



# **Larimer County Analysis – Technical Memorandum No. 8 Natural Hazard Mitigation Plan**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**



## MEMORANDUM

Northern Integrated Supply Project  
Glade Reservoir  
Larimer County 1041 – Geologic Hazards

B&V Project Number 403758  
B&V File 188754/34.3000  
February 14, 2020

To: Larimer County Planning Department  
From: Tim Engemoen, Black & Veatch and Sean Kearney, AECOM

## Introduction

This technical memorandum is written in support of Larimer County Planning Department's 1041 Permit for the Glade Unit construction and documents the natural geologic hazards and proposed mitigation plans associated with the construction of the Glade Unit. The geologic hazard analysis has been completed in accordance with Larimer County Land Use Code Section 8.3, and the mitigation goals are public safety and the protection of the Glade Unit facilities.

## Project Background

The Northern Integrated Supply Project (NISP) will provide a new raw water supply to several municipal water providers in Northern Colorado. NISP includes the following facilities located in Larimer County: the Glade Unit; the Glade Pump Station; raw water distribution piping; and the relocation of U.S. Highway 287. The Glade Unit features the Glade Reservoir Dam, which is an earthen embankment that will impound an off-channel reservoir complete with the hydraulic structures required by the State Engineer's Office: the High Level Outlet Works (HLOW); Low Level Outlet Works (LLOW); and spillway. Glade Reservoir Dam is located just to the north of the junction of U.S Highway 287 and State Highway 14, about 10 miles northwest of Fort Collins. The Glade Unit includes an expansion of the existing Poudre Valley Canal (PVC) and a new forebay constructed downstream of the dam at an elevation that will allow delivery of water from the PVC by gravity. A Control Gate Structure will be constructed to control flow to the existing portion of the PVC downstream of the forebay. The existing PVC Diversion Structure will be demolished and a new Poudre River Diversion Structure built to allow increased diversion of flow from the Poudre River. A portion of the existing Munroe Gravity Canal alignment will be inundated by Glade Reservoir, this open canal will be replaced by the Munroe Canal Bypass (MCB), a conduit and several control structures that will convey flow beneath the reservoir. The Glade Unit also includes: the Glade Pump Station, which will pump water from the forebay into Glade Reservoir; the Electrical/Control building that will distribute power throughout the site and provide control of the various hydraulic features; the Surge Building that will house surge tanks to protect the pump station discharge conduit; and numerous buried conduits with control valve vaults that connect these facilities. Raw water will be conveyed off site via several buried conduits that are being constructed under different NISP contracts. The Glade Unit will include recreational amenities for the general public, including a Visitor Center, campgrounds, a boat ramp, trails and restroom facilities.



Glade Reservoir will submerge a portion of the existing U.S. Highway 287 alignment which will be relocated to the east of the reservoir. An existing power transmission line and several power distribution lines will be inundated by the reservoir which will be relocated as part of the Glade Unit construction. A general location map of the Glade Unit facilities is presented on Figure 1.

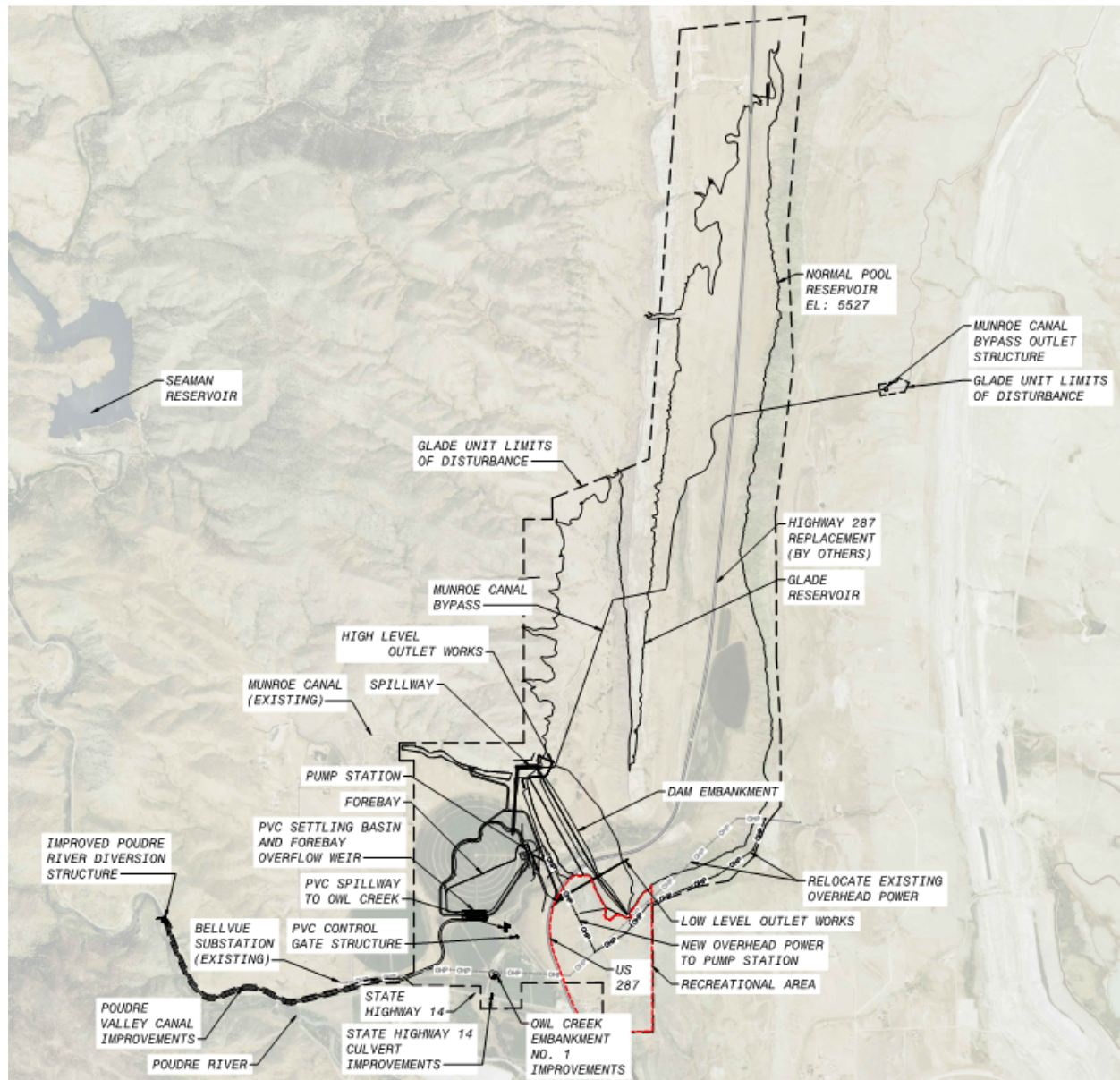


Figure 1 - Glade Unit Overview

The NISP Water Activity Enterprise (NISP Enterprise or Enterprise) assumes financial responsibility for construction of all infrastructure required for the project. The Enterprise is a permanent entity with access to adequate funds to cover project construction and maintenance. The Enterprise's budget will include routine and capital maintenance funds. Northern Water's past performance under other USACE

permits demonstrates its commitment to assure that projects will be fully implemented and maintained by the Enterprise.

## Geologic Hazards

Several geologic hazards have been identified within the Glade Unit project area. The geologic hazards identified are flooding, landslides, rockfalls, debris flows, faults, collapsible soils and ground subsidence.

### Flooding

Potential flooding hazards are shown on Figures 2 through 6 (included in Attachment C to the 1041 Permit Project Description), as depicted by the 100-year floodplain delineation. As shown in this set of figures, the only facility that will be constructed within the 100-year floodplain will be the new Poudre River Diversion Structure. The remaining facilities all fall outside of the floodplain and are not at risk of inundation.

### Landslides

Figure 23 (included in Attachment C to the 1041 Permit Project Description) shows the landslide hazards within the Glade Unit project area. Three landslides have been identified through field mapping and drilling in the vicinity of the left abutment (left side of dam while standing on the water looking downstream) of the dam embankment. Of these three, only one is anticipated to impact the footprint of the embankment. Drilling within this landslide indicated that these deposits are up to 47 feet thick. The remaining two landslides lie within the recreational area. Additional areas along the east rim of the reservoir have been mapped but do not pose a significant risk to the project.

### Rockfalls

Rockfall hazards have been mapped within the Lytle Formation on the bluffs above areas proposed as recreation use. Two areas were identified as being moderate to high risk and one area was identified as being low risk. Large blocks of sandstone have been dislodged and released downslope as toppling failures. The risk of these bluffs releasing blocks increases during heavy precipitation events especially if they are followed by freeze thaw cycles. Figure 24 (included in Attachment C to the 1041 Permit Project Description) shows the rockfall hazards present at the site.

### Debris Flows

The Colorado Geologic Survey (CGS) generated an open file report titled “Debris Flow Susceptibility Map of Larimer County, Colorado” in 2015. Debris flow hazards were identified at the project site within this report. The hazard states that the areas identified on the map are potentially susceptible to debris flows/mudflows during extreme precipitation events. The hazard map factors in slope angle and channel geometry as input parameters for run-out zones. CGS has mapped areas within the Glade unit that are favorable to debris flow conditions. Figure 25 (included in Attachment C to the 1041 Permit Project Description) shows the debris flow hazards present at the site.

## Faults

There are two earthquake faults mapped within the Glade unit. The Bellvue Fault and North Fork Fault have been intercepted at depth by test holes advanced during the project's geotechnical investigations. The Bellvue Fault contains an east and west splay, is a north-south trending reverse fault that intersects the North Fork Fault within the vicinity of the embankment footprint. The North Fork Fault is an east-west trending reverse fault that is mapped through the right abutment (right side of dam while standing on the water looking downstream) of the dam embankment. Both faults are inactive and do not present a seismic risk to the project.

## Collapsible Soils and Ground Subsidence

Collapsible soils tend to consolidate due to porous conditions developing after deposition which can greatly reduce soil strength. Collapsible soils are generally dry, low density, silty soils with high void space or air gaps between the soil grains where the soil particle binding agents are highly sensitive to water. When exposed to and weakened by water, the binding agents break, soften, or dissolve such that the soil grains shear against each other and re-orient in tighter, denser, configurations. This reconfiguration causes a net volume decrease in the soil mass that, in turn, results in settlement of the ground surface. This condition can occur just by the weight of the soil itself, called the overburden, or the weight of a structure, such as a structure foundation or dam abutment. The Colorado Geologic Survey has mapped eolian (windblown) deposits and soluble rock (Lykins Formation) at the site. The Lykins Formation contains soluble gypsum beds that have the potential to go into solution which can create subsurface voids. These voids have the potential to collapse and cause subsidence to the ground above it. Figure 26 (included in Attachment C to the 1041 Permit Project Description) shows the collapsible soils present.

## Geologic Hazard Mitigation

Mitigation strategies for the identified geologic hazards are described below.

### Flooding

In general, flooding hazards are not present at the Glade Unit and therefore do not require mitigation. The Poudre River Diversion Structure is the only facility that is located within the 100-year flood plain and will be designed to withstand flooding events as it's situated in the Poudre River. This structure is an unoccupied structure and will be replacing the existing diversion structure located in the exact same location.

### Landslides

The landslide hazard located on the left abutment below the dam embankment will be mitigated by removing the landslide material down to competent bedrock during construction. The other two mapped landslides in the recreation use areas are not anticipated to be a risk but should be monitored periodically through onsite inspection of the slopes. Slope monitoring devices (inclinometers) could be installed and monitored if slope movement is detected during onsite surveys. These slope areas should not be undercut at the toe or overloaded at the top. Excessive irrigation should be avoided.

### Rockfalls

The rockfall hazards on the left abutment and along existing U.S. Highway 287 will be addressed where recreation areas are being constructed. Potential mitigation methods consist of locating infrastructure and recreation features outside of rockfall areas, slope scaling, trim blasting, mid slope catchment benches, rockfall drapes/netting, rock dowels or rock bolts.

### Debris Flows

The addition of the Glade Reservoir will help to attenuate flows during storm events which will work to reduce velocities downstream and reduce debris flow potential. Additional features could be added during detailed design to mitigate this hazard if determined necessary by additional investigations.

### Faults

Existing faults at the site are not considered to be a geologic/seismic hazard risk to the project. The two faults identified at the Glade unit are inactive and do not rupture the ground surface. AECOM completed a Site-Specific Seismic Hazard analysis for the site dated May 21, 2019. The results of this study have been incorporated into the overall design process.

### Collapsible Soils and Ground Subsidence

The mitigation method for the potentially collapsible soils will be removal. Collapsible soils within the dam embankment, forebay and borrow areas will be removed and used as borrow material in construction. The risk of subsidence from soluble gypsum beds in the Lykins Formation will be mitigated through extensive staged grouting of the bedrock units in the Lykins Formation.



## MEMORANDUM

Northern Integrated Supply Project  
Glade Reservoir  
Larimer County 1041 – Wildfire Hazard Mitigation Plan

B&V Project Number 403758  
B&V File 188754/34.3000  
February 14, 2020

To: Larimer County Planning Department  
From: Tim Engemoen and Mike Johnson, Black & Veatch

## Introduction

This technical memorandum is written in support of Larimer County Planning Department's 1041 Permit for the Glade Unit construction and documents the wildfire hazards per Section 8.3 of the Larimer County Land Use Code and proposed mitigation plan associated with the construction of the Glade Unit.

## Project Background

The Northern Integrated Supply Project (NISP) will provide a new raw water supply to several municipal water providers in Northern Colorado. NISP includes the following facilities located in Larimer County: the Glade Unit; the Glade Pump Station; raw water distribution piping; and the relocation of U.S. Highway 287. The Glade Unit features the Glade Reservoir Dam, which is an earthen embankment that will impound an off-channel reservoir complete with the hydraulic structures required by the State Engineer's Office: the High Level Outlet Works (HLOW); Low Level Outlet Works (LLOW); and spillway. Glade Reservoir Dam is located just to the north of the junction of U.S Highway 287 and State Highway 14, about 10 miles northwest of Fort Collins. The Glade Unit includes an expansion of the existing Poudre Valley Canal (PVC) and a new forebay constructed downstream of the dam at an elevation that will allow delivery of water from the PVC by gravity. A Control Gate Structure will be constructed to control flow to the existing portion of the PVC downstream of the forebay. The existing PVC Diversion Structure will be demolished and rebuilt to allow increased diversion of flow from the Poudre River. A portion of the existing Munroe Gravity Canal alignment will be inundated by Glade Reservoir, this open canal will be replaced by the Munroe Canal Bypass (MCB), a conduit and several control structures that will convey flow beneath the reservoir. The Glade Unit also includes: the Glade Pump Station, which will pump water from the forebay into Glade Reservoir; the Electrical/Control building that will distribute power throughout the site and provide control of the various hydraulic features; the Surge Building that will house surge tanks to protect the pump station discharge conduit; and numerous buried conduits with control valve vaults that connect these facilities. Raw water will be conveyed off site via several buried conduits that are being constructed under different NISP contracts. The Glade Unit will include recreational amenities for the general public, including a Visitor Center, campgrounds, a boat ramp, trails and restroom facilities.

Glade Reservoir will submerge a portion of the existing U.S. Highway 287 alignment which will be relocated to the east of the reservoir. An existing power transmission line and several power



distribution lines will be inundated by the reservoir which will be relocated as part of the Glade Unit construction. A general location map of the Glade Unit facilities is presented on Figure 1.

