FLOOD MITIGATION MASTER PLAN

FOR THE HELENA VALLEY - 2022 UPDATE

FEBRUARY 2022

LEWIS AND CLARK COUNTY

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1.0 INTRODUCTION

Lewis and Clark County (LCC) with the support of RESPEC Inc. has prepared an update to the 2013 Flood Mitigation Master Plan for the Helena Valley (VFMMP) in LCC. The 2022 update to the master plan was deemed necessary to incorporate completed mitigation projects as well as additional data, information, tools developed since the initial master plan. The master plan update will be used to continue guiding mitigation planning for floodwaters of Tenmile Creek and Silver Creek throughout the Helena Valley. The overall planning area is shown in Figure 1-1.

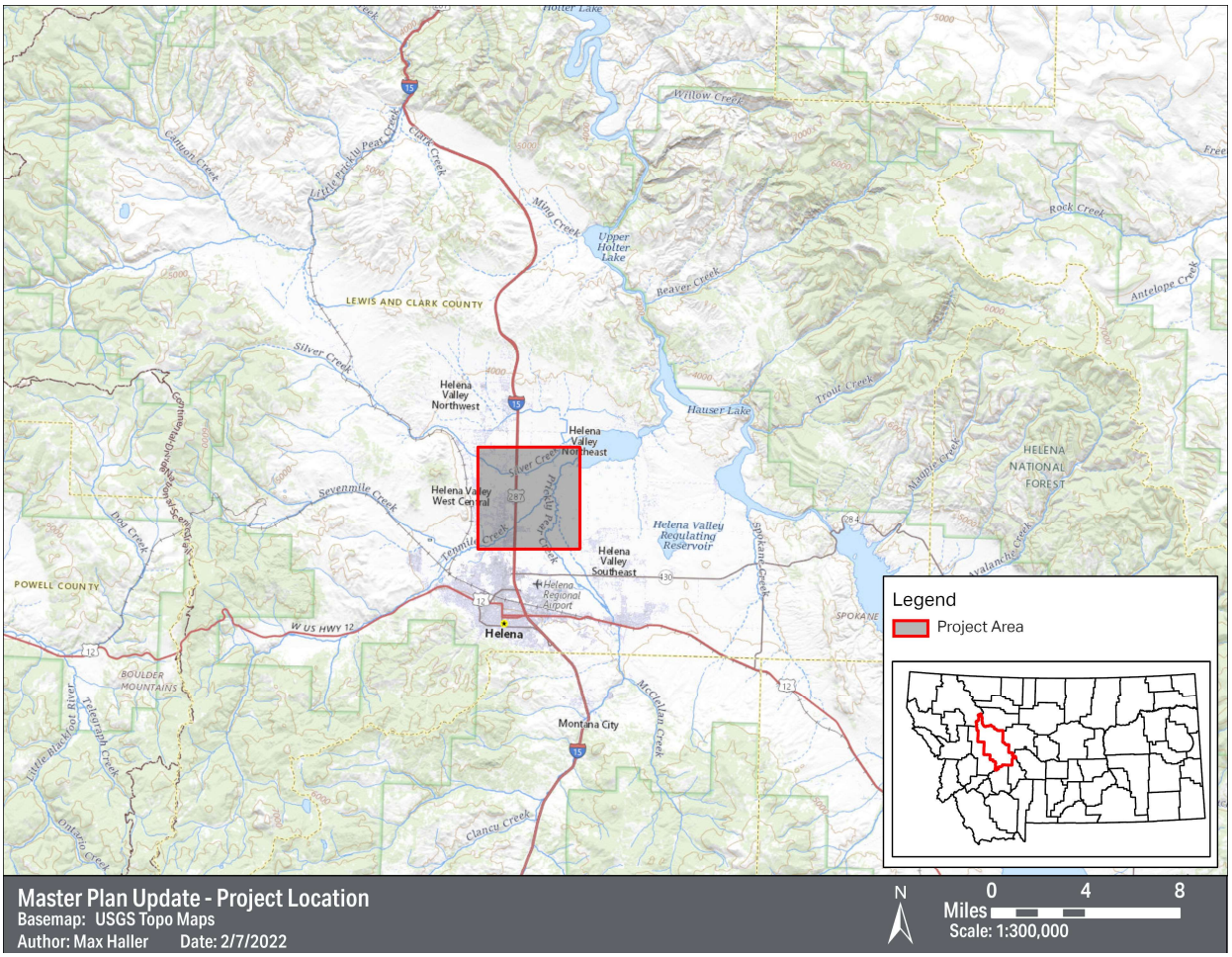


Figure 1-1. Project Location map with the planning area highlighted in (red).

The Helena Valley, herein referred to as the Valley, has a history of flooding with significant flood events in 1964, 1975, 1981, 2011, 2014, and 2018. Flooding is a normal phenomenon primarily due to the nature of both the Silver Creek and Tenmile Creek drainages. Both creeks begin in mountainous drainages and enter the Valley on alluvial fans. Streams through alluvial fans are typically perched channels with low bank heights. As flood stages rise, floodwaters spill from the main channel and can diverge from the primary flow path for appreciable distances. Both Silver Creek and Tenmile Creek show widespread evidence of their primary flow path changing over time. Overbank flooding from both Tenmile Creek and Silver Creek translates to sheet flow flooding throughout the developed Valley, with its direction and quantity primary controlled by the topography, but also influenced by roadways and drainage infrastructure.

The update to the VFMMP aims to mitigate flooding through the Valley by assessing and planning for changing streambed conditions, directing and routing overbank flooding, and sizing and designing adequate flood control infrastructure.

This report provides an overview of the update to the VFMMP, describes the current existing conditions, and summarizes mitigation options, costs, recommendations, and funding options.

1.1 BACKGROUND

Flooding in Helena Valley has been studied several times over the past five decades. Large flood events in 1975, 1981, and the most recent large event in 2011 all triggered flood mitigation investigations. Perhaps the earliest known study was conducted by the Army Corps of Engineers, perhaps in the mid-1960s. Limited information has been located regarding the details of that study.

In 1977, the Lewis and Clark County Commissioners and citizens passed resolutions to create a flood control advisory committee, tasked to develop favorable alternatives for flood control, and to create a flood control district to fund flood control projects.

A flood drainage study for Tenmile Creek was conducted by Morrison-Maierle and published in April, 1982 (Reference 1). That study developed a comprehensive flood drainage plan to reduce future flood losses in the Helena Valley area. Companion studies were also developed for Silver Creek, Eastgate Village/Treasure State Acres, Prickly Pear Creek, and Trout Creek.

In 2006, the United States Geologic Survey (USGS) completed a large-scale flood insurance study of Tenmile Creek, Tenmile Creek Overflow, and Silver Creek (Reference 2). The primary focus of that study was to update the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs). The current effective FIRMs are based on results of that study.

In 2010, PBS&J contracted with Montana Department of Natural Resources and Conservation (DNRC) to conduct a flood re-study of Silver Creek (Reference 3). That study was also focused on updating the FEMA FIRM maps to current conditions.

The 2011 flood event triggered the need for a modern master plan which became the 2013 Flood Mitigation Master Plan for the Helena Valley.

1.1.1 2013 FLOOD MITIGATION MASTER PLAN FOR THE HELENA VALLEY

Following 2011 flooding, LCC contracted with Anderson-Montgomery Consulting Engineers, Inc. (AMCE) in August of 2011 to develop the VFMMP. The goal of the plan was to implement an overall floodwater management system to reduce flooding impacts to residents, businesses, infrastructure and natural resources in the Valley. To develop the plan, AMCE estimated discharges of the 2011 flood event, approximated conveyance capacities of existing hydraulic infrastructure, identified hydraulic restrictions, and developed a list of infrastructure improvement alternatives (Reference 4). The plan has been used to guide flood mitigation in the Valley to-date and should be referenced along with this update. A component of the VFMMP was an application to the FEMA Hazard Mitigation Grant Program (HMGP) for a grant to fund the Trap Club Flood Mitigation Project, which was successful.

1.1.2 2016 TRAP CLUB FLOOD MITIGATION PROJECT

In 2016 LCC contracted with RESPEC to implement flood mitigation projects outlined in the 2013 Master Plan. The Trap Club Flood Mitigation Project included development of a detailed hydrologic and hydraulic analysis

(H&H) as an initial task, herein referred to as the 2017 H&H analysis. The 2017 H&H analysis included two-dimensional models for both Silver Creek and Tenmile Creek. The goal for the detailed analysis was to better understand quantity, timing, and flow patterns throughout the Valley, essential for planning, designing and constructing flood control infrastructure (Reference 5).

The analysis provided a baseline for existing flooding conditions throughout the Valley and has since been used as a foundation for all flood mitigation planning and design. Figure 1-2, taken from the 2017 H&H analysis, depicts two-dimensional hydraulic model results from the analysis.

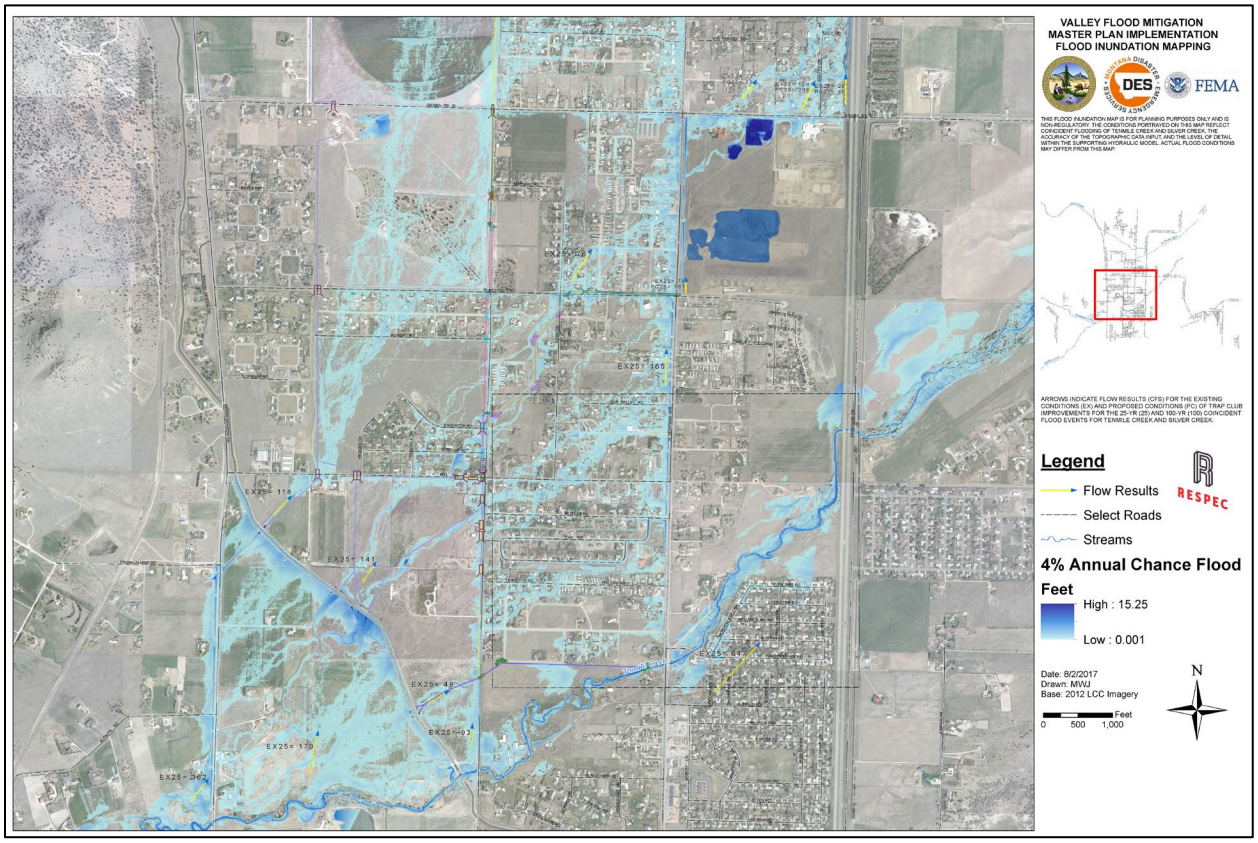


Figure 1-2. Flooding at the 25-year event of existing conditions from the 2017 Hydraulic and Hydrologic analysis.

The Trap Club Flood Mitigation project evolved substantially from the initial HMGP Grant, largely due to the development of the 2017 H&H analysis. The project initially prioritized flood retention project, formalizing the Helena Valley Gun Club (Trap Club) pit into a regional flood detention facility. It was determined that the storage capacity of the pit may limit its effectiveness to significantly reduce flooding. Consequently, the project evolved to focus on conveyance, targeting improvements to drainage infrastructure along Sierra Road and North Montana Avenue.

Upon completion of construction in early 2020, the Trap Club Flood Mitigation project included installation of twelve new reinforced concrete box culverts, a diversion and turnout structure into the Trap Club pit, and roadside ditch enlargement to convey design flows. Design flows were established as the 25-year flood event, with improvements along Sierra Road capable of carrying 400 cfs, while improvements along North Montana Avenue targeted 250 cfs. An overview of the project from the Trap Club Flood Mitigation Project construction plans is shown in Figure 1-3.

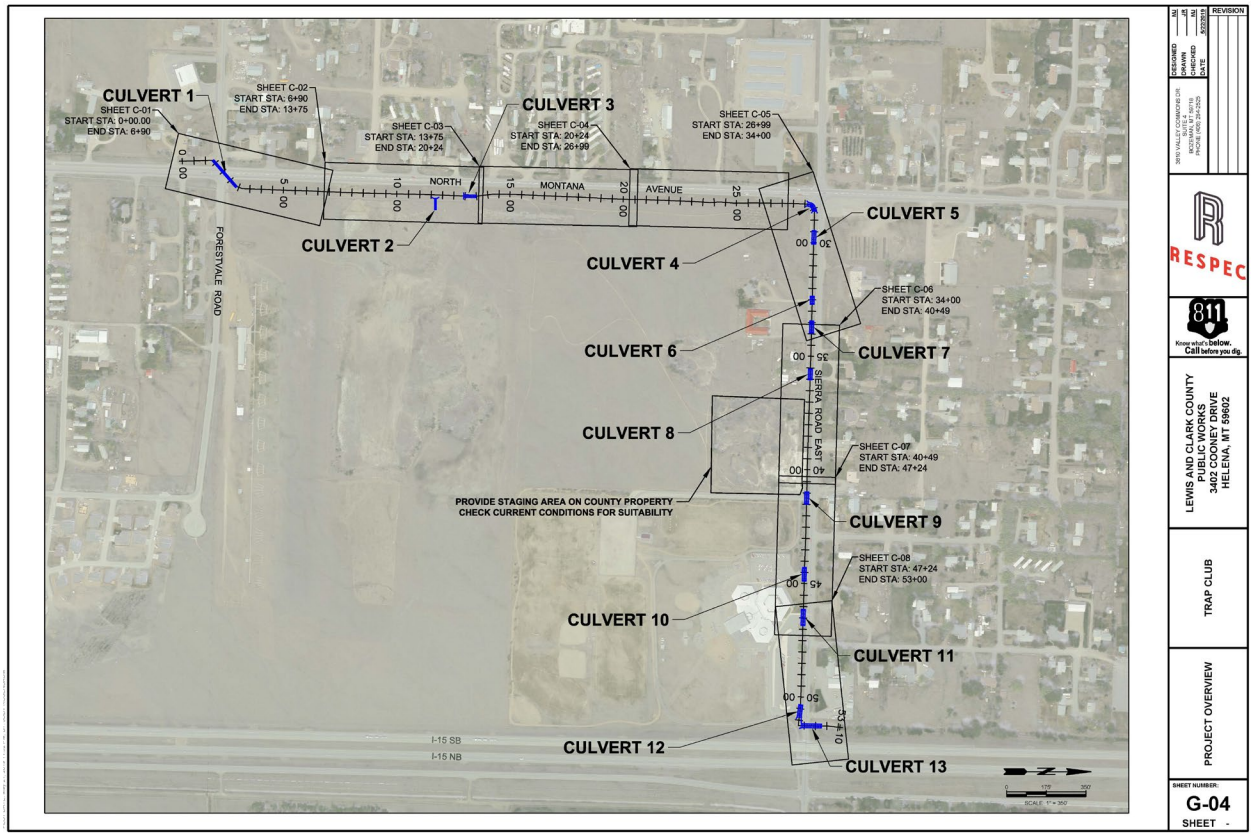


Figure 1-3. Overview of the Trap Club Flood Mitigation project taken from the project's construction plans.

1.1.3 2017 RURAL IMPROVEMENT DISTRICT (RID) ASSESSMENT

In July of 2017 LCC implemented the Helena Valley Flood Mitigation Rural Improvement District (RID). The purpose of the RID is to defray the cost of making flood mitigation improvements through a tax upon benefited properties. The following criteria were used to determine which properties are included in RID:

- Criterion 1: properties that front a proposed improvement;
- Criterion 2: properties that are subject to flooding as indicated by the 1% or .2% annual chance floodplain or floodway;
- Criterion 3: properties that are accessed through roadway(s) subject to flooding as indicated by the 1% or .2% annual chance floodplain or floodway, and do not meet Criteria 1, 2, and 4;
- Criterion 4: properties that are accessed through roadway(s) to be serviced by a proposed improvement and do not meet Criteria 1,2, and 3.

Figure 1-4 depicts the delineation of the RID based on the described criteria.

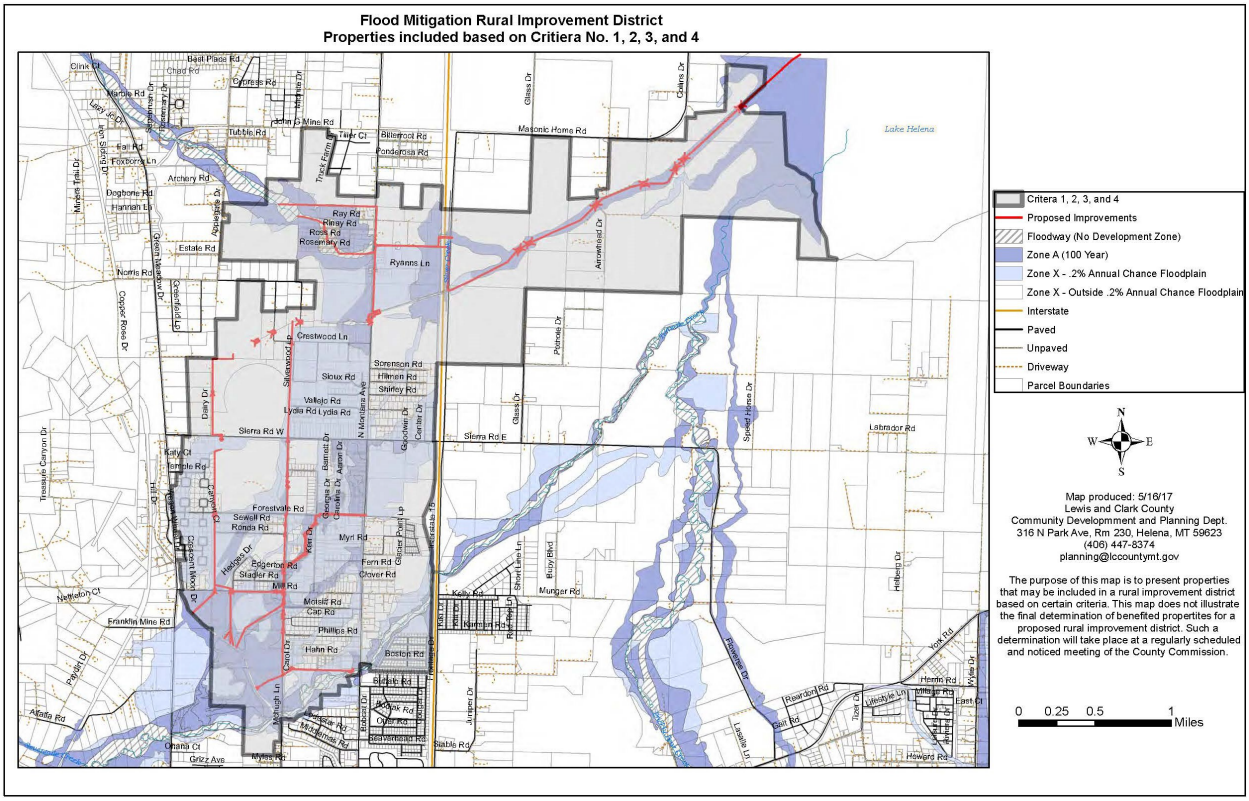


Figure 1-4. LCC Map of the Flood Mitigation Rural Improvement District.

Implementation of the RID consists of collecting revenue through property taxes with Public Works coordinating improvements as ordered by the Commission. The RID funds were imperative to contribute the required 25% local cost share for the Trap Club Flood Mitigation Project.

1.2 PROJECT NEED AND PURPOSE

Need for the update to the VFMMP originated during the Trap Club Flood Mitigation Project. The direction and focus for flood mitigation has shifted. The consensus amongst the community is that the Master Plan should be updated to include the following insights:

- Multiple physical and social constraints were identified while implementing portions of the 2013 Master Plan;
- Development of the valley-wide 2017 hydrologic and hydraulic analysis of flooding in the existing conditions and reviewing those results;
- Discussions amongst public officials, county staff, and valley residents during establishment of a rural improvement district (RID) to fund flood mitigation efforts throughout the valley; and
- Ongoing communications with valley residents to explore viable mitigation alternatives not considered in the 2013 Master Plan.

1.3 UPDATE TO THE VFMMP OVERVIEW

The update to the VFMMP is intended to solidify the path moving forward for flood mitigation in the Valley. Steps for updating the 2013 Master Plan include the following:

- Incorporate results from Valley-wide hydraulic modeling of existing conditions with completed flood mitigation projects including the Trap Club Flood Mitigation Project, flood mitigation work along McHugh Lane, and flood Mitigation work along Forestvale Road;

- Evaluate alternative flood routing scenarios;
- Engage the public officials, county staff, and Valley residents;
- Define, plan, and cost flood mitigation activities moving forward.

1.3.1 EXISTING CONDITIONS UPDATE

As mentioned, several flood mitigation improvements have been implemented across the Valley. To ensure that future planning considers the most current available data, the 2017 hydraulic model was updated to reflect flood mitigation projects on McHugh Lane, Forestvale Road, North Montana Avenue, and Sierra Road. Additionally, the terrain surface in the 2017 hydraulic model was based on 2012 Light Detection and Ranging (LIDAR) data and that surface was updated with 2018 LIDAR data.

The 2017 H&H analysis estimated that during the 25-year flood event at 1,270 cfs enters the spill reach of Tenmile Creek. The spill reach is defined as the section of Tenmile Creek between McHugh Drive and just upstream of Green Meadow Drive. This reach of Tenmile Creek contains a low-lying left bank that is perched relative to the left overbank area. As flood stage rises, floodwaters begin spilling over the left bank of the creek. The quantity of flow leaving is directly related to flood stage, and flood stage in this reach is influenced by channel debris, the capacity of the channel, and constrictions imposed by infrastructure crossings. As flow leaves the main channel, it collects along the upstream embankment of the Helena Valley Irrigation District (HVID) Canal. It was simulated in the hydraulic model that the HVID Canal provides some flood flow attenuation, and approximately 400 cfs is released in the Valley through the various canal underdrains. For the purpose of flood mitigation planning during the Trap Club Flood Mitigation Project, and continued into this update to the Master Plan, a steady state flow rate of 400 cfs was used as the design flow for mitigating Tenmile Creek floodwaters through the Valley.

The 2017 H&H analyses estimated approximately 380 cfs enters the study area of Silver Creek during the 25-year flood event. This flow was used as the design event for mitigating Silver Creek floodwaters through the Valley.

Following the establishment of design flows and the update to existing terrain, the hydraulic models were run and used to guide flood mitigation planning for this update. The existing conditions for the various flood mitigation planning areas are discussed in more detail in Section 2.0.

1.3.2 DEVELOPMENT OF FLOOD MITIGATION ALTERNATIVES

Development of flood mitigation alternatives are based primarily on past studies of flood mitigation planning for the Valley. That information was used in conjunction with results of the updated hydraulic model to further refine mitigation options throughout the Valley. The following regions were identified as focus areas for flood mitigation:

- **Tenmile Creek**, primary focus is the stream from Green Meadow Drive to McHugh Lane;
- **D2 Ditch**, the reach of ditch from North Montana Avenue to Lake Helena;
- **Silver Creek**, stream between Applegate Drive to North Montana Avenue; and
- **Tenmile Overflow**, the area extending from the HVID Canal between Mill Road and McHugh Lane, north-east to the D2 Ditch upstream of I-15.

The following planning areas are depicted in Figure 1-5.

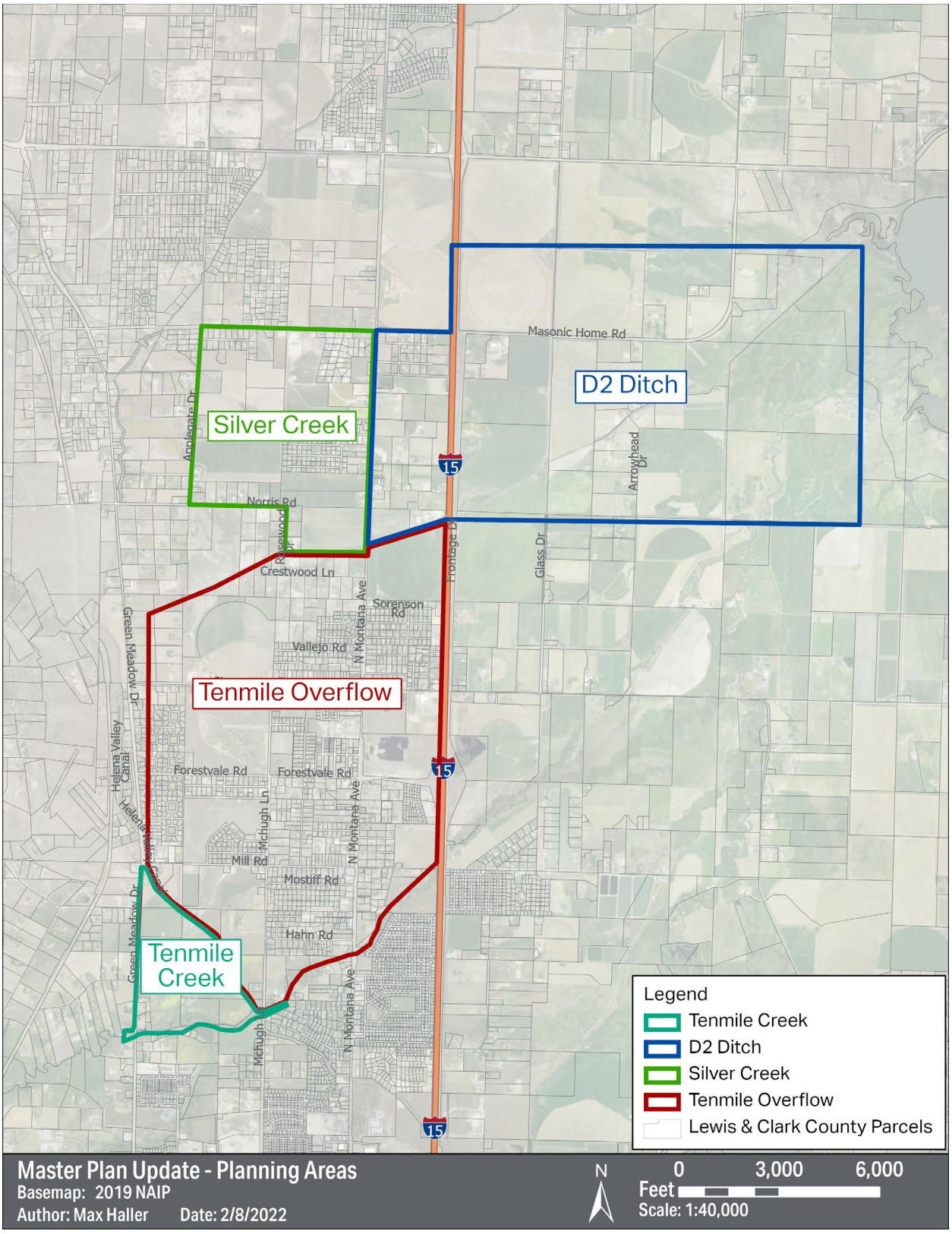


Figure 1-5. Flood mitigation planning areas delineated throughout the Valley.

In each planning area, existing flooding conditions were assessed and subsequently, flood mitigation alternatives were developed. In each planning area, alternatives were developed to completely mitigate the

25-year flood event, minimize need of property easements, minimize environmental impacts, and avoid adverse impacts.

1.3.3 ALTERNATIVES EVALUATION

Alternatives were evaluated based on feasibility and constructability, public safety, effectiveness at mitigating 25-year flooding, cost, maintenance, and overall public benefit. Once quantified, alternatives were presented to the community to garner public feedback to incorporate into the update to the VFMMP.

1.3.4 PUBLIC ENGAGEMENT

1.3.4.1 INITIAL PUBLIC MEETING

An initial public meeting was held July 28, 2020. The meeting was held virtually. The meeting was aimed to engage the public in the discussion and planning for the 2013 Master Plan update. The meeting began with a presentation where the 2013 Master Plan was reviewed and discussed. That review was followed by a discussion of the 2017 H&H modeling developed to support master planning. The meeting closed with discussion and a questions and answer session, and public comments were requested. The presentation and public comments are included in Appendix A.

1.3.4.2 COMMUNITY SURVEY

Following the assessment of existing conditions, an online community survey was advertised to residents living within the RID district and open to anyone. The survey was open from February 5th - February 28th, 2021. Questions were posed to gauge public opinions about the importance of flood mitigation in different areas through the Valley, interest in participating in flood mitigation planning, and how they thought flood mitigation infrastructure should be implemented. Survey results were combined and analyzed and used to assist in the development of flood mitigation alternatives.

Survey results from residents that participated in the survey are attached in Appendix B, comments including any personal information were redacted from the attachment.

1.3.4.3 ALTERNATIVES PUBLIC MEETING

Upon completion of the development and evaluation of flood mitigation alternatives throughout the planning region of the Valley, on January 6, 2022, alternatives were presented to the community. Following the meeting, presentation slides were released, and a two-week period was provided to provide comments. The presentation and public comments are included in Appendix C.

2.0 EXISTING CONDITIONS

Existing conditions were assessed for the four planning areas depicted in Figure 1-5. Conditions were assessed using the updated 2017 hydraulic model results with the mentioned 25-year design discharges for Silver Creek and Tenmile Creek.

2.1 TENMILE CREEK

The reach of Tenmile Creek analyzed in this plan extends from McHugh Lane upstream to Green Meadow Drive. As mentioned, Tenmile Creek begins in the mountains and enters the Valley on an alluvial fan. Alluvial flooding is dynamic by nature, inherent with the establishment of new flow paths, driven by sediment transport processes. Development of infrastructure and confinement of the stream to its current alignment has restricted the dynamic nature of the lower part of the Tenmile Creek Watershed, and confined sediment transport processes to the existing Tenmile Creek channel. Overtime this restriction may have disrupted natural sediment transport processes, impacting the channels capacity. Through observation during flood events and hydraulic modeling of the Valley, it is shown that once Tenmile Creek reaches a defined flood stage near Green Meadow Drive, overbank flooding leaves its primary source and begins flowing northeast into the Valley, with majority of the out of bank flow following an alternative course into Lake Helena. Figure 2-1 shows overbank flooding of Tenmile Creek between Green Meadow Drive and McHugh Lane from the Existing Conditions Model of Tenmile Creek.

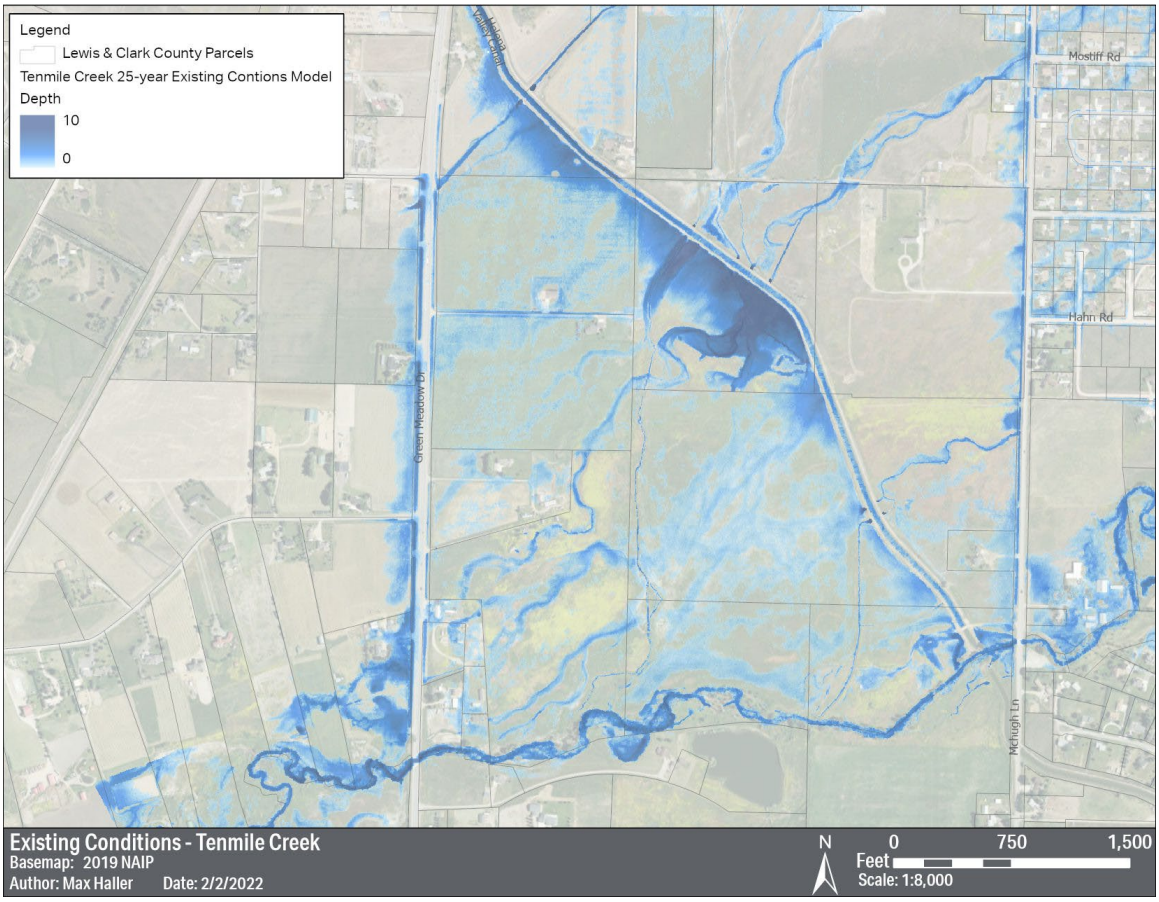


Figure 2-1. Existing Conditions flooding of Tenmile Creek shown from the 25-year Existing Conditions Model.

Since the stage of Tenmile Creek controls the quantity of overbank flooding and subsequentially the quantity of flooding through the Valley, understanding the current and potential conveyance capacity of Tenmile Creek is important for flood mitigation throughout the Valley. Bathymetric survey of Tenmile Creek in the vicinity of Green Meadow Drive and McHugh Lane has not been performed since the early 2000's. Lidar from 2012 and 2018 used in this project indicate that the channel is potentially losing capacity through aggradation but because of the inability for LIDAR to pick up topographic data below the water surface elevation, this indication cannot be confirmed.

Additionally, Lewis and Clark County has been monitoring and removing debris accumulations from Tenmile Creek prior to spring runoff. Large woody debris and other items can obstruct flood flows, increase flood stage, and cause more water to spill into the Valley.

2.2 D2 DITCH

The section of the D2 Ditch, considered for the improvements in the update to the VFMMP extends from Lake Helena to North Montana Avenue. This section of the D2 Ditch acts as a drain to all flooding in the Valley for both Tenmile Creek and Silver Creek. All floodwaters from both Silver Creek and Tenmile Creek convene at the I-15 crossing of the D2 Ditch. The D2 Ditch open channel reaches are capable of conveying floodwaters greater than the 25-year design event but crossings in the ditch are undersized. There are currently 12 crossings in the ditch, 10 of which are undersized. With exception of Arrowhead Drive, all crossings are primarily used for private access and agriculture use. Undersized crossings cause floodwaters from both Tenmile Creek and Silver Creek to backwater and during higher flows, overtop berms along the ditch and flood adjacent properties. Figure 2-2 shows overbank flooding of D2 Ditch downstream of I-15.

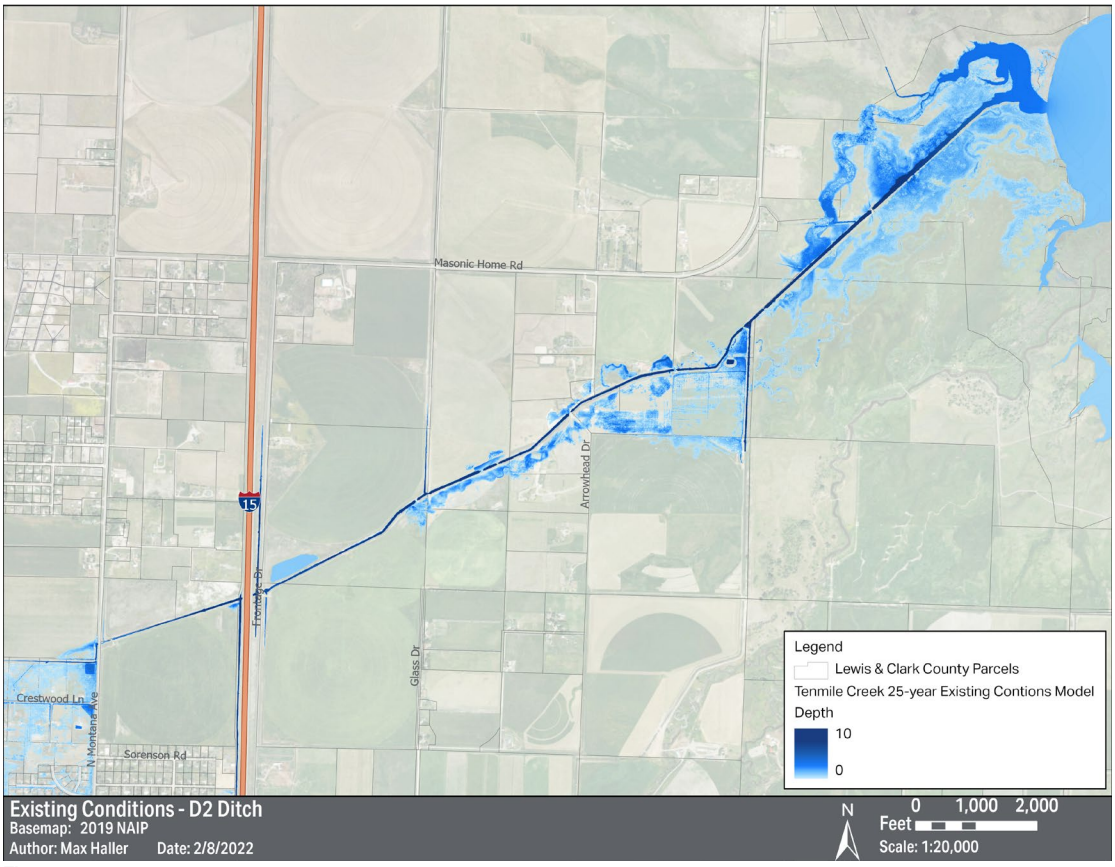


Figure 2-2. Existing Conditions flooding of the D2 Ditch shown from the 25-year Existing Conditions Model.

2.3 SILVER CREEK

Similar to Tenmile Creek, Silver Creek begins in the mountains and enters the Valley on an alluvial fan. Within the study area during the 25-year design event, flooding occurs primary downstream of Applegate Drive. Downstream of Applegate Drive, Silver Creek flows immediately into the Sewell subdivision, flooding the subdivision along with properties adjacent to the subdivision. Silver Creek flows through the subdivision in a small channel, approximately 3-4 feet wide and 2-3 feet deep. The stream channel shows characteristics of an irrigation ditch rather than a natural stream. Estimated capacity is approximately 30 cfs. When flows exceed this amount, flooding occurs throughout the area. Downstream of Sewell Subdivision, North Montana Avenue acts as hydraulic control for Silver Creek floodwaters. Flows bypass North Montana Avenue through two 10'x3' Reinforced Concrete Box (RCB) culverts between Ryanns Lane and Yer Lost Lane and through an 8-foot CMP at the D2 Ditch crossing of North Montana Avenue. At North Montana Avenue flow is spread wide enough across the floodplain that the 3 culverts bypassing North Montana Avenue do not effectively function.

Downstream of North Montana Avenue, a portion of the floodwaters from Silver Creek enter the D2 Ditch and the existing Silver Creek channel while the remaining sheet flow across properties between North Montana Avenue and I-15. At the I-15 embankment, floodwaters backwater again before flowing into the I-15 crossing of the D2 Ditch.

Figure 2-3 shows existing conditions flooding of Silver Creek during the 25-year flood event.

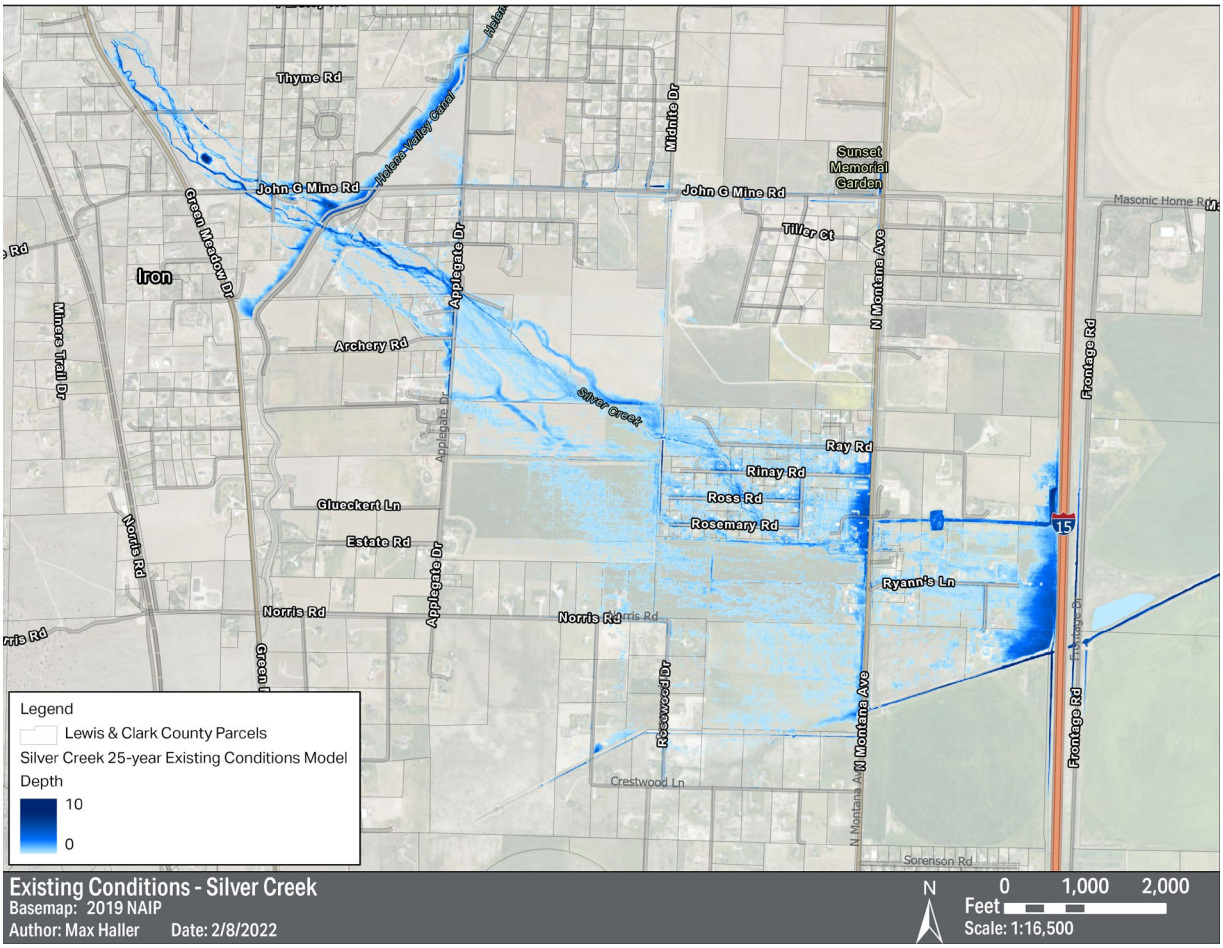


Figure 2-3. Existing conditions flooding of Silver Creek between Applegate Drive and North Montana Avenue from the 25-year Existing Conditions Model.

2.4 TENMILE OVERFLOW

For the purpose of this plan, the Tenmile Overflow area was considered to start immediately downstream of the HVID Canal and extend north to the I-15 crossing of the D2 Ditch. The area includes several flood mitigation projects that have already been implemented including the Trap Club Flood Mitigation Project, ditch and crossing improvements on McHugh Lane near the Forestvale Cemetery, and ditch and crossing Improvements along Forestvale Road between North Montana Avenue and McHugh Lane.

Flooding through the Tenmile Overflow area consists primarily of shallow sheet flow flooding, following the natural gradient of the Valley in the northeast direction. Immediately downstream of the HVID Canal, a series of culverts outlet and floodwaters enter irrigation ditches and historic Tenmile Creek channels. Downstream of HVID Canal culvert outlets, floodwaters intercept Mill Road and McHugh Lane and overtop the respective roads, continuing their path following the natural gradient of the Valley. The theme of floodwaters overtopping roads and continuing on their path continues as floodwaters move in the northeast direction along the natural gradient of the Valley. In the Tenmile Overflow planning area, the I-15 ditch and the D2 Ditch intersection act as the termination point for Tenmile Overflow flooding. Figure 2-4 depicts existing conditions flooding through the Tenmile Overflow area for the 25-year flood event.

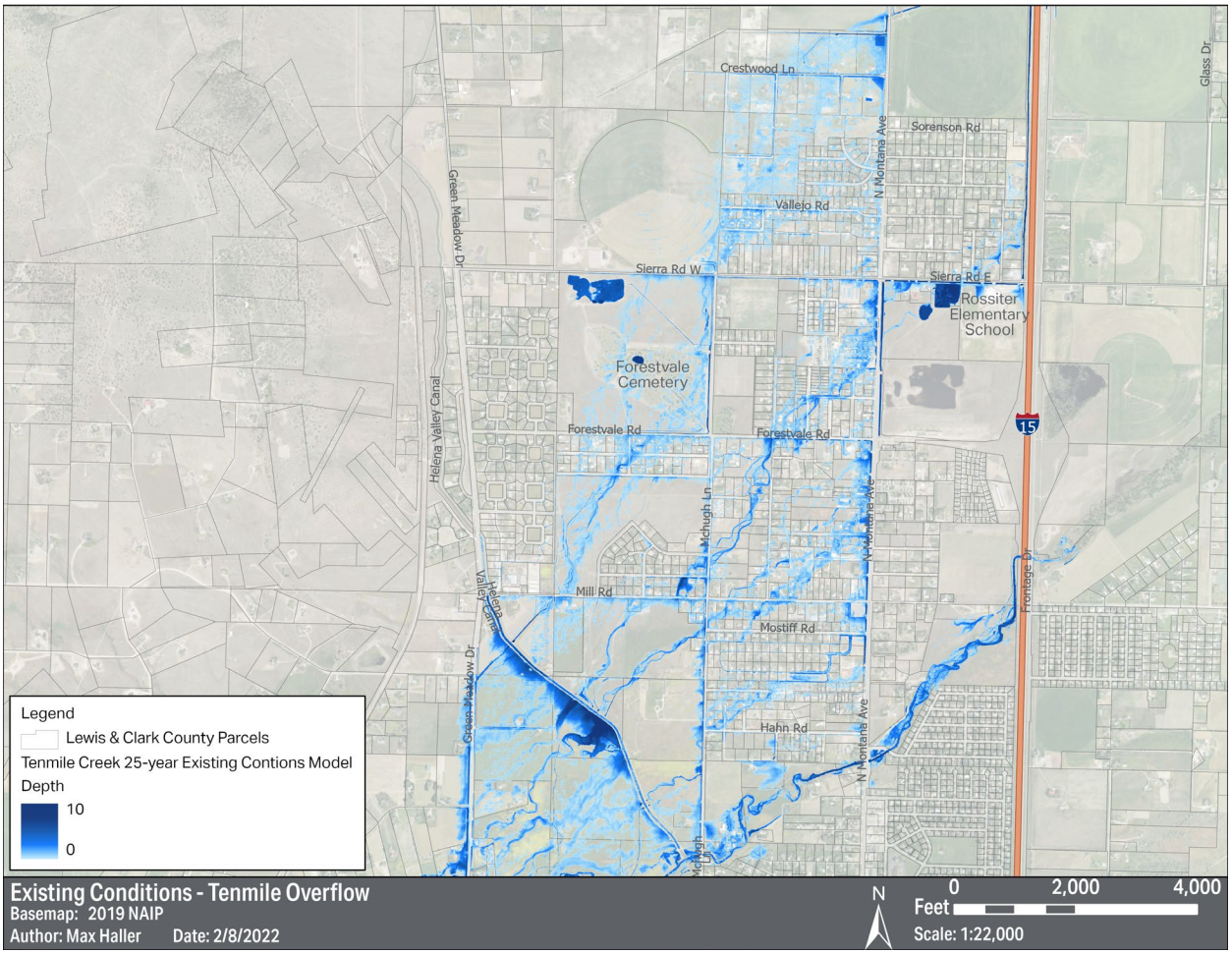


Figure 2-4. Existing conditions flooding of the Tenmile Overflow area from the 25-year Existing Conditions Model.

The Trap Club Flood Mitigation Project, beginning at the intersection of North Montana Avenue and Forestvale Road extends north down North Montana Avenue to Sierra Road, where project improvements then direct

floodwaters east, terminating at the I-15 ditch. Ditches and crossings down North Montana Avenue are capable of conveying 250 cfs. Ditches and crossings down Sierra Road are capable of conveying 400 cfs, the entirety of the 25-year design event. In their existing condition the ditch and crossings along North Montana Avenue are conveying approximately 190 cfs and ditches along Sierra Road are conveying approximately 275 cfs, a portion of their full design capacities. This is due to upstream areas that are still flooding and attenuating flows. The full effectiveness of the Trap Club Flood Mitigation Project will be realized once the Master Plan is fully implemented for the Tenmile Overflow area.

Improvements along Forestvale Road include expanded ditch grading, with 36-inch equivalent arch CMP at crossings. These improvements benefit smaller magnitude floods and local drainage but do not have sufficient capacity to convey the design event.

Improvements along McHugh Lane adjacent to the Forestvale Cemetery consist of substantial ditch increases with 12'x3' aluminum box culverts at crossings. These improvements were calculated to convey approximately 150 cfs. In their current state they are conveying approximately 25 cfs, a fraction of their capacity.

Through the Tenmile Overflow area it is evident that localized improvements only have value if flows are being routed to the improvement areas. Because of the widespread sheet flow flooding inherent to the Valley, for improvements to provide their full mitigation benefit, Valley wide improvements need to be made.

3.0 IMPROVEMENTS OVERVIEW

The following sections provide an overview of flood conveyance improvements and flood conveyance improvement alternatives for Tenmile Creek, the D2 Ditch, Silver Creek, and the Tenmile Overflow area. These alternatives expand upon those presented in the 2013 VFMMP. Detailed quantities and costs for the improvements are included in Appendix D.

3.1 TENMILE CREEK

Tenmile Creek, being the source of flooding through the Tenmile Overflow area and the D2 Ditch, plays an essential role in flood mitigation through the Valley. As mentioned, Lewis and Clark County monitors the reach for debris accumulation prior to spring runoff and should continue doing so in collaboration with relevant local and state agencies. Removal of large debris accumulations will reduce the potential for flow spilling into the Valley.

Also mentioned, large scale flood control projects such as construction of a dam upstream in the watershed or a levee and dredge of Tenmile Creek Channel have been explored in past studies and were determined not cost effective. This is due to the massive implementation cost relative to the cost of damages from these floods. Consequentially, an alternative approach to Tenmile Creek should be considered.

The capacity of Tenmile Creek directly affects the quantity of water that spills into the Valley through this reach. The most recent bathymetric survey in the vicinity of Green Meadow Drive and McHugh Lane was performed by USGS in early 2000's to support the 2006 FIS for Tenmile Creek. Comparison of this survey to more recent LIDAR datasets show that the channel may be aggrading, which would imply more water is able to spill into the Valley for a given flow rate. However, comparing field survey of channel bottom to LiDAR returns is not a definitive method to evaluate bed elevation trends over time. LiDAR is not able to penetrate water, so what may be perceived as aggradation, may actually be reflections off water.

It is generally understood that a wholesale dredging project through this reach of Tenmile Creek is not cost effective, nor supported by regulatory agencies or residents, and is not sustainable due to the infinite supply of sediment from upstream. However, there may be justification for targeted, localized, and specific maintenance efforts to maintain a baseline capacity for Tenmile Creek but even that activity may not be worthwhile.

A sediment maintenance effort may be justified since this stream is no longer able to migrate and create new channels like alluvial fan streams naturally behave over time. However, consideration of such an effort should be based on a definitive understanding of the streambed elevation trend over time. Additionally, since it is well understood that areas of Tenmile Creek downstream of this reach are of limited capacity, care must be taken to not create adverse conditions downstream. The survey collected for the 2006 USGS study may serve as a baseline streambed elevation to target maintenance efforts.

Since current data is not definitive enough to support justification for a sediment cleanout project, an annual streambed monitoring plan should be established to assess streambed elevation trends and understand response to floods. Presentation of annual monitoring data may provide sufficient justification for a sediment cleanout if necessary. The following items should be included in the monitoring plan:

- Repeat field survey of 2006 USGS cross sections at specific locations;
- establishment of a cross section benchmarks at bridges and other key locations in the reach;
- implementation of annual streambed cross section monitoring following spring runoff; and
- assess streambed elevation trends and if supported, develop a Plan of Action for targeted maintenance effort.

In order for sediment maintenance to be effective, the dynamic geomorphic conditions in this reach needs to be fully understood. The 2006 USGS survey provides a defensible baseline for what conditions in Tenmile Creek were at one point and time. Streambed monitoring in strategic locations will aid in determination of whether a sediment maintenance effort is justifiable and worthwhile.

3.2 D2 DITCH

This update to the VFMMP essentially proposes the same improvements to the D2 Ditch as the initial VFMMP. From North Montana Avenue to Lake Helena there are 12 crossings in the D2 Ditch, 10 of which are undersized. As discussed, flood conveyance issues through this area are due to undersized crossings. Upgrading crossings to structures capable of conveying design flows in addition to baseflows in the ditch, resolves overbank flooding issues in the vicinity of the ditch. Additionally, increasing crossing sizes reduces backwater upstream of the ditch. This reduction in backwater improves conveyance through the rest of the Valley, as the D2 Ditch is the drain for the Valley. Figure 3-1 depicts the 10 crossings proposed for upgrades along the D2 Ditch.

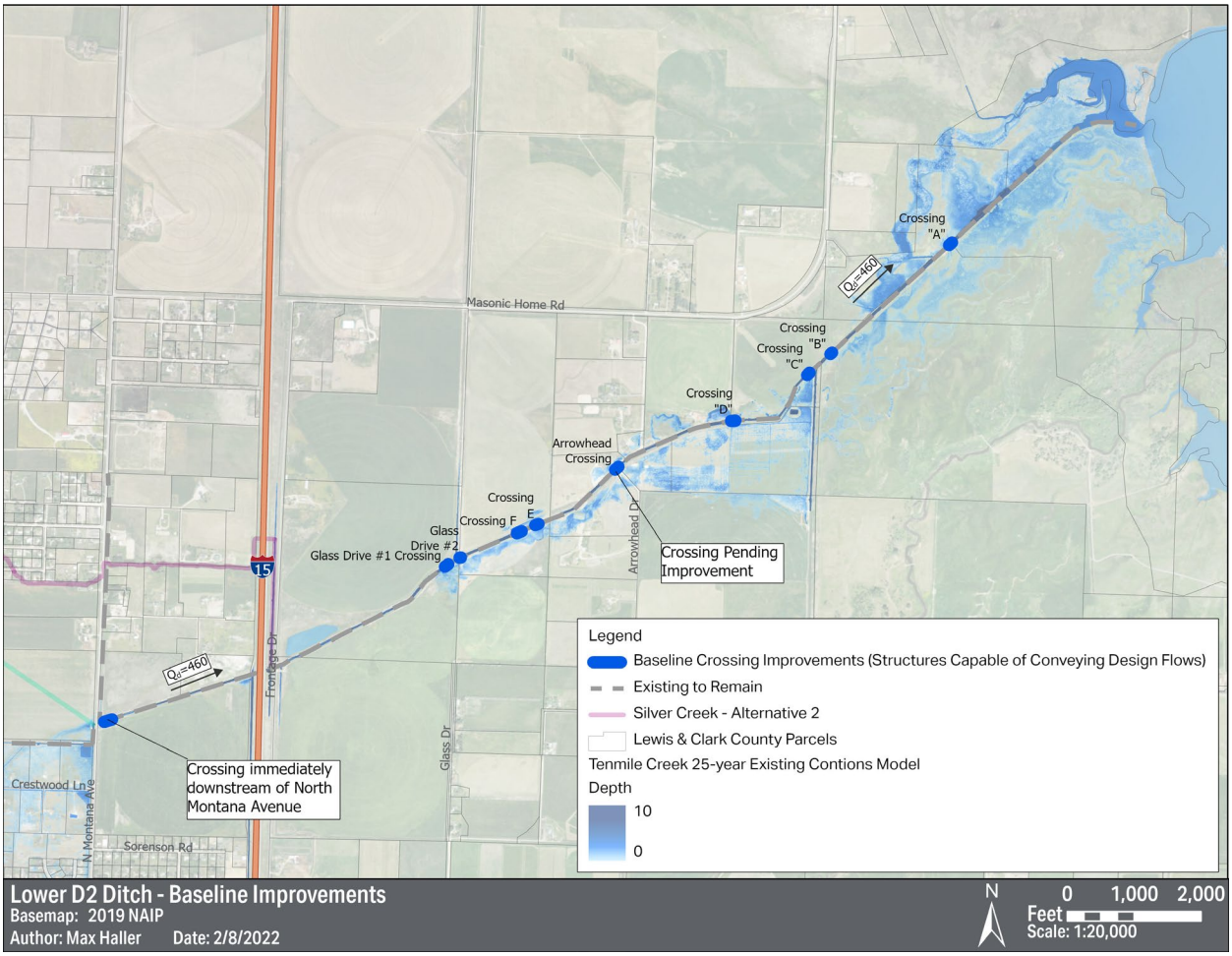


Figure 3-1. Baseline Improvements for the D2 Ditch with the Tenmile Creek Existing Conditions 25-year model results.

As noted in Figure 3-1 the Arrowhead Drive crossing of the ditch, is currently in the process of being replaced with a bridge. Not including the Arrowhead Drive crossing, 9 crossings need to be upgraded throughout the D2 Ditch. Eight of those crossings are downstream of I-15 and should undergo similar upgrades to that of the Arrowhead Drive crossing. The crossing immediately downstream of North Montana Avenue should be replaced with an 8-foot CMP, which matches the North Montana Avenue crossing, and the two crossings immediately downstream at I-15 crossings of the ditch.

Since all crossings except for the Arrowhead Drive crossing are primarily for private access and agricultural use, the county will have to coordinate with landowners to determine the appropriate type of crossing replacement. The Bureau of Reclamation (BOR) holds easements along the D2 Ditch in conjunction with the HVID for irrigation purposes, so coordination with those groups is also required.

Increasing the size of crossings through the D2 Ditch will inevitably increase flow quantity and flow velocity through the ditch. The ditch, used primarily for irrigation purposes contains irrigation infrastructure. Since that infrastructure is not designed for the proposed increase in conveyance, existing irrigation infrastructure will have to be evaluated and potentially replaced as a component of the D2 Ditch improvements.

It should be noted that the community expressed interest in studying future routing paths other than the D2 Ditch for draining floodwaters from the Valley. There are potentially options to route Tenmile Creek floodwaters either back to Tenmile Creek or directly to Lake Helena through alternative paths. Other options

were not explored under this update to the Master Plan but should remain open. A future feasibility study could be developed depending on county and public interest.

3.3 SILVER CREEK

The 2013 VFMMP identified two primary alternatives to mitigate flooding of Silver Creek, with primary focus on the Sewell Subdivision. The two options were to improve existing infrastructure for the current Silver Creek alignment, or intercept flood flows and route around Sewell. It has been determined that upgrading existing infrastructure through Sewell is not a feasible option due to physical space limitations and necessity of property buyouts. Consequently, this update focused on development of routing options.

Two alternatives are considered for routing Silver Creek floodwaters between Applegate Drive and North Montana Avenue. Both alternatives propose capturing floodwaters immediately downstream of Applegate Drive, and then routing waters to the D2 Ditch at North Montana Avenue. Additionally, both alternatives only route floodwaters from Silver Creek, the baseflow in Silver Creek remains in the channel flowing through Sewell Subdivision regardless of any proposed improvements.

3.3.1 ALTERNATIVE 1

Alternative 1 is compromised generally of large-scale, simple earthwork to collect and divert floodwaters away from structures through undeveloped areas, while maintaining the existing agriculture land use. The project targets a cross-sectional cut and fill balance approach. Project components include flow redirection grading, flow diversion embankments, and flood control easements for these developments on private properties.

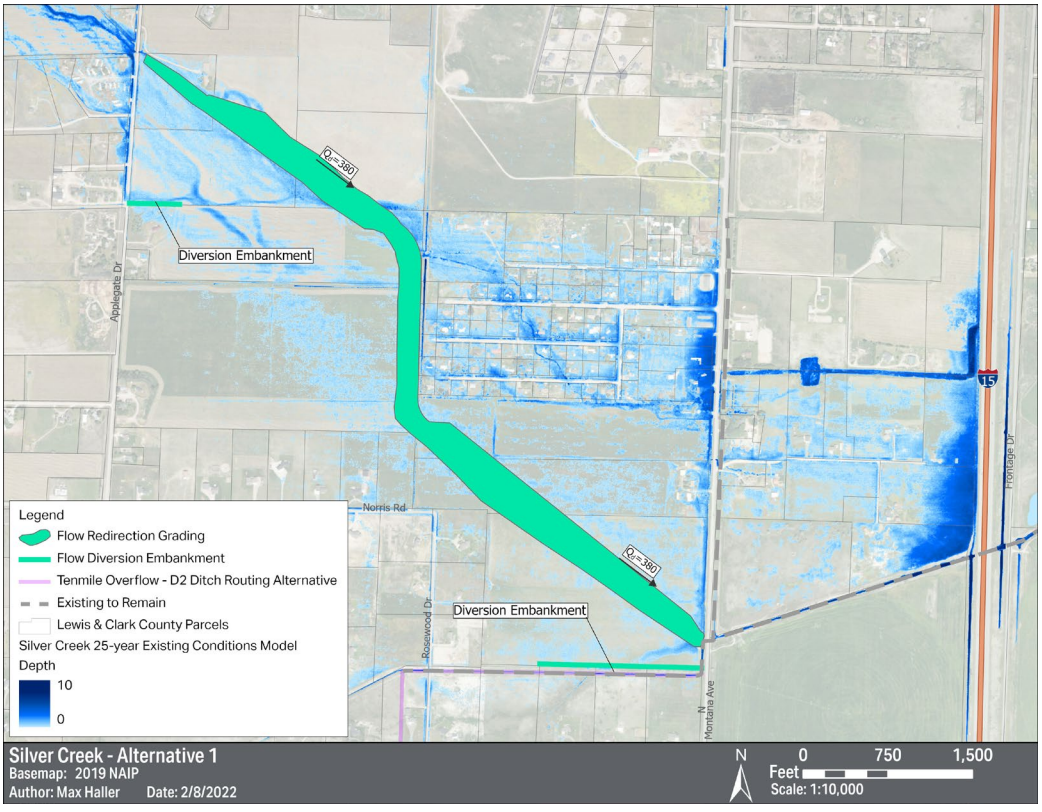


Figure 3-2 depicts the overall layout of the alternative and Figure 3-3 shows the grading details for the redirection grading and diversion embankments.

