



Co-Authors: Nathaniel Todea, Hydraulic Engineer; Jason Roper P.E., Environmental Engineer; Norm Evenstad, Water Res Coordinator, Utah USDA NRCS

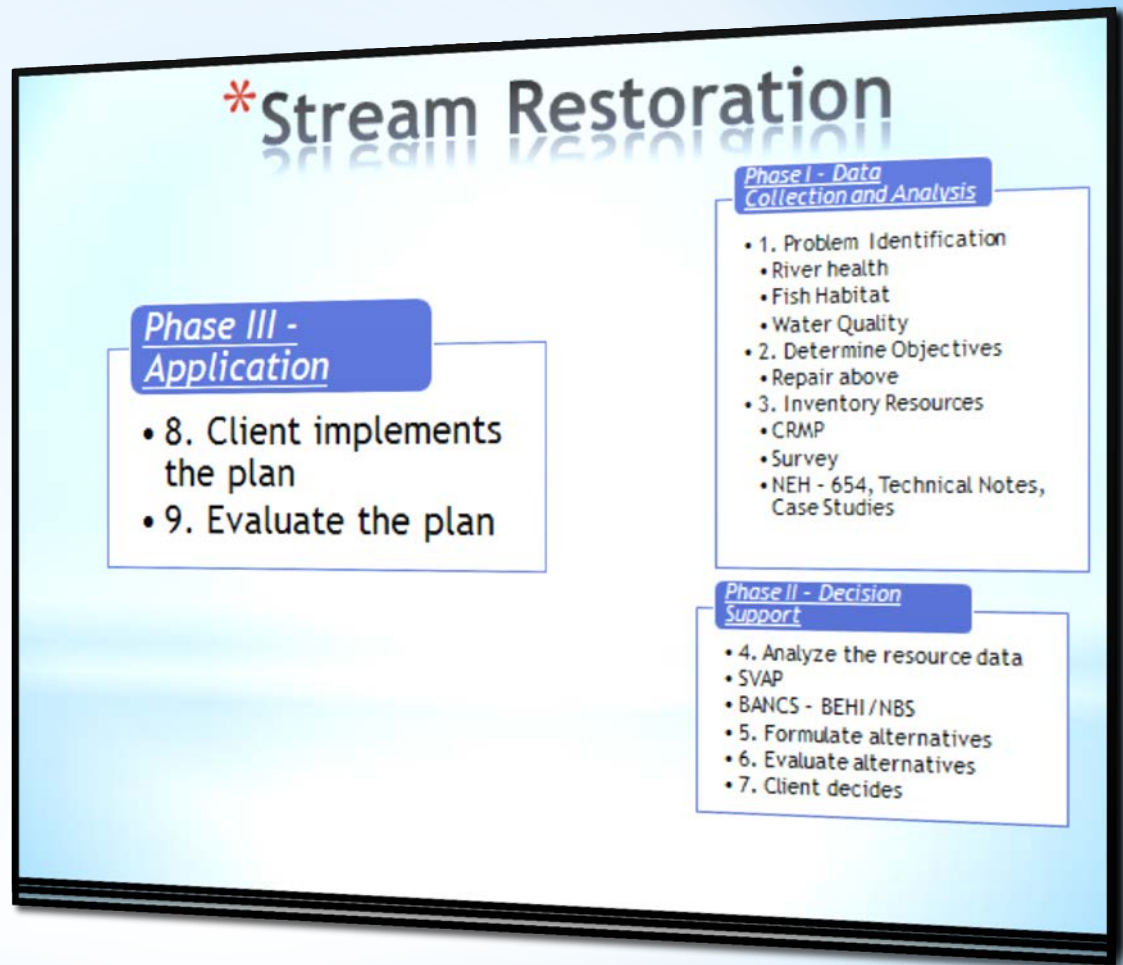


United States Department of Agriculture
Natural Resources Conservation Service

2014 ACE Conference
Bend, Oregon

*Overview

- Location
- CRMP
- 9-steps
- Stream Restoration
 - Phase 1 - data collection and analysis,
 - Phase 2 - decision support, and
 - Phase 3 - application



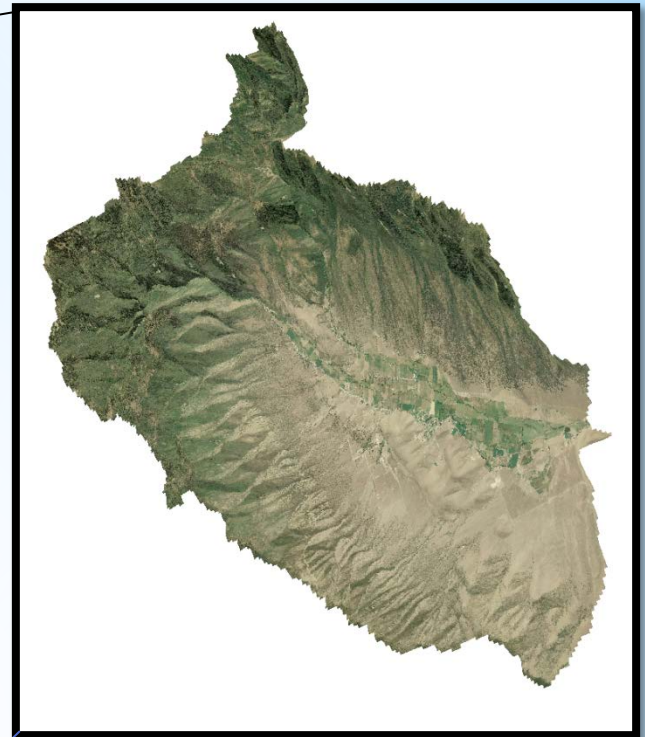
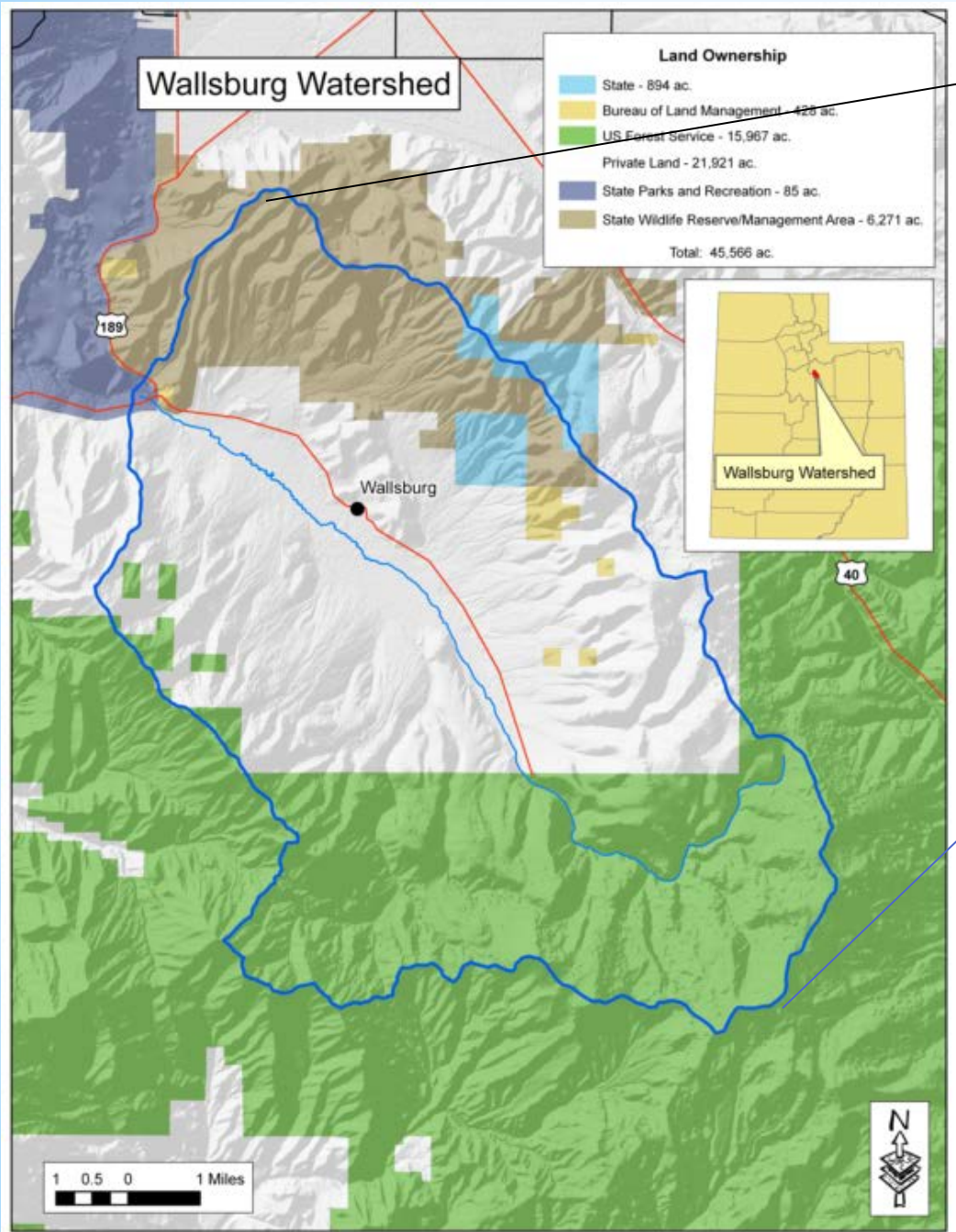
*9-steps of planning