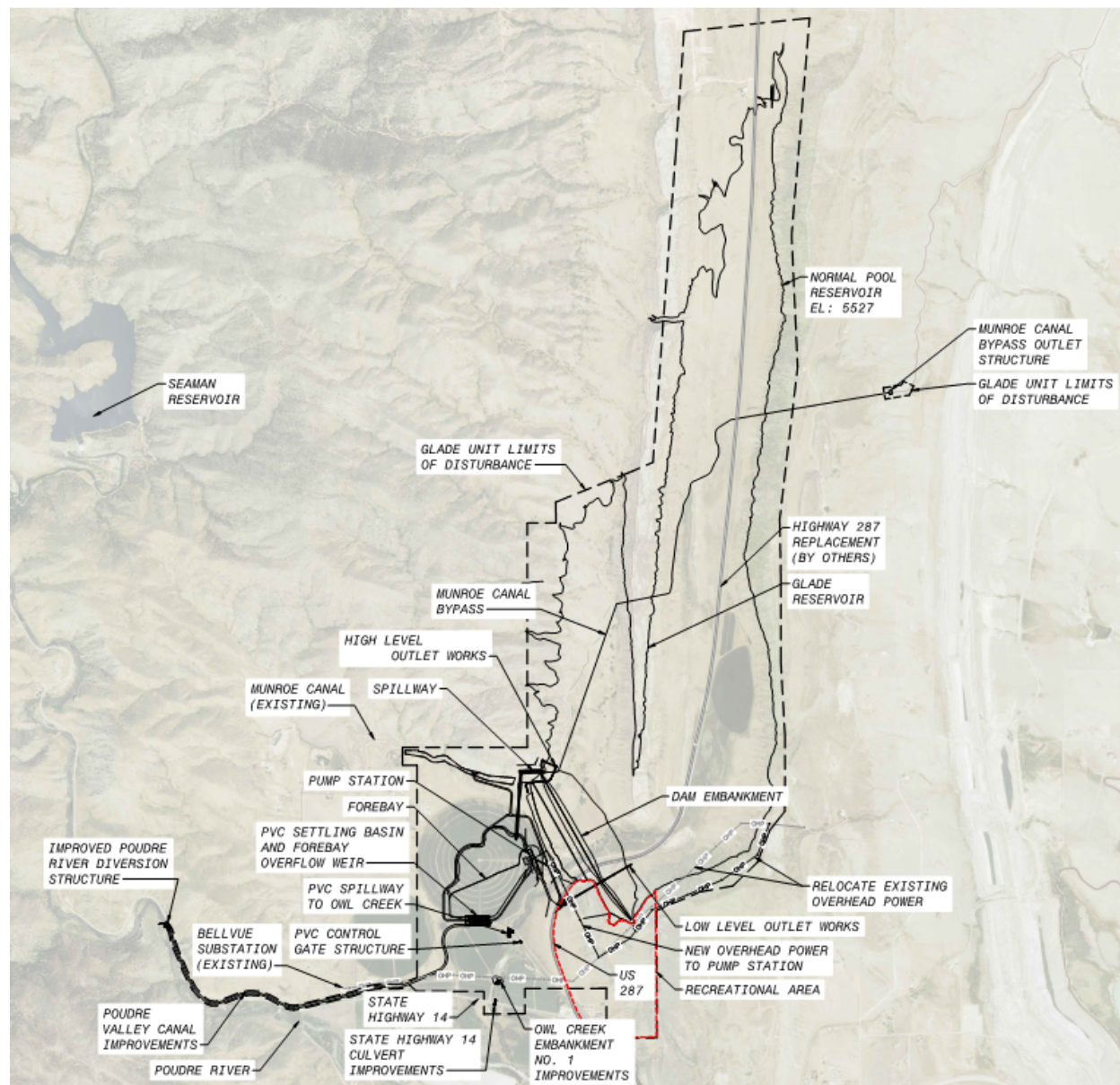


Figure 1 - Glade Unit Overview

The NISP Water Activity Enterprise (NISP Enterprise or Enterprise) assumes financial responsibility for construction of all infrastructure required for the project. The Enterprise is a permanent entity with access to adequate funds to cover project construction and maintenance. The Enterprise's budget will include routine and capital maintenance funds. Northern Water's past performance under other USACE permits demonstrates its commitment to assure that projects will be fully implemented and maintained by the Enterprise.

## Wildfire Hazards

Figure 27 (included in Attachment C to the 1041 Permit Project Description) shows the wildfire hazard area levels as provided by Larimer County. The majority of the Glade Reservoir falls within the “Moderate” hazard range, while the majority of the forebay and Poudre Valley Canal improvements fall within the “Lowest” hazard range. None of the project area falls within the “High” or “Very High” category.

## Wildfire Hazard Mitigation

During construction of the Glade Unit, it is anticipated that the Contractor will employ fire mitigation strategies that include water trucks, coordination with the local fire department (Poudre Fire Authority), and other standard safety practices. After construction is complete, wildfire mitigation will follow Larimer County’s Recreation Regulations. The fire management practices at the recreational area will include fire rings for campfires and limiting fires to designated locations. Most of the project area that currently exists in the “Moderate” range will become either part of the forebay or reservoir and therefore will no longer be susceptible to wildfires. It is anticipated that construction of Glade Reservoir will improve overall wildfire mitigation in the area as the reservoir becomes a barrier to the spread of wildfire.



# **Larimer County Analysis – Technical Memorandum No. 9 Traffic Impact Study**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**





## **MEMORANDUM**

Northern Integrated Supply Project  
Glade Reservoir  
Traffic Impact Study

B&V Project Number 403758  
B&V File 188754/34.3000  
February 14, 2020

To: Larimer County Planning Department  
From: Tim Engemoen and Mike Johnson, Black & Veatch

## **Introduction**

This technical memorandum is written in support of Larimer County Planning Department's 1041 Permit for the Glade Unit construction, and documents short- and long-term impacts of vehicular traffic associated with this new development. In addition to this memorandum, please reference the Technical Memorandum describing the traffic impacts for the proposed NISP delivery pipelines.

## **Project Background**

The Northern Integrated Supply Project (NISP) will provide a new raw water supply to several municipal water providers in Northern Colorado. NISP includes the following facilities located in Larimer County: the Glade Unit; the Glade Pump Station; raw water distribution piping; and the relocation of U.S. Highway 287. The Glade Unit features the Glade Reservoir Dam, which is an earthen embankment that will impound an off-channel reservoir complete with the hydraulic structures required by the State Engineer's Office: the High Level Outlet Works (HLOW); Low Level Outlet Works (LLOW); and spillway. Glade Reservoir Dam is located just to the north of the junction of U.S Highway 287 and State Highway 14, about 10 miles northwest of Fort Collins. The Glade Unit includes an expansion of the existing Poudre Valley Canal (PVC) and a new forebay constructed downstream of the dam at an elevation that will allow delivery of water from the PVC by gravity. A Control Gate structure will be constructed to control flow to the existing portion of the PVC downstream of the forebay. The existing PVC Diversion Structure will be demolished and rebuilt to allow increased diversion of flow from the Poudre River. A portion of the existing Munroe Gravity Canal alignment will be inundated by Glade Reservoir, this open canal will be replaced by the Munroe Canal Bypass (MCB), a conduit and several control structures that will convey flow beneath the reservoir. The Glade Unit also includes: the Glade Pump Station, which will pump water from the forebay into Glade Reservoir; the Electrical/Control building that will distribute power throughout the site and provide control of the various hydraulic features; the Surge Building that will house surge tanks to protect the pump station discharge conduit; and numerous buried conduits with control valve vaults that connect these facilities. Raw water will be conveyed off site via several buried conduits that are discussed in separate reports. The Glade Unit will include recreational amenities for the general public, including a Visitor Center, campgrounds, a boat ramp, trails and restroom facilities.

Glade Reservoir will submerge a portion of the existing U.S. Highway 287 alignment which will be relocated to the east of the reservoir. An existing power transmission line and several power distribution lines will be inundated by the reservoir which will be relocated as part of the Glade Unit construction. A general location map of the Glade Unit facilities is presented on Figure 1.

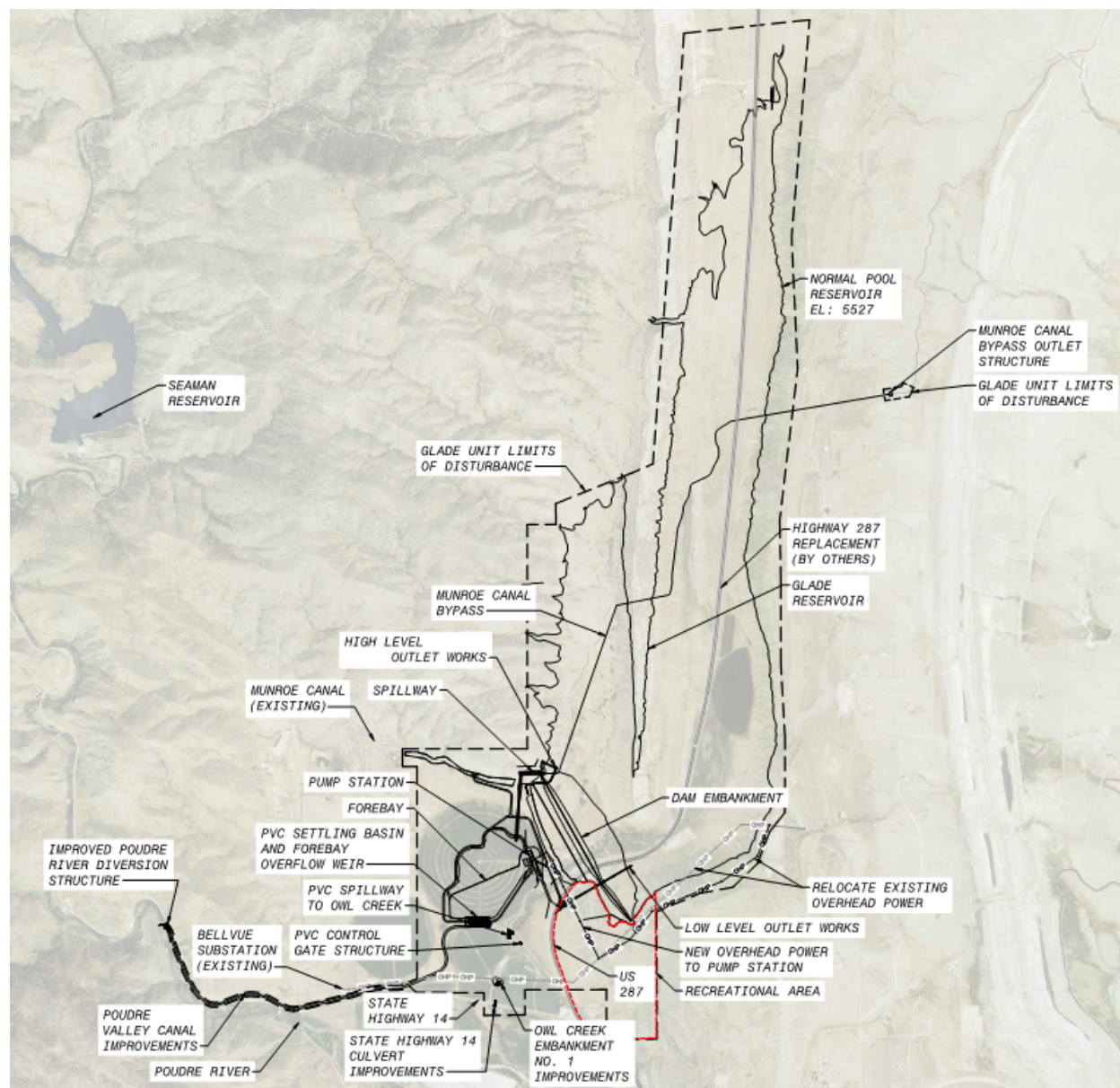


Figure 1 - Glade Unit Overview

## Traffic Impacts During Construction

The Final Environmental Impact Statement (FEIS) for the Northern Integrated Supply Project, dated July 2018, includes a detailed discussion concerning the traffic impacts during the construction of this project

in Section 4.13.3. Due to the length of the document, it has not been included in the appendix of the report but should be referenced for further details.

To summarize the findings in the FEIS, most of the construction-related traffic would be associated with workers accessing the construction site. It was estimated there would be an average of 786 trips per day throughout construction for the workers and deliveries. There will be an estimated peak of 1,572 trips during the summer and a low of 393 trips during the winter. It was noted that the volume of predicted daily construction traffic would have a major impact on State Highway 14, increasing daily volumes by 50% on an average day and 100% on a peak summer day.

A portion of the construction related traffic will be related to hauling aggregate material to the site. The exact quantities of imported material are not currently known as it will be dependent on the results of additional geotechnical investigations. The desire will be to produce as much of the material on site as possible, but if insufficient high-quality material is found onsite, imported material will be required. Any imported material will be hauled to the site using regional highways without the need to route traffic on, or cause impacts to, county roads.

Construction of the Glade Unit will also inundate a 7-mile segment of the existing U.S. Highway 287 between Ted's Place and Larimer County Road (LCR) 68. Larimer County doesn't include highway relocations in their 1041 regulations, so additional information on this relocation is not included in this memo and instead will be evaluated per Larimer County requirements in a separate land application process.

In addition to the increased traffic volume caused by construction activities, there will also be some temporary impacts to local roadways caused by construction activities. These impacts would be mitigated as described in the FEIS by developing traffic control plans and final roadway designs that minimize impacts on traffic and meet requirements of the agency responsible for the impacted roadway.

## Traffic Impacts After Construction

The largest impact to local traffic after construction is complete will be related to recreational activities at the Glade Reservoir site. Like the impacts during construction, the post-construction impacts are discussed in the FEIS document (Section 4.13.3) which should be referenced for additional details that are not included in this memo. To summarize the findings of the FEIS, proposed public recreation at the Glade Reservoir is predicted to be about 379,000 visitor days annually which would increase traffic volume on area roads seasonally. On a weekend in the peak summer season, it is estimated that reservoir use would increase average daily traffic volumes on U.S. Highway 287 from 15,600 to 16,750 representing an increase of 8 percent. Of the additional vehicles, it is estimated that 30 percent would be RVs/campers or vehicles with boat trailers. If the increased recreation traffic was coming from State Highway 14, average daily traffic volumes would increase from 1,500 to 2,150, representing a net increase of 45 percent. It is anticipated that recreation trips would be split between U.S. Highway 287 and State Highway 14 corridors which would reduce the maximum effect to each.

A more detailed evaluation of recreation traffic can be completed in association with the future Recreation Development Plan when traffic generation and associated impacts can be more accurately assessed.

In addition to the recreational traffic, Northern Water staff will need to periodically access all the structures associated with this project for operation and maintenance. Those routine visits will also vary seasonally, with increased visits required when the Pump Station is operated during the spring runoff and reduced visits the remainder of the year. The average number of visits are anticipated to be on the order of several times a week and should not cause any noticeable increase in traffic volume.

## Conclusion

The construction of the Glade Unit will cause impacts to traffic during the construction phase and post-construction. Most of the impacts during construction will be increased traffic volume from the construction workers and delivery trucks. These temporary impacts to roadways caused by construction activities will be mitigated by developing traffic control plans and final roadway designs that minimize impacts on traffic and meet local requirements. Most of the post-construction impacts will be due to increased traffic visiting the recreational facilities associated with Glade Reservoir. Chapter 4.13.3 of the FEIS describes these traffic impacts in greater detail.

**Date:** February 5, 2020

**To:** Larimer County Planning Department

**From:** Randy Parks and Derek Nelson - Dewberry Engineers Inc.

**Subject:** Northern Integrated Supply Project – Traffic Impact Study



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This section addresses requirements of the 1041 Permit item 8.d for Traffic Impact Study. It describes the effects of the NISP conveyance facilities that are within unincorporated parts of Larimer County. Such facilities include:

- Northern Tier Pipeline
- Poudre Release/Glade Release Pipeline
- Poudre Intake Pipeline
- County Line Pipeline
- Glade Reservoir Pump Station
- Poudre Diversion Pump Station

## Methods

Effects on traffic and transportation were assessed based on existing roadway information from the Larimer County Road Information Locator webpage and, when needed, from CDOT Road Traffic Count data. The most recent available data from Larimer County was used, which came from the years 2000, 2009, 2015, 2017, and 2018; depending upon the node. Traffic volumes obtained from CDOT were conducted in 2014. The road classification and Annual Average Daily Traffic (ADT) count from nodes that were available along the alignments can be seen in Map Series 6 in Attachment D to the Project Description.

Since the County Line Pipeline is parallel and adjacent to the roadway, good traffic data existed along the entire alignment. The tabulated data was taken from the ADT found after one another and averaged. The reach between nodes were then designated as a work area. This data is presented in table 4.

Since the Northern Tier Pipeline, Poudre Intake Pipeline, and Poudre Release/Glade Release Pipeline do not parallel roadways consistently, data was tabulated through an alternative method by creating “Traffic Study Areas” which can be seen in map series 6 in Attachment D to the Project Description. Additionally, the density of traffic station locations was significantly less than along the County Line Pipeline, which necessitated a modified approach. Tables 1-3 in this memo list all areas, relevant traffic stations, traffic counts, approximate length of crossing, street impact, closure requirements and estimated duration for the Northern Tier, Poudre Intake, and Poudre Release/Glade Release Pipelines. The Traffic Study Areas were broken up as portions of the pipeline that parallel roadways within 100 feet, cross roadways with trenchless crossings, or cross gravel roads.

## General NISP Conveyance Information

An alternatives alignment study was performed and the preferred alignment for NISP conveyance can be found as part of the Conveyance Routing Assessment (Technical Memorandum 3). Although the final design of the pipeline will be developed at a later date, the NISP conveyance lines are expected to have a 60-foot permanent easement and a 40-foot temporary construction easement. The NISP pipelines are planned to be routed as much as possible in private easement rather than public right-of-way. By routing most of the pipeline in private easements traffic impacts will be lessened.

## Crossings

Water pipeline road crossings in Larimer County will be constructed using trenchless methods on all paved roadways and open-cut construction on unpaved roadways. A list of all anticipated trenchless and open-cut crossings is presented in Tables 1-4. Trenchless construction methods would cause only minor disruption to traffic and would have negligible short-term effects. Any roadway that is unpaved (e.g. gravel) would use open-cut construction. Open-cut construction of pipelines would require a trench to be dug along the length of the pipeline, affecting the segment of the road that requires the trench. The pipeline would then be laid in the trench, and the trench would be backfilled to pre-existing conditions. Roadways that would be open-cut would either have temporary lane closures or would be closed to traffic, and a detour route would be provided during construction. The NISP conveyance will likely cross the Great Western and Union Pacific Railroads in several places. Trenchless construction methods would be used at the railroad crossings.

## General Compliance

For all pipeline alignments adjacent to or crossing the road ROW, Northern Water and/or construction contractors would be required to develop traffic control plans. Traffic control plans would be subject to approval by the transportation agency responsible for the impacted roadway. As such, short-term effects on local roadways during construction are expected to be minor for construction areas. If the level of construction activity impacted traffic to a greater magnitude than anticipated, the construction contractor would work with the responsible transportation agency to reduce the traffic effect to an acceptable level based on their policies and standards.

Further, it is understood that during final design, Northern Water will be required to represent anticipated haul/delivery routes and coordinate same with Larimer County.