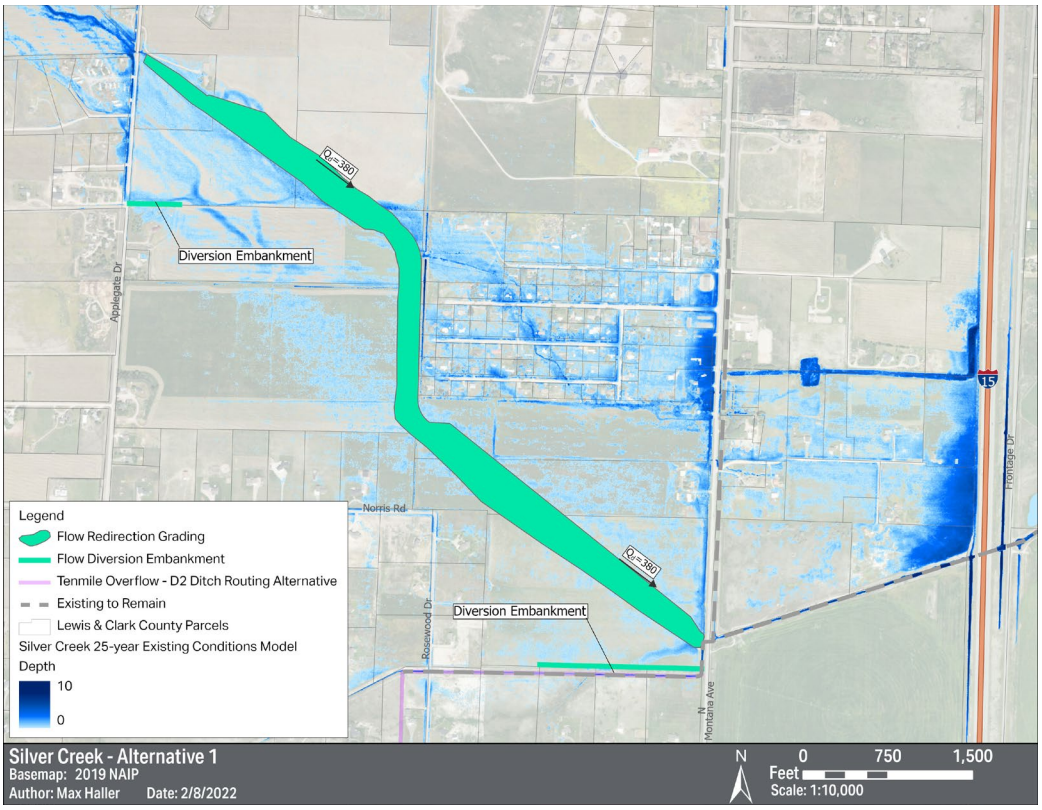


Figure 3-2. Silver Creek Alternative 1 Improvements with the Existing Conditions 25-year model results.

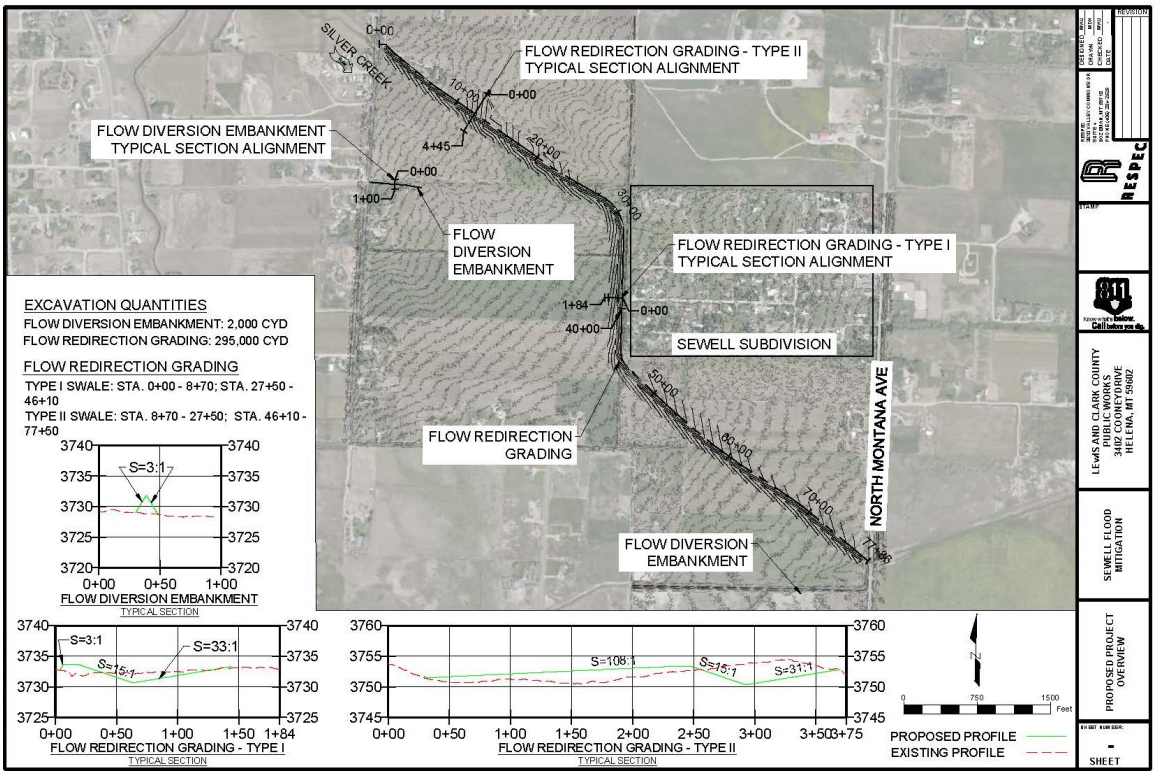


Figure 3-3. Silver Creek Alternative1 flow redirection and diversion embankment grading details.

The project extends between Applegate Drive for the upstream limit and North Montana Avenue for the downstream limit. Beginning at the upstream project extent, the Type II Flow Redirection Grading, depicted in

Figure 3-3, will create a natural floodplain and restore a baseflow channel for Silver Creek. Silver Creek is currently ditched and perched above the surrounding topography causing it to spread. The grading work was designed to allow the existing agriculture land-use to prevail once the work is complete. Type II will extend to the west limit of Sewell Subdivision, where the project reach turns to a north-south orientation, and Silver Creek baseflow channel enters the Sewell Subdivision. The north-south oriented reach will use a Type I design section that reduces the footprint of the elevated berm portion of the section, while allowing the existing agricultural land use to prevail throughout the remainder of the cross section. As the project turns into a southeast trajectory, the Type II section resumes.

Two flow diversion embankments are proposed to direct floodwaters away from existing developments. The embankments are elevated 3 feet above existing ground elevation and will be constructed with 3:1 side slope with compacted structural fill. The embankments are not intended to be certified levee structures that provide flood protection during the 1% annual chance event but rather provide protection during more frequent events of lesser magnitude.

Coordination and participation of landowners is critical to the feasibility of this alternative. The project routes through private properties so flood control easements will be required. The terms of the easements will be identical for each property and will impose an easement to set aside the area defined for the project for flood mitigation. Additionally, this alternative discharges into the D2 Ditch where all irrigation infrastructure downstream would need to be evaluated and potentially upgraded to withstand design flows. The BOR holds easements along the D2 Ditch in conjunction with the HVID for irrigation purposes, so coordination with those groups is also required.

3.3.2 ALTERNATIVE 2

Alternative 2 proposes routing floodwaters from Silver Creek east around the north side of Sewell Subdivision. Similar to Alternative 1, subtle floodplain grading captures floodwaters from Silver Creek downstream of Applegate Drive. Upstream of Sewell Subdivision, subtle grading diverts floodwaters into a ditch directing them eastward to North Montana Avenue, where they cross to the east side of North Montana Ave into an existing irrigation ditch. The irrigation ditch connects to the D2 Ditch immediately downstream of the D2 Ditch crossing of North Montana Avenue.

In its existing condition, the ditch needs improvements to convey design flows. Improvements consist of sediment and debris cleanout and potentially grading on the east bank of the ditch, ensuring that additional floodwaters do not impact landowners adjacent to the ditch. Additionally, all of the crossings and irrigation infrastructure in the existing irrigation ditches would need to be evaluated and potentially upgraded to withstand design flows. Figure 3-4 shows the overall layout of the alternative.

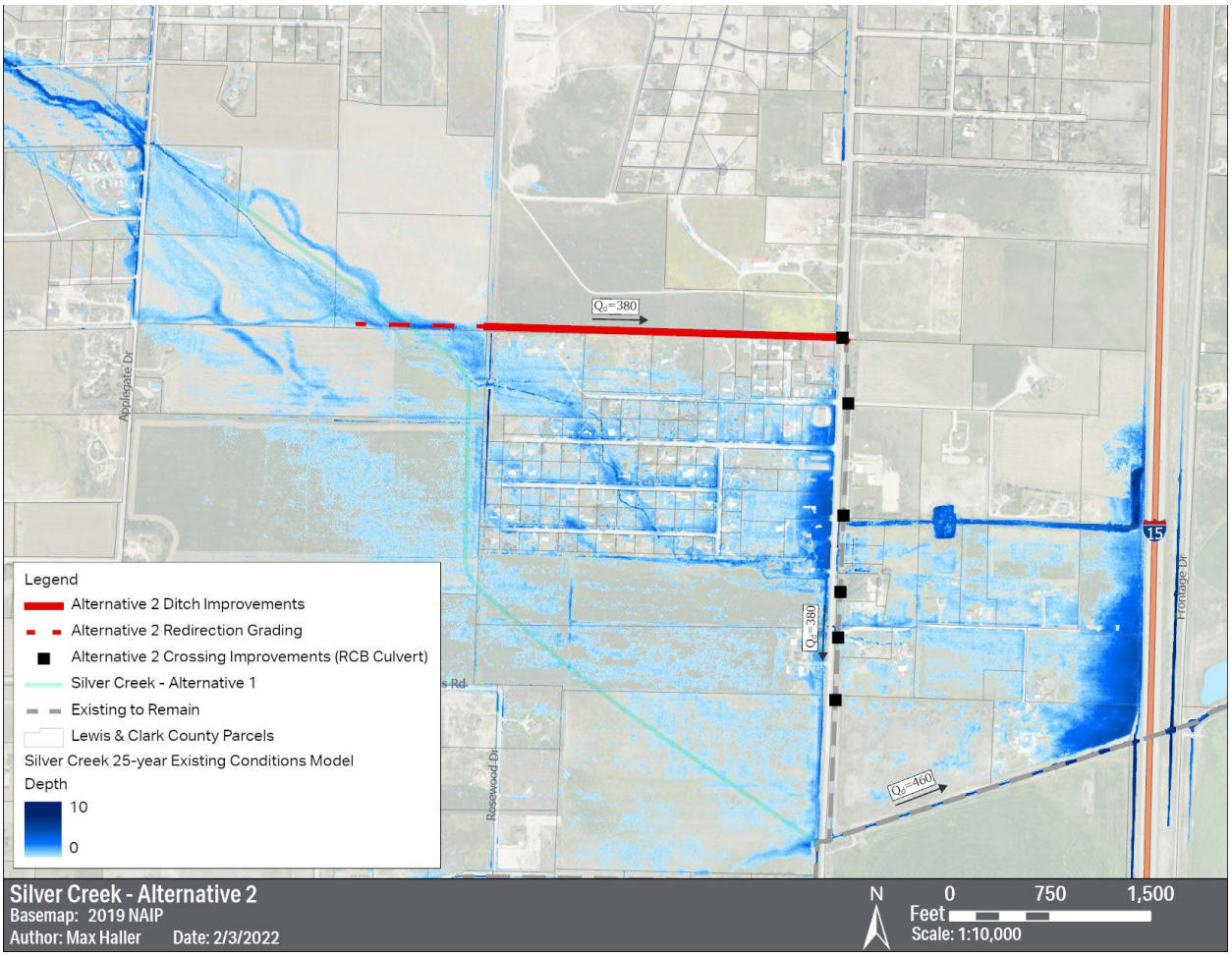


Figure 3-4. Silver Creek Alternative 2 Improvements with the Existing Conditions 25-year model results.

Grading to capture flows from Silver Creek take a similar form to the Type II flow redirection grading discussed in Alternative 1. This includes creating a natural cultivatable floodplain while restoring a baseflow channel for Silver Creek.

The ditch along the north side of Sewell Subdivision will have 4:1 (H:V) vegetated side slopes. The ditch will have a 5-foot depth and a 10-foot bottom width. The culvert crossing at North Montana Avenue will be a 16'x4' RCB culvert. Culvert replacements in the existing irrigation ditch will be double 6'x6' RCB culverts or large CMP culverts capable of conveying design flows in addition to the ditches baseflow.

As described for Alternative 1, coordination and participation of landowners is critical to the feasibility of this alternative. The project routes through private properties so flood control easements will be required. The terms of the easements will be identical for each property and will impose an easement to set aside the area defined for the project for flood mitigation. Additionally, the BOR holds easements along the D2 Ditch in conjunction with the HVID for irrigation purposes, so coordination with those groups is also required. It should also be noted that improvements made around North Montana Avenue fall within Montana Department of Transportation (MDT) Right of Way, where any work done in this area requires coordination with MDT Systems Impacts.

3.4 TENMILE OVERFLOW

3.4.1 IMPROVEMENTS OVERVIEW

There are many similarities in the update to the VFMMP for routing options of Tenmile Overflow floodwaters through the valley and some differences. As mentioned, there is less emphasis on storage in this update and some routing options are not included. The primary focus for this update to the VFMMP is to refine options based on results of the H&H modeling, as well as feasibility and constructability.

Due to the complexity of the existing flood network and proposed flood routing alternatives through the Tenmile Overflow area, the area was partitioned into four improvement areas. The four improvement areas include the following:

- **Baseline Improvements**: designed to convey the entire design flow, 400 cfs, from the HVID Canal to the Intersection of Forestvale Road and McHugh Lane and additionally, 150 cfs to the intersection of Sierra Rd and McHugh Lane;
- **Forestvale Baseline Improvement Options**: designed to convey 250 cfs from the intersection of Forestvale Road and McHugh Lane to the intersection of Forestvale Road and North Montana Avenue;
- **Sierra Routing Alternative Options**: designed to convey 150 cfs from the intersection of Sierra Road and McHugh Lane to the intersection of Sierra Road and North Montana Avenue; and
- **D2 Routing Alternative**: alternative to the Sierra Routing Alternative, designed to convey150 cfs from the intersection of Sierra Road and McHugh Lane, north to the D2 Ditch.

These improvement areas are shown in Figure 3-5 and described in detail in the following sections.

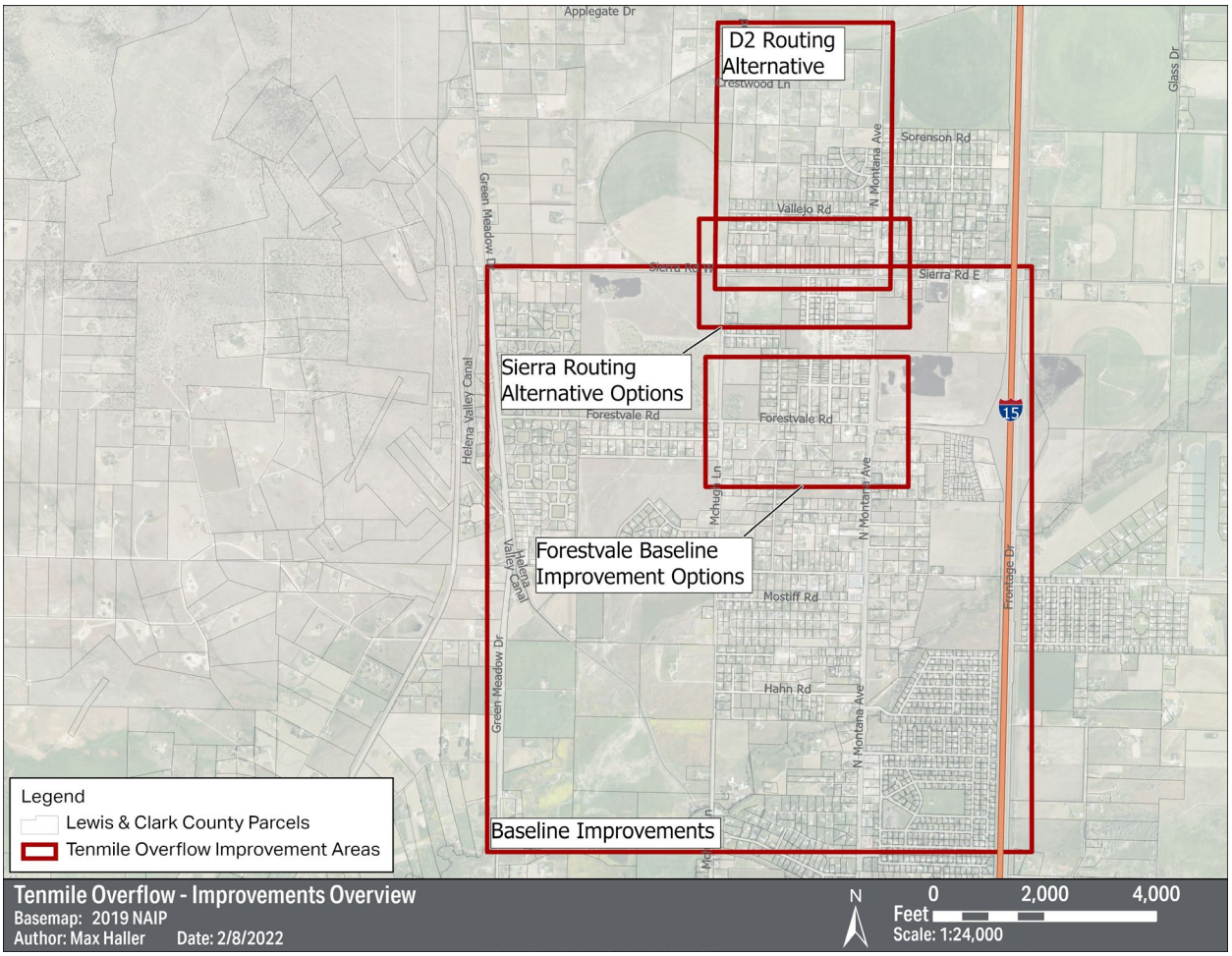


Figure 3-5. Tenmile Overflow improvement areas.

3.4.2 BASELINE IMPROVEMENTS

Baseline Improvements, determined to be necessary with all Tenmile Overflow improvements, are intended to capture floodwaters downstream of the HVID Canal and direct them to logical points of diversion. Improvements begin near the McHugh Lane crossing of Tenmile Creek and near the Mill Road crossing of the HVID Canal. Along both roads, improvements intercept floodwaters that would otherwise overtop the respective roads and divert them to the intersection of McHugh Lane and Mill Road. From the intersection, improvements direct floodwaters north along the west side of McHugh Lane to the intersection of Forestvale Road and McHugh Lane. At the intersection 250 cfs will be diverted down Forestvale Road and the remaining 150 cfs will continue on the west side of McHugh Lane, north through the existing improvements at the Forestvale Cemetery. At the northern edge of the Forestvale Cemetery's property boundary, the existing improvements end. As a part of the Baseline Improvements, a ditch capable of conveying 150 cfs continues north connecting the existing improvements at the cemetery to the intersection of Sierra Road and McHugh Lane.

The described routing path is depicted in Figure 3-6 and is described in detail by road in the following sections.

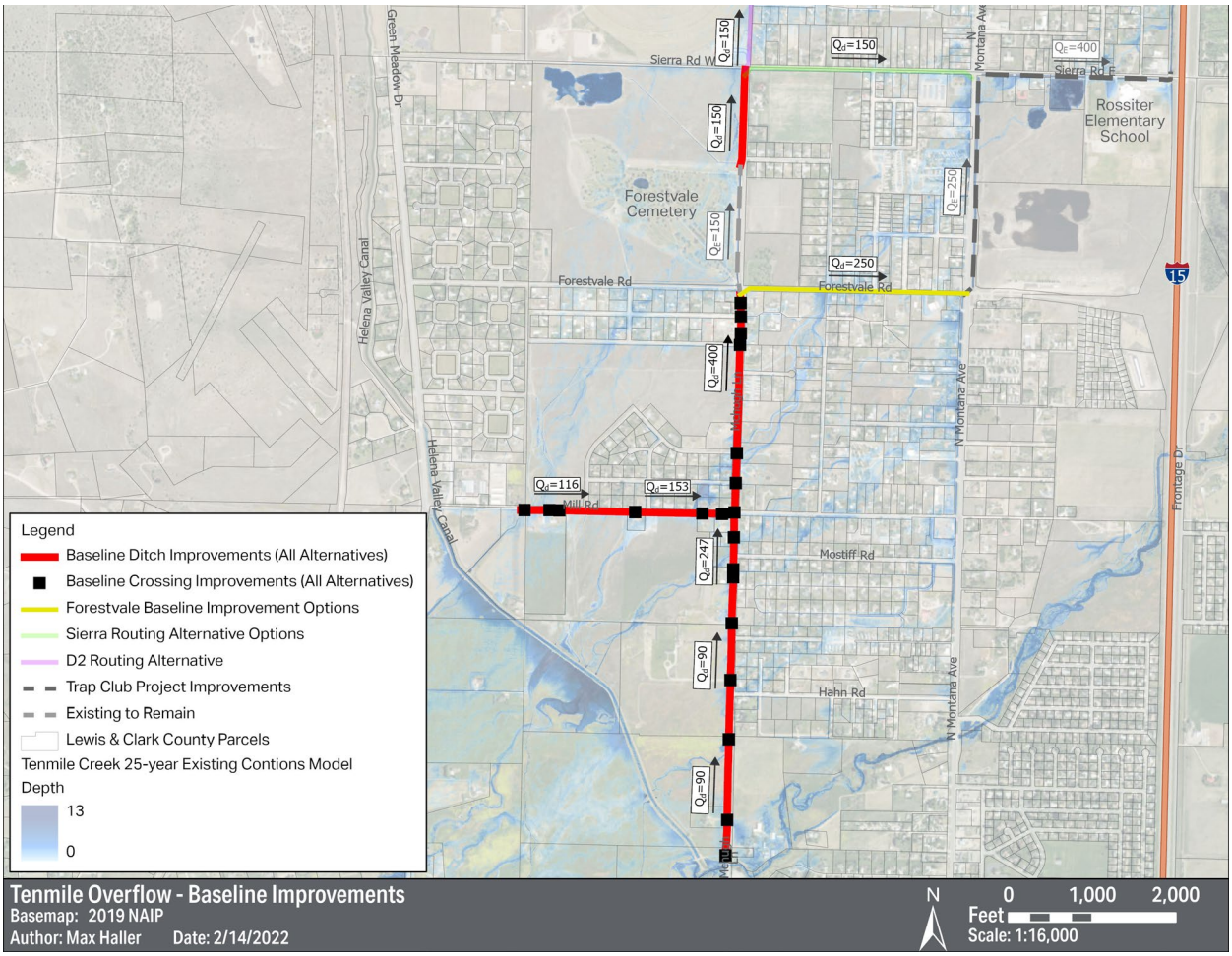


Figure 3-6. Baseline Improvements Overview.

3.4.2.1 MILL ROAD AND MCHUGH SOUTH OF MILL ROAD

As mentioned, Mill Road and McHugh Lane intercept floodwaters downstream of the HVID Canal. At Mill Road, two major flow paths cross the road as shown in Figure 3-7. At the west end of Mill Road, the first major flow path conveying 116 cfs meets the road. Approximately 1,400 feet downstream, an additional 37 cfs intersects the road, combining to 153 cfs as the ditch approaches McHugh Lane. In the existing condition, these flows overtop Mill Road and continue through the Valley. Proposed improvements will intercept floodwaters at Mill Road and direct them east, to the intersection of Mill Road and McHugh Lane.

South of Mill Road, three major flow paths intersect McHugh Lane. The first spills out upstream of the McHugh Lane crossing of Tenmile Creek, conveying approximately 90 cfs. The second and third flow paths cross McHugh Lane just upstream of Hahn Road and adjacent to Mostiff Road respectively. Proposed improvements intend to intercept floodwaters and prevent them from overtopping McHugh Lane. When flows that overtop McHugh Lane in the existing condition are directed north to the intersection, floodwaters in the McHugh Lane ditch will combine to 247 cfs at the intersection of McHugh Lane and Mill Road.

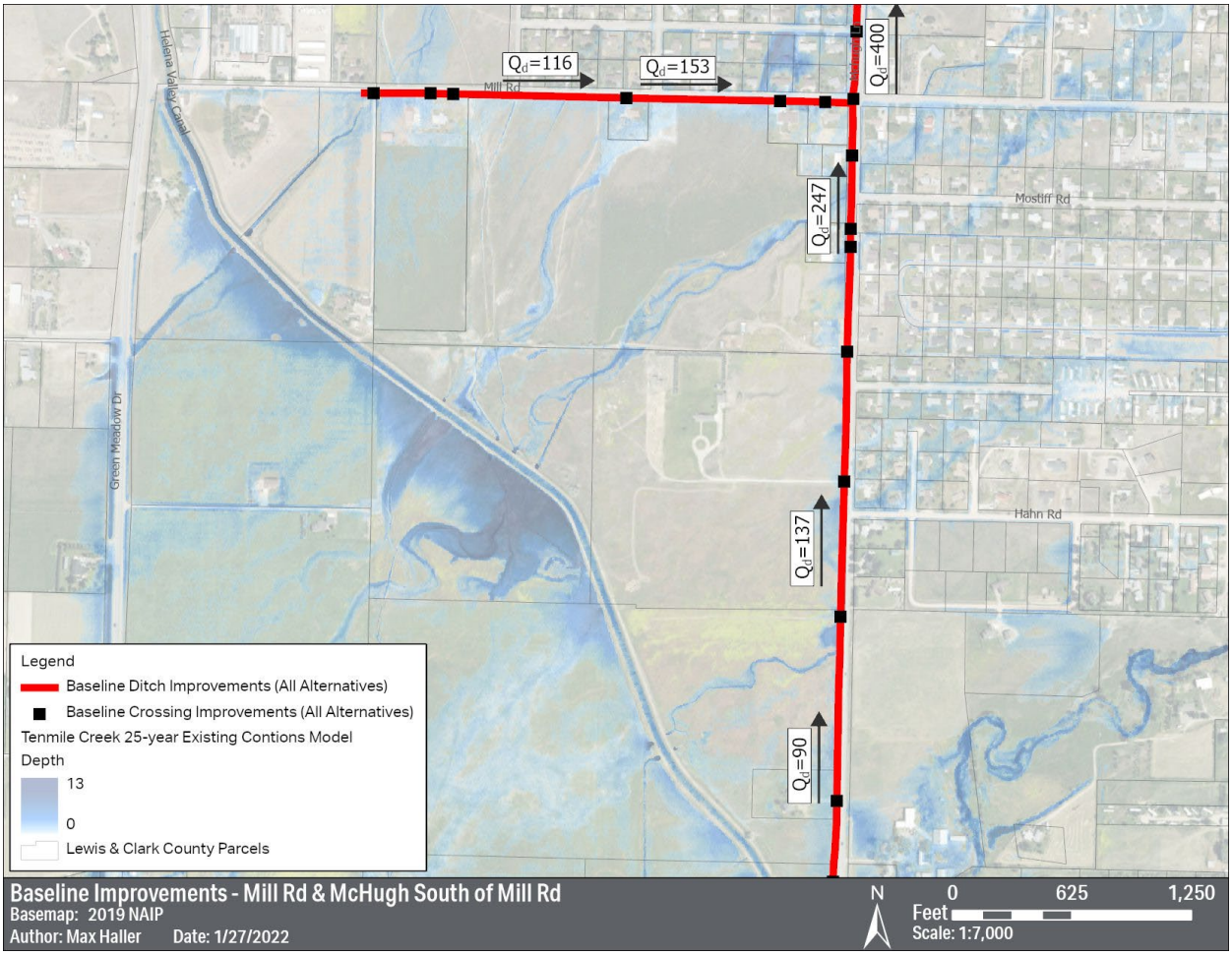


Figure 3-7. Baseline Improvements zoomed in on Mill Road and McHugh Lane with the Existing Conditions 25-year model results.

Improvements along both Mill Road and McHugh Lane consist of trapezoidal ditches and RCB culverts, increasing in size as they approach the intersection.

The ditch along Mill Road will have a 2:1 (H:V) riprap side slope adjacent to the road and a 3:1 (H:V) vegetated side slope on the opposing side. The ditch will be 4 feet in depth and will have a bottom width of 6 feet. Culverts at the upstream end of the ditch, sized for 116 cfs, will be 8'x3' RCB culverts. As additional flows enter the ditch, culvert size will increase to 12'x3' RCB culverts.

Right of Way (R.O.W) for Mill Road was interpolated from R.O.W on Mill Road east of McHugh Lane and was assumed to be 60 feet in width. From the R.O.W interpolation, the roadside ditches fit within the edge of Mill Road and existing R.O.W but this will need to be verified in final design. Steep side slopes adjacent to Mill Road will necessitate guardrail along the length of the ditch. Typical sections depicting existing conditions and ditch and crossing improvements for Mill Road are shown respectively in Figure 3-8 and Figure 3-9.

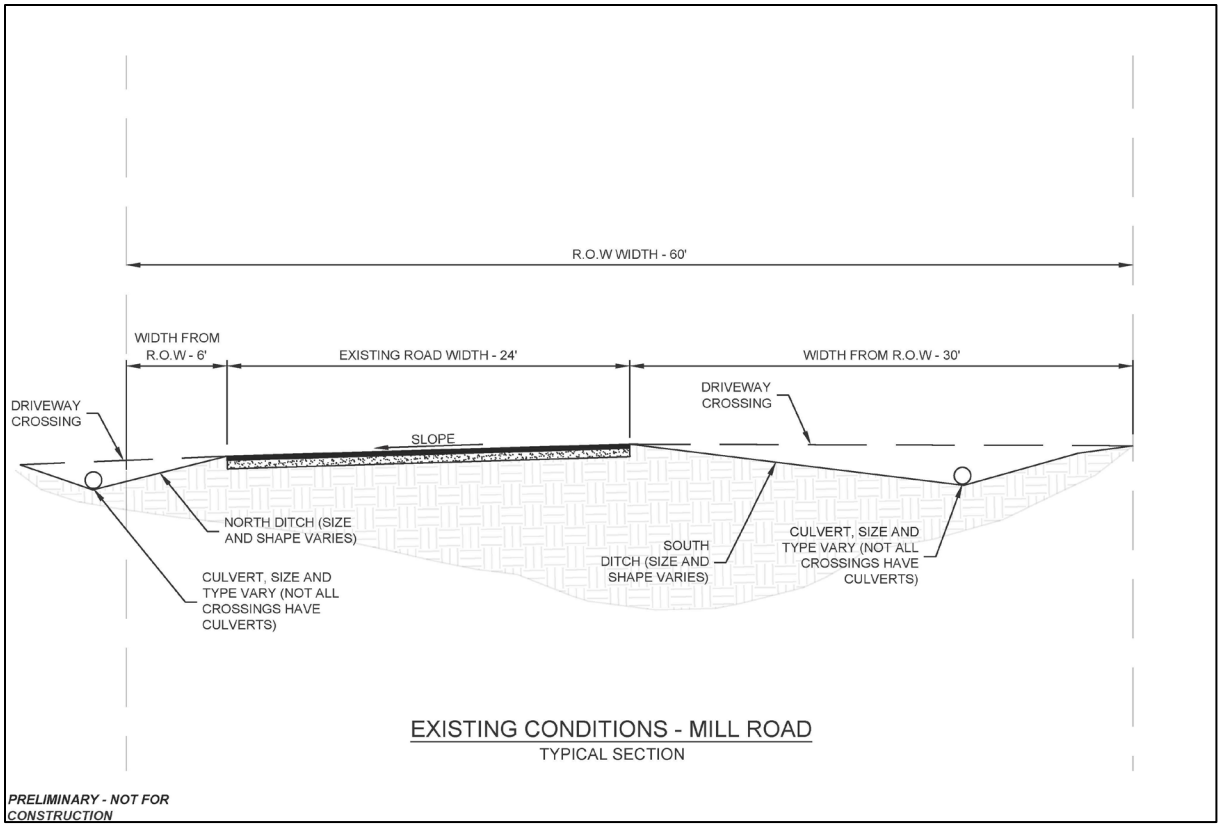


Figure 3-8. Typical section depicting the existing conditions of Mill Road.

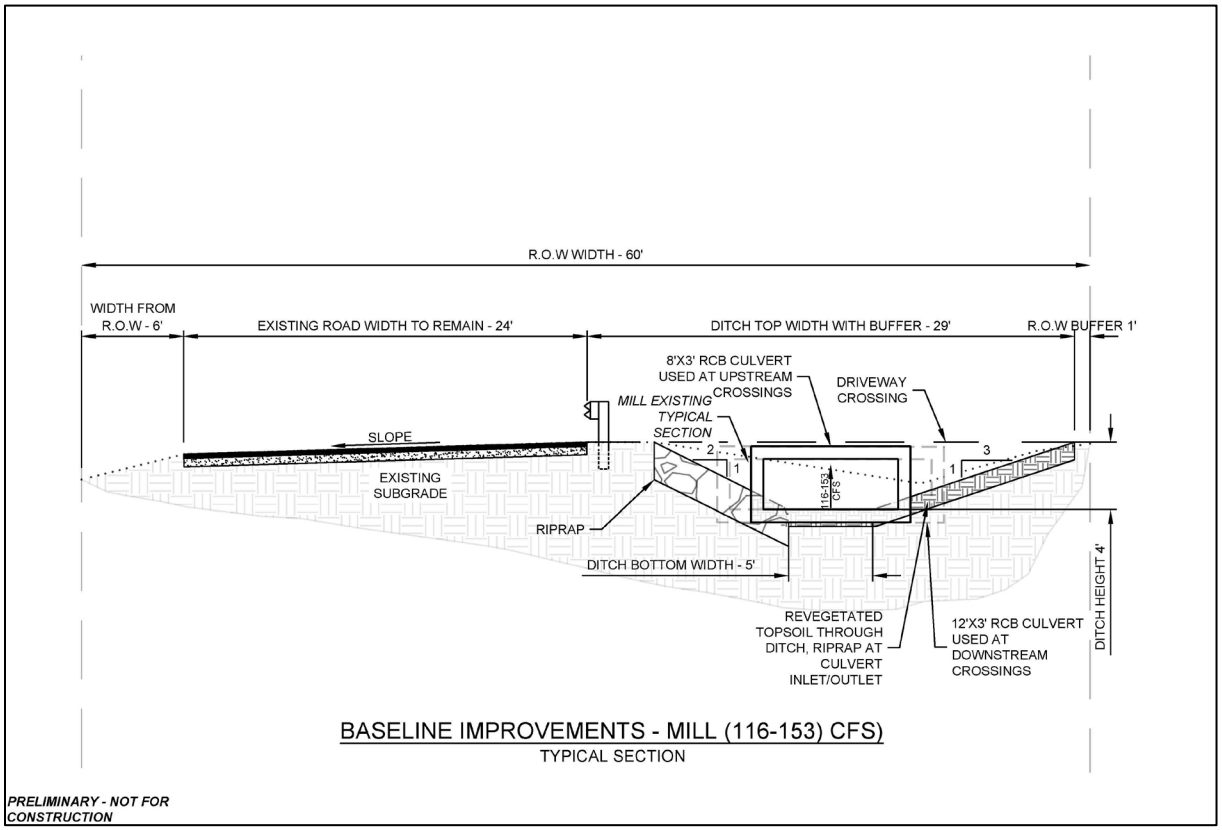


Figure 3-9. Typical section for the roadside ditch and RCB culvert layout along Mill Road.

The ditch along McHugh Lane will have 4:1 (H:V) vegetated side slopes on both sides of the ditch. The ditch will be 4 feet in depth and will have bottom width of 6 feet. Culverts at the upstream end of the ditch, sized for 90 cfs, will be 6'x3' RCB culverts. Culverts through the mid-section of the ditch, sized for 137 cfs, will be 8'x3' RCB culverts. A single culvert at the downstream most end of the ditch, designed to convey 247 cfs, will be a 10'x4' RCB culvert.

Surveyed R,O.W, from the McHugh Lane crossing of Tenmile Creek to a residential driveway 165 feet downstream of Hahn Road is 88 feet in width. From the mentioned residential crossing to the intersection of Mill Road and McHugh Lane, the R.O.W width is 80 feet. South of the residential crossing the proposed improvements will fit within the R.O.W without the need for property acquisition or easement. North of the residential crossing, improvements will extend slightly out of R.O.W and therefore easements or property will need to be acquired. Easements for the four properties on the west side of McHugh Lane, immediately south of the Mill Road and McHugh Lane intersection, will need to be acquired. Typical sections depicting the existing conditions and ditch and crossing improvements for McHugh Lane south of Mill Road are shown respectively in Figure 3-10 and Figure 3-11.

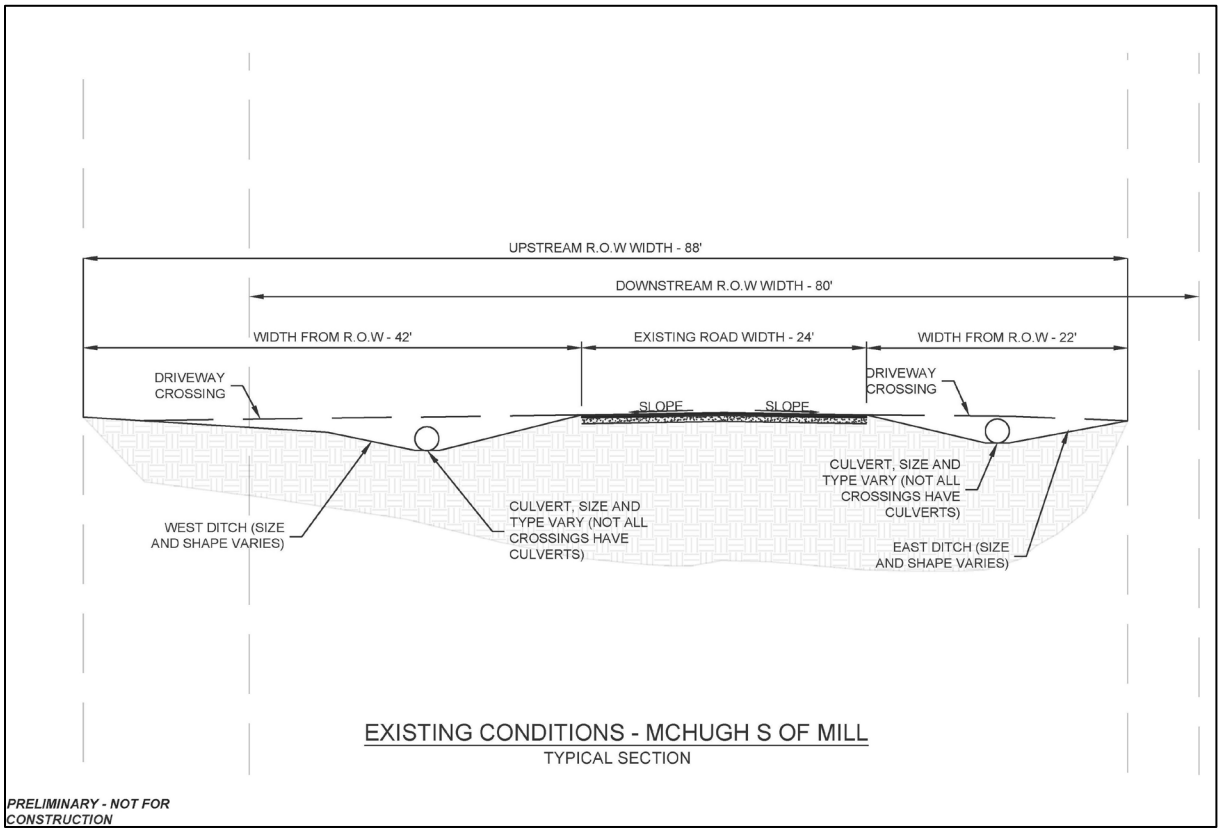


Figure 3-10. Typical section depicting existing conditions on McHugh Lane south of Mill Road.

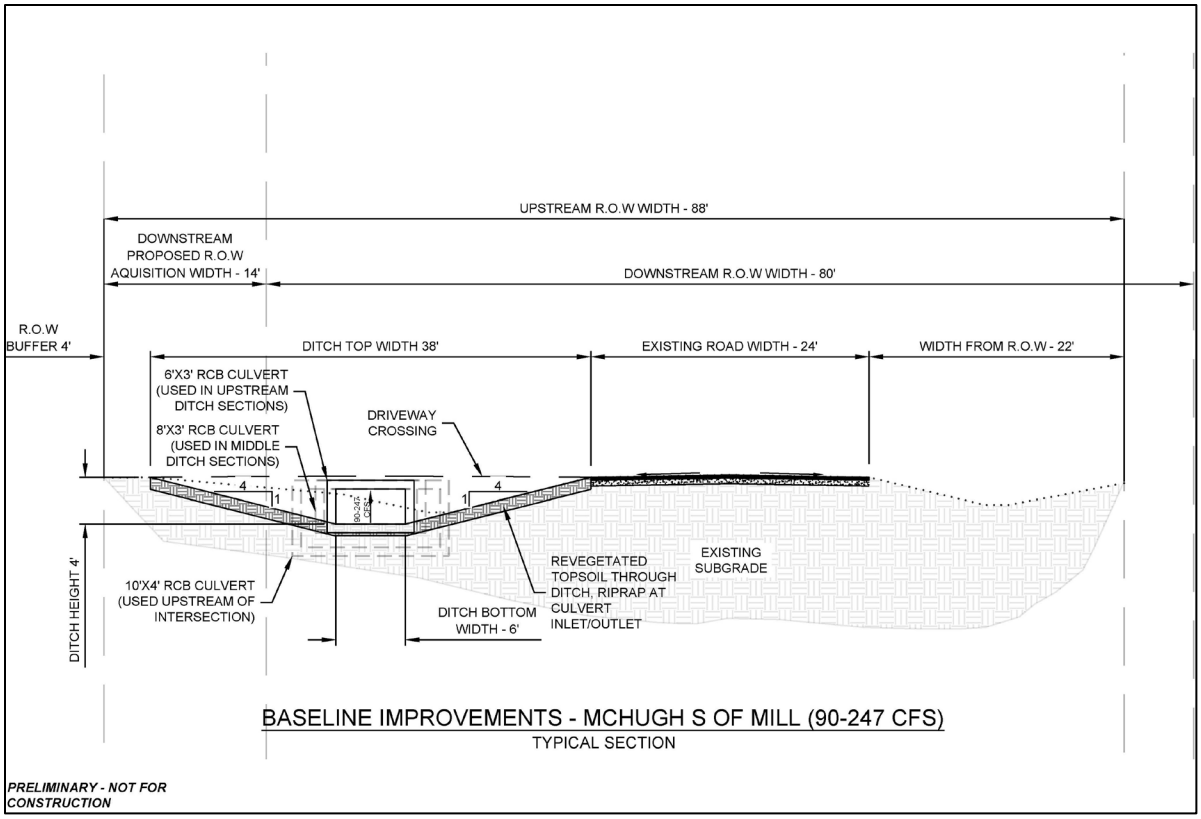


Figure 3-11. Typical section for the roadside ditch and RCB culvert layout along McHugh Lane south of Mill Road.

3.4.2.2 MCHUGH LANE – MILL ROAD TO SIERRA ROAD

Proposed improvements discussed for Mill Road and McHugh Lane south of Mill Road, direct floodwaters to the southwest corner of the Mill Road and McHugh Lane intersection. At the intersection of the two roads the entire design flow, 400 cfs, crosses Mill Road and is conveyed north along the west side of McHugh Lane to Forestvale Road. At the intersection of Forestvale Road, 250 cfs is directed down Forestvale Road and the remaining 150 cfs continues north down McHugh Lane through existing improvements at the Forestvale Cemetery. North of the Forestvale Cemetery improvements, additional improvements will be made to connect the roadside ditch from the cemetery to Sierra Road. The R.O.W. width is 60 feet through this section of McHugh Lane and will need to be expanded for ditch improvements. For the R.O.W expansion, one property easement immediately north of the Forestvale Cemetery, will be required. Improvement routing paths for McHugh Lane between Mill Road and Sierra Road are depicted in Figure 3-12.

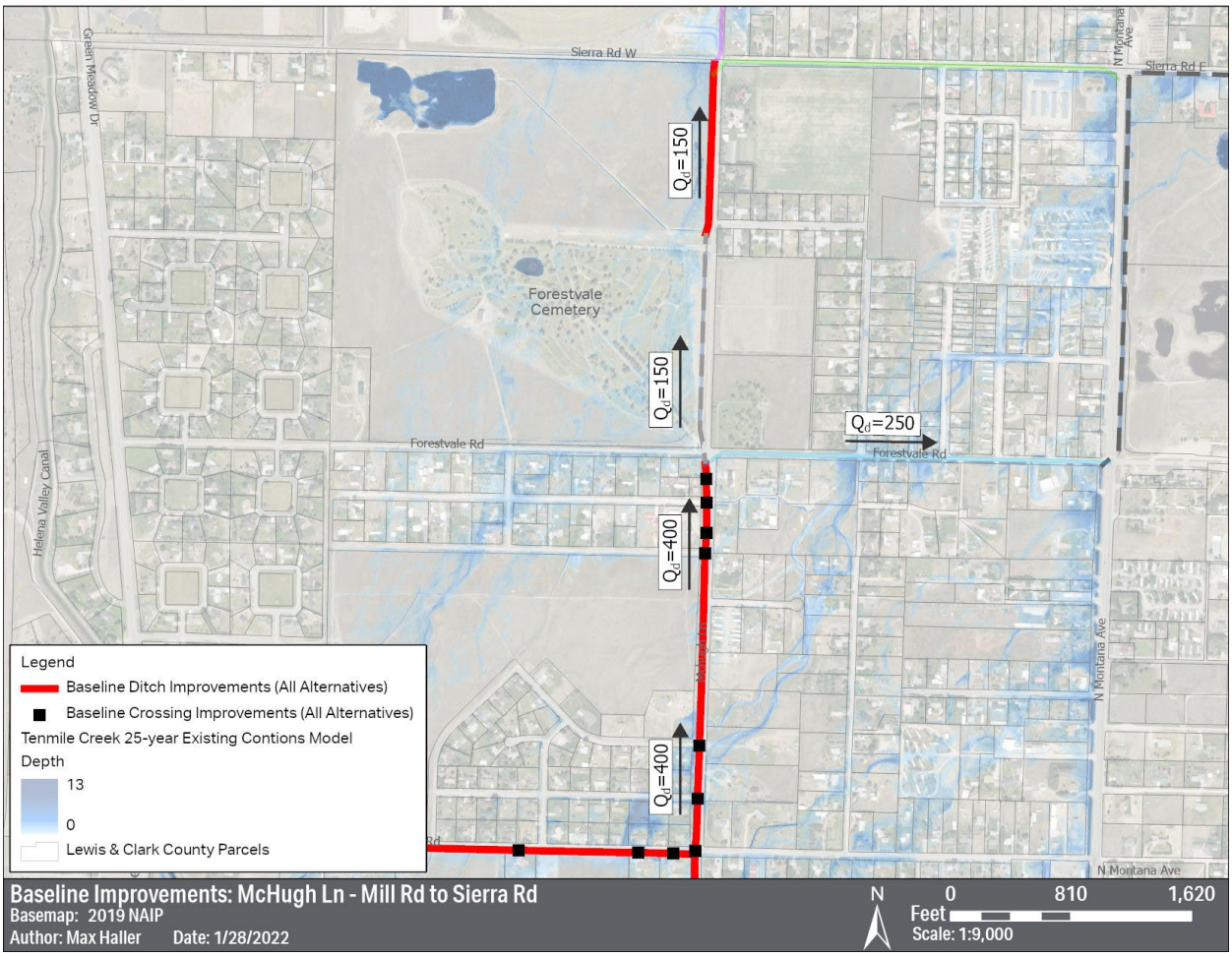


Figure 3-12. Baseline Improvements zoomed in on McHugh Lane between Mill Road and Sierra Road with the Existing Conditions 25-year model results.

The ditch along McHugh Lane between Mill Road and Forestvale Road will have 4:1 (H:V) vegetated side slopes on both sides. The ditch will be 5 feet in depth and have a 10-foot bottom width. All crossings along the referenced stretch of road will be 16'x4' RCB Culverts. A typical section depicting existing conditions and ditch and crossing improvements on McHugh Lane between Mill Road and Forestvale Road is shown in Figure 3-14.

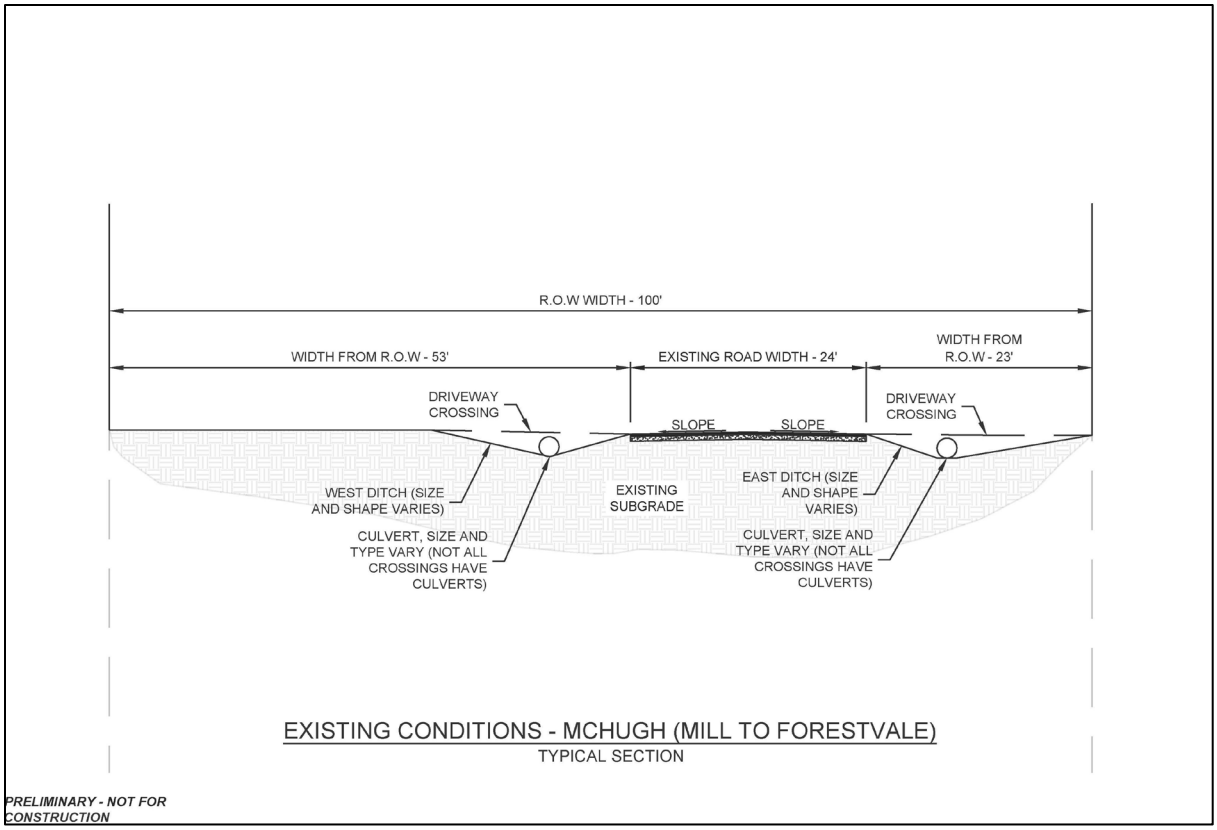


Figure 3-13. Typical section depicting existing conditions on McHugh Lane between Mill Road and Forestvale Road.

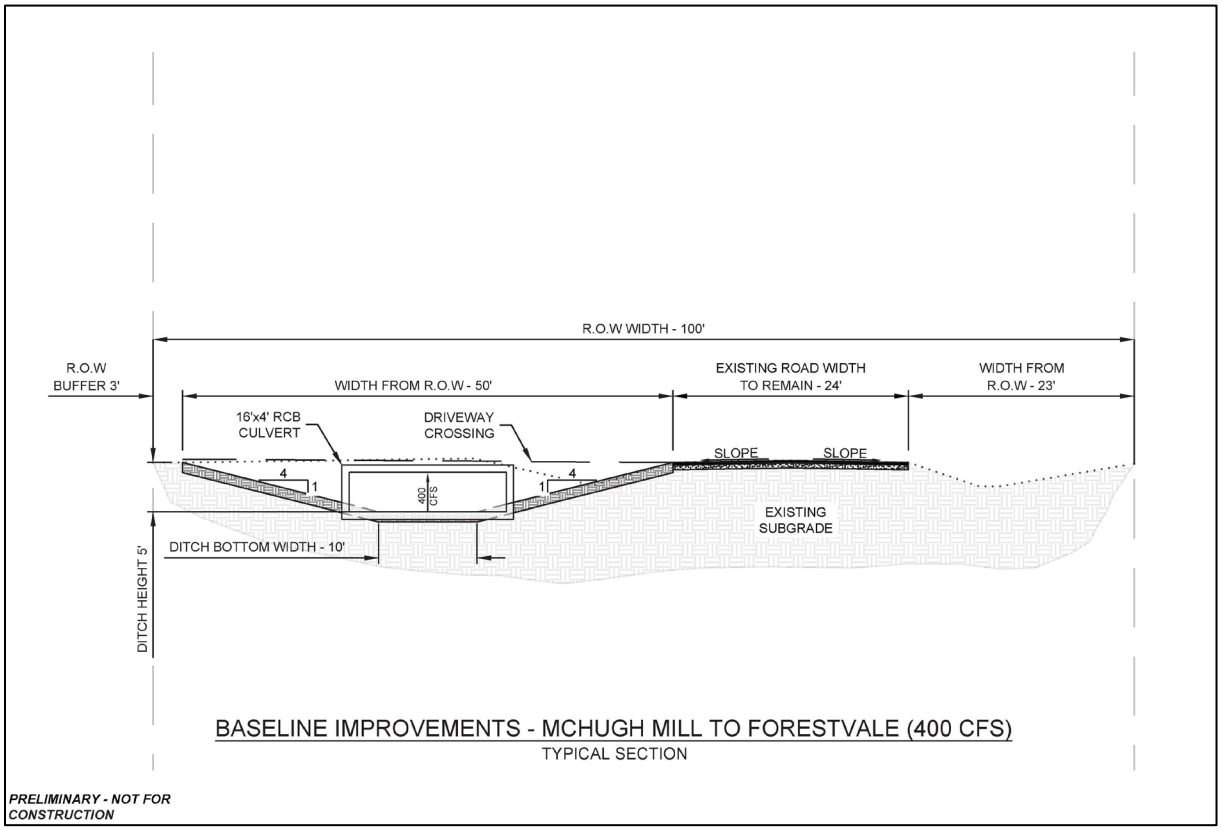


Figure 3-14. Typical section for the roadside ditch and RCB culvert layout along McHugh Lane between Mill Road and Forestvale Road.

North of Forestvale Road, between the Forestvale Cemetery and Sierra Road the ditch will have 4:1 (H:V) vegetated side slopes adjacent to the road and 3:1 (H:V) vegetated side slopes on the opposing side. The ditch will be 4 feet in depth and have a 10-foot bottom width. A typical section for ditch and crossing improvements on McHugh Lane between the Forestvale Cemetery and Sierra Road is shown in Figure 3-15.

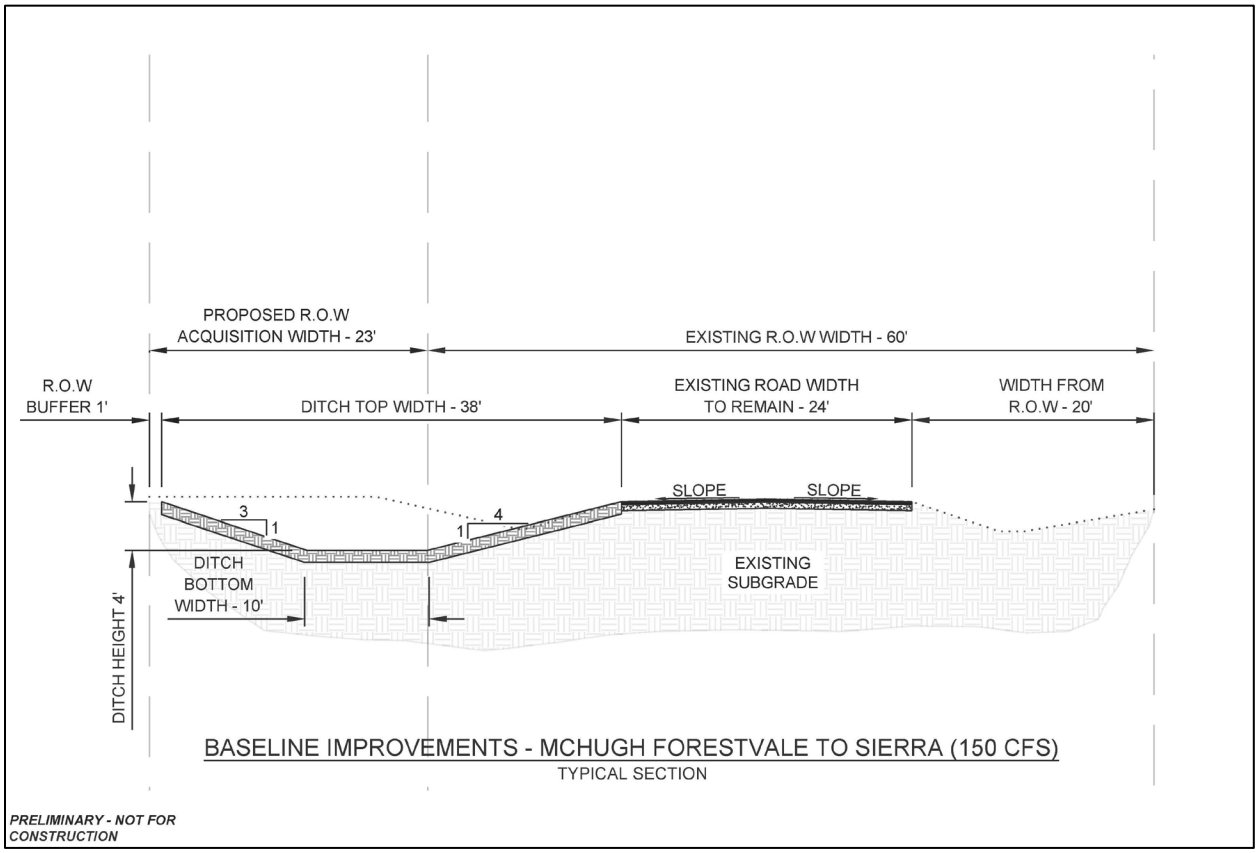


Figure 3-15. Typical section for the roadside ditch layout along McHugh Lane between the Forestvale Cemetery and Sierra Road.

3.4.3 FORESTVALE BASELINE IMPROVEMENTS

All of the Forestvale Baseline Improvement Options route 250 cfs from the southwest corner of the Forestvale Road and McHugh Lane intersection east, down Forestvale Road to the existing Trap Club project improvements. The different options for the improvements discussed in the following sections assess use of different flood conveyance infrastructure for directing 250 cfs down Forestvale Road. The Tenmile Overflow Improvements need to incorporate one of the four Forestvale Baseline Improvement Options, there is not a routing alternative for this area of improvements.

It should be noted that several private properties along the south side of Forestvale Road may need fill placed into areas of low-lying ground along the south edge of the proposed route. The low-lying areas are historic Tenmile Creek channels. Specific areas should be determined during final design and landowners may choose to participate to reduce flooding in their yard.

A typical section, intended to be used for comparison with proposed improvements options, depicting the existing conditions of Forestvale Road is provided in Figure 3-16.

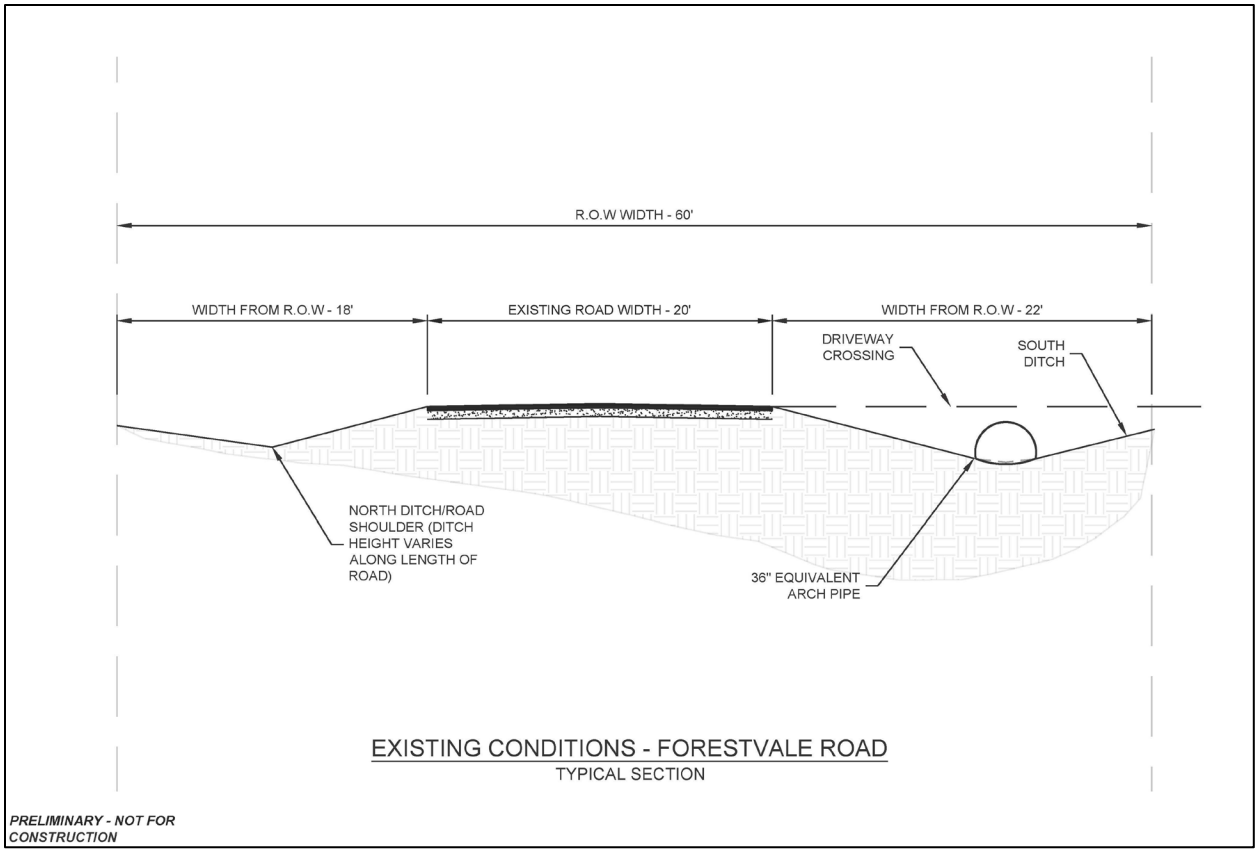


Figure 3-16. Typical section depicting the existing conditions on Forestvale Road.

3.4.3.1 OPTION 1

Option 1 proposes to convey floodwaters through roadside ditches and RCB culverts along the south side of Forestvale Road. The option will require shifting the existing road north to the edge of the existing R.O.W. For compliance with current county road standards the road will be rebuilt to a 24-foot width, 4 feet wider than the existing road. The option spans the entire existing 60-foot R.O.W width with a 1-foot buffer from the road shoulder and ditch edge. Option 1 culvert and ditch approximate locations are shown in Figure 3-17.

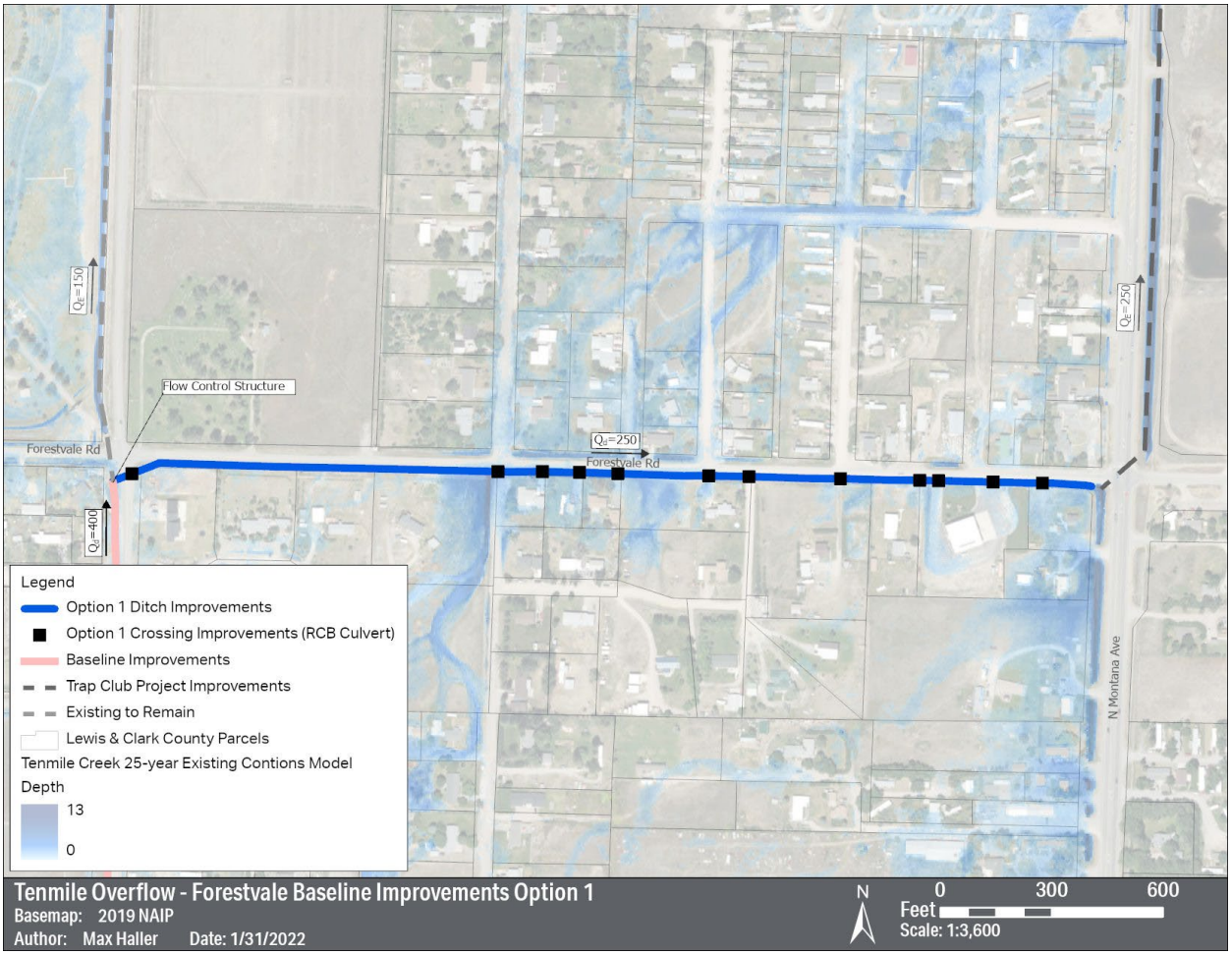


Figure 3-17. Forestvale Baseline Improvements Option 1 with the Existing Conditions 25-year model results.