Phase III - Application
8. Client implements the plan
9. Evaluate the plan

Phase I - Data Collection and Analysis
1. Problem Identification
2. Determine Objectives
3. Inventory Resources

Phase II – Decision Support
4. Analyze the resource data
5. Formulate alternatives
6. Evaluate alternatives
7. Client decides





* **Location**

*Stream Restoration

Phase I - Data Collection and Analysis

- 1. Problem Identification
 - River health
 - Fish Habitat
 - Water Quality
 - Water Quantity
- 2. Determine Objectives
 - Repair above
- 3. Inventory Resources
 - CRMP
 - Survey
 - SVAP
- NRCS-NEH - Part 654, Technical Notes, Case Studies

Phase II - Decision Support

- 4. Analyze the resource data
 - SVAP
 - BANCS - NBS/BEHI
- 5. Formulate alternatives
- 6. Evaluate alternatives
- 7. Client decides

Phase III - Application

- 8. Client implements the plan
- 9. Evaluate the plan

*What is a Coordinated Resource Management Plan? (CRMP)

- Voluntary / Team Based
- Locally Led - Consensus Process
- Includes all affected interests - Private and Public
- Over-arching intent is to build trust, to establish common goals, and resolve issues
- Managing natural resources.

* WATERSHED CHARACTERIZATION

- * Watershed Area
 - * Topography, Wallsburg Town, Roads, Climate
- * Authorities and Jurisdictions
 - * Federal Agencies
 - * State Regulatory and Management Agencies
 - * Municipal Government
- * Population and Land Use
 - * Population
 - * Land Cover, Ownership, and Land Use
- * Social Environment and Recreation
- * Water Resources
 - * Surface Waters , Irrigation Canals, Wetlands, Water Quality
- * Wildlife and Habitat
 - * Aquatic Species, Wildlife Species, Vegetation

* WATERSHED PLANNING ELEMENTS

- * Economic Overview
- * Riparian Assessment and Inventory
- * Range Assessment and Inventory
- * Water Quality Assessment
- * Wildlife Management
- * Forestry Assessment and Inventory
- * Water Rights Inventory
- * Septic Tank Functionality
- * Hydrology
- * Pastureland Assessment

* RECOMMENDATIONS



Goal of this specific CRMP is.....

- Enhance the *water quality* of Main Creek
- Improve *vegetative cover* along the Main Creek riparian corridor
- Establish *long-term* stream corridor *management* practices that stakeholders can sustain into the future

*Stream Restoration

Phase II - Decision Support

- 4. Analyze the resource data
 - BANCS - BEHI/NBS
- 5. Formulate alternatives
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Phase I - Data Collection and Analysis

- 1. Problem Identification
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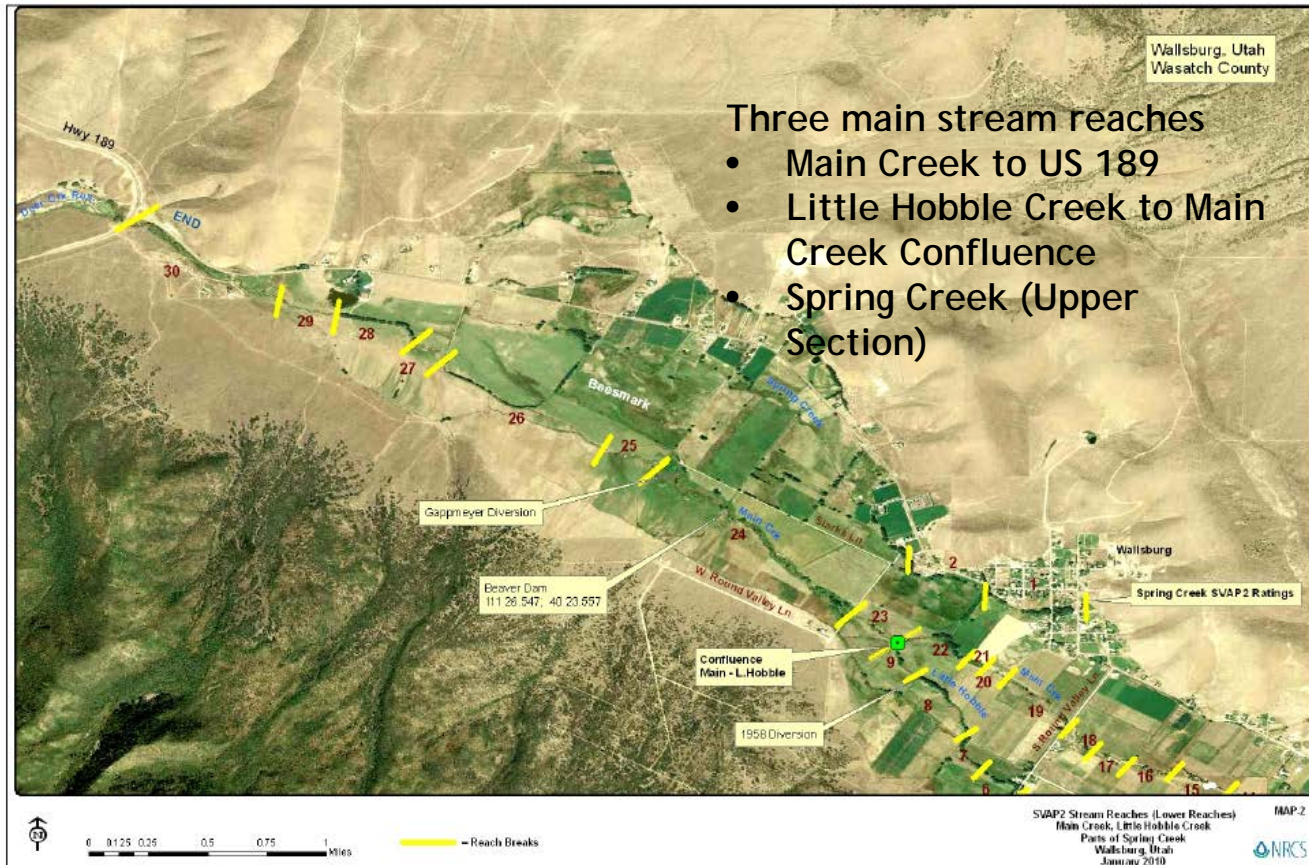
Phase III - Application