All activities in or adjacent to, access to and from, and including hauling/delivery on Larimer County roads/ROW must abide by the Larimer County Access Policy and Larimer County Land Use Code.

## Mitigation

Mitigation of traffic impacts will be addressed on a road-by-road basis and for local community/residences/businesses during final design. General mitigation measures that may be implemented include:

- Utilization of major roads and bridges for haul routes whenever feasible.



- Minimization of hauling/deliveries during peak driving hours.
- Coordination with the County and other entities to avoid planned concurrent road construction.
- Coordination with local schools on bus routes and pickup or drop-off times.
- Maintenance of access to residents and businesses to include emergency vehicles, trash pickup, and postal/delivery services.
- Stabilized construction access in accordance with erosion control and streets ordinances.
- Dust control during construction.

## Durations

Construction durations per work area were estimated with production rates using factors including pipe diameter, route complexity, route length, available construction corridor area and access, utility density, and terrain challenges. Estimated construction durations per work area can be found in Tables 1-4.

Table 1- Northern Tier Annual Average Daily Traffic (ADT)

	Traffic Station 1 Type	Traffic Station 1	Traffic Count 1	Traffic Station 2 Type	Traffic Station 2	Traffic Count 2	Traffic Count Used	Approx. Length (ft)	Street Impacted	Type of Impact	Closure Required?	Estimated Duration (Days)
Area N-1	CDOT	014B	3000	-	-	-	3000	300	HW 14	Trenchless Crossing	No	10
Area N-2	CDOT	014B	3000	-	-	-	3000	400	HW 14	Parallel	No	2
Area N-3	CDOT	105333	8800	-	-	-	8800	1500	HW 287	Parallel	No	8
Area N-4	CDOT	105333	8800	CDOT	000008	8200	8500	900	HW 287	Parallel	No	9
Area N-5	CDOT	105333	8800	CDOT	000008	8200	8500	1200	HW 287	Trenchless Crossing	No	40
Area N-6	CDOT	105333	8800	CDOT	000008	8200	8500	24,000	HW 287	Parallel	No	120
Area N-7	LC	488	800	-	-	-	800	300	CR 21-C	Trenchless Crossing	No	10
Area N-8	LC	488	800	LC	760	900	850	2800	W CR 56	Parallel	No	14
Area N-9	LC	488	800	LC	760	900	850	300	W CR 56	Trenchless Crossing	No	10
Area N-10	LC	418	2500	-	-	-	2500	300	Taft Hill Rd	Trenchless Crossing	No	10
Area N-11	LC	758	190	-	-	-	190	3000	Travis	Parallel	No	15



Area N-12	CDOT	100004	7200	-	-	-	-	7200	300	HW 1	Trenchless Crossing	No	10
Area N-13	LC	763	130	-	-	-	-	130	300	E CR 56	Gravel Crossing	No- single lane flagged	8
Area N-14	LC	240	275	-	-	-	-	275	300	N CR 13	Gravel Crossing	No- single lane flagged	8
Area N-15	LC	199	130	-	-	-	-	130	300	Turnberry	Gravel Crossing	No- single lane flagged	8
Area N-16	LC	750	1400	LC	751	1400	1400	1400	300	CR 54/Douglas	Trenchless Crossing	No	10
Area N-17	LC	750	1400	LC	751	1400	1400	1400	3000	CR 54/Douglas	Parallel	No	15
Area N-18	LC	750	1400	LC	751	1400	1400	1400	300	CR 54/Douglas	Trenchless Crossing	No	10
Area N-19	LC	750	1400	LC	751	1400	1400	1400	1800	CR 54/Douglas	Parallel	No	9
Area N-20	LC	140	2400	-	-	-	-	2400	300	Giddings	Trenchless Crossing	No	10
Area N-21	LC	752	90	LC	753	80	85	10000	10000	CR 54/Douglas	Parallel	No	50
Area N-22	CDOT	000127	34000	-	-	-	-	34000	800	I-25	Trenchless Crossing	No	27
Area N-23	LC	727	600	LC	728	350	475	6000	6000	CR 52/Richards Lake	Parallel	No	30
Area N-24	LC	727	600	LC	728	350	475	300	300	CR 52/Richards Lake	Trenchless Crossing	No	10
Area N-25	LC	727	600	LC	728	350	475	3000	3000	CR 52/Richards Lake	Parallel	No	15

Area N-26	LC	727	600	LC	728	350	475	300	CR 52/Richards Lake	Parallel	No- single lane flagged	8
Area N-27	LC	727	600	LC	728	350	475	2300	CR 52/Richards Lake	Parallel	No	12
Area N-28	LC	727	600	LC	728	350	475	1800	CR 52/Richards Lake	Parallel	No	9
Area N-29	LC	24	130	-	-	-	130	300	CR 3	Gravel Crossing	No- single lane flagged	8
Area N-30	LC	729	235	LC	730	250	242.5	1000	CR 52/Richards Lake	Gravel	No- single lane flagged	25
Area N-31	LC	729	235	LC	730	250	242.5	1600	CR 52/Richards Lake	Parallel	No	8
Area N-32	LC	729	235	LC	730	250	242.5	300	CR 52/Richards Lake	Gravel Crossing	No- single lane flagged	8
Area N-33	LC	729	235	LC	730	250	242.5	6000	CR 52/Richards Lake	Parallel	No	30

Table 2- Poudre Intake Annual Average Daily Traffic (ADT)

	Traffic Station 1 Type	Traffic Station 1	Traffic Count 1	Traffic Station 2 Type	Traffic Station 2	Traffic Station 2	Traffic Count 2	Traffic Count Used	Approx. Length (ft)	Street Impacted	Type of Impact	Closure Required?	Estimated Duration (Days)
Area P-1	CDOT	100637	31000	CDOT	100638	-	40000	35500	400	Mulberry	Trenchless Crossing	No	13
Area P-2	CDOT	100638	40000	-	-	-	-	40000	3000	Mulberry	Parallel	No	30
Area P-3	LC	192	4500	-	-	-	-	4500	300	Timberline	Trenchless Crossing	No	10
Area P-4	LC	134	2200	-	-	-	-	2200	300	Summit View	Trenchless Crossing	No	10
Area P-5	CDOT	101036	63000	-	-	-	-	63000	800	I-25	Trenchless Crossing	No	27
Area P-6	LC	671	1600	LC	672	2100	1850	1850	300	Prospect	Trenchless Crossing	No	10
Area P-7	LC	418	2500	-	-	-	-	2500	300	CR 5	Trenchless Crossing	No	10
Area P-8	LC	67	1800	-	-	-	-	1800	300	CR 42 E	Trenchless Crossing	No	10

Table 3- Poudre Intake Annual Average Daily Traffic (ADT)

	Traffic Station 1 Type	Traffic Station 1	Traffic Count 1	Traffic Station 2 Type	Traffic Station 2	Traffic Station 2	Traffic Count 2	Traffic Count 2	Traffic Count Used	Approx. Length (ft)	Street Impacted	Type of Impact	Closure Required?	Estimated Duration (Days)
Area P/G R-1	CDOT	014B	3000	-	-	-	-	-	3000	5000	HW 287	Parallel	No	25
Area P/G R-2	CDOT	014B	3000	-	-	-	-	-	3000	300	HW 287	Trenchless Crossing	No	10
Area P/G R-3	CDOT	014B	3000	-	-	-	-	-	3000	500	HW 287	Parallel	No	2.5

Table 4- County Line Annual Average Daily Traffic (ADT)

Work Area	Station 1	ADT 1	Station 2	ADT 2	Average Traffic Count	Trenchless Crossings (paved)	Open-Cut Crossings (gravel)	Duration (days)
C-1	983	210	982	500	355	1. Trenchless crossing 2,640-feet north of CR 48 across CR 1	0	117
						2. Trenchless crossing 1,780-feet north of CR 48 across CR 1		
						3. Trenchless crossing across CR 48 at the intersection with CR 1		
C-2	981	500	980	475	488	1. Trenchless crossing across Hwy 14 at the intersection with CR 1	0	39
C-3	979	550	978	325	438	1. Trenchless crossing across CR 44 at the intersection with CR 1	0	39
C-4	977	650	1138	275	463	1. Trenchless crossing across Wildwing Dr. at CR 1 2. Trenchless crossing 2,375-feet north of WCR 78 across CR 1	1. Open-cut crossing across WCR 78	78
C-5	1138	275	1200	2000	1138	1. Trenchless crossing diagonally across the intersection of LCR 40 and CR 1	0	195
						2. Trenchless crossing diagonally across the intersection of LCR 38 and CR 1		
						3. Trenchless crossing under railroad 6,500 feet south of LCR 38		
						4. Trenchless crossing 1,350-feet north of LCR 32E across CR 1		
						5. Trenchless crossing across LCR 32E at the intersection with CR 1		
C-6	1200	2000	1199	1500	1750	0	0	15

<b>C-7</b>	1199	1500	976	4500	3000	1. Trenchless crossing across Hwy 392	0	39
<b>C-8</b>	976	4500	1203	4700	4600	1. Trenchless crossing 1,900 feet south of Hwy 392 across CR 2. Trenchless crossing across Steeplechase Dr 3. Trenchless crossing across Bounty Dr 4. Trenchless crossing across WCR 62	1. Open-cut crossing across WCR 64	156
<b>C-9</b>	1203	4700	975	4800	4750	1. Trenchless crossing 2,530 feet south of WCR 62 across CR 1 2. Trenchless crossing 4,590 feet south of WCR 62 across CR 1	1. Open-cut crossing beneath WCR 60	78
<b>C-10</b>	975	4800	CDOT traffic count	2200	3500	1. Trenchless crossing across Hwy 34 2. Trenchless crossing 400 feet south of Hwy 34 3. Trenchless crossing 800 feet south of Hwy 34 under railroad 4. Trenchless crossing 2,800 feet south of Hwy 34 under railroad 5. Trenchless crossing under railroad at CR 20C 6. Trenchless crossing 6,000 feet south of Hwy 34 across CR1 7. Trenchless diagonal crossing across LCR 18 8. Trenchless crossing across LCR 16 9. Trenchless crossing north of LCR 14 and CR 1 across CR1	0	351



# **Larimer County Analysis – Technical Memorandum No. 10 Drainage Plan**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**



## MEMORANDUM

Northern Integrated Supply Project  
Glade Reservoir  
Larimer County 1041 – Drainage/Erosion Control

B&V Project Number 403758  
B&V File 188754/34.3000  
February 14, 2020

To: Larimer County Planning Department  
From: Tim Engemoen and Mike Johnson, Black & Veatch

## Introduction

This Drainage and Erosion Control Report and Plan is written in support of Larimer County Planning Department's 1041 Permit for the Glade Unit construction and describes the hydraulic and hydrologic analyses completed for this project.

## Project Background

The Northern Integrated Supply Project (NISP) will provide a new raw water supply to several municipal water providers in Northern Colorado. NISP includes the following facilities located in Larimer County: the Glade Unit; the Glade Pump Station; raw water distribution piping; and the relocation of U.S. Highway 287. The Glade Unit features the Glade Reservoir Dam, which is an earthen embankment that will impound an off-channel reservoir complete with the hydraulic structures required by the State Engineer's Office: the High Level Outlet Works (HLOW); Low Level Outlet Works (LLOW); and spillway. Glade Reservoir Dam is located just to the north of the junction of U.S Highway 287 and State Highway 14, about 10 miles northwest of Fort Collins. The Glade Unit includes an expansion of the existing Poudre Valley Canal (PVC) and a new forebay constructed downstream of the dam at an elevation that will allow delivery of water from the PVC by gravity. A PVC Control Gate structure will be constructed to control flow to the existing portion of the PVC downstream of the forebay. The existing PVC Diversion Structure will be demolished and rebuilt to allow increased diversion of flow from the Poudre River. A portion of the existing Munroe Gravity Canal alignment will be inundated by Glade Reservoir, this open canal will be replaced by the Munroe Canal Bypass (MCB), a conduit and several control structures that will convey flow beneath the reservoir. The Glade Unit also includes: the Glade Pump Station, which will pump water from the forebay into Glade Reservoir; the Electrical/Control building that will distribute power throughout the site and provide control of the various hydraulic features; the Surge Building that will house surge tanks to protect the pump station discharge conduit; and numerous buried conduits with control valve vaults that connect these facilities. Raw water will be conveyed off site via several buried conduits (the stormwater plan for these facilities is provided in a separate report). The Glade Unit will include recreational amenities for the general public, including a Visitor Center, campgrounds, a boat ramp, trails and restroom facilities.

Glade Reservoir will submerge a portion of the existing U.S. Highway 287 alignment which will be relocated to the east of the reservoir. An existing power transmission line and several power



distribution lines will be inundated by the reservoir which will be relocated as part of the Glade Unit construction. A general location map of the Glade Unit facilities is presented on Figure 1.

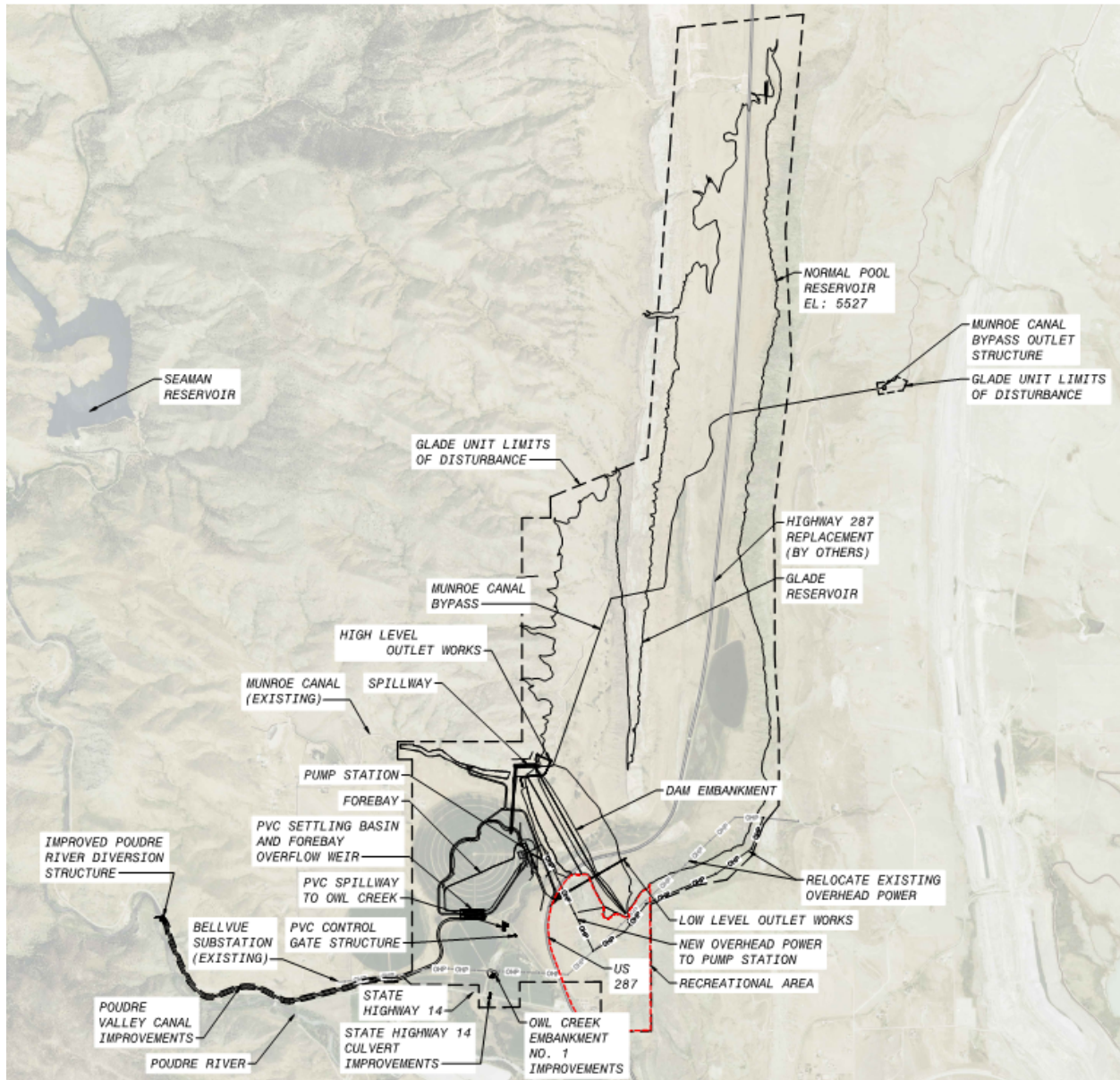


Figure 1 - Glade Unit Overview

## Site Drainage Upstream of Glade Reservoir

The drainage areas that are tributary to Glade Reservoir are shown in Figure 2.