The Option 1 ditch will run along the south side of Forestvale Road and will have 2:1 (H:V) riprap side slopes. The ditch will have a depth of 5 feet and a bottom width of 6 feet. Steep roadside ditches necessitate guardrail along the length of the ditch. Culverts along Forestvale Road will be 12'x4' RCB culverts, with the exception of the culvert crossing McHugh Lane at the upstream end of the improvements. As a means to ensure that flows don't exceed 250 cfs along Forestvale Road, a 10'x4' will be used at the crossing of McHugh Lane. A typical section depicting the culvert and ditch layout along Forestvale Road is shown in Figure 3-18.

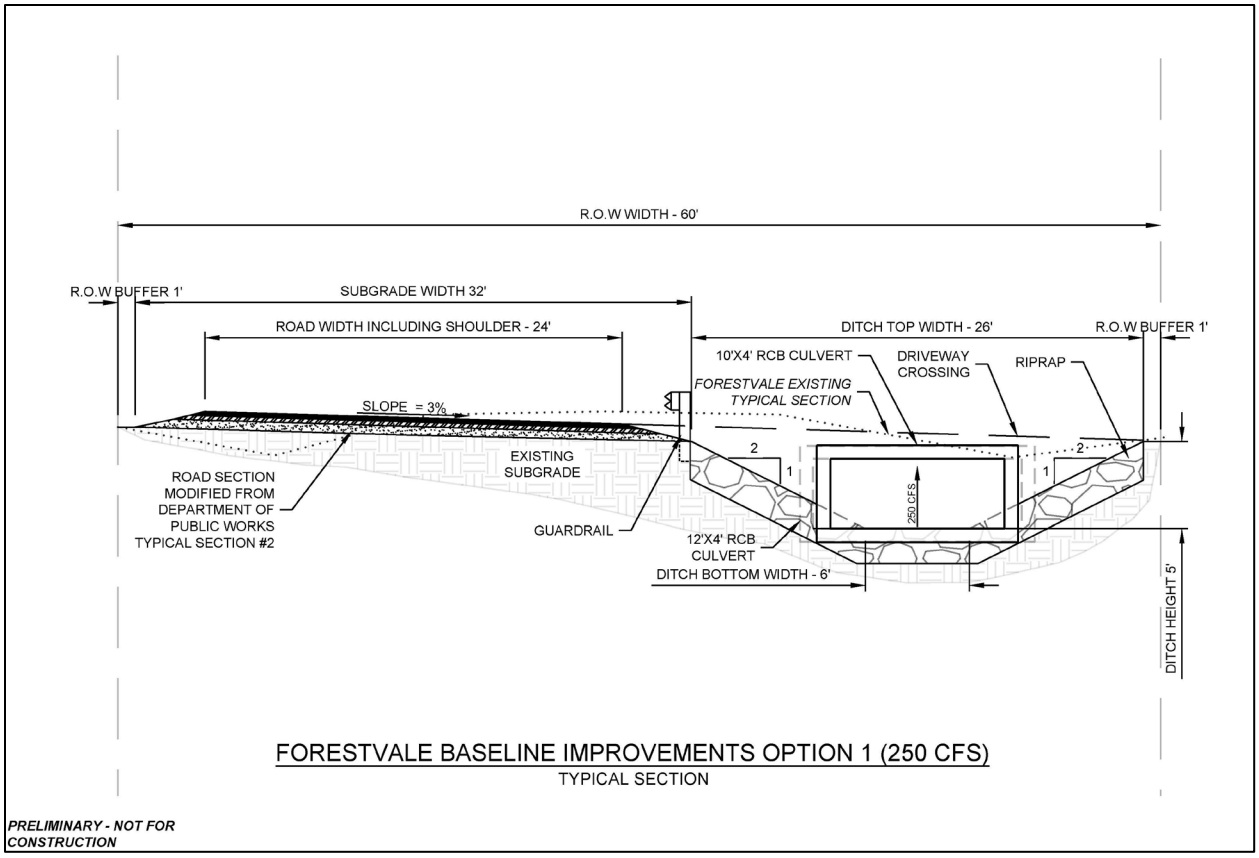


Figure 3-18. Typical section for the roadside ditch and RCB culvert layout for Forestvale Baseline Improvements Option 1.

3.4.3.2 OPTION 2

Similar to Option 1, Option 2 also proposes conveying floodwaters through trapezoidal ditches and RCB culverts along the south side of Forestvale Road. As a means to minimize steep riprap side slopes, the option proposes shifting Forestvale Road to the north edge of the existing R.O.W and converting it to a one-way road. Reducing road width will provide more room for ditch improvements, allowing for implementation of flatter ditch side slopes. The option will span the entire existing 60-foot R.O.W width, with a 1-foot buffer from the one-way road shoulder and ditch edge. Option 2 culvert and ditch approximate locations are shown in Figure 3-19.

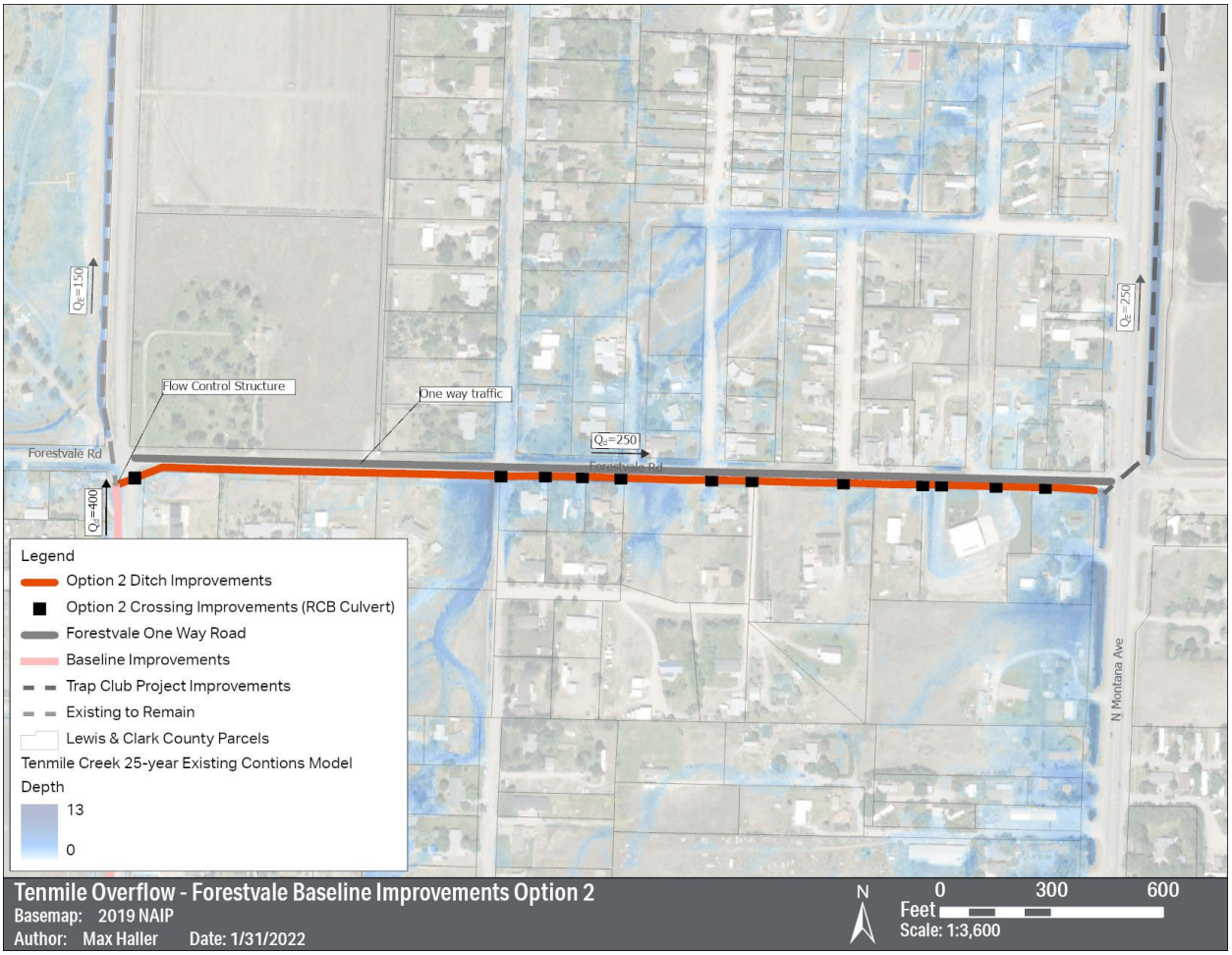


Figure 3-19. Forestvale Baseline Improvements Option 2 with the Existing Conditions 25-year model results.

The Option 2 ditch along Forestvale Road consists of 4:1 (H:V) vegetated side slopes on the road edge and 2:1 (H:V) riprap slopes on the opposing side. The 4:1 side slope on the roadside edge eliminate the need for guardrail. Culverts associated with Option 2 improvements mirror Option 1 improvements with a 10'x4' RCB culvert crossing McHugh Lane and 12'x4' RCB culverts through the remainder of the improvement area. A typical section depicting the culvert and ditch layout along Forestvale Road are shown in Figure 3-20.

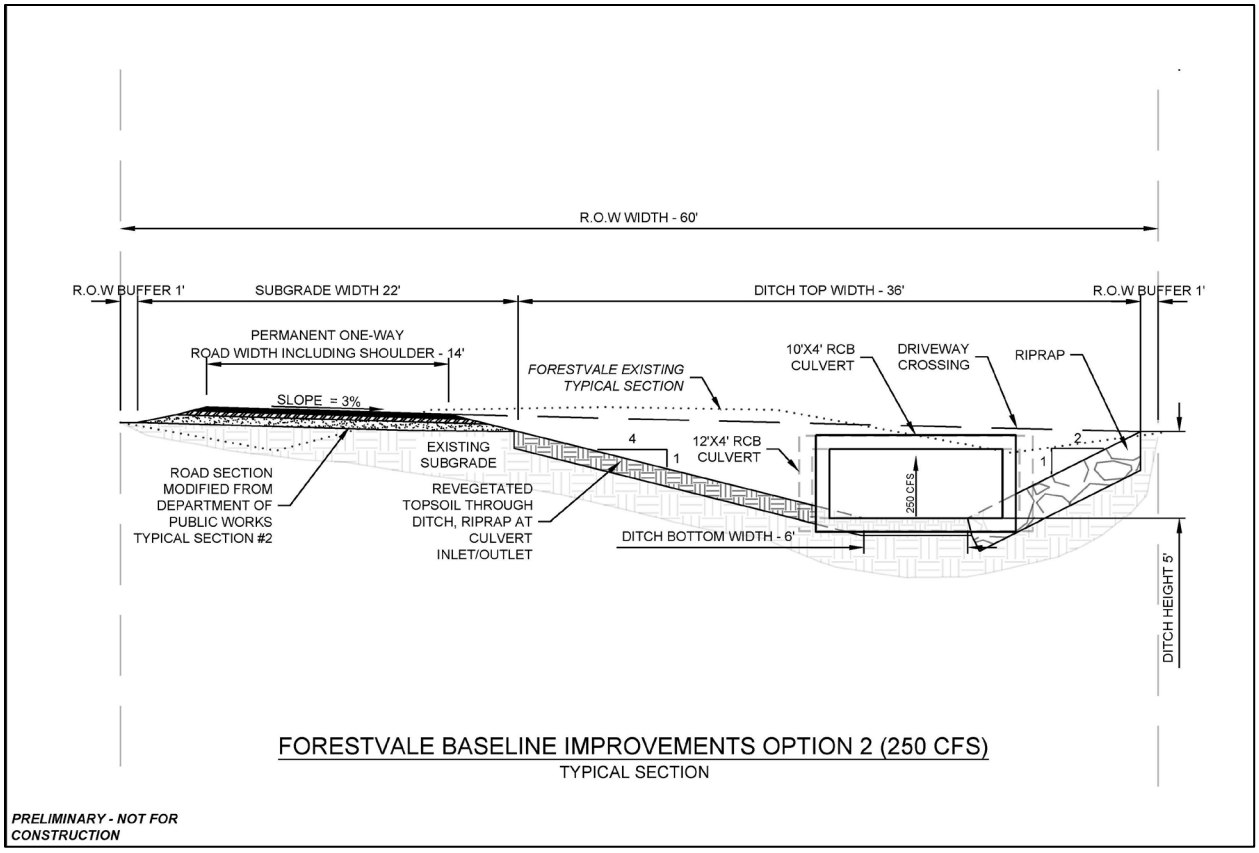


Figure 3-20. Typical section for the roadside ditch and RCB culvert layout for Forestvale Baseline Improvements Option 2.

3.4.3.3 OPTION 3 & 4

Option 3 and Option 4 propose placing buried Corrugated Metal Pipe (CMP) along the length of Forestvale Road. Buried CMP will inlet at the southwest corner of the Forestvale Road and McHugh Lane intersection and outlet at the southwest corner of the Forestvale Road and North Montana Avenue intersection, just upstream of the Trap Club Project Improvements. For sediment cleanout, precast concrete junction boxes will be placed every 500 feet. Additionally, to accommodate for local drainage, drop inlet structures will be placed every 200 feet,

Differences between Option 3 and Option 4 are centralized in the CMP alignment. Option 3 will be aligned along the existing roadway centerline. Construction will require complete removal of the existing road, similar to Option 1 and Option 2 the road will be rebuilt to current county standards. Opposingly, buried CMP in Option 4 will be aligned on the south side of Forestvale Road, in the existing ditch. Construction will require partial removal of the existing road. To provide a lower cost buried CMP alternative, Option 4 will consists of rebuilding the existing road to its current condition rather than to current county standards like the other three options.

Option 3 and Option 4 approximate buried CMP and junction box locations are shown in Figure 3-21, it should be noted that at the figures scale, the differences in the buried CMP alignments are negligible.

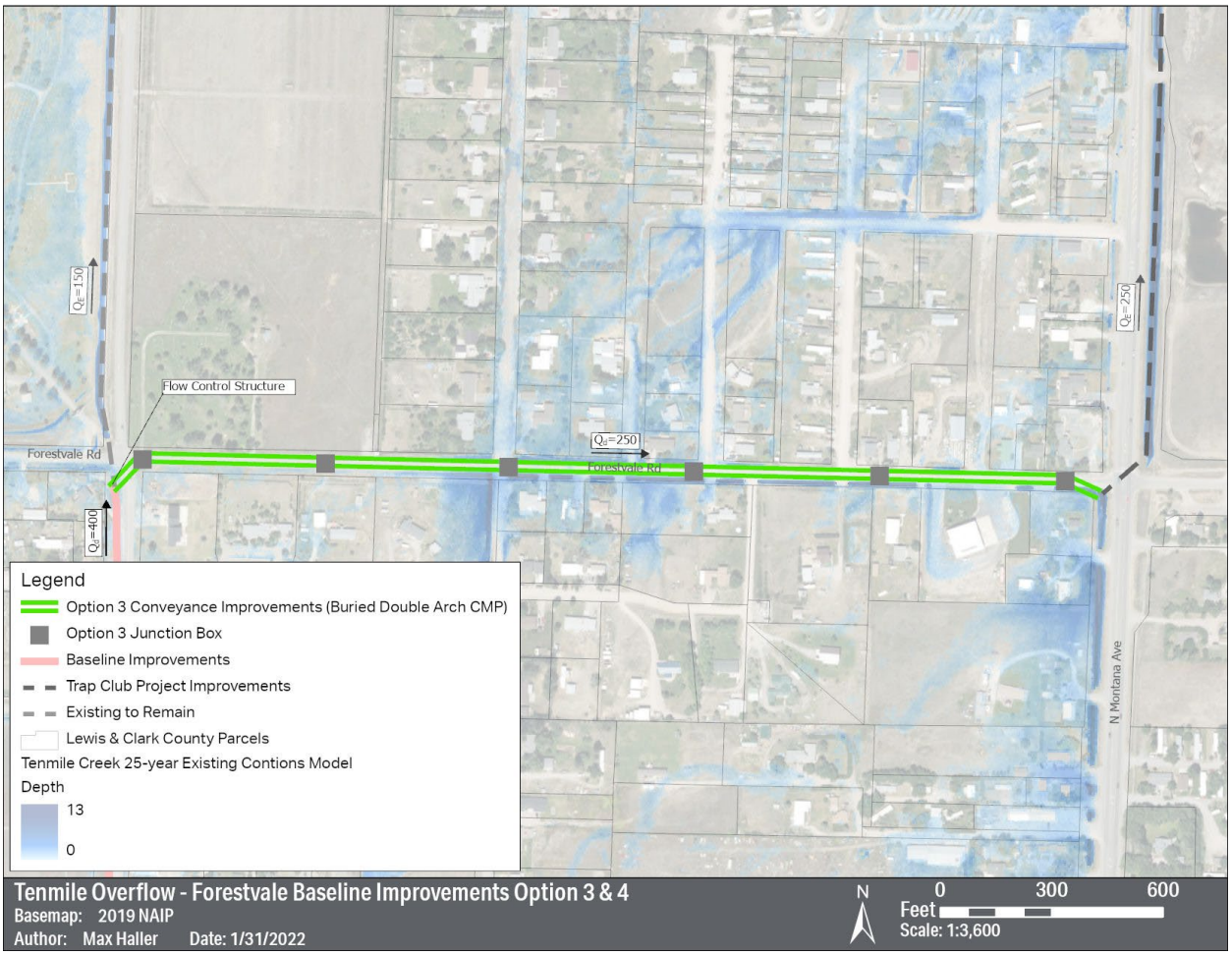


Figure 3-21. Forestvale Baseline Improvements Option 3 & 4 with the Existing Conditions 25-year model results.

Buried CMP in both Option 3 and Option 4 will consist of double 60-inch equivalent arch CMP. Option 3 will be centered along the newly construction road while Option 4 will be aligned in the existing roadside ditch. To ensure appropriate cover depths for buried CMP in Option 4, a 3:1 (H:V) side slope will be required from the existing R.O.W on the south side of the road. The height of this slope will vary along the length of the ditch depending on local site conditions, but the slope height will never exceed the roadway crest height. Typical sections depicting the buried CMP layout for Option 3 and Option 4 are depicted respectively in Figure 3-22 and Figure 3-23.

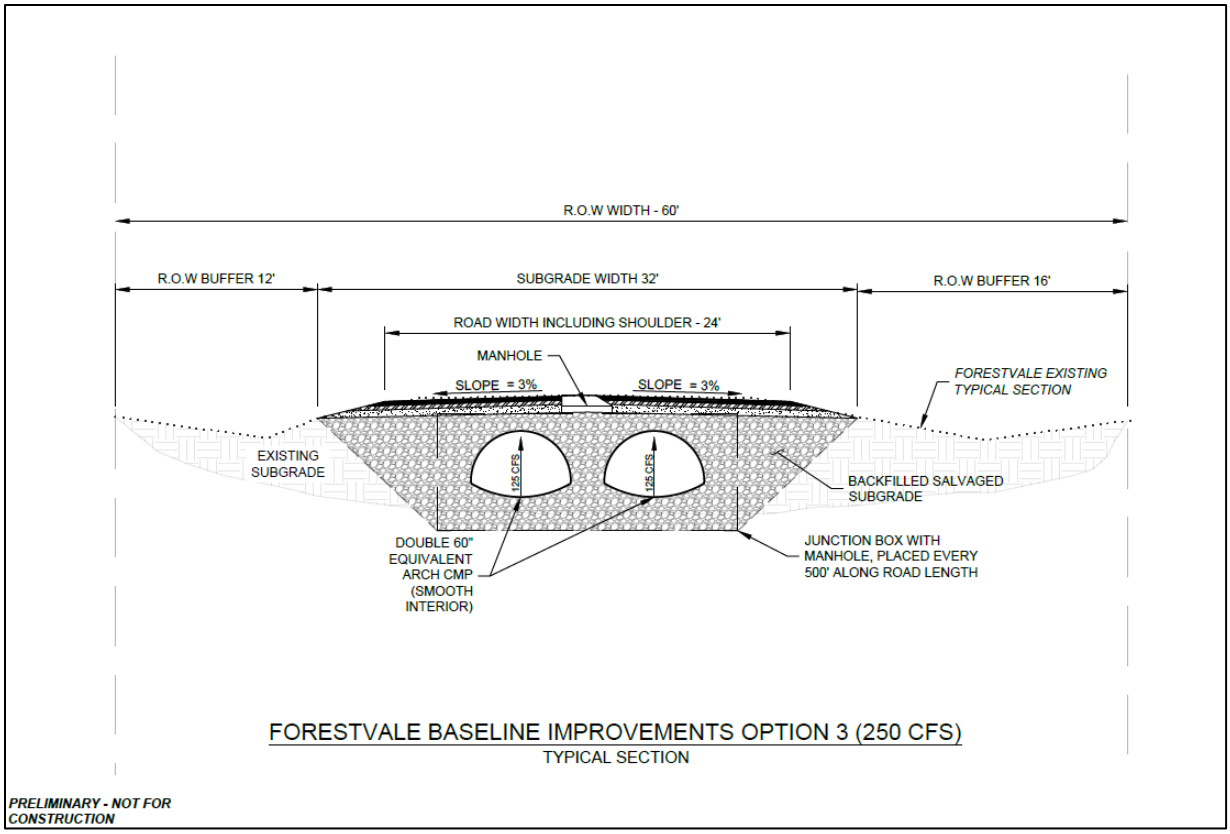


Figure 3-22. Typical section for the buried CMP layout for Forestvale Baseline Improvements Option 3.

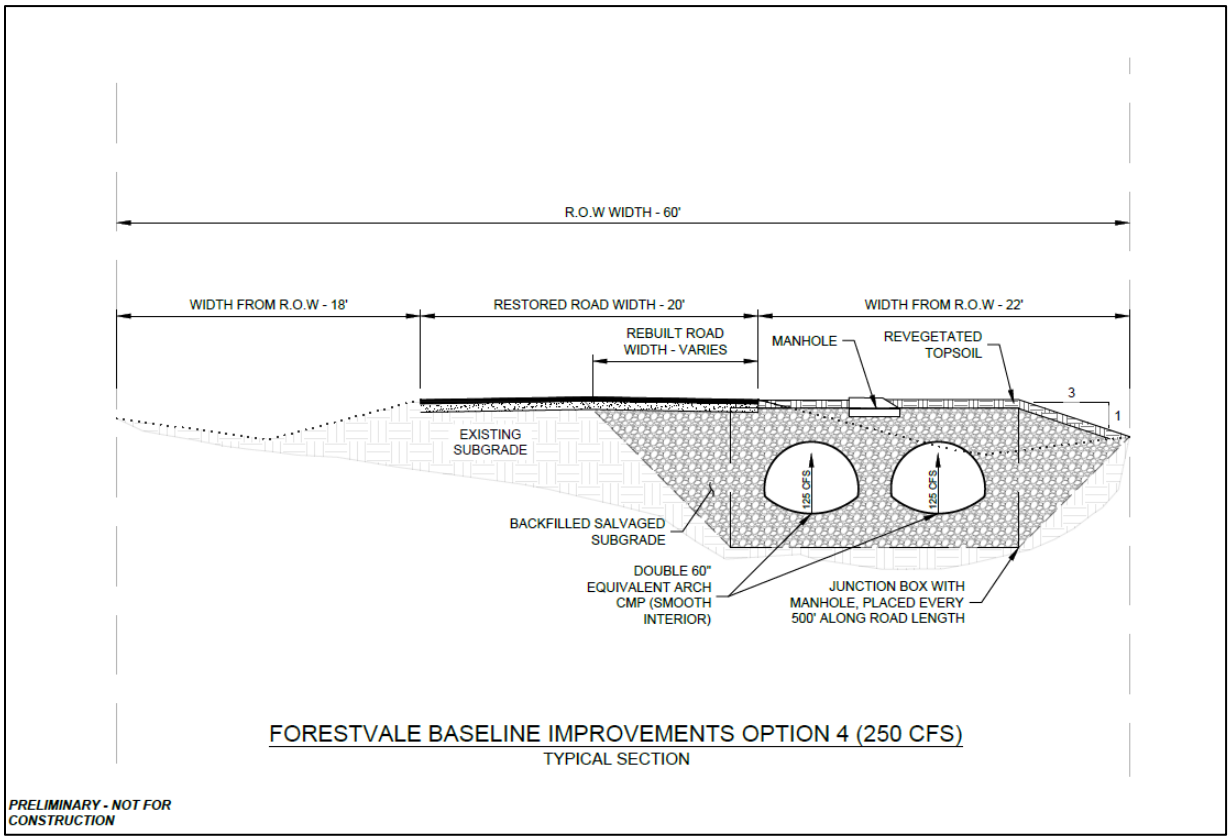


Figure 3-23. Typical section for the buried CMP layout for Forestvale Baseline Improvements Option 4.

3.4.4 SIERRA ROUTING ALTERNATIVE OPTIONS

All Sierra Routing Alternative Options consist of routing 150 cfs from the southwest corner of the Sierra Road and McHugh Lane intersection east, down Sierra Road to the existing Trap Club project improvements. Improvement options discussed in the following sections assess use of different flood conveyance infrastructure for directing 150 cfs down Sierra Road. Unlike the Forestvale Baseline Improvement Options, the Sierra Routing Alternative Options provide a flood routing alternative. If the Sierra Routing Alternative is not selected there will be no flood conveyance improvements on Sierra Road.

A typical section, intended to be used for comparison with proposed improvements options, depicting the existing conditions of Sierra Road is provided in Figure 3-24.

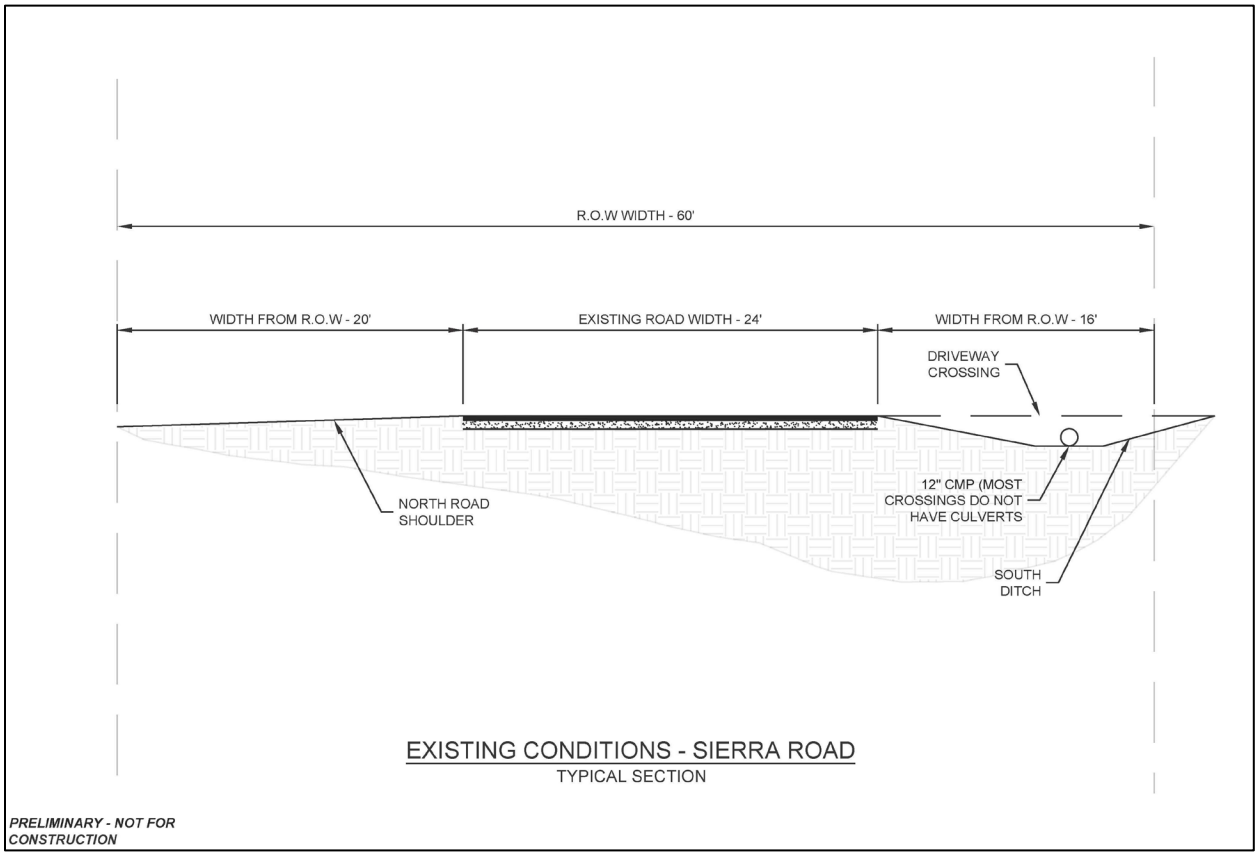


Figure 3-24. Typical section depicting the existing conditions on Sierra Road.

3.4.4.1 OPTION 1

Option 1 proposes to convey floodwaters through roadside ditches and RCB culverts along the south side of Sierra Road. The option will require shifting the existing road north to the edge of the existing R.O.W. For compliance with current county road standards, the road will be rebuilt to a 28-foot width, 4 feet wider than the existing road. The option spans the entire existing 60-foot R.O.W width with a 1-foot buffer at the ditch edge. Option 1 culvert and ditch approximate locations are shown in Figure 3-25.

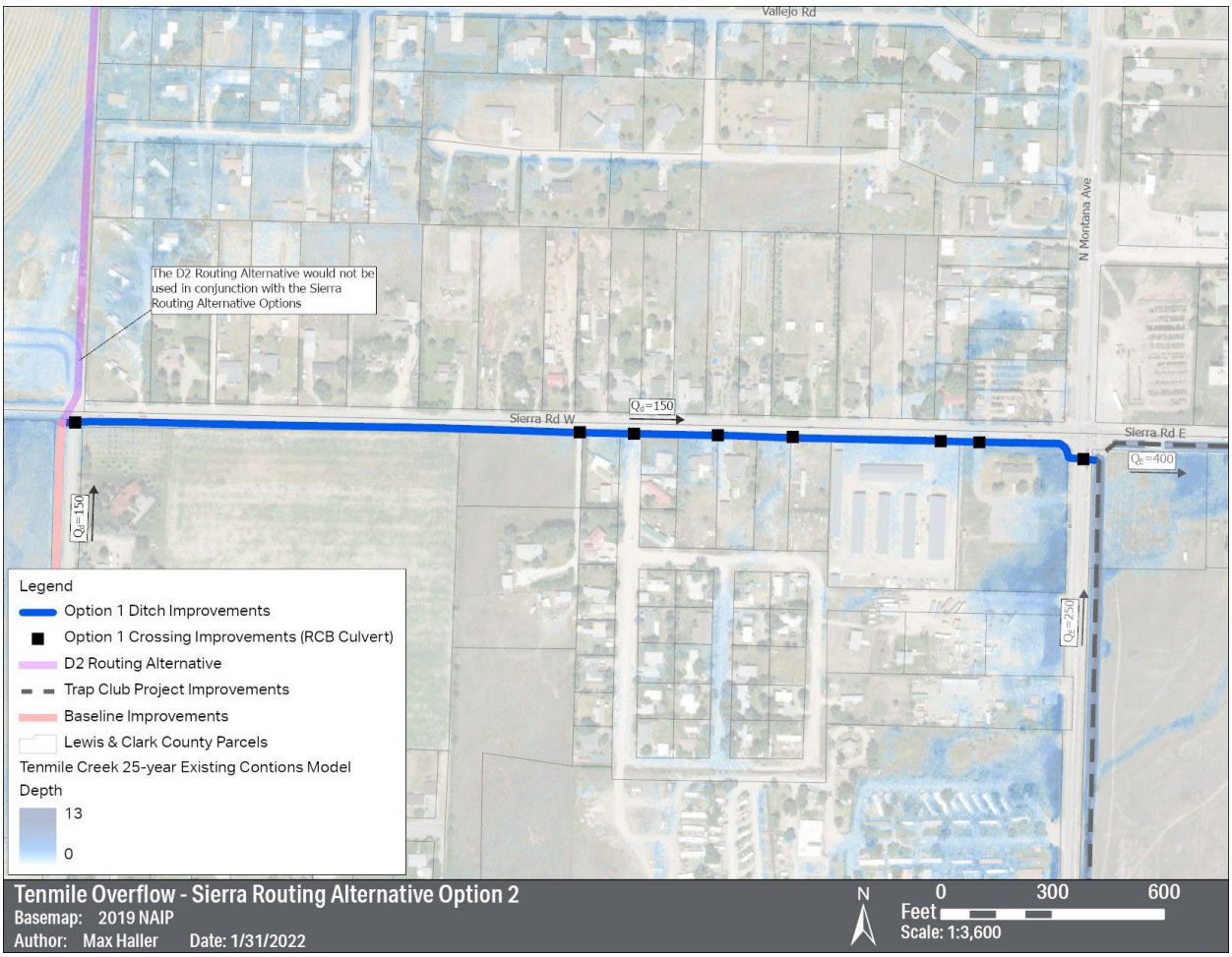


Figure 3-25. Sierra Routing Alternative Option 1 with the Existing Conditions 25-year model results.

The proposed ditch will have 2:1 (H:V) riprap side slopes throughout its length. The ditch will have a depth of 5 feet and a bottom width of 5 feet. Steep roadside ditches necessitate guardrail along the length of the ditch. Culverts along the Sierra Road will be 8'x4' RCB culverts.

A typical section depicting the culvert and ditch layout along Sierra Road is shown in Figure 3-26.

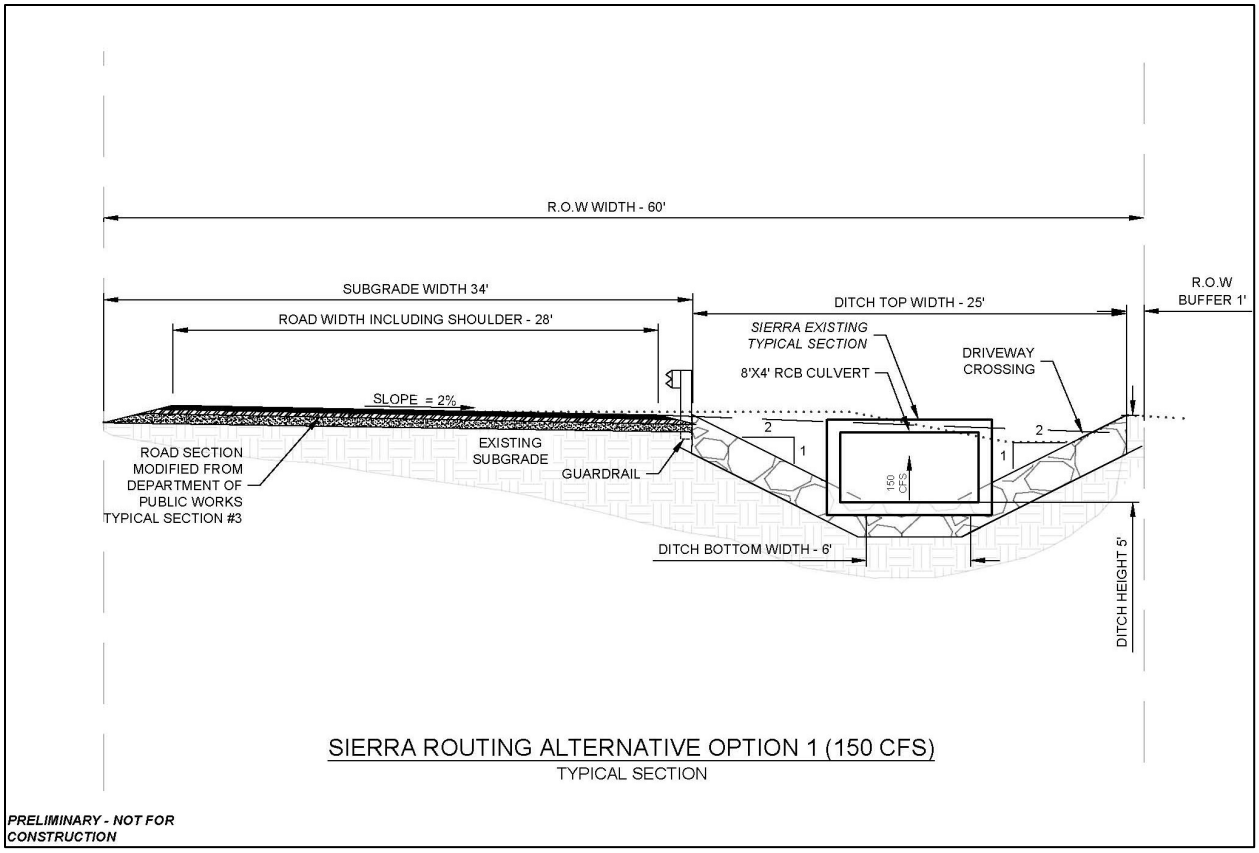


Figure 3-26. Typical section for the roadside ditch and RCB culvert layout for Sierra Routing Alternative Option 1.

3.4.4.2 OPTION 2

Similar to Option 1, Option 2 proposes conveying floodwaters through trapezoidal ditches and RCB culverts along the south side of Sierra Road. As a means to minimize steep ditch sides slopes, the option proposes shifting Sierra Road to the north edge of the existing R.O.W and converting it to a one-way road. The option will span the entire existing 60-foot R.O.W width. Option 1 culvert and ditch approximate locations are shown in Figure 3-27.

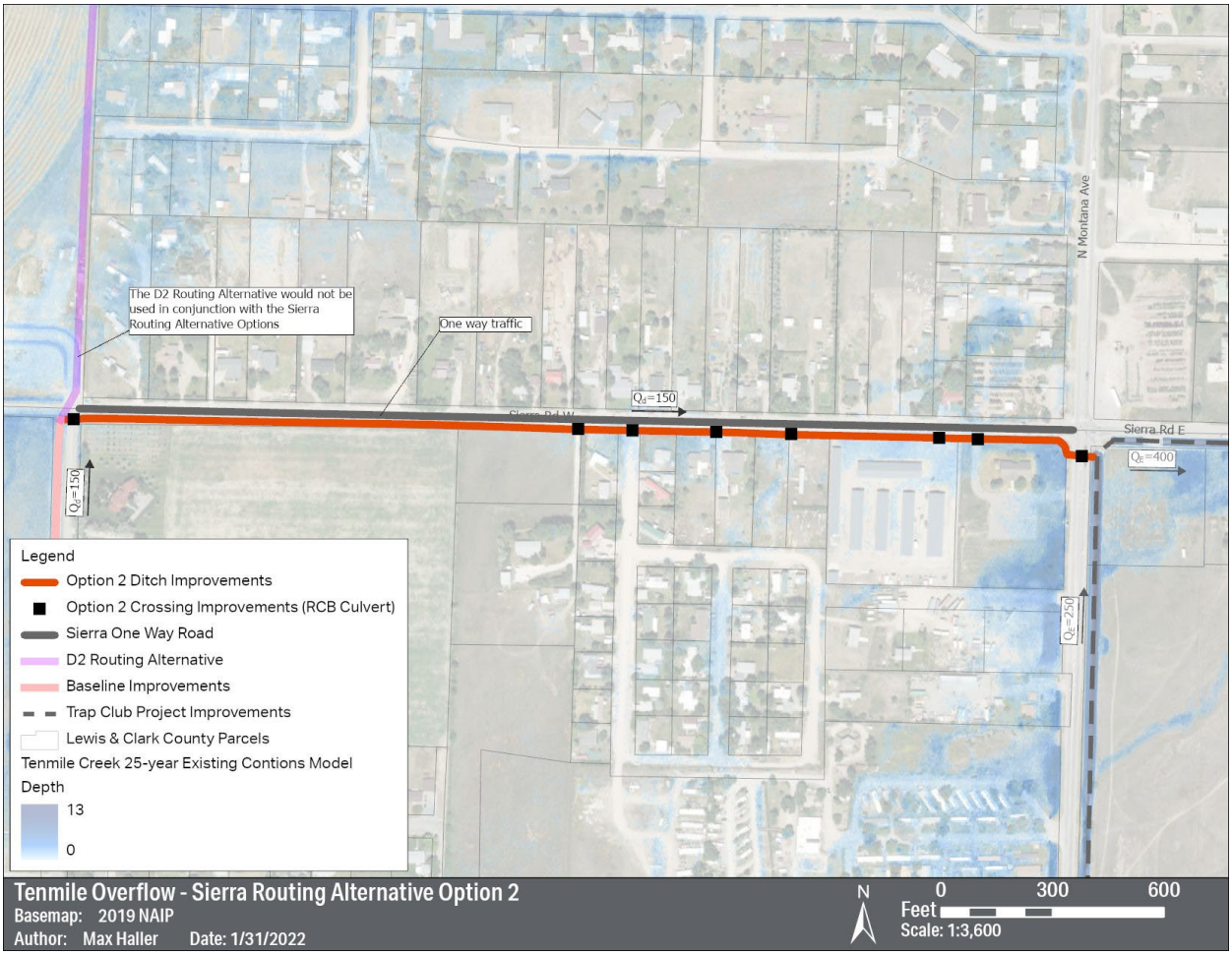


Figure 3-27. Sierra Routing Alternative Option 2 with the Existing Conditions 25-year model results.

The Option 2 ditch will have 4:1 (H:V) vegetated side slopes on the road edge and 3:1 (H:V) vegetated side slopes on the opposing side. The 4:1 side slope on the roadside edge eliminate the need for guardrail. Culverts associated with Option 2 improvements mirror Option 1 improvements with 8'x4' RCB culverts located at crossings between McHugh Lane and North Montana Avenue. A typical section depicting the culvert and ditch layout along Sierra Road is shown in Figure 3-28.

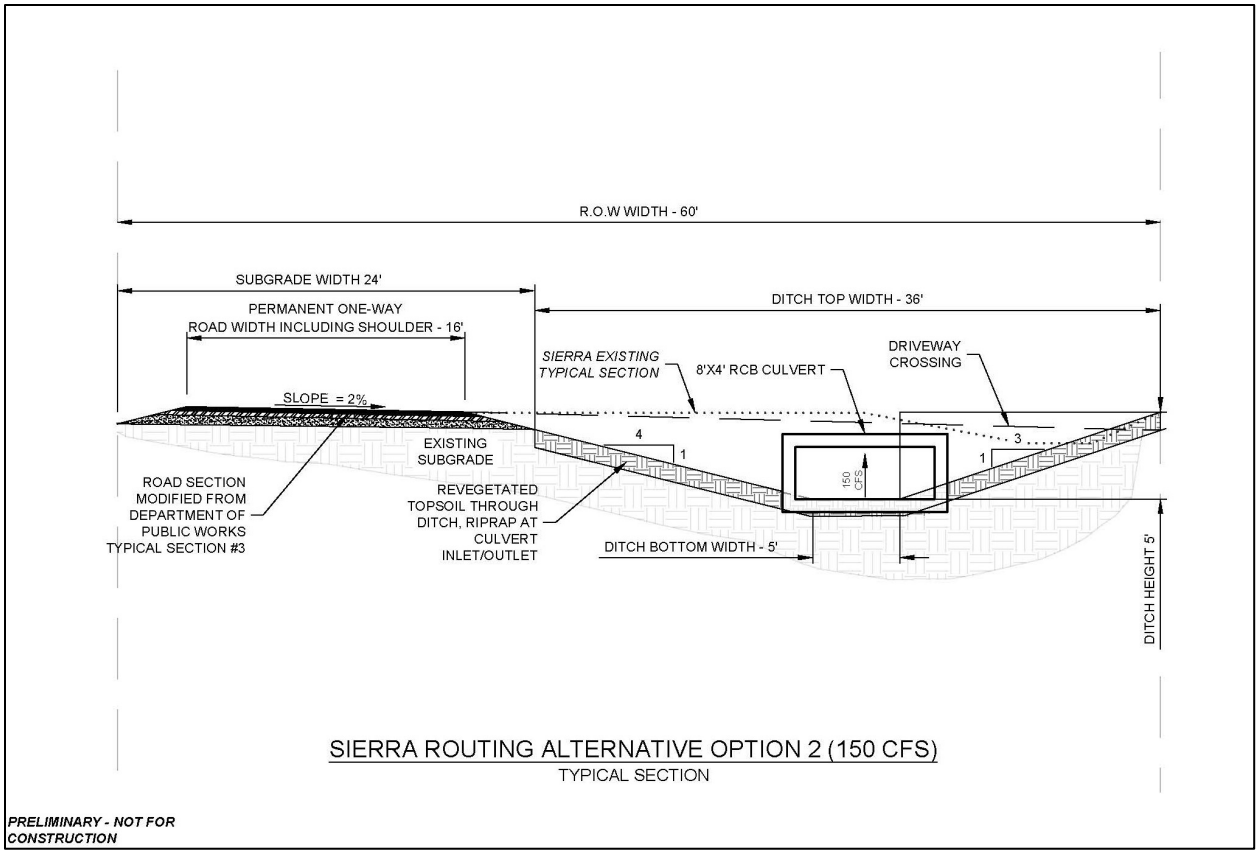


Figure 3-28. Typical section for the roadside ditch and RCB culvert layout for Sierra Routing Alternative Option 2.

3.4.4.3 OPTION 3 & 4

Option 3 and Option 4 propose placing buried CMP along the length of Sierra Road. Buried CMP will inlet at the southwest corner of the Sierra Road and McHugh Lane intersection and outlet at the southwest corner of the Sierra Road and North Montana Avenue intersection, just upstream of the Trap Club project improvements. Minor ditch improvement will have to be made at the southwest corner of the intersection and an 8'x4' RCB Culvert will be placed across N Montana Ave, connecting the improvements to the existing Trap Club project improvements. For sediment cleanout, precast concrete junction boxes will be placed every 500 feet of CMP. Additionally drop inlet structures will be placed every 200 feet of CMP to accommodate for local drainage.

Differences between Option 3 and Option 4 are centralized in the CMP alignment. Option 3 will be aligned along the existing roadway centerline. Construction will require complete removal of the existing road, similar to Option 1 and Option 2 the road will be rebuilt to current county standards. Opposingly, buried CMP in Option 4 will be aligned on the south side ditch along Sierra Road. Construction will require partial removal of the existing road. To provide a lower cost buried CMP alternative, Option 4 consists of rebuilding the existing road to its current condition and not to current county standards.

Option 3 and Option 4 approximate buried CMP and junction box locations are shown in Figure 3-29, it should be noted that at the figure's scale, the differences in the buried CMP alignments are negligible.

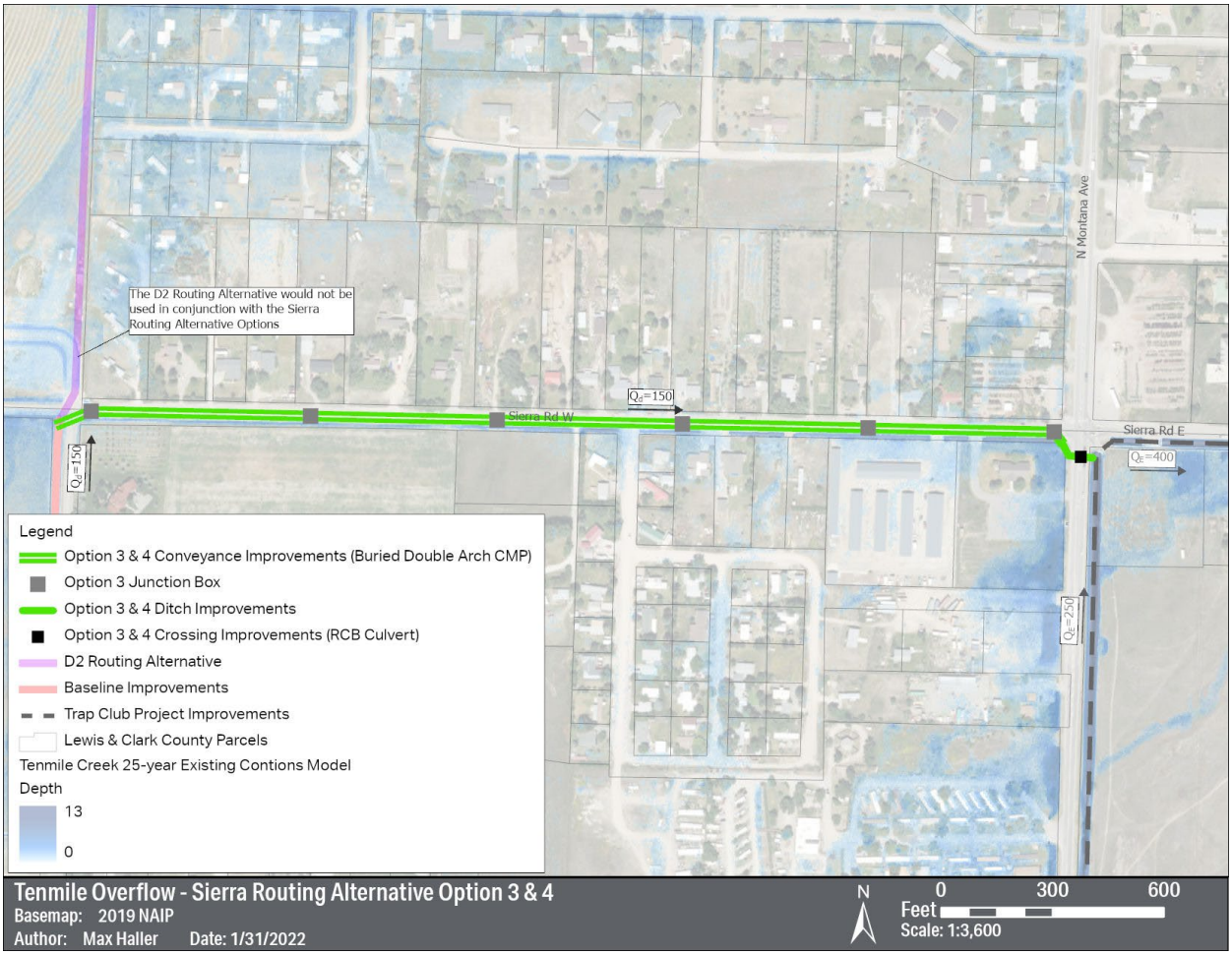


Figure 3-29. Sierra Routing Alternative Option 2 with the Existing Conditions 25-year model results.

Buried CMP in both Option 3 and Option 4 will be double 48-inch equivalent arch CMP. Option 3 will be centered along the newly constructed road while Option 4 will be aligned in the existing roadside ditch. To ensure cover depths for buried CMP in Option 4, a 3:1 (H:V) side slope will be required from the existing R.O.W on the south side of the road. The height of this slope varies along the length of the ditch depending on local site conditions, but the slope height never exceeds the roadway crest height. Typical sections depicting the buried CMP layout for Option 3 and Option 4 are depicted respectively in Figure 3-30 and Figure 3-31.

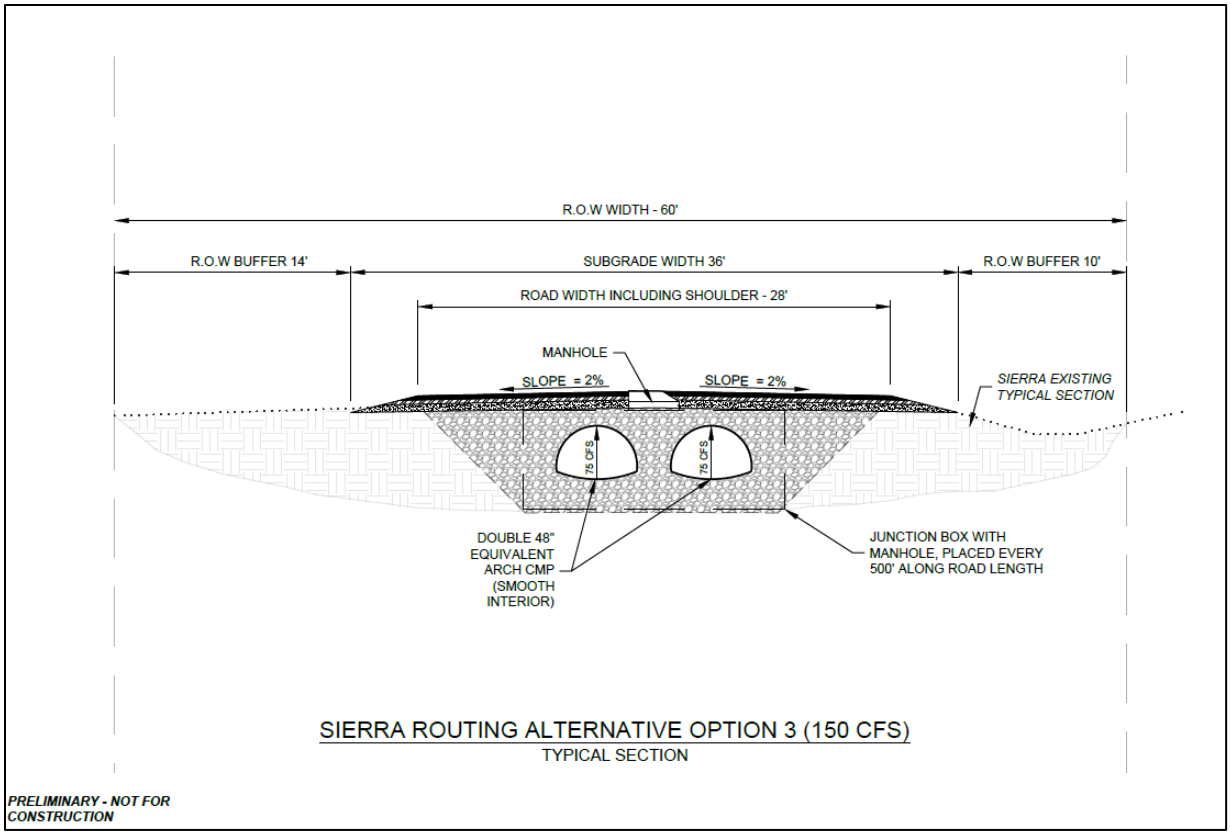


Figure 3-30. Typical section for the roadside ditch and RCB culvert layout for Sierra Routing Alternative Option 3.

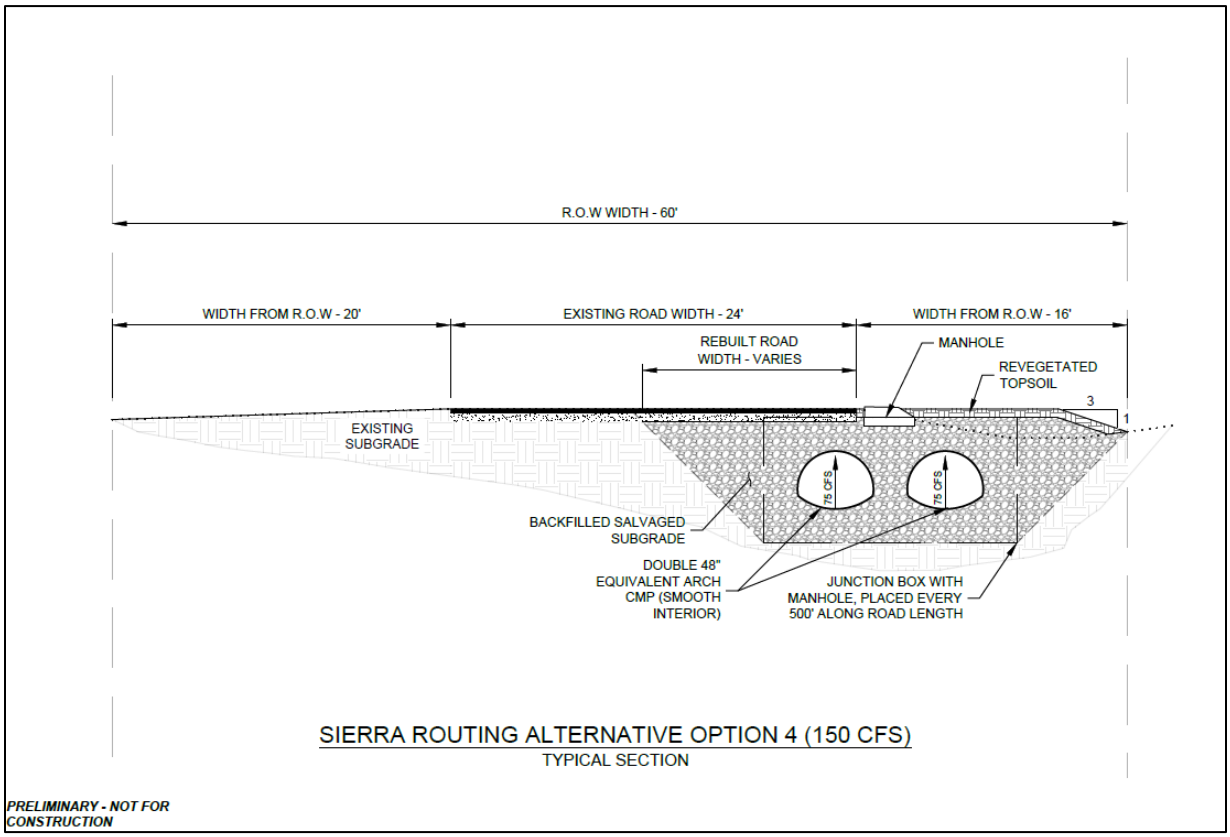


Figure 3-31. Typical section for the roadside ditch and RCB culvert layout for Sierra Routing Alternative Option 4.

3.4.5 D2 ROUTING ALTERNATIVE

The D2 Routing Alternative proposes to direct 150 cfs from the intersection of Sierra Road and McHugh Lane north to the D2 Ditch. The proposed routing path from the intersection contains a combination of buried CMP, trapezoidal ditch, and RCB culvert crossings. The alternative also includes two crossing improvements on the D2 Ditch located in between the North Montana Avenue and the Rosewood Drive crossings of the D2 Ditch.

Besides several county road crossings, the routing path is located entirely on private property. In total, implementation requires four property easements. One property easement, already acquired by LCC extends from the Sierra Road and McHugh Lane intersection north to the property boundary approximately 700 feet south of the intersection Silverwood Loop and Crestwood Lane. This easement requires buried CMP from the Intersection of Sierra Road and McHugh Lane for approximately 750 feet, to a point near Lydia Road. From the end of the buried CMP the easement specifies that open ditch can be used to convey floodwaters through the remaining extent of the property.

For flood routing through properties where easements have not been acquired, it was assumed that open ditch and concrete box culverts could be used. It should be noted that this is likely to change based on landowners' requirements upon easement procurement.

The improvements flood routing path is depicted in Figure 3-32.

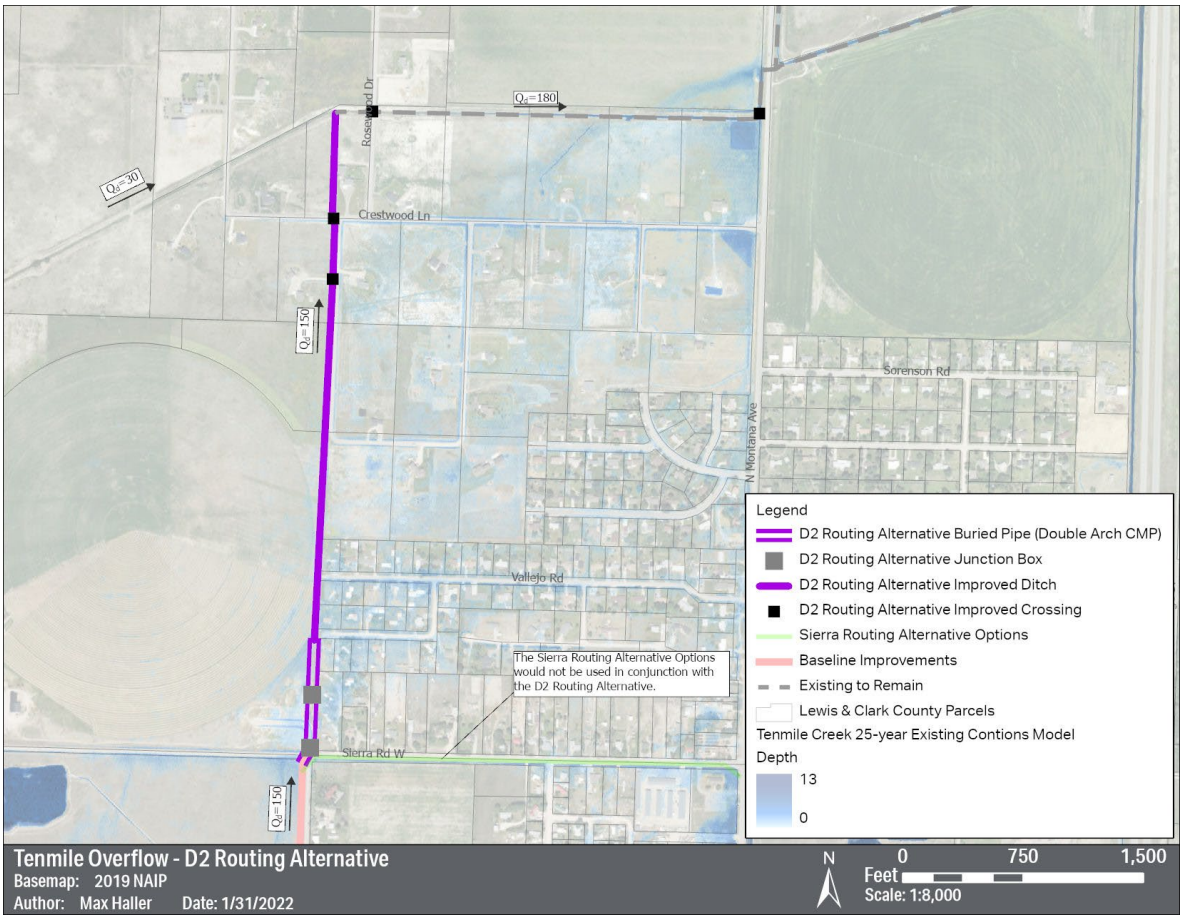


Figure 3-32. D2 Routing Alternative with the Existing Conditions 25-year model results.

Buried CMP from the intersection of Sierra Road and McHugh Lane to Lydia Road will be double 48-inch arch CMP. From the outlet of the buried arch CMP to the confluence with the D2 Ditch, floodwaters are conveyed through trapezoidal ditch and RCB culverts. The ditch will have 4:1(H:V) side vegetated side slopes with a 6-foot bottom width and 4-foot depth. Driveway and road crossings will be 12'x3' RCB culverts. It should be noted that there is a slope break in the existing topography just upstream of the Crestwood Lane crossing of the D2 Routing alternative. At the break, the longitudinal slope along the alignment transitions from approximately a 0.6 % slope to a slope near 0.0%, because of this ditch downstream of Crestwood Lane needs to daylight near the bottom of the D2 Ditch. Daylighting to the bottom of the D2 Ditch equates to approximately a 0.2%, given the described ditch and culvert size, this slope will be adequate for conveying the 150 cfs design flow. Just downstream of where flow enters the D2 Ditch, the Rosewood Drive and field access crossing just upstream of North Montana Avenue will need to be upgraded from their existing size to 72-inch CMP's.

Coordination and participation of landowners is critical to the feasibility of this alternative. The project routes through private properties so flood control easements will be required. The terms of the easements will be identical for each property and will impose an easement to set aside the area defined for the project for flood mitigation. Additionally, this alternative discharges into the D2 Ditch where all irrigation infrastructure downstream would need to be evaluated and potentially upgraded to withstand design flows. The BOR holds easements along the D2 Ditch in conjunction with the HVID for irrigation purposes, so coordination with those groups is also required.

4.0 DISCUSSION AND RECOMMENDATIONS

The flood mitigation improvements discussed in Section 3.0 were evaluated based on feasibility and constructability, public safety, effectiveness at mitigating 25-year flooding, cost and maintenance, and overall public benefit. The following sections discuss the evaluation of proposed improvements in each of the flood mitigation planning areas. Additionally, the sections provide a recommended alternative based on the evaluation.

4.1 TENMILE CREEK

4.1.1 DISCUSSION

Tenmile Creek is unique to the other planning areas because of the absence of definitive data. It's possible that aggradation is taking place and potentially impacting the amount of water spilling from Tenmile Creek into the Valley. However, available data is not definitive enough to validate this assumption. Establishing a monitoring plan that accurately assess how streambed conditions are changing over time and how they will continue to change, will provide data to justify a sediment maintenance effort if deemed effective and sustainable.

4.1.2 ESTIMATE OF PROBABLE COST

Monitoring of Tenmile Creek could be done primarily with LCC staff, therefore overall cost is relatively low. A repeat survey of the 2006 USGS cross sections will need to be performed to provide a relative benchmark for future monitoring. Additionally, physical benchmarks will need to be set at structures and select cross sections for use in monitoring level surveys.

The total cost for monitoring of Tenmile Creek, excluding county costs for annual monitoring, is estimated to be $15,000. This cost includes the repeat survey of the USGS cross sections, survey processing and

comparison with the USGS cross sections and, selection and placement of physical benchmarks at select cross sections and structures.

