BY:
 DATE: 4/29/19

Anchor Details



Typical Stream Dewatering Plan

Scale 1" = 10'



North Fork Teanaway LWD Trapping



REVISIONS				
REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

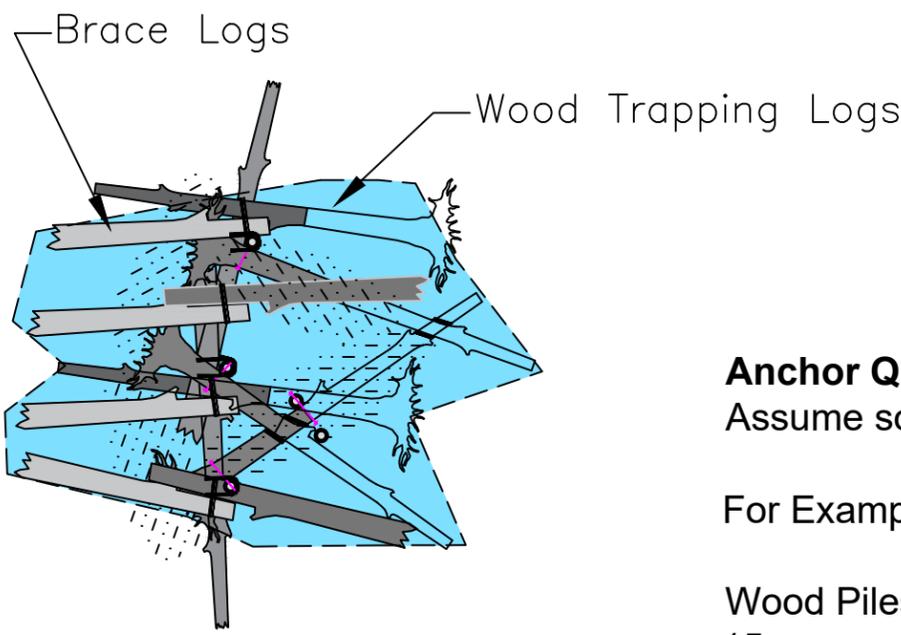
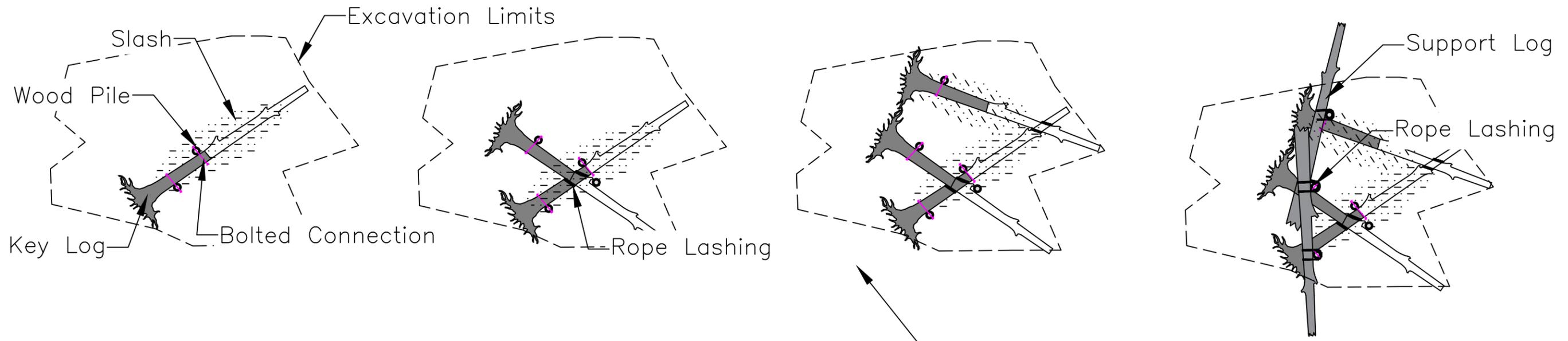
DESIGNED BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

Details

13 OF
SHEET



Excavation Depth Varies 3 to 5'
40 yds per Structure. Backfill within new Structure After Complete

Anchor Quantity Notes:

Assume some combination of Wood Piles and LWD Ballast Anchors per Structure

For Example: Amounts may be reduced based on quality of cobble/boulder backfill.

Wood Piles	LWD Ballast Anchors (2 Rocks Per Anchor)
15	0
8	4 (8 Rocks)
0	8 (16 Rocks)

LWD Trapping Structure Typical Assembly Sequence

Scale 1" = 20'



North Fork Teanaway
LWD Trapping



REVISIONS				
REV	DATE	BY	APPD	DESCRIPTION

SCALE VERIFICATION: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DESIGNED BY:
Waterfall Engineering

DRAWN BY:

DATE:
4/29/19

Details