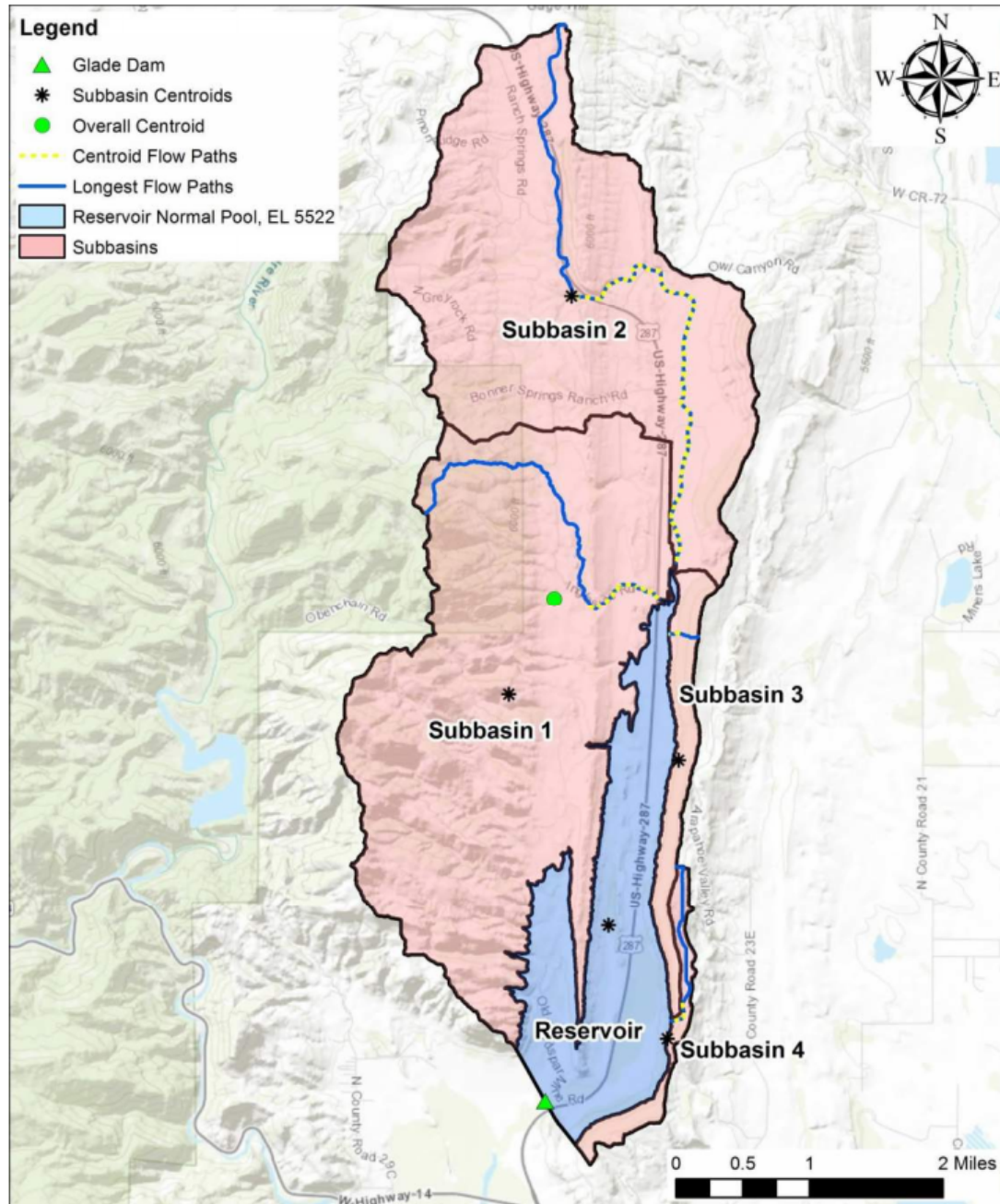


Figure 2 - Drainage Areas Upstream of Glade Reservoir

These drainage areas are also shown in Figure 17 that is included with Attachment C to the 1041 Permit Project Description. The general flow regime on the site is from north to south and the total drainage area is 16.3 square miles.

The inflow design flood (IDF) for an extreme hydrologic hazard classification is based on the critical duration probable maximum precipitation (PMP) event. 72-hour general storm, 24-hour hybrid storm, 6-hour local storm, and 2-hour local storm PMP depth-duration relationships were estimated using the Colorado-New Mexico Regional Extreme Precipitation Study PMP Tool. Forty-eight-hour, 6-hour, and 2-hour precipitation frequency (PF) depth-duration relationships were estimated using the Colorado-New Mexico Regional Extreme Precipitation Study Precipitation Frequency Tool.

Based on the estimated Glade Reservoir drainage basin characteristics and hydrologic analysis using CO-NM REPS PMP data, the IDF was determined to result from the 24-hour duration PMP storm event. Reservoir peak inflows for the various PMP storm durations and distributions were estimated to range between about 16,600 and 57,700 cfs. Total reservoir inflow runoff volumes were estimated to range between about 12,000 and 17,500 acre-feet. Due to the reservoir surcharge storage capacity, the inflow flood with the largest inflow runoff volume (i.e., the 24-hour duration PMP) produced the highest reservoir elevation (i.e., El. 5532.2) and was adopted as the IDF. With a dam crest at El. 5535.2, there would be 3 feet of residual freeboard, which conforms to minimum freeboard design criteria for the IDF event.

Based on use of CO-NM REPS precipitation frequency data, the 48-hour duration storm events produced the highest reservoir elevations and associated peak outflows for the precipitation frequency Annual Exceedance Probability (AEP), durations, and distributions evaluated. As such, the 48-hour duration is the critical duration for precipitation frequency events. Reservoir peak inflows for the various precipitation frequency events were estimated to range between about 1,200 cfs and 40,000 cfs. Total reservoir inflow runoff volumes were estimated to range between about 570 and 11,700 acre-feet.

Glade reservoir will provide a significant amount of attenuation for the IDF and reduce the outflow from the reservoir. The spillway crest is set at El 5532, and the resulting maximum outflow from the IDF is 1,200 cfs. When the spillway activates, flow is routed to the Forebay via the spillway chute. Once the Forebay level reaches El. 5245, the Forebay Overflow activates and discharges flow into the Poudre Valley Canal (PVC). Once the level in the PVC reaches El 5247, the Owl Creek Spillway activates and flow is directed into the Owl Creek Drainage. This drainage is being improved so that this flow can be safely conveyed under Highway 14.

Refer to Figure 13 included in Attachment C to the 1041 Permit Project Description for the structures that are part of the drainage flow path. Appendix A includes the full analysis of this drainage area.



## Site Drainage Downstream of Glade Reservoir

The drainage areas that are tributary to the Forebay are shown in Figure 3. This is a detailed map of the sub-basins that comprise Basin 5 as shown on Figure 17 included in Attachment C to the 1041 Permit Project Description. Because the Forebay and the PVC are hydraulically connected via the Forebay Overflow Weir, the drainage areas which drain into the PVC upstream of the Forebay are included in this analysis. Total drainage area analyzed is 3.8 square miles.

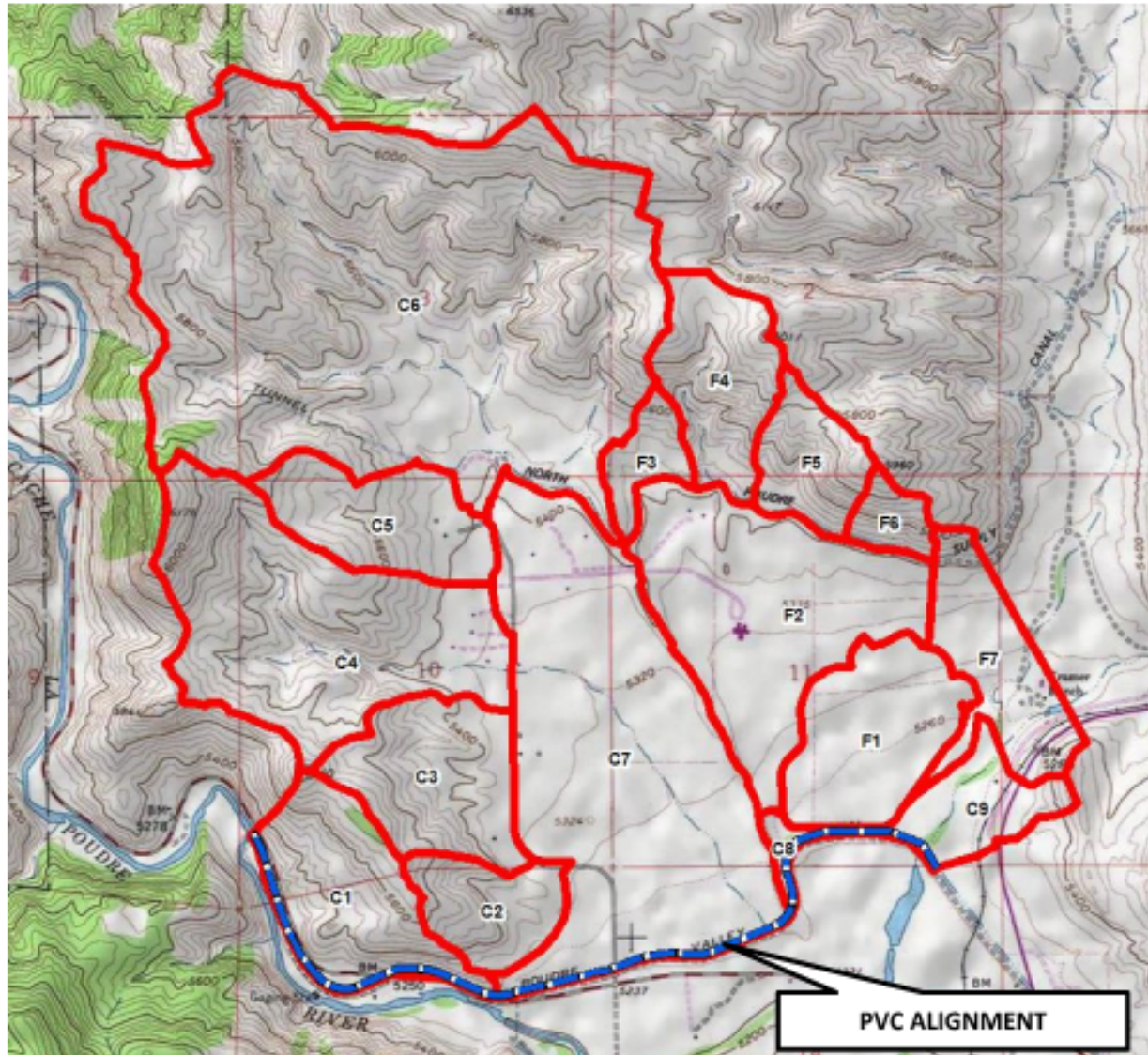


Figure 3 - Drainage Areas Downstream of Glade Reservoir

The IDF for a low hydrologic hazard classification like the Forebay is based on the critical duration 100-year event. 72-hour general storm, 24-hour hybrid storm, 6-hour local storm, and 2-hour local storm 100-year depth-duration relationships were estimated using the Colorado-New Mexico Regional

Extreme Precipitation Study PMP Tool. 48-hour, 6-hour, and 2-hour precipitation frequency (PF) depth-duration relationships were estimated using the Colorado-New Mexico Regional Extreme Precipitation Study Precipitation Frequency Tool.

The three storms were modeled using HEC-HMS for the forebay drainage area. It was determined that the critical storm was a 2-hour local storm as it produced the highest water surface elevation in the future forebay and the largest discharge outflow at the spillway into Owl Creek. The results of this analysis for the 2-hour local storm included a maximum water surface in the Forebay of El 5249.32 and a maximum discharge rate of 1,855 cfs into Owl Creek. Thus, even though the drainage area upstream of Glade Reservoir is significantly larger than the area downstream of the reservoir, the area downstream results in a larger outflow to Owl Creek. This is because the Forebay offers significantly less attenuation than Glade Reservoir. The intent of the design is to ensure there won't be an increase in peak flow rates for the drainage basins downstream of the reservoir.

When the water surface in the Forebay reaches El. 5245, the Forebay Overflow activates and discharges flow into the Poudre Valley Canal (PVC). Once the level in the PVC reaches El 5247, the Owl Creek Spillway activates and flow is directed into the Owl Creek Drainage. This drainage is being improved so that this flow can be safely conveyed under Highway 14.

Refer to Figure 13 included in Attachment C to the 1041 Permit Project Description for the structures that are part of the drainage flow path. Appendix B includes the full analysis of this drainage area.

## Drainage Basin No. 6

In addition to the drainage basins which have been analyzed upstream and downstream of Glade Reservoir, there is another drainage basin which occupies a portion of the site impacted by the Glade Unit. This area is shown on Figure 17 included in Attachment C to the 1041 Permit Project Description and is labeled Basin 6 and is also shown below in Figure 4. This basin includes the land along Highway 14 south of the PVC and the area which is planned to be occupied by the recreational facilities. Some of this basin will drain to Owl Creek while other portions of this basin will drain directly into the Poudre River. Because the recreational area layout and design haven't been completed, this basin has not yet been analyzed to determine the hydrologic impact on the drainage from this area.

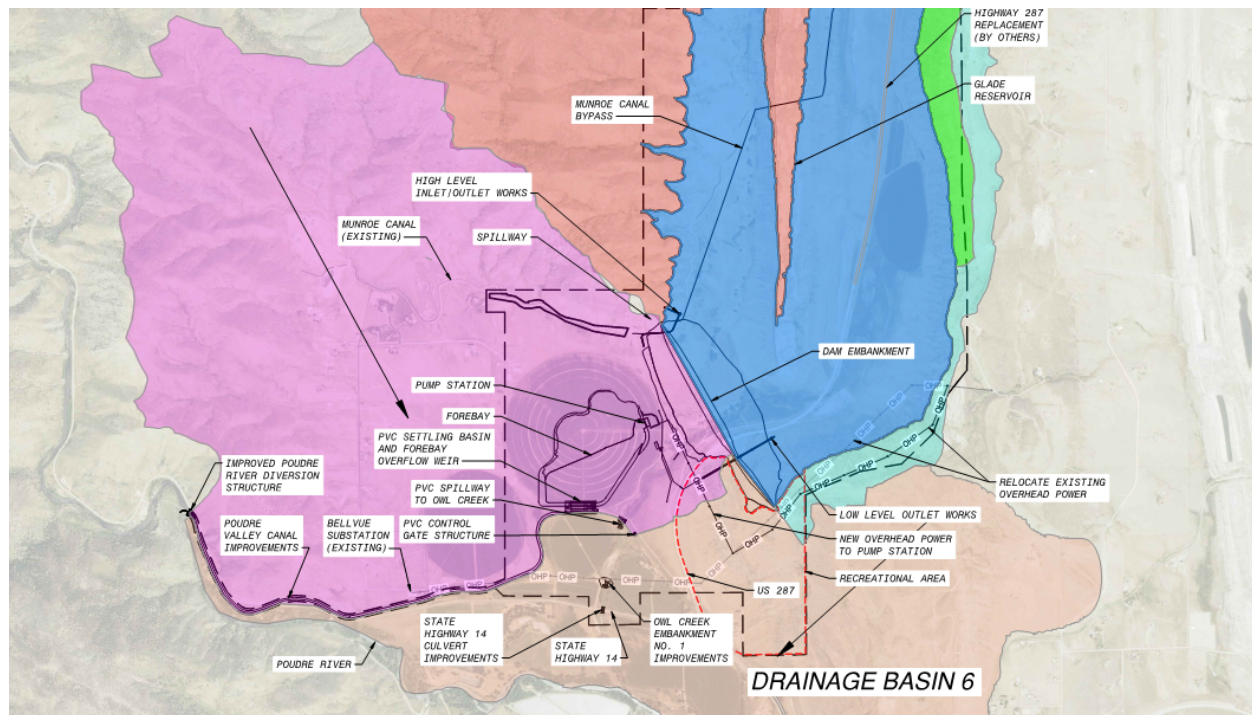


Figure 4 - Drainage Basin 6

The drainage analysis and designs will be completed as recreation infrastructure design progresses in compliance with the Larimer County Stormwater Design Standards.

## Environmental Compliance

Environmental compliance during construction is described as part of the Final EIS Conceptual Mitigation Plan and includes a significant listing of Best Management Practices (BMPs) which are required due to federal, state, and local permitting activities.

The following BMPs will be implemented during construction for protection of existing streams and wetlands.

- Clearing of vegetation will be limited to that required for construction.
- Dredged or excavated materials not utilized for construction would be placed on an upland site above the ordinary high-water mark in a confined area except as specifically authorized by the construction contracts.
- Implement a soil, sediment, and erosion control plan to prevent erosion of disturbed areas into waterways.
- Construction debris such as excess fill material, wood, vegetation, concrete, and other materials will be disposed of in such a manner that debris cannot enter a waterway or wetland.
- Equipment will be allowed into wetlands and waterways only as authorized by the Record of Decision and the 404 Permit.

- Concrete truck wash-out areas will be managed to prevent contamination of waters.
- Containment areas will be required for all petroleum products, chemicals and other deleterious materials stored on-site.
- Contractor will be required to develop a contingency plan in the event of a spill.
- A storm water management plan will be developed in accordance with the State of Colorado Water Quality Program in accordance with the guidelines of the Colorado Department of Public Health and Environment (CDPHE). This permit will incorporate construction dewatering discharge requirements, erosion and sediment controls and other BMPs that apply to storm water runoff from a construction site.