4.1.3 RECOMMENDATION

It is recommended that the proposed monitoring plan begins immediately. Changing conditions in Tenmile Creek could have substantial effects on flood mitigation through the Valley. Because of this, it is essential that changing streambed conditions are monitored, to evaluate the necessity and justify a sediment maintenance effort. The county should also continue to monitor and remove debris accumulation in coordination with local and state regulatory entities.

4.2 D2 DITCH

4.2.1 DISCUSSION

The D2 Ditch acts as the Valley drain for floodwaters from both Silver Creek and Tenmile Creek. Undersized crossings throughout the D2 Ditch have backwatering effects that restrict floodwaters from draining. Additionally, backwater at structures in the ditch floods adjacent properties. Replacing crossings throughout the D2 Ditch from I-15 to Lake Helena will minimize flooding on properties adjacent to the D2 Ditch while simultaneously providing sufficient conveyance to floodwaters from both Silver Creek and Tenmile Creek.

4.2.2 ESTIMATE OF PROBABLE COST

Upgrading crossings on the D2 Ditch between I-15 and Lake Helena is estimated to cost $1,932,610. This cost includes construction costs and all logistical costs associated with design, permitting, and construction.

4.2.3 RECOMMENDATION

It is recommended that all crossings on the D2 Ditch are replaced with structures capable of conveying design flows from the Tenmile Creek and Silver Creek design flood events Figure 4-1 depicts proposed and existing conditions hydraulic modeling for the recommended alternative.

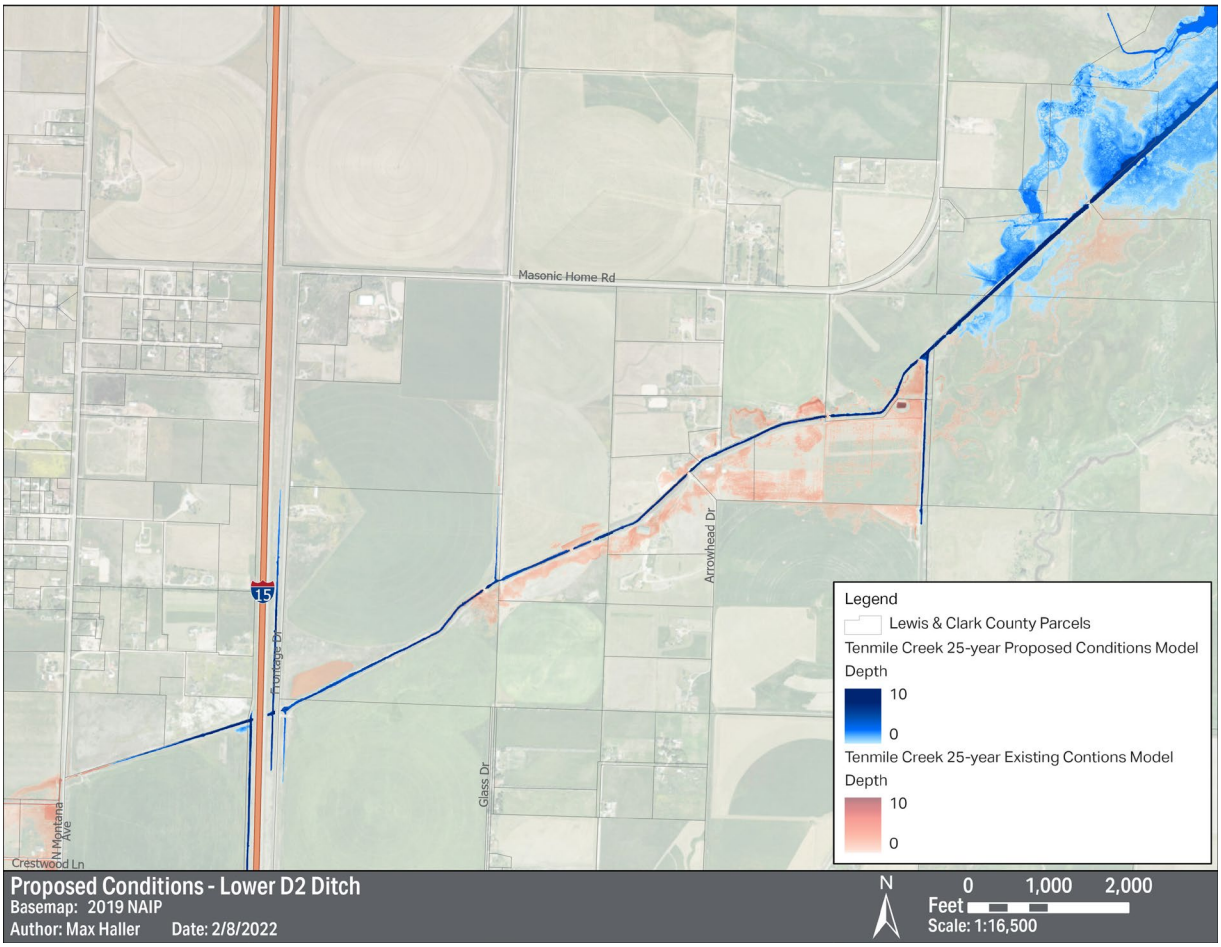


Figure 4-1. Proposed Conditions model results recommended alternative (in blue) and Existing Conditions model results (in red) for the 25-year flood event through the D2 Ditch.

4.3 SILVER CREEK

4.3.1 DISCUSSION

Both Alternative 1 and Alternative 2 provide effective flood mitigation to Sewell Subdivision and properties adjacent to the subdivision. Both alternatives rely on property easements to mitigate flooding, and in some cases, the same property easement. Since Silver Creek flows directly through private property it is not possible to provide flood mitigation without acquiring property easements in some manner. Regardless of alternative selected, coordination with property owners is essential for flood mitigation between Applegate Drive and North Montana Avenue.

Alternative 1, relies solely on earthwork to mitigate flooding in Sewell Subdivision and adjacent properties. Alternative 2 relies on a smaller quantity of earthwork and puts a much larger focus into replacing and implementing new infrastructure in the form of crossing improvements. Challenges with either alternative may be establishment of easements with landowners. Also, either alternative will require coordination with the BOR and HVID for evaluating and potentially improving existing irrigation infrastructure in ditches. Alternative 2 will require coordination with MDT for working within their R.O.W, as well as replacement of several crossings of the existing ditch. Since Alternative 2 requires additional project components relative to Alternative 1, it is likely that implementation of Alternative 2 will be more complex, and consequentially will have higher cost and take more time.

4.3.2 ESTIMATE OF PROBABLE COST

The implementation costs for Alternative 1 is estimated to be approximately $1,007,076. Costs for Alternative 1 are almost entirely rooted in earthwork and property easements. The implementation cost for Alternative 2 is estimated to be $2,864,575. Costs for Alternative 2 are heavily influenced by the procurement and placement of crossings. Cost for both alternatives include construction costs and all logistical costs associated with design, permitting, and construction.

4.3.3 RECOMMENDATION

Based on implementation costs and feasibility it is recommended that Alternative 1 should be used for mitigating Silver Creek floodwaters. Not only is Alternative 1 more cost effective than Alternative 2, but implementation of the alternative is also contingent on fewer items and therefore is more likely to be successfully implemented. Figure 4-2 depicts proposed and existing conditions hydraulic modeling for the recommended alternative.

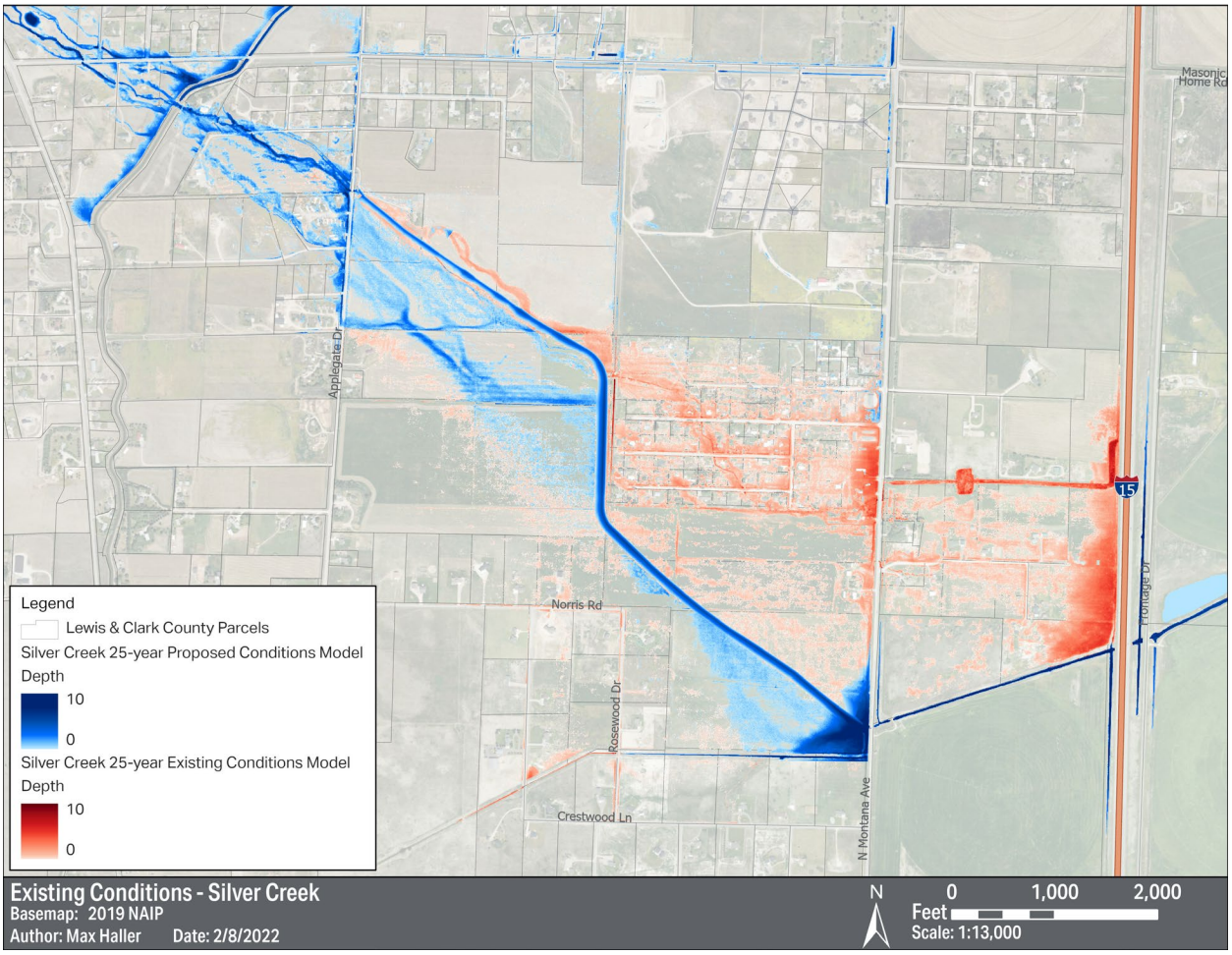


Figure 4-2. Proposed Conditions model results for the recommended alternative (in blue) and Existing Conditions model results (in red) for the 25-year flood event through Silver Creek between Applegate Drive and I-15.

4.4 TENMILE OVERFLOW

4.4.1 DISCUSSION

4.4.1.1 BASELINE IMPROVEMENTS

As discussed, Baseline Improvements will be incorporated in the Tenmile Overflow area regardless of the selection of other alternatives. Beginning near the flooding source, these improvements provide the foundation for routing floodwaters through the Valley and were determined to be the only practical option.

4.4.1.2 FORESTVALE ROAD AND SIERRA ROAD IMPROVEMENT OPTIONS

For the purpose of comparison, the Forestvale Baseline Improvement Options and the Sierra Routing Alternative Options were compared together since the structure of the options is identical. The four different methods for routing floodwaters down Forestvale Road and Sierra Road are reiterated in the following bullets.

- Option 1: Riprap 2:1 (H:V) roadside ditches, RCB culverts, and road updated to current county standards;
- Option 2: Vegetated, flatter ditch side slopes and, RCB culverts, one-way road;
- Option 3: Buried double arch CMP along the road centerline, junction boxes every 500 feet, drop inlets every 200 feet, road built to current county standards;
- Option 4: Buried double arch CMP along the south side of road, junction boxes every 500 feet, drop inlets every 200 feet, road built to existing condition.

Option 2 provides a cost effective alternative for conveying floodwaters down both Forestvale and Sierra Roads but the options were highly unfavorable with the public. Additionally, they were deemed unsafe for first responders, as the West Valley Fire Station is located along Forestvale Road. For these two reasons, Option 2 was excluded from further consideration.

Option 3 and 4 both provide unintrusive means of conveying floodwaters down Forestvale Road and Sierra Roads, but the buried pipe alternatives have drawbacks. Maintenance with buried CMP is substantial relative to maintenance in the open ditch scenario in Option 1. It is anticipated that following every flood occurrence, the CMPs will have to be inspected and sediment removed. Additionally, the risk of failure during a flood event is higher than that of the open ditch scenario. Although pipes will be fastened with trash racks, debris inevitably travels through the buried CMP and it is possible that pipes could become clogged at the rack or in the barrel. Clogging will eliminate the mitigation benefits when needed most and due the inaccessibility of buried pipe, the clog may not be resolved until floodwaters recede.

Option 1 provides a relatively cost-effective means to move floodwaters down Forestvale Road. Although, since the ditch and newly constructed road will span the entire width of the existing R.O.W, the option is more intrusive on adjacent properties than improvements proposed for Option 3 and Option 4. Additionally, guardrail will have to be incorporated along the length of the ditch, this may be considered undesirable for adjacent property owners. Despite the potentially unwanted intrusive elements of the alternative, Option 1 has a relatively low risk of failure when compared to Option 3 and Option 4. RCB culverts associated with Option 1 have a larger cross-sectional area than that of an individual buried pipe, this lends the culvert to pass debris more effectively than the buried CMPs proposed in Option 3 and Option 4. Also, RCB culverts have a substantially shorter buried length, lending them to unclog easier if debris were to get trapped within a culvert.

Option 1 will also handle local drainage and flooding more effectively than either Option 3 or Option 4. Drop inlets in Option 3 and 4 will provide some relief to local drainage and flooding but since they are placed every

200 feet, it is not possible for them to be entirely effective. The open ditch proposed in Alternative 1 on the other hand, will effectively handle local flooding because of the large area in which flows can enter the ditch.

Public safety during flooding is of concern for either the buried or open ditch option. An open ditch conveying floodwaters will have high velocity capable of sweeping a person downstream. The buried pipe option has potential for a person to be entrapped during a flood. The likelihood of either of these scenarios is overall low, but with more open ditch exposed, the risk to public safety may be higher in the open ditch option.

4.4.1.3 D2 ROUTING ALTERNATIVE

When compared to the Sierra Routing Alternative Options, the D2 Routing Alternative provides a relatively simple improvement for directing floodwaters out of the Valley. The D2 Routing Alternative follows a far less developed area of the Valley when compared to other alternatives. Additionally, as proposed in this plan, the D2 Routing Alternative could provide a relatively cost effective way to route floodwaters out of the Valley. The primary constraint on this alternative is its dependence on property easements. If any landowners are not willing to grant an easement, implementation of the alternative may not possible. One easement has already been acquired requires approximately 750 feet of buried CMP. If other landowners require buried CMP, the cost for this alternative could become less competitive with Sierra Routing Alternative Options.

Another consideration is that this alternative conveys 150 cfs away from Sierra Road the Trap Club Flood Mitigation Project. The work along Sierra Road under that project assumed this 150 cfs would convene with 250 cfs from Forestvale Road and the east side of North Montana Avenue to convey the full 400 cfs design flow. Under the D2 Routing Alternative, the Trap Club Flood Mitigation Project along Sierra Road will not be utilized to its full potential.

4.4.1.4 DISCUSSION SUMMARY

The number of alternatives and alternative options through the Tenmile Overflow area complicates comparison of positive and negative factors. To simplify comparison a comparison matrix shown in Table 4-1 was developed. The matrix provides qualitative and quantitative assessments to help guide alternative selection.

Tenmile Overflow Comparison Matrix		
Improvement Option/Alternative	Positive Factors (+)	Negative Factors (-)
Two-way Streets with Open Ditch, RCB, Riprap, Guardrail (Forestvale Baseline Improvements Option 1 and Sierra Routing Alternative Option 1)	- 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 CMP 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
One-Way Streets with Open Ditch and RCB (Forestvale Baseline Improvements Option 2 and Sierra Routing Alternative Option 2)	- 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
Buried CMP Under Center of Road (Forestvale Baseline Improvements Option 3 and Sierra Routing Alternative Option 3)	- 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 CMP Offset from Center of Road (Forestvale Baseline Improvements Option 4 and Sierra Routing Alternative Option 4)	- 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)
Upper D2 Ditch Routing (D2 Routing Alternative)	- 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

Table 4-1. Comparison Matrix for the Tenmile Overflow food conveyance improvement options.

4.4.2 ESTIMATE OF PROBABLE COST

Table 4-2 below summarizes the estimated probable costs for improvements and improvement alternatives throughout the Tenmile Overflow area.

ESTIMATED COST SUMMARY - 02/09/2022		
ALTERNATIVE	**DESCRIPTION SUMMARY**	**ESTIMATED COST**
TENMILE OVERFLOW - BASELINE IMPROVEMENTS	McHugh and Mill Ditch with RCBs Crossings	$4,577,704.40
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 1	Ditch with RCB Crossings, Improved Two-Way Street, Guardrail, Riprap Ditch	$4,107,058.85
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 2	Ditch with RCB Crossings, Improved One-Way Street	$3,210,606.05
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 3	Two Buried CMPs with Junction Boxes, Improved Two-Way Street	$4,996,611.92
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 4	Two Buried CMPs Located in Existing Ditch, Rebuilt Existing Two Way Street	$4,363,339.71
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 1	Ditch with RCB Crossings, Improved Two-Way Street, Guardrail, Riprap Ditch	$3,607,725.03
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 2	Ditch with RCB Crossings, Improved One-Way Street	$2,261,158.52
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 3	Two Buried CMPs with Junction Boxes, Improved Two-Way Street	$4,620,573.04
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 4	Two Buried CMPs Located in Existing Ditch, Rebuilt Existing Two Way Street	$3,793,431.01
TENMILE OVERFLOW - UPPER D2 ROUTING ALTERNATIVE	Two Buried CMPs with Junction Boxes, Ditch to Upper D2 Drain Ditch	$1,793,183.09

Table 4-2. Summary of estimated cost for improvement options and alternatives through the Tenmile Overflow Area.

Costs for all improvements and improvement options include the full cost for project implementation. This includes construction costs and all logistical costs associated with design, permitting, and construction. From all of the alternatives considered for use, Forestvale Baseline Improvement Option 1 and the D2 Routing Alternative are the lowest cost alternatives. The lowest cost option for Forestvale Road is Forestvale Baseline Improvement Option 2 but this alternative was not considered for use because of the safety and public wellbeing considerations. The highest cost option is Forestvale Baseline Improvement Option 3 and the Sierra Routing Alternative Option 3.

4.4.3 RECOMMENDATION

Based on the above discussion it is recommended that for the Tenmile Overflow area, Baseline Improvements should be implemented with Forestvale Baseline Improvement Option 1 and Sierra Routing Alternative Option 1. Although the D2 Routing Alternative provides a cost effective way to convey flows out of the Valley, there is too much uncertainty with property easements to recommend the alternative. If easements were to take form, and easement criteria did not make the alternative cost prohibitive, the alternative would be the preferred low cost option for use in the Tenmile Overflow area. However, for mitigation planning purposes it is recommended that the most feasible alternative should be pursued and since the D2 Routing Alternative is dependent on securing easements, the Sierra Routing Alternative Option 1 is recommended.

Figure 4-3 depicts proposed and existing conditions hydraulic modeling for the recommended alternative.

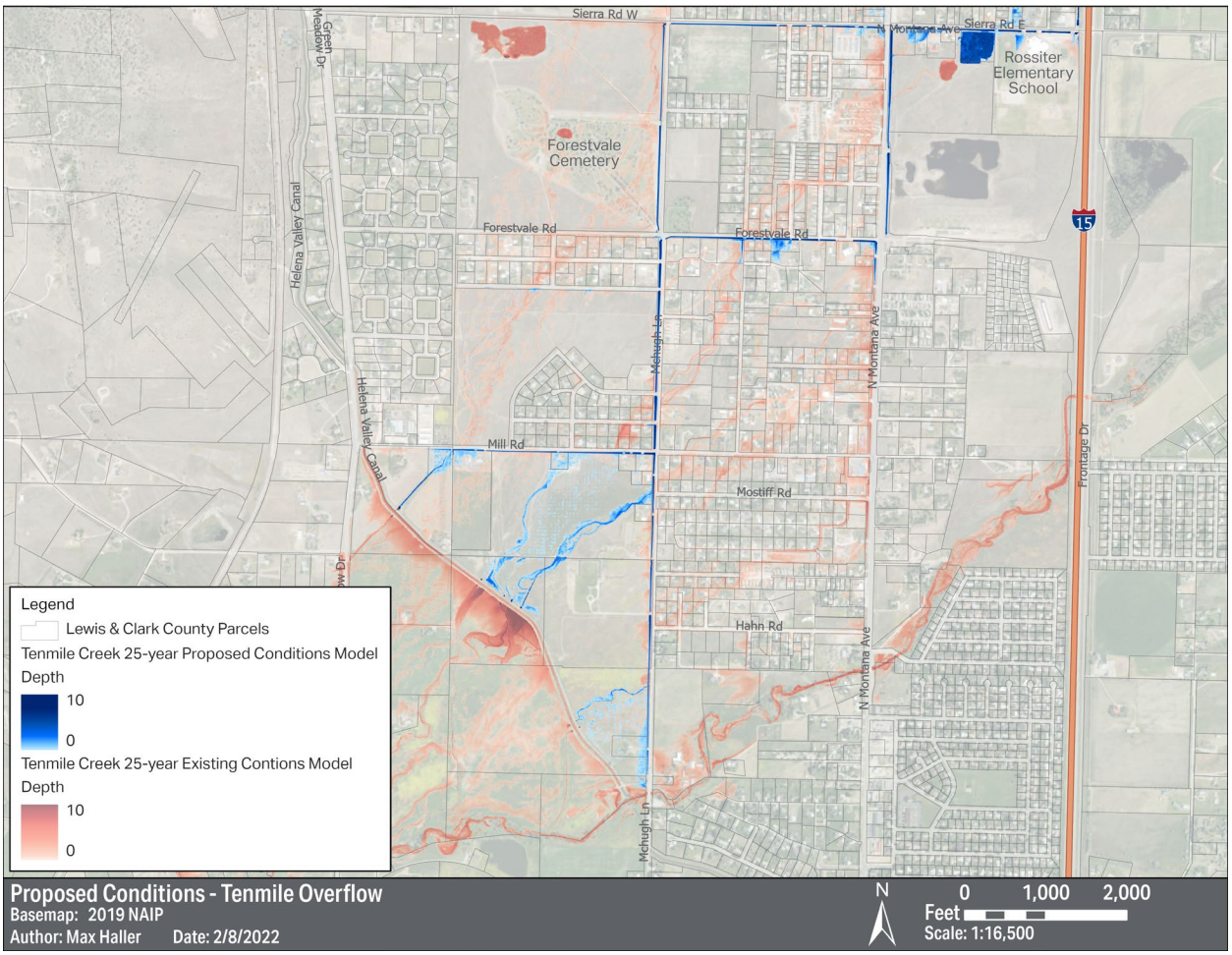


Figure 4-3. Proposed Conditions model results recommended alternative (in blue) and Existing Conditions model results (in red) for the 25-year flood event through the Tenmile Overflow Area.

4.5 DESIGN, PERMITTING, AND PROJECT IMPLEMENTATION PHASING

4.5.1 TENMILE CREEK

Regardless of the selected alternatives in other regions of the planning area, annual streambed monitoring of Tenmile Creek should be established and commence as soon as possible. As mentioned, the stage of Tenmile Creek controls the quantity of floodwaters entering the Valley and consequentially the D2 Ditch. Developing a strong understanding of Tenmile Creeks capacity through annual monitoring will guide the path forward for the Tenmile Creek capacity topic. Monitoring data will support permitting for future work on Tenmile Creek if deemed necessary.

4.5.2 D2 DITCH

Following the Tenmile Creek monitoring, project implementation should start at the downstream most end of flooding, in this case, the downstream most crossing on the D2 Ditch. Project implementation through the D2 Ditch should move from downstream to upstream, ending at the crossing immediately downstream of North Montana Avenue.

Proposed improvements throughout the D2 Ditch fall within a FEMA Special Flood Hazard Area. Since the improvements are located within a mapped hazard area, a floodplain development permit from LCC will be

required for construction. Final design will need to ensure compliance to regulations necessary to acquire these permits.

Additionally, project implementation will require coordination with relevant landowners, the BOR, and the HVID since improvements will be constructed on private property and impact an irrigation facility operated under easement by the BOR.

4.5.3 SILVER CREEK

Following implementation of the D2 Ditch crossing improvements, project implementation could move west up the Valley to Silver Creek or southwest up the Valley to the northwest portion of the Tenmile Overflow improvements. For the purpose of this update to the Master Plan, since few flood mitigation improvements have been made in the Sewell Subdivision area, Silver Creek is prioritized for implementation.

Implementation of either alternative for Silver Creek between Applegate Drive and North Montana Avenue will require thorough landowner coordination. The recommended alternative, Alternative 1, will require 8 property easements.

Additionally, Silver Creek improvements fall within a FEMA Special Flood Hazard area, because of this a floodplain development permit from LCC will be required for construction. Final design will need to ensure compliance to regulations necessary to acquire this permit.

4.5.4 TENMILE OVERFLOW

In the Tenmile Overflow area project implementation should start at Forestvale Road. Since the proposed improvements along Forestvale Road feed directly into the constructed Trap Club Flood Mitigation project, flood mitigation improvements could be implemented solely, without having adverse flooding effects. This logic holds true with the conveyance improvements along Sierra Road. Although, in the current condition, a larger quantity of water overtops Forestvale Road. Because of this, improvements made on Forestvale Road would have a more significant benefit in regard to flood mitigation and reduction of flood damages.

Following implementation of the Forestvale Road flood conveyance improvements, project implementation should shift to Sierra Road. As mentioned, conveyance improvements along Sierra Road connect directly to the Trap Club Project and therefore will not have adverse flooding effects following project implementation.

Once implementation of improvements along Forestvale Road and Sierra Road is complete, Baseline Improvements should be implemented beginning at the intersection of Sierra Road and McHugh Lane. Baseline improvements along McHugh Lane should be implemented from north to south, ending at the intersection of Mill Road and McHugh Lane. Improvements along Mill Road and McHugh Lane south of Mill Road can be made simultaneously or individually, the order is irrelevant since improvements throughout the Valley will have already been constructed.

Similar to the D2 Ditch and Silver Creek, the Tenmile Overflow area falls within a FEMA Special Flood Hazard area, because of this, a floodplain development permit from LCC will be required for construction of all improvements. Final design will need to ensure compliance to regulations necessary to acquire relevant permits.

5.0 FUNDING

Survey results and public comment show that increasing RID taxes is unfavorable for residents living within the RID. RID taxes at their current rate, will not provide enough revenue to exclusively fund any of the described

flood mitigation improvements under a reasonable timeline. The intent with RID funds since establishment, is to serve as a local cost contribution for state and federal funding opportunities. The following list is a summary of some state and federal funding opportunities that if successful, will support flood mitigation improvements throughout the Valley.

- FEMA HMGP
- FEMA Building Resilient Infrastructure Communities (formerly called PDM)
- DNRC RRGL
- MT Governor's Budget, Legislation

Although these opportunities provide adequate means to procure funding for flood mitigation projects, the timelines for these are slow and would likely only fund a portion of all improvements described in this update. Because of the project implementation timeline associated with state and federal funding opportunities and the slow accrual of RID funds at the current tax rate, increasing RID taxes should remain a consideration for the community.

6.0 CONCLUSION

This update to the VFMMP builds off decades of studies and investigation of flooding throughout the Valley. With evolving resources to analyze hydraulic and hydrologic scenarios, studies have gotten more accurate and more informative as the years have progressed. The 2017 H&H analyses bridged a substantial gap in Valley flood mitigation with a two-dimensional hydraulic model, depicting flood events for both Silver Creek and Tenmile Creek. The model established a detailed understanding of the quantity and timing of flooding throughout the Valley. Quantitative results for flooding ultimately changed flood mitigation in the Valley, enabling mitigation planning to be more specific. This change ultimately prompted the need for this update.

The overall goal of the update to the Master Plan is to solidify the path moving forward for flood mitigation in the Valley. The following steps were completed to satisfy the goal:

- Updated the hydraulic analyses to incorporate current existing conditions;
- Evaluated alternative flood routing scenarios;
- Engaged public officials, county staff, and Valley residents;
- Defined, planned, and costed flood mitigation activities moving forward.

Upon completion of the listed steps, flood mitigation alternatives were evaluated and compared, and alternatives were recommended. Project phasing was assessed, and it was determined that implementation should begin downstream and work up, generally in a northeast to southwest trajectory, upgradient through the valley.

Project implementation will consist of funding, design, permitting, and construction of selected improvements. Funding will be the most limiting resource for the implementation timeline. At the current rate, RID funds alone will take decades to implement a portion of the overall proposed improvements. If the public supports flood mitigation plans moving forward and are willing to contribute more through RID taxes, flood mitigation improvements will be implemented faster which will consequentially save landowners money in flood damages, increase property values, and directly benefit public wellbeing.

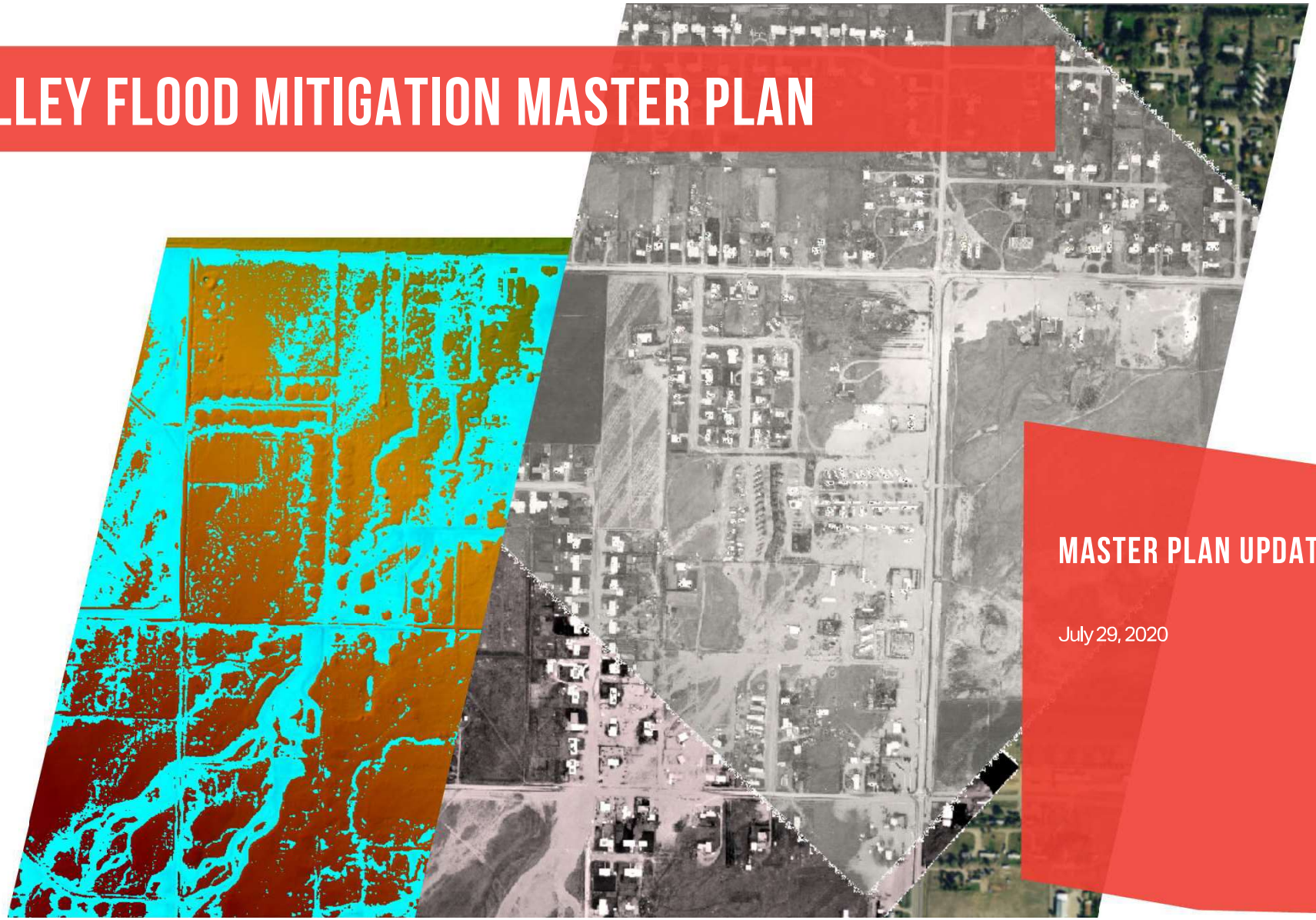
7.0 REFERENCES

1. Morrison – Maierle, Inc., Lewis and Clark County Flood Drainage Study for Tenmile Creek, April 1982.
2. United States Geologic Survey, Technical Support Data Notebook – Flood Insurance Restudy - Tenmile Creek and Silver Creek, September 2006.
3. PBS&J, Silver Creek Hydraulic Analysis - Technical Support Data Notebook, September 2010.
4. Anderson – Montgomery Consulting Engineers, Helena Valley Flood Mitigation Master Plan, April 2013.
5. RESPEC, Valley Flood Mitigation Master Plan – Hydrologic and Hydraulic Analysis, Phase I – Existing Conditions And Trap Club Improvements, May 2017.

APPENDIX A

MEETING 1 PRESENTATION AND PUBLIC COMMENTS

VALLEY FLOOD MITIGATION MASTER PLAN



MASTER PLAN UPDATE 2020

July 29, 2020

RESPEC

HISTORIC SUMMARY

- LARGE FLOODS IN:
  - 1908
  - 1964
  - 1975
  - 1981
  - 1996
  - 2011
  - 2014
  - 2018
- FLOOD MITIGATION INVESTIGATIONS IN:
  - 1977 (SCS)
  - 1982 (SCS/FLOOD COMMITTEE, MORRISON AND MAERLIE)
  - 2013 (ANDERSON MONTGOMERY)
  - 2017 (RESPEC)

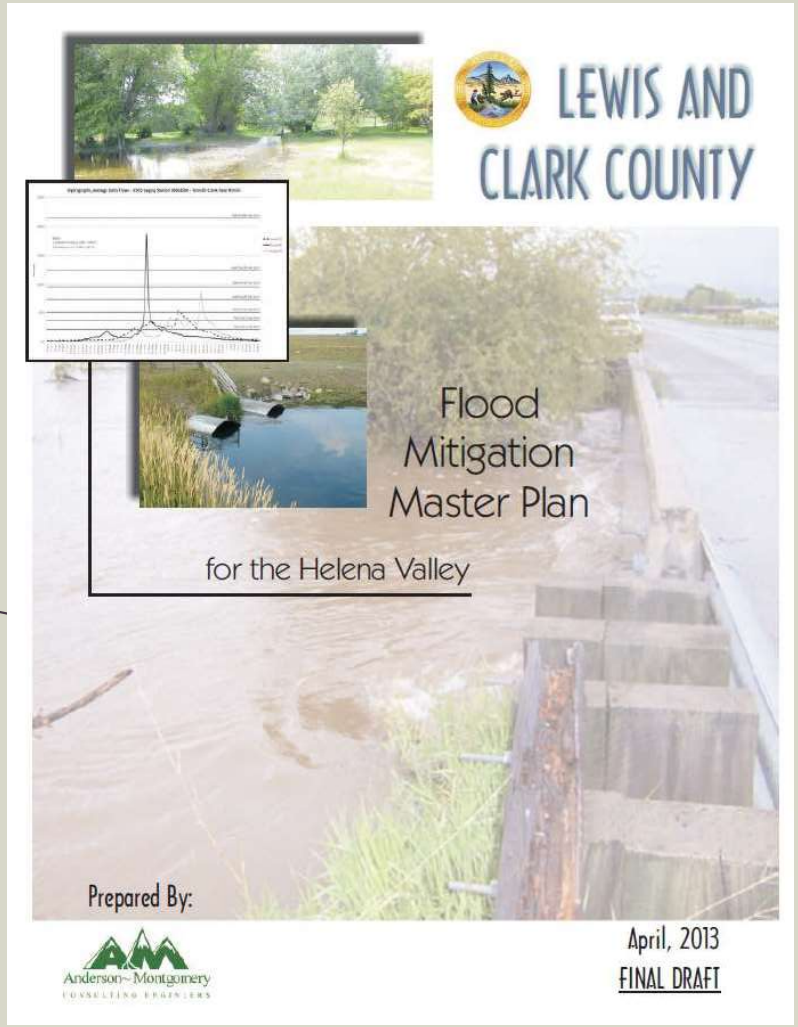
RESPEC

CONSENSUS?

- LARGE SCALE FLOOD REDUCTION PROJECT DOESN'T MEET BENEFIT – COST CRITERIA (SHALLOW SHEET FLOW FLOODING) AND IS NOT SUSTAINABLE ON ALLUVIAL FAN.
  - DAMS
  - LEVEE SYSTEM
  - CHANNELIZATION

- NO ONE SOLUTION – PROPOSED EFFORTS ARE MULTI-FACETED

- ALL STUDIES HAVE FOCUSED ON A COUPLE THEMES:
  - LOCALIZED CHANNEL CLEANING (DEBRIS REMOVAL) MAY HELP
  - ESTABLISH CONVEYANCE FOR OVERFLOW
  - IMPROVEMENTS TO D2 DRAIN DITCH:
    - LOWEST POINT IN HELENA VALLEY
    - COLLECTS ALL TENMILE CREEK OVERFLOW
    - COLLECTS SILVER CREEK



VALLEY FLOOD MITIGATION MASTER PLAN (2013)

- HIGH-LEVEL PLANNING DOCUMENT – ADVANCING THE DISCUSSION
- INTRODUCED CONCEPTUAL FLOOD MITIGATION SOLUTIONS AND COSTS
- UTILIZED APPROXIMATE ENGINEERING CALCULATIONS FOR FLOOD FLOW QUANTITY AND INFRASTRUCTURE FLOW CAPACITIES
- FOCUSED ON
  - TENMILE CREEK OVERFLOW
  - SILVER CREEK
  - D2 DRAIN DITCH

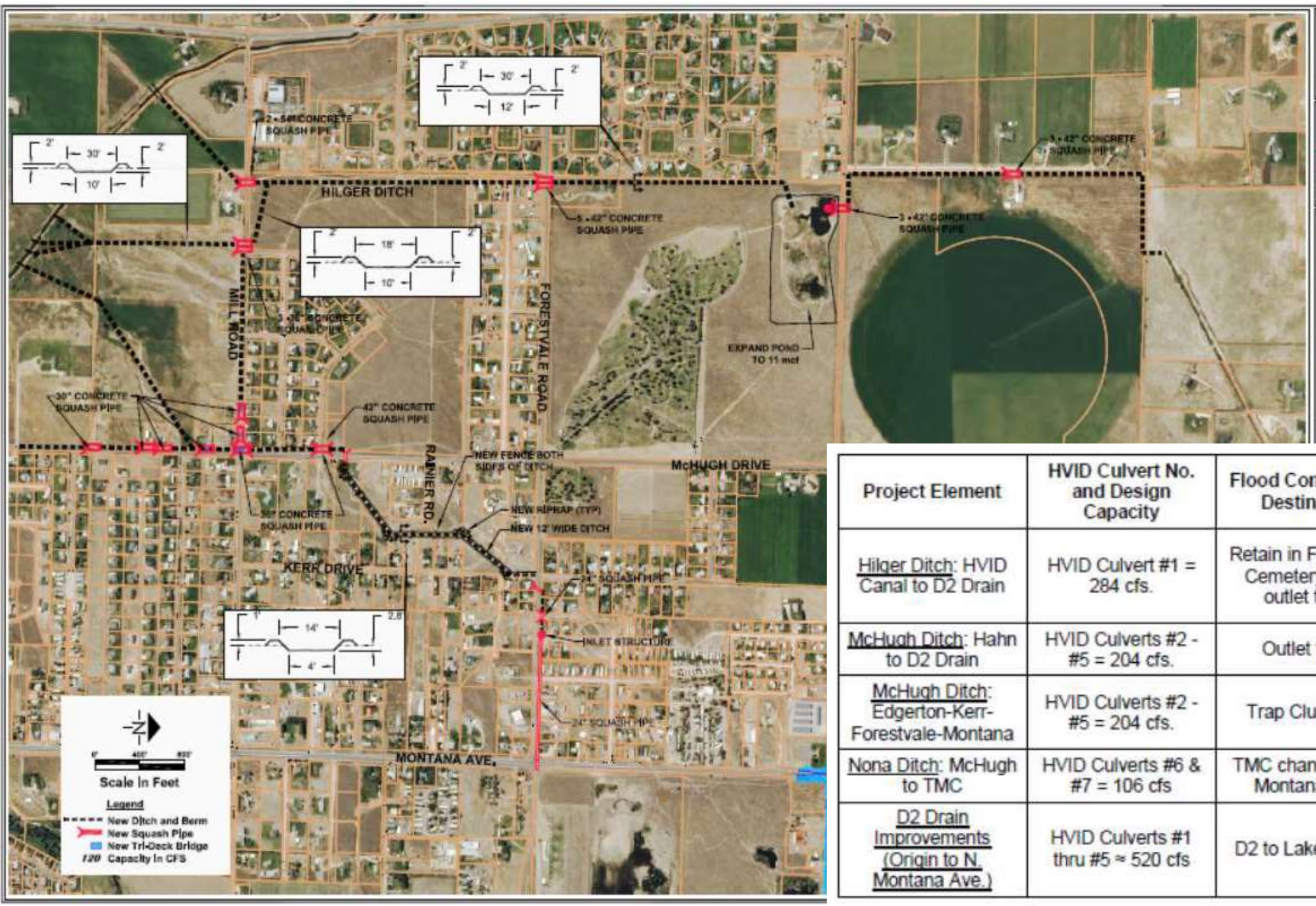
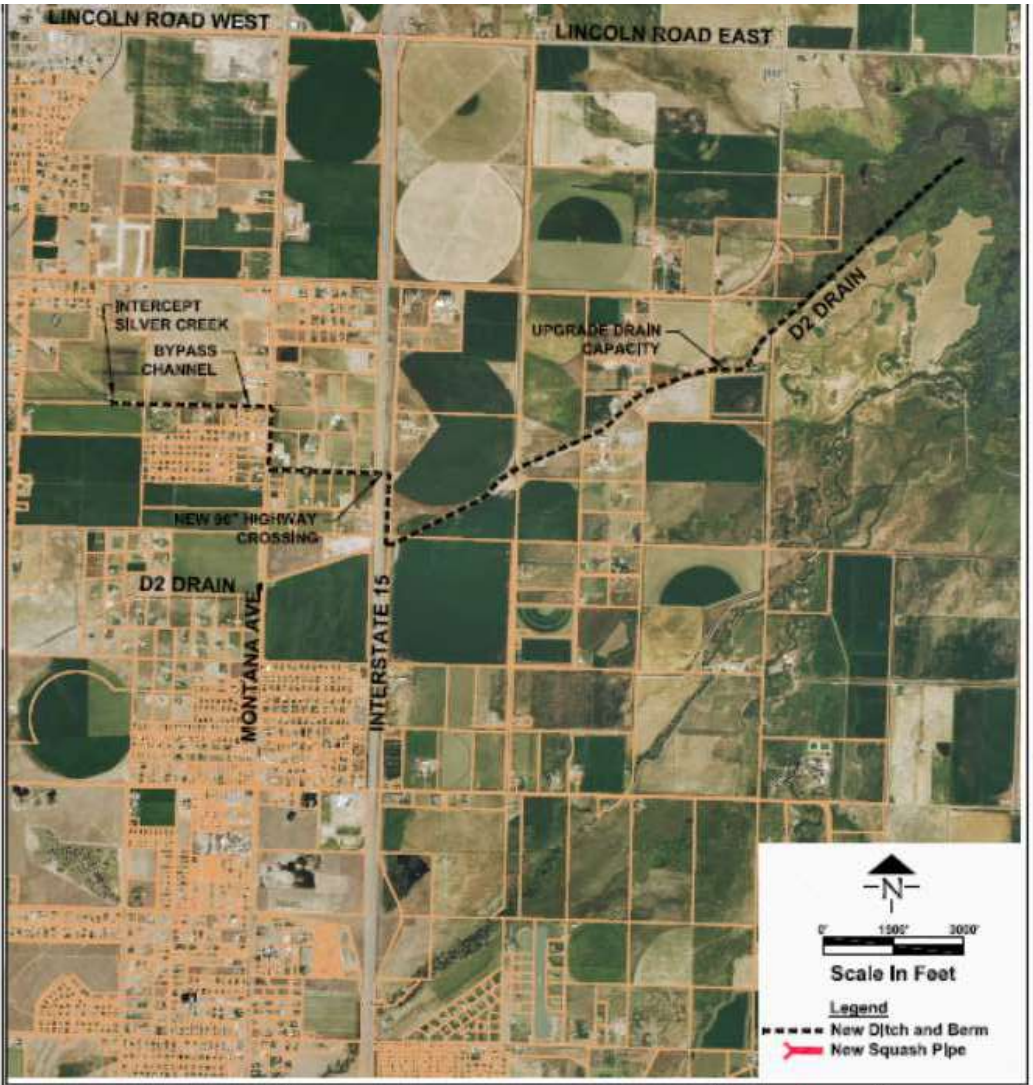


Figure: 4A

Title: Mill Road, McHugh Drive and Hilger Ditch

Project Element	HVID Culvert No. and Design Capacity	Flood Conveyance Destination	Engineer's Estimate of Probable Cost
Hilger Ditch: HVID Canal to D2 Drain	HVID Culvert #1 = 284 cfs.	Retain in Forestvale Cemetery Pond, outlet to D2	$666,860 ($2.16M including expansion of pond volume to 13M ft[3])
McHugh Ditch: Hahn to D2 Drain	HVID Culverts #2 - #5 = 204 cfs.	Outlet to D2	$1,809,900
McHugh Ditch: Edgerton-Kerr-Forestvale-Montana	HVID Culverts #2 - #5 = 204 cfs.	Trap Club Pond	$894,000
Nona Ditch: McHugh to TMC	HVID Culverts #6 & #7 = 106 cfs	TMC channel @ N. Montana Ave.	$116,700
D2 Drain Improvements (Origin to N. Montana Ave.)	HVID Culverts #1 thru #5 ≈ 520 cfs	D2 to Lake Helena	$318,000



PROJECT COST ESTIMATE

LEWIS AND CLARK COUNTY FLOODPLAIN IMPROVEMENTS

Sewell Subdivision - Bypass Channel

				Engineers Estimate	
Item No.	Item	Unit	Quant.	Unit Price	Total Price
1.	Mobilization	LS	1	$125,000.00	$125,000.00
2.	Install New Culverts 3 -30" CMP	LF	90	$60.00	$5,400.00
3.	Clean Silver Creek Channel	CY	180	$45.00	$8,100.00
4.	Renovate MT Ave Culvert	LS	1	$4,500.00	$4,500.00
5.	Second MT Ave Culvert	LF	50	$150.00	$7,500.00
6.	Excavation	CY	131200	$4.50	$590,400.00
7.	Embankment	CY	86,192	$6.95	$599,034.40
8.	Road Restoration	LS	3	$3,500.00	$10,500.00
9.	Seeding/fertilizing	SY	45000	$1.25	$56,250.00
10.	New Pipe Crossing Under I-15	LF	200	$1,200.00	$240,000.00
11.	Utility Conflicts	EA	20	$530.00	$10,600.00
12.	Permitting	LS	1	$8,000.00	$8,000.00
13.	Traffic Control	LS	1	$5,000.00	$5,000.00
14	Easement Acquisition	LS	1	$30,000.00	$30,000.00
	Construction Subtotal				$1,700,284.40
15.	Contingency		10%		$170,028.44
16.	Engineering		22%		$374,062.57
			Estimated Price		**$2,244,375**

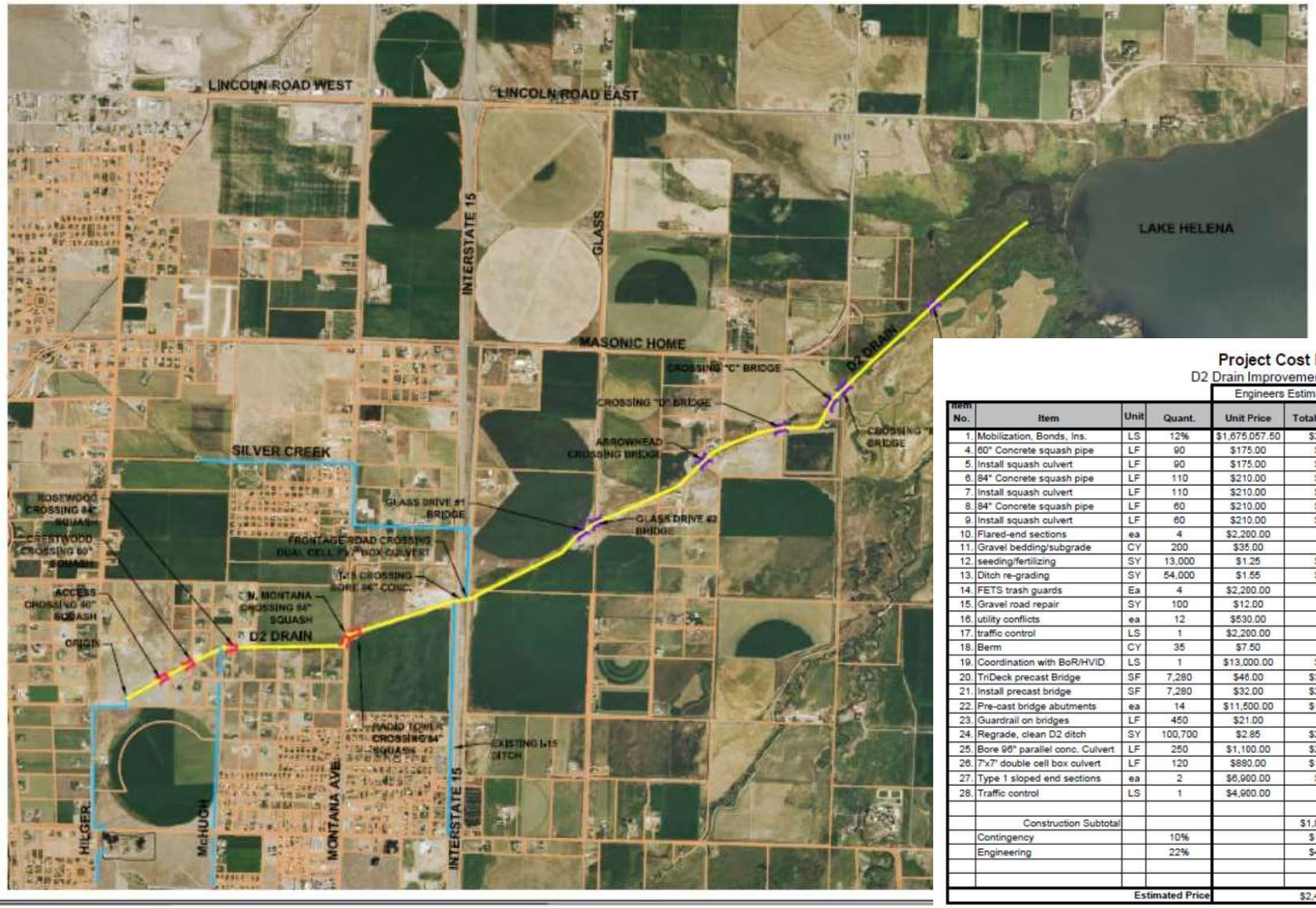


Figure 16

Helena Proposed
to Accomodate
er Creek Flooding

Project Cost Estimate

D2 Drain Improvements - OVERALL

Item No.	Item	Unit	Quant.	Engineers Estimate Unit Price	Engineers Estimate Total Price	
1.	Mobilization, Bonds, Ins.	LS	12%	$1,675,057.50	$201,007	
4.	60" Concrete squash pipe	LF	90	$175.00	$15,750	D2 crossing under Access and Crestwood
5.	Install squash culvert	LF	90	$175.00	$15,750	crossings (labor/equipment)
6.	84" Concrete squash pipe	LF	110	$210.00	$23,100	crossing under Rosewood and @ N. Montana (material cost)
7.	Install squash culvert	LF	110	$210.00	$23,100	crossings (labor/equipment)
8.	84" Concrete squash pipe	LF	60	$210.00	$12,600	crossing under access east of Montana (material cost)
9.	Install squash culvert	LF	60	$210.00	$12,600	crossing under access east of Montana (labor/equipment)
10.	Flared-end sections	ea	4	$2,200.00	$8,800	on upstream ends of each squash culvert (installed)
11.	Gravel bedding/subgrade	CY	200	$35.00	$7,000	bedding for culverts and road subgrade
12.	seeding/fertilizing	SY	13,000	$1.25	$16,250	entire disturbed area
13.	Ditch re-grading	SY	54,000	$1.55	$83,700	along Rosewood
14.	FETS trash guards	Ea	4	$2,200.00	$8,800	Easements, R.O.W., Landowner negotiations
15.	Gravel road repair	SY	100	$12.00	$1,200	crossings at Crestwood and Rosewood
16.	utility conflicts	ea	12	$530.00	$6,360	Crestwood, Rosewood
17.	traffic control	LS	1	$2,200.00	$2,200	Crestwood, Rosewood
18.	Berm	CY	35	$7.50	$263	at N. Montana to contain flow toward 96" CMP under Montana
19.	Coordination with BoR/HVID	LS	1	$13,000.00	$13,000	Eng.effort to coordinate project, easement compliance, pub. Ed.
20.	TriDeck precast Bridge	SF	7,280	$46.00	$334,880	Seven bridges east of I-15 over existing crossing points:
21.	Install precast bridge	SF	7,280	$32.00	$232,960	Arrowhead; accesses, etc.
22.	Pre-cast bridge abutments	ea	14	$11,500.00	$161,000	Seven bridges east of I-15.
23.	Guardrail on bridges	LF	450	$21.00	$9,450	both sides of all seven bridges.
24.	Regrade, clean D2 ditch	SY	100,700	$2.85	$286,995	East of I-15 to Lake Helena - higher unit cost due to mucking
25.	Bore 96" parallel conc. Culvert	LF	250	$1,100.00	$275,000	Under I-15. Added capacity 340 cfs.
26.	7'x7' double cell box culvert	LF	120	$880.00	$105,600	Under Frontage Rd. east of I-15
27.	Type 1 sloped end sections	ea	2	$6,900.00	$13,800	ends of double cell box culverts under Frontage Rd.
28.	Traffic control	LS	1	$4,900.00	$4,900	for Frontage Road.
	Construction Subtotal				$1,876,064	$1,675,058
	Contingency		10%		$187,606	
	Engineering		22%		$412,734	
			Estimated Price		$2,476,405	

5070 lineal feet of re-graded ditch and 4 crossings

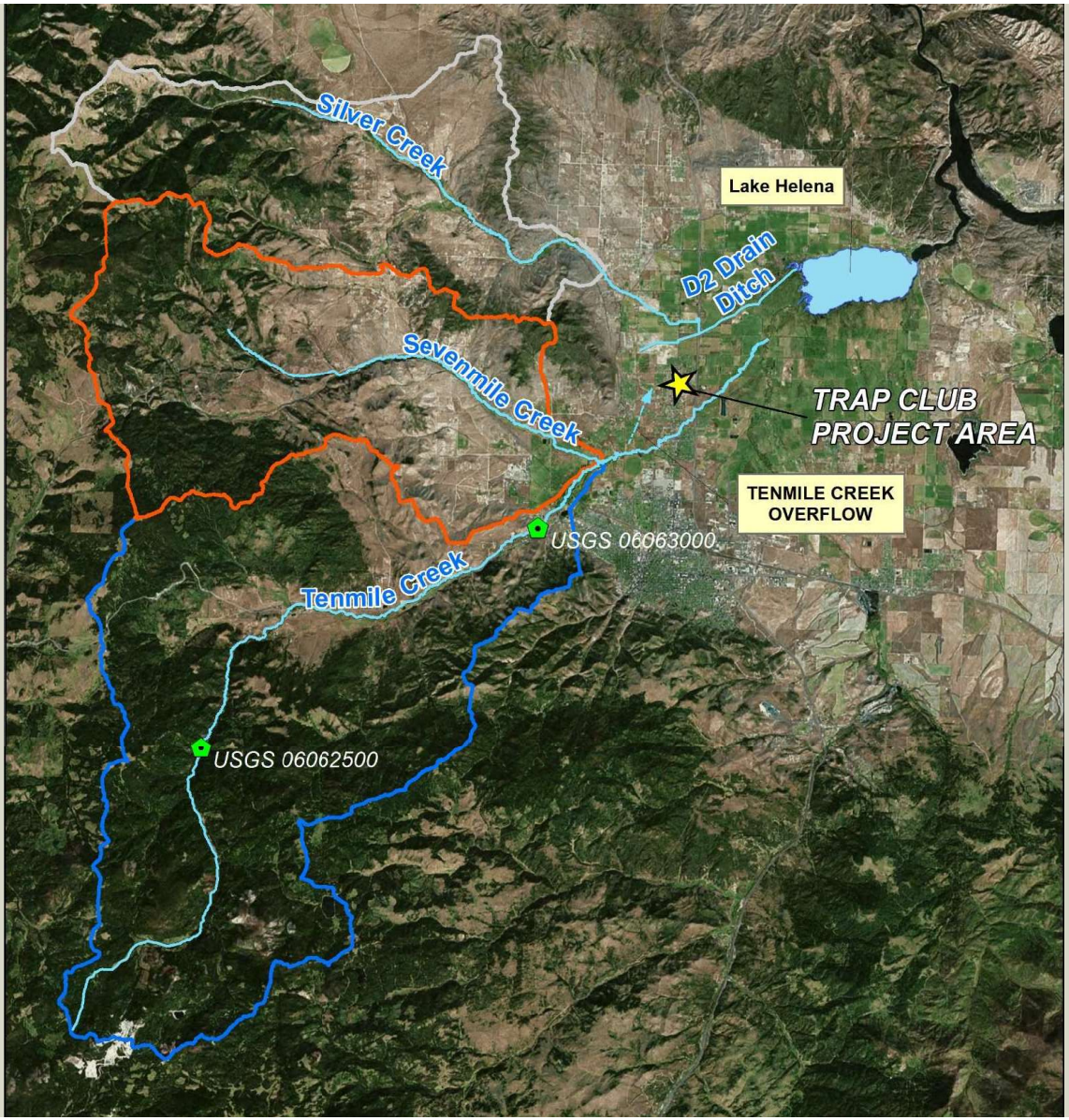
RESPEC

WHY ANOTHER STUDY? WHY UPDATE?

