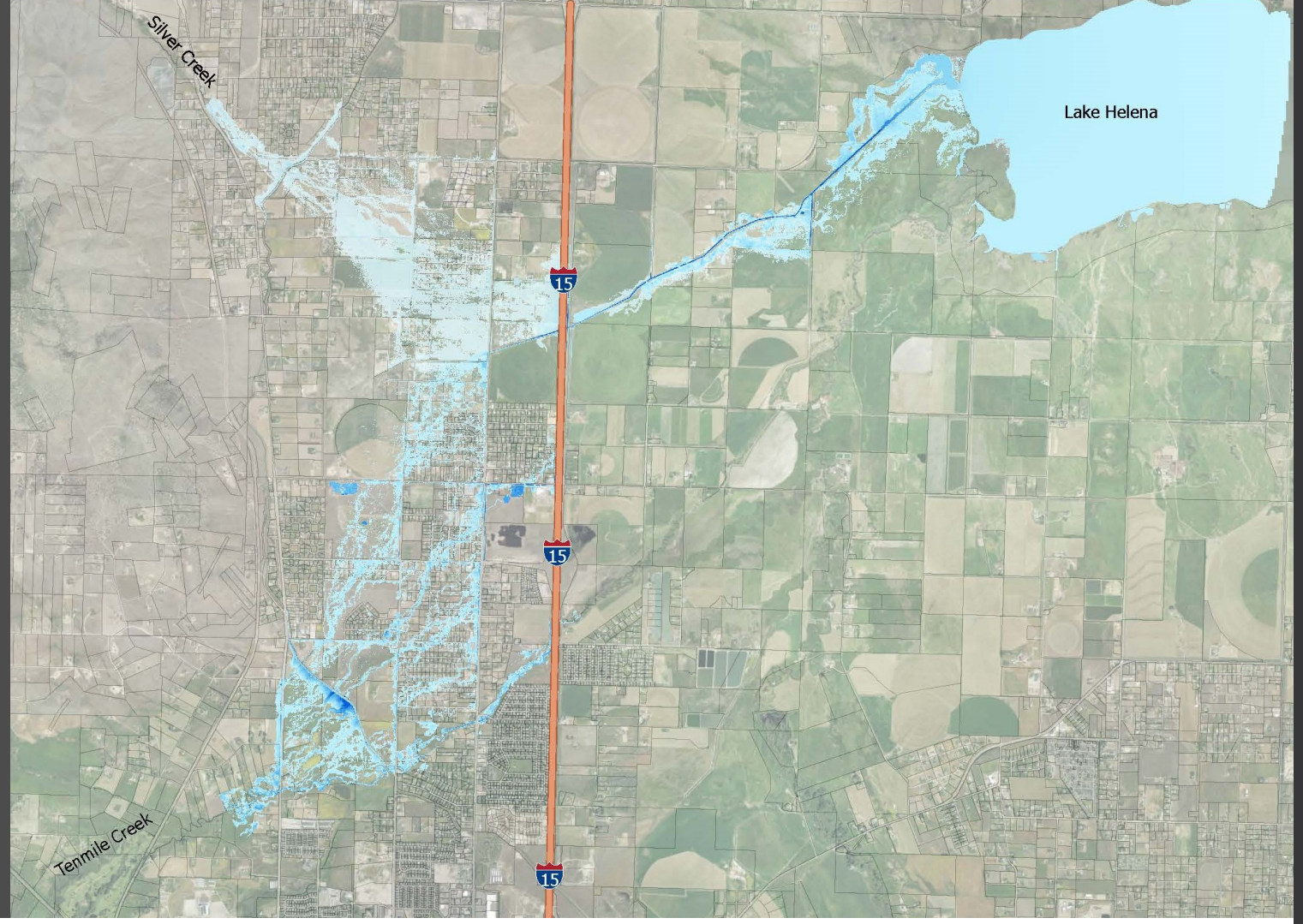


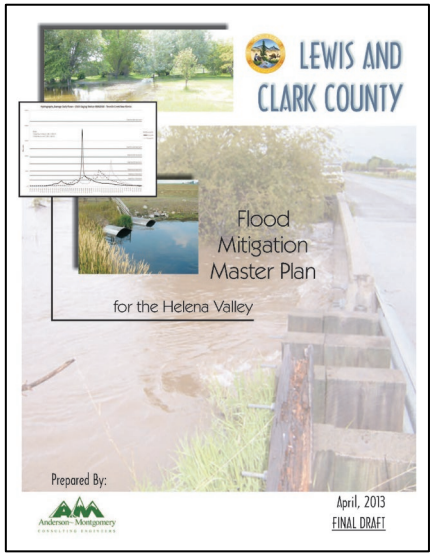
Helena Valley Flood Mitigation Master Plan Update

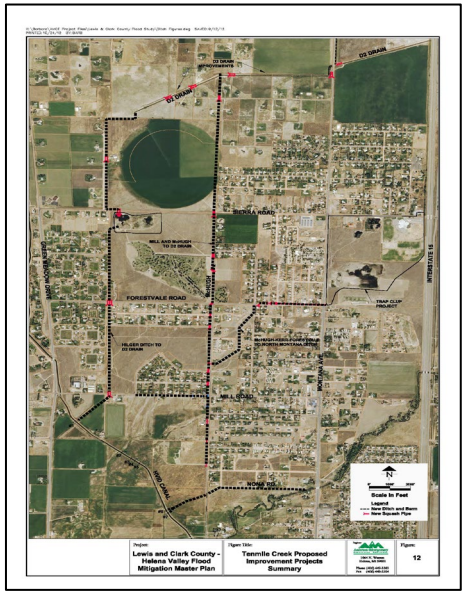
PRESENTATION OUTLINE

- BACKGROUND
- COMMUNITY SURVEY RESULTS OVERVIEW
- MITIGATION ALTERNATIVES OVERVIEW
  - TENMILE CREEK
  - LOWER D2 DRAIN DITCH
  - SILVER CREEK
  - TENMILE OVERFLOW
- COST COMPARISON
- CONSIDERATIONS
- RECOMMENDED ALTERNATIVES AND PHASING
- FUNDING OPPORTUNITIES
- NEXT STEPS
- DISCUSSION

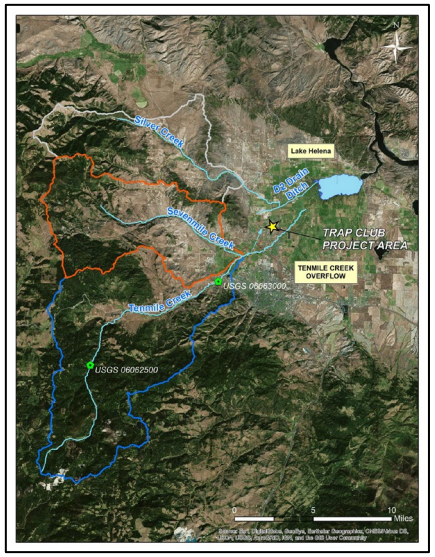
BACKGROUND

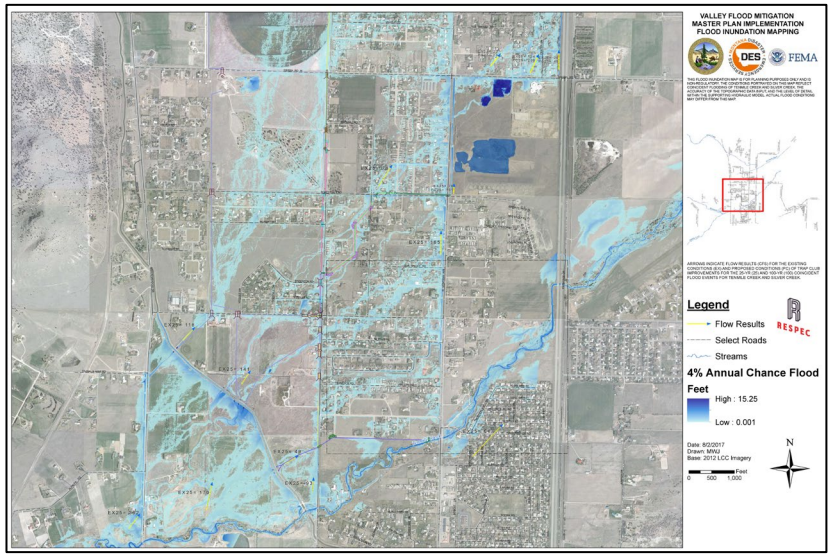
- 2013 Valley Flood Mitigation Master Plan
  - Provided alternatives for flood mitigation through the valley.
  - Was not based on detailed hydrologic and hydraulic analyses.
  - Did not include Tenmile Creek.





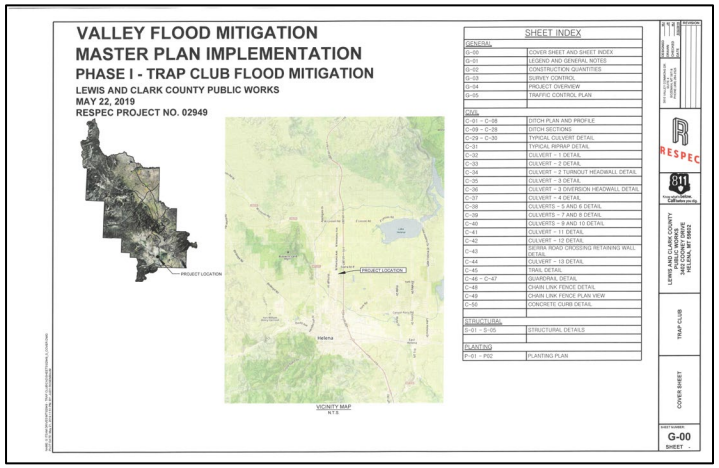
- 2017 Valley Flood Mitigation Master Plan - Hydraulic and Hydrologic Analysis
  - Hydrologic analysis of Tenmile Creek and Silver Creek.
  - Two-Dimensional hydraulic analysis of floodwaters from Tenmile Creek and Silver Creek.
- 2017 RID Assessment





BACKGROUND

- 2019 Trap Club Flood Mitigation Project
  - Phase I of the Valley Flood Mitigation Master Pan Implementation.
  - Implemented large box culverts and roadside flood conveyance.
  - Successfully completed in 2020.



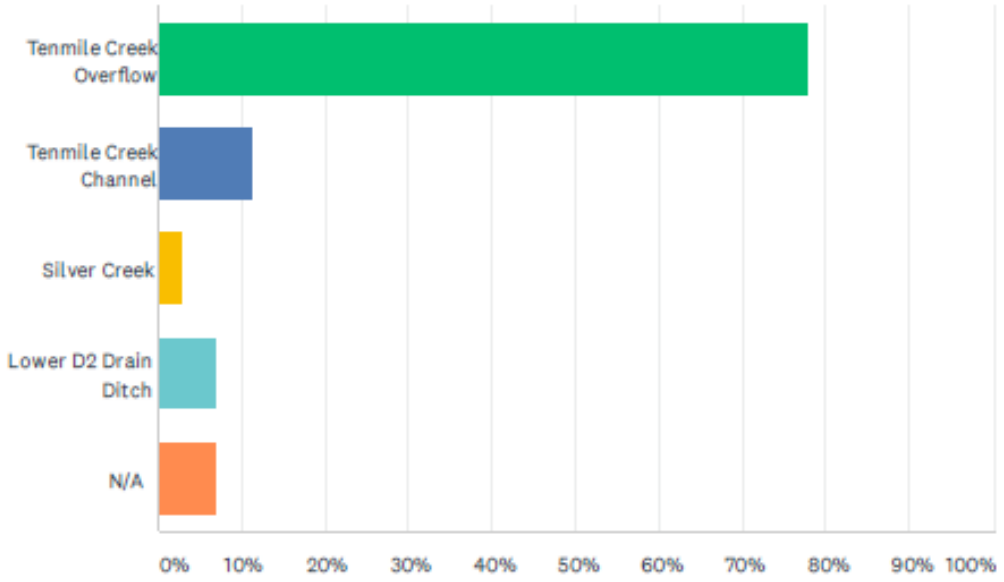
- 2022 Valley Flood Mitigation Master Plan Update
  - Update flood routing alternatives for Tenmile Overflow Area, Silver Creek and D2 Ditch based on updated hydrologic and hydraulic analyses.
  - Develop a plan to better understand aggradation trends in Tenmile Creek to establish annual monitoring and maintenance plan.
  - Provide opportunity for public comment.
  - Identify selected alternatives, phasing, and estimated costs.

- Progress to date:
  - Meeting 1: Virtual, held July 2020
  - Online Survey, February 2021
  - Developed suite of alternatives and costs
  - Meeting 2: January 2022

COMMUNITY SURVEY

Q36 In what general area of the RID do you reside and/or own property?

Answered: 72 Skipped: 8

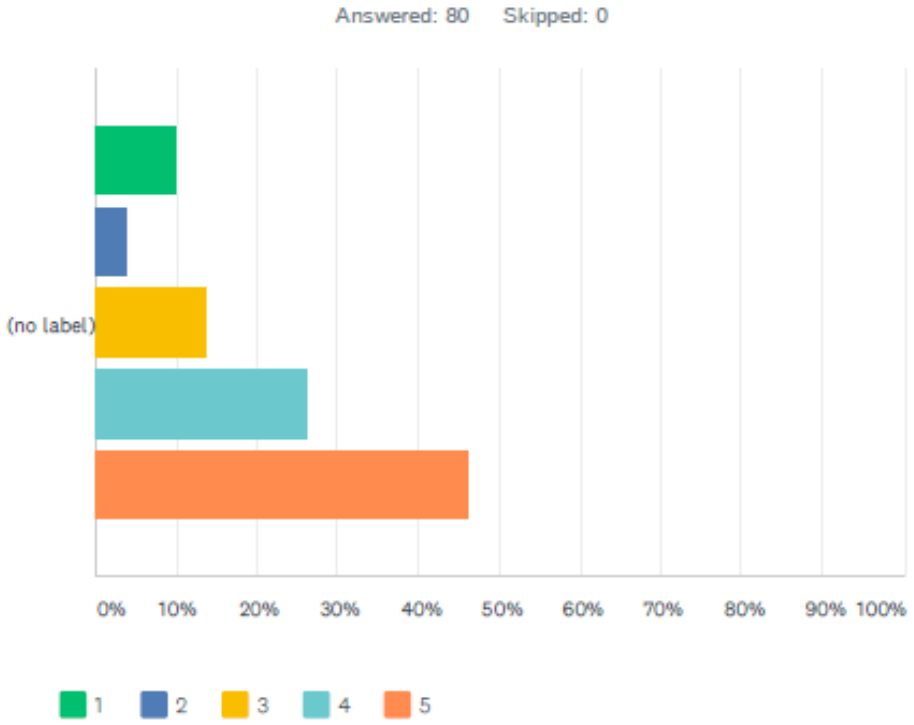


ANSWER CHOICES	RESPONSES	
Tenmile Creek Overflow	77.78%	56
Tenmile Creek Channel	11.11%	8
Silver Creek	2.78%	2
Lower D2 Drain Ditch	6.94%	5
N/A	6.94%	5
Total Respondents: 72		

COMMUNITY SURVEY

Q1 On a scale of 1 to 5, how important is it to manage flooding within the RID through flood mitigation capital improvement projects? Not Important 1 2 3 4 5 Very Important.

Answered: 80 Skipped: 0

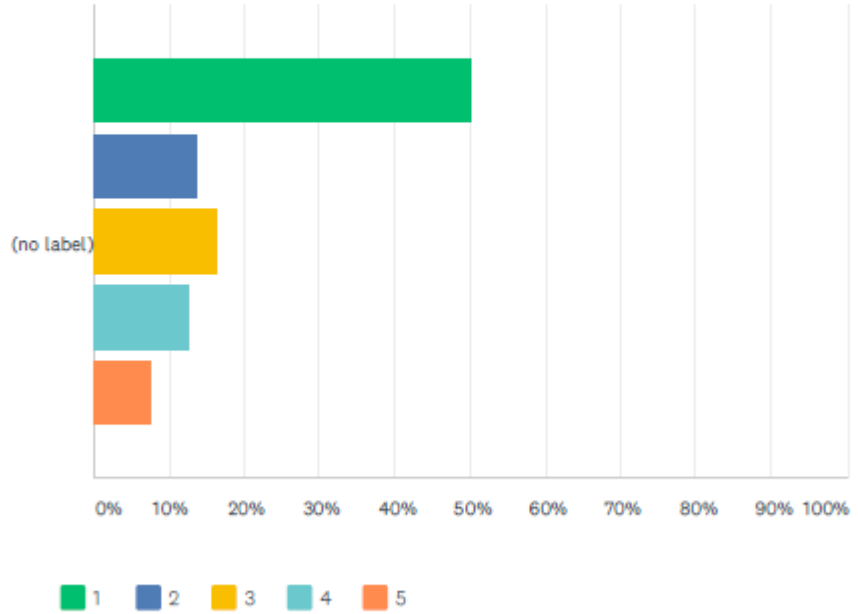


	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	10.00% 8	3.75% 3	13.75% 11	26.25% 21	46.25% 37	80	3.95

COMMUNITY SURVEY

Q4 On a scale of 1 to 5, how interested are you in an increase to the annual assessment amount ($100/year) with the intent to expedite the timeline for flood mitigation implementation throughout the RID, potentially funding capital improvements without the need for winning competitive federal grants? Not Interested 1 2 3 4 5 Very Interested

Answered: 80 Skipped: 0

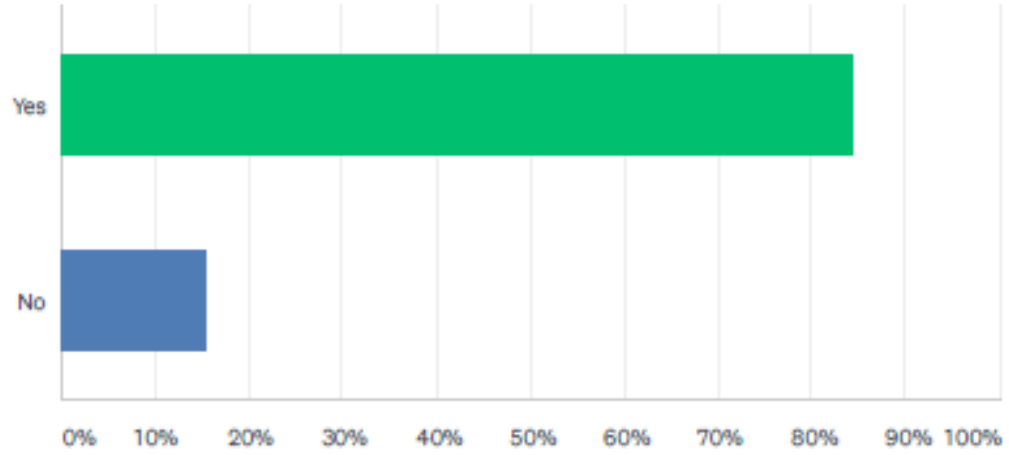


	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	50.00% 40	13.75% 11	16.25% 13	12.50% 10	7.50% 6	80	2.14

COMMUNITY SURVEY

Q6 Do you think the Master Plan should include a focus to manage the main channel of Tenmile Creek?

Answered: 78 Skipped: 2

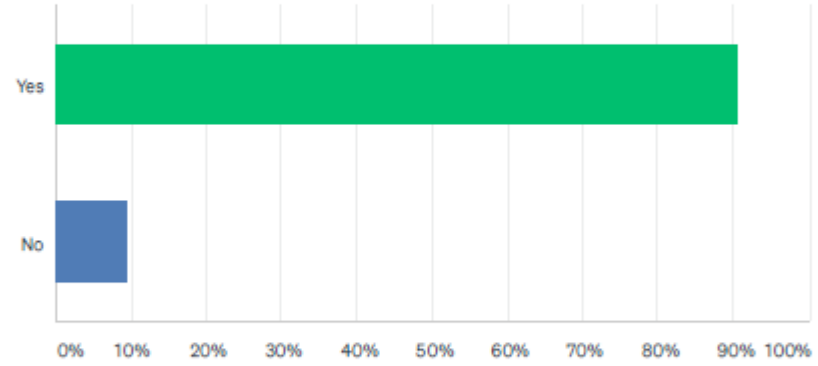


ANSWER CHOICES	RESPONSES	
Yes	84.62%	66
No	15.38%	12
Total Respondents: 78		

COMMUNITY SURVEY

Q8 Do you support the county to invest in development of a plan to monitor change in streambed elevations and perform annual monitoring? The purpose would be to identify where sediment is accumulating and affecting capacity of the creek.

Answered: 64 Skipped: 16

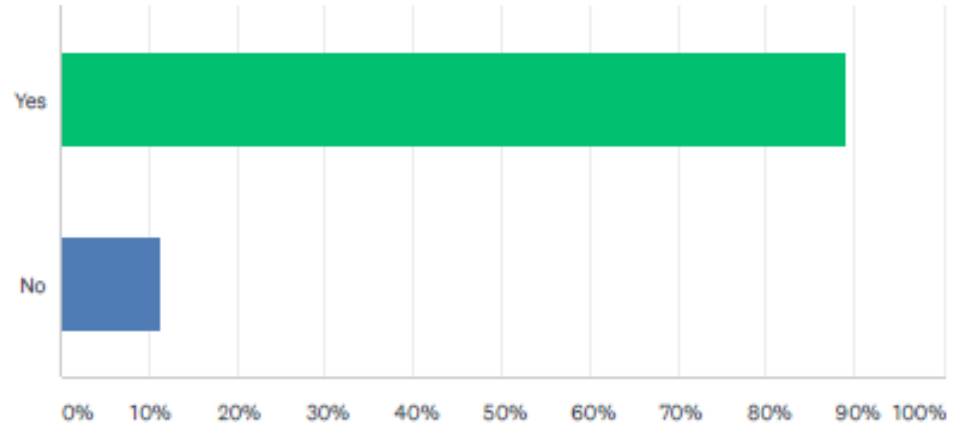


ANSWER CHOICES	RESPONSES	
Yes	90.63%	58
No	9.38%	6
Total Respondents: 64		

COMMUNITY SURVEY

Q29 Do you support the design and construction of capacity improvements along the D2 Drain Ditch to accommodate Tenmile Creek and Silver Creek floodwater?

Answered: 72 Skipped: 8

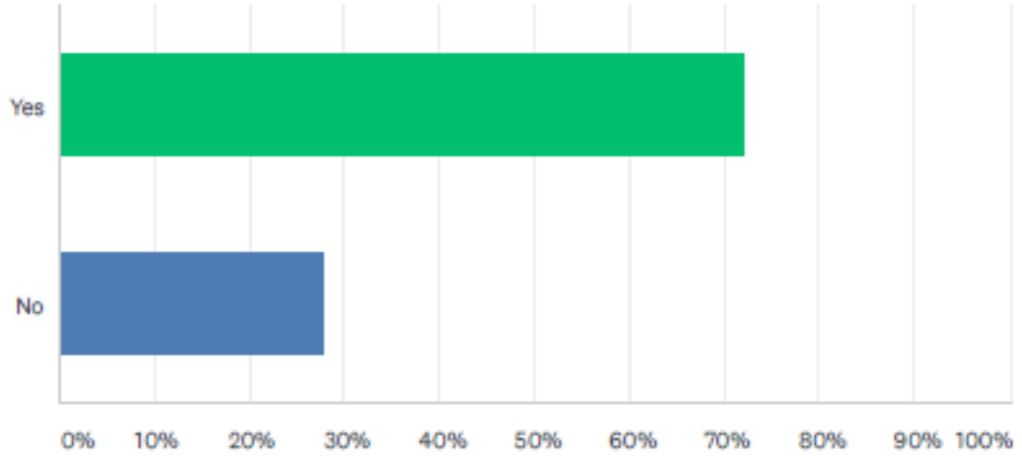


ANSWER CHOICES	RESPONSES	
Yes	88.89%	64
No	11.11%	8
Total Respondents: 72		

COMMUNITY SURVEY

Q30 Do you support investing in a study of alternative flood routing options for Tenmile Creek floodwaters outside the D2 drain Ditch? This could include options like constructing new channels at Sierra Road, Forestvale Road or Mill Road to direct floodwater back to Tenmile Creek.