**APPENDIX A**

**GLADE RESERVOIR FLOOD HYDROLOGY REPORT,**  
**PREPARED BY BLACK & VEATCH/AECOM,**  
**OCTOBER 2019**



**APPENDIX B**

**FOREBAY HAZARD CLASSIFICATION ANALYSIS**

**PREPARED BY BLACK & VEATCH/AECOM**

**NOVEMBER 2019**

**(ONLY THE HYDROLOGY PORTION OF THIS  
REPORT IS INCLUDED)**

## Memorandum

**Date:** February 17, 2020  
**To:** Christie Coleman, Northern Colorado Water Conservancy District  
**From:** Scott Fanello/Bridget Mitchell – Pinyon Environmental, Inc.  
**Project:** Northern Integrated Supply Project (NISP)  
**Subject:** Drainage Narrative - Recommended Stormwater Control Measures for Conveyance System Construction to Satisfy 1041 Permit

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### Introduction

This memorandum (memo) presents the drainage narrative (narrative) developed for the Northern Integrated Supply Project's (NISP or the Project) use in the NISP Water Activity Enterprise's (WAE) 1041 Permit application. The purpose of this narrative is to document the Project's extensive coordination efforts and commitments to avoid, minimize, mitigate, and enhance construction related stormwater impacts by the Project in unincorporated Larimer County, Colorado in accordance with Larimer County Land Use Code (Larimer County, 2019). NISP WAE is the permittee and the entity that will implement the identified mitigation measures.

Pinyon Environmental, Inc. (Pinyon), has prepared this narrative to evaluate potential increased stormwater and water quality impacts associated with the proposed development and recommend control measures to mitigate these impacts.

### Project Overview

Northern Colorado Water Conservancy District (Northern Water), acting by and through the NISP WAE, has contracted Pinyon to provide environmental compliance services during the pre-construction phase of the NISP. The Project will provide a new reliable water supply to Northern Colorado and consists of constructing the following in Larimer County:

- Glade Reservoir Complex and Appurtenances, which includes Poudre Valley Canal improvements, and construction of the forebay area, the dam structure (including intake and release structures), a pump station, and recreation areas located adjacent to the new reservoir
- A realigned portion of U.S. Highway 287
- New pipeline conveyance systems, which include the Northern Tier, Poudre Intake, Glade Release, and County Line Alignments

The purpose of the Project is to meet a portion of the NISP Participants' (15 towns and water districts in Larimer, Weld, Morgan, and Boulder counties) current and projected future water supply needs. The overall goal of the Project is to provide 40,000 acre-feet of new, annual water to the NISP Participants.

This narrative only covers the NISP conveyance system in unincorporated Larimer County (Figure 1). Work associated with the Glade Reservoir 1041 Permit Drainage Narrative is being developed by others under a separate cover. In addition, Larimer County 1041 Permit requirements do not apply to Colorado Department of Transportation (CDOT) highway relocations. As a result, the scope and effects of the realignment of U.S. Highway 287 will be evaluated per Larimer County requirements as a separate process.

## Existing Water Resources

Pinyon mapped water resources data using a variety of methodologies: desktop analysis using readily available data, field verifications, and wetland delineation (Pinyon, 2020). As part of that process, the National Hydrography Dataset (NHD), United States Geological Survey (USGS) mapping, aerial photography, Natural Resources Conservation Service (NRCS) maps, and other data sources were reviewed.

The following is a brief overview of the major rivers, streams, named ditches, and reservoirs that the Project either crosses or passes adjacent to. A more comprehensive list of rivers and streams expected to be impacted can be found in *Larimer County 1041 Permit: Wetland Mitigation Plan* (Pinyon, 2020).

The pipeline conveyance system in Larimer County consists of four lines: Northern Tier Alignment, Poudre Intake Alignment, County Line Alignment, and Glade Release Alignment (Figures 1 - 5). The list below starts with water bodies at the northwestern-most side of the Project along Poudre Canyon Road northwest of Bellvue. It follows water bodies along the Project going east until County Road (CR) 13. Then it follows the Project south to East Prospect Road. At that point the Project has a western spur that stretches west to the intersection of Mulberry Street and South Lemay Avenue in Fort Collins. The list of water bodies then restarts back at the intersection of CR 13 and East Prospect Road where it continues south along CR 13 till the Project ends north of the intersection of CR 13 and CR 30.

- Cache La Poudre River
- Poudre Valley Canal
- Larimer County Ditch
- Dry Creek
- Annex Reservoir #8
- Elder Reservoir
- Boxelder Creek
- Larimer County Canal
- Deadman Lake
- Cache La Poudre Reservoir Canal
- Cache La Poudre Reservoir Inlet
- Larimer and Weld Canal
- Timnath Reservoir
- Lake Canal
- Greeley No 2 Canal
- Oklahoma Reservoir
- Farmers Ditch
- Big Thompson River
- Hill and Brush Ditch
- Hillsboro Ditch

No changes to groundwater, aquifers, or aquifer recharge areas are anticipated.

## Regulatory Requirements

The U.S. Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA) are responsible for regulating activities in waters of the U.S., including wetlands, under Section 404 (1)(b) of the Clean Water Act (CWA). NISP WAE is in the process of obtaining a Section 404 permit for unavoidable permanent impacts to waters of the U.S. This means the Project will take all appropriate and practicable steps to avoid and minimize adverse impacts to waters of the U.S. Unavoidable permanent impacts will be offset as described in the Project's *Larimer County 1041 Permit: Wetland Mitigation Plan* (Pinyon, 2020).

Construction activities would be regulated by a National Pollutant Discharge Elimination System (NPDES) general construction permit that would require Control Measures (CMs) to minimize possible impacts from erosion or other nonpoint source pollutants. Permanent erosion control measures will not be required since disturbed areas will be returned to mimic pre-existing vegetation patterns.

Prevention of erosion and sedimentation is an important part of the construction process. As a component of the Colorado Department of Public Health and Environment (CDPHE) General Permit, the applicant and its sub-contractors will draft a site-specific SWMP providing comprehensive information about stormwater pollution prevention practices during construction. The SWMP will identify potential sources of pollution associated with the proposed Project that may contribute pollutants to stormwater. Additionally, the SWMP will identify and describe control measures that will reduce or eliminate any possible water quality impacts when implemented.

The SWMP typically includes the following:

- A description of the site and the nature of the construction activity. The proposed sequence, estimates of disturbance areas, and names of receiving water(s) will also be included.
- A site map identifying items such as construction site boundaries and activities, locations of all best management practices (BMPs), and locations of springs, streams, wetlands or other surface waters.
- Identification of potential pollutant sources, and stormwater management controls to address pollutants including structural and non-structural BMPs. Information for BMP implementation, stabilization practices, as well as materials handling and spill prevention will also be included.
- Inspection schedules and BMP maintenance procedures.

A Spill Prevention, Control, and Countermeasure (SPCC) plan will also be prepared to provide measures for the prevention and mitigation of inadvertent releases of petroleum products. No petroleum products or hazardous materials will be stored within 50 horizontal feet of identified waters.

### **Potential Pollution Sources of Stormwater and Anticipated Control Measures**

Pipeline construction will consist of the following steps:

- 1) Remove and stockpile topsoil
- 2) Remove and stockpile subsoil separately from topsoil to depth needed for pipeline placement (typically 8-12 feet)
- 3) Place bedding material and pipeline in trench
- 4) Replace subsoil then topsoil
- 5) Reclaim area to pre-existing conditions

The conveyance system will be constructed to minimize temporary impacts. No permanent impacts to wetlands or open waters will occur in unincorporated Larimer County from construction of the conveyance system. The Poudre River Intake pump station will create a small area of impervious surface adjacent to an open water.

A collection of BMP details from Dewberry for wetland and stream crossings that will be used during construction is attached. In addition to those BMPs, the following includes a list of potential sources of pollution of stormwater that may occur during construction as well as suggested control measures that may be used by the contractor.

Refer to the construction BMP fact sheets in the Urban Drainage Stormwater Criteria Manual Volume 3 for more details on any of the BMPs below (UDSCM, 2019).

- a. **Disturbed and Stored Soils** – Soils may be disturbed during removal of existing vegetation and excavation. Stockpiles of topsoil and other construction materials may be kept on-site during

construction. These materials may erode during precipitation events. Movement of disturbed soils or erosion of stockpiles off-site may be prevented using silt fence, erosion control logs, rock socks, and/or similar control measures.

- b. **Water Body Crossings** – Soils may be disturbed during removal of existing vegetation and excavation for the pipe installation at crossings of rivers, streams, canals, and ditches as well as adjacent to reservoirs and lakes. As discussed above soils may erode. Excavation may impact environmental resources in these areas. These resources may be protected with the minimization of soil disturbance and the use of control measures including plastic fencing, silt fence, erosion control logs, and/or rock socks. Clean water diversions may be used at crossings with flowing water. Ditch and canal crossings may be coordinated with the appropriate ditch company to avoid and minimize impact.
- c. **Vehicle Tracking of Sediments** – Vehicles traveling over disturbed soils on-site may track sediments off-site. Use of vehicle tracking controls may be required to prevent tracking of sediments off-site. Furthermore, dust suppression via spraying may be used on haul roads.
- d. **Management of Contaminated Soils** – Contaminated soils are not anticipated to be encountered during construction. If contaminated soils are encountered a materials management plan may be needed.
- e. **Loading and Unloading Operations** – Loading and unloading may consist of several erodible materials (e.g. topsoil, fill soils). Dust suppression via water spraying may be used on haul roads.
- f. **Outdoor Storage Activities** – Outdoor storage of equipment and construction materials may occur throughout the Project. When a risk of contaminating soils exists, these materials may be stored under cover (e.g. within metal containment structures). Stockpiles may be controlled as discussed above.
- g. **Vehicle and Equipment Maintenance and Fueling** – vehicle maintenance and fueling operations may be controlled through good housekeeping and by following the directions in the SPCC for any spills. Spill kits may be available in maintenance and fueling areas. On-site tanks may be managed via direction in the SPCC.
- h. **Significant Dust or Particle Generating Processes (E.G. Saw Cutting)** – Dust and particle generating processes may be controlled via water sprays and/or by limiting cutting to low-wind days. Water used for dust suppression may not exceed State groundwater standards in Regulations 5 CCR 1002-41 and 42.
- i. **Routine Maintenance Activities Involving Fertilizers, Pesticides, Herbicides, Detergents, Fuels, Solvents, Oils, Etc.** – Vehicle and equipment maintenance controls are described above. Other chemicals, if used, may be used according to their printed instructions. All chemicals on-site may have Safety Data Sheets (SDS) on file in the Project office. SDSs may include instructions on handling accidental exposure. Spills of these materials may be immediately controlled via spill kits.
- j. **On-Site Waste Management Practices (Waste Piles, Liquid Wastes, Dumpsters)** – Waste areas may be designated in the SWMP. Waste may be handled according to good housekeeping practices outlined in the SWMP.
- k. **Concrete Truck/Equipment Washing, Including Washing of The Concrete Truck Chute and Associated Fixtures and Equipment** – Concrete truck washing may be handled according to instructions in the SWMP. Vehicle and equipment washing may be minimized on-site. Washing areas may be contained so that contaminated wash-water cannot leave the site and is properly captured and treated prior to disposal.
- l. **Dedicated Asphalt, Concrete Batch Plants and Masonry Mixing Stations** – Dedicated asphalt or concrete plants are not anticipated. If required, they may have separate stormwater permits and SWMPs to govern their pollution sources and control measures.
- m. **Non-Industrial Waste Sources Such as Worker Trash and Portable Toilets** – Worker trash may be managed via good housekeeping practices as outlined in the SWMP. Portable toilets may be staked or held down by weights or trailers to prevent tipping. Additional details may be discussed as needed in the SWMP.
- n. **Other Good Housekeeping Measures** – Adequate care may be taken by all contractors to prevent contamination of groundwater. Pouring of any wash water, solvent, or wastewater onto the ground

would be prohibited. All waste materials may be sent for off-site disposal. All spills shall be cleaned up immediately and placed in suitable containers. Any contaminated soil or other media may also be containerized for disposal.

### **Commitments to Match Pre-Existing Vegetation through Proper Re-Grading and Revegetation**

As discussed above, post-construction vegetation of disturbed areas will be designed and installed to match pre-existing vegetation conditions. Post-construction grading of disturbed soils will be done to mimic pre-existing topography. Permanent stormwater controls for flooding or water quality are not needed given that the Project site surface condition will be restored to pre-construction conditions. No increase in stormwater runoff is anticipated post construction.

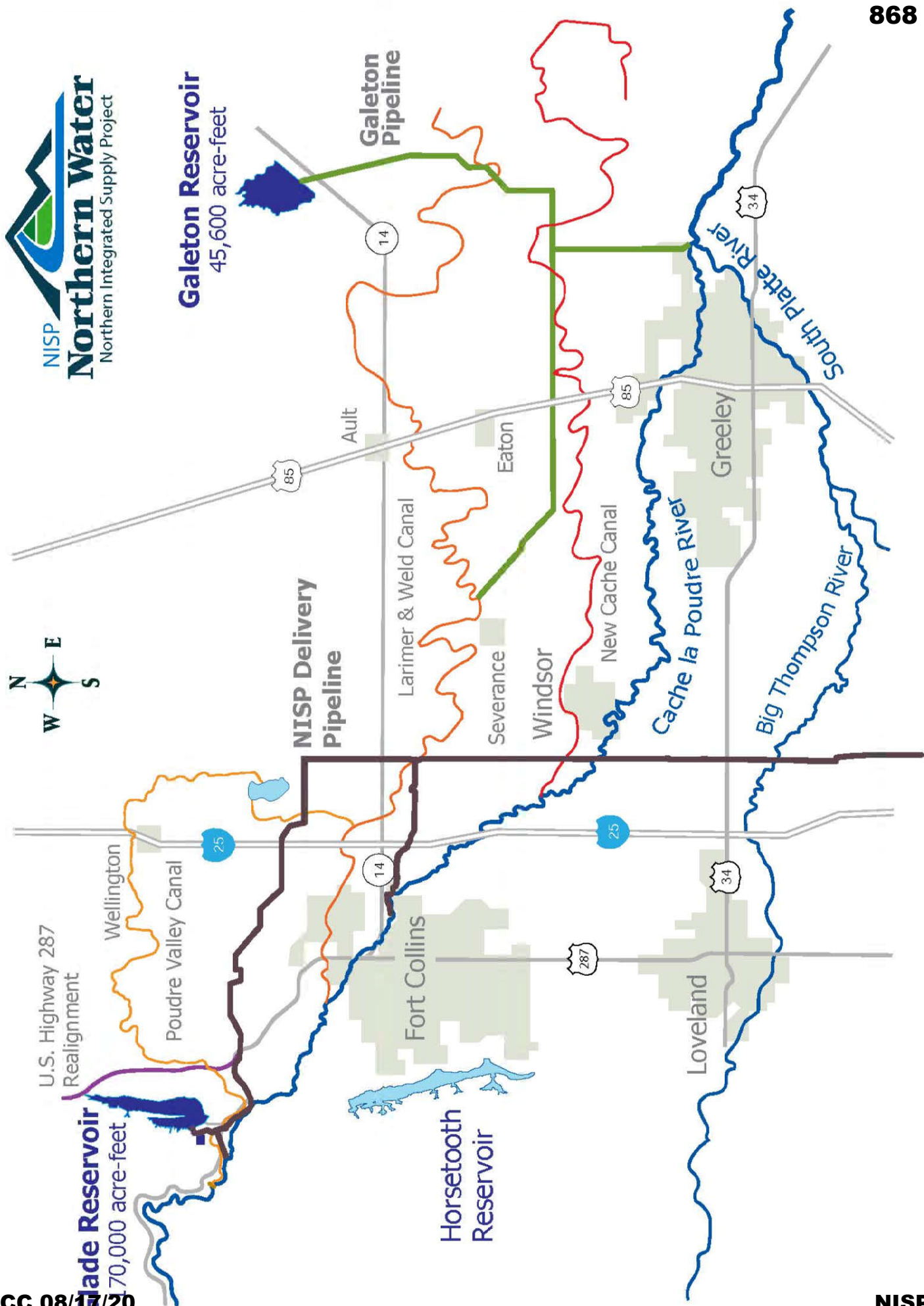
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- Larimer County, 2019. Larimer County Code of Ordinances, Land Use Code, 14.9 1041 Permit Application and Review Process. Online content updated on October 15, 2019. Available at: [https://library.municode.com/co/larimer\\_county/codes/code\\_of\\_ordinances?nodeId=PTIILAUSCO\\_14.0ARACSTIN\\_14.91041PEAPREPR](https://library.municode.com/co/larimer_county/codes/code_of_ordinances?nodeId=PTIILAUSCO_14.0ARACSTIN_14.91041PEAPREPR). Accessed December 2019.
- UDSCM, 2019. Urban Drainage Stormwater Criteria Manual, Volume 3. Prepared by the Mile High Flood District. Online content updated October 2019. Available at: <https://udfcd.org/volume-three>.

### **Attachments**

- Figure 1. Project Location
- Figure 2. Northern Tier Alignment
- Figure 3. Poudre Intake Alignment
- Figure 4. County Line Alignment
- Figure 5. Glade Release Alignment
- Dewberry Typical Wetland Crossing and Stream Crossing Details

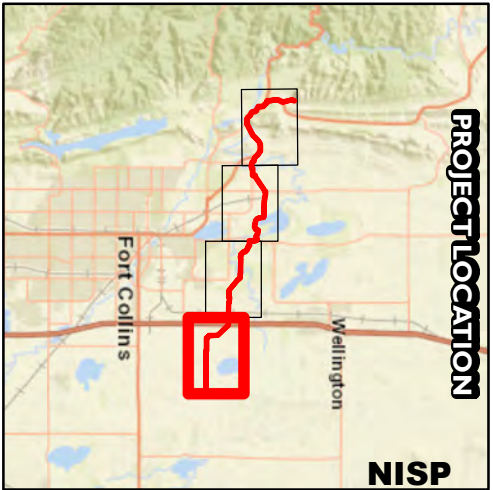
## Figure I. Project Location





## Figure 2. Northern Tier Alignment





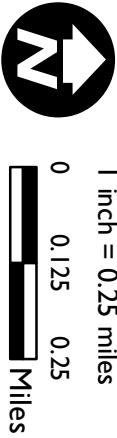
## Legend

- NISP Conveyance – Northern Tier Temporary Impact Area
- Incorporated Larimer County and/or Weld County\*
- Open Waters
- Wetland
- Major Stream/Ditch
- Minor Stream/Ditch

Note  
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Wetland and Open Water boundaries have been exaggerated for visual purposes.