- 8. Client implements the plan
- 9. Evaluate the plan

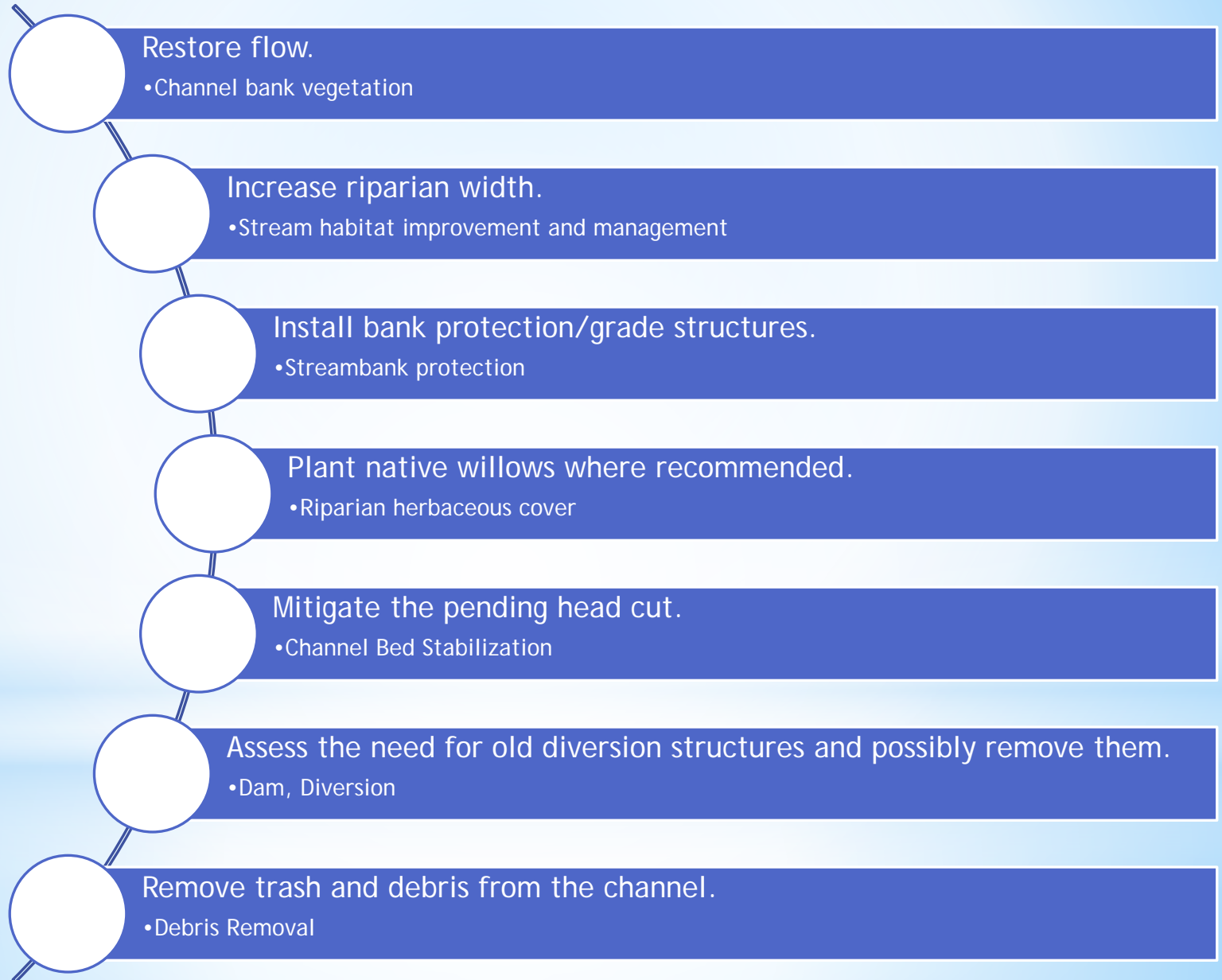
SVAP2 Indicators

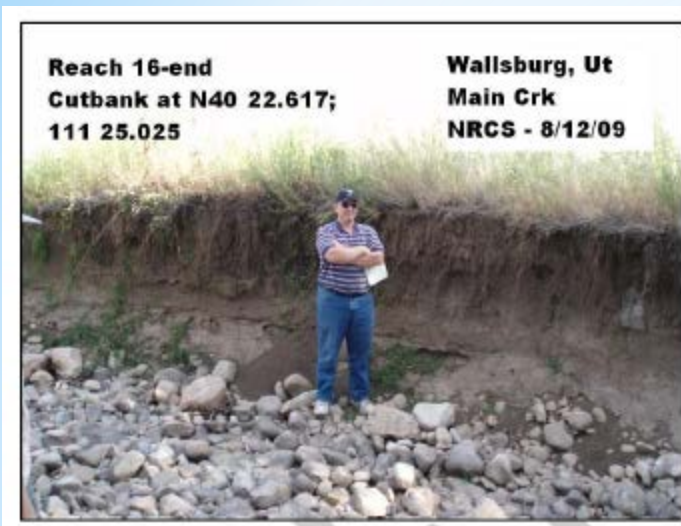
- | | |
|--------------------------|-----------------------------------|
| 1 Channel Condition | 9 Manure or Human Waste |
| 2 Hydrologic Alteration | 10 Pools |
| 3 Bank Condition | 11 Barriers to Movement |
| 4 Riparian Area Quantity | 12 Aquatic Invertebrate Habitat |
| 5 Riparian Area Quality | 13 Fish Habitat Complexity |
| 6 Canopy Cover | 14 Embeddedness |
| 7 Water Appearance | 15 Salinity |
| 8 Nutrient Enrichment | 16 Aquatic Invertebrate Community |

Figure 5-2. SVAP2 Stream Reaches (Lower Reaches)