Answered: 72 Skipped: 8

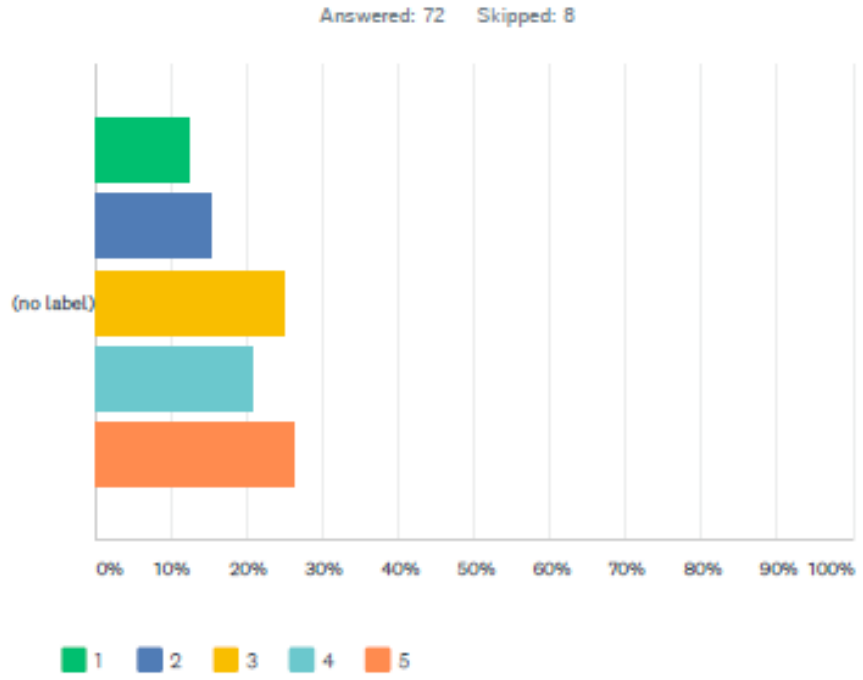


ANSWER CHOICES	RESPONSES	
Yes	72.22%	52
No	27.78%	20
Total Respondents: 72		

COMMUNITY SURVEY

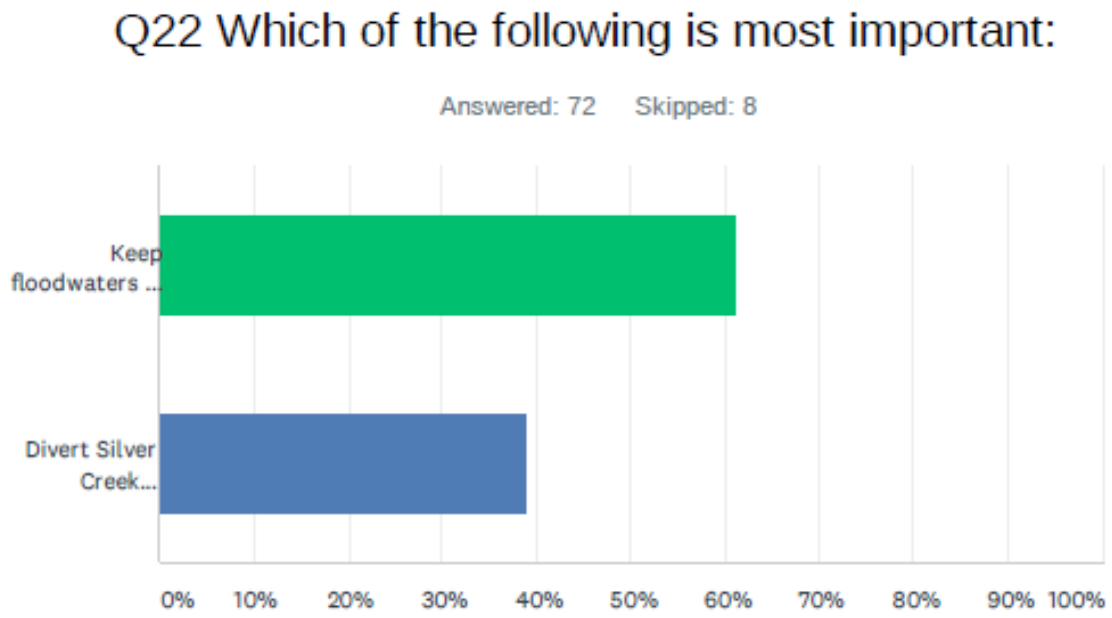
Q21 On a scale of 1 to 5, how important is it to mitigate Silver Creek flooding between Applegate Drive and North Montana Avenue? Not important 1 2 3 4 5 Very Important

Answered: 72 Skipped: 8



	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	12.50% 9	15.28% 11	25.00% 18	20.83% 15	26.39% 19	72	3.33

COMMUNITY SURVEY

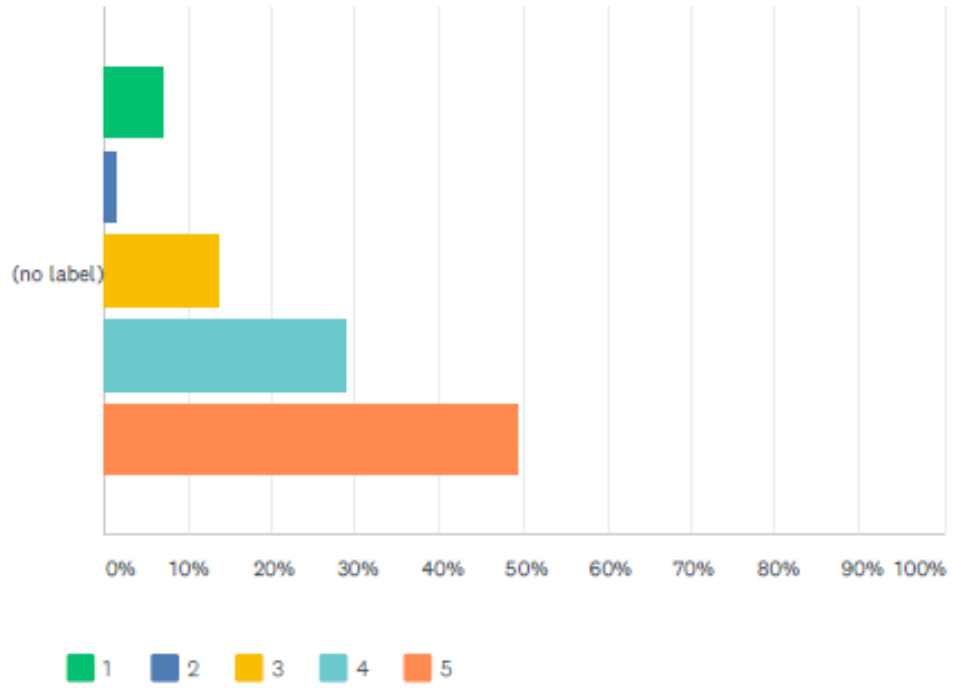


ANSWER CHOICES	RESPONSES	
Keep floodwaters in Silver Creek through Sewell subdivision but increase the size of the channel and road crossings to convey floodwater.	61.11%	44
Divert Silver Creek floodwater around Sewell subdivision and reduce flooding between Applegate Drive and North Montana Avenue.	38.89%	28
TOTAL		72

COMMUNITY SURVEY

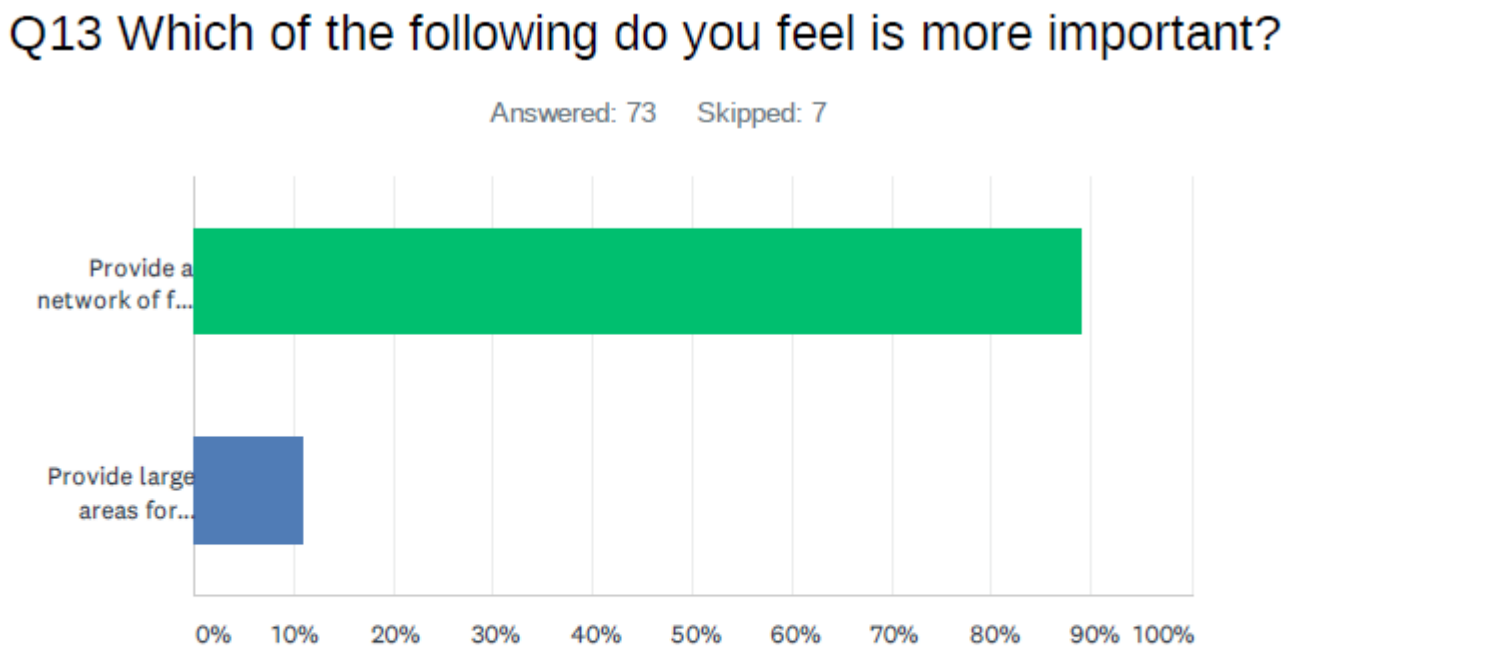
Q12 On a scale of 1 to 5, how important is it to manageTenmile Creek Overflow flooding between Tenmile Creek channel and Interstate 15? Not important 1 2 3 4 5 Very Important

Answered: 73 Skipped: 7



	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	6.85% 5	1.37% 1	13.70% 10	28.77% 21	49.32% 36	73	4.12

COMMUNITY SURVEY

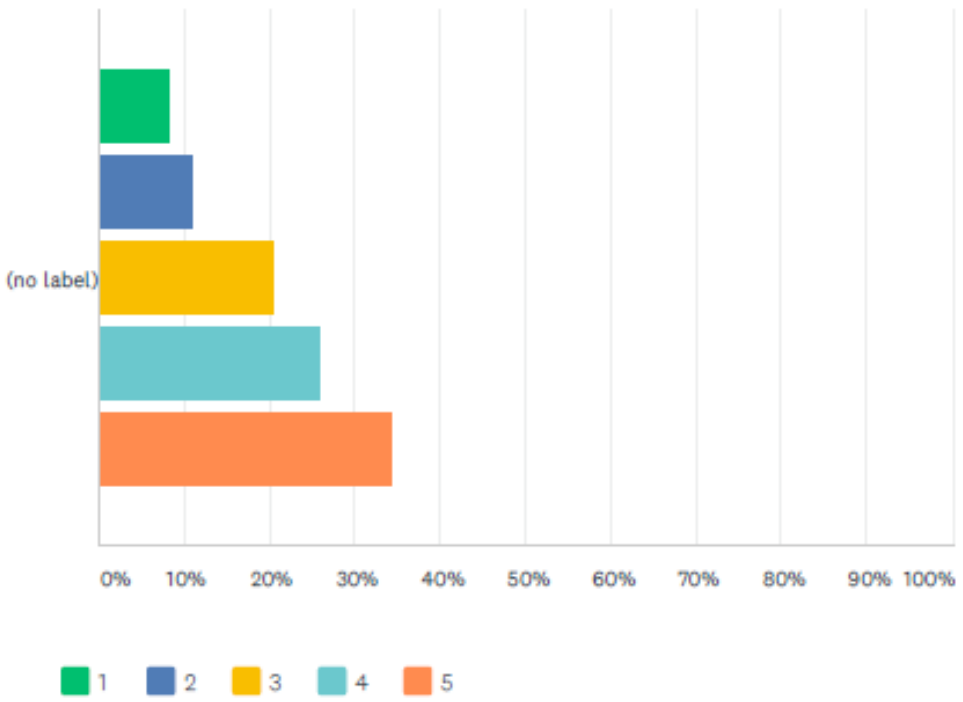


ANSWER CHOICES	RESPONSES	
Provide a network of flow conveyance channels to route floodwater through the upper valley.	89.04%	65
Provide large areas for detention and storage of floodwater from Tenmile Creek.	10.96%	8
TOTAL		73

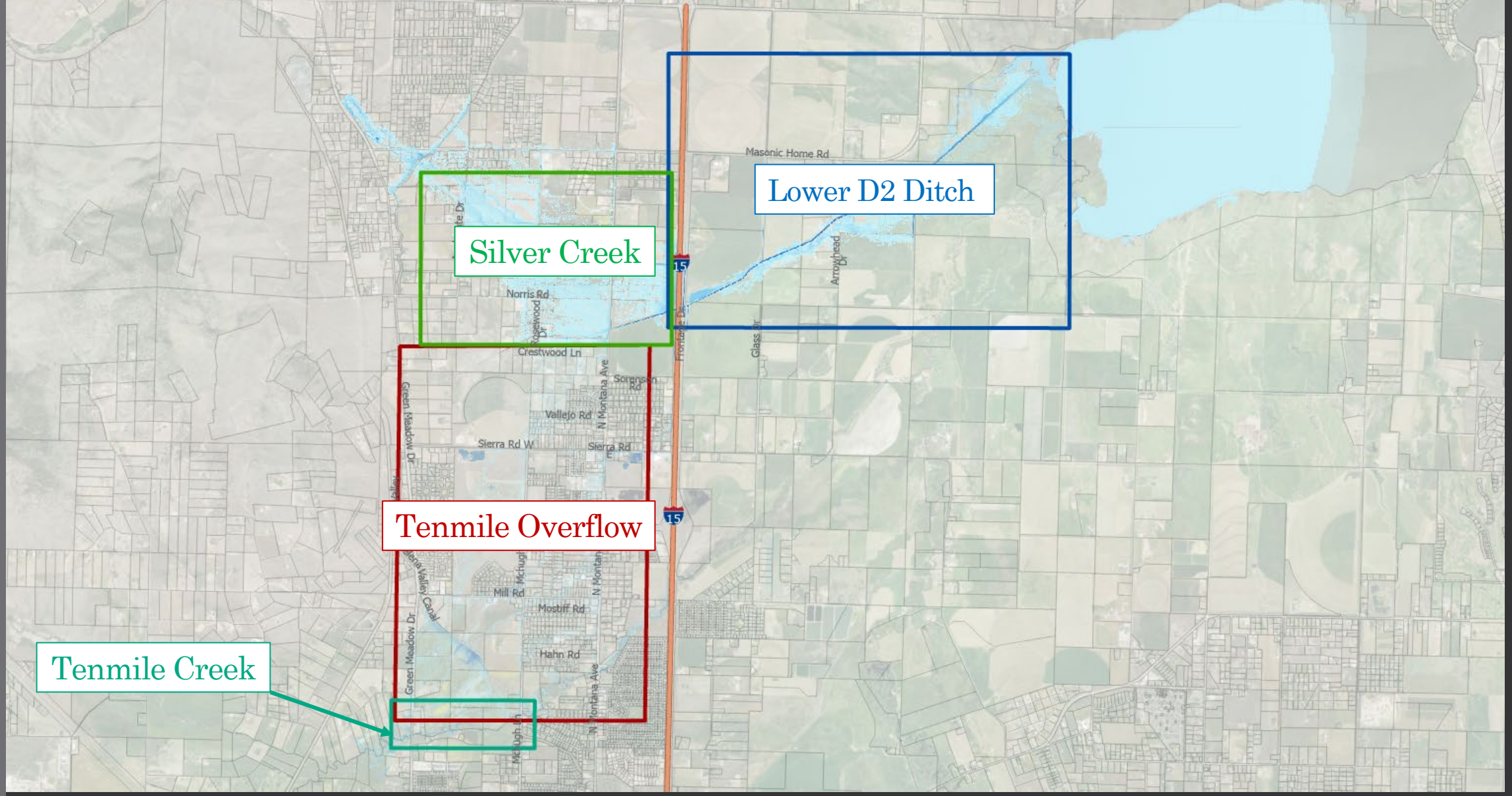
COMMUNITY SURVEY

Q14 On a scale of 1 to 5, how willing are you to support creation of one-way streets for east/west streets to accommodate the construction of floodwater conveyance infrastructure? Unwilling 1 2 3 4 5 Very Willing

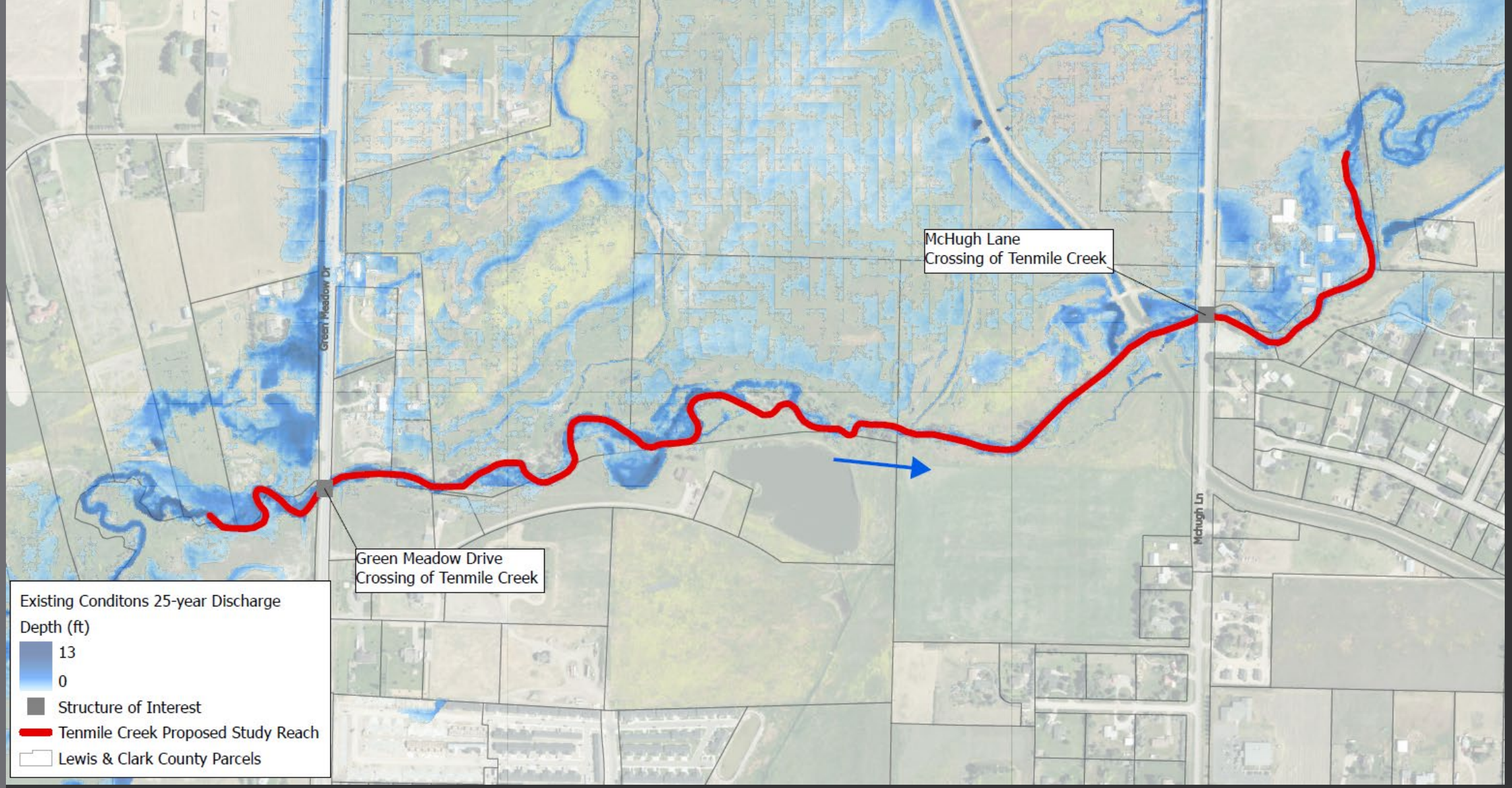
Answered: 73 Skipped: 7



	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	8.22% 6	10.96% 8	20.55% 15	26.03% 19	34.25% 25	73	3.67