\*All non-hatched areas are Unincorporated Larimer County

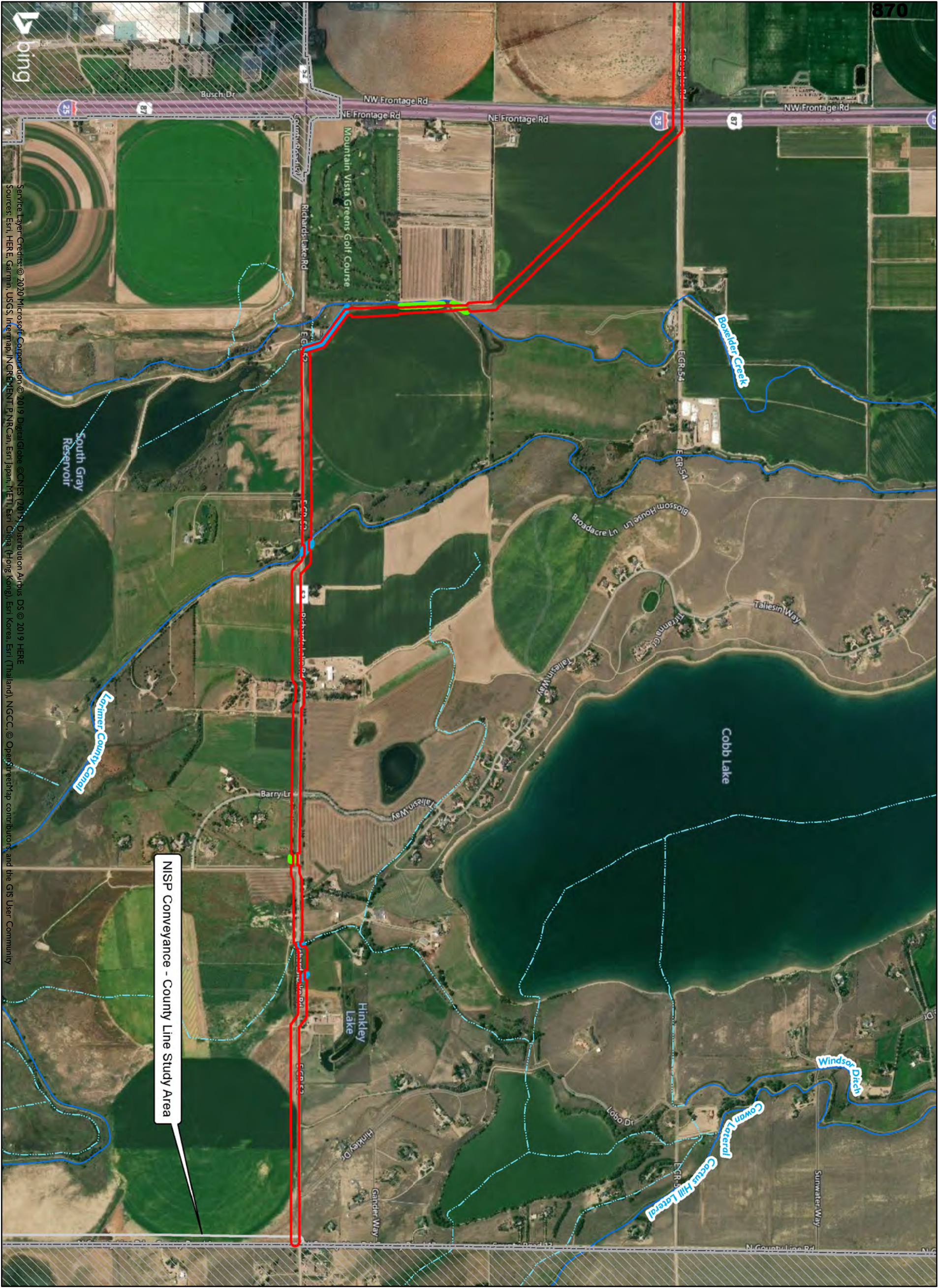
Wetlands Data Sources: ERO 2019 and 2016;  
AECOM 2018; Pinyon 2019



**NISP CONVEYANCE - NORTHERN TIER  
ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Drawn By: MJS      Figure 2, Page 1 of 4

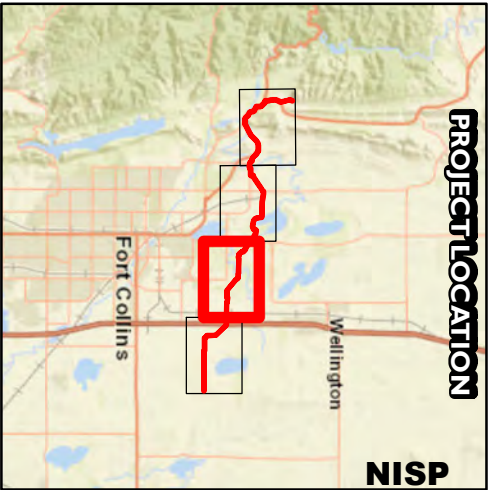
Reviewed By: KKM      Date: 1/23/2020



Site Location: Larimer County, Colorado

Pinyon Project Number: 11881402





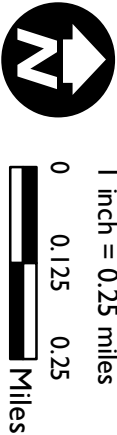
## Legend

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Wetlands Data Sources: ERO 2019 and 2016;  
AECOM 2018; Pinyon 2019



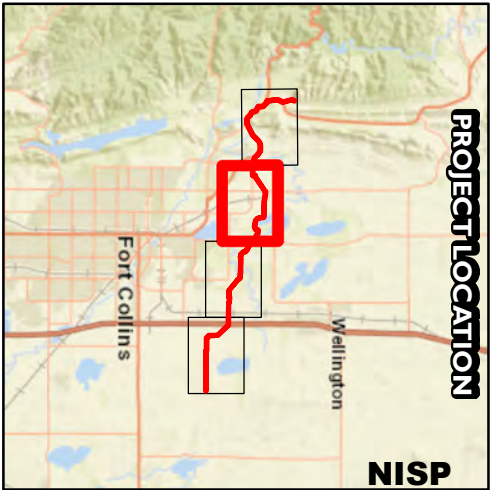
**NISP CONVEYANCE - NORTHERN TIER  
ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado



Site Location: Larimer County, Colorado

Pinyon Project Number: 11881402





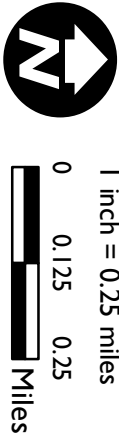
## Legend

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Wetlands Data Sources: ERO 2019 and 2016;  
AECOM 2018; Pinyon 2019



**NISP CONVEYANCE - NORTHERN TIER  
ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Drawn By: MJS      Figure 2, Page 3 of 4

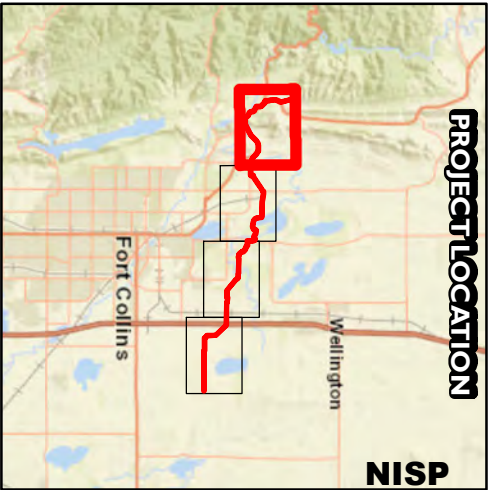
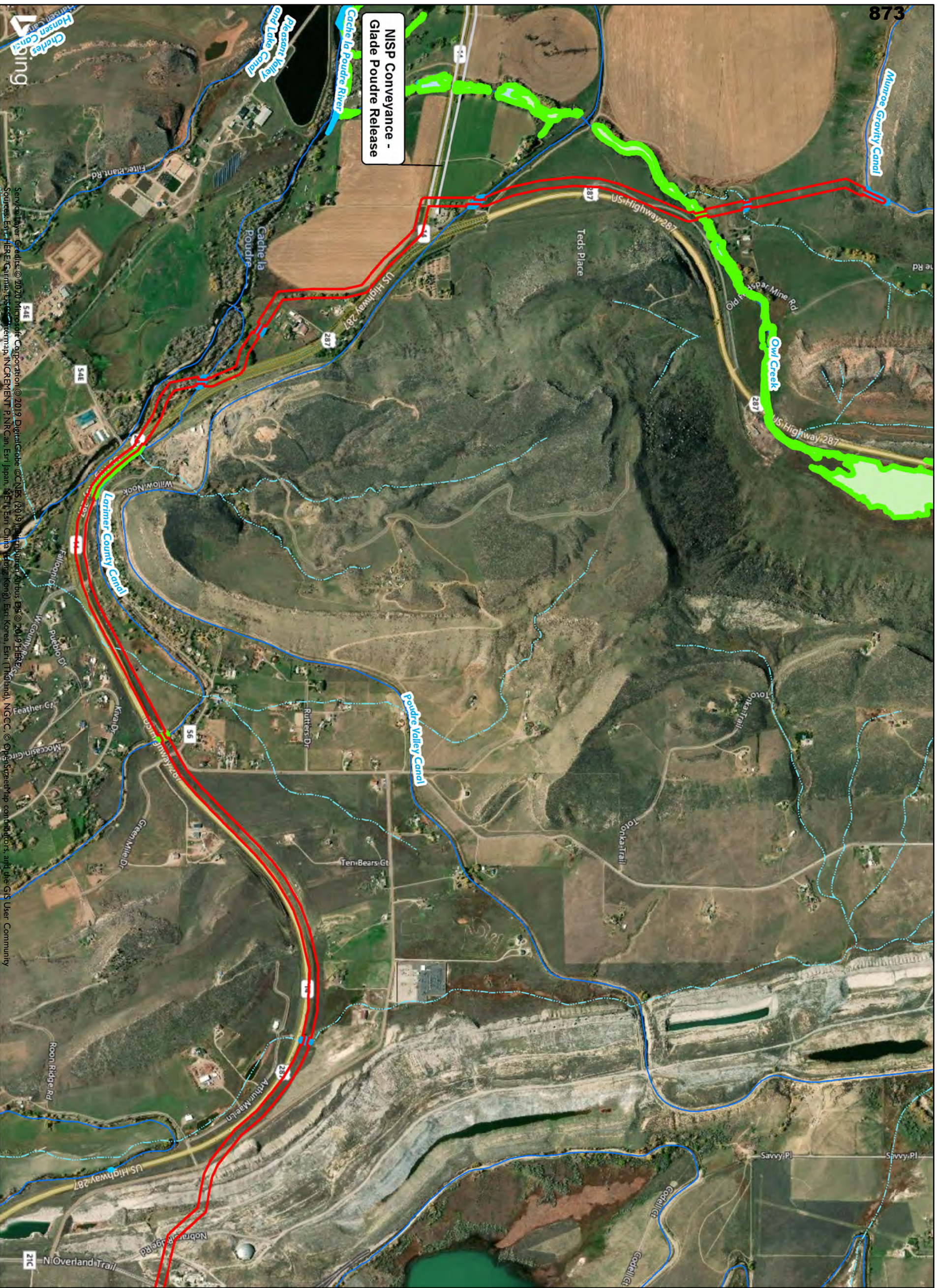
Reviewed By: KKM      Date: 1/23/2020









Site Location: Larimer County, Colorado

Pinyon Project Number: 11881402





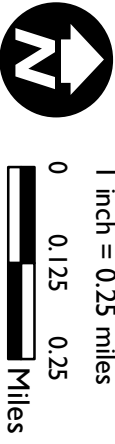
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|  | Incorporated Larimer County<br>and/or Weld County*       |
|  | Open Waters  |
|  | Wetland  |
|   | Major Stream/Ditch                                       |
|    | Minor Stream/Ditch                                       |

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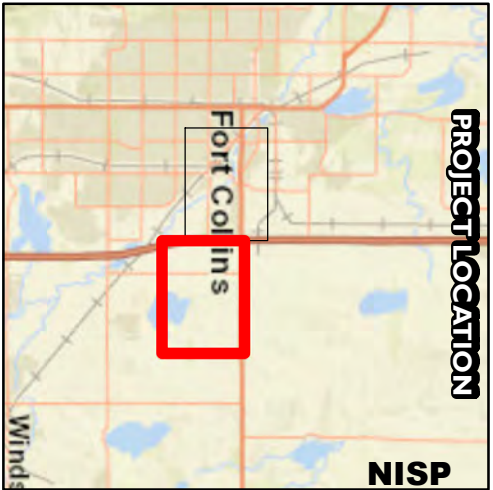
Wetlands Data Sources: ERO 2019 and 2016;  
AECOM 2018; Pinyon 2019





**Figure 3. Poudre Intake Alignment**





## Legend

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- NISP Conveyance – Poudre Intake Temporary Impact Area
- Incorporated Larimer County and/or Weld County\*

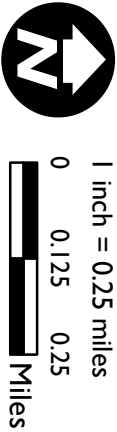
- Open Waters
- Wetland

- Major Stream/Ditch
- Minor Stream/Ditch

Note  
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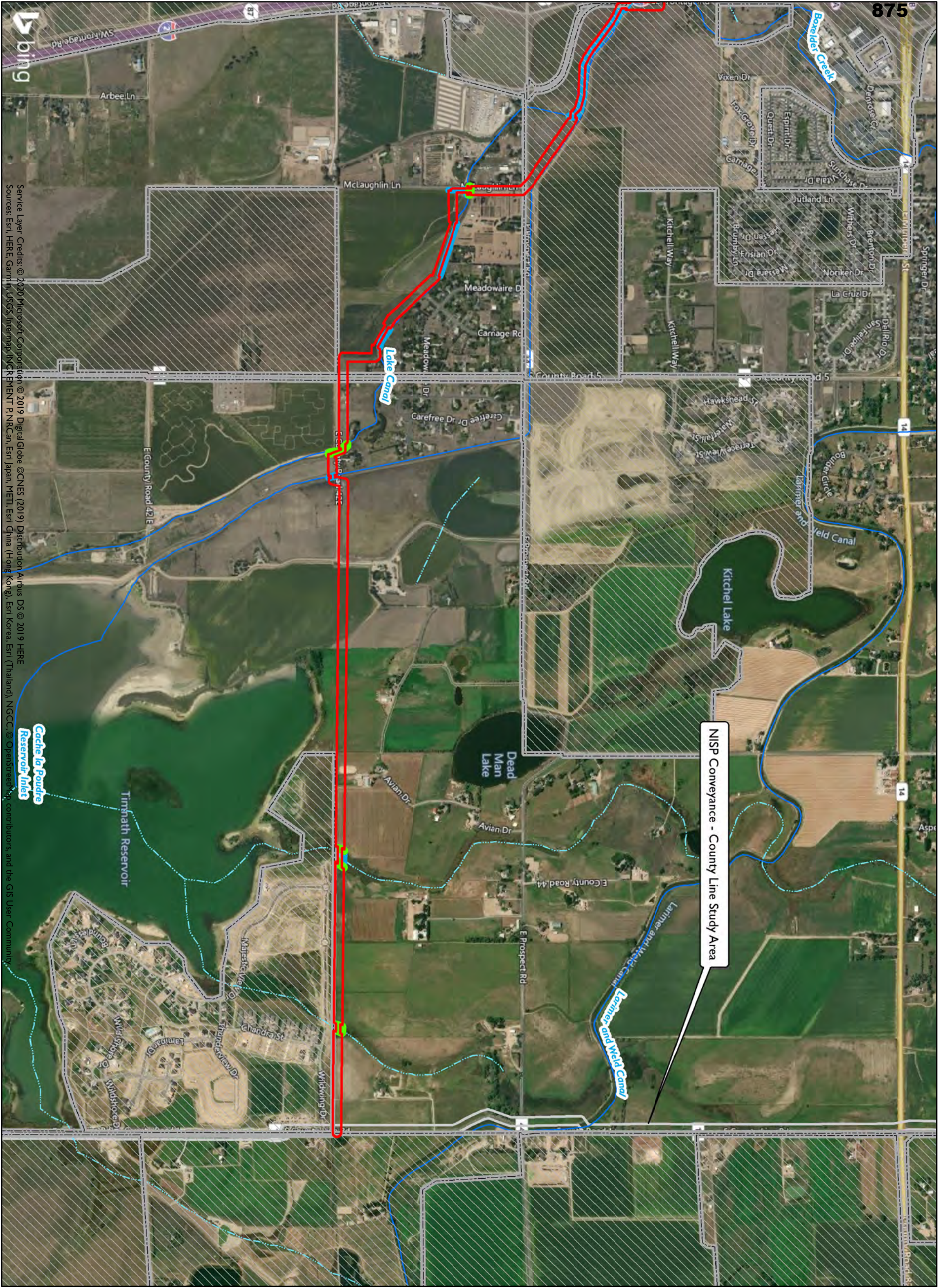
Wetland Data Source: Pinyon 2019