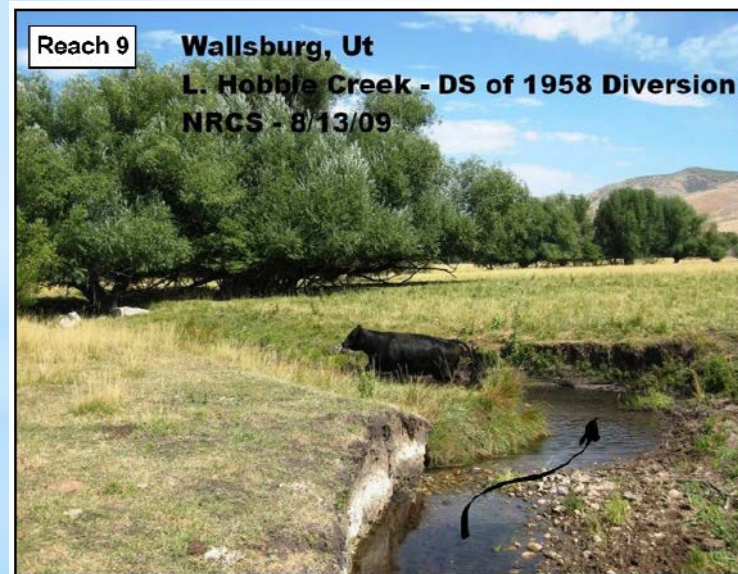


Recommendation / Practice Standard





- High bank erosion
- Incised channel
- No riparian cover/high water temperature



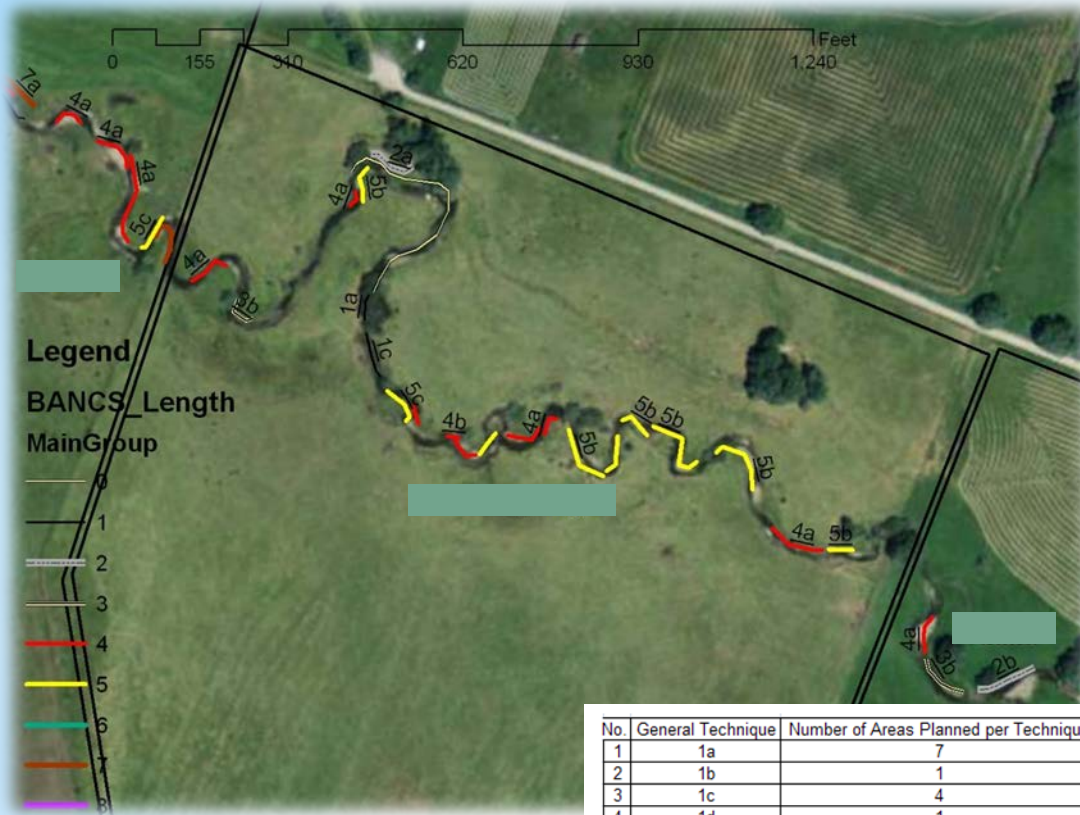
Recommendation / Practice Standard

- Control noxious/invasive plants.
 - Pest management
- Control livestock access/fencing.
 - Fence, Prescribed grazing, Watering facility

No.	General Technique	Number of Areas Planned per Technique						
1	1a	7	BKFB	LB-5'	VF			
2	1b	1	BKFB	NBF	VF			
3	1c	4	BKFB	VF				
4	1d	1	NBF	F				
5	2a	1	D	LB				
6	2b	2	D					
7	3a	1	F	Rock it				
8	3b	6	F					
9	4a	29	LB	VF				
10	4b	3	J-hook	LB	VF			
11	4c	1	LB	RR	J-hook	VF		
12	5a	3	RC	BKFB	TW	VF		
13	5b	12	RC	TW				
14	5c	7	RC	LB				
15	5d	1	RC	J-hook				
16	6a	1	TW	LB	NBF			
17	6b	1	TW	LB				
18	7a	5	V					
19	8a	2	RR	BKFB				
20	8b	3	RR	VF	LBL			

BKFB	Create a bank full bench with willow and fencing
D	Diversion, lateral boulders to stop flanking, willows, create bankfull bench, B-channel
F	Do only fencing to keep animals off banks
J-hook	
LB	Lay bank back at 4:1 with revegetation
LBL	Lay back little-100 ft.
NBF	Narrow Bank Full Width Ratio
RC	Radius of Curvature by laying bank back with willow planting
Rock	Rock structure with vegetation
TW	Remove trees, plant native willow
TW	Toe Wood
V	Vegetate
VF	Vegetation (plant) and Fence
VL	Very Low
L	Low
M	Moderate
H	High
VH	Very High
EX	Extreme
RR	Riprap

* Possible Treatment



Legend

BANCS Length
MainGroup



No.	General Technique	Number of Areas Planned per Technique				
1	1a	7	BKFB	LB-5'	VF	
2	1b	1	BKFB	NBF	VF	
3	1c	4	BKFB	VF		
4	1d	1	NBF	F		
5	2a	1	D	LB		
6	2b	2	D			
7	3a	1	F	Rock it		
8	3b	6	F			
9	4a	29	LB	VF		
10	4b	3	J-hook	LB	VF	
11	4c	1	LB	RR	J-hook	VF
12	5a	3	RC	BKFB	TW	VF
13	5b	12	RC	TW		
14	5c	7	RC	LB		
15	5d	1	RC	J-hook		
16	6a	1	TW	LB	NBF	
17	6b	1	TW	LB		
18	7a	5	V			
19	8a	2	RR	BKFB		
20	8b	3	RR	VF	LBL	

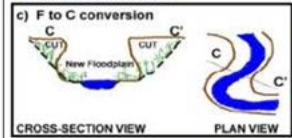
BKFB	Create a bank full bench with willow and fencing
D	Diversion, lateral boulders to stop flanking, willows, create bank
F	Do only fencing to keep animals off banks
J-hook	
LB	Lay bank back at 4:1 with revegetation
LBL	Lay bank little-100 ft.
NBF	Narrow Bank Full Width Ratio
RC	Radius of Curvature by laying bank back with willow planting
Rock	Rock structure with vegetation
TW	Remove trees, plant native willow
V	Vegetate
VF	Vegetation (plant) and Fence
VL	Very Low
L	Low
M	Moderate
H	High
YH	Very High
EX	Extreme
RR	?? Riprap



Site 100

BANCS Length (ft) 45;
 Number of Stream Banks Assessed 1;
 Near Bank Stress (NBS) M;
 Bank Erosion Hazard Index (BEHI) H;
 BANCS Erosion Sub-Total (ft³/yr) 61,425;
 Years to Stability 2.56

Recommendations



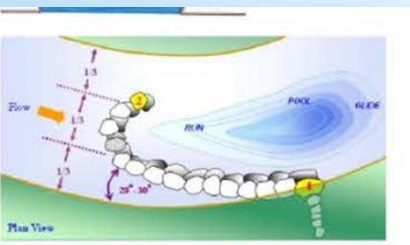
Reshape Vertical Banks to a 4:1 Slope and Create a Bankfull Bench



Vegetate Banks



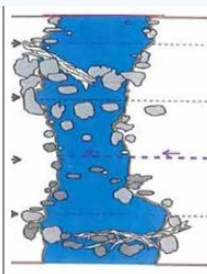
Manage Livestock Grazing with Fencing and Water Facilities