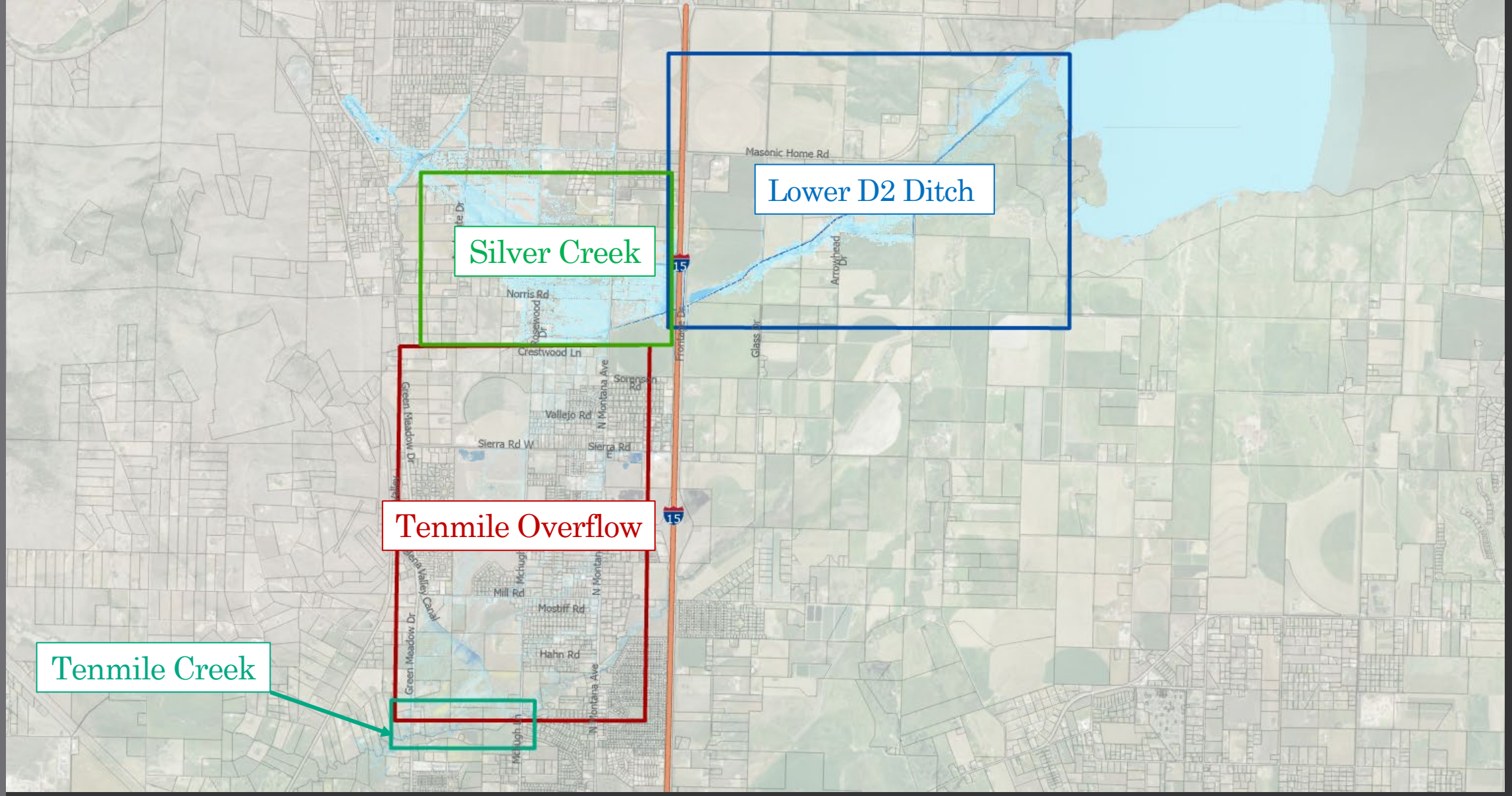
MASTER PLAN OVERVIEW



TENMILE CREEK CHANNEL CAPACITY MONITORING

TENMILE CREEK CHANNEL CAPACITY MONITORING

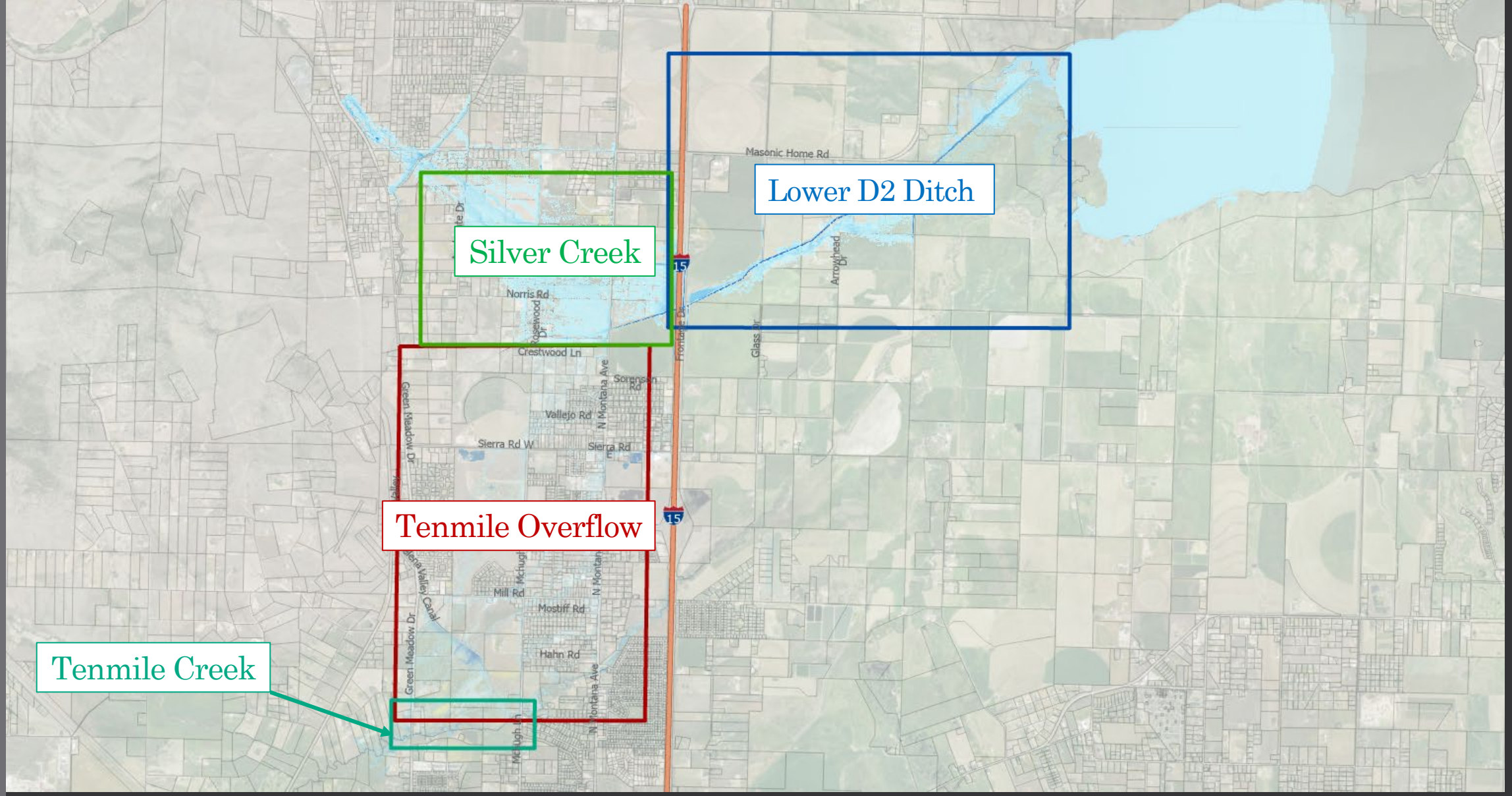
- The topics of a new dam/reservoir or to levee and dredge are not considered in this plan. These topics have been fully vetted extending back to the 1960s and determined not cost effective. The plan will identify need to define localized sections of the creek that may be suitable for maintenance.
- Comparison of topographic data for Tenmile Creek
  - 2006 USGS Ground Survey (benchmark)
  - 2012 LIDAR
  - 2018 LIDAR
- Measurable aggradation apparent but not definitive
  - Consistent data required
- Monitoring Plan
  - Set up a simple level survey at bridges and other key locations in the reach
  - Monitoring to be performed annually post spring runoff
  - Compare to 2006 USGS benchmark survey and previous year survey
- Year over year monitoring can be analyzed to identify trends and justify need to address.