- COMPLEX PROBLEM
- ALL STUDIES HAVE BUILT UPON PREVIOUS EFFORTS
- NO ONE SIMPLE SOLUTION – PROPOSED SOLUTIONS ARE MULTI-FACETED
- NO PREVIOUS STUDIES HAD TOOLS WE HAVE TODAY – TECHNOLOGICAL ADVANCEMENTS

- HYDROLOGIC AND HYDRAULIC ANALYSIS (2017)
  - NEED DEFINITIVE UNDERSTANDING OF FLOW QUANTITIES AND FLOW ROUTES FOR DESIGN
  - NEED A MODEL TO UNDERSTAND EFFECTIVENESS OF PROPOSED PROJECTS AND RAMIFICATIONS OF PROJECT IMPLEMENTATION
  - NO-ADVERSE IMPACTS/FLOODPLAIN PERMITTING
  - NEED TO IMPLEMENT FEMA PROJECT BEFORE END OF PERIOD OF PERFORMANCE

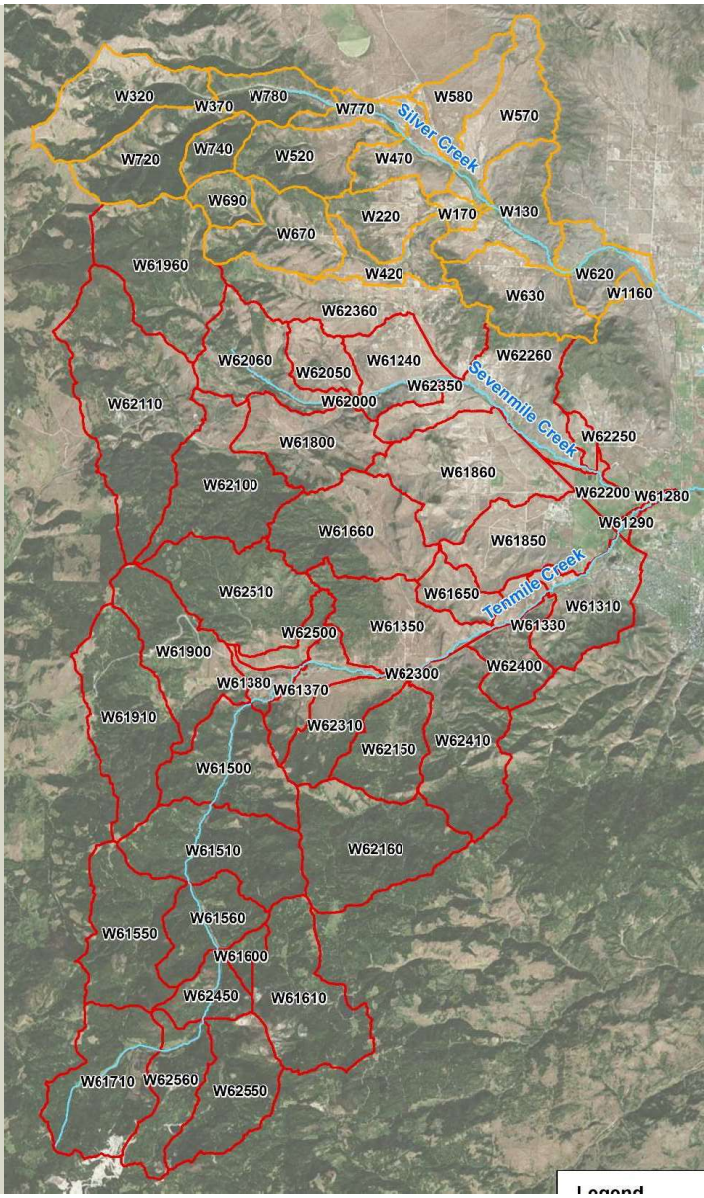
RESPEC


Silver Creek
Lake Helena
D2 Drain Ditch
Sevenmile Creek
TRAP CLUB PROJECT AREA
TENMILE CREEK OVERFLOW
USGS 06063000
Tenmile Creek
USGS 06062500

RESPEC

HYDROLOGY

- SILVER CREEK AT GREEN MEADOW DRIVE
  - 19 SUBBASINS
- TENMILE CREEK AT GREEN MEADOW DRIVE
  - 44 SUBBASINS
  - INCLUDES SEVEMILE CREEK WATERSHED
- EVENT BASED RAINFALL-RUNOFF MODEL METHODS
  - LOSS METHOD: SCS CURVE NUMBER
  - TRANSFORM METHOD: SCS UNIT HYDROGRAPH
  - ROUTING: MUSKINGHAM-CUNGE
  - METEOROLOGICAL MODEL: 24-HOUR DESIGN STORM
  - PRECIPITATION: NOAA ATLAS 2

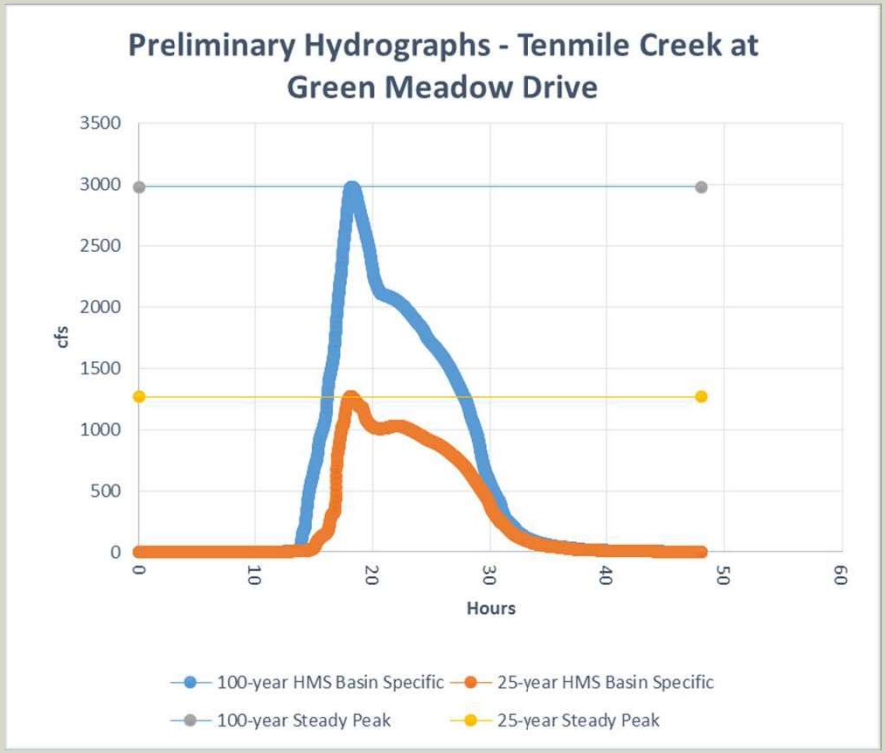


RESPEC

HYDROLOGY

PEAKS WERE QUASI-CALIBRATED TO USGS PEAK FLOOD FREQUENCY RESULTS AT RIMINI AND HELENA GAGING STATIONS BY ADJUSTING INITIAL ABSTRACTION FOR SELECT BASINS:

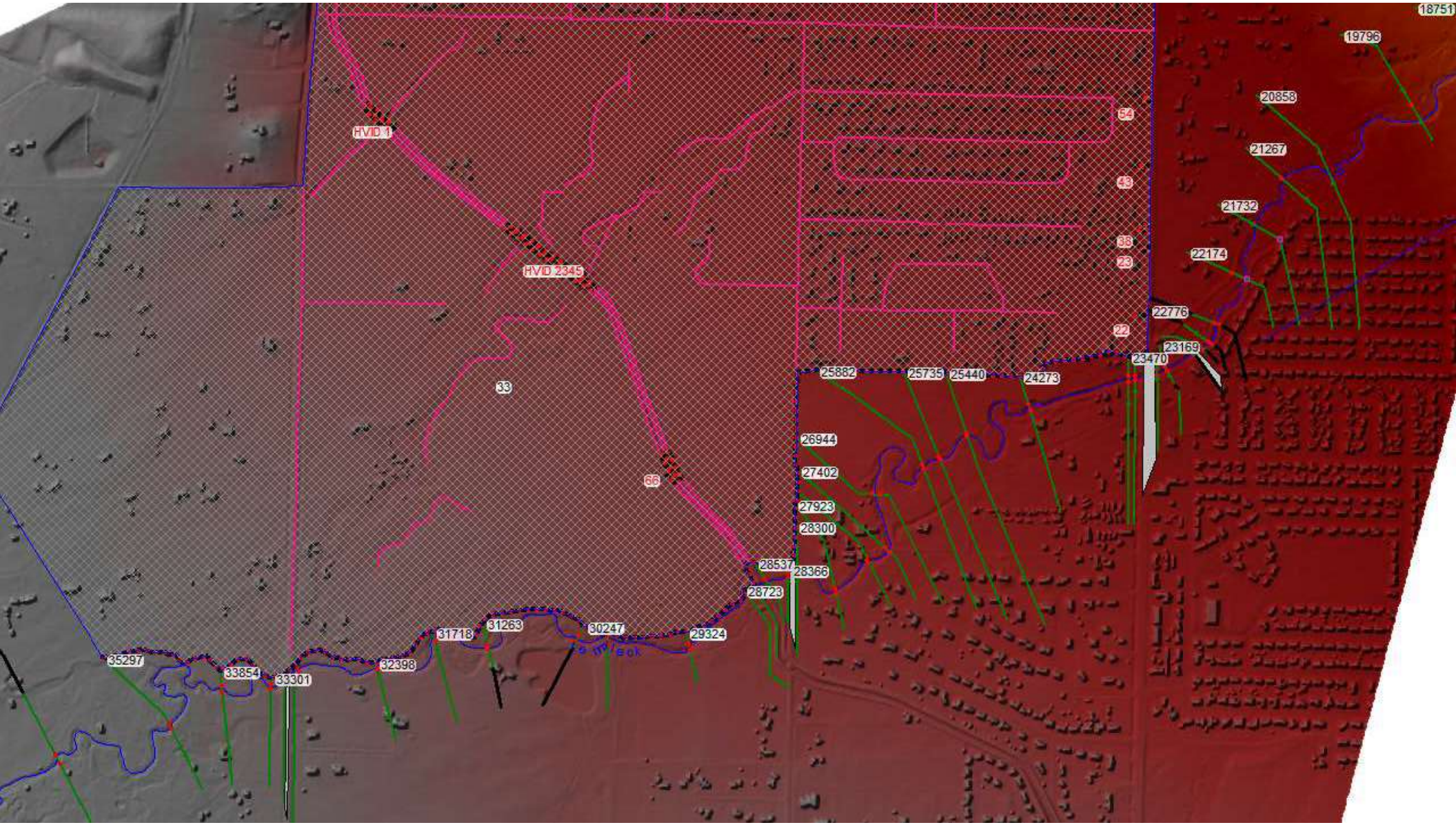
	RI (Method)	Peak Flow (cfs)		
		Rimini Gage	Helena Gage	At Green Meadow Drive
RESPEC 2017	25-year (HMS)	708	926	1,270
	100-year (HMS)	1,540	1,910	2,980
USGS 2015 Report	25-year (LP3)	721	968	-
	100-year (LP3)	1,460	1,860	-



RESPEC

HYDRAULICS

- TENMILE CREEK OVERFLOW, SILVER CREEK, AND UPPER D2 DITCH
  - UTILIZED USGS 2006 HEC-RAS MODEL FOR TENMILE CREEK
    - MODIFIED TO INTERFACE WITH HELENA VALLEY 2D FLOW AREA
  - ALL TENMILE CREEK OVERFLOW, SILVER CREEK, AND UPPER D2 SIMULATED IN ONE 2D FLOW AREA
  - PROBABILITY OF COINCIDENT FLOODS IS LOW
  - SIMULATED THE EXISTING CONDITIONS (EX) – 10%, 4%, 2%, AND 1% ANNUAL CHANCE EVENTS
  - FROM EX, REVISED THE MODEL TO INCORPORATE TRAP CLUB IMPROVEMENTS (PC)
    - IGNORED TRAP CLUB DETENTION POND
  - COMPARE TIME-SERIES FLOW RESULTS IN AREAS OF INTEREST


HVID 1
HVID 2345
54
43
38
29
22
33
66
18751
19796
20858
21267
21732
22174
22776
23169
23470
25882
25735
25440
24273
26944
27402
27923
28300
28537
28366
28723
29324
30247
31263
31718
32398
33301
33854
35297

RESPEC

SIMULATION ANIMATION - EX

- FLOODS OF INTEREST:
  - 4% (25-YEAR) DESIGN EVENT
  - 1% (100-YEAR) FOR FLOODPLAIN PERMITTING/NO ADVERSE IMPACT

- DISCLAIMERS:
  - NON-REGULATORY MAPS, DIFFERENT APPROACH THAN THE FIRM
  - NO CONSIDERATIONS FOR SANDBAGGING OR CULVERT PLUGGING

RESPEC

HYDRAULIC RESULTS SUMMARY

- TENMILE CREEK OVERFLOW
  - HVID CANAL BUFFERS PEAK FLOW, REGULATED THROUGH ITS CULVERTS FOR EVENTS THAT DO NOT BREACH THE CANAL
  - MOST FLOW LEAVES CHANNEL JUST UPSTREAM OF GREEN MEADOW DRIVE, SOME AT HVID CANAL, SOME AT MCHUGH
- SILVER CREEK, AND UPPER D2 DITCH
  - NORTH MONTANA AVENUE AND INTERSTATE 15 ACT AS DAMS SIGNIFICANTLY BUFFERING PEAK FLOWS
- CULVERT AND DITCH GRADING COMPONENTS OF THE TRAP CLUB PROJECT
  - CHANGES DISTRIBUTION OF PEAK FLOW RATES FOR AREAS UPSTREAM OF INTERSTATE 15, SPECIFICALLY FLOWS CROSSING SIERRA
  - DOES NOT SIGNIFICANTLY CHANGE PEAK FLOW RATES THROUGH INTERSTATE 15 DUE TO DAM AFFECT/ATTENUATION
  - FLOODS THAT OVERTOP INTERSTATE 15 SHOW MINOR CHANGE (< 1%) TO PEAK FLOW IN LOWER D2 DITCH

VALLEY FLOOD MITIGATION
MASTER PLAN IMPLEMENTATION
PHASE I - TRAP CLUB FLOOD MITIGATION

LEWIS AND CLARK COUNTY PUBLIC WORKS
MAY 22, 2019
RESPEC PROJECT NO. 02949

LEWIS AND CLARK COUNTY, MONTANA
N.T.S.

VICINITY MAP
N.T.S.

5/22/19
DATE

MATTHEW WYNN JOHNSON
REGISTERED PROFESSIONAL ENGINEER
STATE OF MONTANA NO. PEL-PE-LIC-32920

SHEET INDEX	
GENERAL	
G-00	COVER SHEET AND SHEET INDEX
G-01	LEGEND AND GENERAL NOTES
G-02	CONSTRUCTION QUANTITIES
G-03	SURVEY CONTROL
G-04	PROJECT OVERVIEW
G-05	TRAFFIC CONTROL PLAN
CIVIL	
C-01 - C-08	DITCH PLAN AND PROFILE
C-09 - C-28	DITCH SECTIONS
C-29 - C-30	TYPICAL CULVERT DETAIL
C-31	TYPICAL RIPRAP DETAIL
C-32	CULVERT - 1 DETAIL
C-33	CULVERT - 2 DETAIL
C-34	CULVERT - 2 TURNOUT HEADWALL DETAIL
C-35	CULVERT - 3 DETAIL
C-36	CULVERT - 3 DIVERSION HEADWALL DETAIL
C-37	CULVERT - 4 DETAIL
C-38	CULVERTS - 5 AND 6 DETAIL
C-39	CULVERTS - 7 AND 8 DETAIL
C-40	CULVERTS - 9 AND 10 DETAIL
C-41	CULVERT - 11 DETAIL
C-42	CULVERT - 12 DETAIL
C-43	SIERRA ROAD CROSSING RETAINING WALL DETAIL
C-44	CULVERT - 13 DETAIL
C-45	TRAIL DETAIL
C-46 - C-47	GUARDRAIL DETAIL
C-48	CHAIN LINK FENCE DETAIL
C-49	CHAIN LINK FENCE PLAN VIEW
C-50	CONCRETE CURB DETAIL
STRUCTURAL	
S-01 - S-05	STRUCTURAL DETAILS
PLANTING	
P-01 - P02	PLANTING PLAN

REVISION	DESIGNED	DRAWN	CHECKED	DATE
	JSJ	AB	JSJ	5/22/19

811 Know what's below. Call before you dig.

LEWIS AND CLARK COUNTY
PUBLIC WORKS
3402 COONEY DRIVE
HELENA, MT 59602

TRAP CLUB

COVER SHEET

SHEET NUMBER:
G-00
SHEET -


EX 1
Utility
MODERN

RESPEC

MASTER PLAN UPDATE 2020

FEMA FMA GRANT –UPDATE/AMEND 2013 VFMMP

- FULL PROPOSED CONDITIONS MODELING – CONCEPTUAL DESIGNS
- UPDATE HYDRAULICS TO 2018 LIDAR
- EXPLORE ADDITIONAL MITIGATION OPTIONS
  - ALTERNATE ROUTING OPTIONS
  - TENMILE CREEK CAPACITY ENHANCEMENT ANALYSIS
    - SEDIMENT DEPOSITION ANALYSIS
    - DOWNSTREAM EXISTING INFRASTRUCTURE CAPACITY
- DEFINITIVE PLAN FORWARD
  - PHASING, COSTS, TIMELINE

RESPEC

MASTER PLAN UPDATE 2020

STEPS

1. MEETING 1 - FLOOD MITIGATION ALTERNATIVES DISCUSSION (THIS MEETING)
2. COMMUNITY SURVEY (ONLINE)
3. ALTERNATIVES EVALUATION – HYDRAULIC ANALYSIS
4. MEETING 2 – DEFINE SELECTED ALTERNATIVE
5. FINALIZE SELECTED ALTERNATIVE AND VALLEY FLOOD MITIGATION MASTER PLAN REPORT UPDATE

MASTER PLAN UPDATE 2020

- ROUTING ALTERNATIVES FIGURES
  - OVERALL FIGURE WITH 2013 FEATURES AND ADDITIONAL POTENTIAL FUTURE
  - VALLEY SPECIFIC FIGURES WITH 2013 FEATURES AND ADDITIONAL POTENTIAL FUTURE
    - UPPER TENMILE OVERFLOW AREA
    - SILVER CREEK/SEWELL SUBDIVISION AREA
    - LOWER D2 DRAIN DITCH AREA

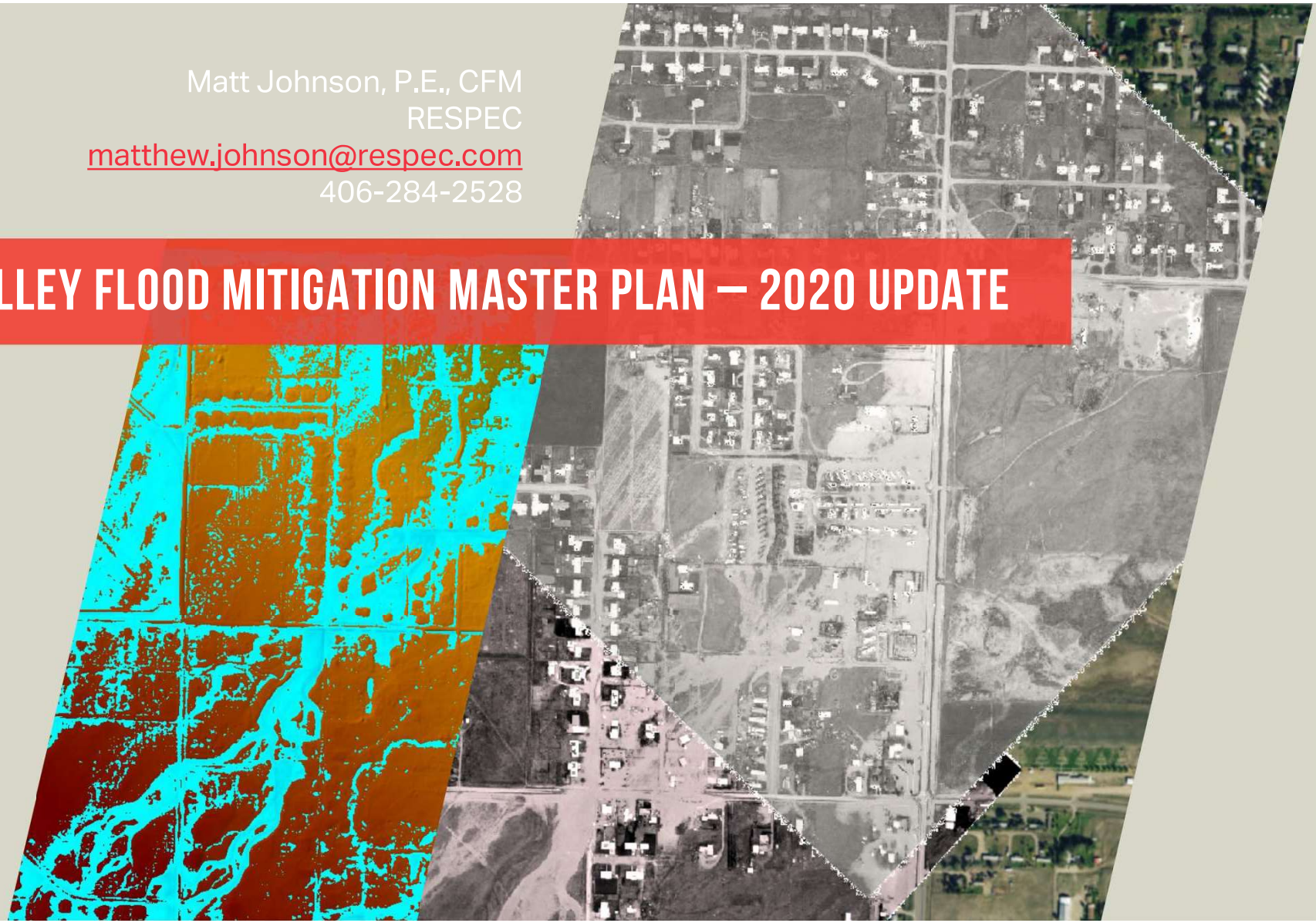
RESPEC

MASTER PLAN UPDATE 2020

- ADDITIONAL FLOODWATER ROUTING ALTERNATIVES NOT PRESENTED IN THE 2013 PLAN THAT SHOULD BE EXPLORED FURTHER?
- BREAKOUT SESSIONS ~ 30 MIN.
  - UPPER TENMILE OVERFLOW AREA
  - SILVER CREEK/SEWELL SUBDIVISION AREA
  - LOWER D2 DRAIN DITCH AREA
- COUNTY MODERATORS FOR EACH GROUP
- EACH GROUP IDENTIFY A SPOKESPERSON TO TAKE NOTES AND SUMMARIZE THE DISCUSSION TO THE GREATER GROUP

Matt Johnson, P.E., CFM
RESPEC
matthew.johnson@respec.com
406-284-2528

VALLEY FLOOD MITIGATION MASTER PLAN – 2020 UPDATE



From: Jack Carlson <carlsonjd@mt.net>
Sent: Sunday, July 26, 2020 7:36 AM
To: Dan Karlin <DKARLIN@lccountymt.gov>
Subject: flood mitigation

Mr. Karlin
As land owners along HVID lateral known as D-2, we would offer the following comments for your consideration.

Construction of this drainage conveyance was done by easement granted by the land owners for the purpose of controlling Helena valley **drainage water** (not flood water). No attempt that I am aware of has ever been made to obtain an easement for Ten Mile flood water has ever been made.

A previously completed engineering study's recommendation stated that improvements to D-2 should be made from its lowest point, Lake Helena; working upstream. These recommendations have not been followed.

The existing crossing structure (culvert) at Arrowhead Rd. is at, or near capacity, most of the year handling only drainage water. Five residences would be left inaccessible in the event the crossing fails. In addition, two additional residences plus a church (with another residence inside) and access to our home which is along the north bank of D-2 would be flooded. Additionally, our stack yard housing round hay bales would be flooded and threaten everything downstream.

We would urge you to visit this situation personally and keep us informed as to the priorities established by your meeting. In particular, as your mailing states, "additional floodwater routing alternatives".

Jack and Debbie Carlson
4935 Arrowhead Dr
Helena, MT 59602

From: SHANE shaw <JOELSHW@msn.com>
Sent: Friday, July 17, 2020 12:40 PM
To: Dan Karlin <DKARLIN@lccountymt.gov>
Subject: flood plan update

Hi Dan,

I received a post card in the mail about a virtual meeting concerning updates to the flood mitigation plan for the valley.

I have been hoping we could meet with the county to discuss some of the options going forward.

The Valley Flood Committee has been mostly inactive since Covid 19 and thankfully we didn't have much in the way of high water this year.

I talked with Harold Beggar at his place of employment last week - (he was working at the solid waste transfer station). Harold told me that he is working more than one job and is working on Thursday evenings so he can't be at flood committee meetings. He asked me to head up the meetings but I have not agreed and there has been no formal action taken. He also said he talked to you and that you didn't see any point to having a meeting at this point. I don't disagree with your assessment about the value in having a meeting right now.

I want to meet with the irrigation district/Bureau of Reclamation about the continued high, water table in the central valley and whether the drainage ditch system is working.

I wanted to have a discussion that would include the Army Corp of Engineers about the flooding issue. From comments I have read and discussions I have been party to or listened in on, there is a large consensus that we need to do a few things to keep more water in the Ten Mile Creek bed. Everywhere I go, I see dikes and banks and cement walls and gravel barriers designed to keep water in a specific bed or to direct it in a certain

direction. When this has been brought up at flood committee meetings, we hear it blamed on the Army Corp or we get the alluvial plain explanation. Neither explanation holds much water in my view.

The irrigation canal limits the alluvial plain explanation because the canal regroups the water into specific streams and ditches reenergizing the flood waters. I have heard about these old stream beds but I don't see any trees marking the streambeds so they have been inactive for a long time.

Personally, I favor a dual approach...adding to the lower or northern bank of ten mile east of Green meadow and then picking the places where we send the water. Currently, we would flood a couple of subdivisions if we sent all of the water down the stream bed, but there are dikes along the Ten Mile subdivision so I know it's possible to raise the sides of the stream bed, even though its pretty flat between Green Meadow and McHugh.

With the deeper canal along Sierra, and the opportunity to send some water north from McHugh, we should plan to send water in specific channels rather than just let it flood neighborhoods who are just out of luck.

I hope you haven't had a lot of flack for the Trap Club project because it's a very important addition to the valley.

Shane Shaw

JuDan Karlin, PE
County Engineer
Lewis and Clark County Public Works
Office (406) 447-8034
dkarlin@lccountymt.gov

From: Lyle Lallum
D2 Ditch Owner & Resident
(406) 458-4966
lllmboy@yahoo.com

Subject: Flood Mitigation

I will be unable to participate in the Zoom Meeting tonight for health and other reasons but have the following comments:

I hope that before the recent Trap Club Project is finalized, an engineering firm will provide the project flood flow elevations for various sections of the D2 Ditch reflecting flow conditions prior to the Trap Club Project and flow conditions projected from the Trap Club Project completion. This information is required to be prepared by an Engineering Firm in accordance with the requirements of the L&C County Flood Ordinance. It should have been done during the initial phases of the Trap Club Project but for some reason, it was not.

Also, as I'm sure you are fully aware of, both fairly recent flood mitigation studies prepared by Engineering Firms, indicated the flood mitigation work in a drainage needs to start at the lower end of the drainage and proceed upstream. This standard engineering practice was ignored with the Gun Club Project being located about midway in the floodway. This has placed several properties and residences in the D2 Ditch area in considerable jeopardy due to the Trap Club Project completion.

In summary, it is imperative that any future flood mitigation work needs to center on the needs in the D2 Ditch area. The Arrowhead Road Crossing and the Glass Drive Crossing need to be replaced with bridges deigned handle project flood flows in accordance with FEMA and/or L&C County Flood Ordinance requirements

Thank you for the opportunity to comment.

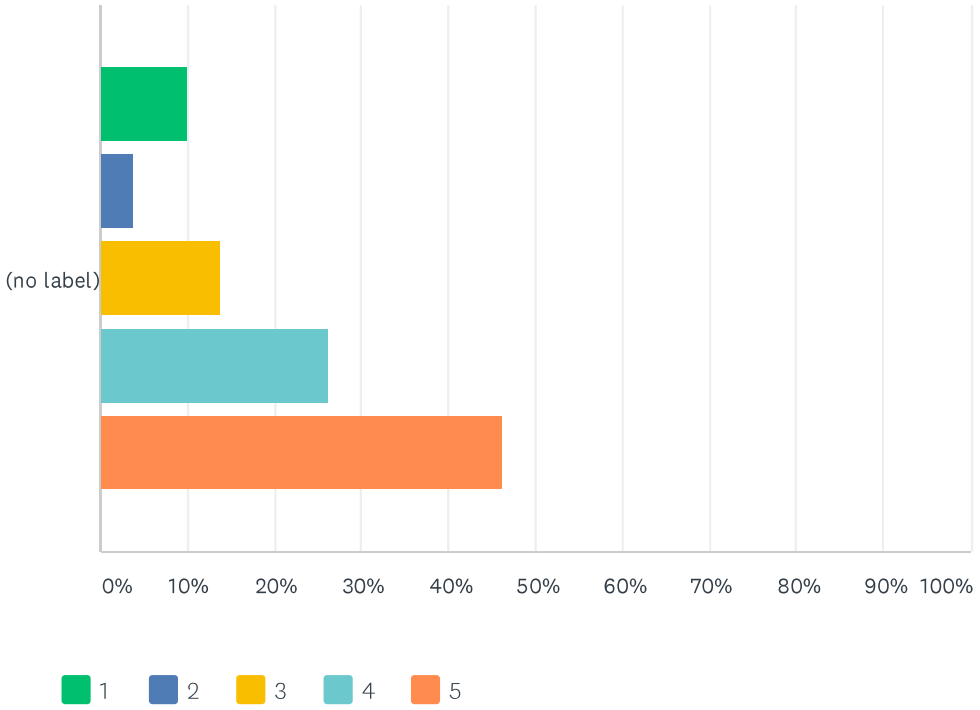
Lyle Lallum

APPENDIX B

COMMUNITY SURVEY AND PUBLIC COMMENTS

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.

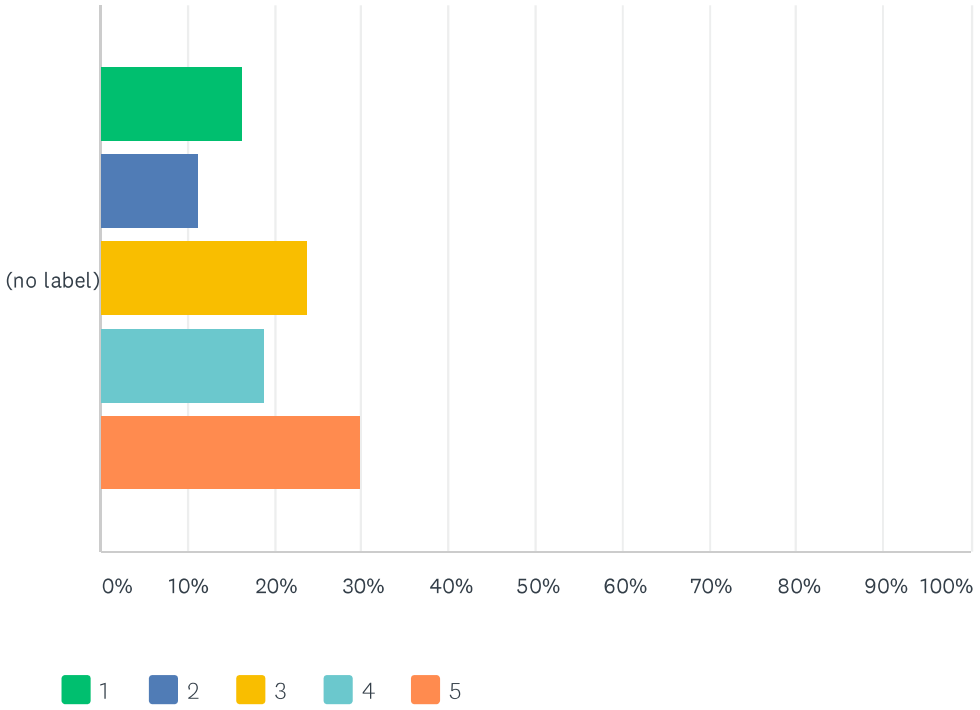
Answered: 80 Skipped: 0



	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

Q2 On a scale of 1 to 5, how interested are you in participating in discussions on flood mitigation planning? Not Interested 1 2 3 4 5 Very Interested

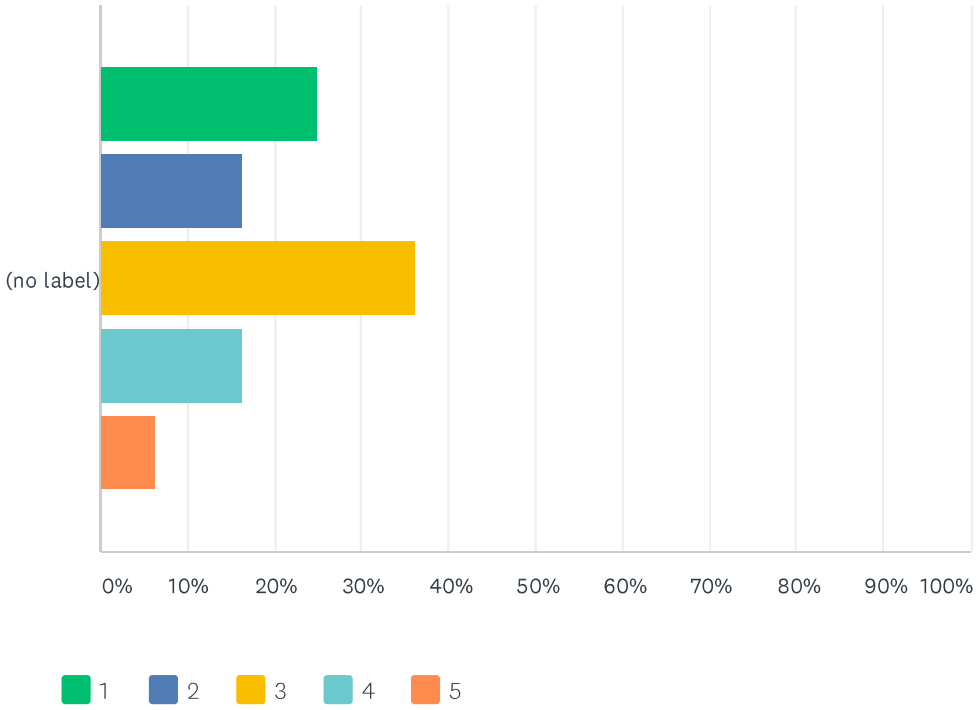
Answered: 80 Skipped: 0



	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	16.25% 13	11.25% 9	23.75% 19	18.75% 15	30.00% 24	80	3.35

Q3 On a scale of 1 to 5, how satisfied are you with the RID and progress on implementing the Master Plan to-date. Not Satisfied 1 2 3 4 5 Very Satisfied

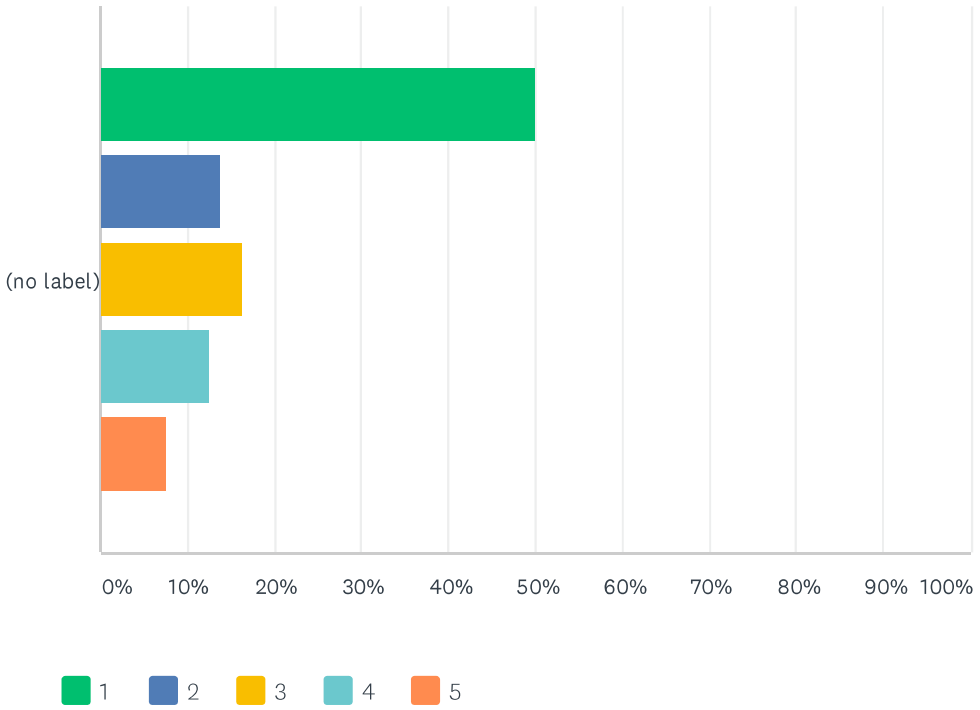
Answered: 80 Skipped: 0



	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	25.00% 20	16.25% 13	36.25% 29	16.25% 13	6.25% 5	80	2.63

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

Q5 Additional comments (if any):

Answered: 33 Skipped: 47

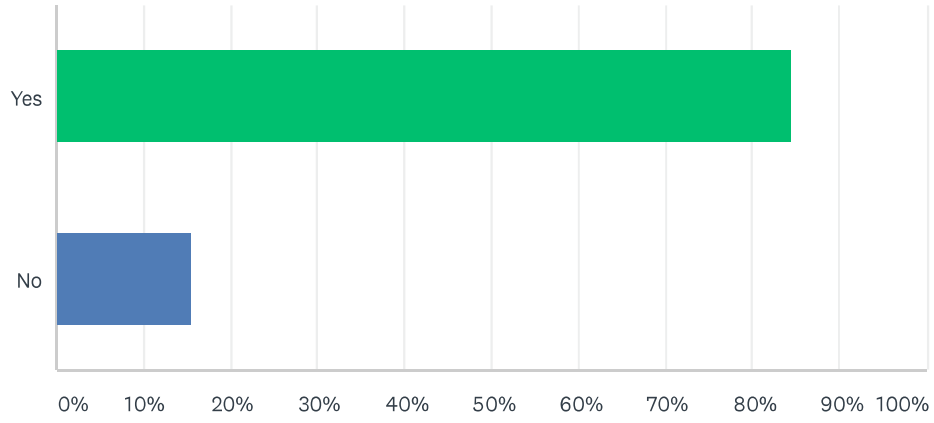
#	RESPONSES	DATE
1	Any Helena Valley Flood mitigation has to start at the lower end of the drainage as indicated in both engineering studies to date. Any mitigation work needs to be in full compliance with FEMA and/or the Helena Valley Flood Ordinance requirements. None of these requirements were complied with under the recent "Gun Club" mitigation project.	2/28/2021 10:26 AM
2	I'm willing to increase the assessment, but know the residents can't fund projects of this size, as it would take centuries to complete any projects. I believe engaging our Senators and Representatives needs to be further pursued	2/26/2021 9:29 AM
3	I would be interested in an increase in annual assessment, however, our taxes have increase so much lately due to the mill levies, we really can't afford more.	2/24/2021 12:19 PM
4	If you would have spent the mega bucks on cleaning out the two ditches INSTEAD of a huge canyon along MT Avenue the cost to DIG the ditches would have left a lot of dollars to do whatever But now you want US to PAY for your b.s. mistakes - DIG OUT THE DITCHES!!!!! STOP SPENDING & DO THE RIGHT THING !	2/23/2021 9:47 AM
5	A previous flood plan had my property listed as the number priority to address. The 2013 plan didn't have it all. Seems the people who complain and are self appointed to "advisory boards" get their property dealt with first, IE McHugh Drive and Rossiter School. Last spring I was threatened by the Helena Valley Irrigation District with federal prison time if I did anything to relief the flooding which was at the time threatening my house. I call the county commissioners office and didn't even get a return phone call. You want to increase my taxes and take care of others but let me house just float away.	2/22/2021 7:46 AM
6	I have not participated in any planning for the recent flood mitigation work along Forestvale. The large ditch along near Rossiter school looks a little concerning. I was forced to answer question (3) however I have no basis to answer ie NA	2/21/2021 10:38 PM
7	10 Mile Creek Estate residents already pay a Huge assessment due to our sewer upgrade/maintenance. NO NEW TAXES!	2/21/2021 7:26 PM
8	My address has never flooded and I was not asked when they added a hundred dollars in taxes the first time. Very disturbing	2/21/2021 11:12 AM
9	Clean existing Barrow pits and ditches	2/21/2021 10:01 AM
10	I wonder if the culvert that was placed on Mchugh rd by Hahn rd used RID funding. If so it will cause major problems for the homeowners in Hahn subdivision. The was the dumbest place to put a culvert and if and when it does flood again....the county will be hearing from us.	2/19/2021 10:48 AM
11	My only worry on question #4 is that the money is guaranteed to be used for flood mitigation and not diverted somewhere else by wrong minded politicians.	2/16/2021 1:16 PM
12	After participating in multiple past meetings about flood control, there continues to be a lack of clear communication from the county as to how they are deciding on and implementing mitigation plans. For example, the map shown above does not even show the improvements made near Rossiter. It does not indicate clearly why a very large culvert channel was created under Forestvale near McHugh with no clear exit for the channeled water. We cannot figure out your master plan and timeline for implementation.	2/15/2021 1:00 PM
13	Any increases in the annual assessment amount should be reasonably scaled from $20 to $50 given the reality of median income of homeowners in the RID would not likely support any increases.	2/12/2021 2:42 PM
14	your map should be able to be expanded so a person can actually see what is involved and understand the area included. the map is useless as it is. The first and most important part of this is to be able to understand the area involved. Need a map that can actually be interpreted.	2/12/2021 12:37 PM
15	Have lived in the flood plain area since 1976 and have not been adversely affected by any of the flood events since.	2/12/2021 10:37 AM
16	First of all, my husband and I are both handicapped. Second, CLEAN TEN MILE CREEK, a lot of water will flow down Ten Mile Creek that comes across our property first. Cleaning Ten Mile Creek would only cost the County approximately $60,000 every 3 years. This would be a huge improvement. Larger culverts at McHugh and Mill Rd not 18 inch culverts. We installed two 30 inch culverts side by side in our driveway. Try starting at the source of the problem instead of	2/9/2021 4:06 PM

	the end or middle. We had over $30,000 damage to our property and home of which FEMA only reimbursed us $10,000. What about those people who live on just SSN and handicapped and lost everything. I am tired of hiring engineers and paying them $750,000 every time there is a flood. Try common sense for a change. Common sense does alot. As to adding more money to the flood mitigation is not a good idea during a pandemic. Right we pay $300 a year on this flood mitigation. The county put in some very nice culverts by the Rossiter School but with no way to get the water to them. And what about those homes where children live and their homes are flooded. Give me more time and I will think of more things.	
17	lived in area for over 30 years this should have been done after floods in the past, poor planning and management!!!	2/9/2021 11:30 AM
18	Grant funding/matching should be a top priority to maximize the funding and benefits of implementing flood mitigation program(s).	2/9/2021 11:17 AM
19	The people in the Helena Valley cannot be expected to fund more and more of these costs with no promise or expectation that they won't be flooded over and over.	2/9/2021 7:22 AM
20	Not enough property owner's are included in this assessment. More taxpayer's that use North Montana to get to and from work in Helena. Not just Glacier Point & 10 mile creek subdivisions.	2/8/2021 5:40 PM
21	There have been good Flood Plans from Qualified People that have Not Been Considered in the past. They should be looked at now, and brought in for Discussion.	2/8/2021 4:02 PM
22	To whom this may concern: One of the most effective and inexpensive methods for mitigating floods with “new construction” is to simply have a law that requires the contractors to disclose the flood risks to the potential buyers. This will cause the contractor to naturally mitigate the new construction for flooding in order to make the product marketable. I often think of the homes built off of Crestwood Lane (North of Sierra off of Montana) that had groundwater flooding in the basements back in 2018. If the contractors would have been required to disclose the flooding hazards of those homes when those new homes were being sold back around 2005, most likely those homes would either have not been built with basements or their foundations built to be “flood proof” because the contractors know that those homes would not sell if they did not mitigate them against flooding from groundwater. Making one simple law can go a long way in mitigating many future structures against floods going forward. Respectfully, [redacted]	2/8/2021 2:53 PM
23	We already pay plenty and I do t think we should have to pay more when we don’t even know the efficacy of the giant ditches made.	2/8/2021 2:09 PM
24	I suggest ten mile creek should be cleaned .It is full of dead trees and bushes etc.It causes flooding for those who live by the creek.	2/8/2021 12:20 PM
25	my address is [redacted] Arrowhead Drive I just want to know the total cost for the bridge they plan on putting over silvercreek d-2 ditch [redacted]	2/8/2021 11:30 AM
26	Would like to see focus on deepening and widening the ditch along the west side of McHugh from Motsiff north to forestvale cemetary to prevent water from running over McHugh Rd witch then floods many properties that could be avoided.	2/7/2021 1:41 PM
27	Does the plan address rising ground water?	2/7/2021 10:58 AM
28	Someone made a bundle on the zoning to allow all those half million and up homes to be built in a "swamp" with one home abandoned since 2 sump pumps couldn't contain the water. Another built with continuous pumps working in the basement during construction. Yet the fee is the same for ALL of us - many/most retirees on fixed income. I don't object to a small increase (10%) but it definitely shouldn't be the same for the wealthy and the rest of us. Particularly since homes should never have been built there.	2/7/2021 10:18 AM
29	You have Ten Mile Creek Estates included in this area. Have have lived in this subdivision for 29 years and have not once experienced flooding or even ground water issues. We do not have flooding concerns here. Why are we being taxed for something that is a non issue? I diligently researched flooding before building here to make sure there wasn’t a flooding problem. Our Mitigation was done when the subdivision was developed. Your boundaries should be re evaluated. You, the county are making us pay for us pay for issues that aren’t ours?	2/7/2021 9:18 AM
30	This does nothing to control ground water. That is what I get in my basement. If you could help with that I would be all for it.	2/7/2021 8:39 AM

31	I have a home oon freedom rd. Ihave lived here 41yrs. NEVER have i had water in my yard, driveway or basement. When I bought , I went to the Federal housing, they said .we not in flood plain, it is to the north of us!!!	2/6/2021 5:22 PM
32	I am interested to see if the failure to provide Rip Rap the length of the Rossiter/Trap Club causes bigger problems when water inevitable comes. I will work against an increase in the flood plain assessment.	2/6/2021 2:23 PM
33	Control the water in the channel and we will not need to be wasting our money and your time. For the county Engineer, the problem has been identified (the creek channel) Work on the problem to solve the issue. If the water does come out of the channel is needs to be moved through the area as rapidly as possible, do not, I SAY Again DO NOT TRY TO RETAIN THE WATER ANYWHERE IN THE VALLEY!!!!!!!	2/6/2021 11:18 AM

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

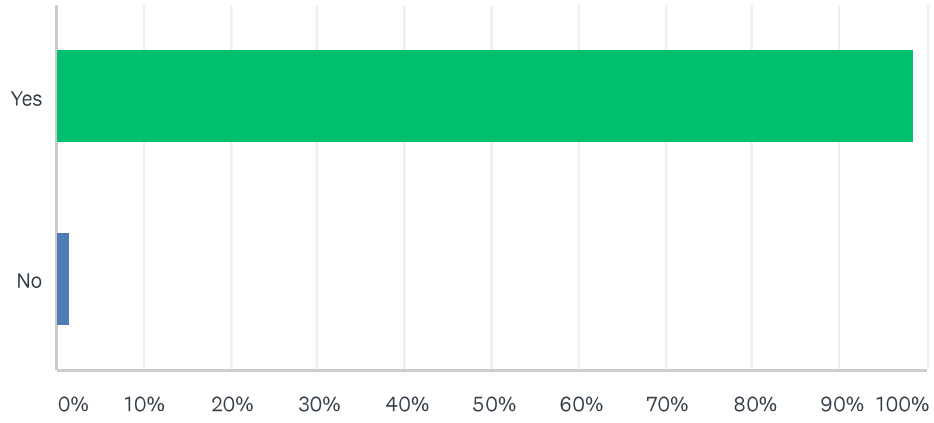
Answered: 78 Skipped: 2



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

Q7 Do you support the county regularly clearing debris from key locations along the stream that are prone to spilling floodwater?

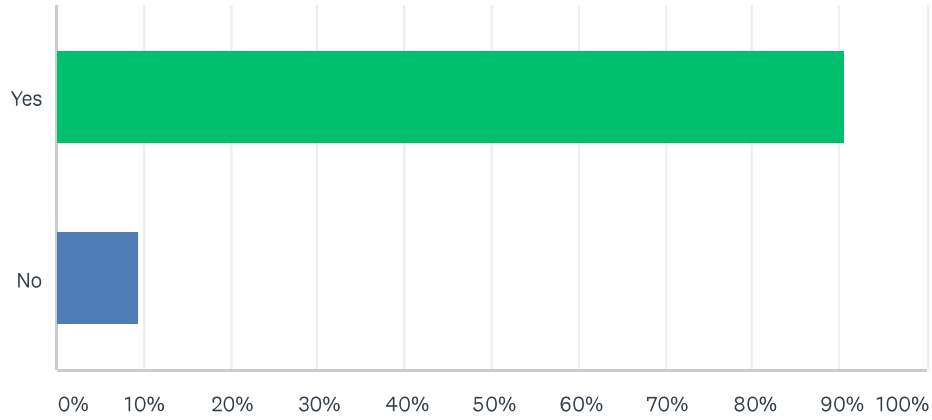
Answered: 64 Skipped: 16



ANSWER CHOICES	RESPONSES	
Yes	98.44%	63
No	1.56%	1
Total Respondents: 64		

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.

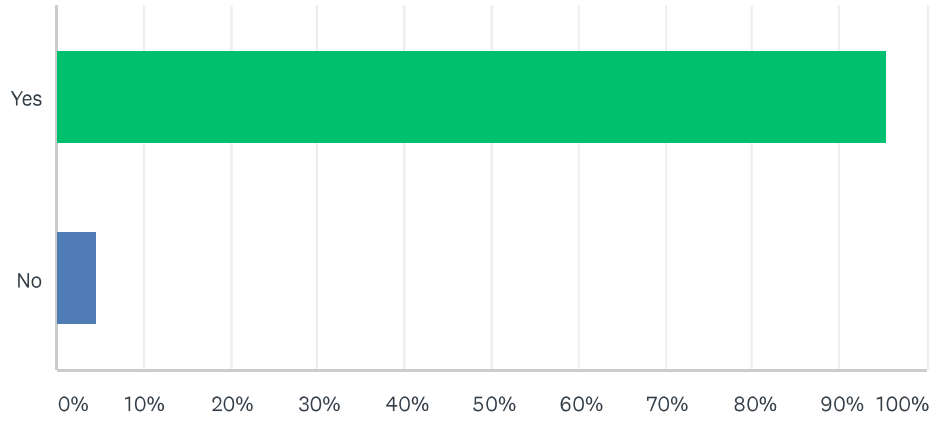
Answered: 64 Skipped: 16



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

Q9 Do you support the county to invest in sediment cleanout infrastructure on Tenmile Creek at bridge crossings that are prone to flooding and perform regular sediment removal at these locations?

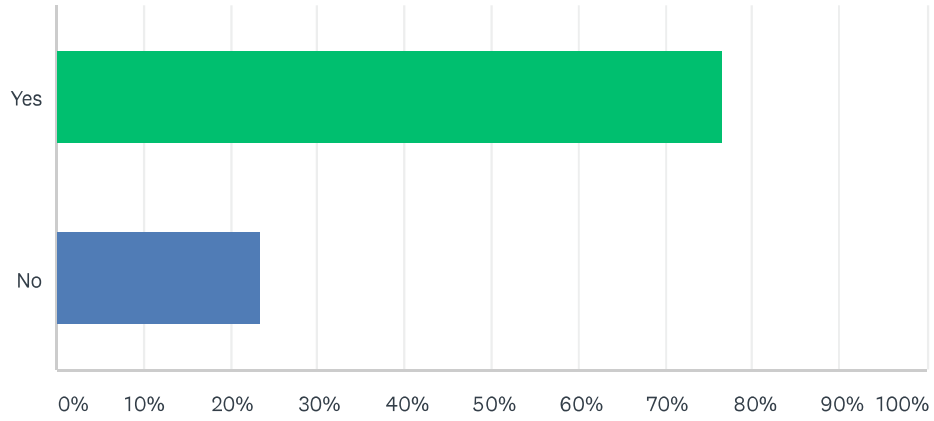
Answered: 64 Skipped: 16



ANSWER CHOICES	RESPONSES	
Yes	95.31%	61
No	4.69%	3
Total Respondents: 64		

Q10 Do you support the county to invest in a current survey and update to the hydraulic model of Tenmile Creek? The purpose would be to determine past and present channel capacities to support management actions.

Answered: 64 Skipped: 16



ANSWER CHOICES	RESPONSES	
Yes	76.56%	49
No	23.44%	15
Total Respondents: 64		

Q11 Additional comments (if any):

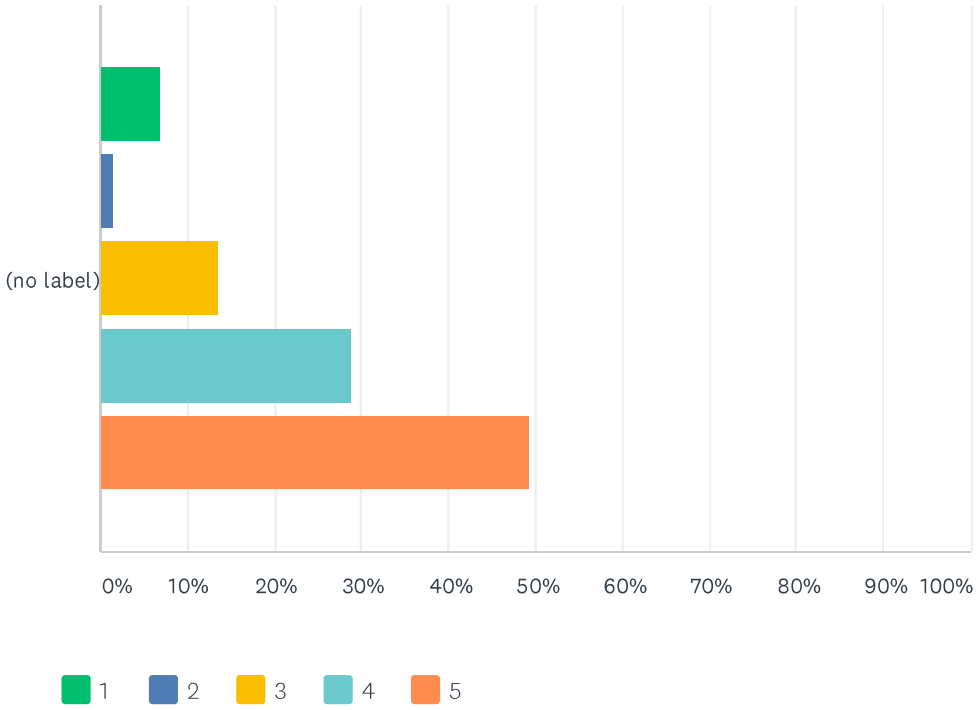
Answered: 26 Skipped: 54

#	RESPONSES	DATE
1	There should be adequate studies of Ten Mile Channel capacities in existence so additional monies for more studies are not warranted.	2/28/2021 10:32 AM
2	We do not support the dredging of streambeds, but support the development of floodplains.	2/27/2021 10:09 AM
3	I firmly believe that the design and/or construction of McHugh Bridge is directly responsible for slowing the flow of the creek, exacerbating all flooding since it's installation. This should, once and for all, finally be addressed	2/26/2021 9:33 AM
4	Dredging is not the answer. However, mitigating constrictions to existing flow should be implemented. Such as bridge restrictions, beaver dams, debris dams, etc.	2/24/2021 12:26 PM
5	CLEAN OUT THE SAND FROM THE CREEK BEDS BEFORE THERE IS NO LONGER A CREEK BED!!	2/23/2021 9:51 AM
6	cleaning out the stream bed just sends all that more water my way and when it reaches me it has no where to go. Not for fixing the problem not studies and making it worse for those down stream.	2/22/2021 7:50 AM
7	That would solve 90% of the problem! You should look into diverting some flood overflow into the Irrigation ditch as well.	2/19/2021 10:53 AM
8	My "yes" answers are based on what seems to make common sense but possibly I don't have enough info. at this point.	2/16/2021 1:21 PM
9	Monitoring Tenmile Creek and removing debris is a necessary adjunct to capital investment in infrastructure because Tenmile Creek runs a course through an alluvial fan landtype subject to natural debris/sediment recruitment that left alone can result in Tenmile Creek shifting (relocating) into natural historic overflow channels that make their way through developed residential/commercial neighborhoods.	2/12/2021 2:53 PM
10	your maps suck. They are of no value as presented!	2/12/2021 12:43 PM
11	Keeping as much water in the existing creek bed is the key.	2/11/2021 3:28 PM
12	The current plan that only assesses 1000 households for flood mitigation is grossly unfair. All the improvements done to date keep the Rossitor School and Montana Avenue from flooding. It does absolutely nothing for all the residents who are currently being charged for the RID. Every household who had children at Rossitor and every household that uses Montana Avenue from Sierra Road South should be paying for this improvement. The county officials that pushed this through did not listen to those of us who are assessed the $100 fee. Everyone in this area who uses Rossitor or drives on Montana Avenue should be paying. Instead people in my neighborhood pay and I have never had flooding on my property in 40 years.	2/10/2021 8:43 PM
13	They need to focus on the origin of the flood problem, not the downstream area and take care of that first.	2/10/2021 2:59 PM
14	I don't think the county needs another survey. Try using common sense.	2/9/2021 4:13 PM
15	monitoring is waste of money if nothing is done to fix issues! dredge ten mile creek that was approved in the 1970s and never done!!!!!!!!!!!!	2/9/2021 11:39 AM
16	The county is faced with a choice...allow Ten Mile to flood out hundreds of homes in the valley or build dikes and levys designed to keep more water in the creek bed. This is the most cost efficient and common sense way to address this. We must choose where excess water leaves the creek bed and manage it. Right now, the refusal to build dikes because it would negatively affect people downstream is just choosing one group of people to be affected over another. The creek bed is where it is and there is adequate infrastructure on I-15 and the frontage road as well as at Montana Ave to handle a lot more water. The creek bed has to handle a lot more of the water that flows in flood times. Just taking the sediment out without raising the lower bank of the creek will not change much.	2/9/2021 7:28 AM
17	10 Mile Creek appears to be worthless as a water removing entity at this point in 2021. It needs to be used as a water removal tool, helping the new construction that has been done so far.	2/8/2021 4:23 PM
18	I support mitigation against flooding. The more structures that can be pulled out of a flood zone from mitigation projects the higher the market value will increase. This will increase the tax	2/8/2021 2:55 PM

	base for both the city and county as well.	
19	done	2/8/2021 11:31 AM
20	Perhaps a gravel mining-crushing-sand effort owned by the county could be considered at the county level to lessen the county's road maintenance costs. A contractor could be brought into the discussion here as well. The effort would be to remove channel blockage and perhaps be a win-win for the taxpayers.	2/7/2021 11:17 AM
21	Maps too small to even see and most of these questions require more background than most of us have.	2/7/2021 10:22 AM
22	The irrigation canal is often running less than 1/2 full when the valley floods. Why not reduce the canal supply and divert the water into the canal? Problem solved.	2/7/2021 9:40 AM
23	I think the land owners on 10 mile should help keep it clean of branches and sediment with county help.	2/7/2021 8:44 AM
24	enough surveys have been done solve the problem	2/6/2021 5:09 PM
25	I am fairly tired of paying planners. While the argument that we don't know the best option unless we plan is somewhat valid, too much money is spent on planning and planners and not enough of doing things that reduce the problem	2/6/2021 2:28 PM
26	Please focus your time and our money to address the problem at the source!!!	2/6/2021 11:22 AM

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

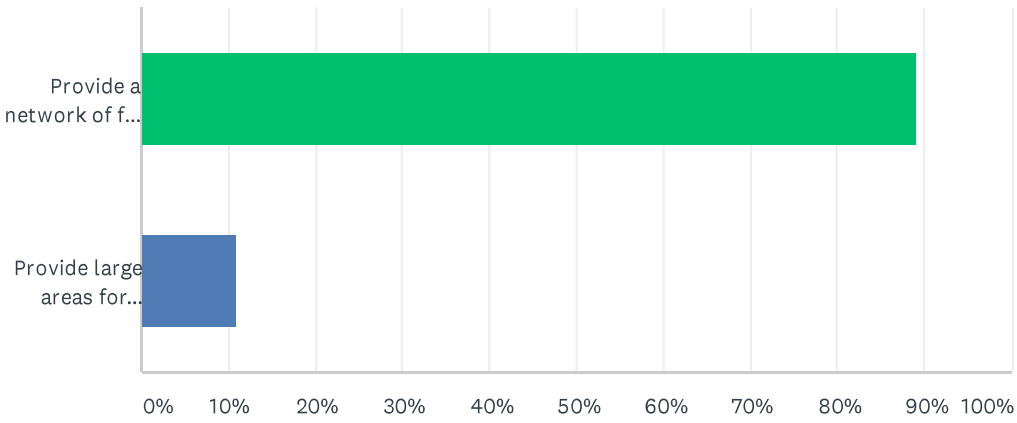
Answered: 73 Skipped: 7



	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

Q13 Which of the following do you feel is more important?

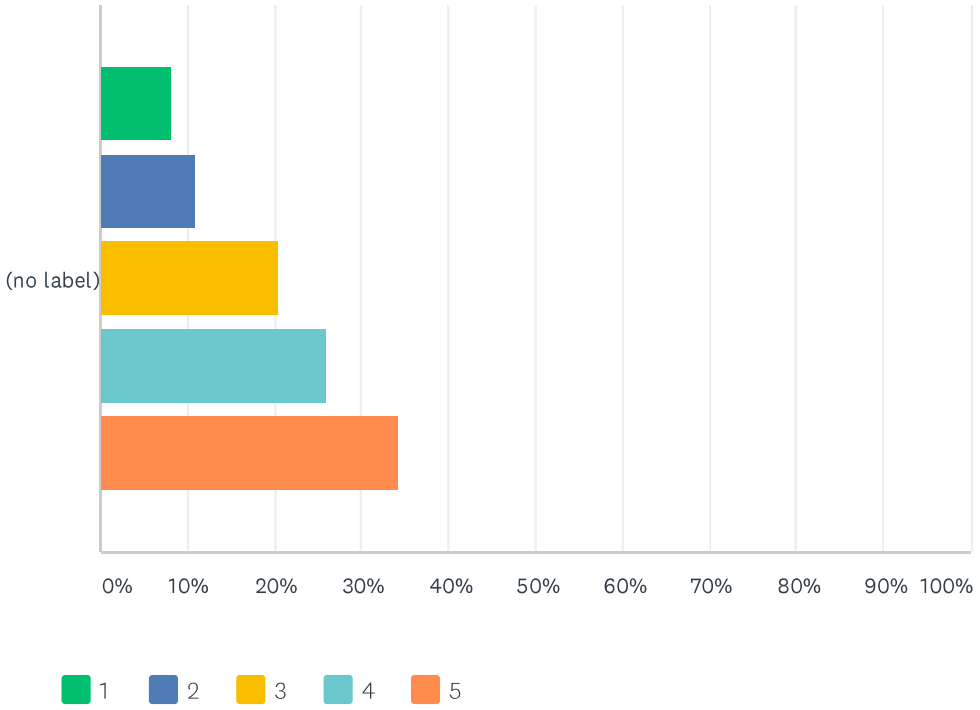
Answered: 73 Skipped: 7



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

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

Q15 Additional comments (if any):

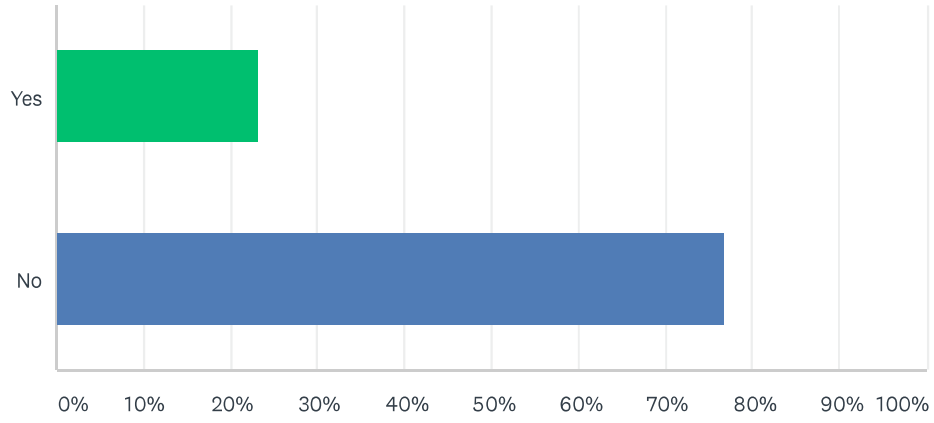
Answered: 27 Skipped: 53

#	RESPONSES	DATE
1	Any mitigation work to improve the movement of floodwaters in the valley need to include the impacts said work will have in the D2 Drain Ditch area.	2/28/2021 10:38 AM
2	Ponding the water in the valley is absolutely a disastrous condition. There is no doubt this causes groundwater flooding for many residences. Of course, we were dunces and bought a property in this area that should never have been zoned residential, but ponding the water should not be considered any sort of solution. County leadership approved the development and should be responsible for the resolution of issues associated with the development.	2/27/2021 1:40 PM
3	We assume that after construction, the affected roads would become 2-way again.	2/27/2021 10:13 AM
4	One way streets would definitely help provide passage for floodwaters. They would need strict monitoring for speed and safety.	2/26/2021 9:35 AM
5	McHugh Ln is a major obstacle to Ten Mile overflow. If it wasn't in the way, many issues in the subdivision west of McHugh and north of Mill would be mitigated. A large conveyance ditch and a few crossings to move it to the east side of McHugh would accomplish a great deal.	2/24/2021 12:33 PM
6	of yes the improvements came all the way to Sierra Road, once it crosses northbound on the west side it gets to my property and has no where to go but back up and flood my house!!! Those above say "just send it down stream so my house doesn't flood" they don't care about those below. Developing holding ponds increases the level of the ground water which is a terrible problem in the north valley.	2/22/2021 7:54 AM
7	I couldn't see map details to identify my home	2/21/2021 10:43 PM
8	NO ADDITIONAL TAXES>I DON'T REMEMBER VOTING FOR ANY OF THIS!	2/21/2021 7:28 PM
9	Taxes should be broad based in the county and voted on. We are already highly taxed in the Ten Mile Creek subdivision and cannot absorb any more costs at this time	2/21/2021 11:21 AM
10	My answer to #2 is debatable.	2/16/2021 1:23 PM
11	We are perplexed to see NO drainage ditch created along Mill Road to channel water to a ditch along McHugh. There are no constructed ditches along Mill, resulting in widespread dispersion of flood water throughout neighborhoods.	2/15/2021 1:11 PM
12	If feasible, some modifications to the existing transportation infrastructure could enhance the conveyance potential of floodwaters and further reduce/minimize risks of floodwaters impacting developed residential areas.	2/12/2021 2:59 PM
13	once again your maps are of no value as presented.	2/12/2021 12:46 PM
14	I feel the choices in question 2 are of equal importance. I chose the option I did because the question required only one choice.	2/12/2021 10:43 AM
15	The current plan that only assesses 1000 households for flood mitigation is grossly unfair. All the improvements done to date keep the Rossitor School and Montana Avenue from flooding. It does absolutely nothing for all the residents who are currently being charged for the RID. Every household who had children at Rossitor and every household that uses Montana Avenue from Sierra Road South should be paying for this improvement. The county officials that pushed this through did not listen to those of us who are assessed the $100 fee. Everyone in this area who uses Rossitor or drives on Montana Avenue should be paying. Instead people in my neighborhood pay and I have never had flooding on my property in 40 years.	2/10/2021 8:44 PM
16	CULVERTS SHOULD BE ENLARGED IN AREAS THAT ROADS WASH OUT INSTEAD OF REINSTALLING THE CULVERT THAT OBVIOUSLY WERE TO SMALL FOR THE WATER FLOW	2/10/2021 6:42 PM
17	One way streets, east and west? Are you kidding me? Unrealistic!!!	2/9/2021 4:16 PM
18	just do it! the flooding has been an issue for years this all should have been done years ago!	2/9/2021 11:44 AM
19	A little inconvenience now to make the flood water disappear Faster Later is a good plan.	2/8/2021 4:27 PM
20	I personally prioritize conveyance channels over storage. From the 2018 floods, some of the storage pits were already overflowing. Seems the conveyance channels will be more effective.	2/8/2021 3:00 PM
21	3 to 5 miles of Box culverts and feeders could be placed under Sierra Road running from the	2/7/2021 11:31 AM

	Green Meadow road area past the I-15 structure near Rossiter school. Federal Highway Aid monies could be used at 90% +/- matching funds and Sierra would have a very nice road over a flood mitigation project. Win-Win.	
22	As a general rule I don't object but our main E/W street is Sierra Rd. with no option I'm aware of to get under the freeway (which by the way is also our closest access to the freeway via the frontage road.	2/7/2021 10:25 AM
23	Divert it into the canal	2/7/2021 9:40 AM
24	This still will not stop the ground water most of us get around me.	2/7/2021 8:48 AM
25	I LIVE IN THE SEWELL ADDITION, WE HAVE PAID 1,500.00 AND NOTHING BEEN DONE TO HELP THE PEOPLE LIVING HERE. SHAME ON THE COUNTY. THIS IS A RIP OFF TO THE COUNTY FOLKS. IT ONLY BENEFITS BUSINESSES. ALL OF HELENA SITS IN A FLOOD PLAIN, WHY NOT CHARGE EVERYONE THIS SO CALLED $100.00. ITS SO SAD YOU PEOPLE GET AWAY WITH THIS. THIS ISN'T THE AMERICA I LIVE IN. YOU ARE A BUNCH OF SOCIALISTS RUN BY DEMOCRATS. SQUEEZE EVERY DOLLAR YOU CAN GET FROM US, AND WE GET NOTHING IN RETURN. I'AM SO ASHAMED OF THIS COUNTY. HELL WE HAVE PAID $1,500.00 FOR NOTHING AND YOU NOW ASK FOR MORE. GOD HELP US ALL.	2/6/2021 3:31 PM
26	Sol your map is fairly uselss, it is too small. My answer to 3 depends on what exact streets you are thinking about and the comments from folks that live on those streets should receive a higher score than those that do not	2/6/2021 2:31 PM
27	If the channel is maintained and working correct, little to no water should traverse through the valley.	2/6/2021 11:26 AM

Q16 Do you own property along McHugh Lane, Mill Road, Forestvale Road, or Sierra Road?

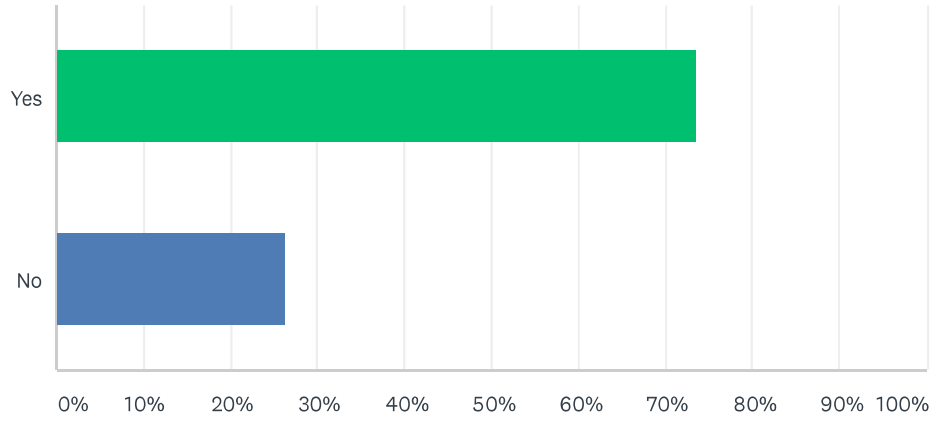
Answered: 73 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	23.29%	17
No	76.71%	56
Total Respondents: 73		

Q17 Are you willing to discuss granting an easement next to the county road for the construction of floodwater conveyance infrastructure?