**NISP CONVEYANCE - POUDRE INTAKE ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Drawn By: MS  
Reviewed By: KKM

Figure 3: Page 1 of 2  
Date: 1/23/2020

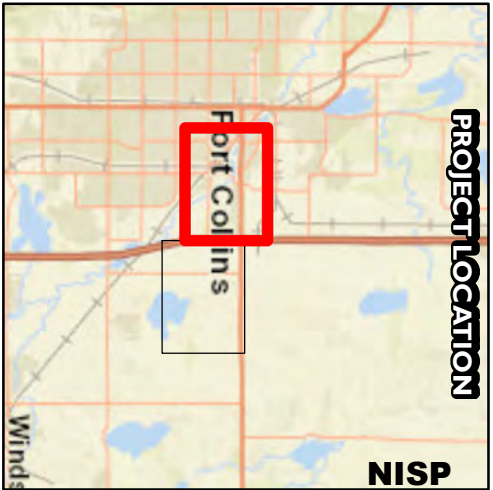


NISP Conveyance - County Line Study Area

Site Location: Larimer County, Colorado

Pinyon Project Number: 11881402





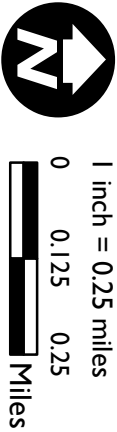
## Legend

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Wetland Data Source: Pinyon 2019

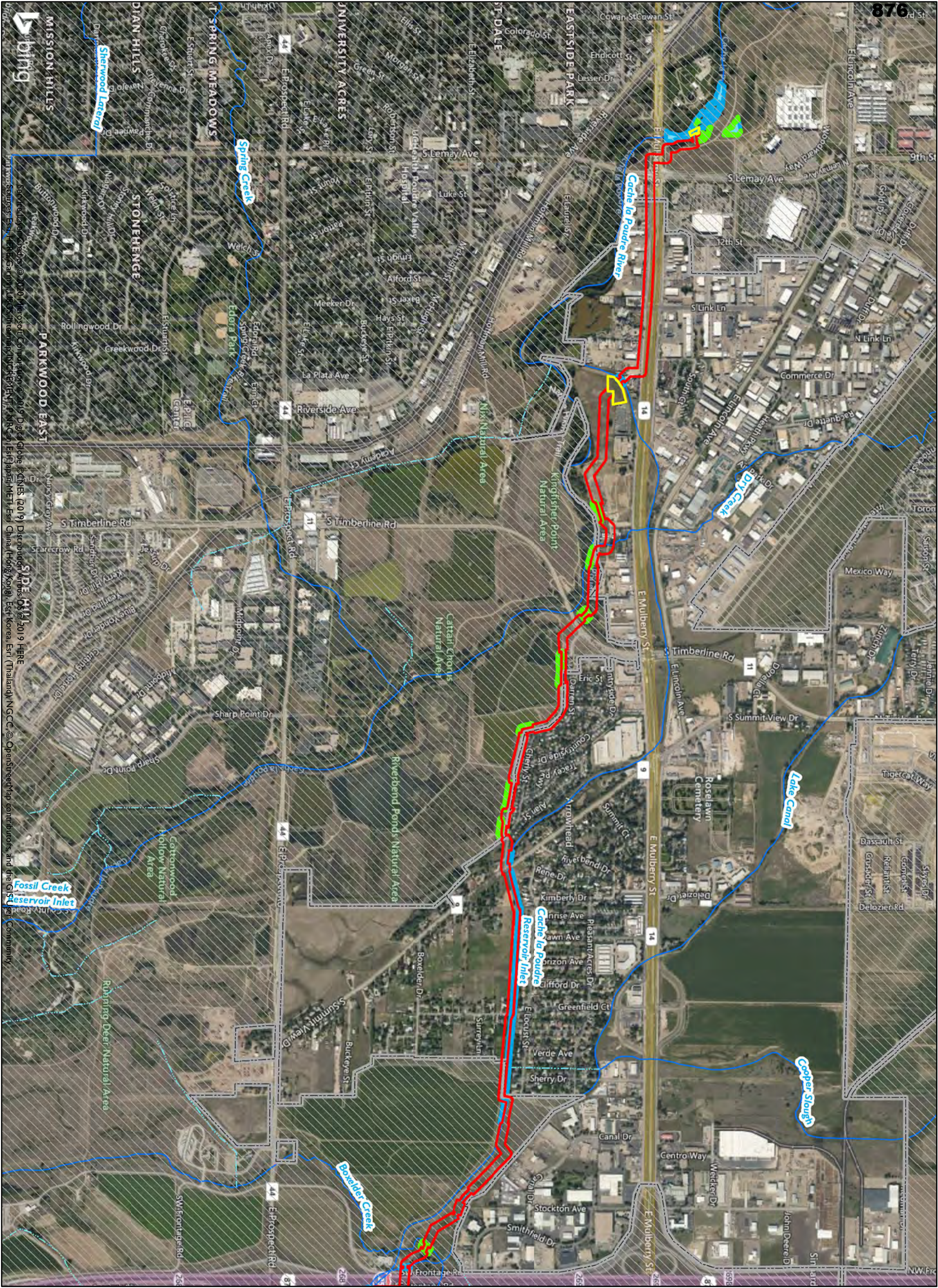


**NISP CONVEYANCE - POUDRE INTAKE  
ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Drawn By: MJS  
Reviewed By: KKM

Figure 3: Page 2 of 2

BCC 08/11/20



Site Location: Larimer County, Colorado

Pinyon Project Number: 11881402

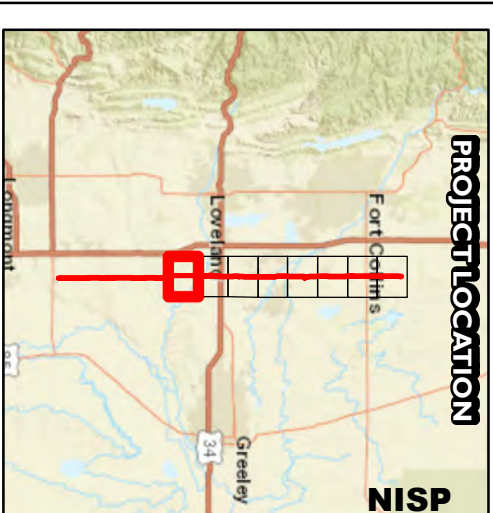








## Figure 4. County Line Alignment



Reviewed By: KKM	Date: 1/23/2020
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Drawn By: MJS Figure 4; Page 1 of 8

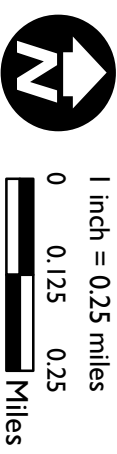


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|---|--|
|  | NISP Conveyance – County Line<br>Temporary Impact Area |
|  | Incorporated Larimer County<br>and/or Weld County*     |
|  | Open Waters  |
|  | Wetland  |
|   | Major Stream/Ditch                                     |
|    | Minor Stream/Ditch                                     |

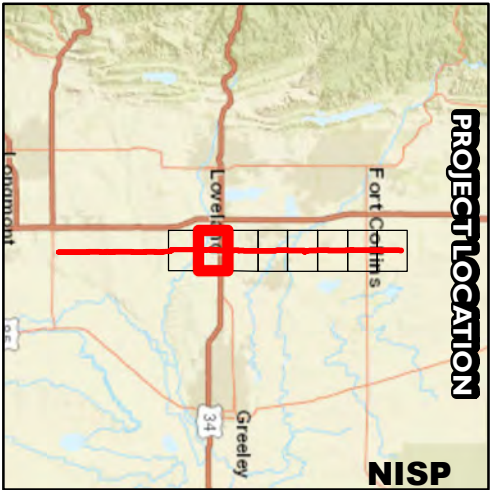
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Wetland Data Source: Pinyon 2019







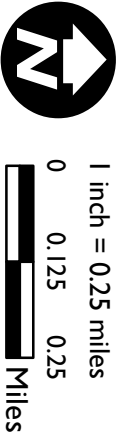
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- Minor Stream/Ditch

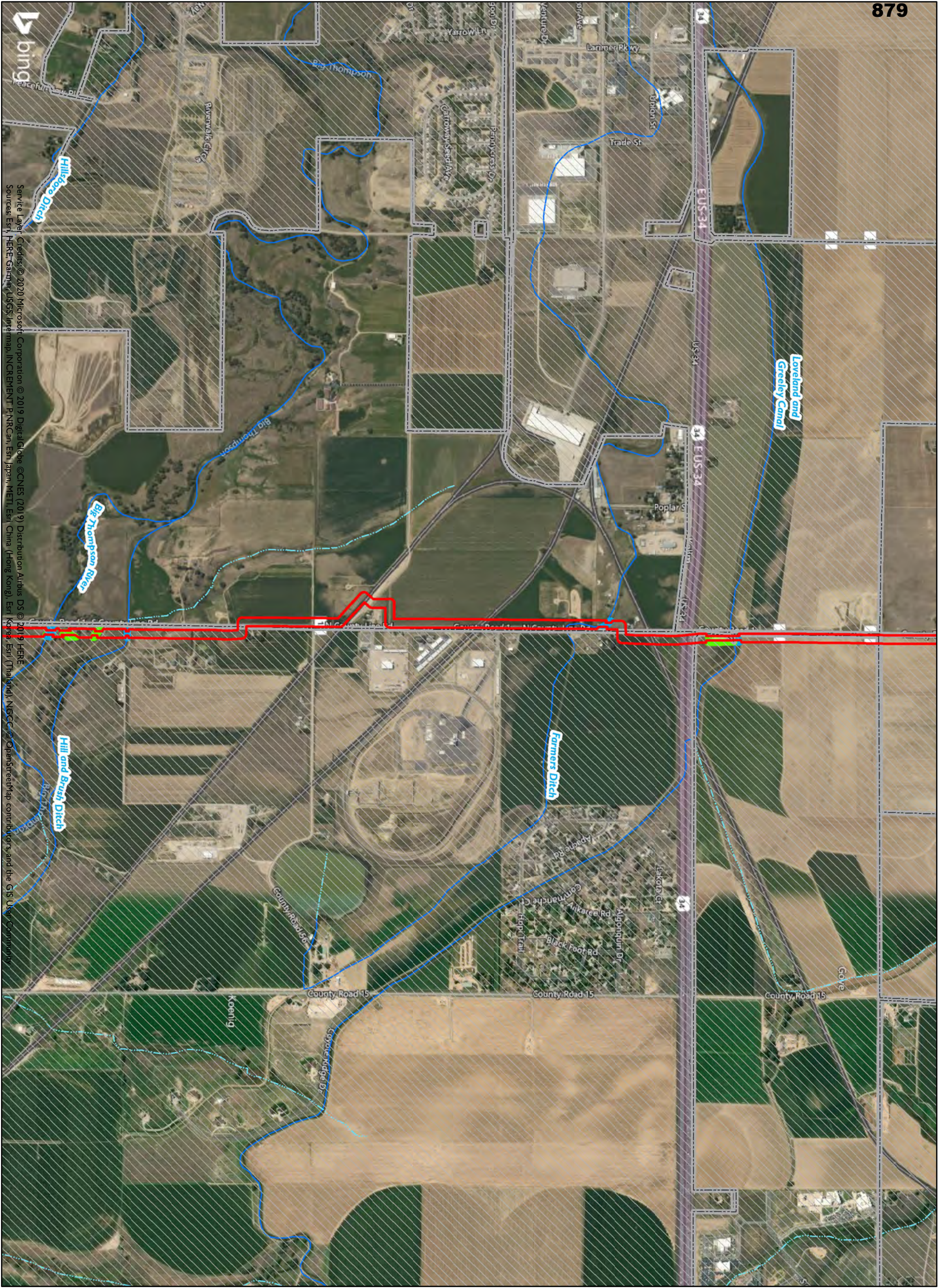
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Wetland Data Source: Pinyon 2019



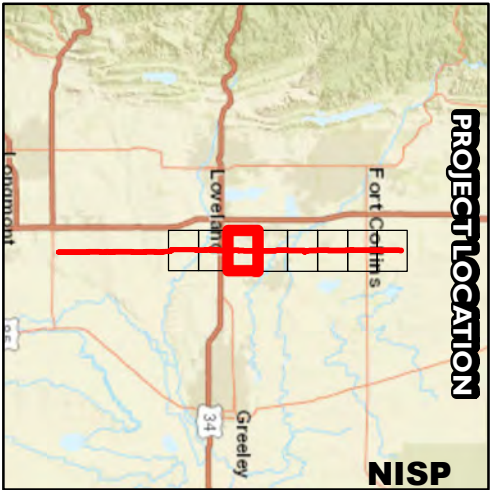
**NISP CONVEYANCE - COUNTY LINE ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado



Site Location: Larimer and Weld Counties, Colorado

Pinyon Project Number: I 1881402





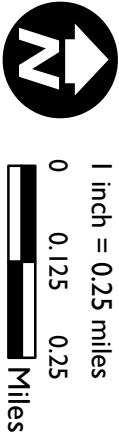
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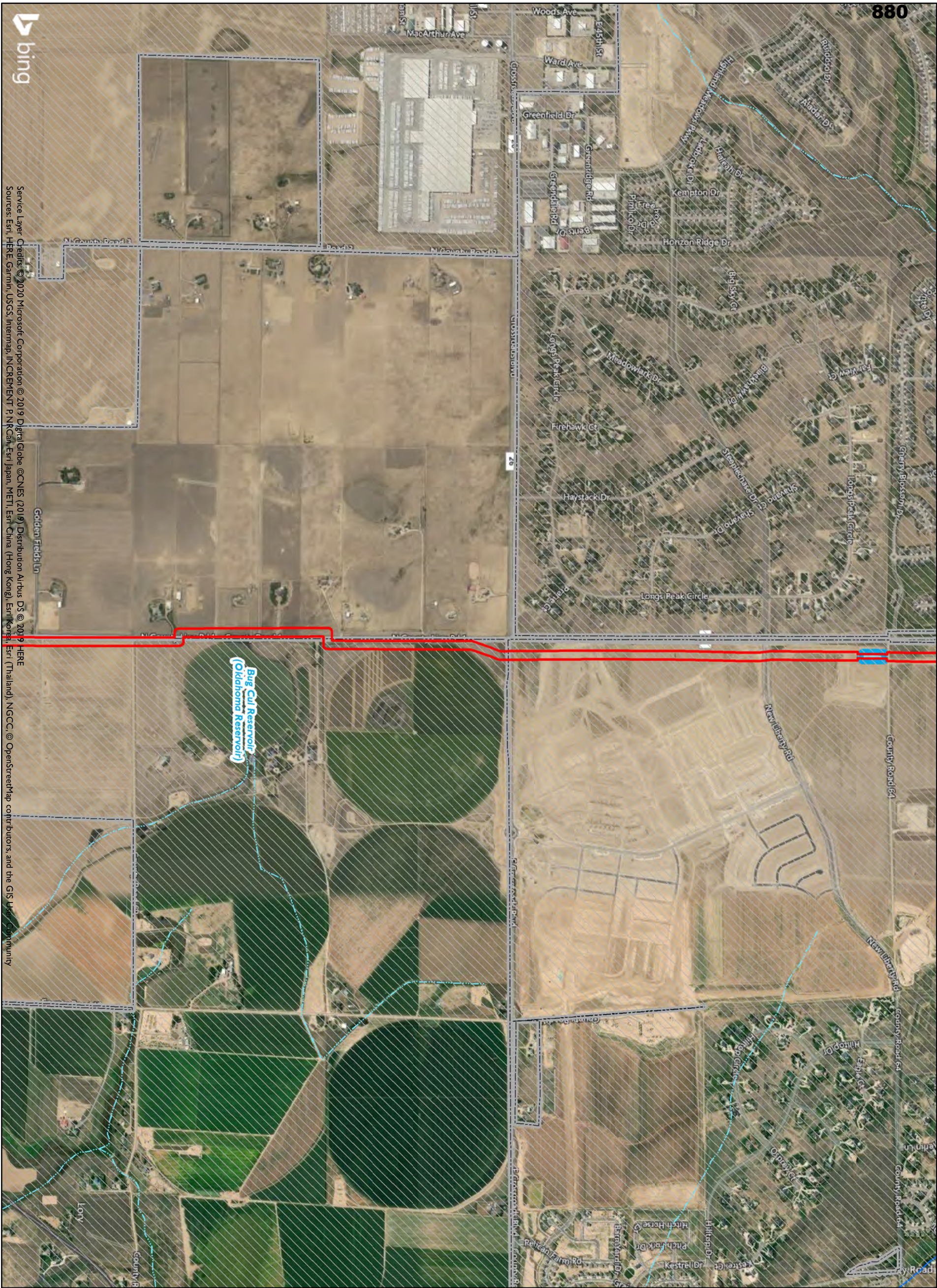
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Wetland Data Source: Pinyon 2019