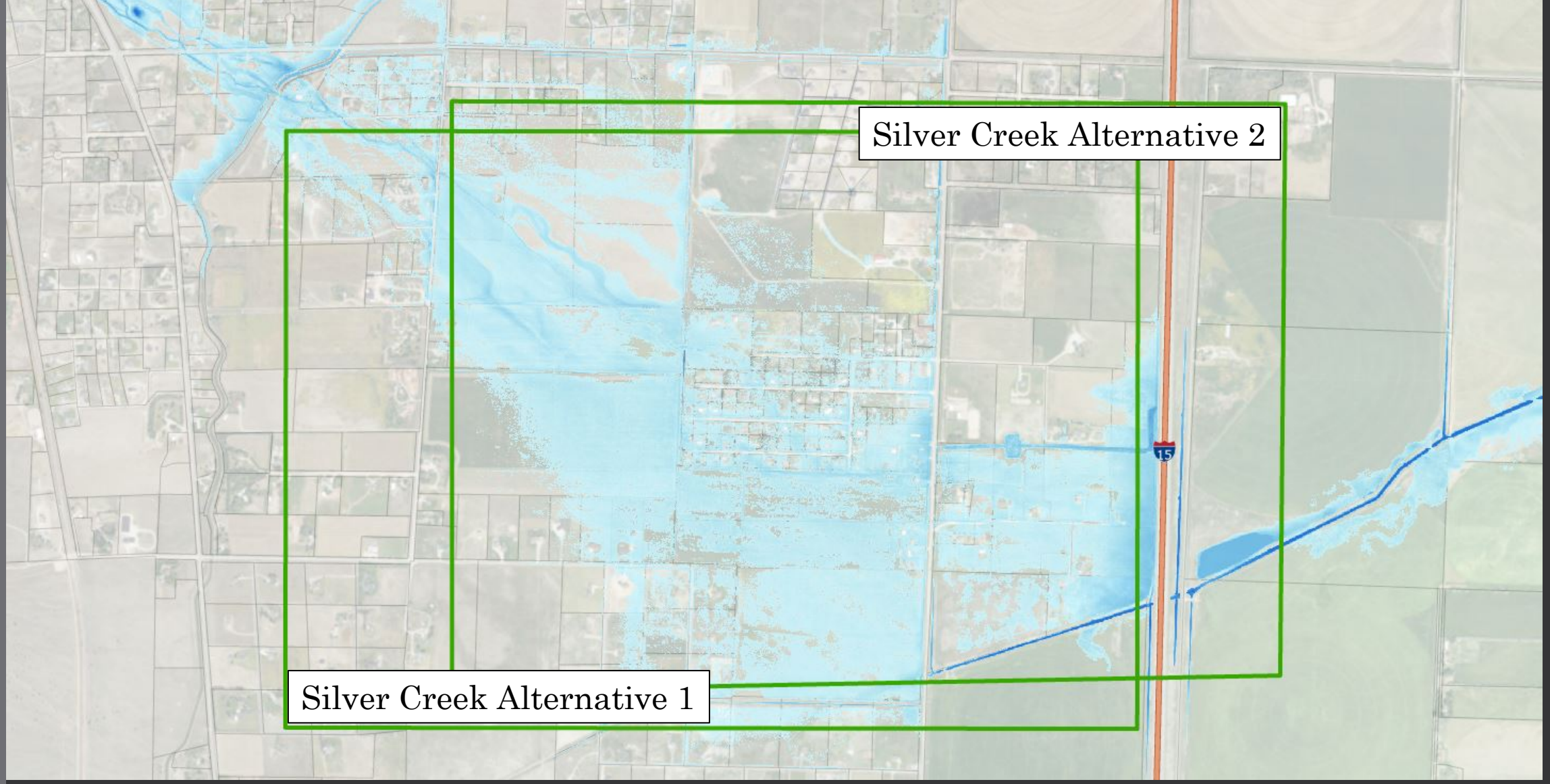
MASTER PLAN OVERVIEW

LOWER D2 DITCH OVERVIEW

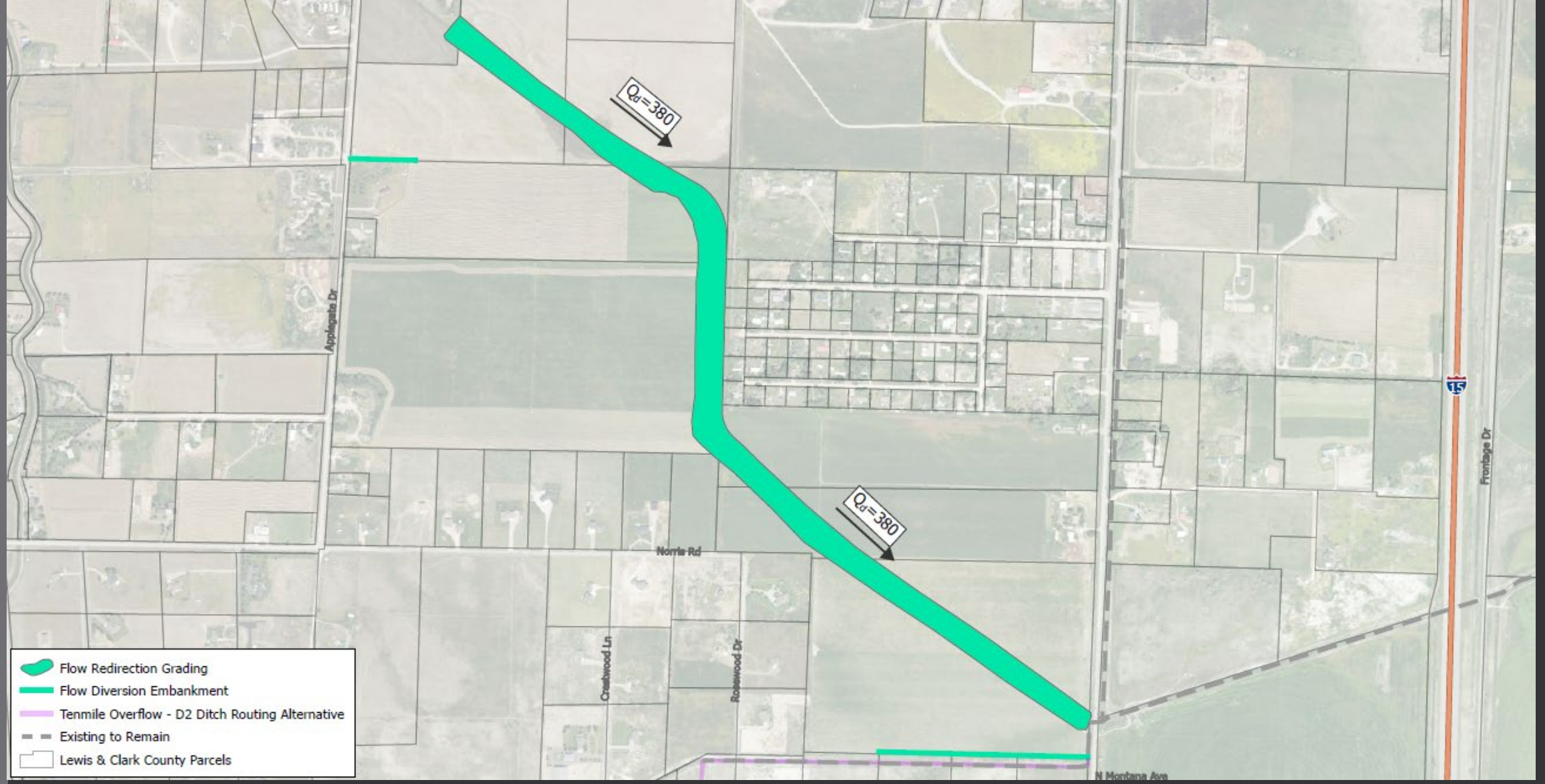
LOWER D2 DITCH BASELINE IMPROVEMENTS



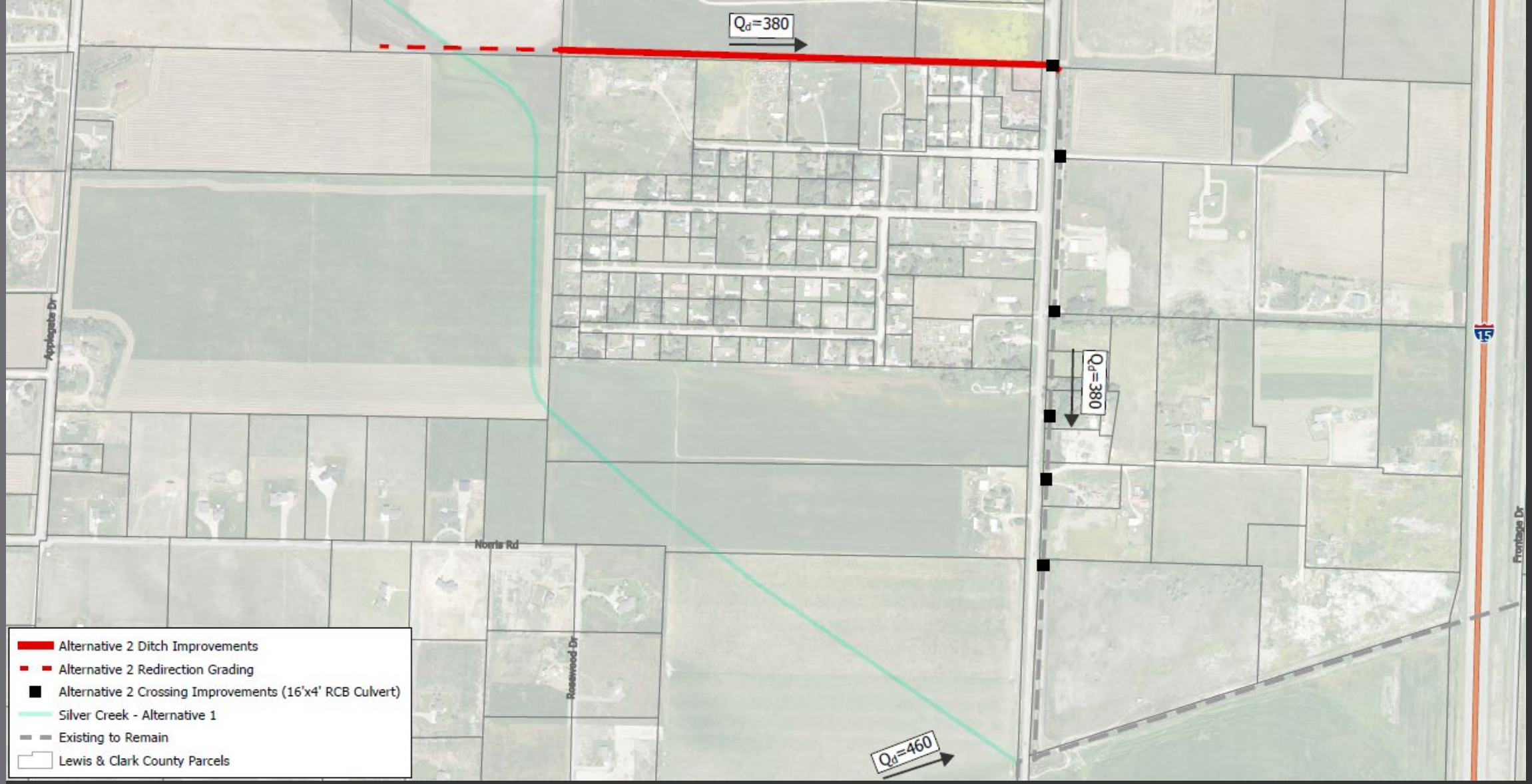
MASTER PLAN OVERVIEW



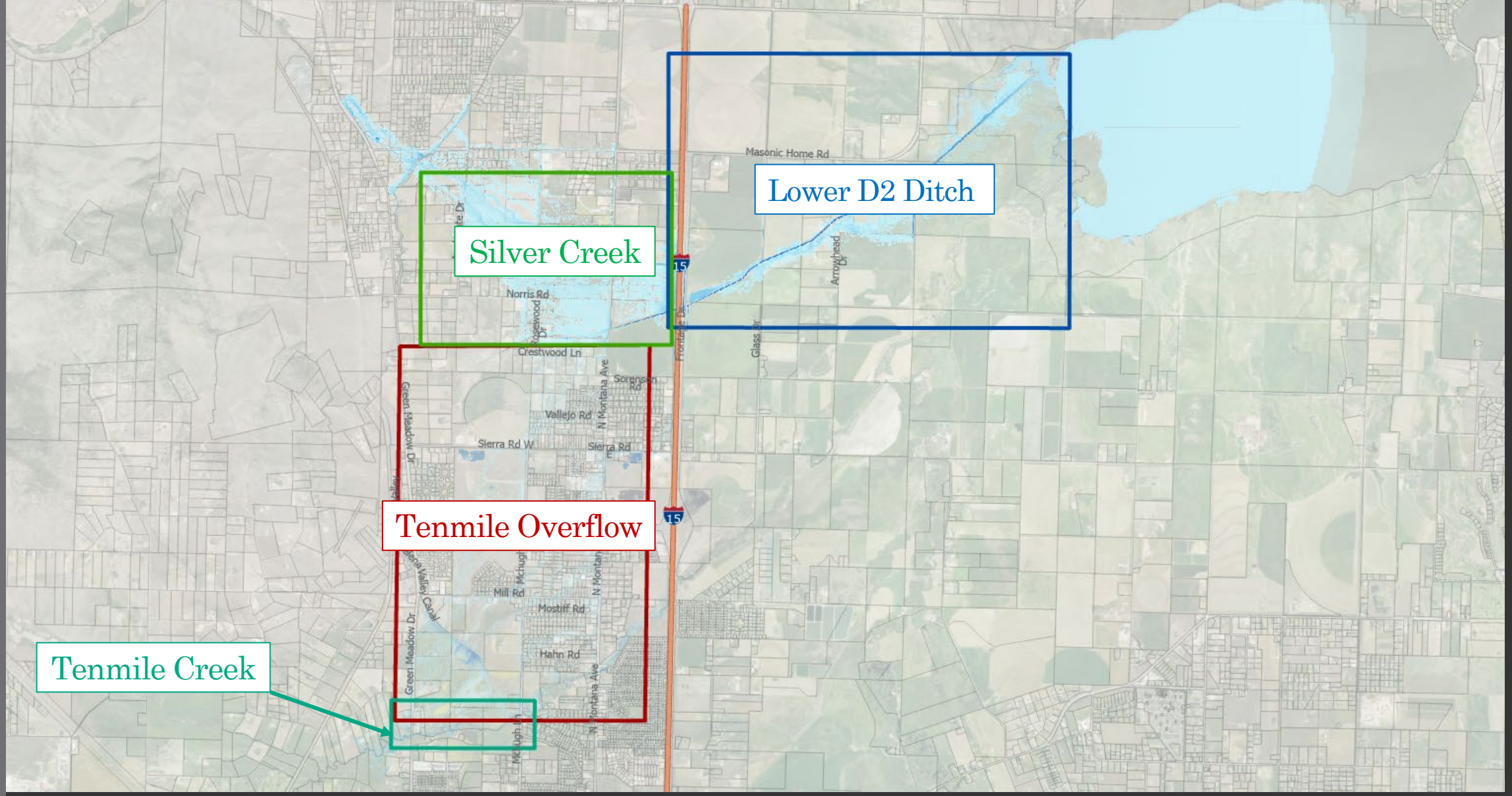
SILVER CREEK OVERVIEW



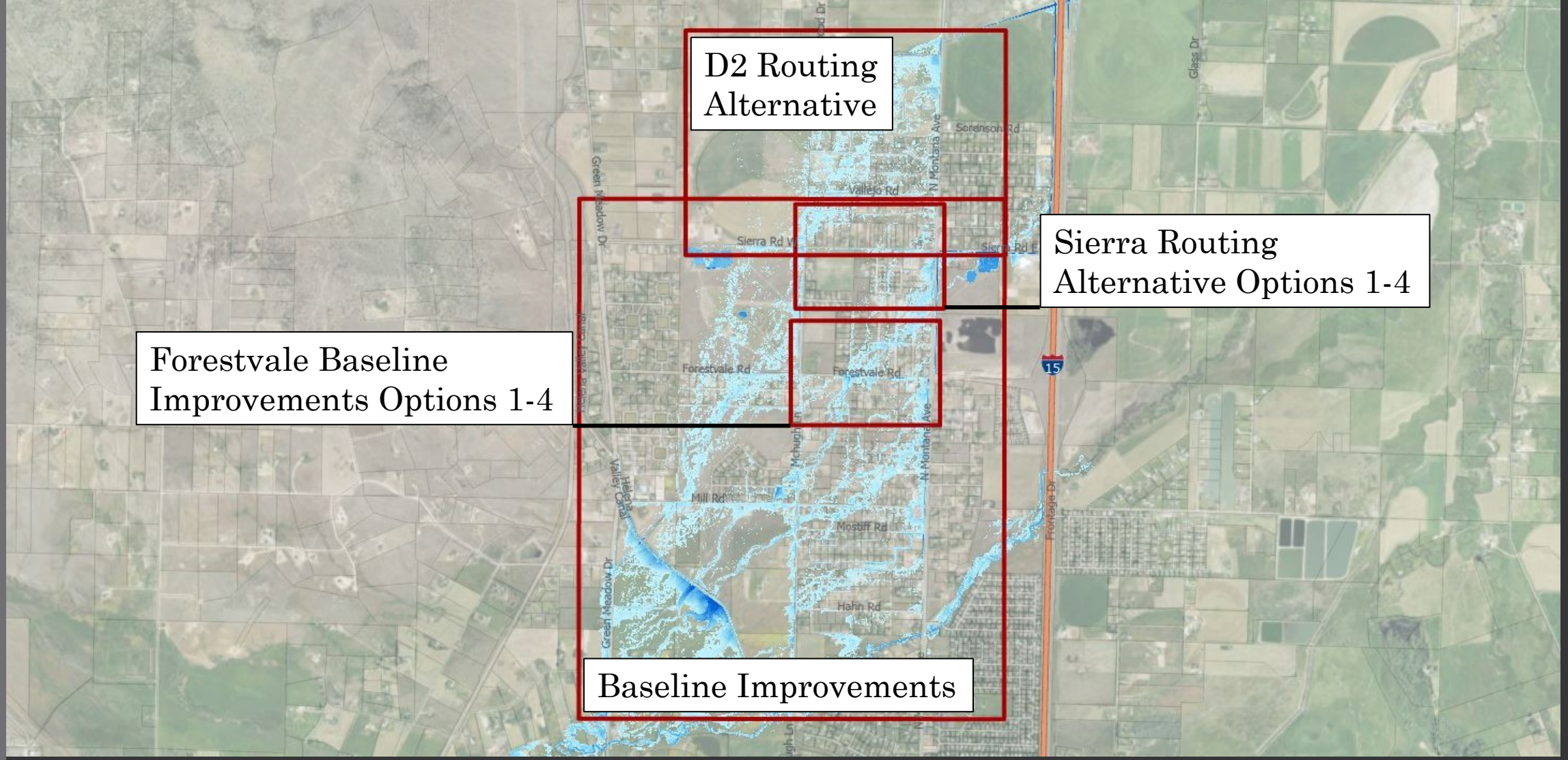
SILVER CREEK ALTERNATIVE 1



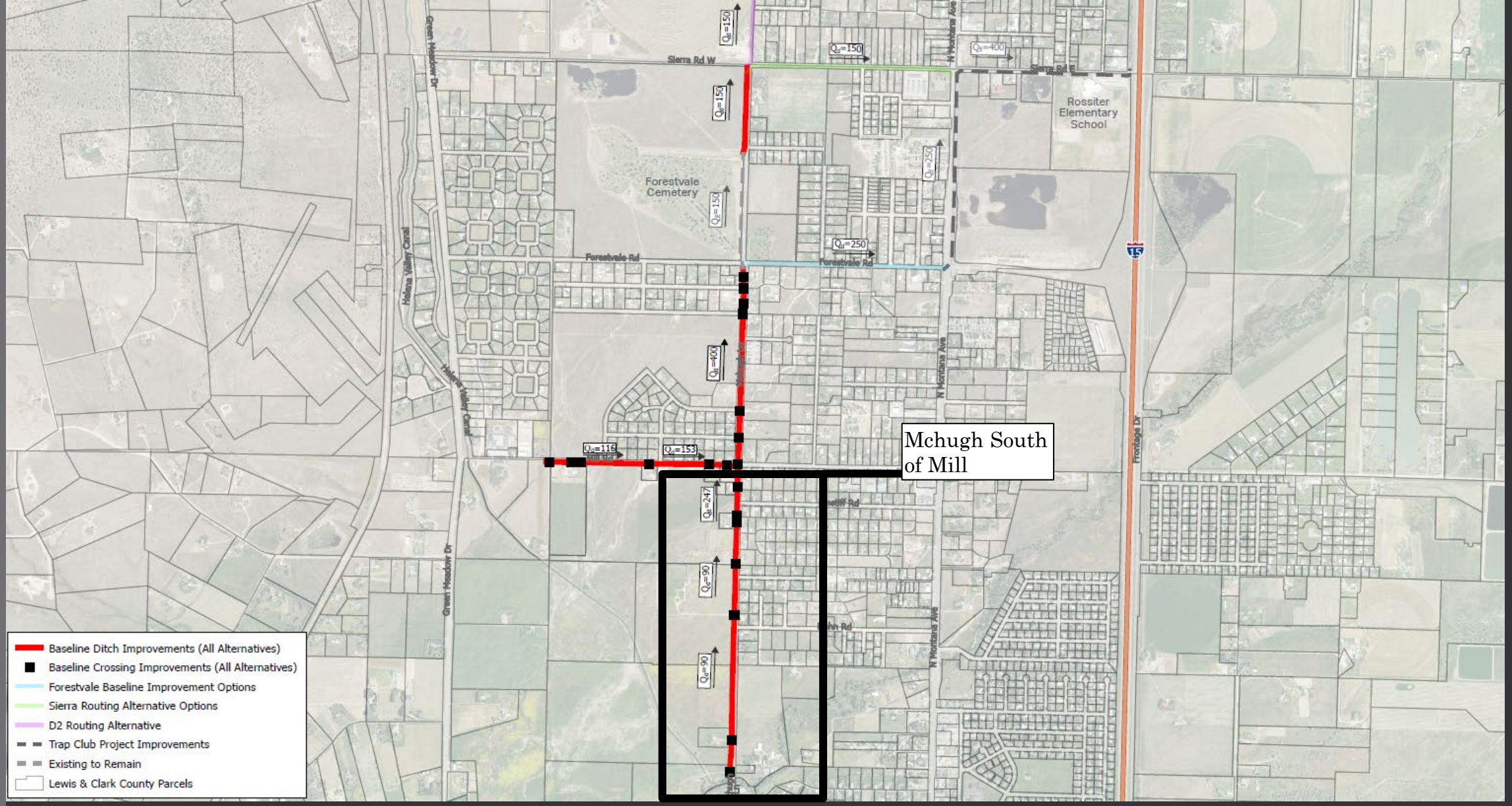
SILVER CREEK ALTERNATIVE 2



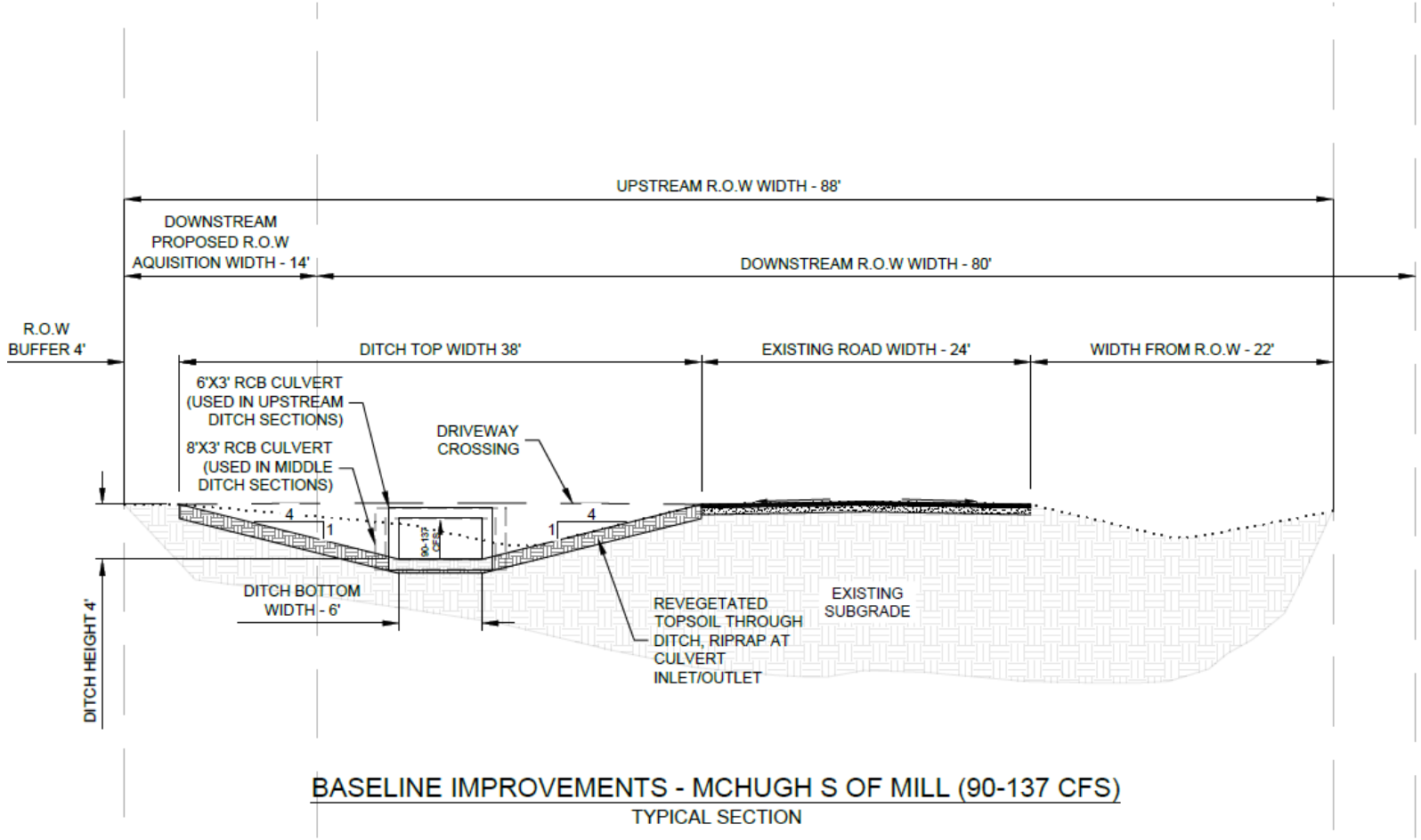
MASTER PLAN OVERVIEW



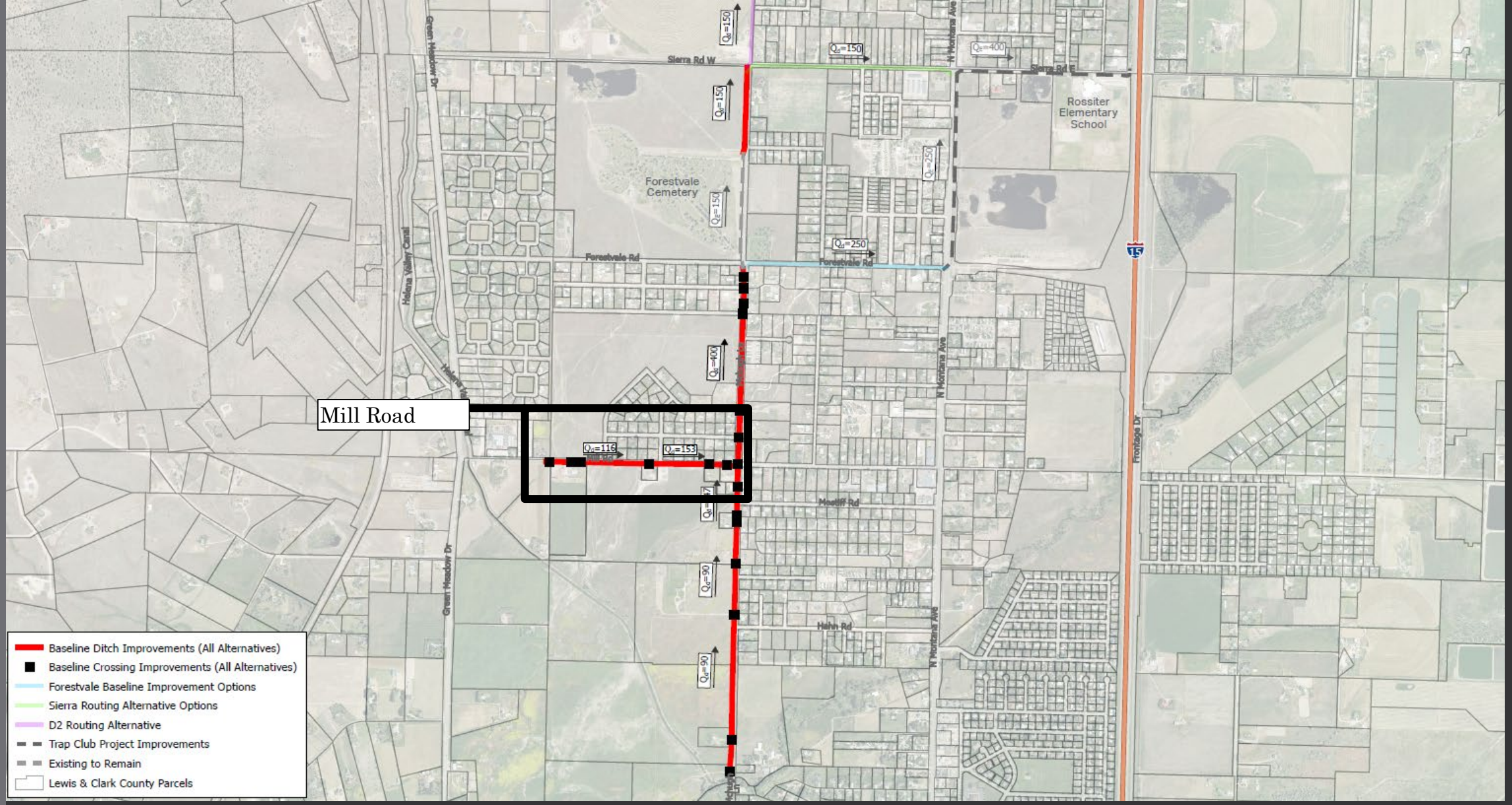
TENMILE OVERFLOW OVERVIEW



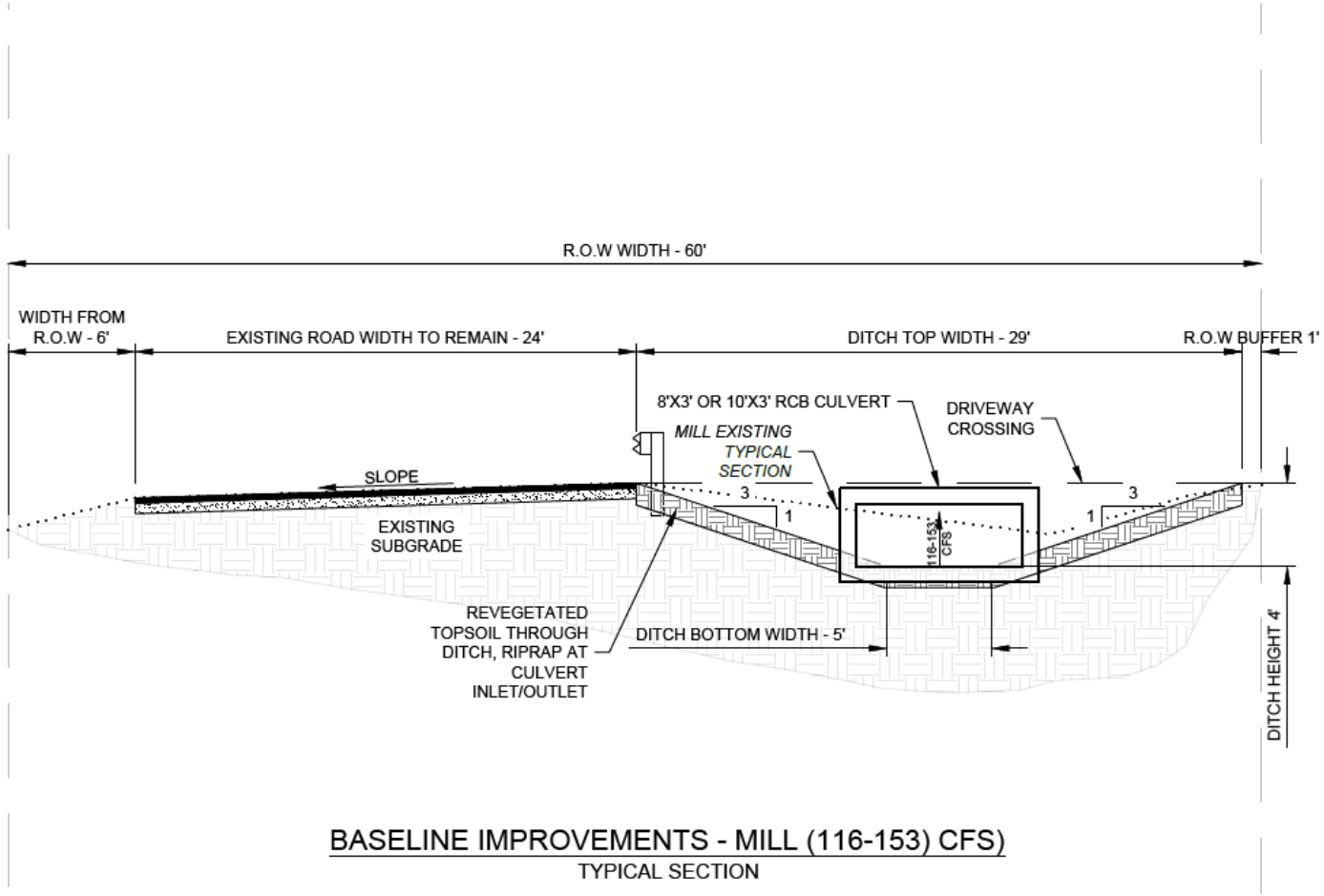
BASELINE IMPROVEMNTS MCHUGH SOUTH OF MILL



MCHUGH SOUTH OF MILL TYPICAL SECTION



BASELINE IMPROVEMNTS
MILL ROAD

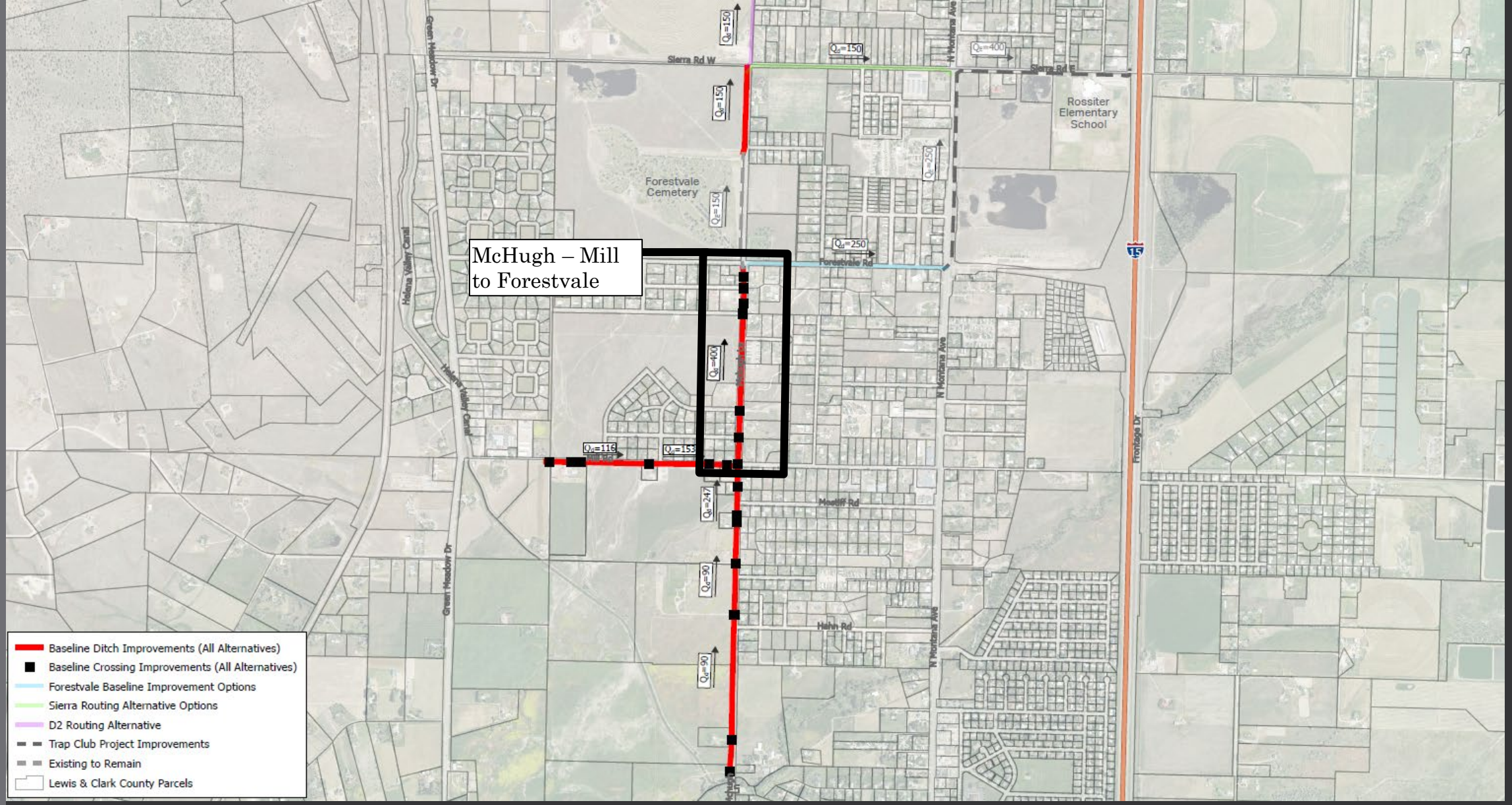


BASELINE IMPROVEMENTS - MILL (116-153) CFS)