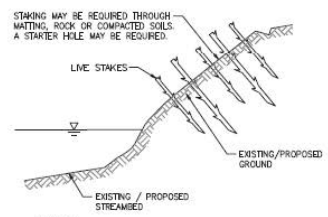
Install J-Hooks to Move Stream Flow Lines Away From Outside Banks

Vegetate Banks

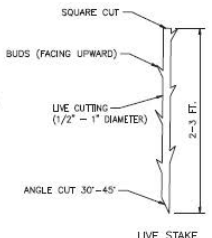
Manage Livestock Grazing with Fencing and Water Facilities



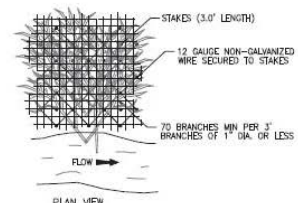
Duplicate Reference Reach



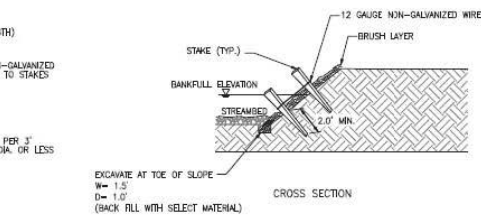
NOTES:
 LIVE STAKES SHALL BE EVENLY SPACED "XX" FT. APART.
 LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY OF LIVE STAKE IS WITHIN GROUND.
 IF STARTER HOLE IS NEEDED, MINIMIZE AIR POCKET.
 UTILIZE ALL ON SITE TRANSPLANT MATERIALS MADE AVAILABLE BY THE OWNER. ONCE SOURCE OF TRANSPLANT MATERIAL HAS BEEN HARVESTED, THEN UTILIZE LIVE STAKING.
 BANK STABILIZATION WITH LIVE STAKES



DETAIL - LIVE STAKING
 NOT TO SCALE



NOTES:
 BRUSH MATTRESS - THIS METHOD USES HARDWOOD BRUSH LAYERED ALONG A STREAMBANK AS A MATTRESS AND ANCHORED IN PLACE WITH GRID OF STAKES AND WIRE. THE TOE BELOW THE WATERLINE IS ANCHORED BY ROCK.
 CUT BRANCHES OF SPECIFIED TYPE AT 45 DEGREE ANGLE LONG ENOUGH TO COVER BANKS PLUS 1' DEEP INTO TRENCH.
 DIG 1' TRENCH AT BASE OF BANK, RESERVING SOIL FOR BACKFILL.
 LAY FIRST LAYER OF CUTTINGS PERPENDICULAR TO SLOPE, MAKING SURE TO PUSH CUT END INTO TRENCH



LAY SECOND LAYER AT 45 DEGREES (UPSTREAM)
 LAY THIRD LAYER AT 45 DEGREE (DOWNSTREAM)
 (OPTIONAL STEP IF NEEDED TO HOLD BRANCHES CLOSE TO GROUND SURFACE AT TOP OF STREAMBANK). ABOUT 1/2-2/3 OF THE WAY UP THE BANK, PLACE STAKES IN A ROW, SPACED 3' APART. HAMMER TO GET STARTED. WRAP WIRE AROUND 1ST STAKE. CONNECT TO 2ND STAKE AND WRAP; CONNECT TO 3RD STAKE AND WRAP, ETC.
 USING SHOVELS AND BUCKETS OR TRACK HOE BUCKET, SPRINKLE SOIL THROUGH THE CUTTINGS

IF USING OPTIONAL STAKES, HAMMER INTO BANK INSTALL COIR MATTING
 WRAP WIRE NEAR TOP OF STAKES IN CRISSCROSS PATTERN
 FINISH BY HAMMERING REMAINING STAKES INTO BANK

SELECT MATERIAL	HARDWOOD SPECIES
X	X

DETAIL - BRUSH MATTRESS
 NOT TO SCALE

Group 4

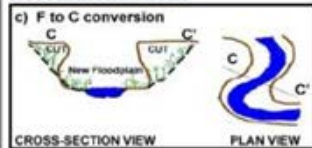
29

Site 80



BANCS Length (ft) 71;
 Number of Stream Banks Assessed 1;
 Near Bank Stress (NBS) H;
 Bank Erosion Hazard Index (BEHI) H;
 BANCS Erosion Sub-Total (ft³/yr) 185.31;
 Years to Stability 1.94

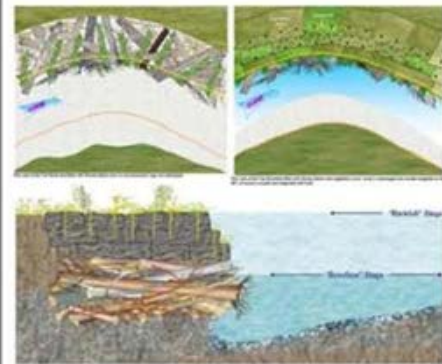
Recommendations



Reshape Vertical Banks to a 4:1 Slope and Create a Bankfull Bench and Vegetate Banks



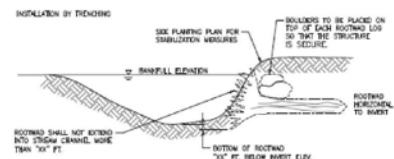
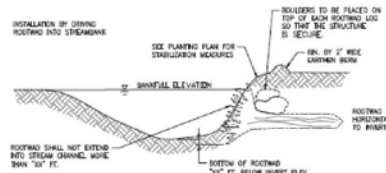
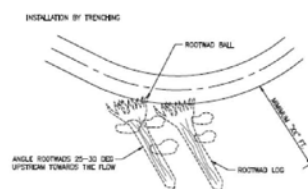
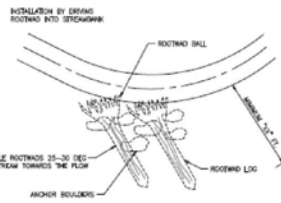
Increase the Radius Curvature Around the Bend with Steps



Install Toe Wood to Maintain a Low Channel Width/Depth Ratio, Enhance Fish Habitat, and Stabilize Stream Bank



Vegetate Banks

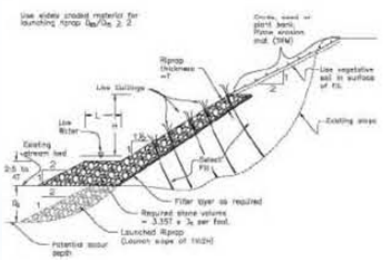


NOTES:
 ALL STONES ARE TO BE STRUCTURE STONE
 SEE SLOPES SHALL BE NOTED.
 6 IN. BY 2 FT. WIDE EASTERN BROWN LOCATED DRIVING ROOTWADS EXTENDING A MINIMUM OF 5 FT. BEYOND UPSTREAM AND DOWNSTREAM ENDS OF ROOT WADS TO DIRECT SHEET FLOW AWAY FROM ROOTWADS.
 WHEN UNACKELLING OVER AND ANCHOR ROOT WAD LOGS PLACE STONE BETWEEN ALL WADS TO TIGHTLY SECURE ALL CONNECTIONS AND CAPS. ROOT WAD SHALL OVERLAY STRUCTURE STONE PLACED BETWEEN ROOT WADS. NO GAP BETWEEN BOTTOM OF ROOT WAD AND STREAMBED. ROOT WADS SHALL BE EXPOSED UNLESS ROOT WAD SHALL NOT BE DETERMINED AT THE TIME OF INSTALLATION.
 ALL MATERIALS ARE TO BE APPROVED BY DESIGNER OR ENGINEER'S CHIEF CONSTRUCTION MANAGER.