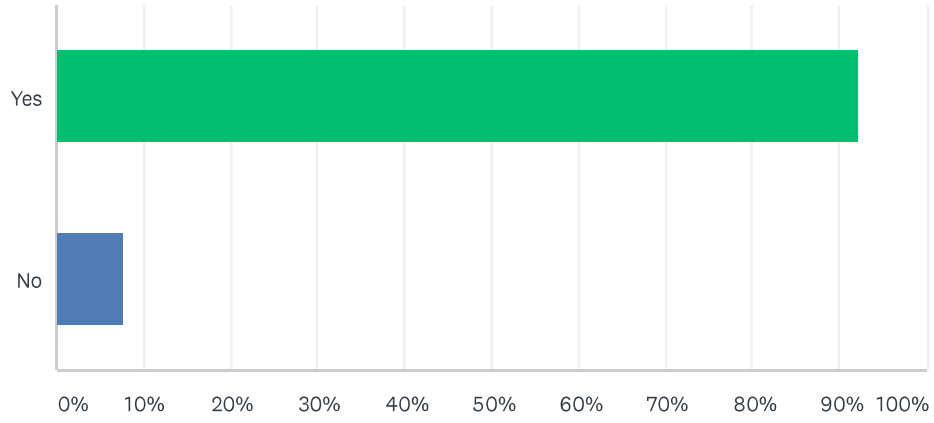
Answered: 19 Skipped: 61



ANSWER CHOICES	RESPONSES	
Yes	73.68%	14
No	26.32%	5
Total Respondents: 19		

Q18 Are you willing to provide your contact information for the county to follow up with you?

Answered: 13 Skipped: 67



ANSWER CHOICES	RESPONSES	
Yes	92.31%	12
No	7.69%	1
Total Respondents: 13		

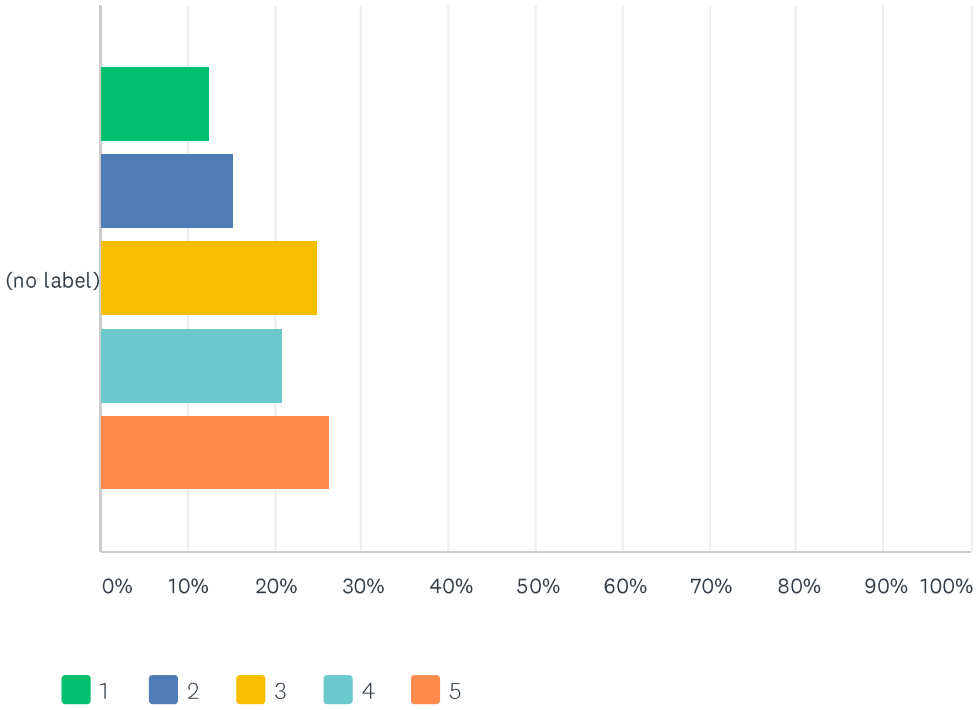
Q20 Additional comments (if any):

Answered: 3 Skipped: 77

#	RESPONSES	DATE
1	I wish this would have been pursued years ago.	2/26/2021 9:37 AM
2	Thank you for your on-going attention to mitigate this issue.	2/24/2021 12:34 PM
3	I'm happy to see the improvements that have been made since the 2018 flood.	2/16/2021 1:25 PM

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

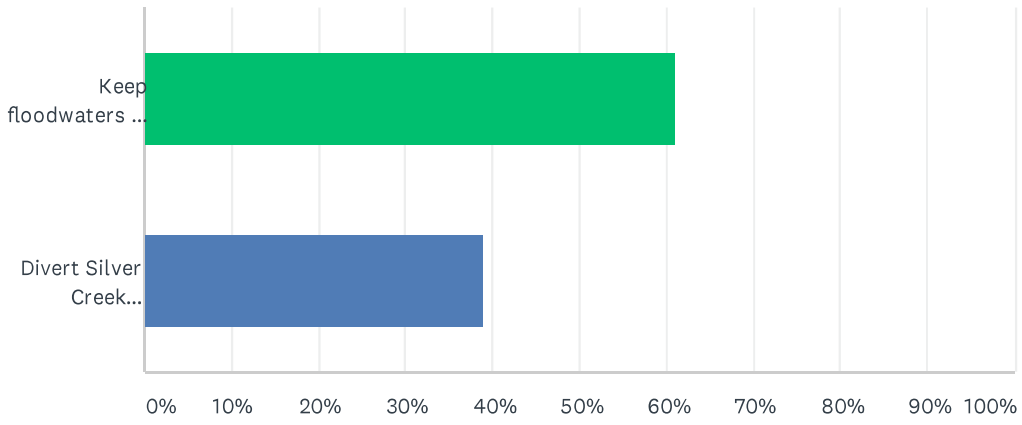
Answered: 72 Skipped: 8



	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

Q22 Which of the following is most important:

Answered: 72 Skipped: 8



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

Q23 Additional comments (if any):

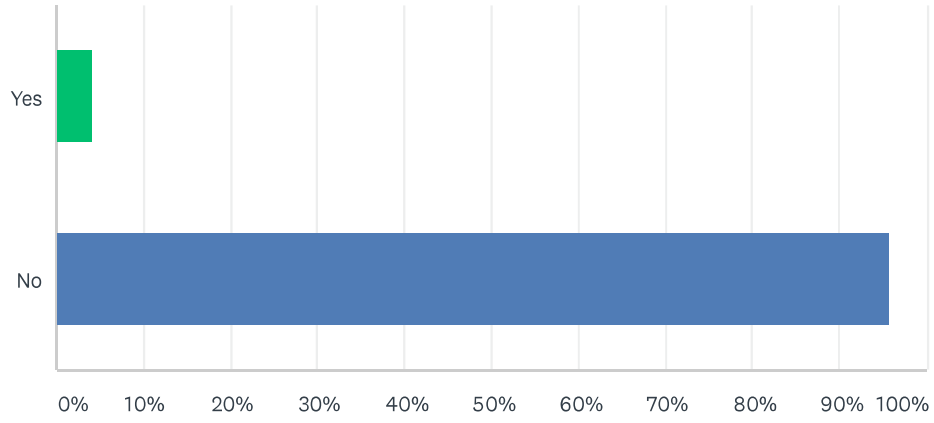
Answered: 20 Skipped: 60

#	RESPONSES	DATE
1	Any Silver Creek Flood mitigation activity needs to fully comply with current FEMA and County Flood Plain Ordinance requirements. Activities nned to include impacts on properties and residents downstream from Montana Avenue.	2/28/2021 10:45 AM
2	We do not live in this affected area.	2/27/2021 10:16 AM
3	I wish I could have not answered #2..... as I'm not sure which is the better choice	2/26/2021 9:38 AM
4	I am not affected by Silver Crk directly, but I do support its mitigation. Its just good for the community.	2/24/2021 12:37 PM
5	We went from Sierra Road to Applegate. That whole area along North Montana between Sierra and Forestvale is the lowest point in the valley. You seem to be forgetting those of us who live there. Again the squeaky wheel, McHugh Drive and Applegate folks get the priority.	2/22/2021 7:57 AM
6	NONE OF THE ABOVE...	2/21/2021 7:29 PM
7	I am not familiar with this area	2/21/2021 10:09 AM
8	I'm not familiar with this situation enough to really judge. I'm guessing on the answers.	2/16/2021 1:28 PM
9	Local residents who have experienced flooding from Silver Creek have expressed that increasing the capacity of undersized crossings and the existing channel would provide the best mitigation at the least cost.	2/12/2021 3:03 PM
10	your maps are of no value	2/12/2021 12:47 PM
11	The current plan that only assesses 1000 households for flood mitigation is grossly unfair. All the improvements done to date keep the Rossitor School and Montana Avenue from flooding. It does absolutely nothing for all the residents who are currently being charged for the RID. Every household who had children at Rossitor and every household that uses Montana Avenue from Sierra Road South should be paying for this improvement. The county officials that pushed this through did not listen to those of us who are assessed the $100 fee. Everyone in this area who uses Rossitor or drives on Montana Avenue should be paying. Instead people in my neighborhood pay and I have never had flooding on my property in 40 years.	2/10/2021 8:45 PM
12	I do not live in that area so it does not effect us!	2/9/2021 4:20 PM
13	Diversion around the subdivision may be a cost/benefit question vs augmenting flow through the subdivision. Also, would diversion present another problem to be addressed?	2/9/2021 11:54 AM
14	would have helped to show where Sewell subdivision was on map! my guess is in the black square	2/9/2021 11:50 AM
15	I do support flood mitigation anywhere. But I must emphasize that the Ten Mile Creek Overflow needs a higher priority as there are more populations at risk and market value at risk.	2/8/2021 3:01 PM
16	Normal water can be in the old channel, flood waters could be diverted into the new channel.	2/7/2021 11:39 AM
17	I'm not familiar with the area and you didn't provide a "no opinion" option so my opinion on this isn't based on any facts.	2/7/2021 10:27 AM
18	na	2/7/2021 8:50 AM
19	I HAVE LIVED HERE FOR 30 PLUS YEARS, THE ONLY TIME SEWELL ADDITION FLOODED IS WHEN WATER WAS BACKING UP ON A FARMERS PROPERTY WEST OF US AND HE WENT AHEAD AND DYNAMITED A DIKE AND THAT ALLOWED ALL THE WATER TO COME AT ONCE. SILVER CREEK RUN JUST FINE YOU HAVE A FEW PROBLEMS, ONE TREES ARE GROWING IN SILVER CREEK, PEOPLE HAVE THERE CULVERT CEMENTED SHUT. I HAVE TOLD YOU AT A MEETING BACK IN 2017 YOUR MAIN PROBLEM IS YOU HAVE WAY TOO SMALL OF A CULVERT GOING UNDER MONTANA AVENUE, SO THE WATER CAN NOT GO THROUGH FAST ENOUGH. THAT CAUSES IT TO BACK UP AND FLOOD PROPERTY. CLOSE TO MONTANA AVENUE. NO CHARGE FOR THAT ADVISE. IT IS SAD A ENGINEER CAN'T FIGURE THAT OUT. BUT AS THE STORY GO'S ON THE PEOPLE IN THE SEWELL ADDITION WILL NEVER GET ANY HELP FROM THIS COUNTY.	2/6/2021 3:45 PM
20	I don't have a feel for question 2. This survey is worthless. If I don't have a feel for question 2,	2/6/2021 2:33 PM

	then I should not be made to answer it so do not count my answer.		

Q24 Do you own property along Silver Creek or within the Sewell Subdivision?

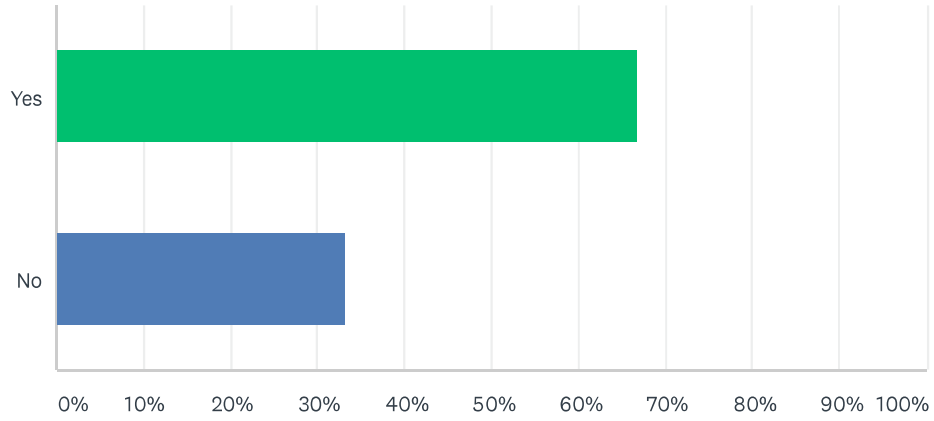
Answered: 72 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	4.17%	3
No	95.83%	69
Total Respondents: 72		

Q25 Are you willing to discuss granting an easement next to the county road for the construction of floodwater conveyance infrastructure?

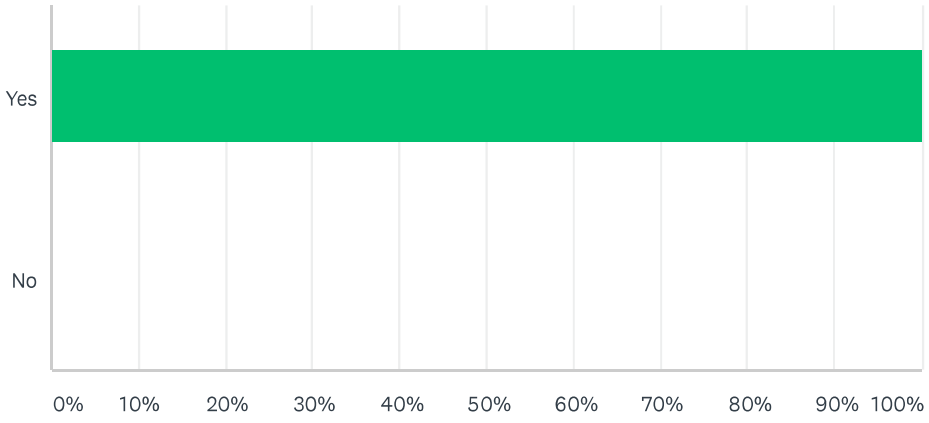
Answered: 3 Skipped: 77



ANSWER CHOICES	RESPONSES	
Yes	66.67%	2
No	33.33%	1
Total Respondents: 3		

Q26 Are you willing to provide your contact information for the county to follow up with you?

Answered: 2 Skipped: 78



ANSWER CHOICES	RESPONSES	
Yes	100.00%	2
No	0.00%	0
Total Respondents: 2		

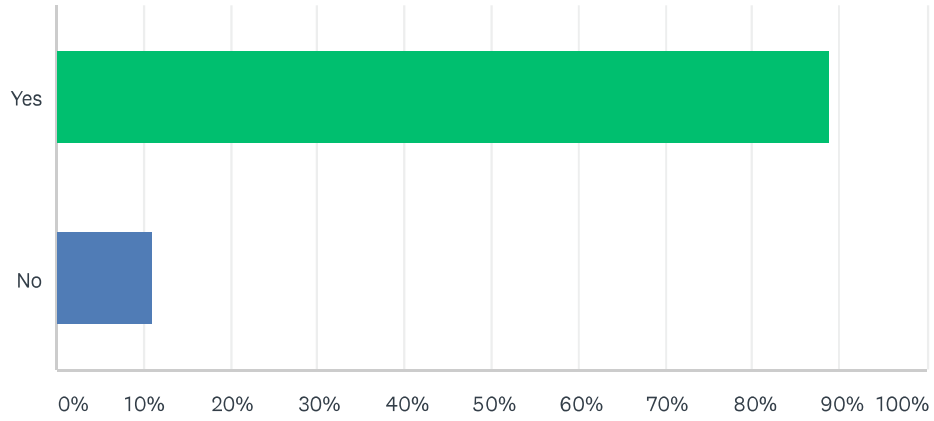
Q28 Additional comments (if any):

Answered: 0 Skipped: 80

#	RESPONSES	DATE
	There are no responses.	

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

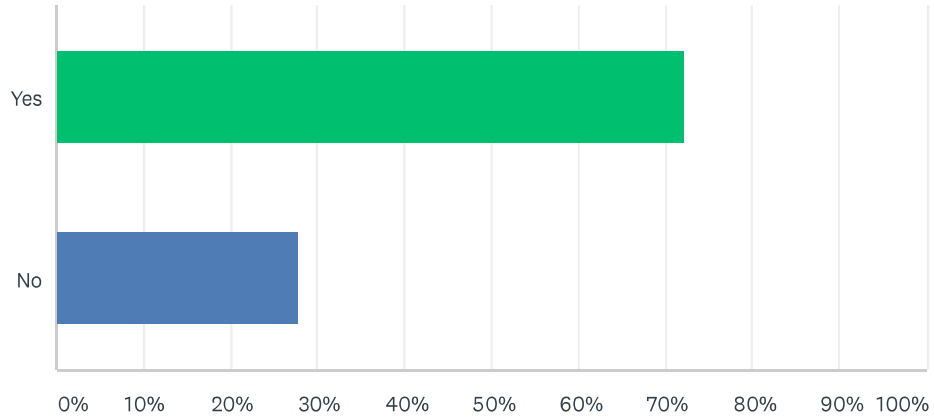
Answered: 72 Skipped: 8



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

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.

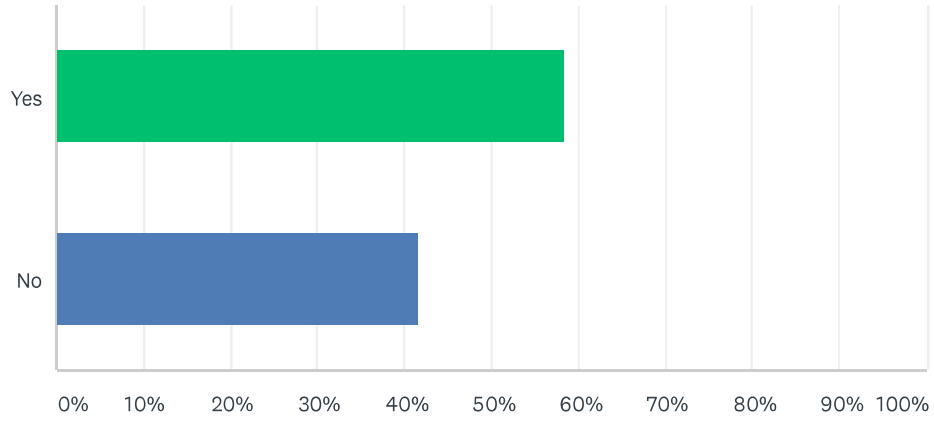
Answered: 72 Skipped: 8



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

Q31 Do you support investing in a study of alternative flood routing options for Silver Creek floodwaters to Lake Helena outside the D2 Drain Ditch?

Answered: 72 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	58.33%	42
No	41.67%	30
TOTAL		72

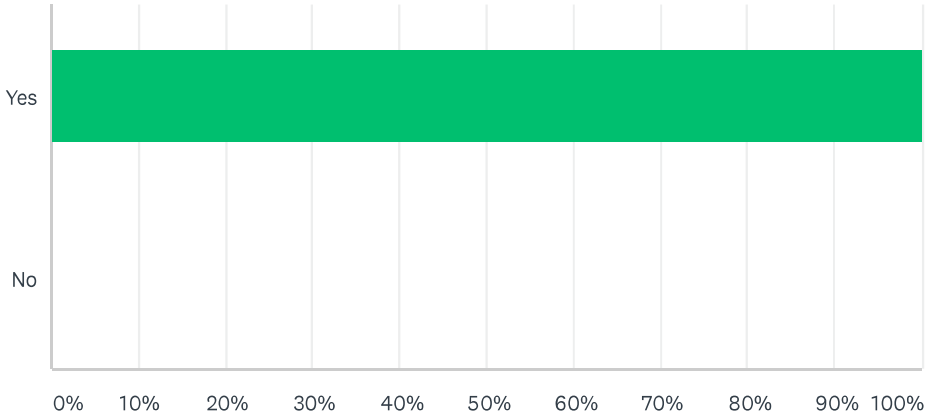
Q32 Additional comments (if any):

Answered: 19 Skipped: 61

#	RESPONSES	DATE
1	If alternate flood routing around the D2 Ditch is not established. all of the structures on the D2 ditch below the Interstate need to be replaced before any further Valley Flood mitigation work is commenced.	2/28/2021 10:52 AM
2	It never hurts to look at options.	2/27/2021 10:18 AM
3	D2 starts on the east side of Montana just north of Crestwood Lane. All of the water coming from the west can not get through to D2. I know that is my property that floods, every year!!! There is a Helena Valley overflow ditch at the back of my property which isn't maintained. It's full of sediment. This was in the first flood plan the number 1 priority to address. Why fix everything above to send the water downstream to a place where it has no place to go. There were recommendations for and 84 inch culvert which just seemed to disappear. I challenge you to come out and look at it, or do we need to pay for another study?	2/22/2021 8:03 AM
4	We should have not had taxes added to Ten Mile Creek subdivision as they were never approved by homeowners.	2/21/2021 11:26 AM
5	Too much money goes to study's rather than actual improvement	2/21/2021 10:15 AM
6	You've studied this to death already, lets get something actually done!!	2/19/2021 11:00 AM
7	Not sure on these questions above as I need more info	2/14/2021 7:48 PM
8	I think the best option for the Sewell residents is improving the existing conveyance channel through this subdivision because many residents expressed reservations about big-price projects for an area of limited means. The area should once again be reviewed for its history to see what changes were brought about that resulted in locating the Sewell subdivision in its existing location and whether it is feasible to relocate (swap) some high risk homes to locate on higher elevations to alleviate wastewater contamination concerns during flooding. However, the lower frequencies of flood events (and costs) compared to Tenmile Creek may not justify this as an option.	2/12/2021 3:15 PM
9	your maps are of no help to understand your proposal.	2/12/2021 12:49 PM
10	The current plan that only assesses 1000 households for flood mitigation is grossly unfair. All the improvements done to date keep the Rossitor School and Montana Avenue from flooding. It does absolutely nothing for all the residents who are currently being charged for the RID. Every household who had children at Rossitor and every household that uses Montana Avenue from Sierra Road South should be paying for this improvement. The county officials that pushed this through did not listen to those of us who are assessed the $100 fee. Everyone in this area who uses Rossitor or drives on Montana Avenue should be paying. Instead people in my neighborhood pay and I have never had flooding on my property in 40 years.	2/10/2021 8:45 PM
11	Who came up with these idiotic ideas?	2/9/2021 4:24 PM
12	I support investing in studies. The importance of studies has become more apparent when the study for the culvert sizes along Rossiter showed that the previous culverts were way to small (especially considering that the previously smaller culverts were installed without a study and found to be ineffective during the 2018 flooding).	2/8/2021 3:01 PM
13	you're on the right track if you agree with my answers	2/8/2021 11:37 AM
14	Relieving the flooding will only get more expensive as time passes by. Get to work on it.	2/7/2021 11:49 AM
15	Don't know the specific location of D2 but obviously alternatives should be studied.	2/7/2021 10:29 AM
16	Just try and keep the water flowing away from homes is a good thing.	2/7/2021 8:57 AM
17	NO MORE STUDIES	2/6/2021 5:12 PM
18	Rather than investing in a study why don't you spend more time visiting with the property owners who live there. It is very important to fix the downstream area first before fixing the upstream section.	2/6/2021 2:36 PM
19	Maintaining the channels of both cheeks will go a long way in preventing overflow. Focus on the problems when you are trying to come up with a solution. If you are not addressing the problem you will continue to chase your tail.	2/6/2021 11:34 AM

Q33 Are you currently a resident within Lewis and Clark County?

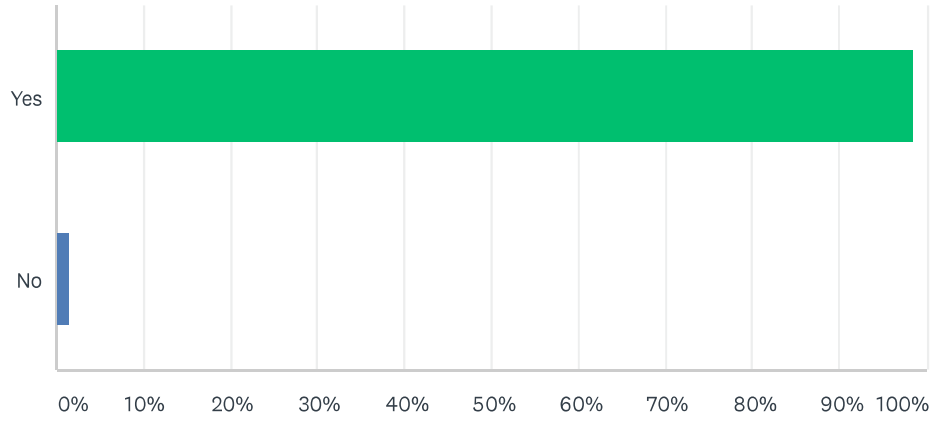
Answered: 72 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	100.00%	72
No	0.00%	0
Total Respondents: 72		

Q34 Are you currently a resident within the Helena Valley Flood Mitigation Rural Improvement District?

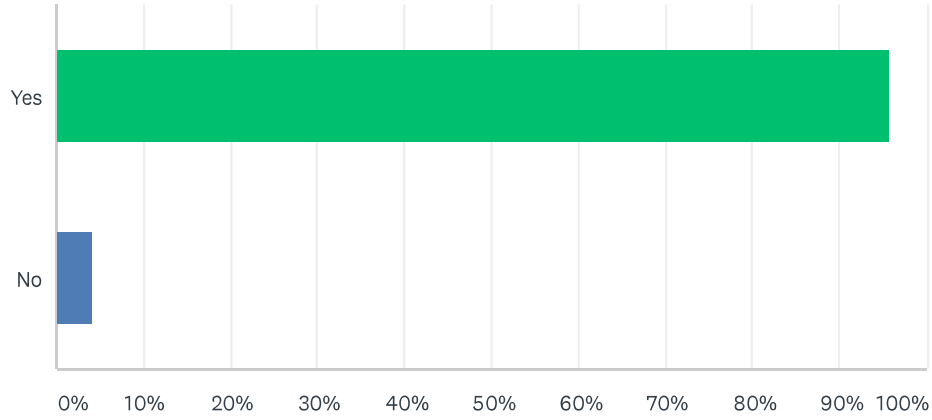
Answered: 72 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	98.61%	71
No	1.39%	1
Total Respondents: 72		

Q35 Do you own property and contribute to the annual RID assessment?

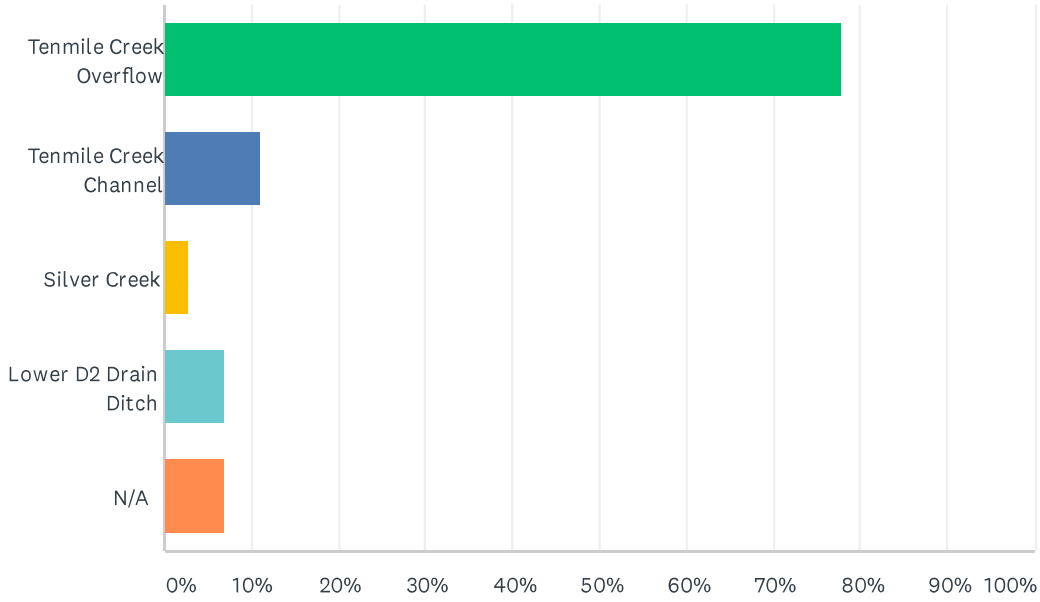
Answered: 72 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	95.83%	69
No	4.17%	3
Total Respondents: 72		

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

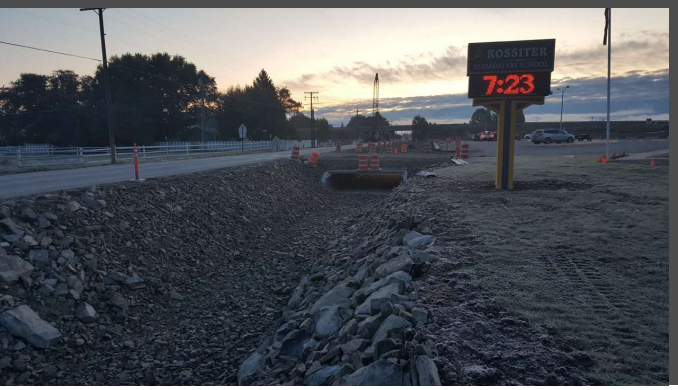
Answered: 72 Skipped: 8

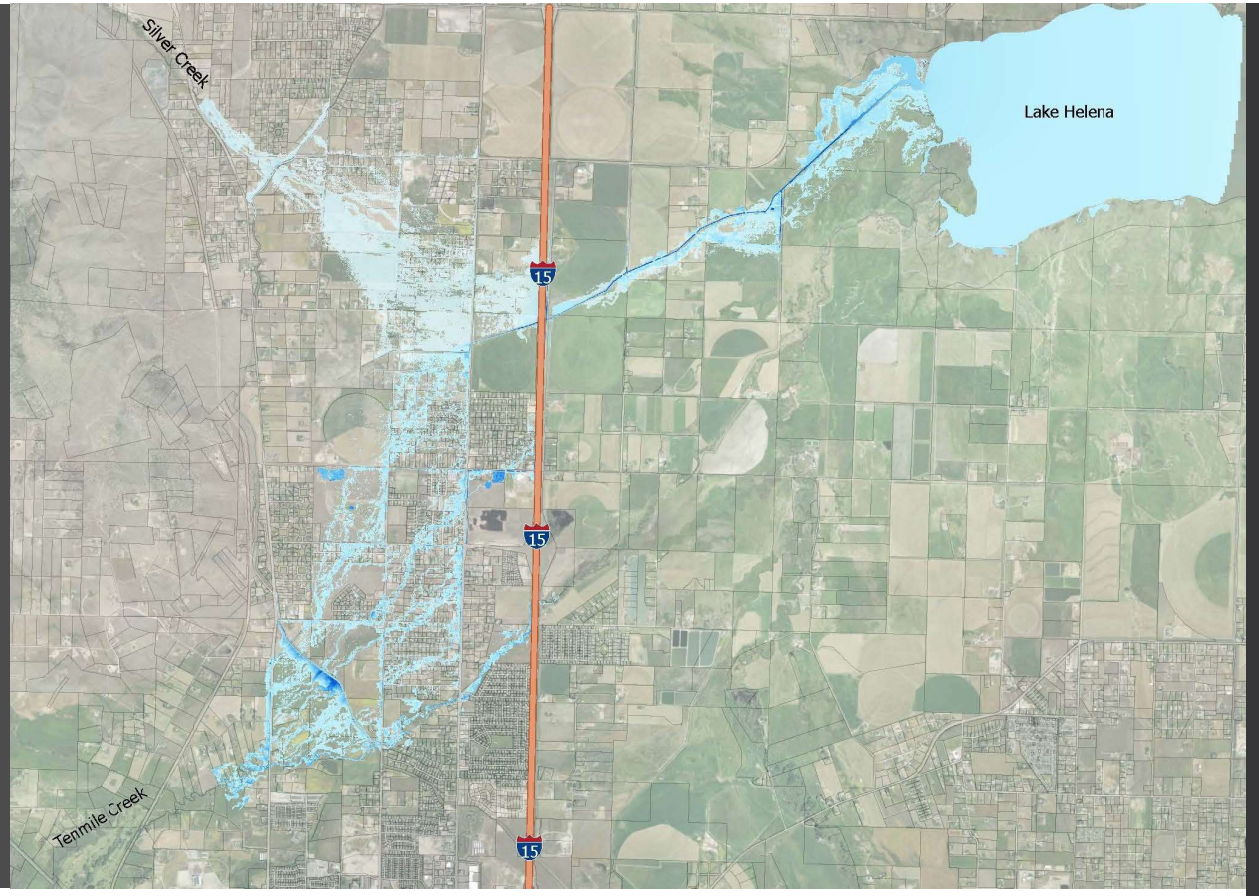


ANSWER CHOICES	RESPONSES	
Tenmile Creek Overflow	77.78%	56
Tenmile Creek Channel	11.11%	8
Silver Creek	2.78%	2
Lower D2 Drain Ditch	6.94%	5
N/A	6.94%	5
Total Respondents: 72		

APPENDIX C

MEETING 2 PRESENTATION AND PUBLIC COMMENTS





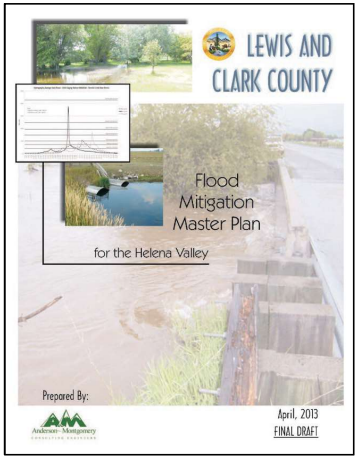
Helena Valley Flood Mitigation Master Plan Update

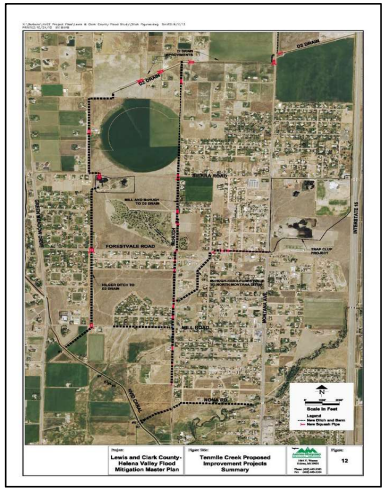
PRESENTATION OUTLINE

- 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

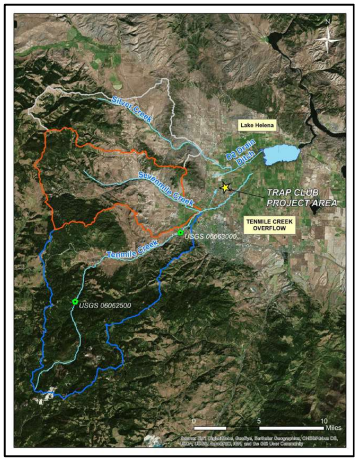
BACKGROUND

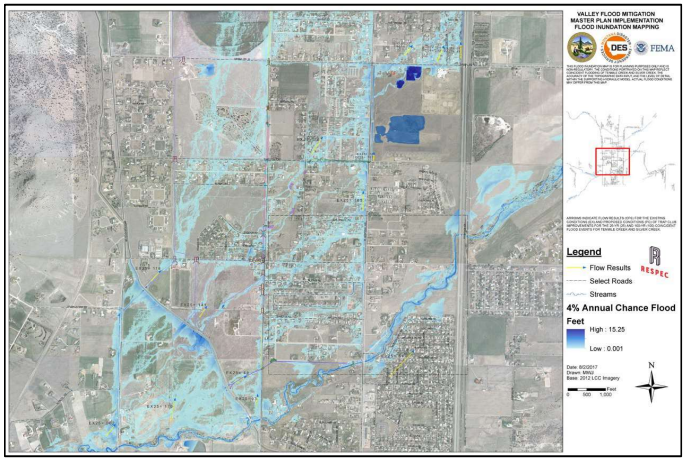
- 2013 Valley Flood Mitigation Master Plan
  - Provided alternatives for flood mitigation through the valley.
  - Was not based on detailed hydrologic and hydraulic analyses.
  - Did not include Tenmile Creek.





- 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.

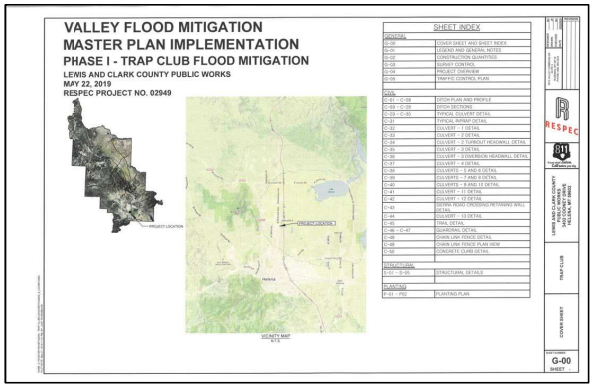




- 2017 RID Assessment

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.



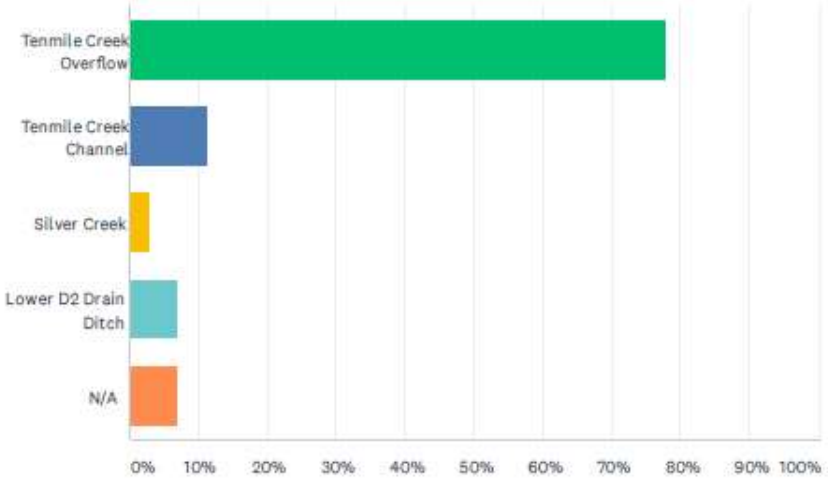
- 2022 Valley Flood Mitigation Master Plan Update
  - Update flood routing alternatives for Tenmile Overflow Area, Silver Creek and D2 Ditch based on updated hydrologic and hydraulic analyses.
  - Develop a plan to better understand aggradation trends in Tenmile Creek to establish annual monitoring and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

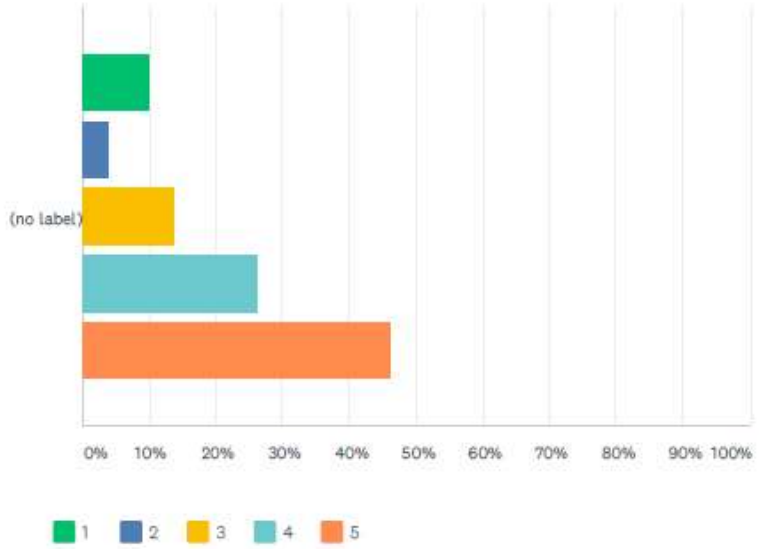


ANSWER CHOICES	RESPONSES	
Tenmile Creek Overflow	77.78%	56
Tenmile Creek Channel	11.11%	8
Silver Creek	2.78%	2
Lower D2 Drain Ditch	6.94%	5
N/A	6.94%	5
Total Respondents: 72		

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

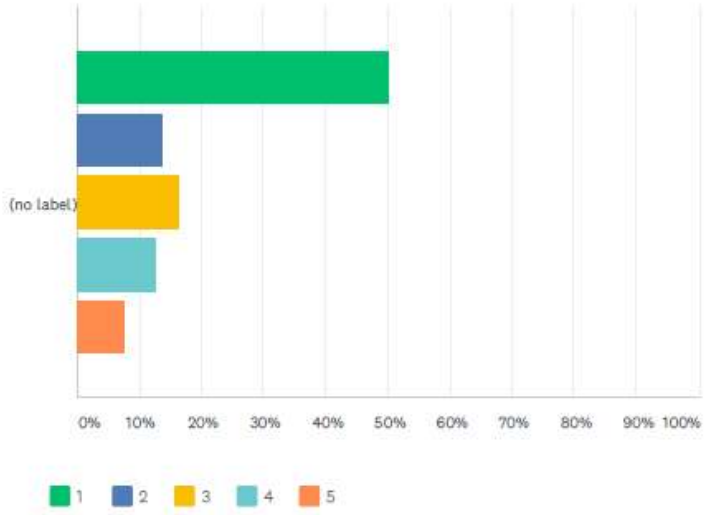


	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	10.00% 8	3.75% 3	13.75% 11	26.25% 21	46.25% 37	80	3.95

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

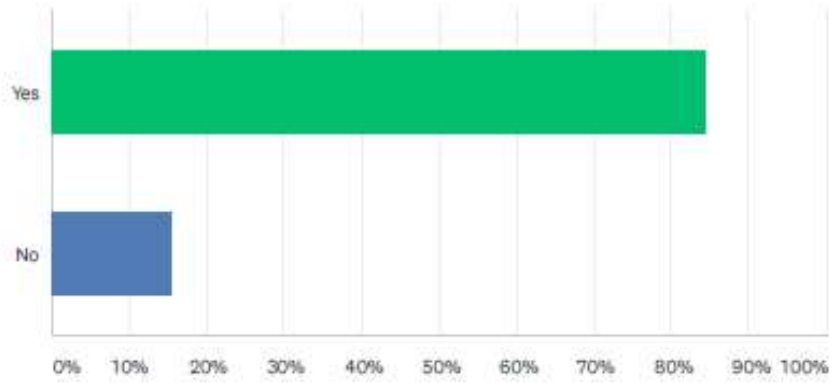


	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	50.00% 40	13.75% 11	16.25% 13	12.50% 10	7.50% 6	80	2.14

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

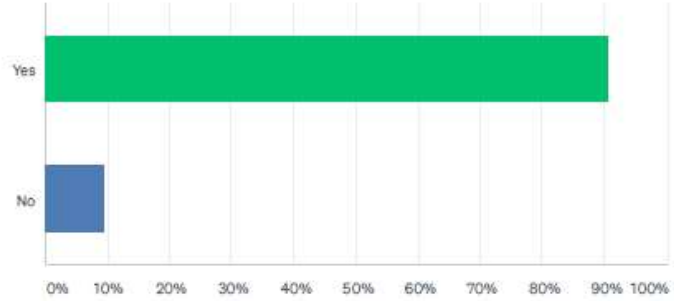


ANSWER CHOICES	RESPONSES	
Yes	84.62%	66
No	15.38%	12
Total Respondents: 78		

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

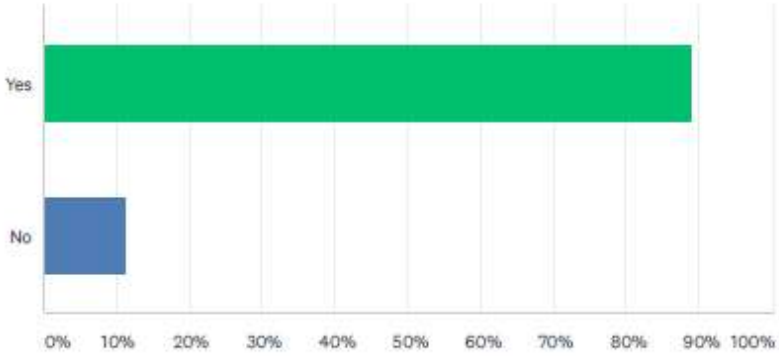


ANSWER CHOICES	RESPONSES	
Yes	90.63%	58
No	9.38%	6
Total Respondents: 64		

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

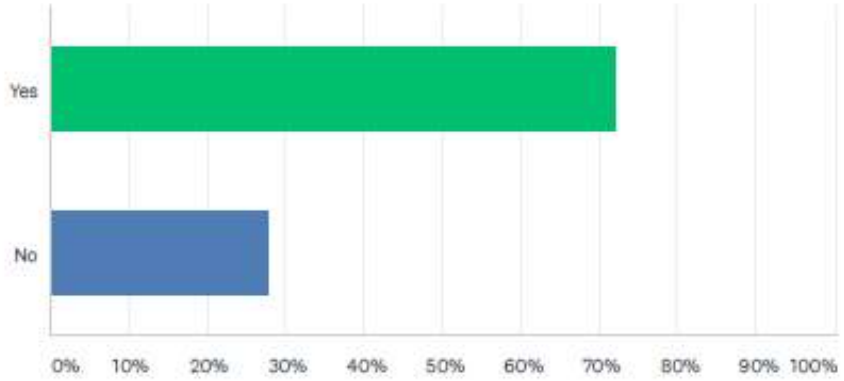


ANSWER CHOICES	RESPONSES	
Yes	88.89%	64
No	11.11%	8
Total Respondents: 72		

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

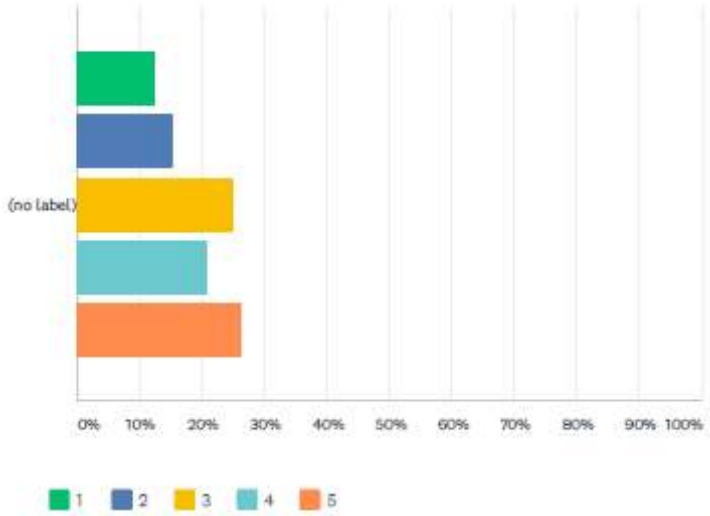


ANSWER CHOICES	RESPONSES	
Yes	72.22%	52
No	27.78%	20
Total Respondents: 72		

COMMUNITY SURVEY

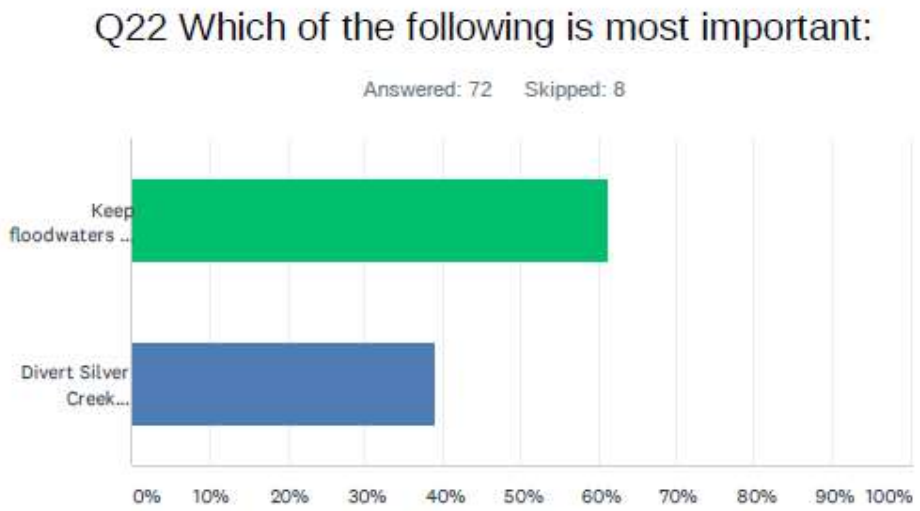
Q21 On a scale of 1 to 5, how important is it to mitigate Silver Creek flooding between Applegate Drive and North Montana Avenue? Not important 1 2 3 4 5 Very Important

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

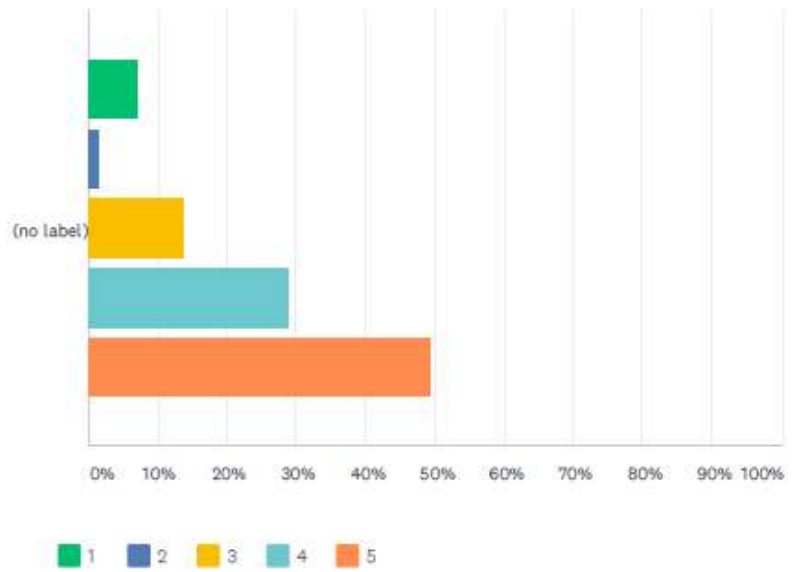


ANSWER CHOICES	RESPONSES	
Keep floodwaters in Silver Creek through Sewell subdivision but increase the size of the channel and road crossings to convey floodwater.	61.11%	44
Divert Silver Creek floodwater around Sewell subdivision and reduce flooding between Applegate Drive and North Montana Avenue.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

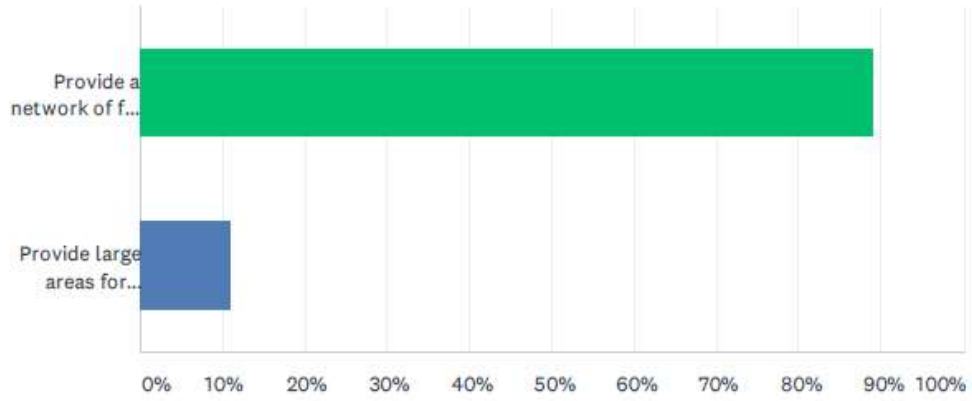


	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
(no label)	6.85% 5	1.37% 1	13.70% 10	28.77% 21	49.32% 36	73	4.12

COMMUNITY SURVEY

Q13 Which of the following do you feel is more important?

Answered: 73 Skipped: 7

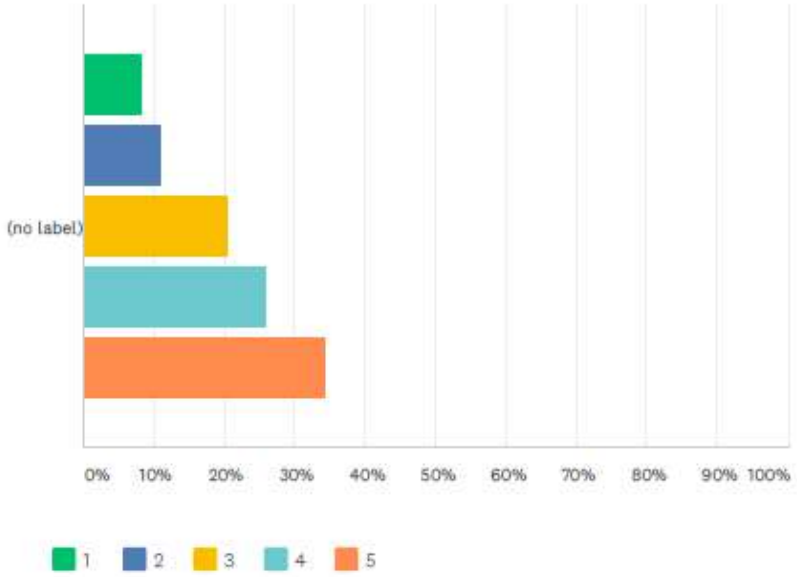


ANSWER CHOICES	RESPONSES	
Provide a network of flow conveyance channels to route floodwater through the upper valley.	89.04%	65
Provide large areas for detention and storage of floodwater from Tenmile Creek.	10.96%	8
TOTAL		73

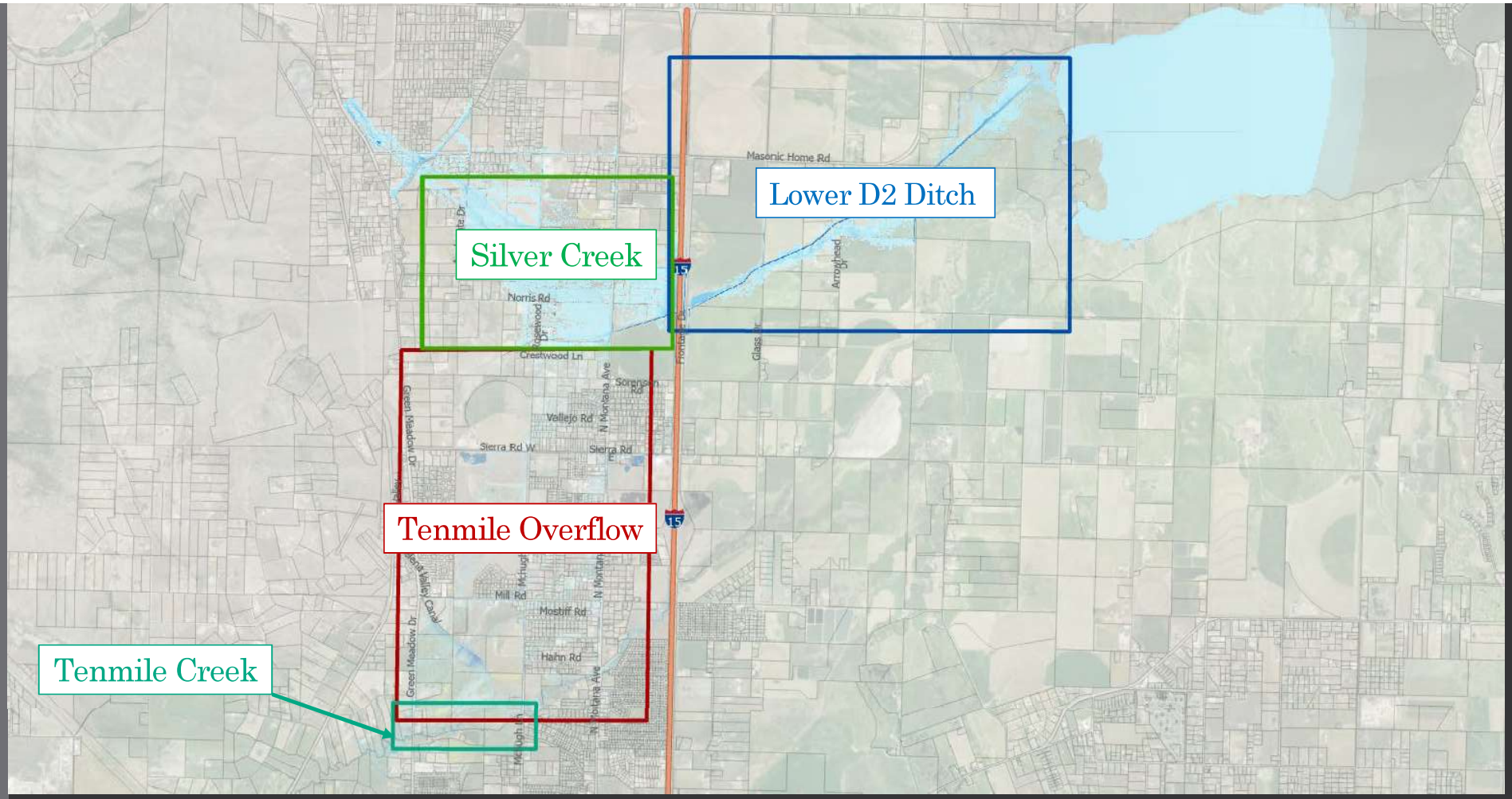
COMMUNITY SURVEY

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

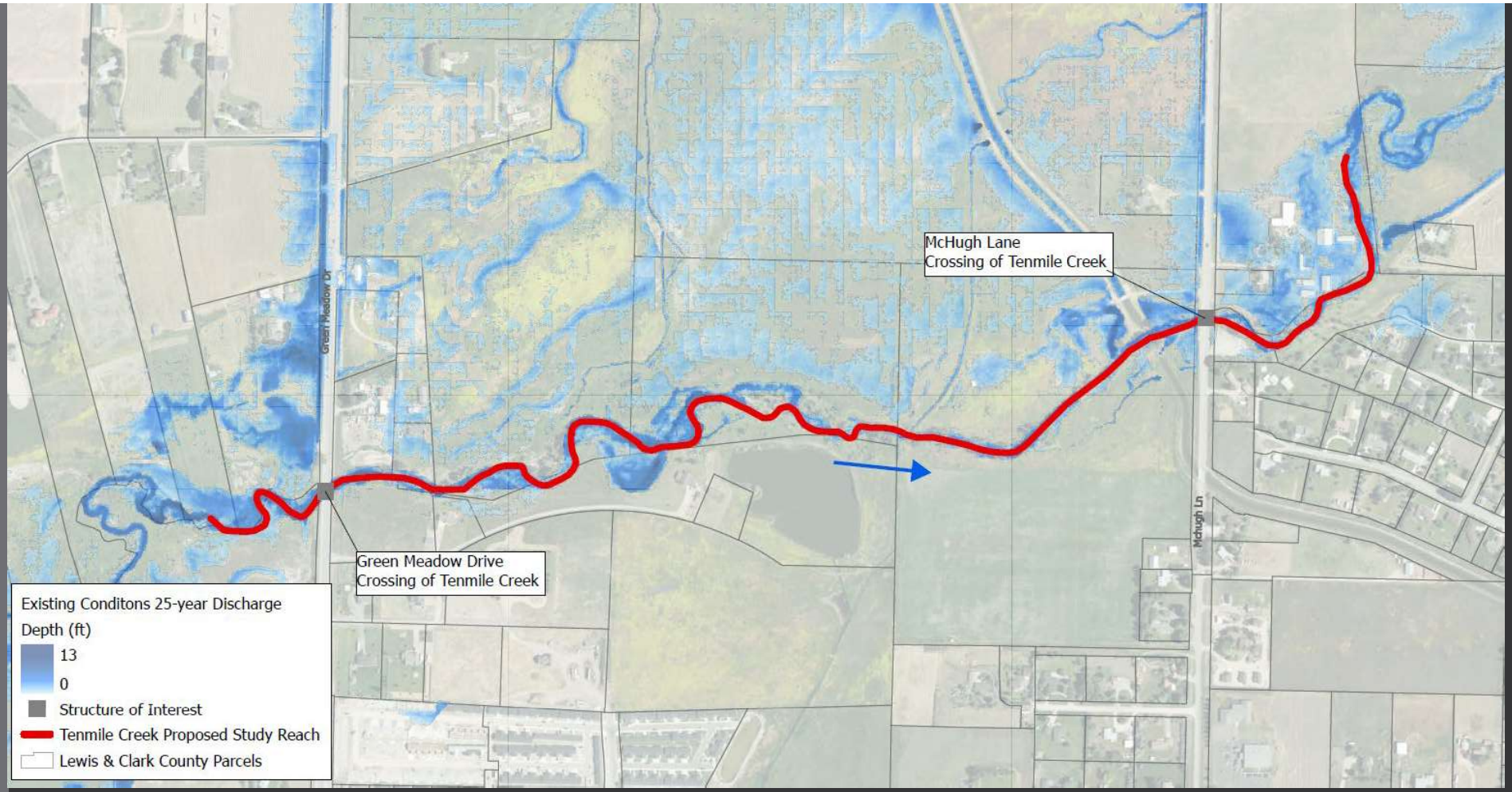
Answered: 73 Skipped: 7



	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



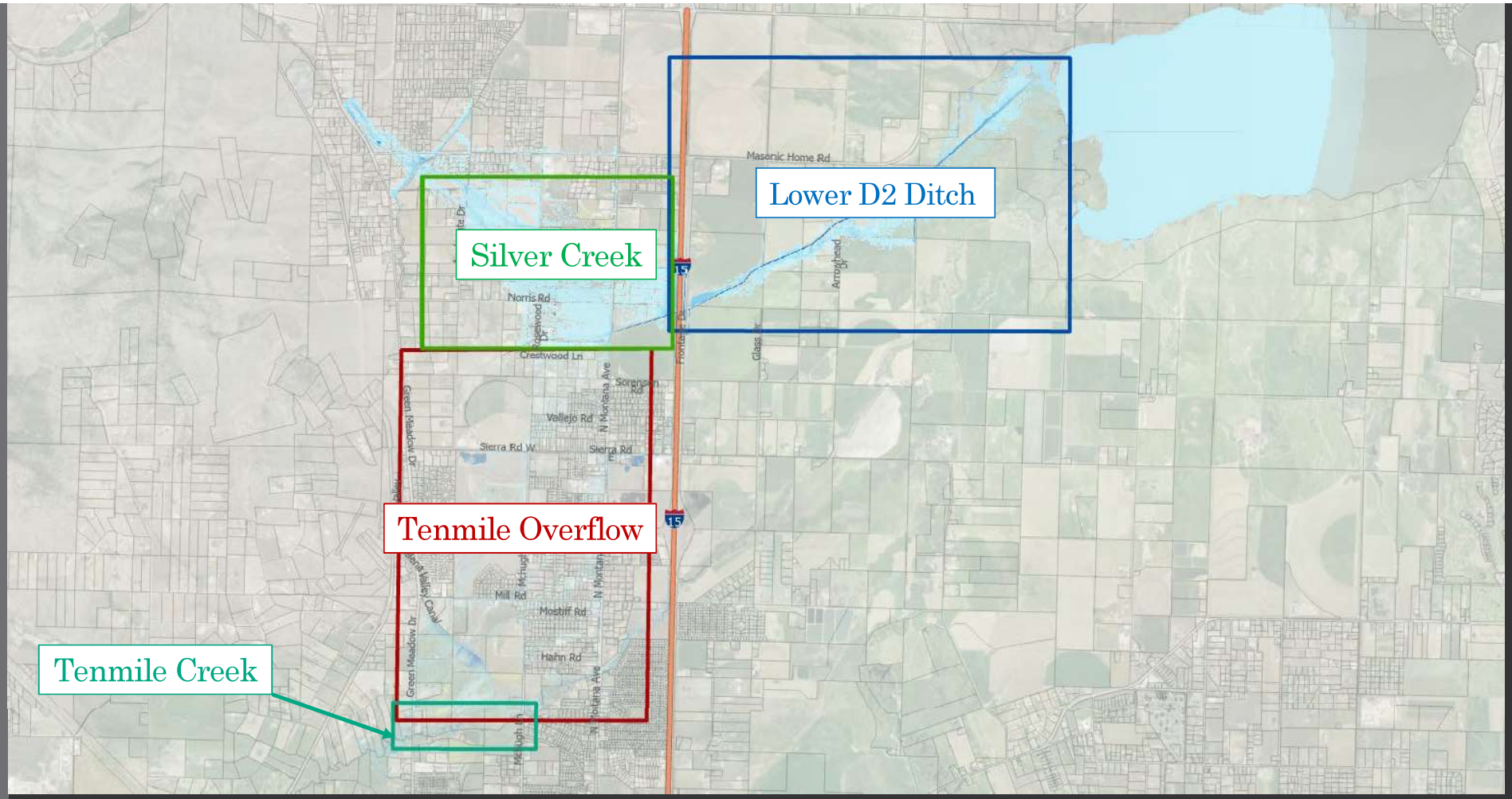
MASTER PLAN OVERVIEW



TENMILE CREEK
CHANNEL CAPACITY MONITORING

TENMILE CREEK
CHANNEL CAPACITY MONITORING

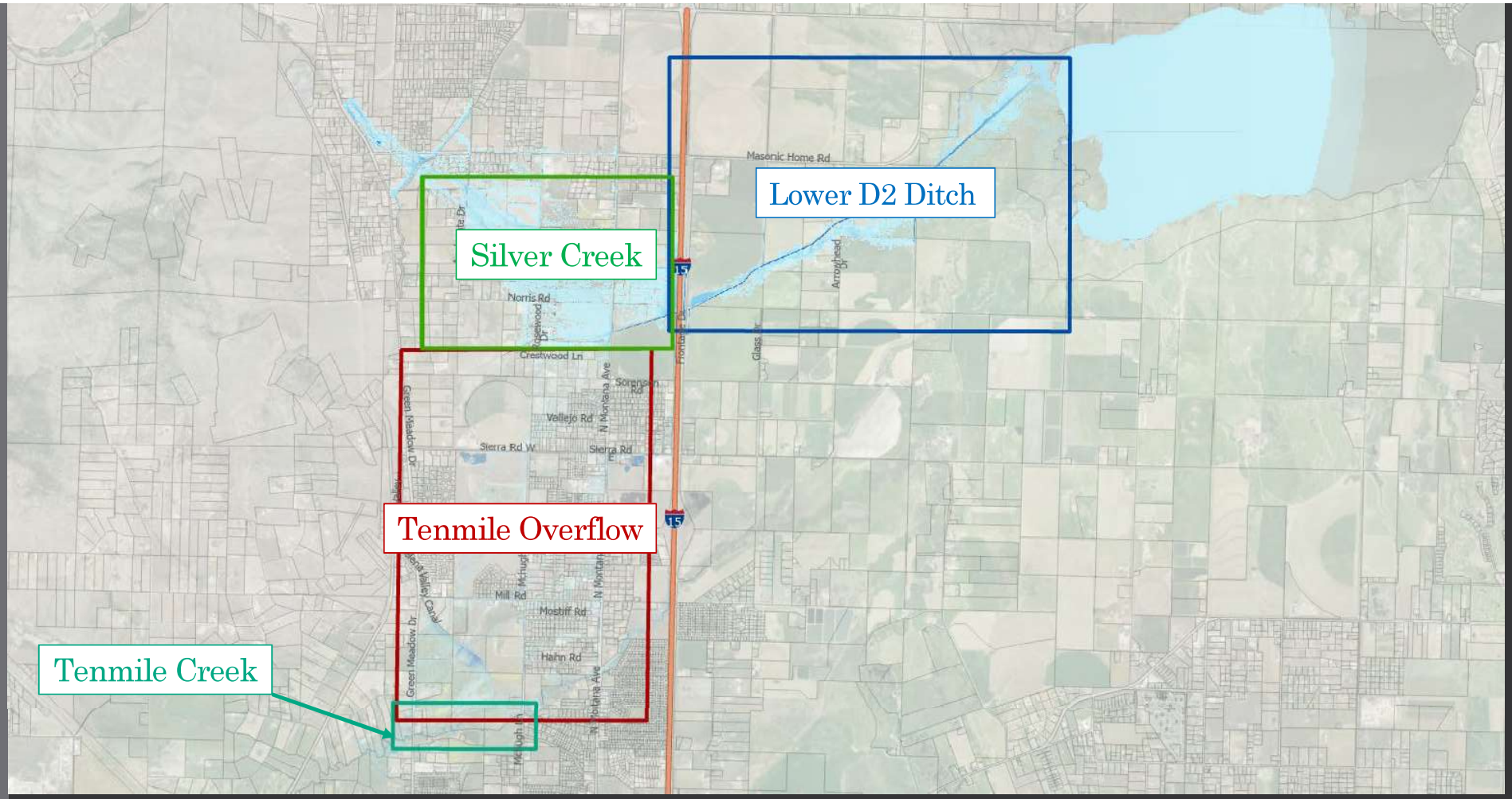
- The topics of a new dam/reservoir or to levee and dredge are not considered in this plan. These topics have been fully vetted extending back to the 1960s and determined not cost effective. The plan will identify need to define localized sections of the creek that may be suitable for maintenance.
- 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.