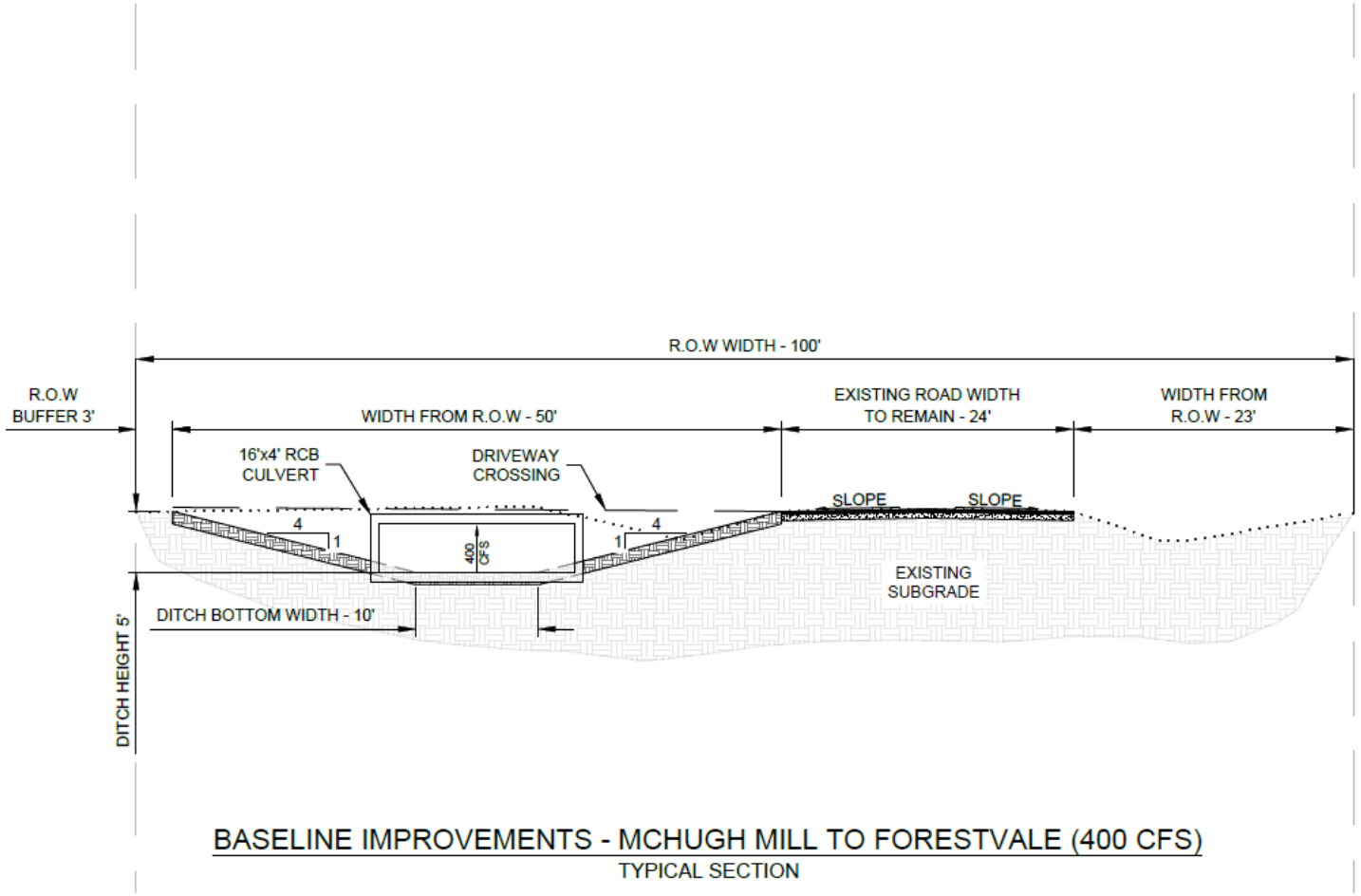
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

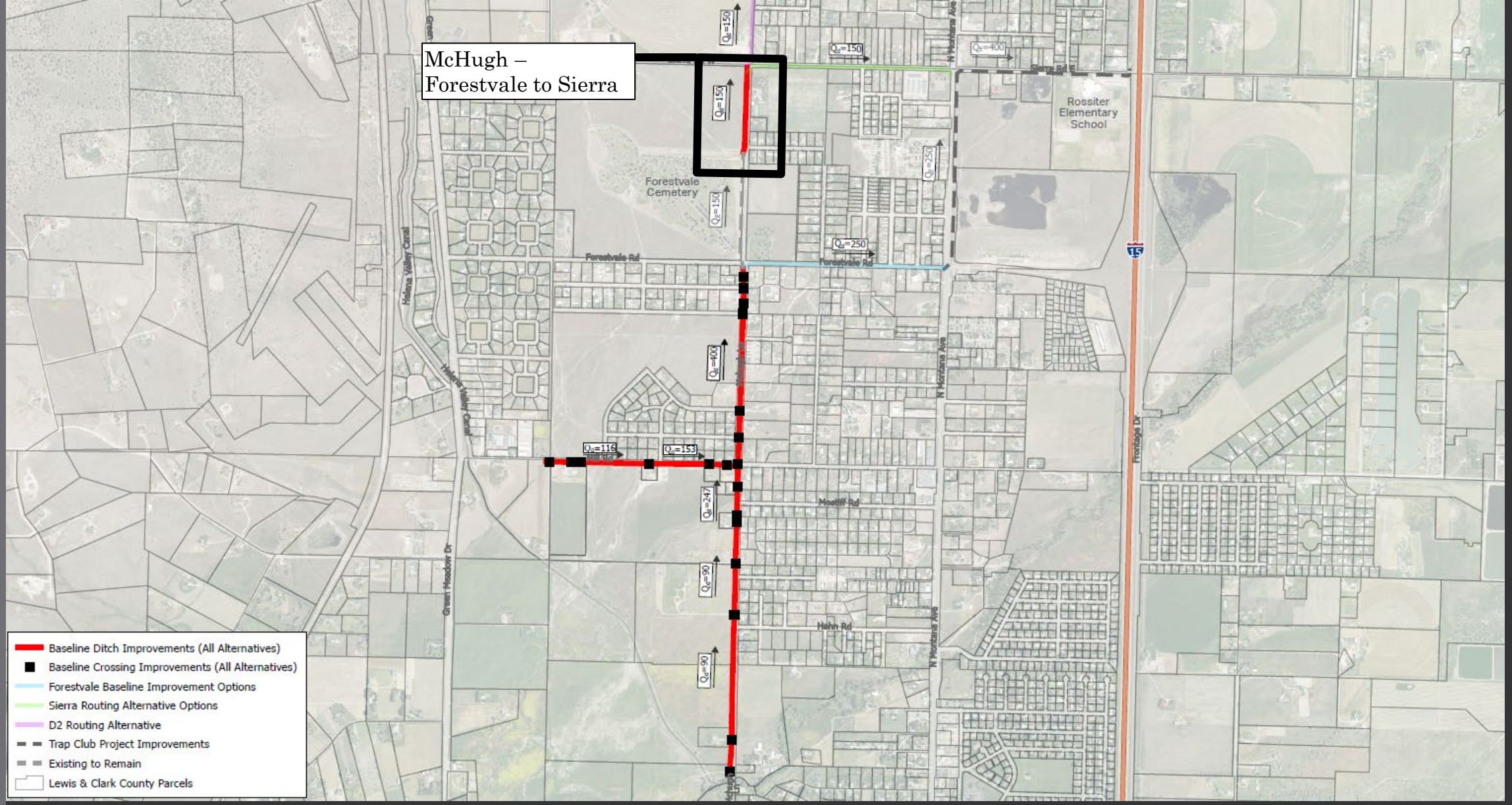
MILL ROAD TYPICAL SECTION



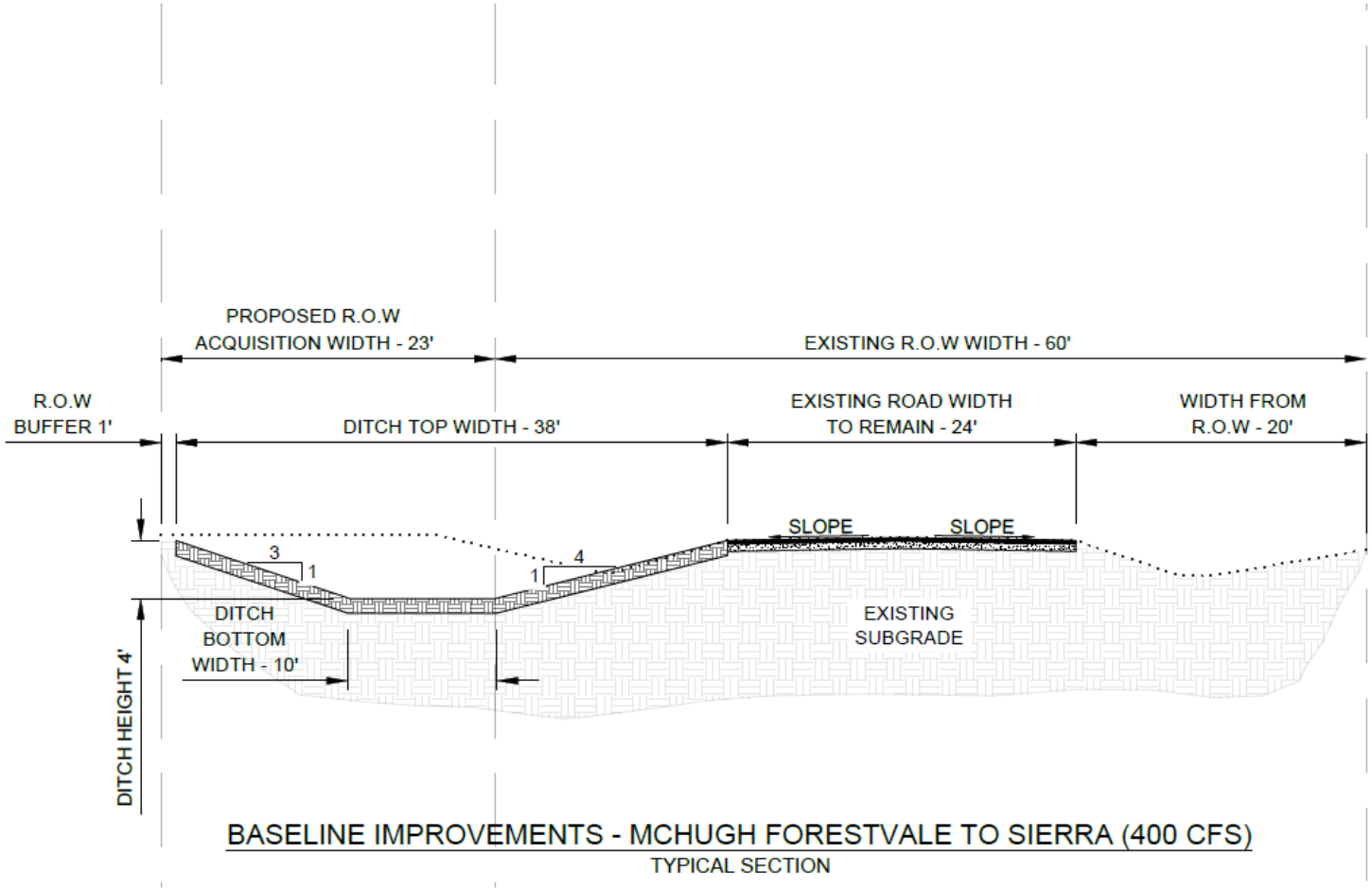
BASELINE IMPROVEMNTS
MCHUGH - MILL TO FORESTVALE



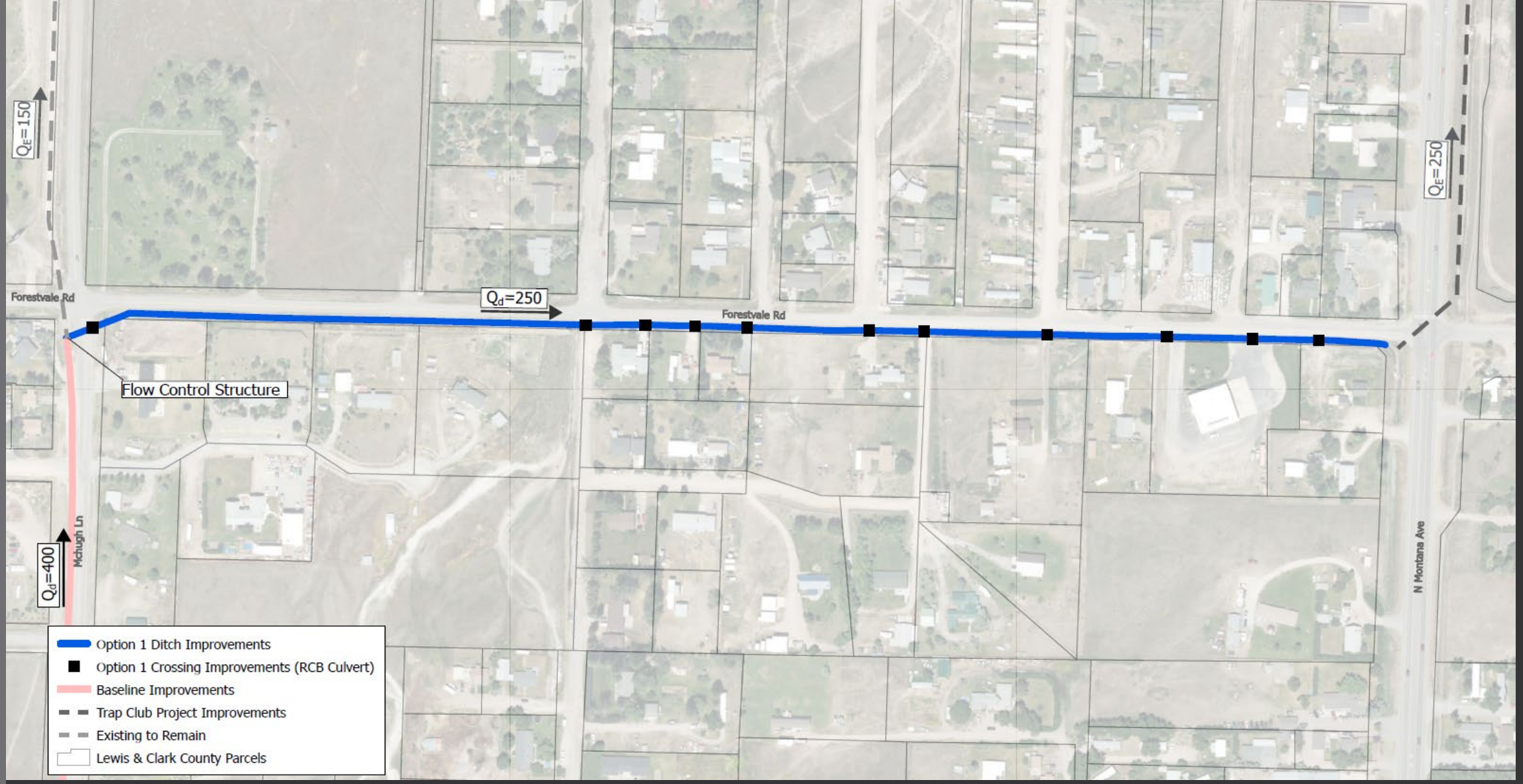
MCHUGH - MILL TO FORESTVALE TYPICAL SECTION



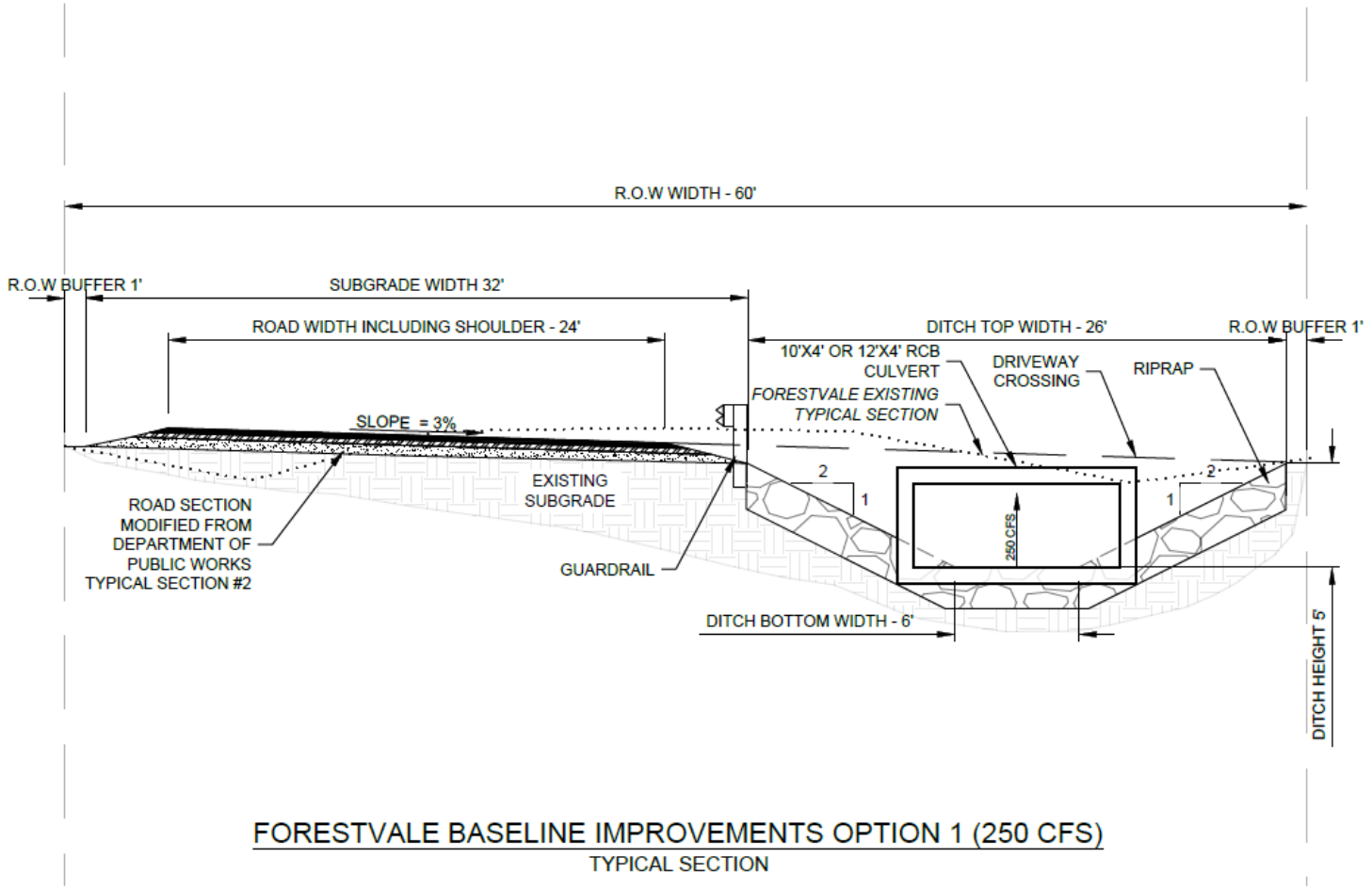
BASELINE IMPROVEMNTS
MCHUGH - FORESTVALE TO SIERRA



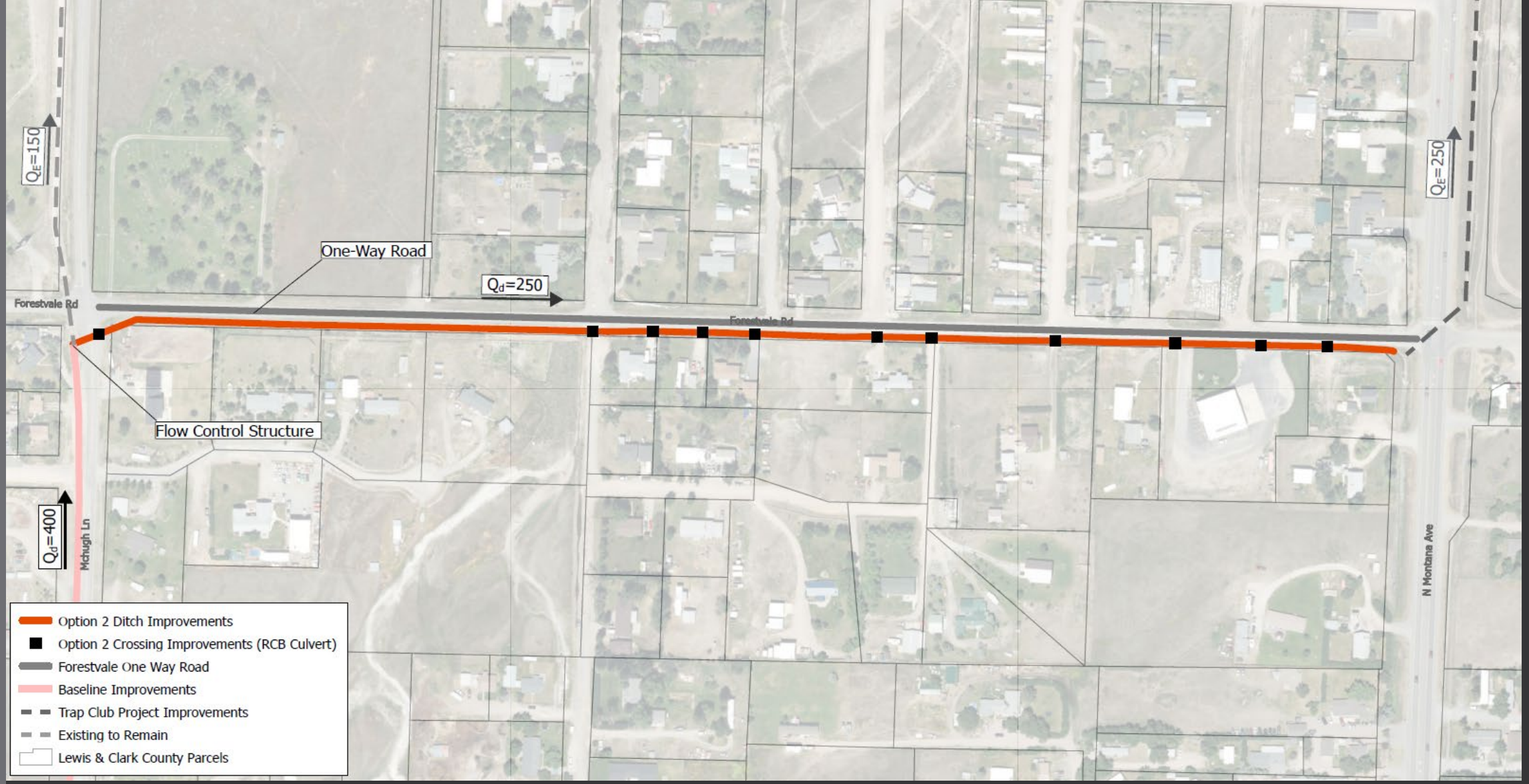
MCHUGH - FORESTVALE TO SIERRA TYPICAL SECTION