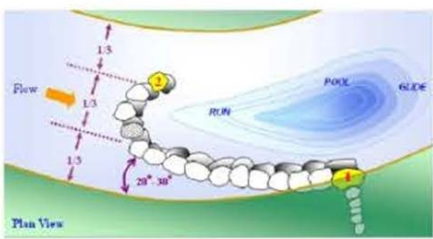
ROOT WADS - CROSS-SECTION (CUT)

ROOTWAD CHANNEL (FT.)	ROOTWAD LOG WIDTHEN (IN.)	BOLDBER SIZE
X	X	X

DETAIL - ROOTWAD NOT TO SCALE



Rock structure with vegetation

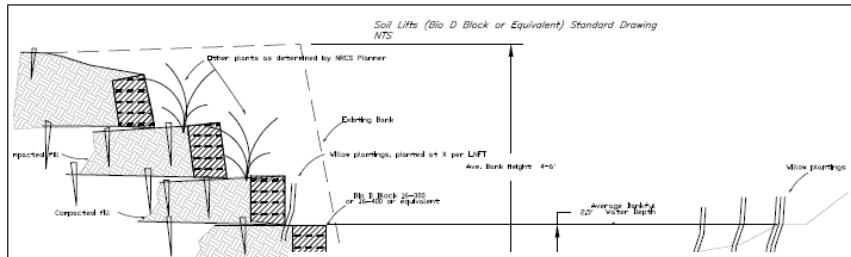


Install J-Hooks to Move Stream Flow Lines Away From Outside Banks

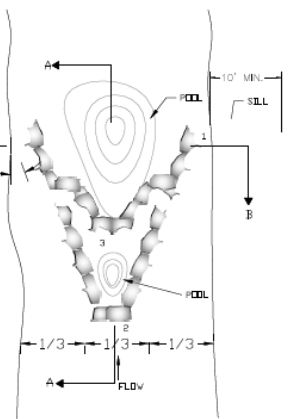
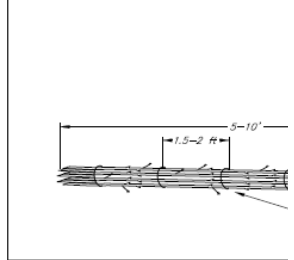
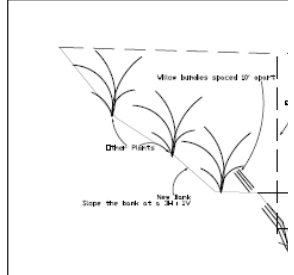


Soil Lifts (Ho D Block)
or Log Bank bank Treatment
See Page 3
For Details
NRCS Engineer will stake out
treatment areas.

All treatment lengths are estimates. I
stake out the treatment reach and do
treatment prior to construction or pre-
bid.
There will be up to 900 LF of rock p.
Block structures. This will be in
stream length. There will be various p.
stream restoration work. These will b
sides of the stream for approximate 1
This includes areas we treat along wd
locations along the stream. The plan
provide by a NRCS Planner.



- Planting Notes
1. Willows shall be adventitious rootable stock $\frac{1}{2}$ to 2 inch diameter, 3 to 10 ft long
 2. Material shall be from an area with similar soil, climate, and location
 3. The material shall be free of disease, rot or insect infestation
 4. Material shall be harvested while dormant and soaked (1 to 14 days) prior to installation
 5. Side branches can be left intact
 6. Tie the bundles with a string or non-galvanized wire
 7. Use two (2) 2" X 4" wedges to secure the bundle
 8. Drive wedges through bundle
 9. Other plants should be approved by NRCS planner prior to purchasing
 10. The NRCS Engineer will determine how many bundles per treatment area
 11. Follow Manufacturer's recommendations for installing Ho D Block material
 12. Treatment areas shall be vegetated as per NRCS planting guide. This is attached to the specifications.



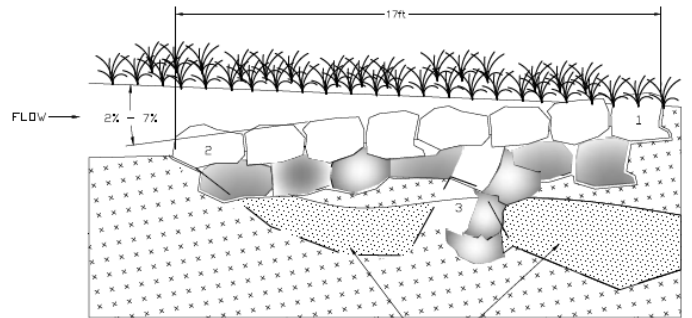
PLAN VIEW
SCHEMATIC (NOT TO SCALE)

- NOTES
1. Rock size shall have a diameter between 12-24 inches.
 2. Individual rock fragments shall be dense, sound and free from cracks, seams, and other defects conducive to accelerated weathering. Except as otherwise specified, the rock fragments shall be angular to subangular. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment. ASTM E 4950 provides the guidance on selecting rock from a source. NRCS will approve all rock material.
 3. Bankfull Depth (A) = 10 feet, Bankfull Width (B) = 12 feet.
 4. J-Hook Bank Average Length (C) = 10 feet, Number of banks (D) = 3.
 5. Length of SLL = 10 feet, Rock size for SLL = 12-18 inches.
 6. Appropriate amount of rock = 22,000 lbs.
 7. The rock shall be angular with a minimum unit weight = 165 lbs/ft³

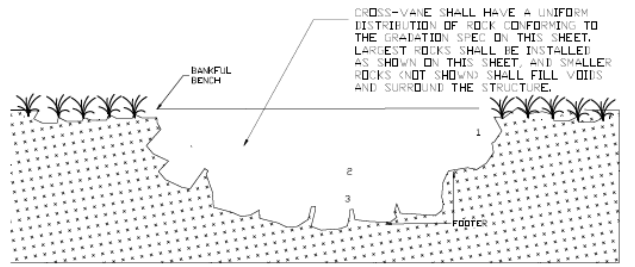
NOTE: THE TOTAL VOLUME OF ROCK REQUIRED PER J-HOOK STRUCTURE = 75 YDS

CROSS-VANE ROCK GRADATION	
ROCK SIZE	PERCENT SMALLER BY WEIGHT
12"	15
14"	30
18"	50
21"	75
24"	100

ALL ROCK SHALL BE ANGULAR WITH A MINIMUM UNIT WEIGHT = 165 LBS/FT³



PROFILE A-A
SCHEMATIC (NOT TO SCALE)



CROSS SECTION B-B
SCHEMATIC (NOT TO SCALE)

*DETAILS TAKEN FROM
DAVE HOSSEN'S PAPER
TITLED 'THE CROSS-VANE,
W-WEIR AND J-HOOK VANE
STRUCTURE'

* Stream Restoration

Phase III - Application

- 8. Client implements the plan
 - Cost Share
 - NRCS-EQIP
 - 319 Water Quality Money
 - Other State and Federal Money
- 9. Evaluate the plan

Phase I - Data Collection and Analysis

- 1. Problem Identification
 - River health
 - Fish Habitat
 - Water Quality
- 2. Determine Objectives
 - Repair above
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 - Survey
 - NEH - 654, Technical Notes, Case Studies

Phase II - Decision Support

- 4. Analyze the resource data
 - SVAP
 - BANCS - BEHI/NBS
- 5. Formulate alternatives
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*Photos Courtesy of Daniel Gunnell
Zone 3 Resource Coordinator*