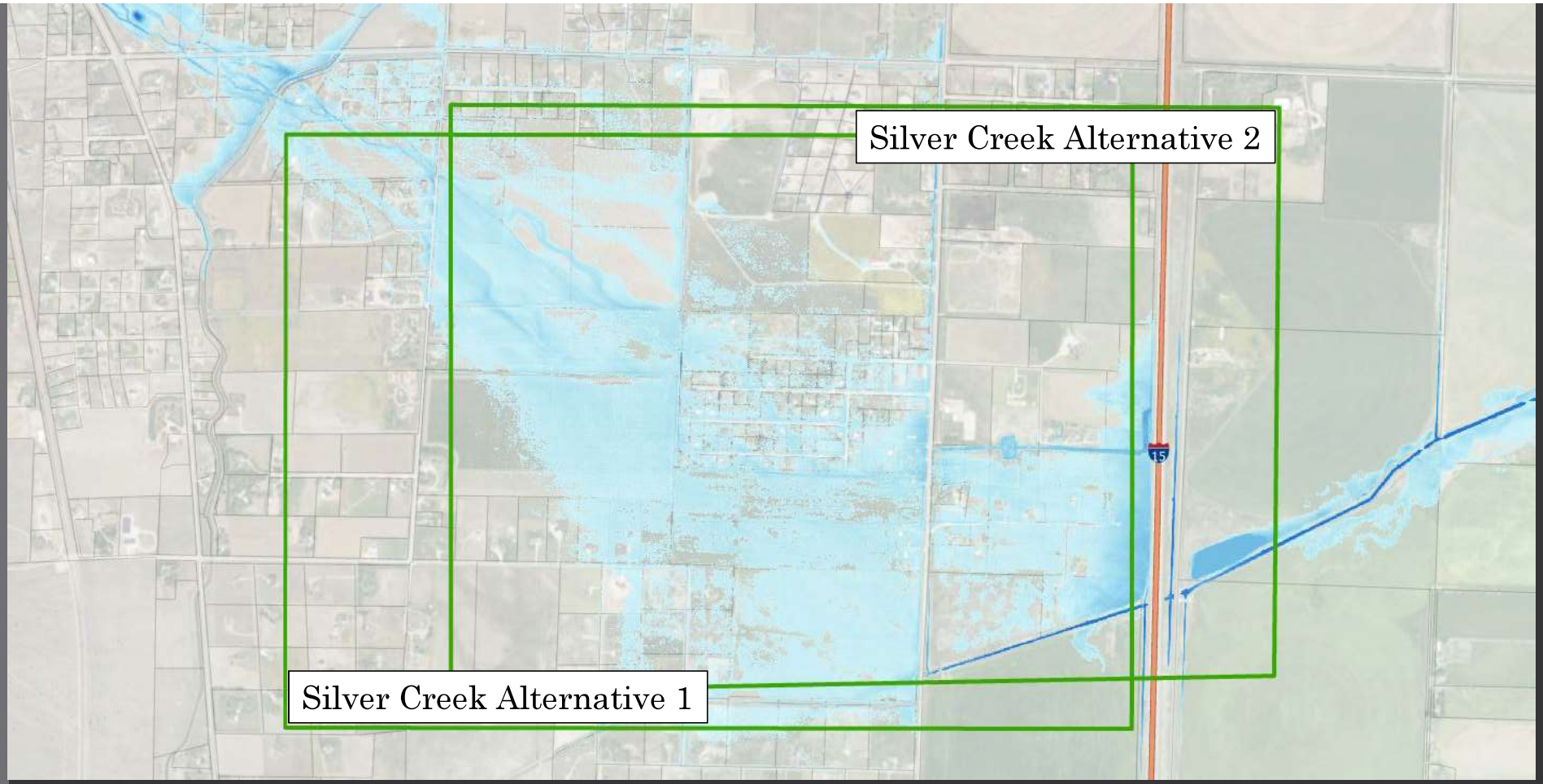
MASTER PLAN OVERVIEW

LOWER D2 DITCH OVERVIEW

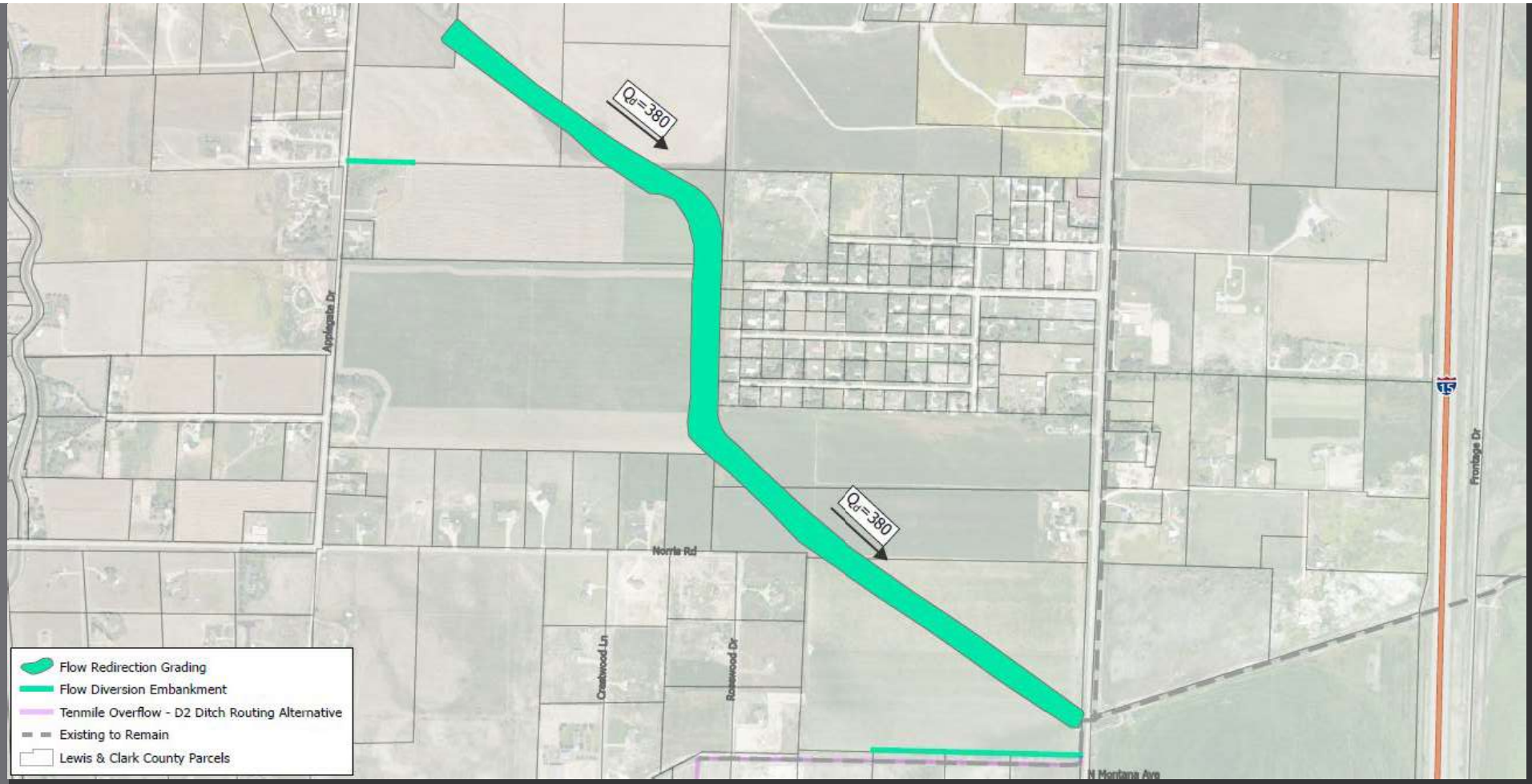
LOWER D2 DITCH
BASELINE IMPROVEMENTS



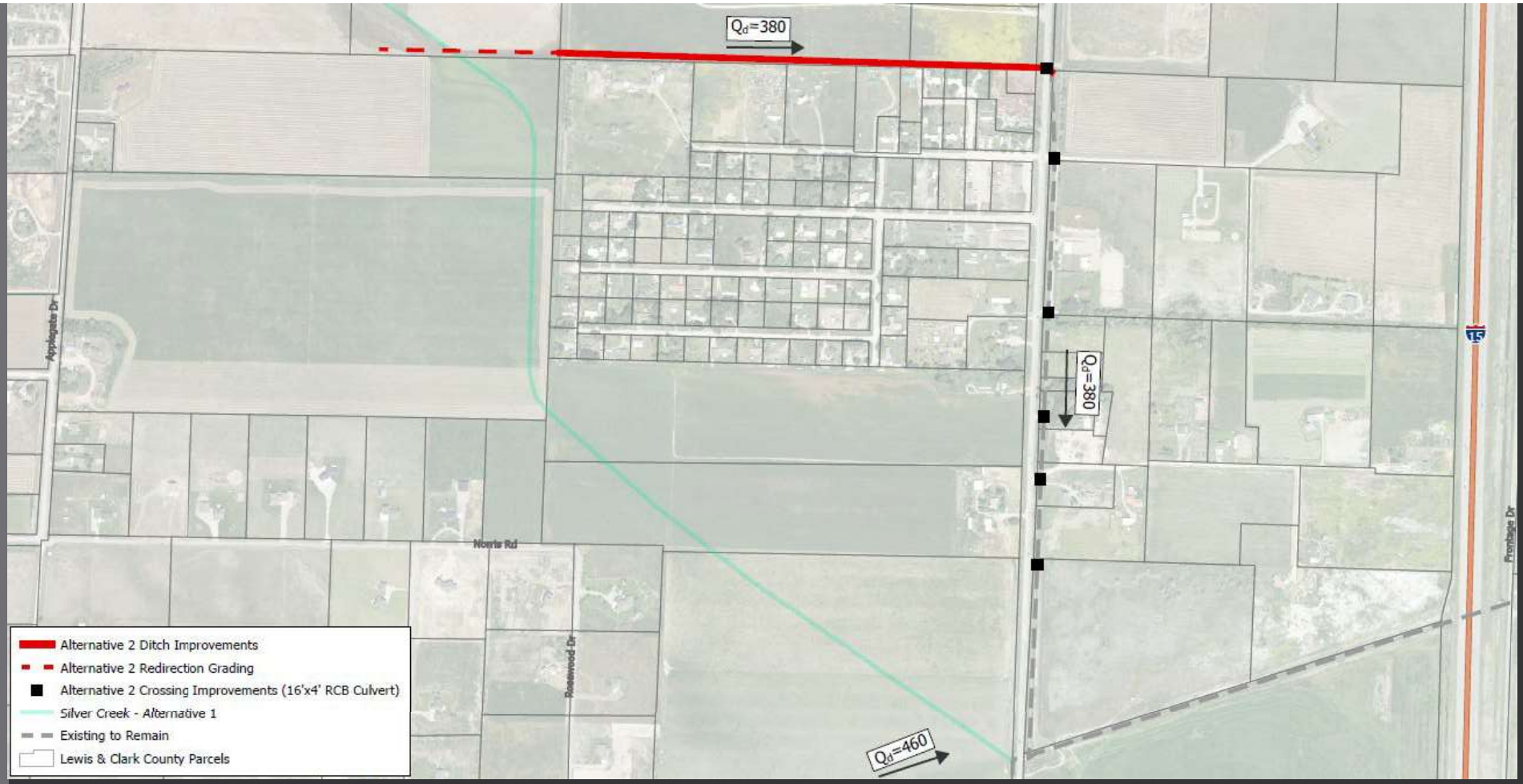
MASTER PLAN OVERVIEW



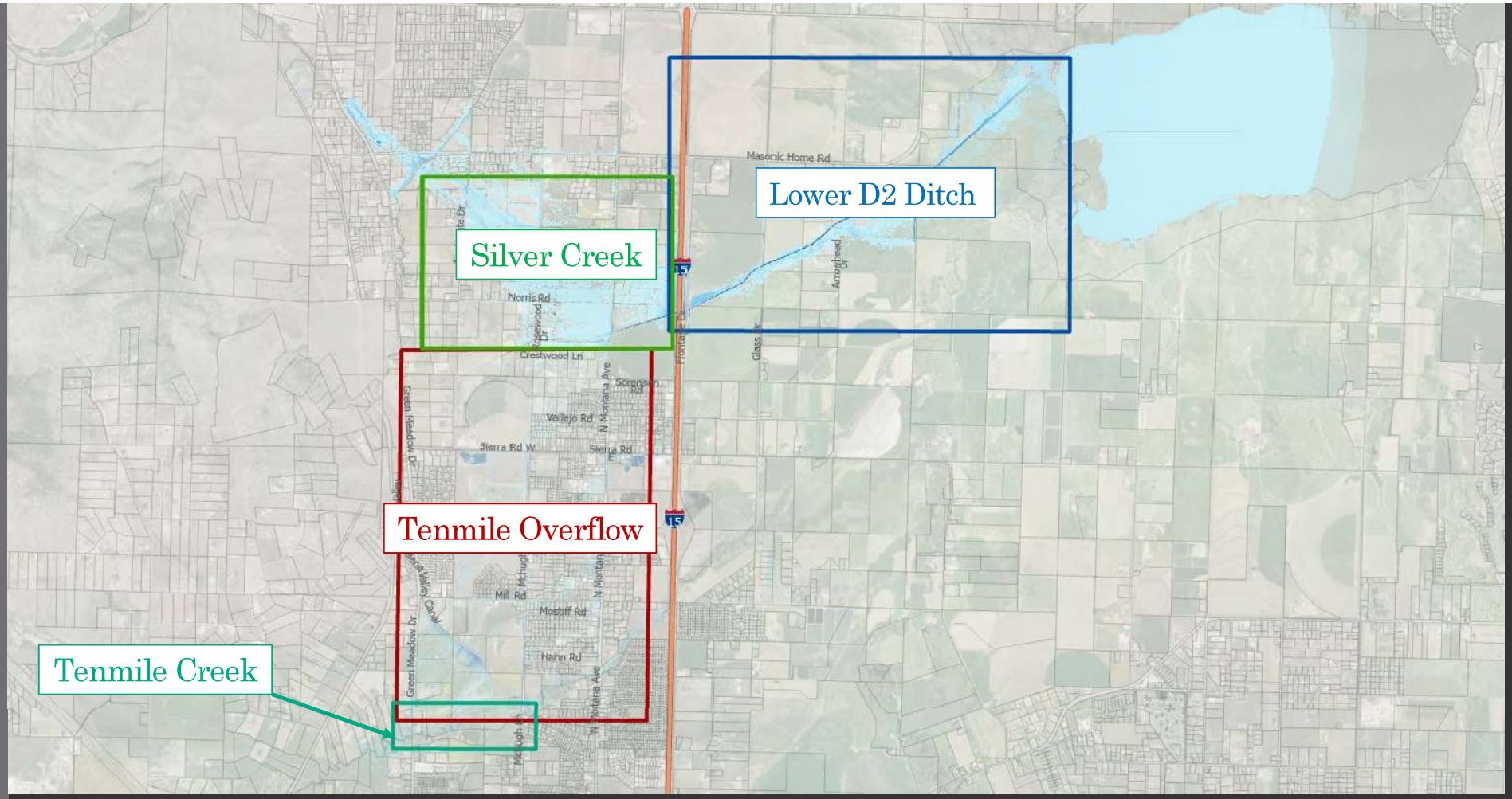
SILVER CREEK OVERVIEW



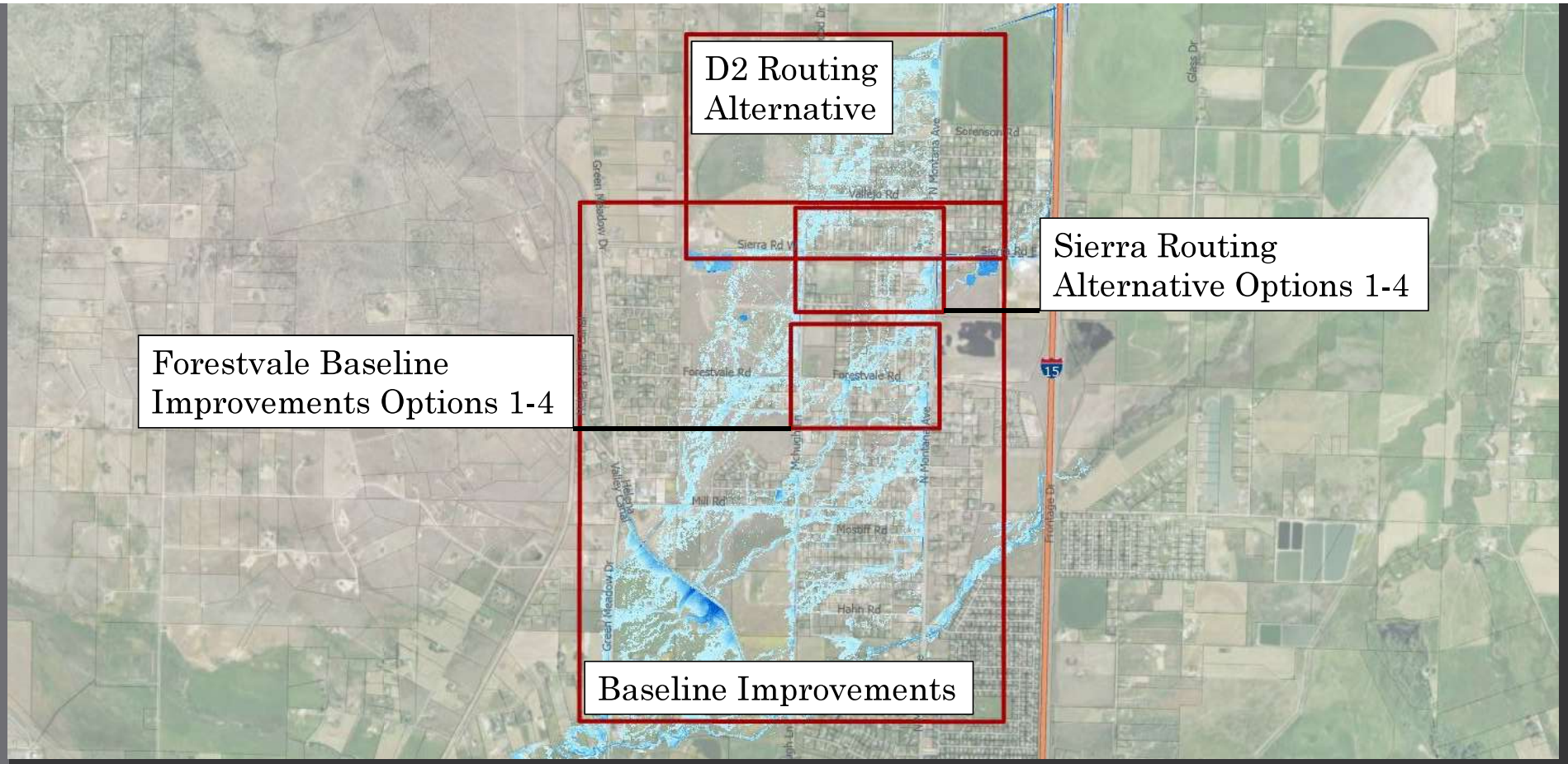
SILVER CREEK ALTERNATIVE 1



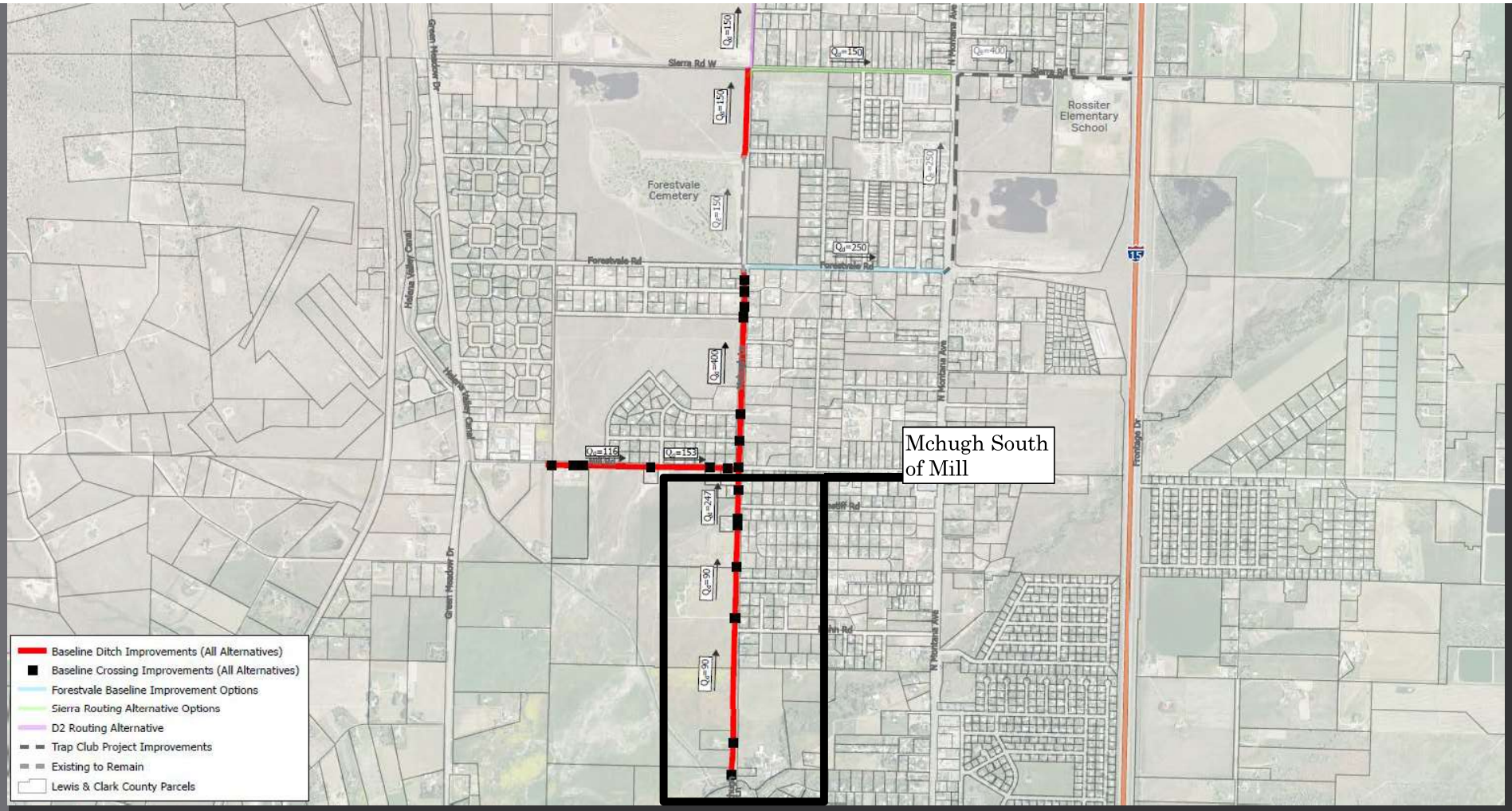
SILVER CREEK ALTERNATIVE 2



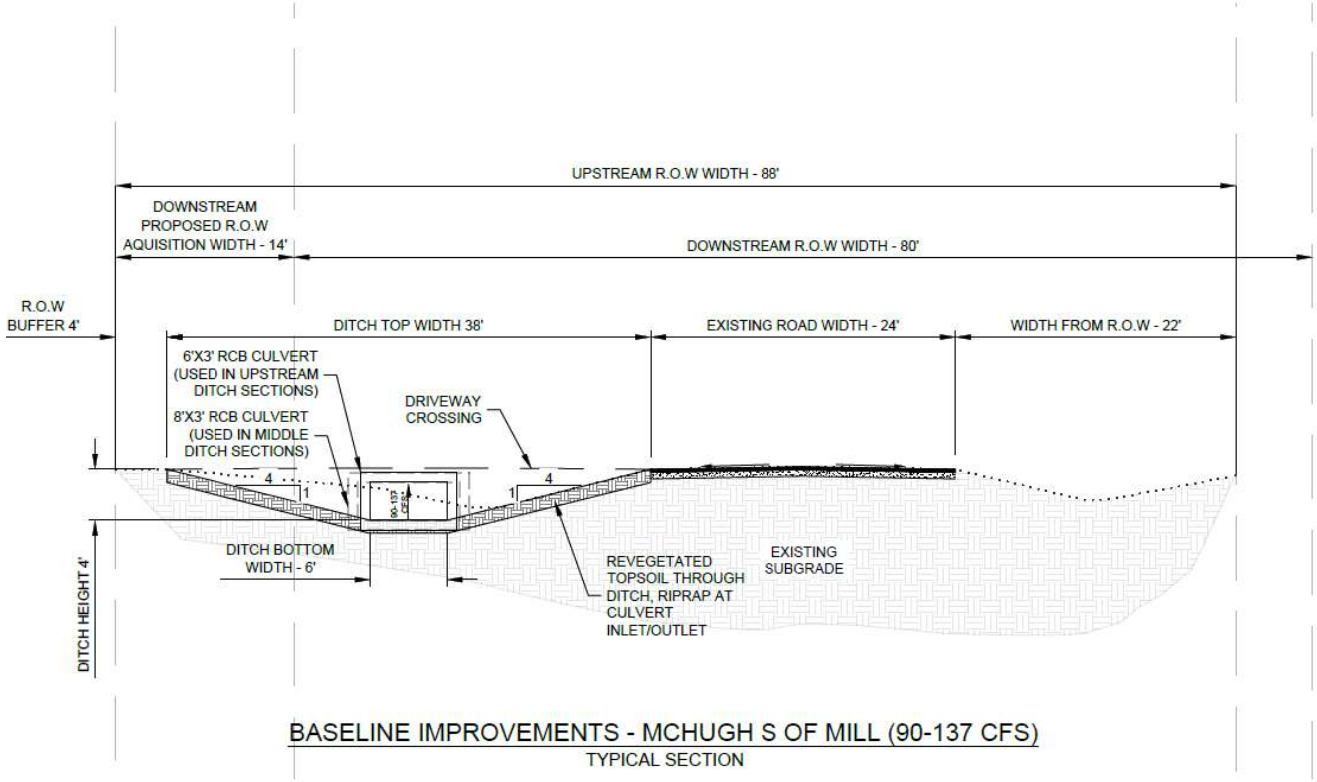
MASTER PLAN OVERVIEW



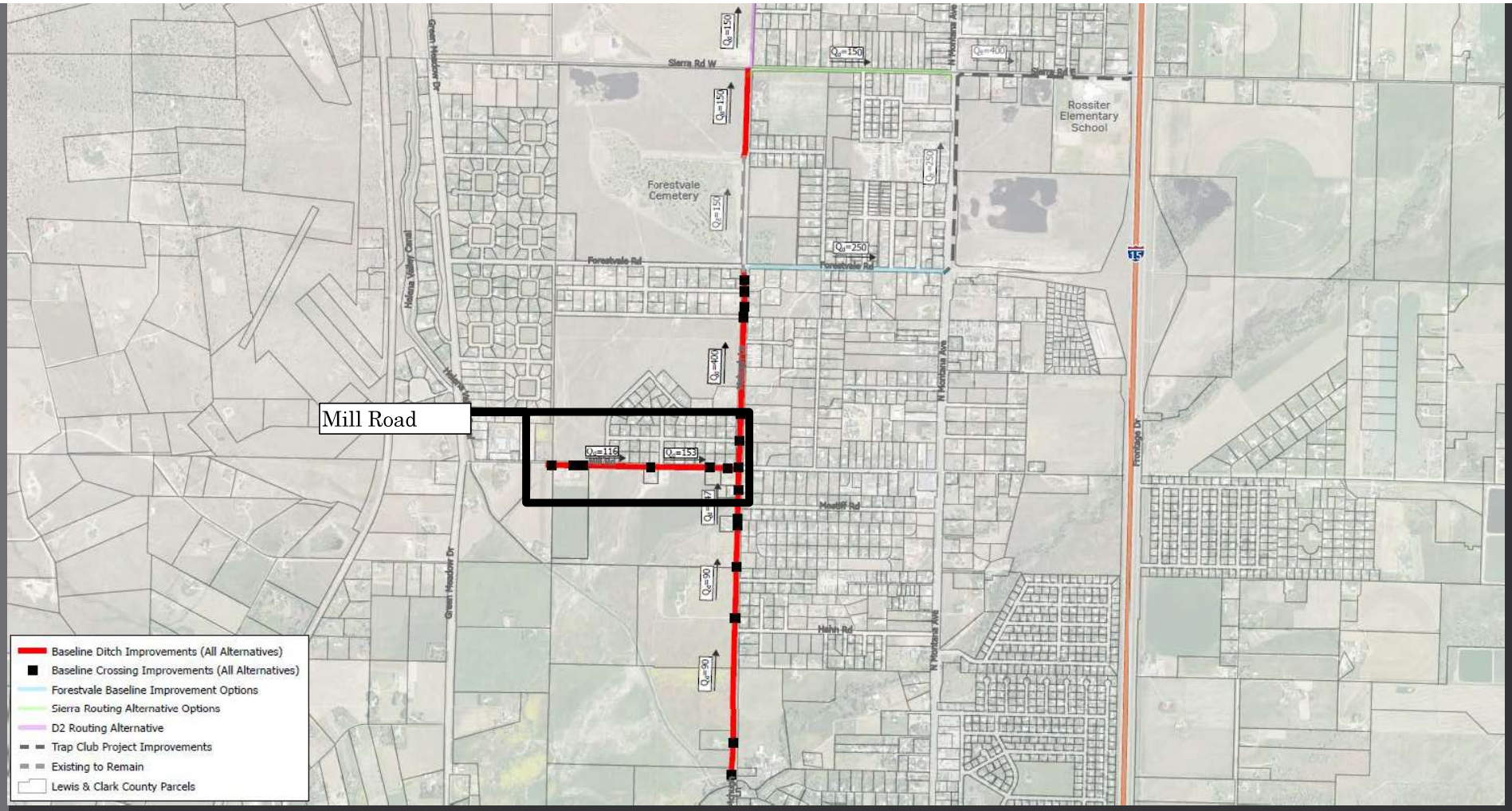
TENMILE OVERFLOW OVERVIEW



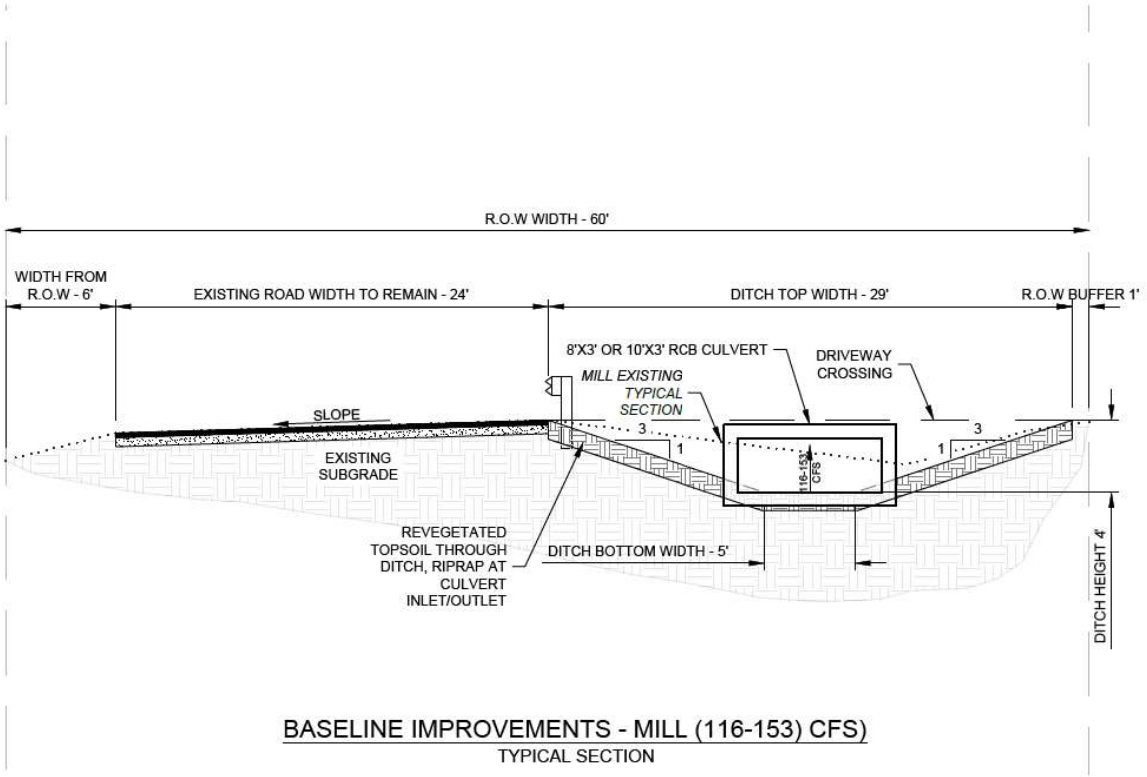
BASELINE IMPROVEMNTS MCHUGH SOUTH OF MILL



MCHUGH SOUTH OF MILL TYPICAL SECTION



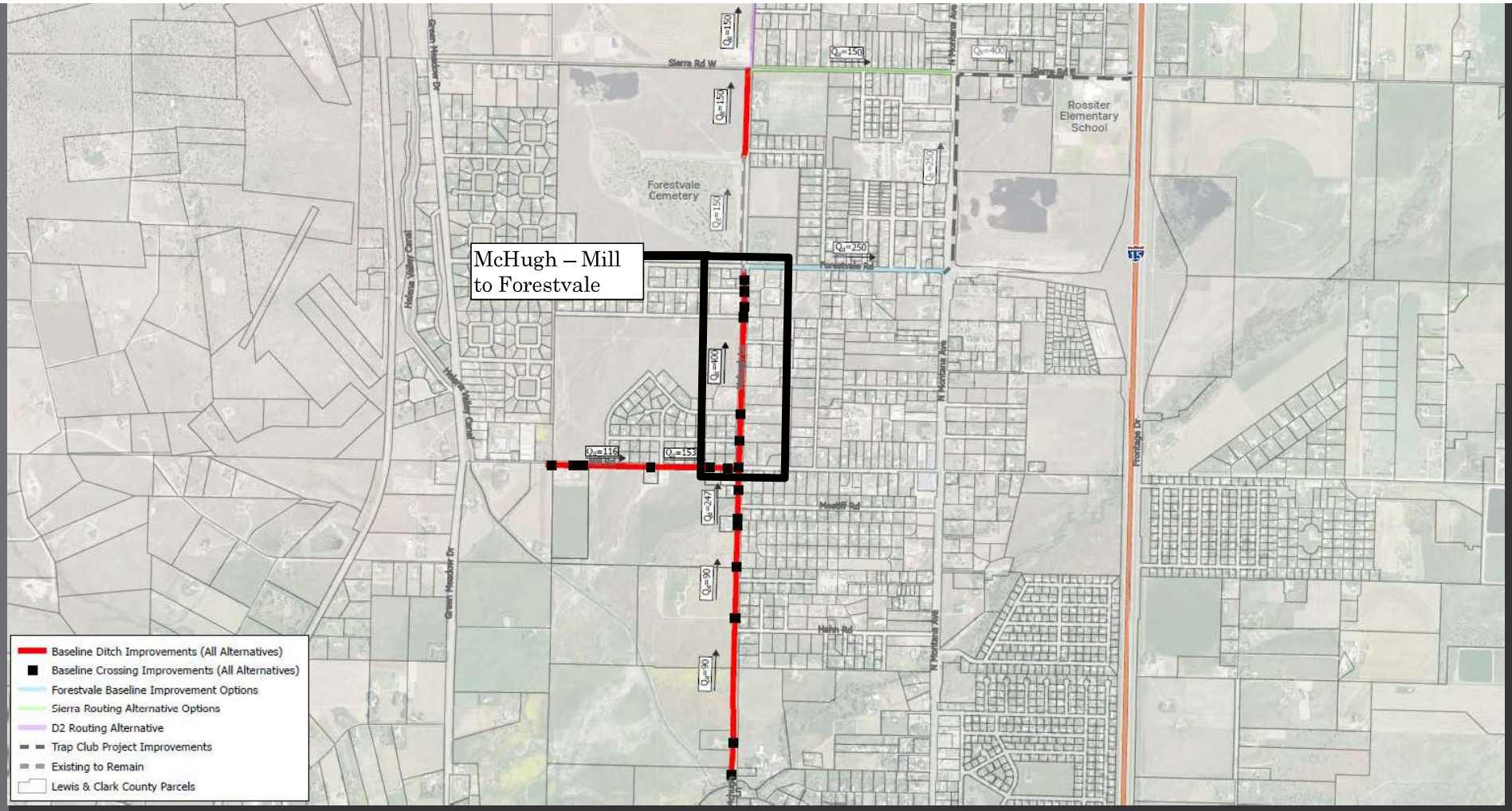
BASELINE IMPROVEMNTS
MILL ROAD



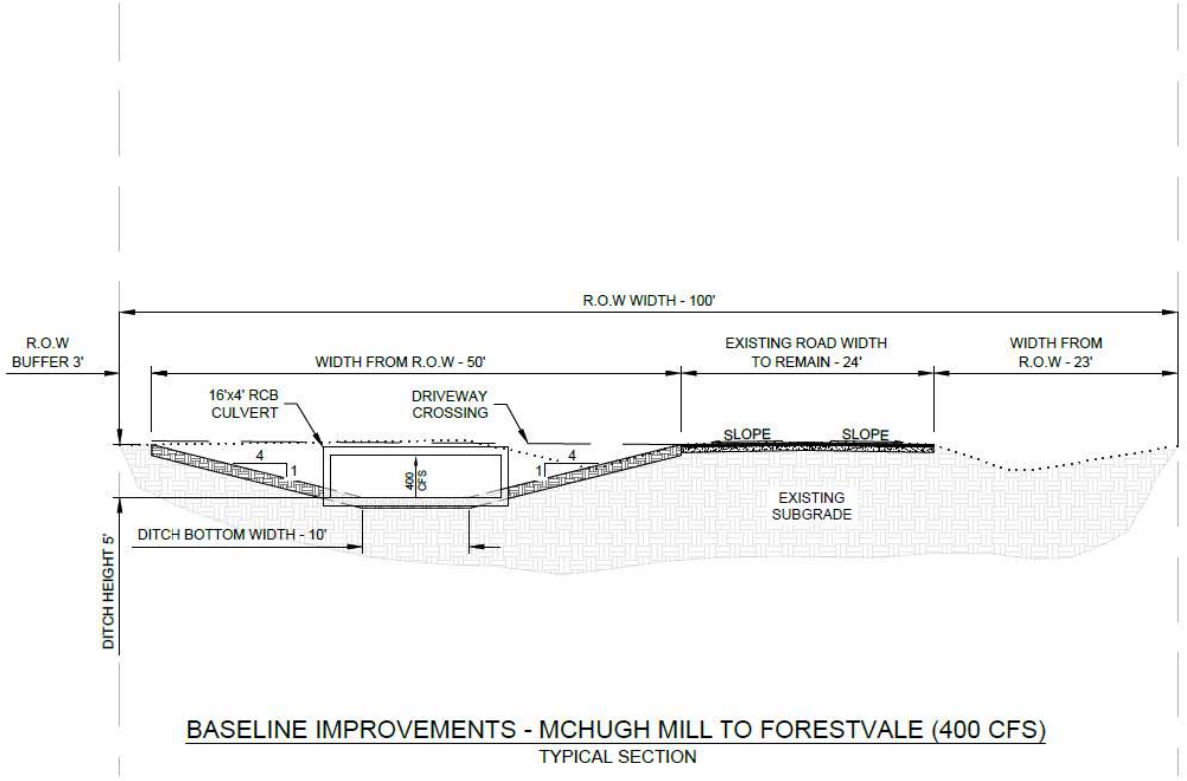
BASELINE IMPROVEMENTS - MILL (116-153) CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

MILL ROAD TYPICAL SECTION



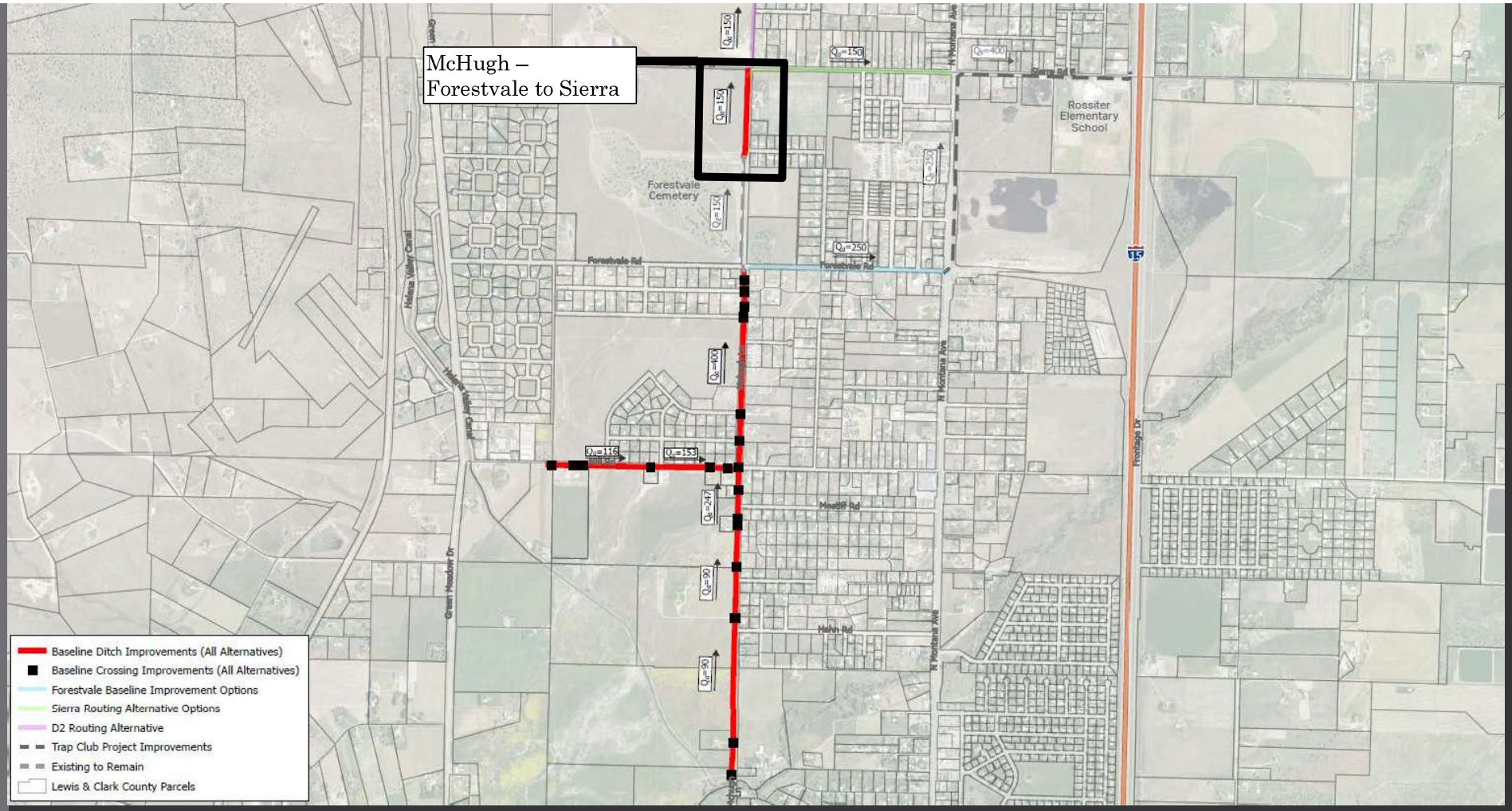
BASELINE IMPROVEMNTS
MCHUGH - MILL TO FORESTVALE



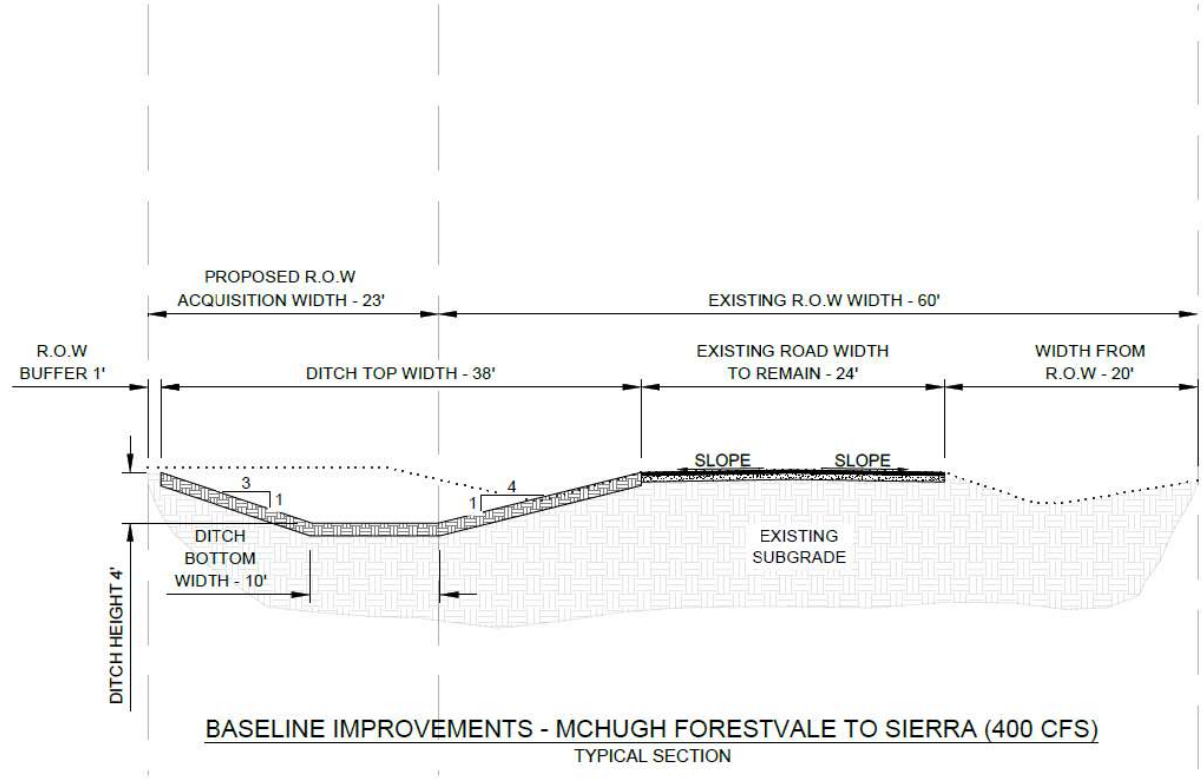
BASELINE IMPROVEMENTS - MCHUGH MILL TO FORESTVALE (400 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

MCHUGH - MILL TO FORESTVALE TYPICAL SECTION

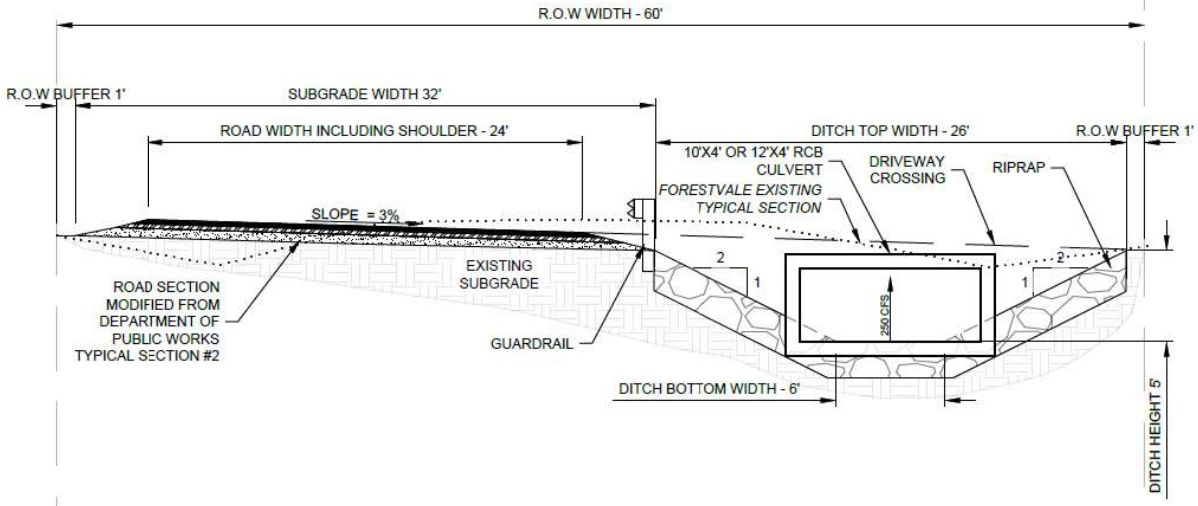


BASELINE IMPROVEMNTS
MCHUGH - FORESTVALE TO SIERRA



MCHUGH - FORESTVALE TO SIERRA TYPICAL SECTION

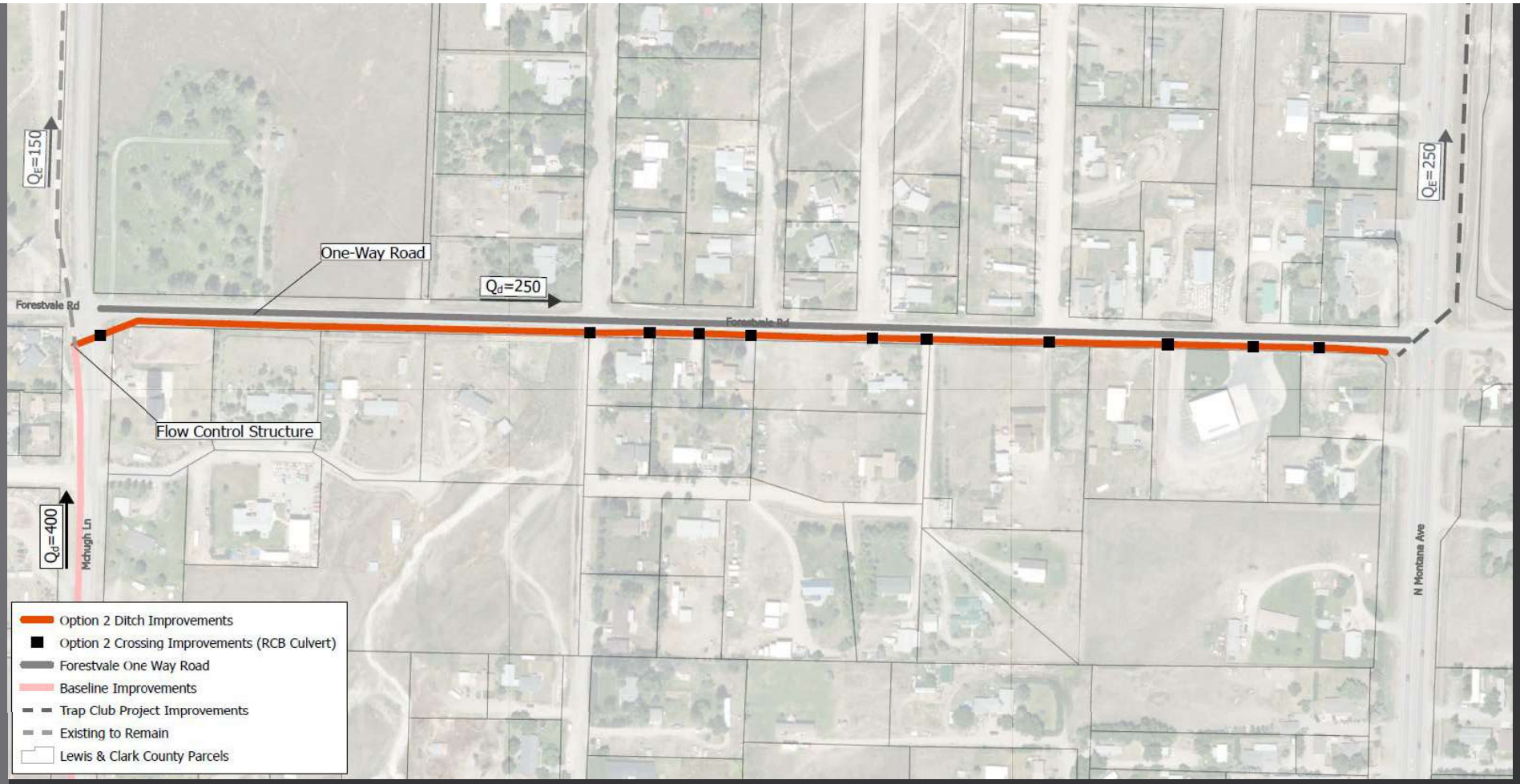
FORESTVALE IMPROVEMENTS OPTION 1



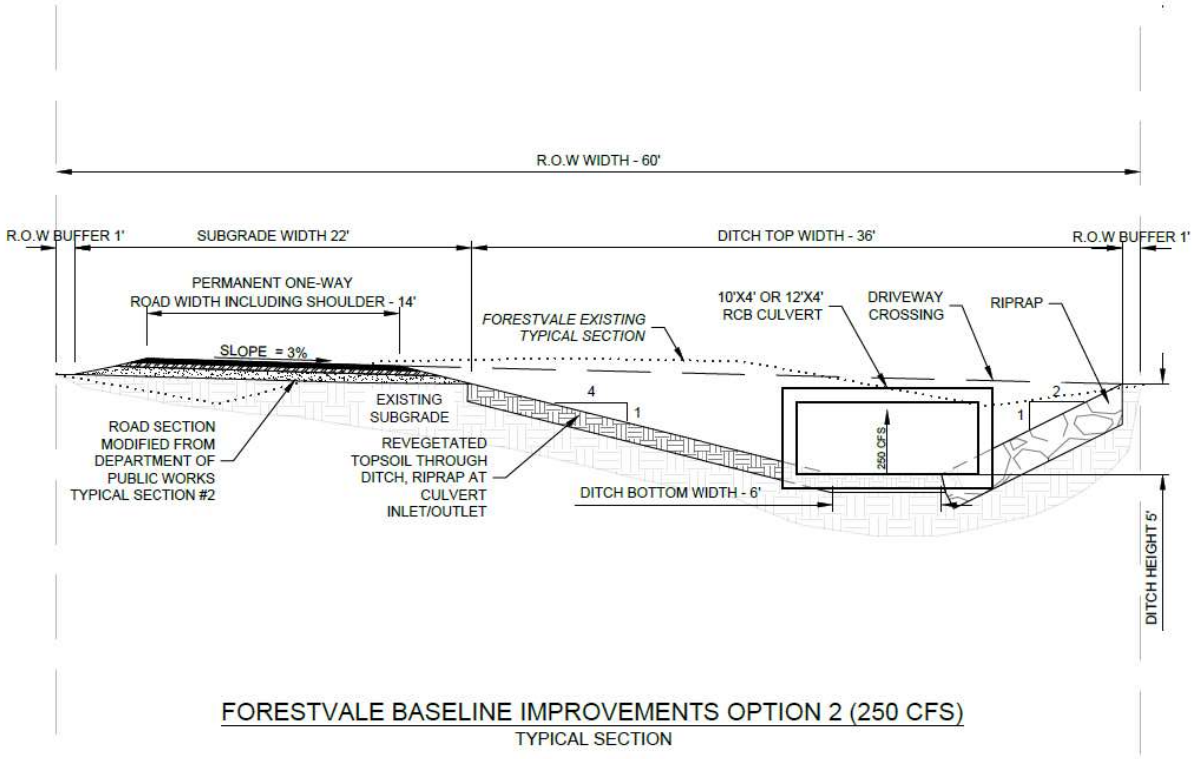
FORESTVALE BASELINE IMPROVEMENTS OPTION 1 (250 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

FORESTVALE IMPROVEMNTS OPTION 1 TYPICAL SECTION

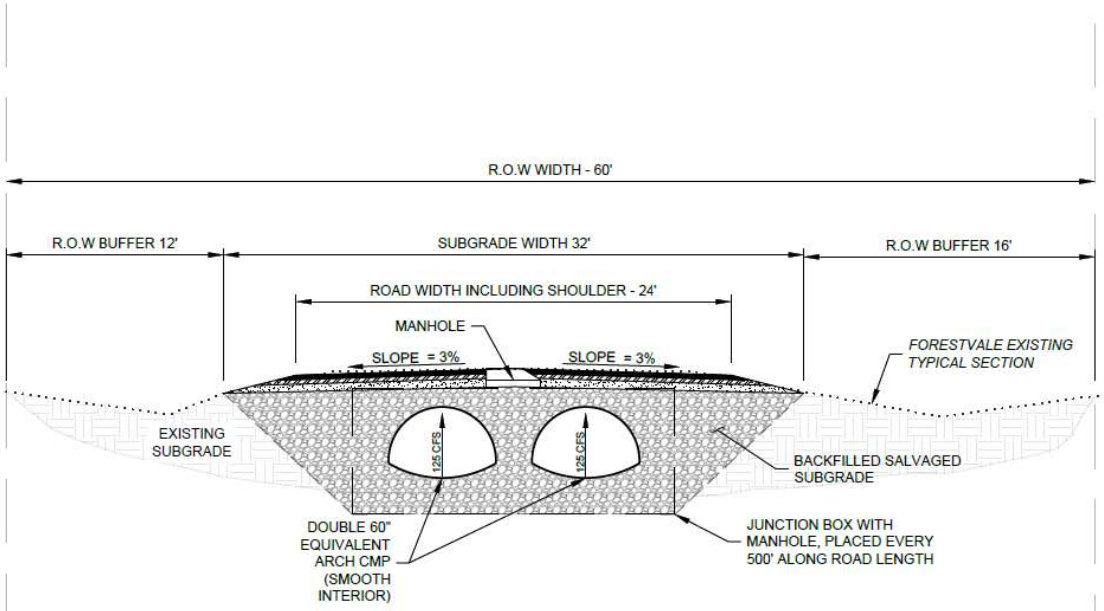


FORESTVALE IMPROVEMENTS OPTION 2



FORESTVALE IMPROVEMNTS OPTION 2 TYPICAL SECTION

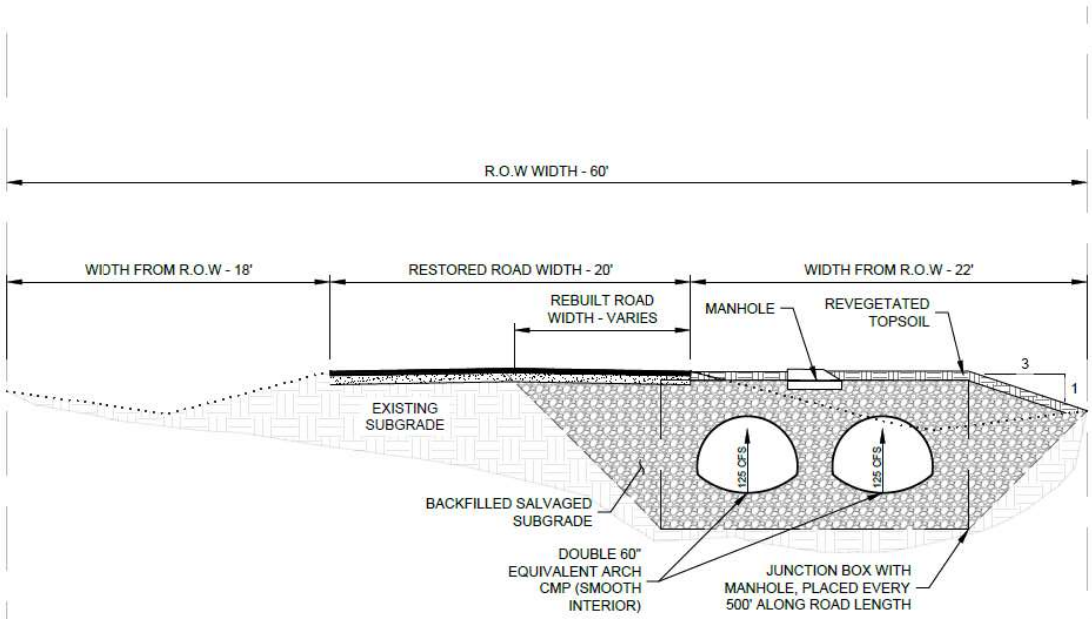
FORESTVALE IMPROVEMENTS OPTION 3



FORESTVALE BASELINE IMPROVEMENTS OPTION 3 (250 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

FORESTVALE IMPROVEMNTS OPTION 3 TYPICAL SECTION

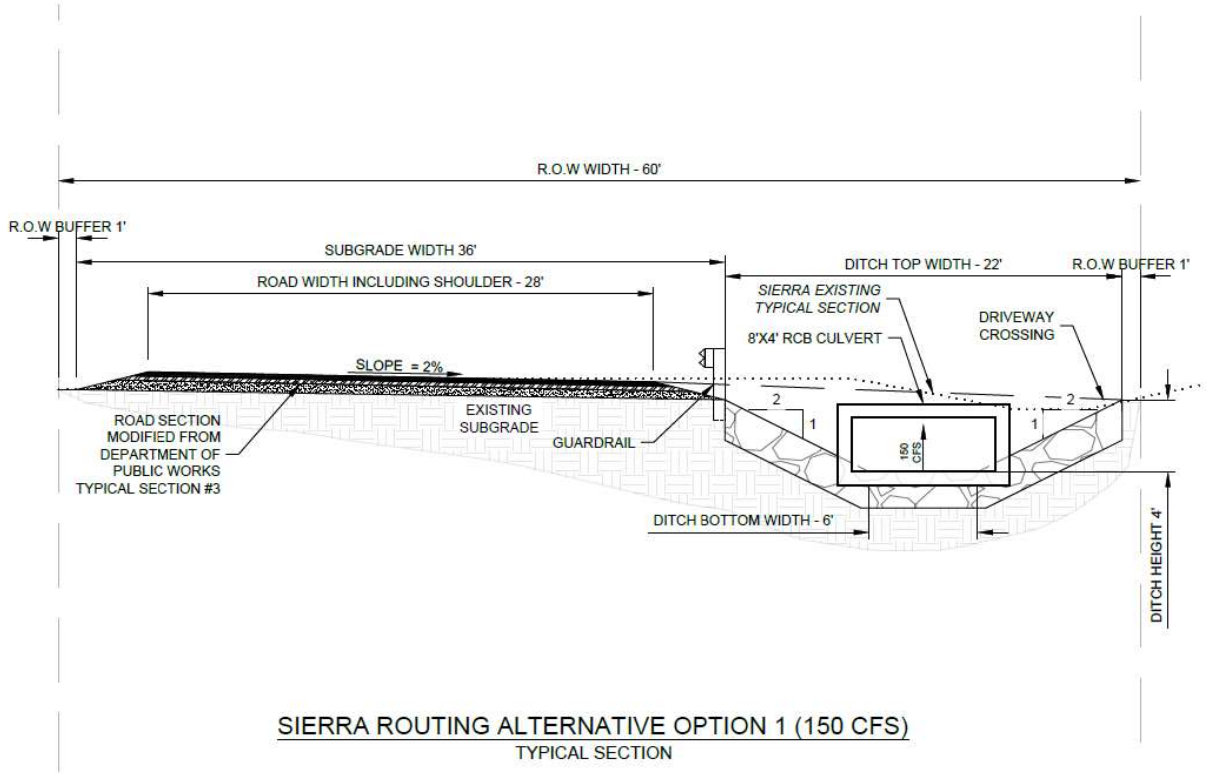


FORESTVALE BASELINE IMPROVEMENTS OPTION 4 (250 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

FORESTVALE IMPROVEMNTS OPTION 4 TYPICAL SECTION

SIERRA ROUTING ALTERNATIVE OPTION 1

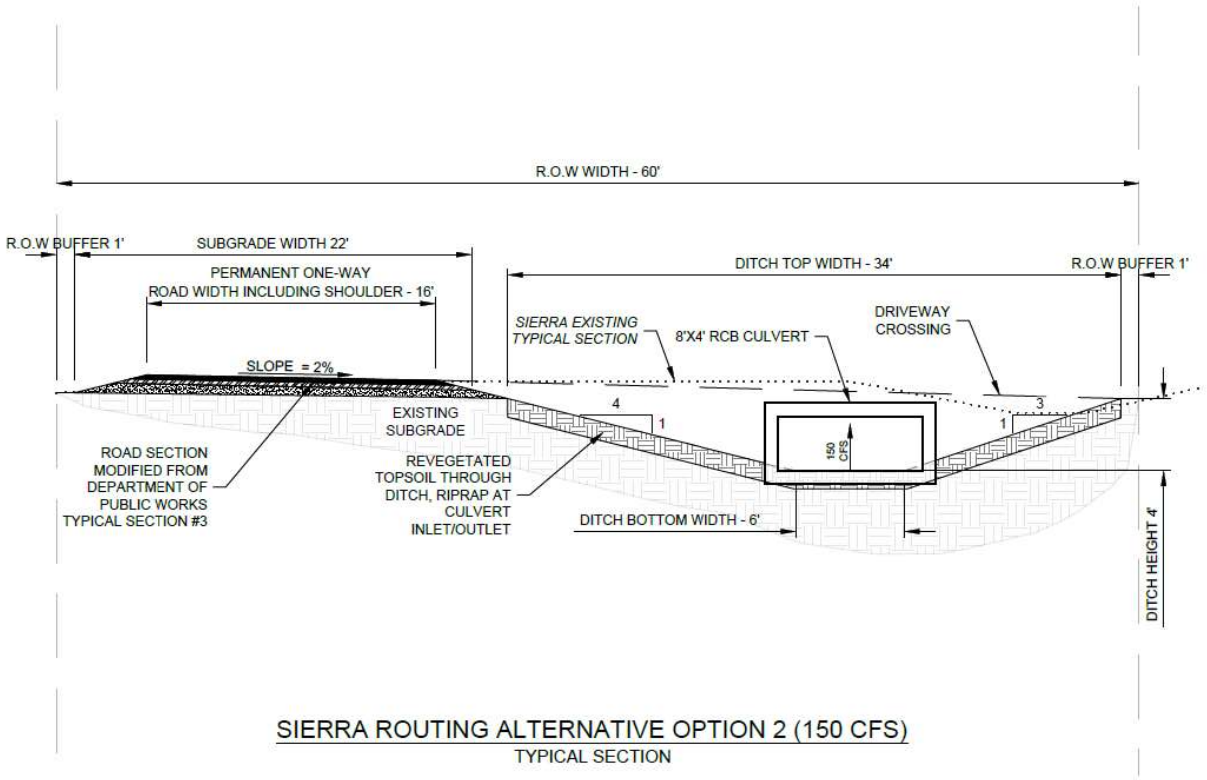


SIERRA ROUTING ALTERNATIVE OPTION 1 (150 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