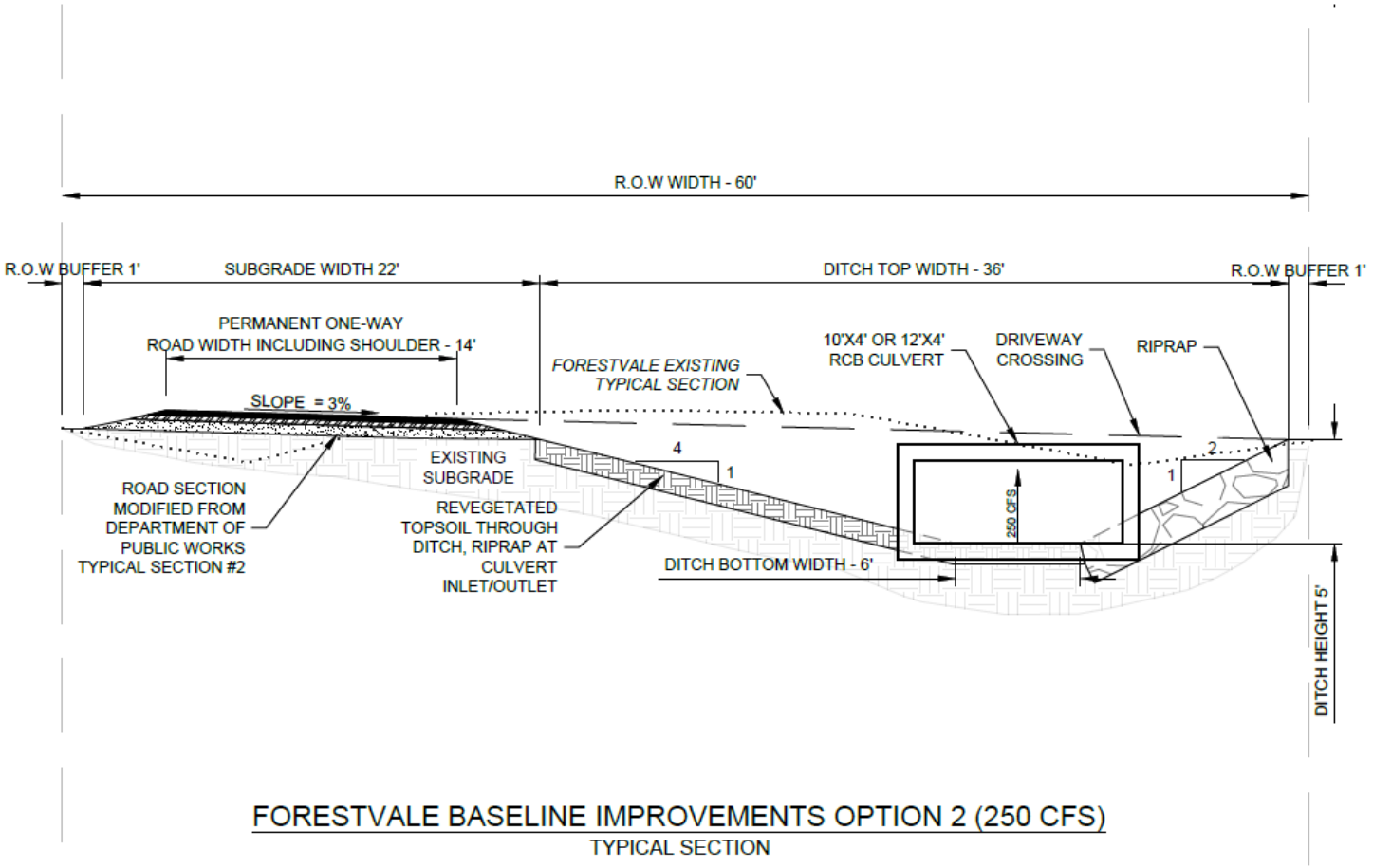
FORESTVALE IMPROVEMENTS OPTION 1



FORESTVALE IMPROVEMNTS OPTION 1 TYPICAL SECTION



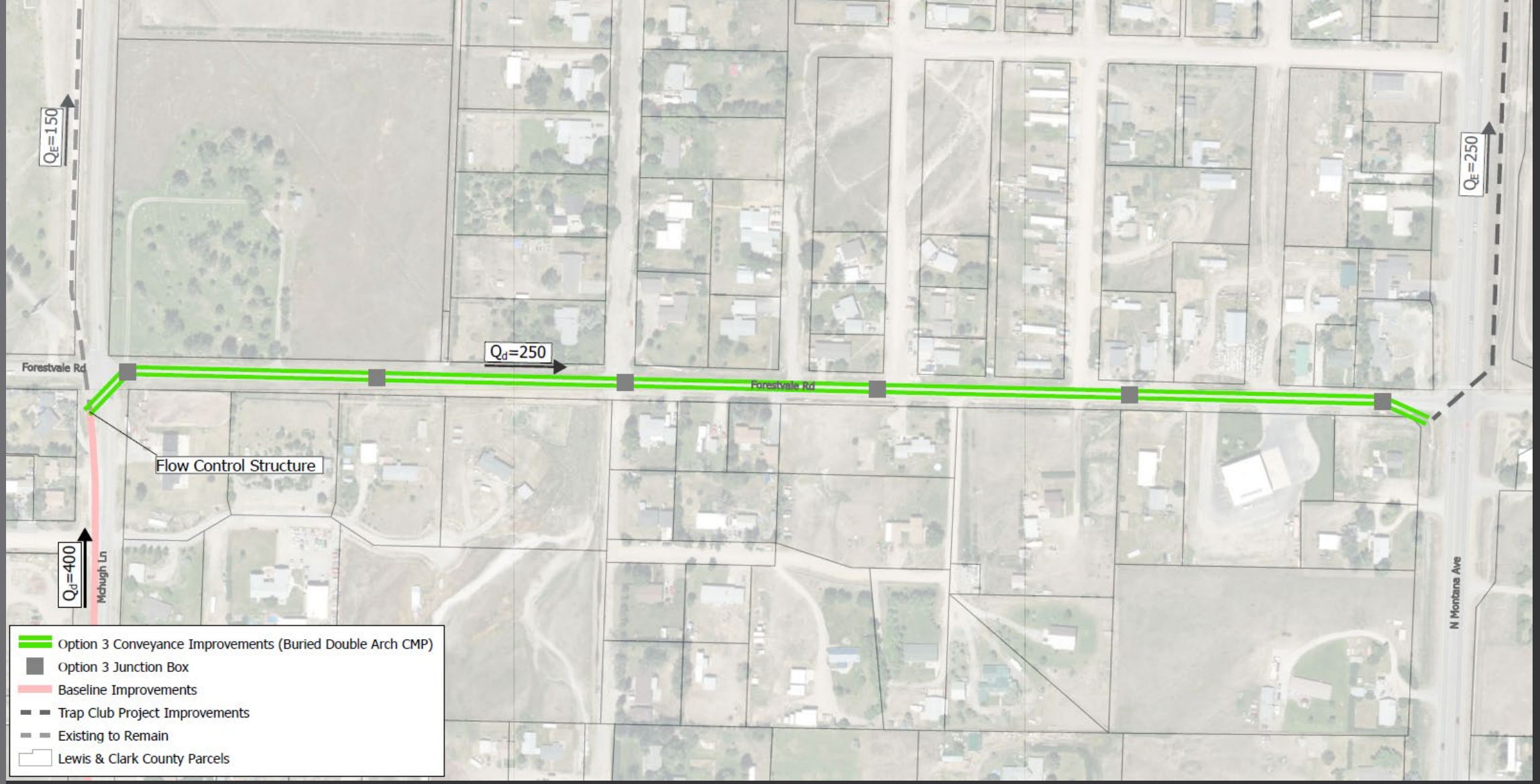
FORESTVALE IMPROVEMENTS OPTION 2



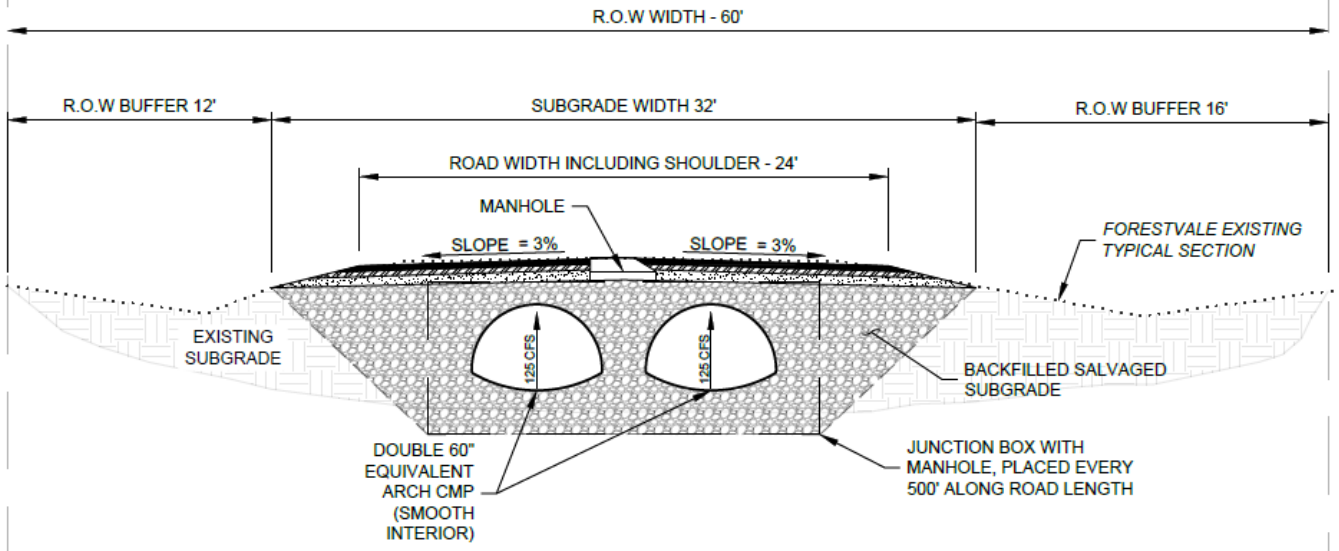
FORESTVALE BASELINE IMPROVEMENTS OPTION 2 (250 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

FORESTVALE IMPROVEMNTS OPTION 2 TYPICAL SECTION



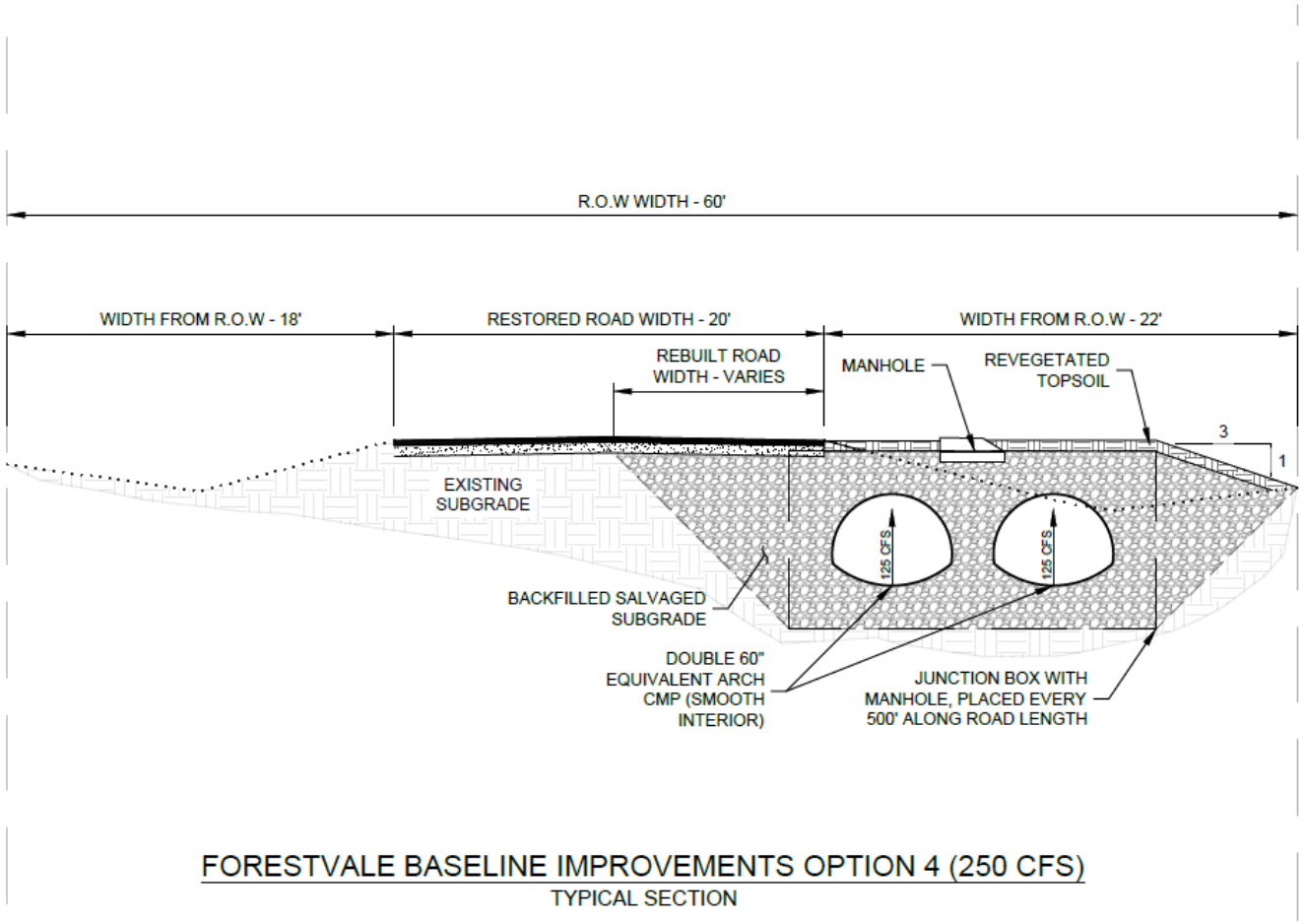
FORESTVALE IMPROVEMENTS OPTION 3



FORESTVALE BASELINE IMPROVEMENTS OPTION 3 (250 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

FORESTVALE IMPROVEMNTS OPTION 3 TYPICAL SECTION

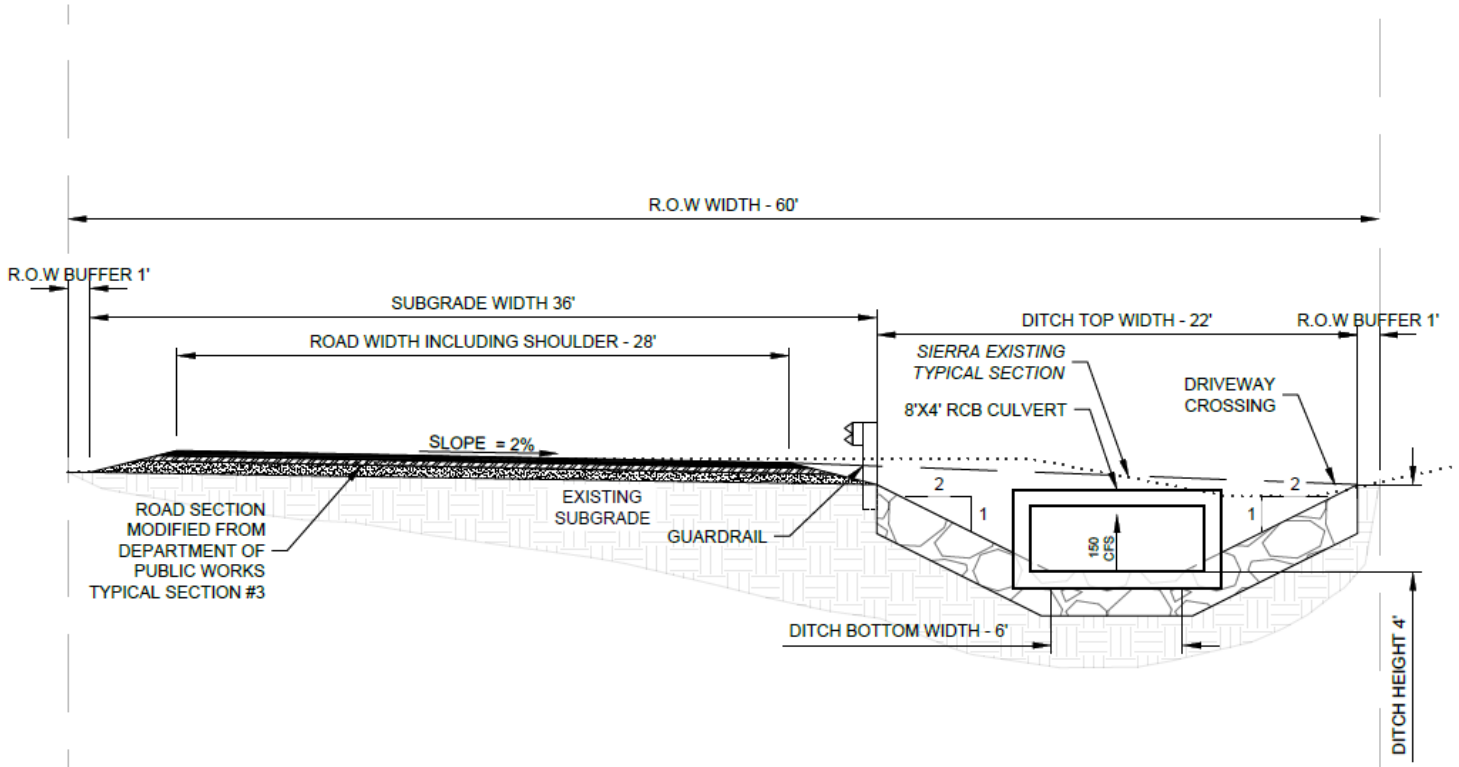


FORESTVALE BASELINE IMPROVEMENTS OPTION 4 (250 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

FORESTVALE IMPROVEMNTS OPTION 4 TYPICAL SECTION

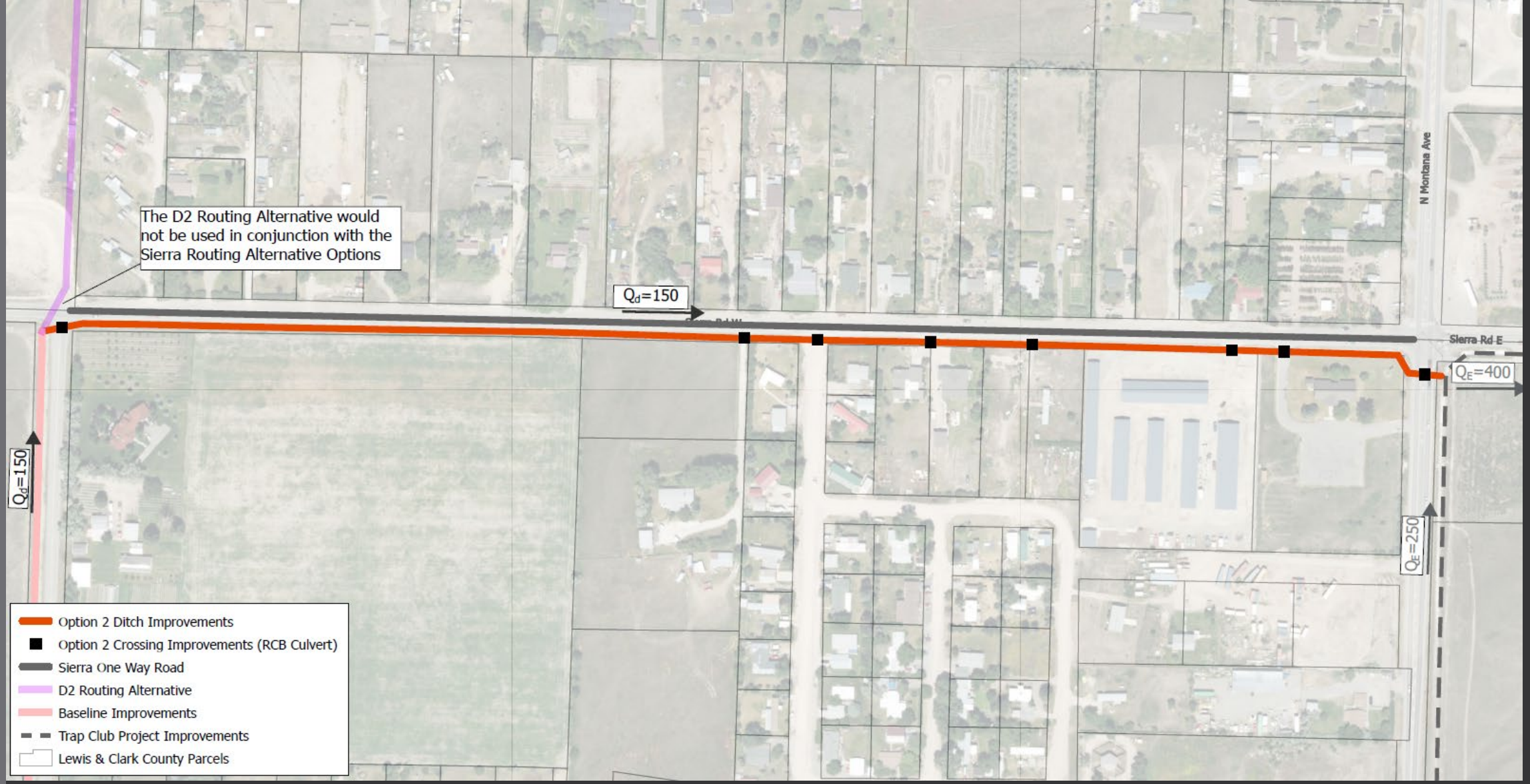
SIERRA ROUTING ALTERNATIVE OPTION 1



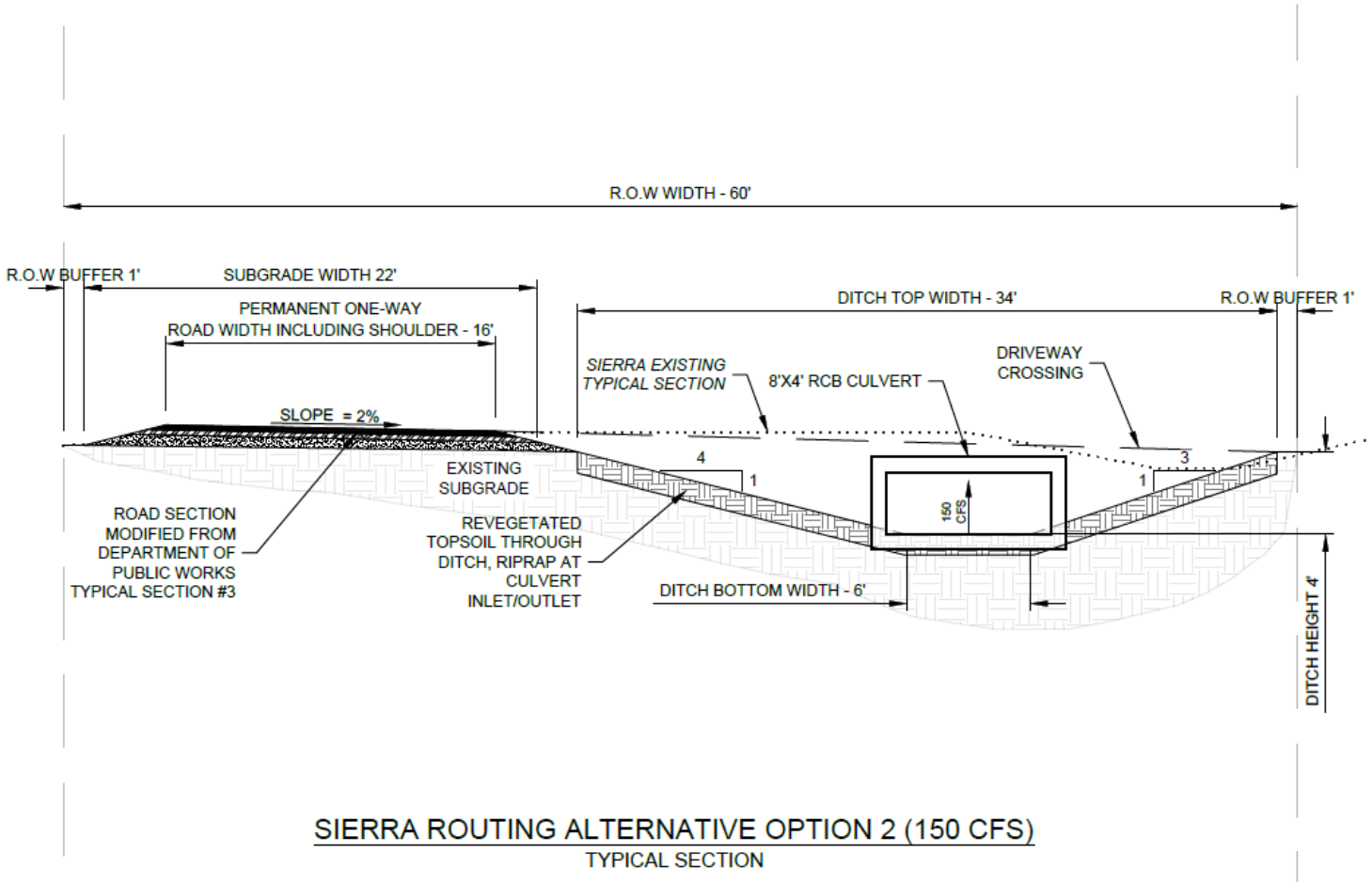
SIERRA ROUTING ALTERNATIVE OPTION 1 (150 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