BEFORE



AFTER



BEFORE



AFTER



* Summer 2014

One year after construction



*Summer 2014

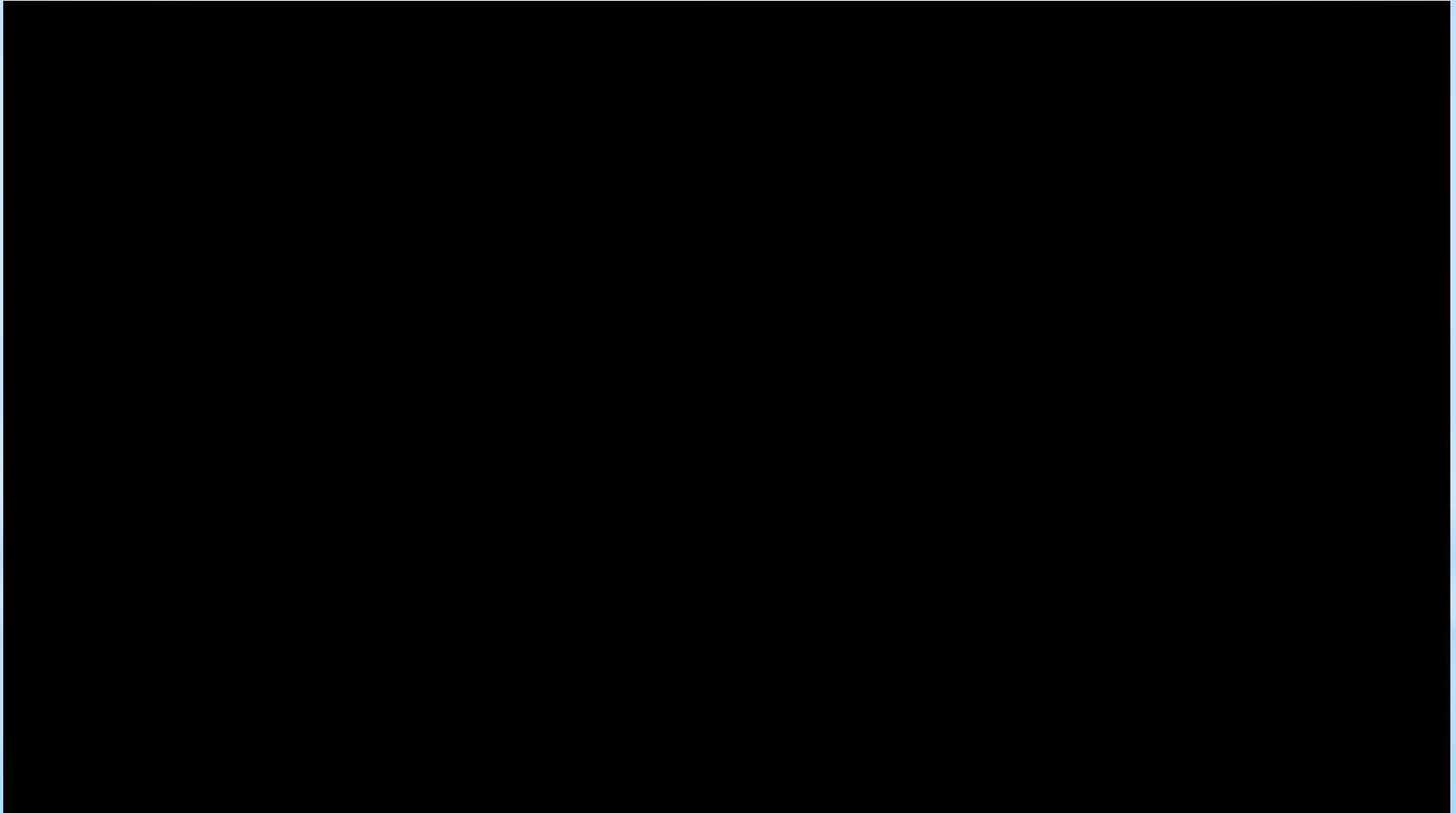
One year after construction



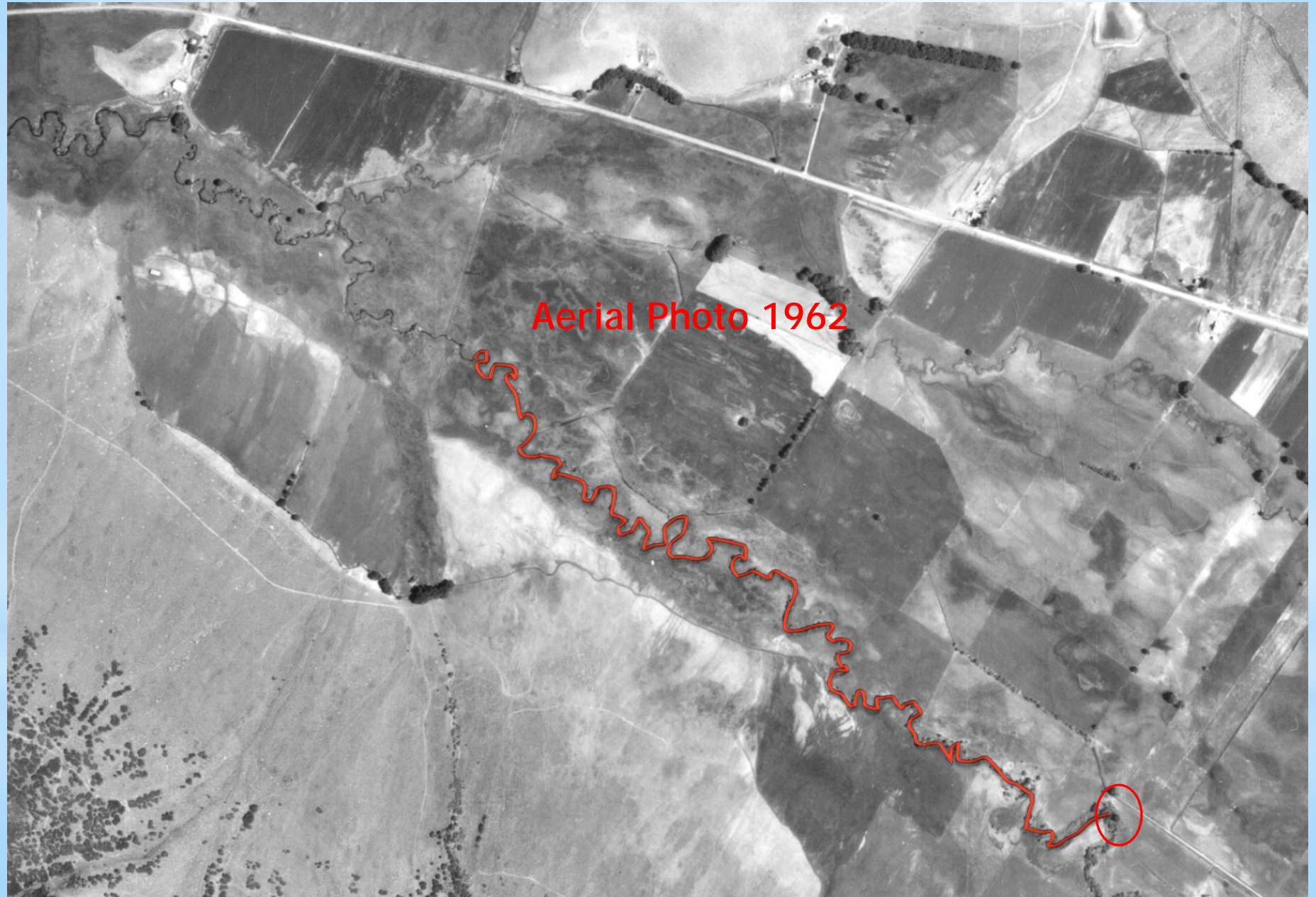
Spring 2014



Fall 2014



Phase II

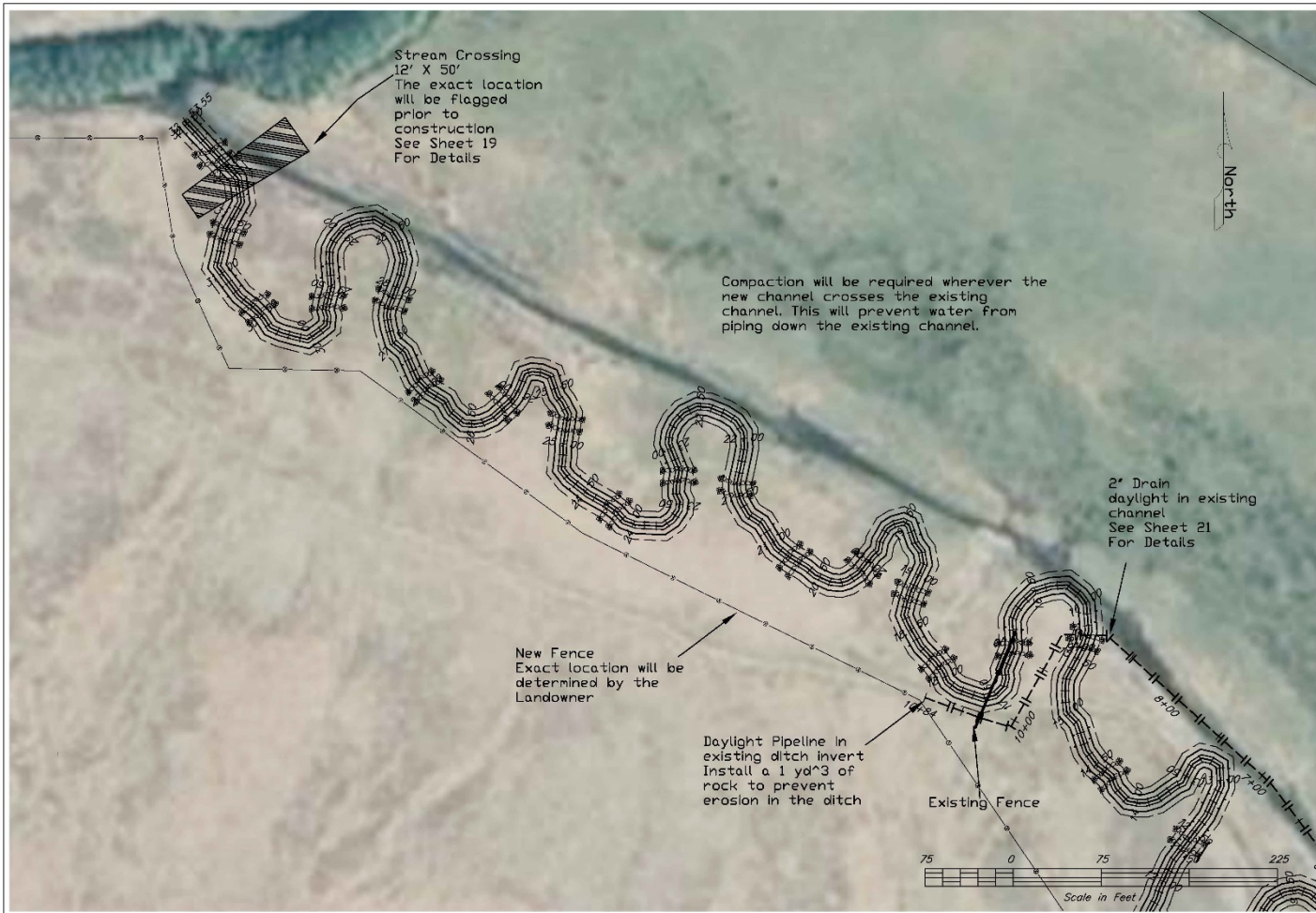
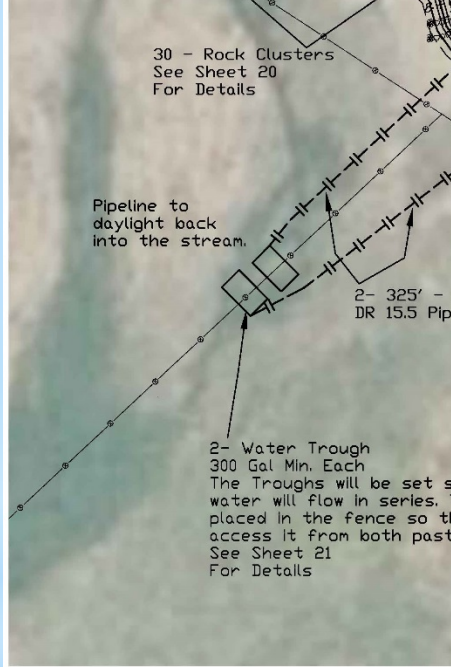
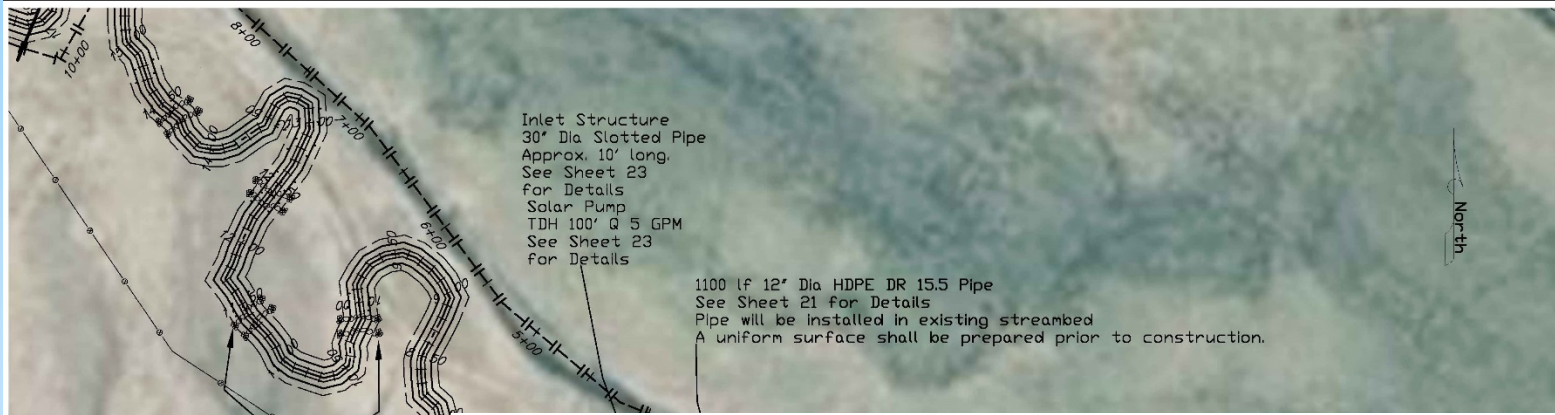


Aerial Photo 1962

Phase II

Aerial Photo 2009





- * Wasatch Conservation District
- * Local Land Owners
- * Utah Association of Conservation Districts
- * Utah Department of Agriculture and Food
- * Utah Grazing Improvement Program
- * NRCS
- * Wasatch County

- * Utah Division of Water Quality
- * Provo River Watershed Council
- * Utah Division of Wildlife Resources
- * Reclamation and Mitigation Commission
- * US Fish and Wildlife
- * Wallsburg Town
- * Volunteers

* **Partners**

Partners
Volunteers
NRCSers
Implementers
Land Owners

Questions



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