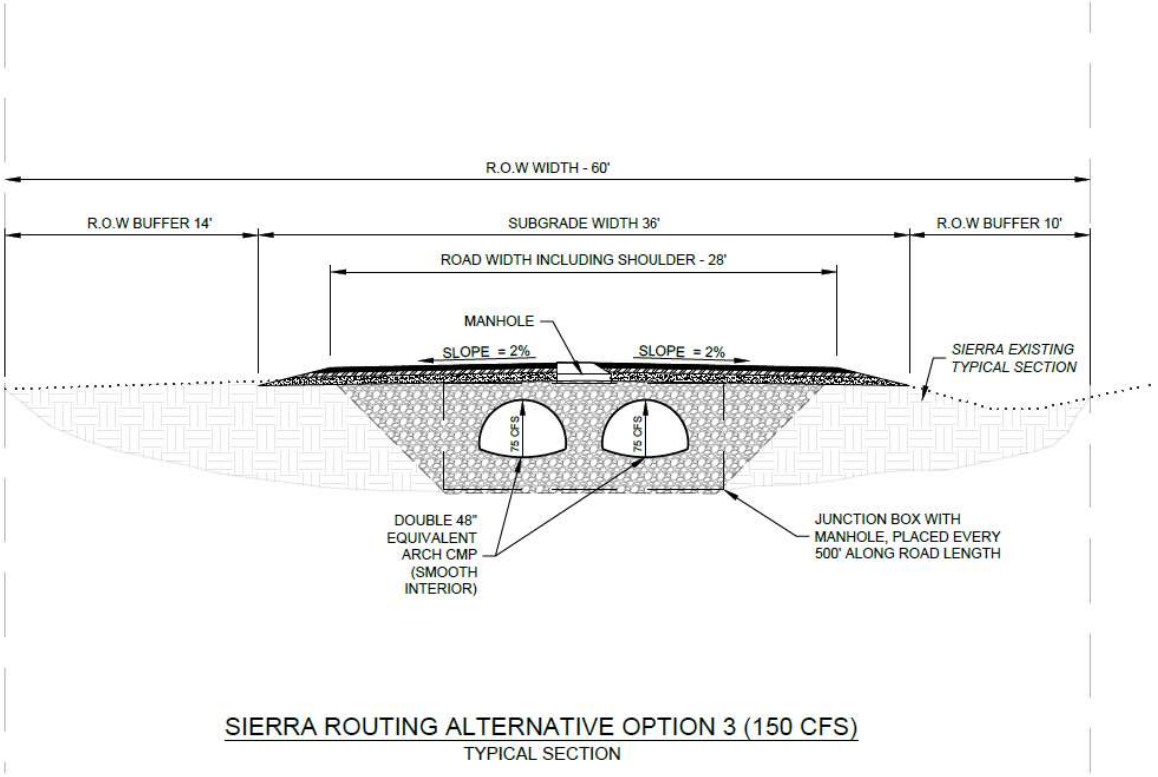
SIERRA ROUTING ALTERNATIVE OPTION 1 TYPICAL SECTION

SIERRA ROUTING ALTERNATIVE OPTION 2



SIERRA ROUTING ALTERNATIVE OPTION 2 TYPICAL SECTION

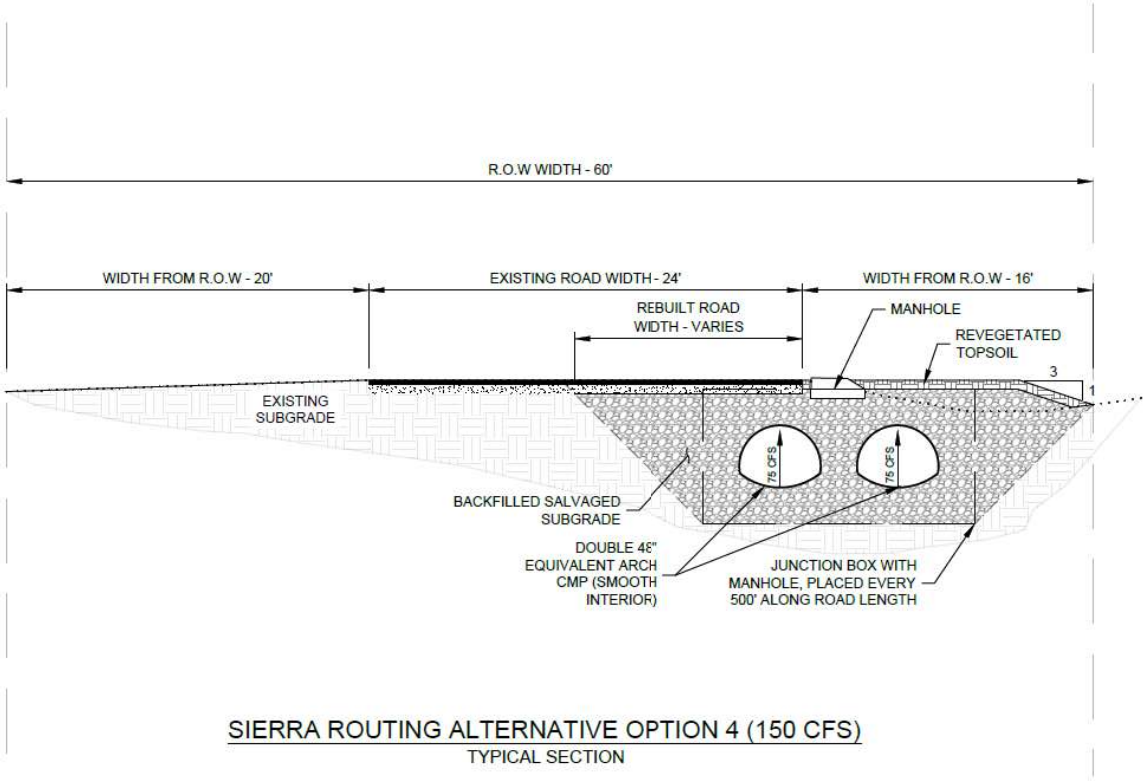
SIERRA ROUTING ALTERNATIVE OPTION 3



SIERRA ROUTING ALTERNATIVE OPTION 3 (150 CFS)
TYPICAL SECTION

PRELIMINARY - NOT FOR CONSTRUCTION

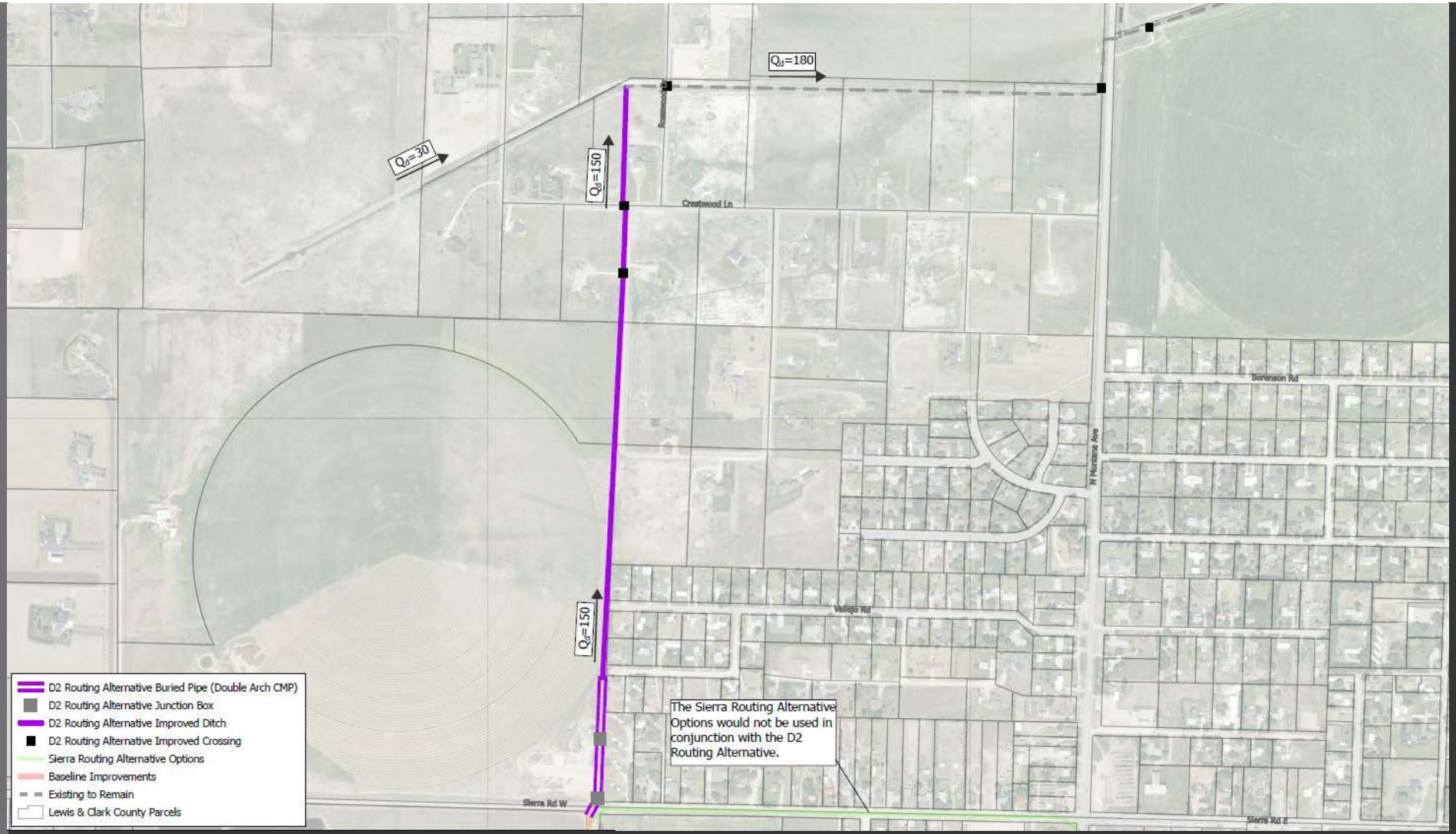
SIERRA ROUTING ALTERNATIVE OPTION 3 TYPICAL SECTION



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

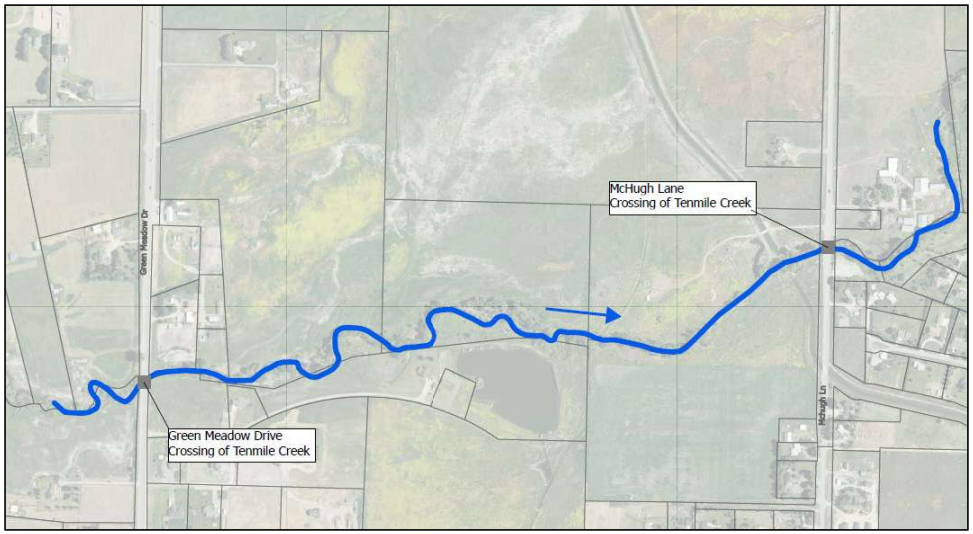
- Tenmile Overflow
  - Implementation Cost
  - Dependence on Easements
  - Long Term Maintenance
  - Certainty of Feasibility
  - Risk of Failure
  - Public Safety

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)

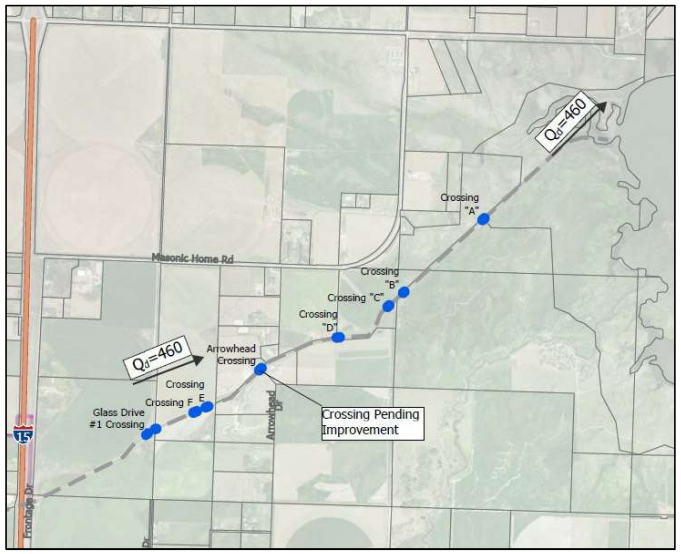
RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

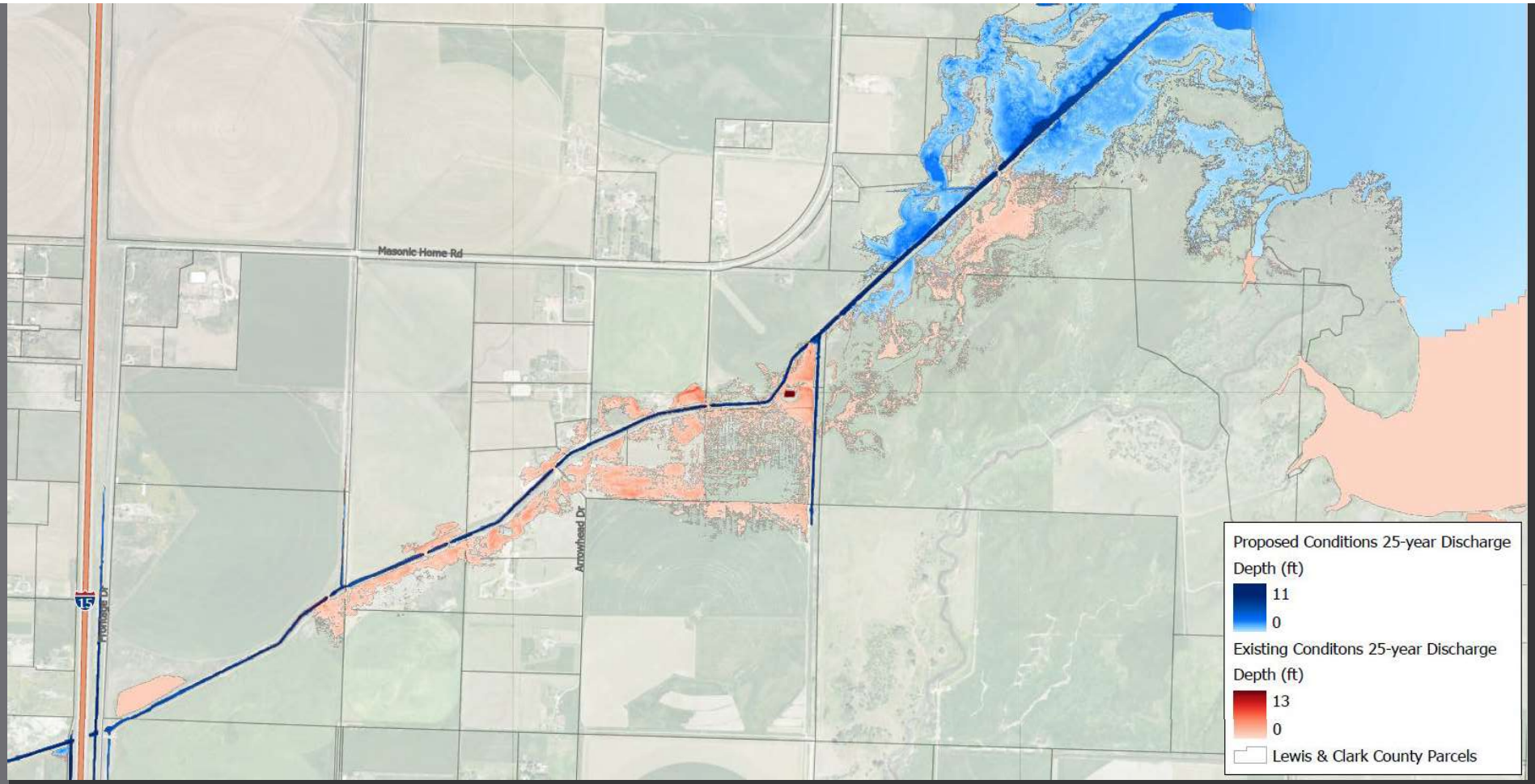
1. Tenmile Creek Capacity Monitoring
   - Develop benchmark survey and annual monitoring plan and begin implementation
   - Compare benchmark survey to USGS 2006 survey, simulate in model, quantify difference in flow spilling into valley, define feasible and effective reaches for maintenance
   - Start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

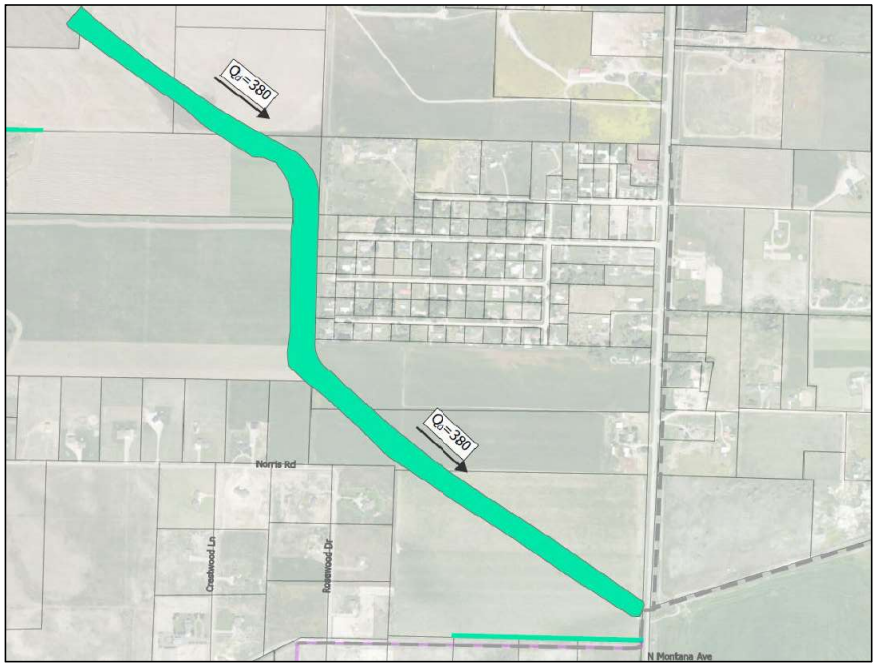




LOWER D2 DITCH
PROPOSED CONDITIONS MODEL RESULTS

RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

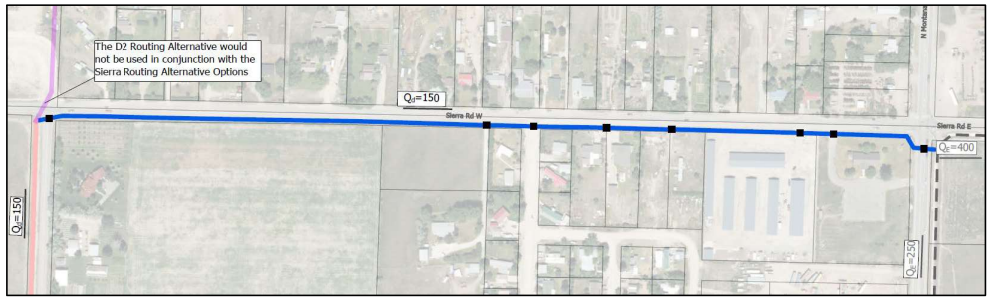
3. Silver Creek – Alternative 1



RECOMMENDED ALTERNATIVES AND IMPLEMENTATION PHASING

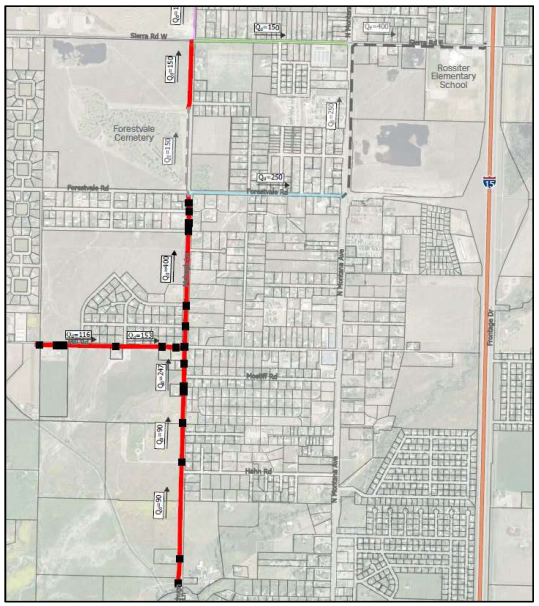
4. Tenmile Overflow

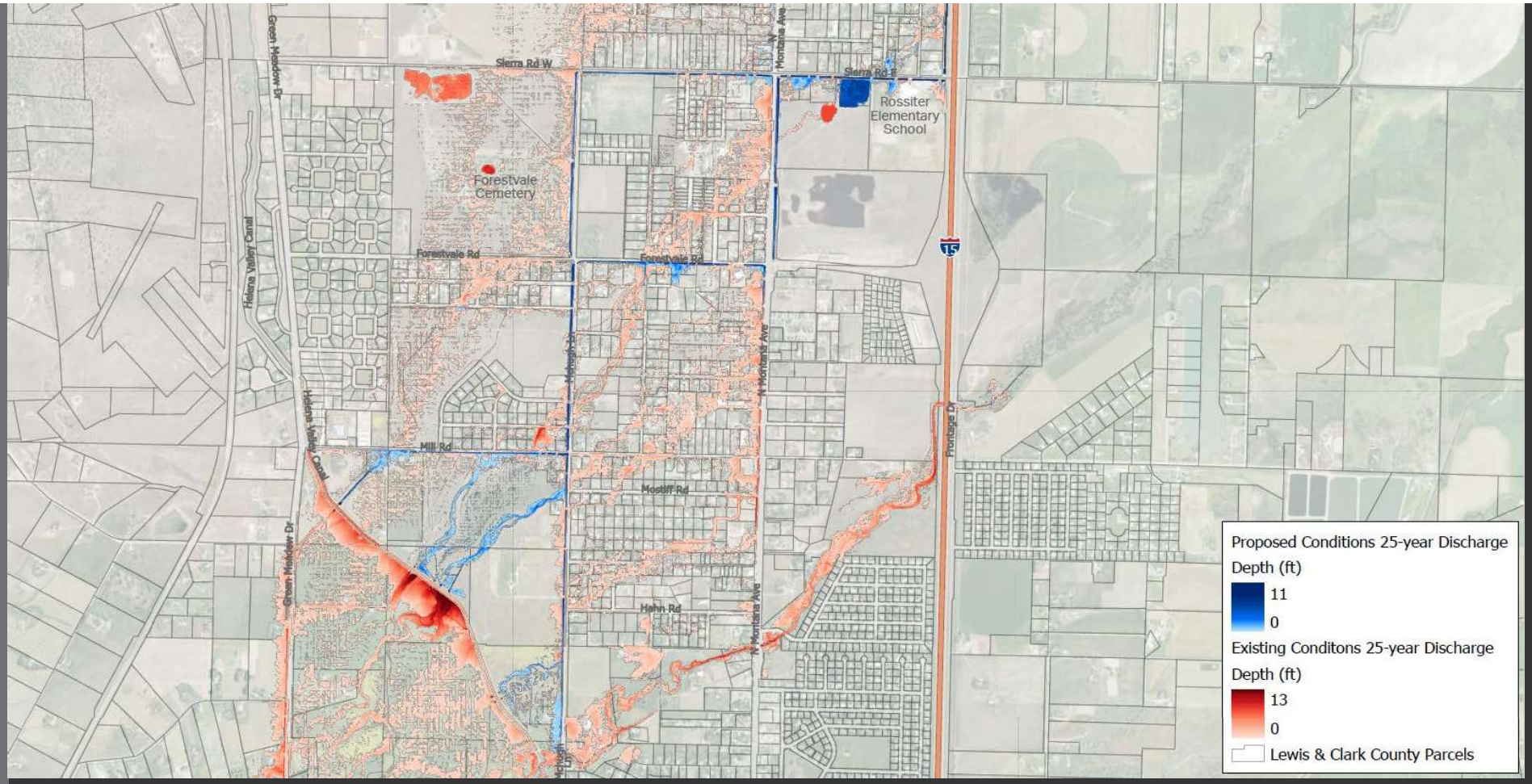
A. Sierra Routing Alternative Option 1



B. Forestvale Baseline Improvements Option 1

C. Baseline Improvements





TENMILE OVERFLOW
PROPOSED CONDITIONS MODEL RESULTS

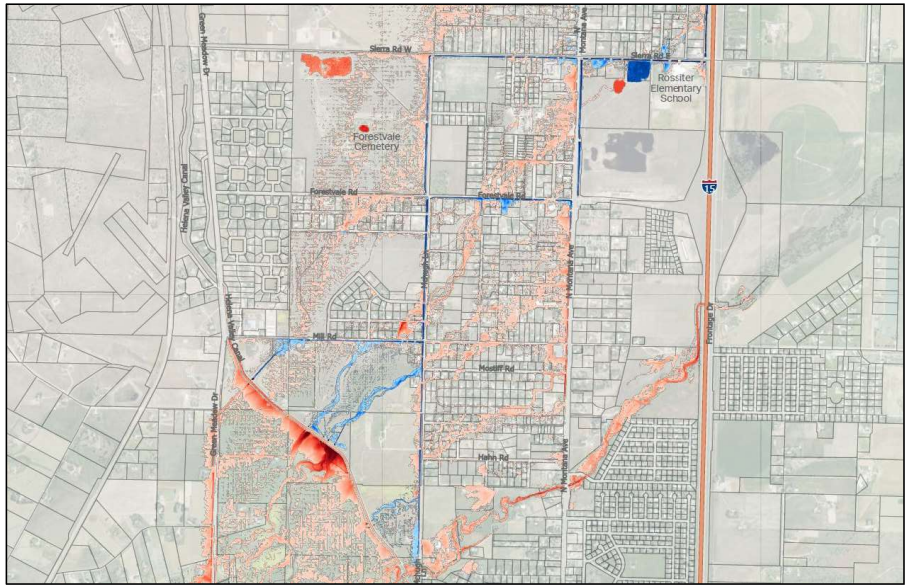
Grant Funding Opportunities

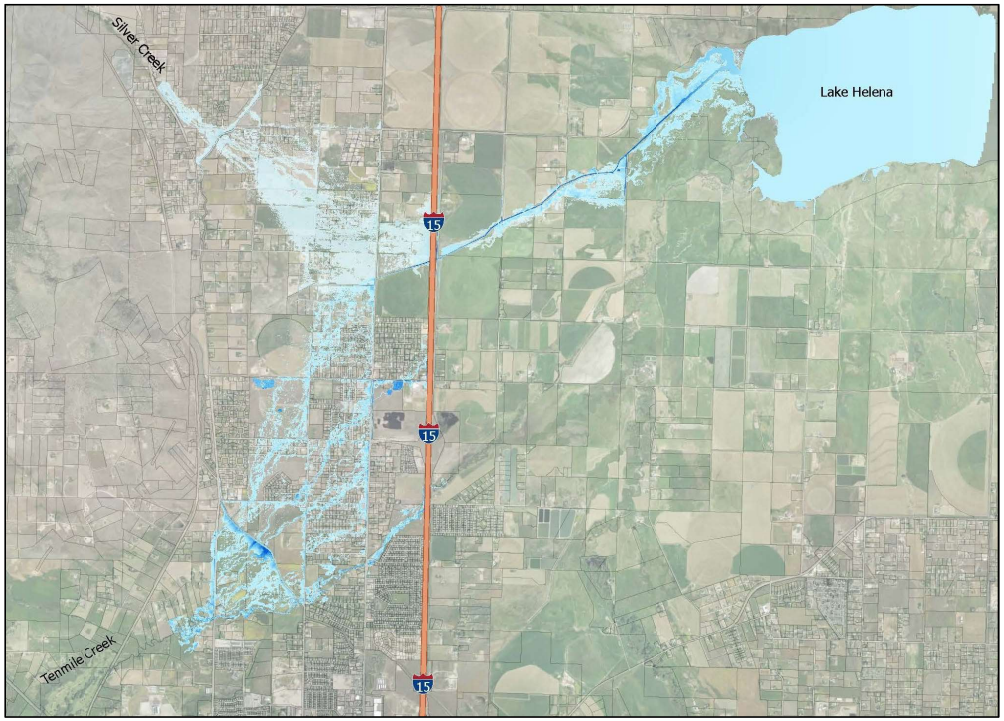
- FEMA HMGP
- FEMA BRIC (formerly called PDM)
- US Infrastructure Bill
- DNRC RRGL
- MT Governor's Budget, Legislation

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
Rossiter Elementary School
Forestvale Cemetery
Forestvale Rd
Mill Rd
Mosiff Rd
Hahn Rd
Frontage Dr
15


Silver Creek
Lake Helena
Tenmile Creek
15
15
15

LARRY AND SYLVIA MICHAELSON
6995 APPLEGATE DRIVE
HELENA, MONTANA 59602

Re: Flood Mitigation in the Helena Valley
Daniel Karlin, PE, County Engineer
Lewis And Clark County Public Works

Dear Daniel Karlin, PE:

In no way will my wife Sylvia and I allow the Silver Creek channel on our 6995 Applegate Drive property to be changed. We have lived in our Applegate Drive homestead close to 50 years now and we know a thing or two about the lay of the land and have a great deal of insight into what happens concerning flooding in our area. Problems with flooding does not flow from our property. Flooding has always been caused by blocks of ice with trash built up under the Applegate Drive bridge over Silver Creek causing excessive backup of water and runoff. Every year, whether seasonal flooding occurs or not, this blockage remains a problem. In addition, at the East boundary of my property, culverts are way too small to allow debris to pass through the channel. Hence, the blockage there also causes a backup of water and ice. Consequently, we are not in agreement with your proposed improvements on our property. Nor will we grant an easement on our property to the County for flood mitigation.

Respectfully,

Larry Michaelson Larry Michaelson Date: 12/28/21

And

Sylvia Michaelson Sylvia Michaelson Date: 12-28-21

From: Bill Prendergast <billpotp@gmail.com>
Sent: Monday, December 20, 2021 2:22 PM
To: Dan Karlin <DKARLIN@lccountymt.gov>
Subject: Flood mitigation valley project

Dan I received your letter, I am at 6400 silverwood loop. Please let me know what this letter means to me. Bill P 422-2234

Archie Harper
West Valley Community Alliance Network; Valley Flood Committee
901 Lynn Road
Helena, Montana 59602
January 17, 2022

Dan Karlin, County Engineer
Lewis & Clark County Public Works Dept.
3402 Cooney Drive
Helena, Montana 59602

Dan:

Thank you and the staff of RESPEC for the presentation on Thursday, January 6th, about updating the 2013 Helena Valley Flood Mitigation Master Plan. I am writing comments that represent primarily my own observations, but also incorporate thoughts from neighbors of both the Valley Flood Committee and West Valley Community Alliance Network.

First, my personal thoughts about the disappointing number of responses from the broader RID audience to your earlier survey is that the 80 or so individuals who responded likely depicts a fairly accurate indicator regarding overall RID community thinking on flood mitigation going forward. I believe this based on past experience in the federal agency system from like surveys where large numbers of mailings went unanswered, yet the answers from those administrating the survey is best summed up this way: 1) Addressees were happy with the way a project/program was proceeding so did not feel compelled to respond, 2) Addressees did not have a significant issue or concern so did not bother to respond, 3) Addressees did not take the survey seriously enough to feel compelled to respond, or 4) Other residents are by nature passive/inactive and tend to let others represent, vote or advocate on their behalf. Therefore, I feel confident in those who replied and/or showed up at your meetings because they generally have the resources, energy, or knowledge of local conditions that would lend towards improved feedback and credibility for the best flood mitigation project going forward.

The presentation laid out three phases for flood mitigation:

1. ***D2 Ditch - Baseline Improvements***
   In the interest of sequencing flood mitigation projects, investing in the D2 Drain makes the most sense in that it builds from the lowest points in the valley working upstream to minimize risks to downstream properties over the duration of implementing mitigation projects. Citizens sharing residences within the same watershed can easily relate to this basic principle of implementing watershed projects.

I favor replacing all nine D2 Drain crossings with bridges at an accelerated pace if that becomes financially feasible. One concern I heard relative to this flood mitigation update was the impact on the drain tile system that branches out from the D2, which serves to lower shallow ground water for agricultural use. Flooding in the lower D2 can back up into the drain tile system. However, this is more a function of nine (9) existing undersized pipe crossings installed in the lower D2 drain. The existing pipes exacerbate flooding impacts in this area, and this situation is substantially mitigated by upgrading to full-span bridges for all D2 crossings east of I-15. Observations from my work history on federal lands where similarly undersized CMP crossings often failed causing erosional impacts off channel and excess sediment loading downstream to irrigation infrastructure is that upgrading using full span bridges significantly reduced the impacts both upstream and downstream of each crossing. Moreover, flood hazard risk was almost completely removed short of totally removing the crossing structure permanently.

2. ***Silver Creek Alternatives 1 and 2***

Alternatives 1 and 2 propose to redirect floodwaters around the Silver Creek (Sewell) subdivision, and redirect it to the east side of N Montana Avenue where it ultimately delivers to the D2 Drain. Alternative 1 routes floodwater *south* of the subdivision more directly to the D2 Drain and costs about $500,000 less than Alt 2. Alternative 2 redirects floodwaters *north* of the subdivision to N Montana Avenue where it is then re-directed straight south some 3700 feet via an existing irrigation channel to the D2 Drain.

To accommodate floodflows that approach 380 cfs, Alternative 2 would necessitate improvements to the existing irrigation ditch that parallels N Montana Avenue on the east side, and this apparently contributes to the additional $0.5 million cost to perform the same service as Alt 1. Easements notwithstanding, Alternative 1 appears to be the more favorable option that could be implemented quicker if achieving a grant worth less than Alt 2 by $0.5 million makes any difference in moving the project forward for grant considerations.

3. ***Tenmile Overflow – Baseline Improvements***

Common amongst all alternatives, this baseline improvement relies on roadside ditches adjacent Mill Road and McHugh Lane (from Tenmile Creek bridge to Forestvale Rd). Flood waters emanating from the northeast side of the Helena Valley Canal would be intercepted and re-conveyed along Mill road east to McHugh Lane, and also along the west side of McHugh Lane north to the intersection at Forestvale Road. For Mill Road this involves increasing the capacities of the current ditch and all crossings to pass 116 cfs; and for McHugh Lane ditch capacities would be expanded to 90 cfs north of Tenmile bridge increasing to 247 cfs south of Mill Road. Continuing north of Mill Road, the improved conveyance ditch on the west side of McHugh Lane would be expanded to convey design flows of 400 cfs.

Essentially, these baseline improvements would be the foundation for intercepting and conveying Tenmile flood overflows and should satisfactorily manage/mitigate flooding in this area up to the 25-year flood frequency event. Conceptually, the infrastructure proposed along the Mill Road branch line appears sufficient in design for intercepting and conveying flood waters to prevent sheet flows from reaching the Sewell subdivision (Rhonda/Sewell roads) via the open 70-acre parcel south of Rhonda Road and north of the Big Sky subdivision. It remains unclear, however, whether ground water supply issues may well up within existing abandoned irrigation ditches and ephemeral channels present within this open pastureland putting residents north of Rhonda road at risk. Therefore, I encourage reserving the south side of Rhonda Road as potentially another east-west branch interceptor as backup to the Mill Road flood infrastructure based on monitoring ground water seepage within the open pasture during flood runout years.

3.A *Forestvale Routing Improvements (4 Options)*

Option 1: Proposes an improved trapezoidal ditch and concrete box culverts at crossings on the south side of Forestvale Road for routing 250 cfs flows from the intersection at McHugh Lane east to Trap Club project at north Montana Ave. Forestvale Road would be upgraded to an improved 2-way street. I support this option with the only reservation that there is somewhat of a safety concern with an open flood channel this size so close to neighboring homes. Traffic and pedestrian use in this area have been increasing and is likely to become more congested under current growth trends in the valley.

Option 2: This option is basically the same as Option 1 except it proposes to convert Forestvale Road to a one-way street. Although it is the least costly of the four options, I cannot support it as this area of the valley woefully lacks east-west connectors between North Montana Avenue and Green Meadow Drive or McHugh Lane. Three east-west connectors exist north of Tenmile Creek: Mill Road, Forestvale Road, and Sierra Road. And all three are at least 0.5 mile distant from the other. Without the opportunity of paralleling east-west routes within a block distance (such as Motsiff and Mill Roads) that lend themselves to the one-way street scheme for dense residential areas, converting Forestvale and/or Sierra Road to one-way streets will further complicate and encumber citizens' commute experience, including first responder and mail services, to and from the city and other destinations from their home base. Therefore, I believe the west valley community would not support the one-way street feature under this option.

Option 3: This option consists of routing 250 cfs just like option 1 except through double 60" equivalent arch CMPs buried under the roadway. Precast concrete junction boxes would be located every 500 feet. Forestvale Road would be upgraded to an improved 2-way street. Although it is the highest cost of four choices, I support this option the most because it is most consistent with key point #1 in the County's Valley Growth Policy – Roads. It is broadly

recognized the county's road network has fallen short of the development booms of the 1990s and 2000s and the trend continues. This option would make a significant improvement in our most important east-west connectors in the West Helena Valley. Importantly, this option further addresses the public safety issue best because it is mostly buried out of the way of bystanders and traffic that will increase as population pressures continue their upward spiral in the foreseeable future.

Note: For this option, I suggest maintaining some modicum of the current southside ditch to handle flood waters that potentially could spill down the historic Tenmile channel bisected at the corner of Forestvale Road and Kerr Drive. This is a possibility in the event flood waters exceed the 250 cfs design capacity of the Forestvale baseline improvements and/or debris partially blocks some portion(s) of Tenmile baseline improvements causing flood waters to spill down the historical pathway of Tenmile Creek.

Option 4: This option follows the buried double arch cmp design aspect of Option 3 only they would be located within the current roadside ditch on the south of Forestvale Road. Again, this helps minimize safety issues inherent to open flood canals so close to residential properties, but this option would return Forestvale to the existing 2-way street and not the "improved" 2-way motorway under Option 3. It also would make it unfeasible to maintain another auxiliary ditch as noted above under Option 3 to handle flood spills that exceed 250 cfs design capacity and/or spillover of Tenmile floodwater from McHugh Road down the existing historic Tenmile channel. Therefore, I recommend Option 3 as the superior of these two burial options.

3.B. ***Sierra/McHugh Routing Improvements (5 Options)***

Option 1. Option 1 would route 150 cfs from McHugh Lane at the junction with Sierra Road east toward the completed Trap Club Project using an improved ditch on the south side of Sierra Rd. Floodwaters would be conveyed through an open trapezoidal roadside ditch and reinforced concrete box culverts (at crossings). Sierra Road would be upgraded to an improved 2-way street with guardrails and riprapped ditch. I support this option with some reservation about safety due to an open flood channel close to neighboring homes. Traffic and pedestrian use in this area are expected to become more congested under current growth trends in the valley.

Option 2. I do not support this option as pointed out under Option 2 of the Forestvale Road Routing Improvements.

Option 3. Although this option is the most expensive of the five Sierra Routing improvements, it goes the furthest in terms of providing public safety and the best road improvements consistent with key point #1 (Roads) in the County's Valley Growth Policy.

Option 4. This Option achieves the same purposes as Option 3 in terms of public safety while efficiently routing 150 cfs to the Trap Club Project but for a price $540,000 less than option 3. The tradeoff is Sierra Road would be returned to its existing 24' 2-way design while using the existing roadside ditch for the double arch cmp infrastructure.

Option 5. In place of the Sierra Rd routing alternatives, Option 5 would route 150 cfs in McHugh ditch straight north under Sierra Road on to the D2 Drain. This would be implemented using buried double 4' equivalent CMPs from Sierra Rd north to Lydia Rd where an improved ditch would carry design flows the rest of the way to the D2 Drain.

I approve of this alternative the most of the five because it is by far the least costly to the county at $1.6 million and provides a high degree of public safety as it redirects flows most directly to the D2 drain and minimizes exposure to dense residential neighborhoods. This also lessons the flood exposure to the Rossitor School complex versus the Sierra Road routing options. Additionally, this option would have the least amount of disruption upon east-west traffic on Sierra Road during the implementation phases.

The challenge for Option 5 is obtaining easements from 2 or 3 property owners nearer the D2 Drain. To make this option more palatable to affected property owners, ground surveys coordinated with affected property owners should be completed to establish an agreed upon route and design satisfactory to all interests. To avoid surface disruption of private property, buried double CMPs could be implemented with an option to bury infrastructure under Rosewood Drive or parallel to property lines.

One final observation to share relates to rising ground water and its impacts on those residences that have basements or crawlspaces. I have taken note over the past four decades that whenever and wherever surface flooding occurs, especially over the flood hazard zones (100-year floodways) and ephemeral channels, the underlying ground water both elevates and migrates laterally into nearby basements and some crawlspaces depending on both distance and elevation from the floodwater sources. This occurs regardless of whether affected property owners experience any surface floodwaters on their respective properties.

However, I found once surface flooding is diverted or minimized temporally, groundwater issues become almost a non-issue [emphasis added]. At least that has been the shared experience amongst my neighbors living in this area of the Tenmile alluvial fan. Therefore, I have reason to believe that by restricting flood waters within improved conveyance canals that efficiently and directly move them northeast to the D2 Drain, basement and crawlspace flooding will become minimized, even eliminated in some places, as the flood mitigation infrastructure moves toward completion.

Respectfully,

Archie Harper
WVCAN and VFC

From: Dan Karlin <DKARLIN@lccountymt.gov>
Sent: Friday, January 7, 2022 1:19:05 PM
To: Tammysue <valleyhubllc@gmail.com>
Subject: Re: Valley Flood Mitigation

Thanks for the email. We'll include that in the plan as a comment and follow up with you after we get it finalized.

Thanks,

Daniel Karlin, PE
County Engineer
Lewis and Clark County Public Works
Office: (406) 447-8034
dkarlin@lccountymt.gov

Please excuse brevity and typos as this was typed on a mobile device.

From: Tammysue <valleyhubllc@gmail.com>
Sent: Friday, January 7, 2022 1:15:40 PM
To: Dan Karlin <DKARLIN@lccountymt.gov>; Tamarasue <valleyhubllc@gmail.com>
Subject: RE: Valley Flood Mitigation

Hello Dan,

We attended the Zoom meeting last night. Lots of potential solutions
To the flooding issue.

You mentioned Mill Road in your meeting.

My parents home , at 970 Mill Road, (Myron and I now own the property)
Is across from Chaffee Tire….In years past, when there was a flood, the water
Will go down Mill and then Turns directly down my parents drive way…
My brother came up with an idea that we would be willing to participate in, with
The county. Potentially granting an easement beside the driveway, since that seems
To be the natural flow of the flooding.

With the Grants you spoke about, you could put a ditch or drain system down Mill
And angle it through our parents driveway…Our neighbors said they would possibly
Be willing to participate, as the flooding damages their property also.

Of course, you would need to acquire additional landowner participation to encourage
Flood waters to end up at the Gun Club….

Please consider this option and contact us if you would like to discuss this issue further.
I would be willing to meet you at the property if that is something you are interested in.

Respectfully,
Tamara Bailey Laib
406-431-4592
valleyhubllc@gmail.com

Sent from Mail for Windows

From: Dan Karlin
Sent: Wednesday, January 5, 2022 1:54 PM
To: Tammysue
Subject: RE: Valley Flood Mitigation

Tamara and Myron,
Thank you for the email. I appreciate your offering to have a one on one conversation. I tried to call a moment ago and couldn't leave a message. When is a good time to meet to discuss this?

Thanks,

Daniel Karlin, PE
County Engineer
Lewis and Clark County Public Works
Office: (406) 447-8034
dkarlin@lccountymt.gov

From: Tammysue <valleyhubllc@gmail.com>
Sent: Wednesday, January 5, 2022 12:41 PM
To: Dan Karlin <DKARLIN@lccountymt.gov>

Cc: Tamarasue <valleyhubllc@gmail.com>
Subject: FW: Valley Flood Mitigation

Sent from Mail for Windows

From: Tammysue
Sent: Wednesday, January 5, 2022 12:39 PM
To: dkarlin@lccountymt.gov
Cc: Tamarasue
Subject: Valley Flood Mitigation

Dear Dan Karlin,
In response to the drawing of the flood mitigation on Applegate:

We Loudly Protest the taking of our Hay field on Applegate!!!!
We Hay that entire field and are not willing to sacrifice our ability to hay
The entire property , with your ditch running through the middle of our
Field.

We would be willing to have a one on one discussion with your people, to
Determine whether there is a reasonable compromise that we could agree
With.

Respectfully,
Tamara B & Myron D Laib
406-431-4592

Sent from Mail for Windows

APPENDIX D

ESTIMATE OF PROBABLE COST AND QUANTITIES

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (D2 DITCH)

2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
D2 DITCH - BASELINE IMPROVEMENTS	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	9	EA	$500	$4,500
STRUCTURE REPLACEMENT	8	EA	$150,000	$1,200,000
CULVERT PROCURMENT & PLACEMENT (CMP 96")	50	LF	$650	$32,500
TOTAL CONSTRUCTION COST:				$1,237,000
BOR AND HVID COORDINATION			LS	$40,000
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$247,400
TRAFFIC CONTROL			3%	$37,110
UTILITIES			5%	$61,850
MOBILIZATION, INSURANCE, BONDING			10%	$123,700
CONTINGENCY			15%	$185,550
TOTAL PROJECT COST:				$1,932,610

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (SILVER CREEK ALTERNATIVE 1)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
SILVER CREEK ALTERNATIVE 1	QUANTITY	UNIT	UNIT COST	TOTAL COST
EROSION AND SEDIMENT CONTROL	1	LS	$21,991	$21,991
SURVEY AND STAKING	1	LS	$10,000	$10,000
TOPSOIL STRIPPING	23804	CY	$1	$23,804
FLOW DIVERSION EMBANKMENT GRADING	2750	CY	$3	$8,250
FLOW REDIRECTION GRADING	295000	CY	$1	$368,750
REVEGETATION	45	ACRE	$1,500	$67,500
TOTAL CONSTRUCTION COST:				$525,310
PROPERTY EASEMENT			LS	$250,000
ENGINEERING, DESIGN AND PERMITTING			15%	$78,797
CONSTRUCTION ENGINEERING			10%	$52,531
COUNTY ADMINISTRATION			9%	$47,907
CONTINGENCY			10%	$52,531
TOTAL PROJECT COST:				$1,007,076

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (SILVER CREEK ALTERNATIVE 2)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
SILVER CREEK - ALTERNATIVE 2	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	6	EA	$500	$3,000
CULVERT PROCURMENT & PLACEMENT (DBL RCB 6'x6')	342	LF	$3,000	$1,026,000
CULVERT / DITCH EXCAVATION	17366	CY	$5	$86,830
FLOW REDIRECTION GRADING	1	LS	$10,000	$10,000
EXISTING DITCH IMPROVEMENTS	3705	LF	$100	$370,500
RIPRAP PROCURMENT AND PLACEMENT	2072	CY	$50	$103,600
FORTIFY EXISTING IRRIGATION INFRASTRUCTURE	1	LS	$40,000	$40,000
HAUL OFF	17366	CY	$10	$173,660
REVEGETATION	3	ACRE	$1,500	$4,047
TOTAL CONSTRUCTION COST:				$1,817,637
BOR AND HVID COORDINATION			LS	$35,000
MDT COORDINATION			LS	$100,000
PROPERTY EASEMENT			LS	$110,000
ENGINEERING, DESIGN AND PERMITTING			15%	$272,646
CONSTRUCTION ENGINEERING			10%	$181,764
COUNTY ADMINISTRATION			9%	$165,765
CONTINGENCY			10%	$181,764
TOTAL PROJECT COST:				$2,864,575

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (BASELINE IMPROVEMENTS)

2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - BASELINE IMPROVEMENTS	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	23	EA	$500	$11,500
CULVERT PROCURMENT & PLACEMENT (RCB 16'x4')	456	LF	$1,700	$775,200
CULVERT PROCURMENT & PLACEMENT (RCB 10'x4')	48	LF	$1,500	$72,000
CULVERT PROCURMENT & PLACEMENT (RCB 12'x3')	198	LF	$1,550	$306,900
CULVERT PROCURMENT & PLACEMENT (RCB 8'x3')	360	LF	$1,350	$486,000
CULVERT PROCURMENT & PLACEMENT (RCB 6'x3')	60	LF	$1,250	$75,000
CULVERT / DITCH EXCAVATION	44769	CY	$5	$223,844
RIPRAP PROCURMENT AND PLACEMENT	7110	CY	$50	$355,480
GUARDRAIL	2246	LF	$45	$101,070
HAUL OFF	44769	CY	$10	$447,689
REVEGETATION	8	ACRE	$1,500	$12,281
PROPERTY EASMENTS	5	EA	$25,000	$125,000
TOTAL CONSTRUCTION COST:				$2,991,964
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$598,393
TRAFFIC CONTROL			3%	$89,759
UTILITIES			5%	$149,598
MOBILIZATION, INSURANCE, BONDING			10%	$299,196
CONTINGENCY			15%	$448,795
TOTAL PROJECT COST:				$4,577,704

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (FORESTVALE BASELINE IMPROVEMENTS OPTION 1)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 1	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	11	EA	$500	$5,500
CULVERT PROCURMENT & PLACEMENT (RCB 12'x4')	570	LF	$1,600	$912,000
CULVERT PROCURMENT & PLACEMENT (RCB 10'x4')	114	LF	$1,500	$171,000
FLOW CONTROL STRUCTURE	1	LS	$50,000	$50,000
CULVERT / DITCH EXCAVATION	15181	CY	$5	$75,905
RIPRAP PROCURMENT AND PLACEMENT	6283	CY	$50	$314,173
ASPHALT REMOVAL	5929	SY	$5	$29,644
ASPHALT PAVING	7115	SY	$115	$818,187
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	2372	CY	$28	$66,404
GUARDRAIL	1994	LF	$45	$89,730
HAUL OFF	15181	CY	$10	$151,809
TOTAL CONSTRUCTION COST:				$2,684,352
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$536,870
TRAFFIC CONTROL			3%	$80,531
UTILITIES			5%	$134,218
MOBILIZATION, INSURANCE, BONDING			10%	$268,435
CONTINGENCY			15%	$402,653
TOTAL PROJECT COST:				$4,107,059

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (FORESTVALE BASELINE IMPROVEMENTS OPTION 2)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 2	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	11	500	$500	$5,500
CULVERT PROCURMENT & PLACEMENT (RCB 12'x4')	570	1600	$1,600	$912,000
CULVERT PROCURMENT & PLACEMENT (RCB 10'x4')	114	1500	$1,500	$171,000
FLOW CONTROL STRUCTURE	1	50000	$50,000	$50,000
CULVERT / DITCH EXCAVATION	14315	5	$5	$71,577
RIPRAP PROCURMENT AND PLACEMENT	3942	50	$50	$197,087
ASPHALT REMOVAL	5929	5	$5	$29,644
ASPHALT PAVING	4150	115	$115	$477,276
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	1383	28	$28	$38,735
HAUL OFF	14315	10	$10	$143,155
REVEGETATION	2	1500	$1,500	$2,461
TOTAL CONSTRUCTION COST:				$2,098,435
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$419,687
TRAFFIC CONTROL			3%	$62,953
UTILITIES			5%	$104,922
MOBILIZATION, INSURANCE, BONDING			10%	$209,844
CONTINGENCY			15%	$314,765
TOTAL PROJECT COST:				$3,210,606

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (FORESTVALE BASELINE IMPROVEMENTS OPTION 3)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 3	QUANTITY	UNIT	UNIT COST	TOTAL COST
CULVERT PROCURMENT & PLACEMENT (DBL 60" EQUIVALENT CMP ARCH)	2628	LF	$775	$2,036,879
FLOW CONTROL STRUCTURE	1	LS	$50,000	$50,000
60" JUNCTION BOX	6	EA	$25,000	$150,000
CULVERT / DITCH EXCAVATION	12681	CY	$5	$63,407
RIPRAP PROCURMENT AND PLACEMENT	155	CY	$50	$7,733
ASPHALT REMOVAL	5929	SY	$5	$29,644
ASPHALT PAVING	7115	SY	$115	$818,187
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	2372	CY	$28	$66,404
HAUL OFF	4351	CY	$10	$43,506
TOTAL CONSTRUCTION COST:				$3,265,759
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$653,152
TRAFFIC CONTROL			3%	$97,973
UTILITIES			5%	$163,288
MOBILIZATION, INSURANCE, BONDING			10%	$326,576
CONTINGENCY			15%	$489,864
TOTAL PROJECT COST:				$4,996,612

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (FORESTVALE BASELINE IMPROVEMENTS OPTION 4)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - FORESTVALE BASELINE IMPROVEMENTS OPTION 4	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	11	EA	$500	$5,500
CULVERT PROCURMENT & PLACEMENT (DBL 60" EQUIVALENT CMP ARCH)	2628	LF	$775	$2,036,879
DROP INLET STRUCTURE	14	EA	$5,000	$70,000
FLOW CONTROL STRUCTURE	1	LS	$50,000	$50,000
60" JUNCTION BOX	6	EA	$25,000	$150,000
CULVERT / DITCH EXCAVATION	12681	CY	$5	$63,407
RIPRAP PROCURMENT AND PLACEMENT	155	CY	$50	$7,733
ASPHALT REMOVAL	3285	SY	$5	$16,424
ASPHALT PAVING	3285	SY	$115	$377,749
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	1095	CY	$28	$30,658
HAUL OFF	4351	CY	$10	$43,506
TOTAL CONSTRUCTION COST:				$2,851,856
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$570,371
TRAFFIC CONTROL			3%	$85,556
UTILITIES			5%	$142,593
MOBILIZATION, INSURANCE, BONDING			10%	$285,186
CONTINGENCY			15%	$427,778
TOTAL PROJECT COST:				$4,363,340

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (SIERRA ROUTING ALTERNATIVE OPTION 1)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 1	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	6	EA	$500	$3,000
CULVERT PROCURMENT & PLACEMENT (RCB 8'x4')	474	LF	$1,400	$663,600
CULVERT / DITCH EXCAVATION	12461	CY	$5	$62,307
RIPRAP PROCURMENT AND PLACEMENT	6256	CY	$50	$312,805
ASPHALT REMOVAL	7235	SY	$5	$36,173
ASPHALT PAVING	8440	SY	$115	$970,651
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	2813	CY	$28	$78,777
GUARDRAIL	2357	LF	$45	$106,064
HAUL OFF	12461	CY	$10	$124,613
TOTAL CONSTRUCTION COST:				$2,357,990
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$471,598
TRAFFIC CONTROL			3%	$70,740
UTILITIES			5%	$117,900
MOBILIZATION, INSURANCE, BONDING			10%	$235,799
CONTINGENCY			15%	$353,699
TOTAL PROJECT COST:				$3,607,725

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (SIERRA ROUTING ALTERNATIVE OPTION 2)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 2	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	6	EA	$500	$3,000
CULVERT PROCURMENT & PLACEMENT (RCB 8'x4')	474	LF	$1,400	$663,600
CULVERT / DITCH EXCAVATION	9017	CY	$5	$45,087
RIPRAP PROCURMENT AND PLACEMENT	747	CY	$50	$37,333
ASPHALT REMOVAL	7235	SY	$5	$36,173
ASPHALT PAVING	4823	SY	$115	$554,658
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	1608	CY	$28	$45,016
HAUL OFF	9017	CY	$10	$90,174
REVEGETATION	2	ACRE	$1,500	$2,840
TOTAL CONSTRUCTION COST:				$1,477,881
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$295,576
TRAFFIC CONTROL			3%	$44,336
UTILITIES			5%	$73,894
MOBILIZATION, INSURANCE, BONDING			10%	$147,788
CONTINGENCY			15%	$221,682
TOTAL PROJECT COST:				$2,261,159

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (SIERRA ROUTING ALTERNATIVE OPTION 3)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 3	QUANTITY	UNIT	UNIT COST	TOTAL COST
CULVERT PROCURMENT & PLACEMENT (DBL 48" EQUIVALENT CMP ARCH)	2665	LF	$650	$1,732,250
48" JUNCTION BOX	6	EA	$20,000	$120,000
CULVERT / DITCH EXCAVATION	9653	CY	$5	$48,264
RIPRAP PROCURMENT AND PLACEMENT	133	CY	$50	$6,667
ASPHALT REMOVAL	7235	SY	$5	$36,173
ASPHALT PAVING	8440	SY	$115	$970,651
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	2813	CY	$28	$78,777
HAUL OFF	2720	CY	$10	$27,200
TOTAL CONSTRUCTION COST:				$3,019,982
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$603,996
TRAFFIC CONTROL			3%	$90,599
UTILITIES			5%	$150,999
MOBILIZATION, INSURANCE, BONDING			10%	$301,998
CONTINGENCY			15%	$452,997
TOTAL PROJECT COST:				$4,620,573

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (SIERRA ROUTING ALTERNATIVE OPTION 4)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - SIERRA ROUTING ALTERNATIVE OPTION 4	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	6	EA	$500	$3,000
CULVERT PROCURMENT & PLACEMENT (DBL 48" EQUIVALENT CMP ARCH)	2665	LF	$650	$1,732,250
DROP INLET STRUCTURE	14	EA	$5,000	$70,000
48" JUNCTION BOX	6	EA	$20,000	$120,000
CULVERT / DITCH EXCAVATION	9653	CY	$5	$48,264
RIPRAP PROCURMENT AND PLACEMENT	133	CY	$50	$6,667
ASPHALT REMOVAL	3617	SY	$5	$18,087
ASPHALT PAVING	3651	SY	$115	$419,827
AGGREGATE BASE COURSE (ASPHALT SUBGRADE)	1217	CY	$28	$34,073
HAUL OFF	2720	CY	$10	$27,200
TOTAL CONSTRUCTION COST:				$2,479,367
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$495,873
TRAFFIC CONTROL			3%	$74,381
UTILITIES			5%	$123,968
MOBILIZATION, INSURANCE, BONDING			10%	$247,937
CONTINGENCY			15%	$371,905
TOTAL PROJECT COST:				$3,793,431

VFMMP UPDATE - ESTIMATE OF QUANITITIES AND PROBABLE COST (UPPER D2 ROUTING ALTERNATIVE)
2/9/2022

PRELIMINARY ENGINEER'S ESTIMATE				
TENMILE OVERFLOW - UPPER D2 ROUTING ALTERNATIVE	QUANTITY	UNIT	UNIT COST	TOTAL COST
CUT / REMOVE / ABANDON / DISPOSAL EXISTING CULVERT	2	EA	$500	$1,000
CULVERT PROCURMENT & PLACEMENT (RCB 12'x3')	90	LF	$1,550	$139,500
CULVERT PROCURMENT & PLACEMENT (CMP 72")	102	LF	$450	$45,900
CULVERT PROCURMENT & PLACEMENT (DBL 48" EQUIVALENT CMP ARCH)	771	LF	$650	$501,150
48" JUNCTION BOX	2	EA	$20,000	$40,000
CULVERT / DITCH EXCAVATION	16014	CY	$5	$80,070
RIPRAP PROCURMENT AND PLACEMENT	436	CY	$50	$21,778
HAUL OFF	16014	CY	$10	$160,139
REVEGETATION	3	ACRE	$1,500	$4,047
PROPERTY EASMENTS	4	EA	$25,000	$100,000
TOTAL CONSTRUCTION COST:				$1,093,584
PROPERY EASEMENT			LS	$100,000
BOR AND HVID COORDINATION			LS	$20,000
ENGINEERING, DESIGN, PERMITTING, AND CM			20%	$218,717
TRAFFIC CONTROL			3%	$32,808
UTILITIES			5%	$54,679
MOBILIZATION, INSURANCE, BONDING			10%	$109,358
CONTINGENCY			15%	$164,038
TOTAL PROJECT COST:				$1,793,183