SIERRA ROUTING ALTERNATIVE OPTION 1 TYPICAL SECTION

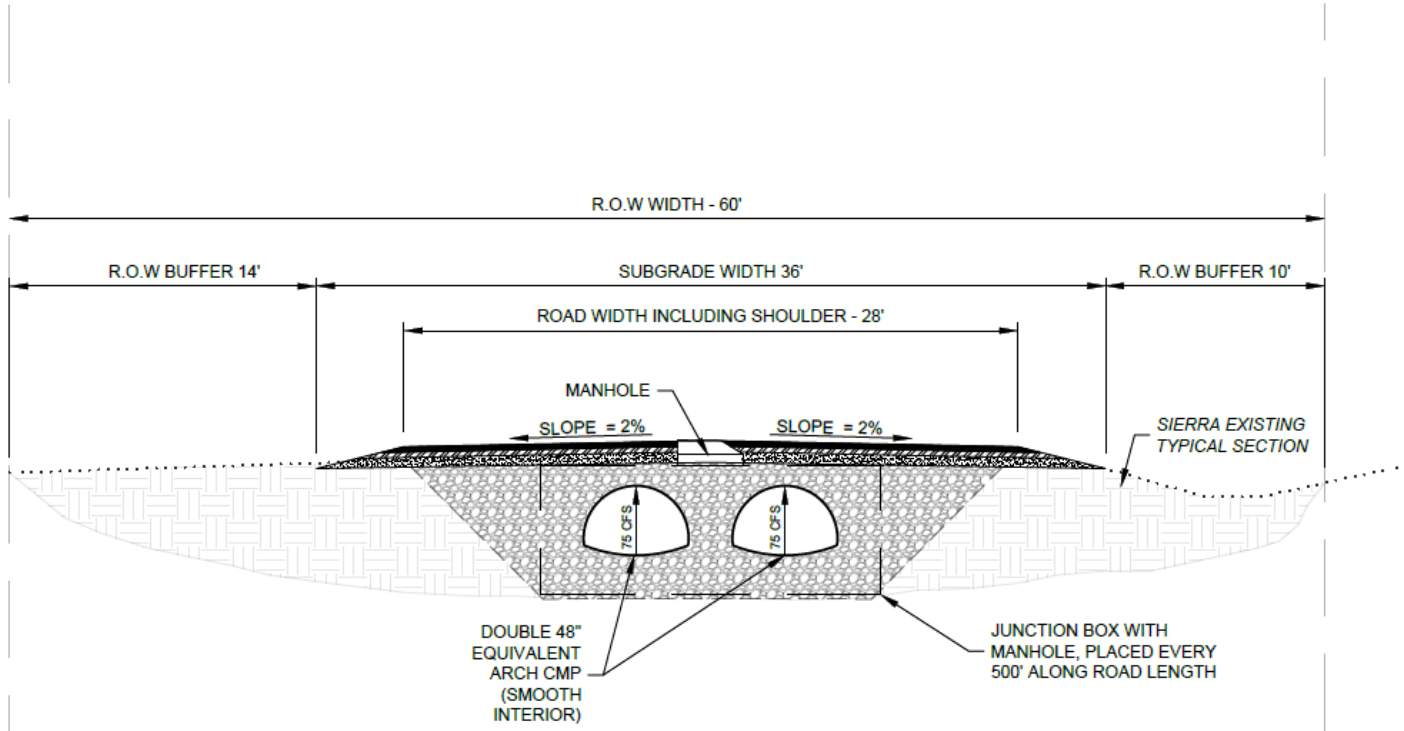


SIERRA ROUTING ALTERNATIVE OPTION 2



SIERRA ROUTING ALTERNATIVE OPTION 2 TYPICAL SECTION

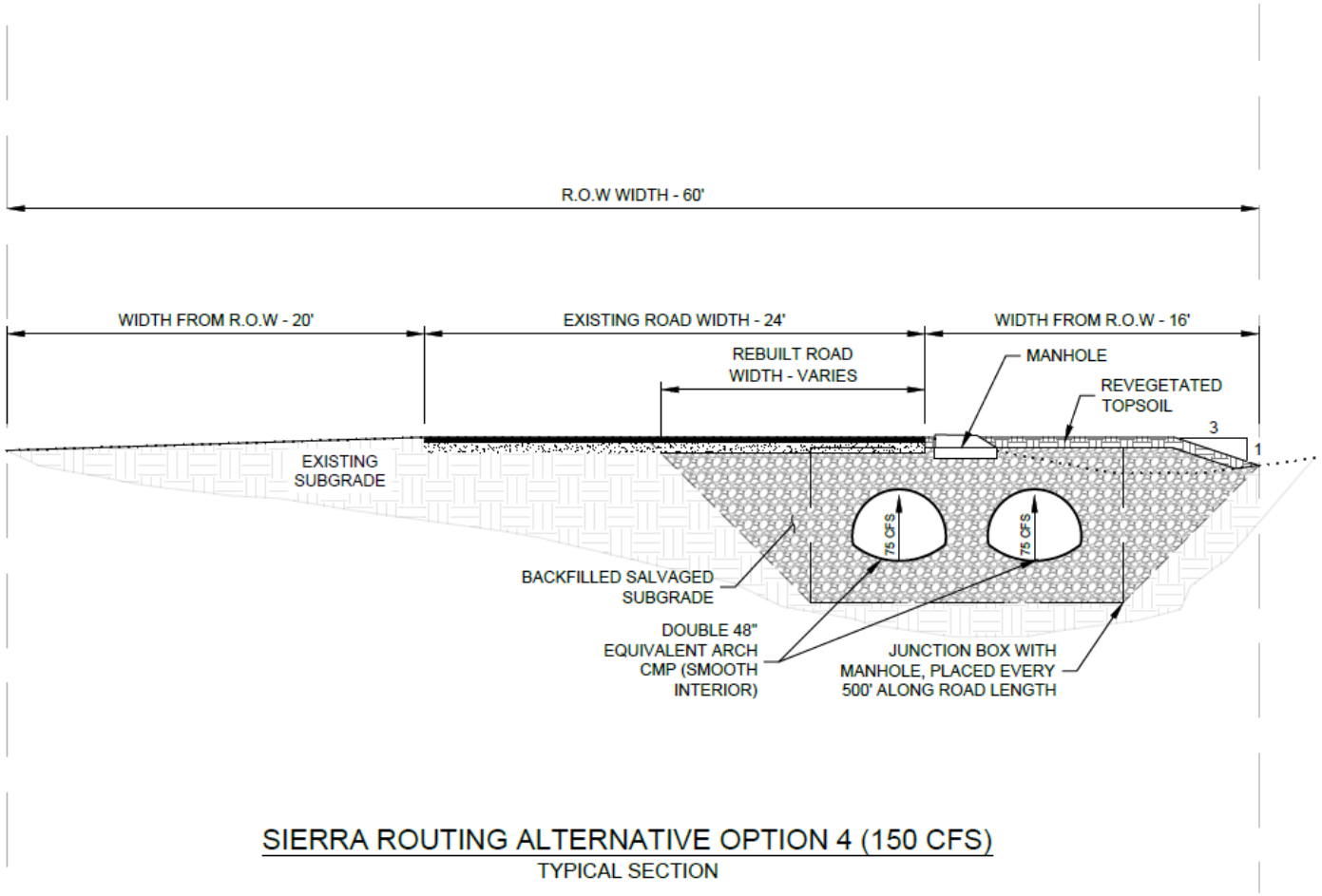
SIERRA ROUTING ALTERNATIVE OPTION 3



SIERRA ROUTING ALTERNATIVE OPTION 3 (150 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

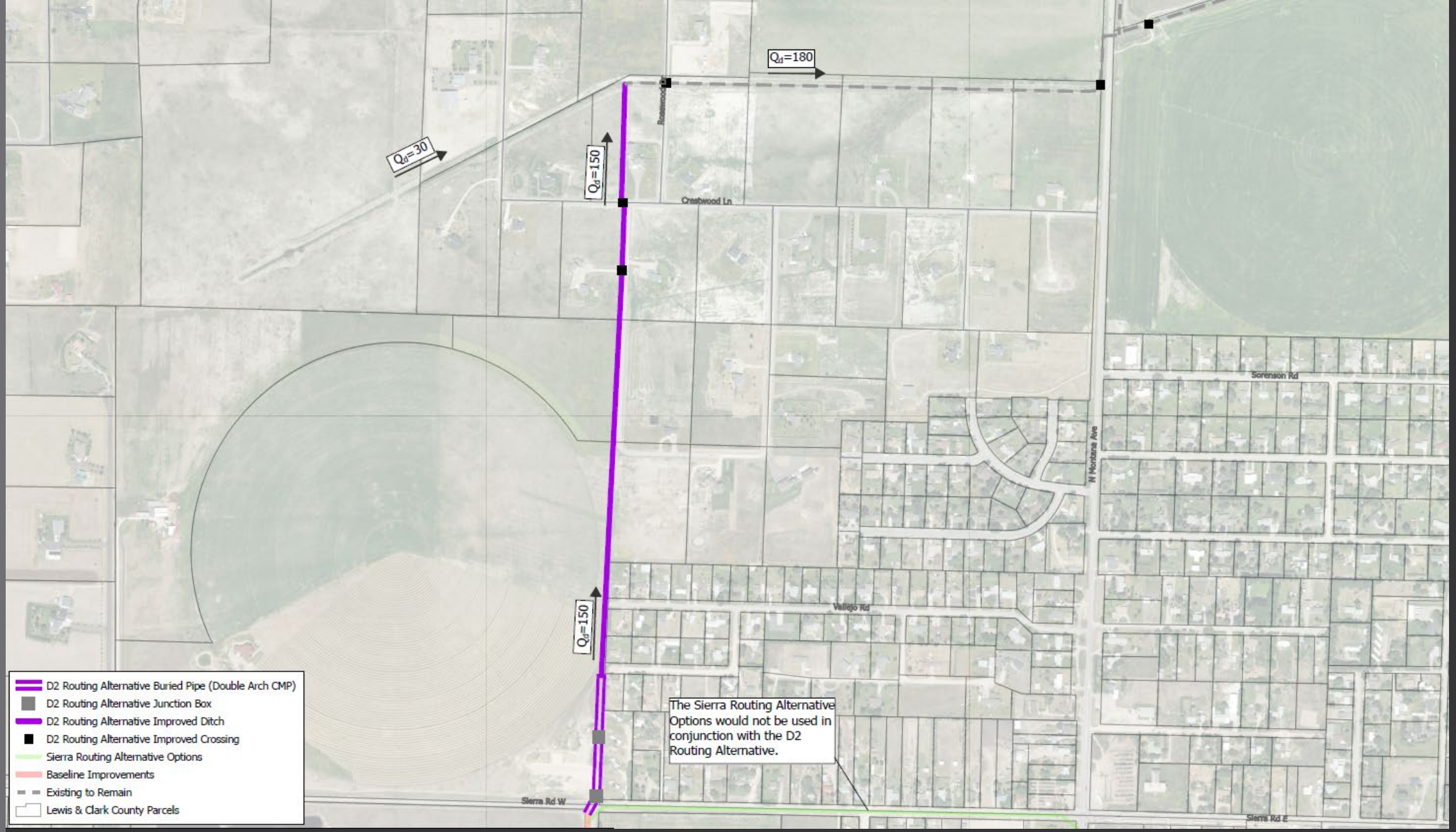
SIERRA ROUTING ALTERNATIVE OPTION 3 TYPICAL SECTION



SIERRA ROUTING ALTERNATIVE OPTION 4 (150 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

SIERRA ROUTING ALTERNATIVE OPTION 4 TYPICAL SECTION



D2 ROUTING ALTERNATIVE

COST COMPARISON

ESTIMATED COST SUMMARY - 11/11/2021		
ALTERNATIVE	**DESCRIPTION SUMMARY**	**ESTIMATED COST**
D2 DITCH - BASELINE IMPROVEMENTS	Replace All Crossings with Bridges Capable of Conveying Design Flows	$1,997,000
SILVER CREEK ALTERNATIVE 1	Flow redirection and swale grading south of Sewell Subdivion to D2 Drain Ditch	$1,008,000
SILVER CREEK - ALTERNATIVE 2	Flow Redirection and Swale Grading North of Sewell Subdivion	$1,515,000
TENMILE OVERFLOW - BASELINE IMPROVEMENTS	McHugh and Mill Ditch with RCBs Crossings	$3,962,000
MCHUGH/FORESTVALE - OPTION 1	Ditch with RCB Crossings, Improved Two-Way Street, Guardrail, Riprap Ditch	$4,277,000
MCHUGH/FORESTVALE - OPTION 2	Ditch with RCB Crossings, Improved One-Way Street	$3,392,000
MCHUGH/FORESTVALE - OPTION 3	Two Buried CMPs with Junction Boxes, Improved Two-Way Street	$4,772,000
MCHUGH/FORESTVALE - OPTION 4	Two Buried CMPs Located in Existing Ditch, Rebuilt Existing Two Way Street	$4,357,493
MCHUGH/SIERRA - OPTION 1	Ditch with RCB Crossings, Improved Two-Way Street, Guardrail, Riprap Ditch	$3,776,000
MCHUGH/SIERRA - OPTION 2	Ditch with RCB Crossings, Improved One-Way Street	$2,433,000
MCHUGH/SIERRA - OPTION 3	Two Buried CMPs with Junction Boxes, Improved Two-Way Street	$4,414,000
MCHUGH/SIERRA - OPTION 4	Two Buried CMPs Located in Existing Ditch, Rebuilt Existing Two Way Street	$3,874,000
MCHUGH/SIERRA - OPTION 5	Two Buried CMPs with Junction Boxes, Ditch to Upper D2 Drain Ditch	$1,623,000

COST COMPARISON

ESTIMATED COST SUMMARY - 11/11/2021								
ALTERNATIVE	**DESCRIPTION SUMMARY**	**ESTIMATED COST**	**LOW COST**	**FORESTVALE AND SIERRA AS ONE-WAYS**	**LOW COST NO ONE-WAYS**	**FORESTVALE AND SIERRA DITCH/RCB**	**FORESTVALE AND SIERRA BURIED CMP IN ROADSIDE DITCH**	**FORESTVALE AND SIERRA BURIED CMP ALONG ROAD CENTERLINE**
D2 DITCH - BASELINE IMPROVEMENTS	Replace All Crossings with Bridges Capable of Conveying Design Flows	$1,997,000	x	x	x	x	x	x
SILVER CREEK ALTERNATIVE 1	Flow redirection and swale grading south of Sewell Subdivion to D2 Drain Ditch	$1,008,000	x	x	x	x	x	x
SILVER CREEK - ALTERNATIVE 2	Flow Redirection and Swale Grading North of Sewell Subdivion	$1,515,000						
TENMILE OVERFLOW - BASELINE IMPROVEMENTS	McHugh and Mill Ditch with RCBs Crossings	$3,962,000	x	x	x	x	x	x
MCHUGH/FORESTVALE - OPTION 1	Ditch with RCB Crossings, Improved Two-Way Street, Guardrail, Riprap Ditch	$4,277,000			x	x		
MCHUGH/FORESTVALE - OPTION 2	Ditch with RCB Crossings, Improved One-Way Street	$3,392,000	x	x				
MCHUGH/FORESTVALE - OPTION 3	Two Buried CMPs with Junction Boxes, Improved Two-Way Street	$4,772,000						x
MCHUGH/FORESTVALE - OPTION 4	Two Buried CMPs Located in Existing Ditch, Rebuilt Existing Two Way Street	$4,357,493					x	
MCHUGH/SIERRA - OPTION 1	Ditch with RCB Crossings, Improved Two-Way Street, Guardrail, Riprap Ditch	$3,776,000				x		
MCHUGH/SIERRA - OPTION 2	Ditch with RCB Crossings, Improved One-Way Street	$2,433,000		x				
MCHUGH/SIERRA - OPTION 3	Two Buried CMPs with Junction Boxes, Improved Two-Way Street	$4,414,000						x
MCHUGH/SIERRA - OPTION 4	Two Buried CMPs Located in Existing Ditch, Rebuilt Existing Two Way Street	$3,874,000					x	
MCHUGH/SIERRA - OPTION 5	Two Buried CMPs with Junction Boxes, Ditch to Upper D2 Drain Ditch	$1,623,000	x		x			
			$11,982,000	$12,792,000	$12,867,000	$15,020,000	$15,198,493	$16,153,000

CONSIDERATIONS

- Tenmile Creek
  - Annual monitoring and maintenance cost
  - Permitting
  - Longevity
- Lower D2 Drain Ditch – Baseline Improvements
  - Other alternatives to using Lower D2 require further study and will be expensive
- Silver Creek
  - Through Sewell is not a practical option (no space, easements, buyouts, crossings)
  - Routing south of Sewell
    - Dependence on Easements
    - Low-cost option
    - No land use change needed
    - Will require private easements and coordination with Bureau of Reclamation
  - Routing North of Sewell
    - Dependence on Easements
    - Higher-cost, discharges into existing lateral of D2 Drain Ditch
    - Existing Irrigation infrastructure
    - Will require (fewer) private easements and coordination with Bureau of Reclamation

CONSIDERATIONS

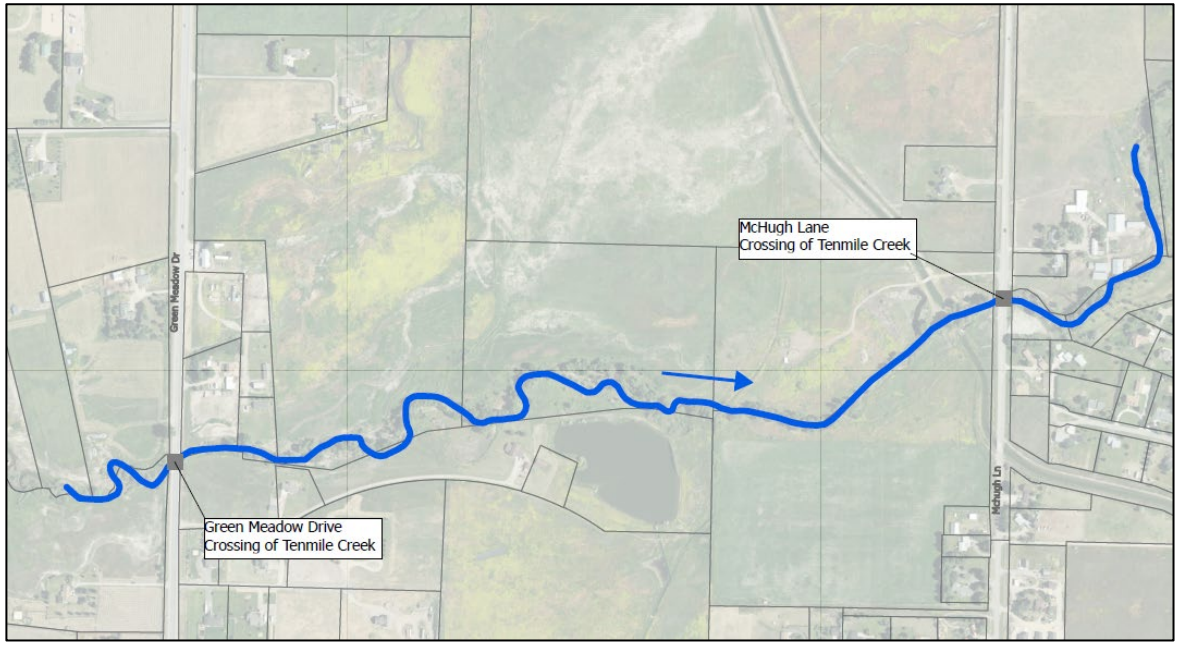
- Tenmile Overflow
  - Implementation Cost
  - Dependence on Easements
  - Long Term Maintenance
  - Certainty of Feasibility
  - Risk of Failure
  - Public Safety

CONSIDERATIONS

Tenmile Overflow Comparison Matrix	Positive Factors (+)	Negative Factors (-)
Upper D2 Ditch Routing	- Lowest Cost Option since minimal infrastructure needed - Direct route north of McHugh into Upper D2 Ditch avoiding existing infrastructure	- Will require easements - Will require coordination/permitting with BOR and HVID - Doesn't utilize full design capacity of Trap Club Project along Sierra - Sierra Road not improved
One-Way Streets with Open Ditch and RCB	- Low-Cost Option - More Open Space - Maintenance needs are lowest - Gradual ditch side slopes do not need riprap for stabilization or guardrail for traffic safety - Roadway rebuilt to modern county road standards (wider lane with shoulders) - Should provide additional mitigation above design event - No easements required - Utilizes fullest potential of Trap Club Project and McHugh improvements	- Long travel time between eastbound and westbound transportation routes - Weed control in ditches, annual clearing of debris - Safety concern with open ditch and flowing water
Two-way Streets with Open Ditch, RCB, Riprap, Guardrail	- Lowest Cost Option without One-Way streets - Roadway rebuilt to modern county road standards (wider lanes with shoulder) - Should provide additional mitigation above design event - Lower maintenance needs than buried pipe options - No easements required - Utilizes fullest potential of Trap Club Project and McHugh improvements	- Little open space remaining, not aesthetic - Weed control in ditches, annual clearing of debris - Safety concern with open ditch and flowing water
Buried Pipe Under Center of Road	- Buried infrastructure creates more open space - Roadway rebuilt to modern county road standards (wider lanes with shoulder)	- Highest Maintenance Needs, Sediment accumulation - High Risk of Plugging and Flooding - Safety concern with debris removal at inlet and need for risky maintenance - Little mitigation provided above design event
Buried Pipe Offset from Center of Road	- Buried infrastructure creates more open space	- Highest Maintenance Needs, Sediment accumulation - High Risk of Plugging and Flooding - Safety concern with debris removal at inlet and need for risky maintenance - Filling existing ditch to just below roadway elevation - Little mitigation provided above design event - Roadway rebuilt to existing conditions (narrow, no shoulder)

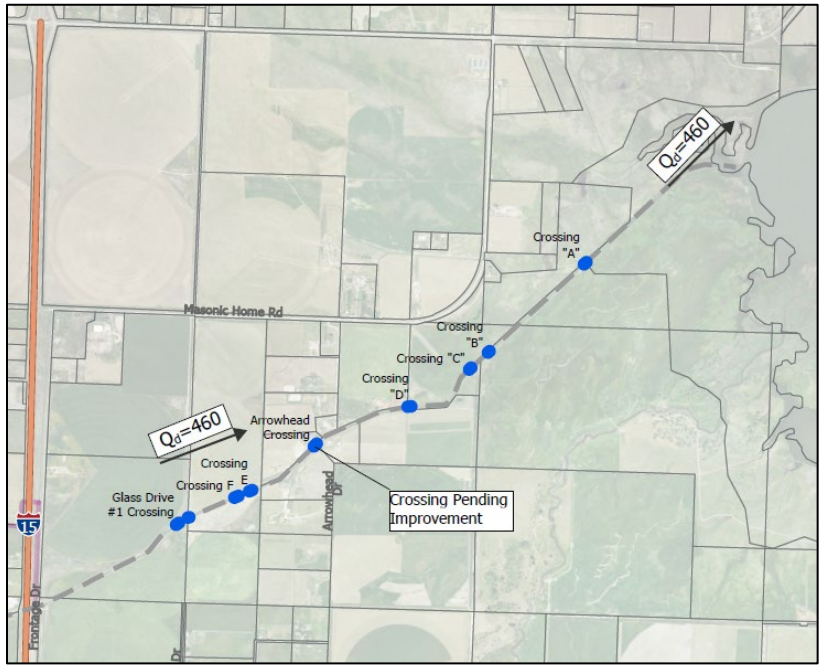
RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

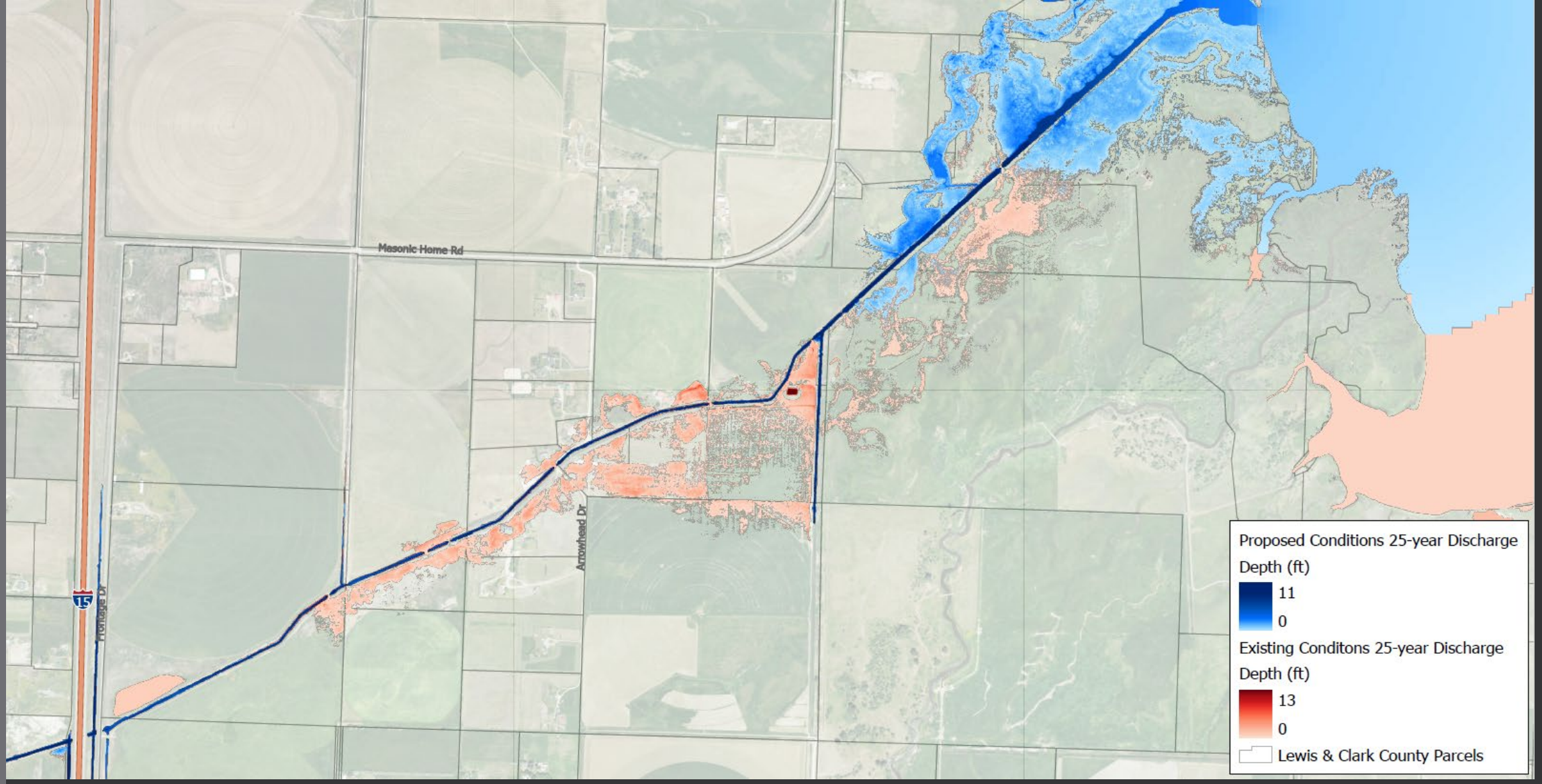
1. Tenmile Creek Capacity Monitoring
   - Develop benchmark survey and annual monitoring plan and begin implementation
   - Compare benchmark survey to USGS 2006 survey, simulate in model, quantify difference in flow spilling into valley, define feasible and effective reaches for maintenance
   - Start discussions with permitting agencies



RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

2. Lower D2 Ditch
   - Start at downstream end of D2 ditch and work up to I-15.

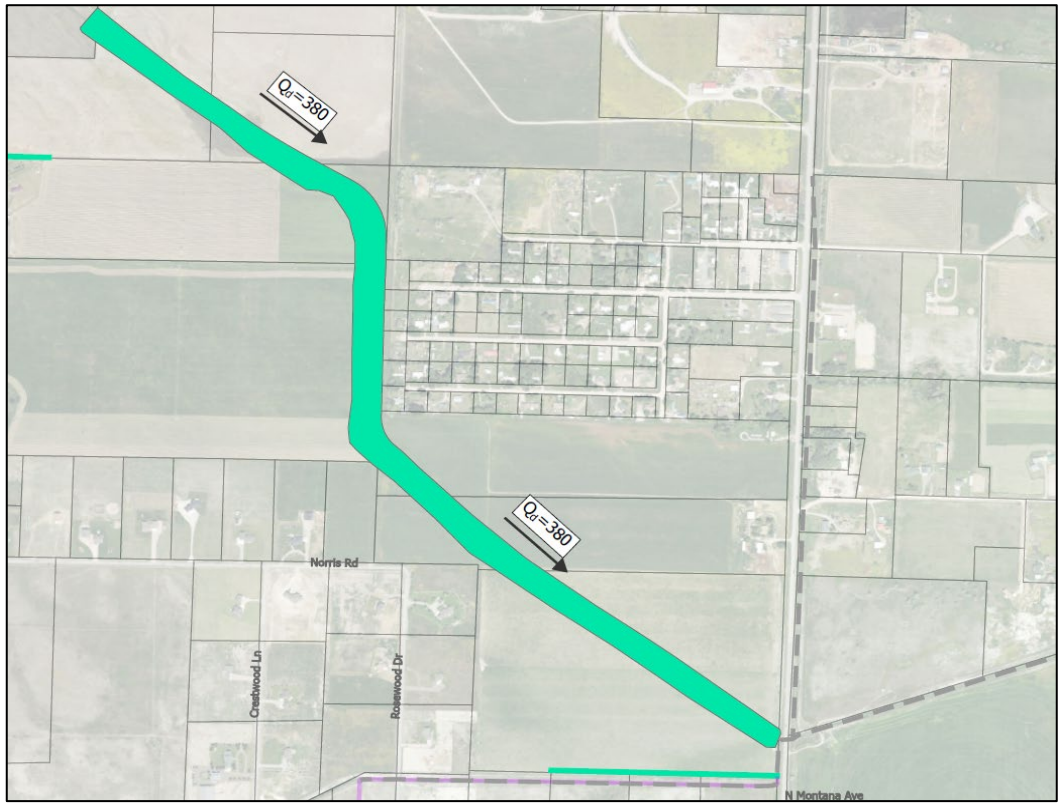




LOWER D2 DITCH
PROPOSED CONDITIONS MODEL RESULTS

RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

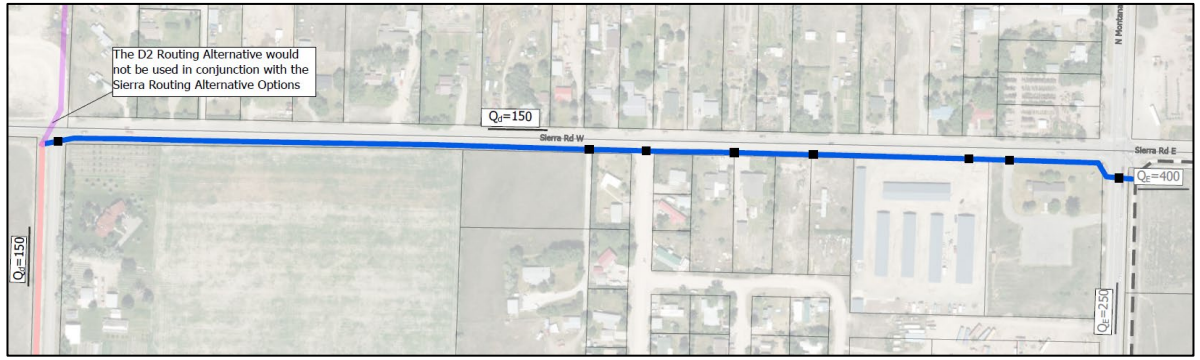
3. Silver Creek – Alternative 1



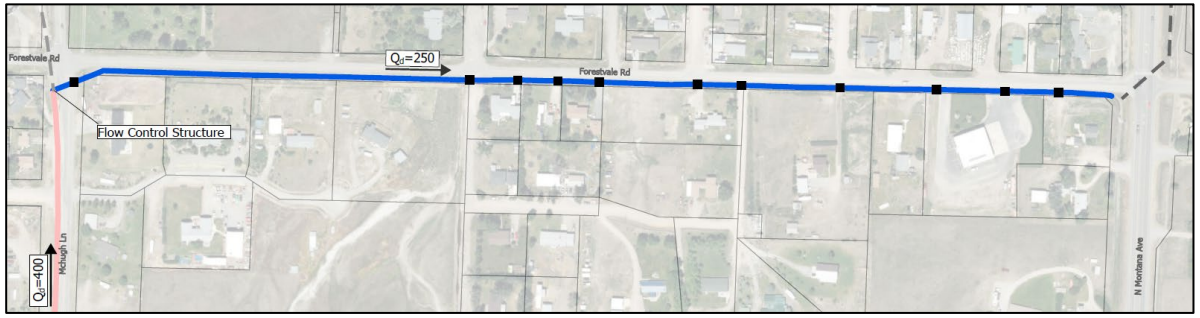
RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

4. Tenmile Overflow

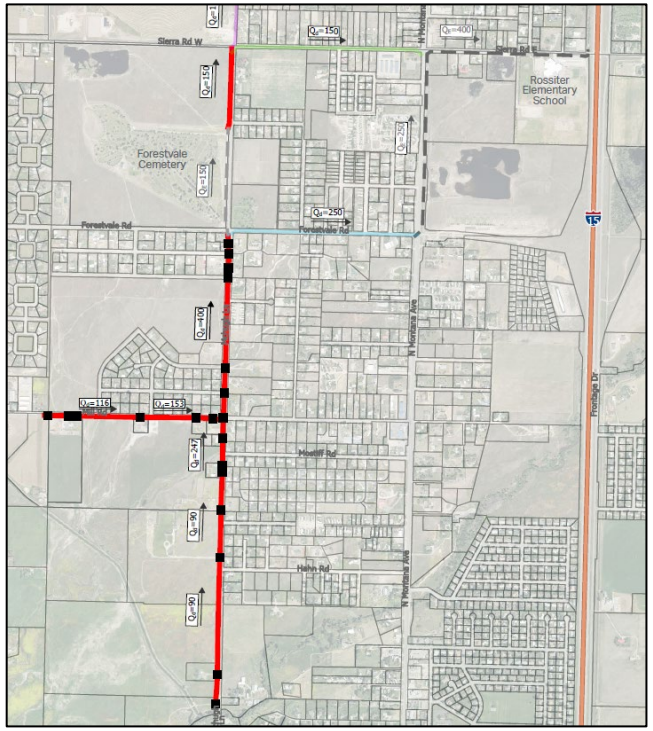
A. Sierra Routing Alternative Option 1

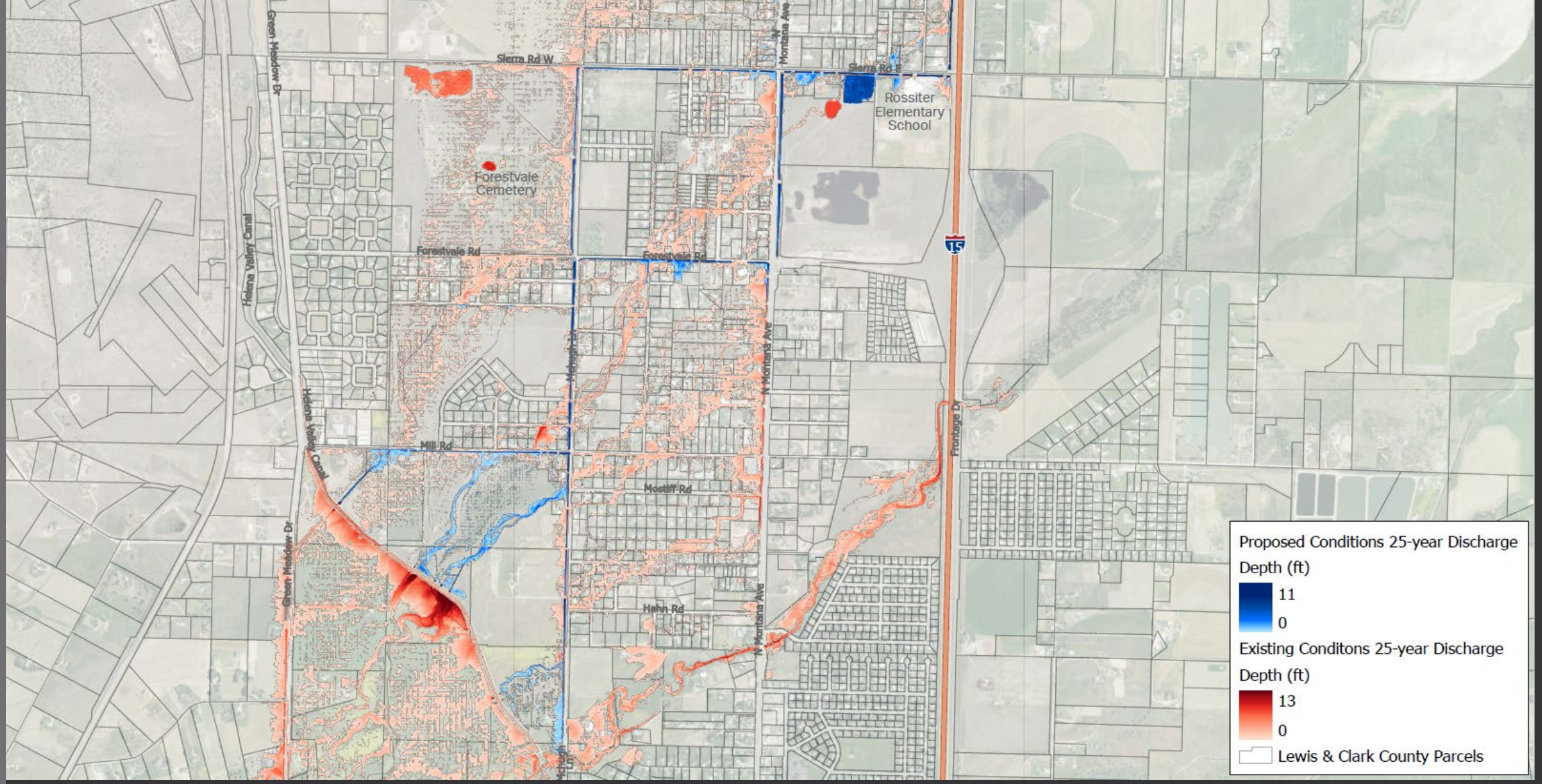


B. Forestvale Baseline Improvements Option 1



C. Baseline Improvements





TENMILE OVERFLOW PROPOSED CONDITIONS MODEL RESULTS

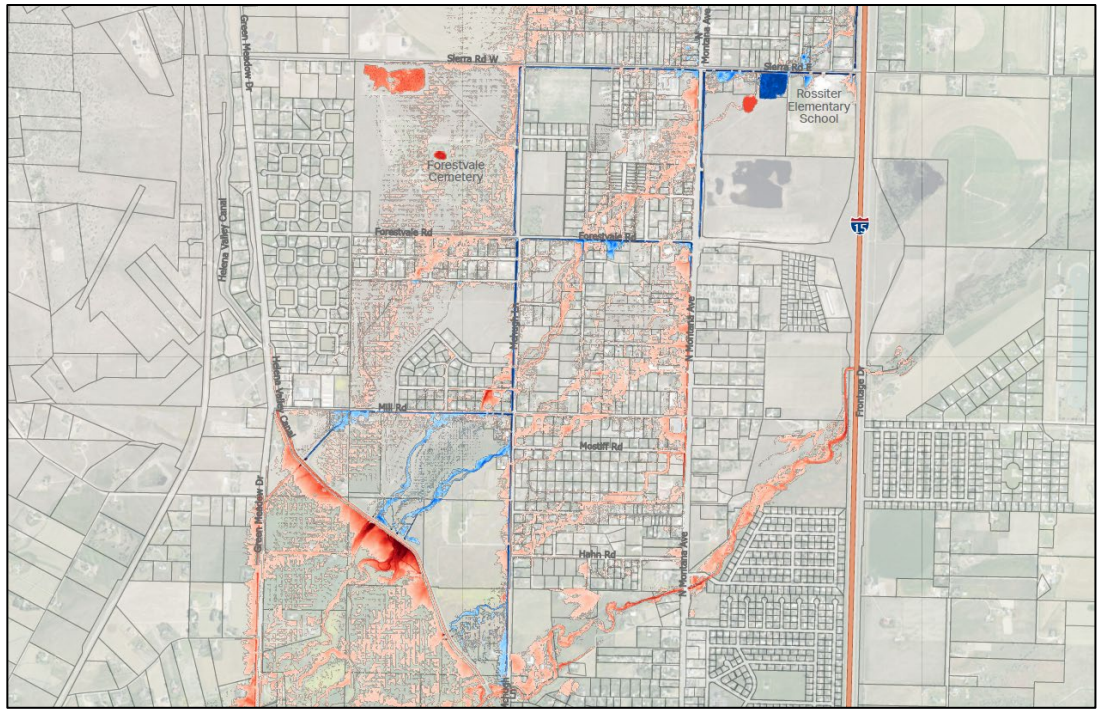
Grant Funding Opportunities

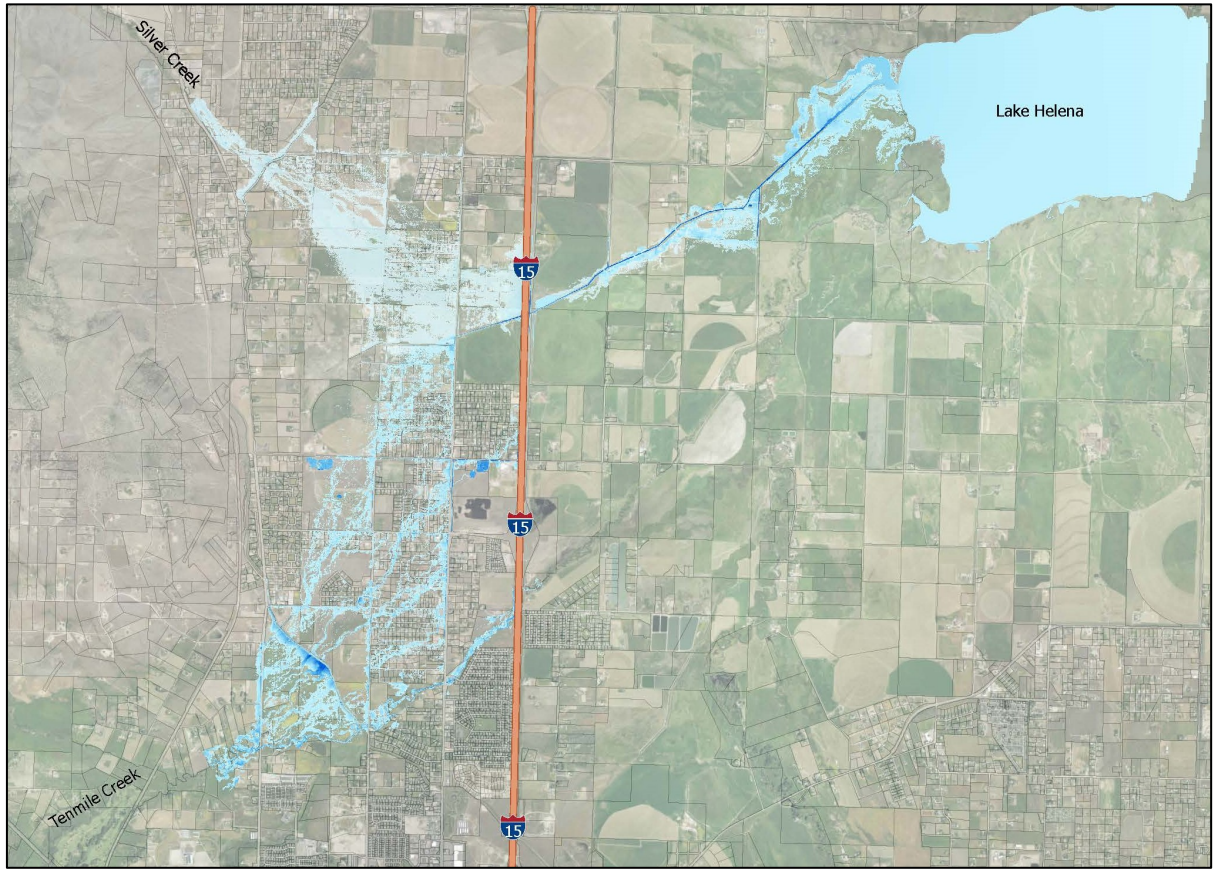
- FEMA HMGP
- FEMA BRIC (formerly called PDM)
- US Infrastructure Bill
- DNRC RRGL
- MT Governor's Budget, Legislation

Next Steps for the Update

- Gather general public comments (January)
  - https://www.surveymonkey.com/r/9Z8MJ6D
  - https://www.lccountymt.gov/des/flood-information/flood-preparedness.html
- Prepare Master Plan Update Report (January/February)

DISCUSSION


Sierra Rd W
Sierra Rd E
Rossiter Elementary School
Forestvale Cemetery
Forestvale Rd
Mill Rd
Mostiff Rd
Hahn Rd
Green Meadow Dr
N Montana Ave
Frontage Dr
15


Silver Creek
Lake Helena
Tenmile Creek
15