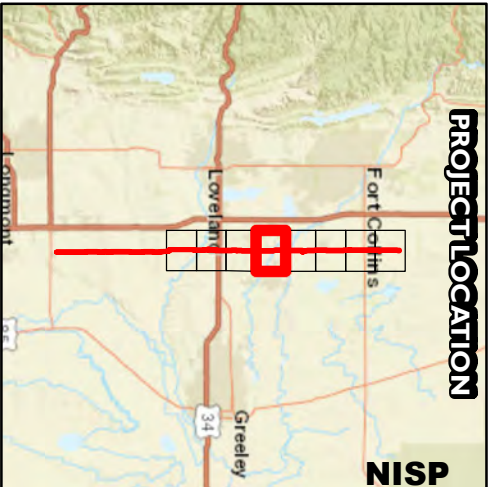
**NISP CONVEYANCE - COUNTY LINE ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado



Site Location: Larimer and Weld Counties, Colorado

Pinyon Project Number: I 1881402





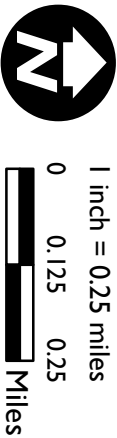
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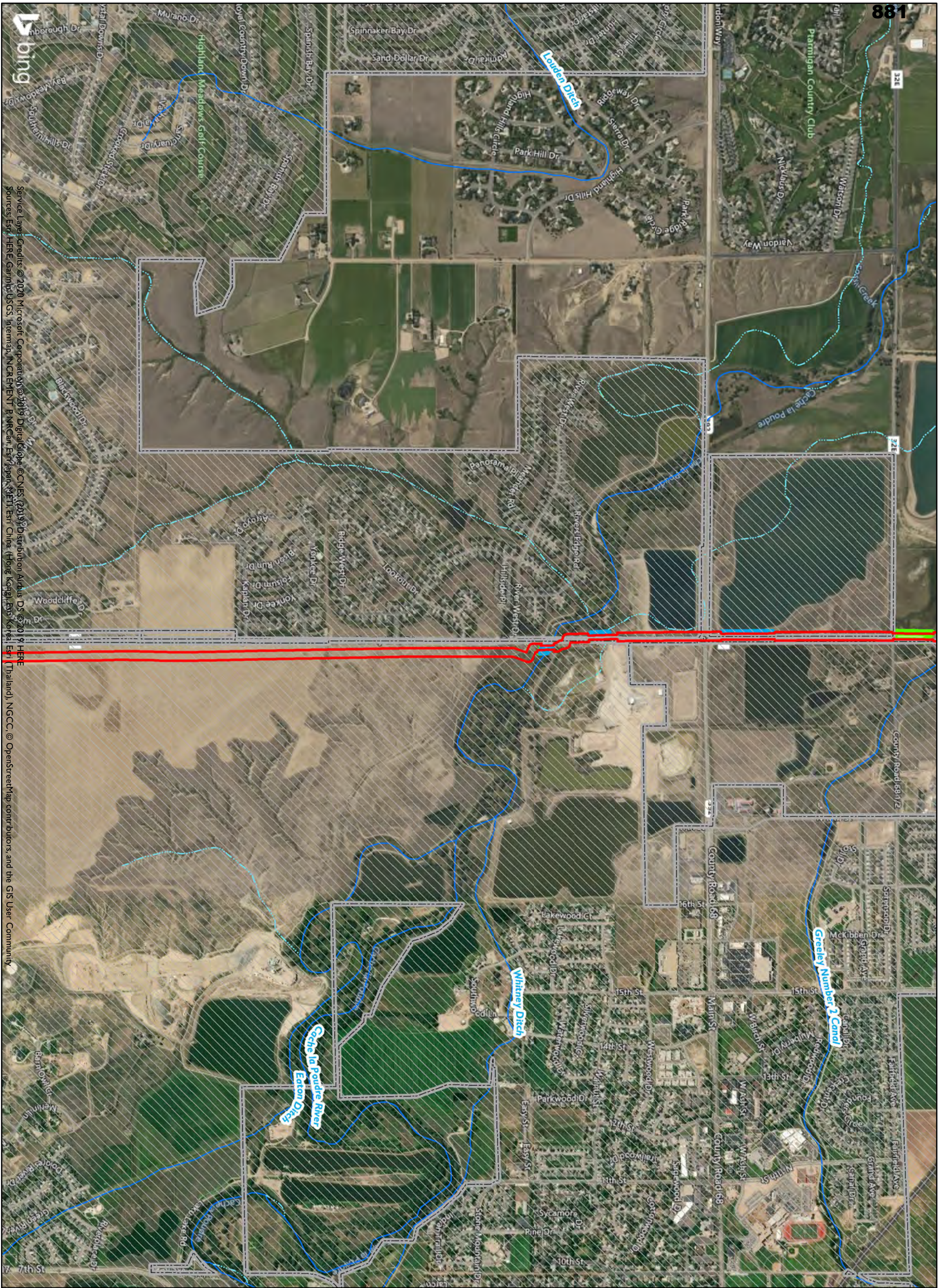
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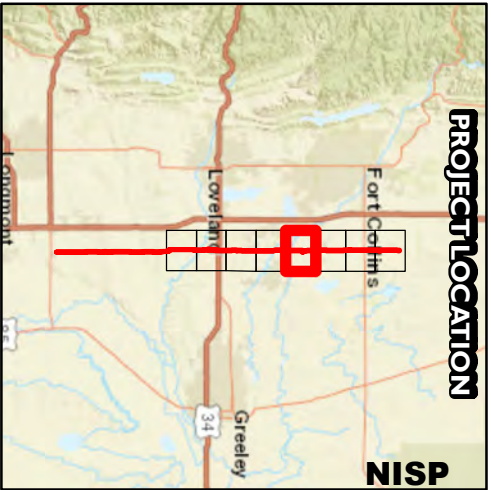
**NISP CONVEYANCE - COUNTY LINE ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado



Site Location: Larimer and Weld Counties, Colorado

Pinyon Project Number: I 1881402





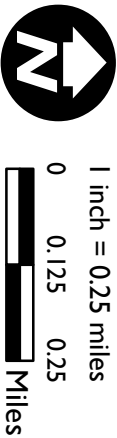
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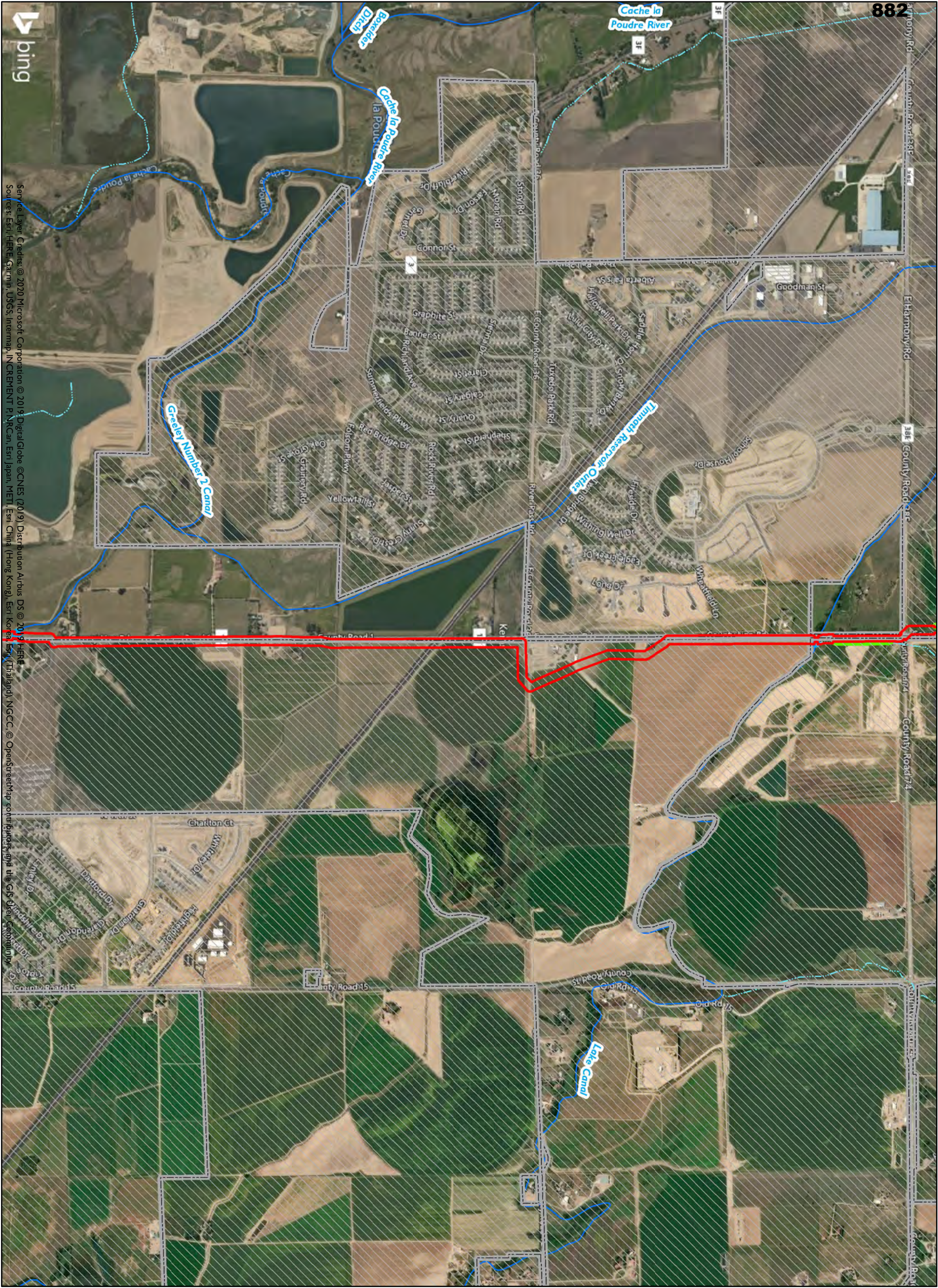
Wetland Data Source: Pinyon 2019



**NISP CONVEYANCE - COUNTY LINE ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Drawn By: MJS      Figure 4, Page 5 of 8

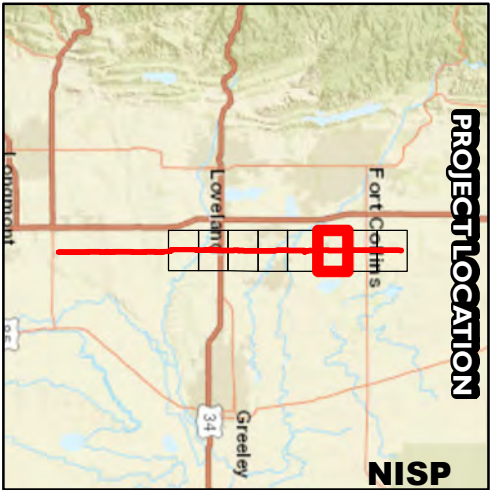
Reviewed By: KKM      Date: 1/23/2020



Site Location: Larimer and Weld Counties, Colorado

Pinyon Project Number: I 1881402





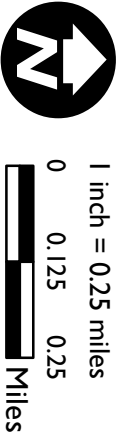
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Wetland Data Source: Pinyon 2019



**NISP CONVEYANCE - COUNTY LINE ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Site Location: Larimer and Weld Counties, Colorado

Pinyon Project Number: I 1881402

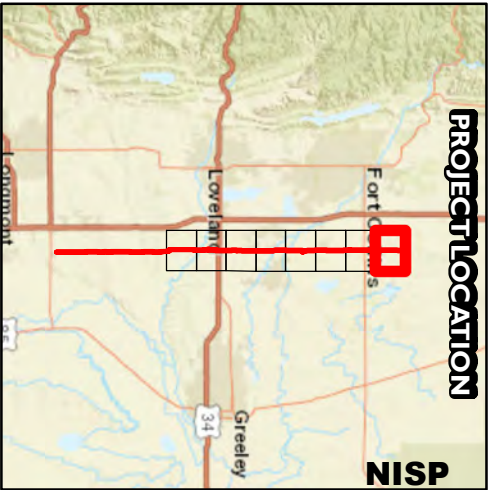


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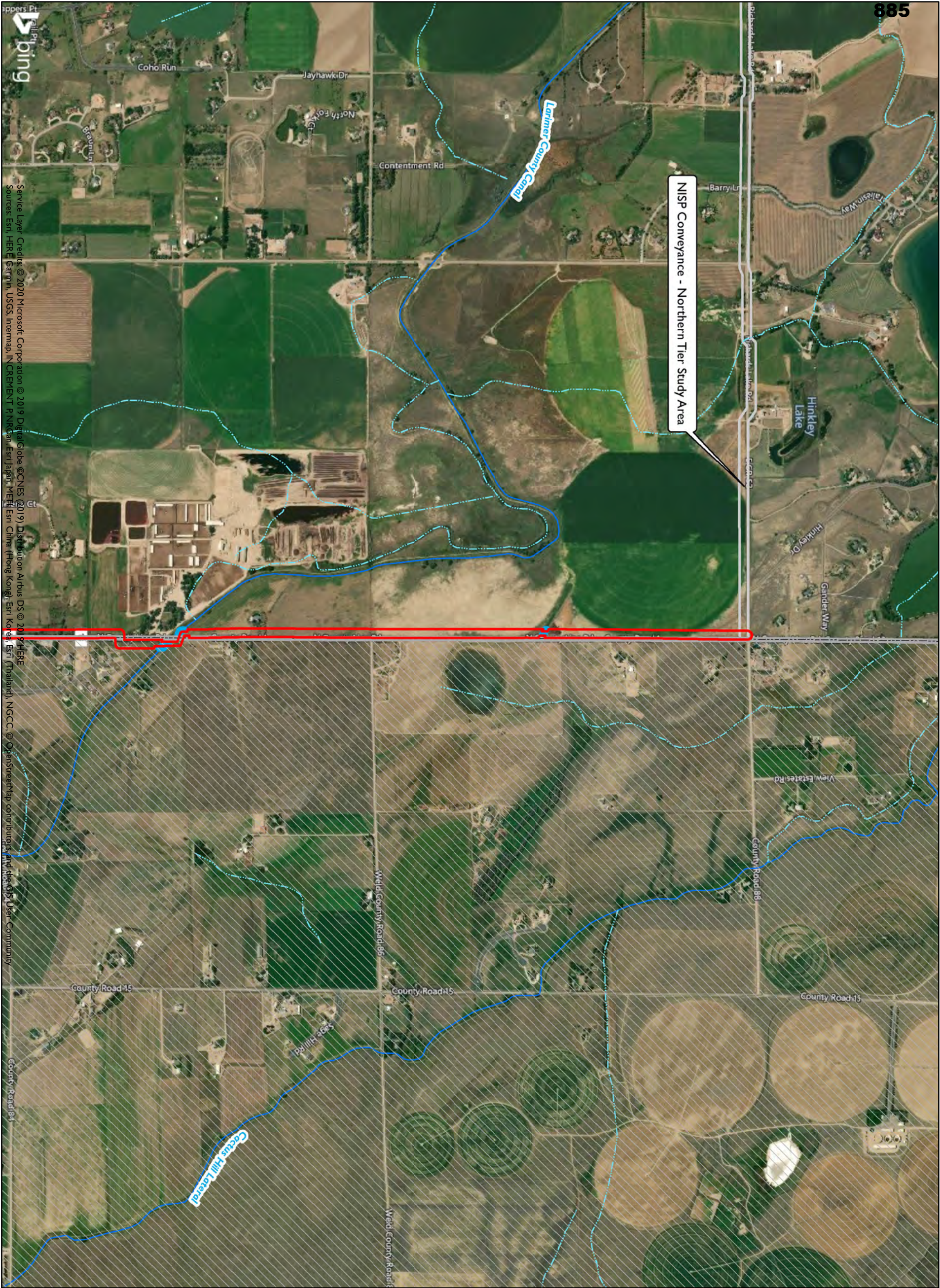
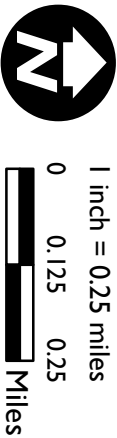
**Legend**

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Wetland Data Source: Pinyon 2019



Site Location: Larimer and Weld Counties, Colorado

Pinyon Project Number: I 1881402

**NISP CONVEYANCE - COUNTY LINE ALIGNMENT WATER RESOURCES**

Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

Drawn By: MJS      Figure 4, Page 8 of 8  
Reviewed By: KKM      Date: 1/23/2020

BCC 08/17/20



## Figure 5. Glade Release Alignment





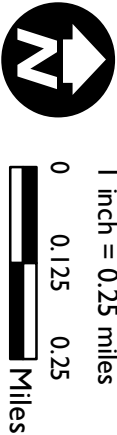
## Legend

- NISP Conveyance - Glade Release Temporary Impact Area
- NISP Conveyance - Glade Release Permanent Impact Area
- Open Waters
- Wetland
- Major Stream/Ditch
- Minor Stream/Ditch

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Wetlands Data Sources: ERO 2019 and 2016;  
AECOM 2018; Pinyon 2019



**NISP CONVEYANCE - GLADE RELEASE  
ALIGNMENT WATER RESOURCES**  
Northern Integrated Supply Project  
Larimer and Weld Counties, Colorado

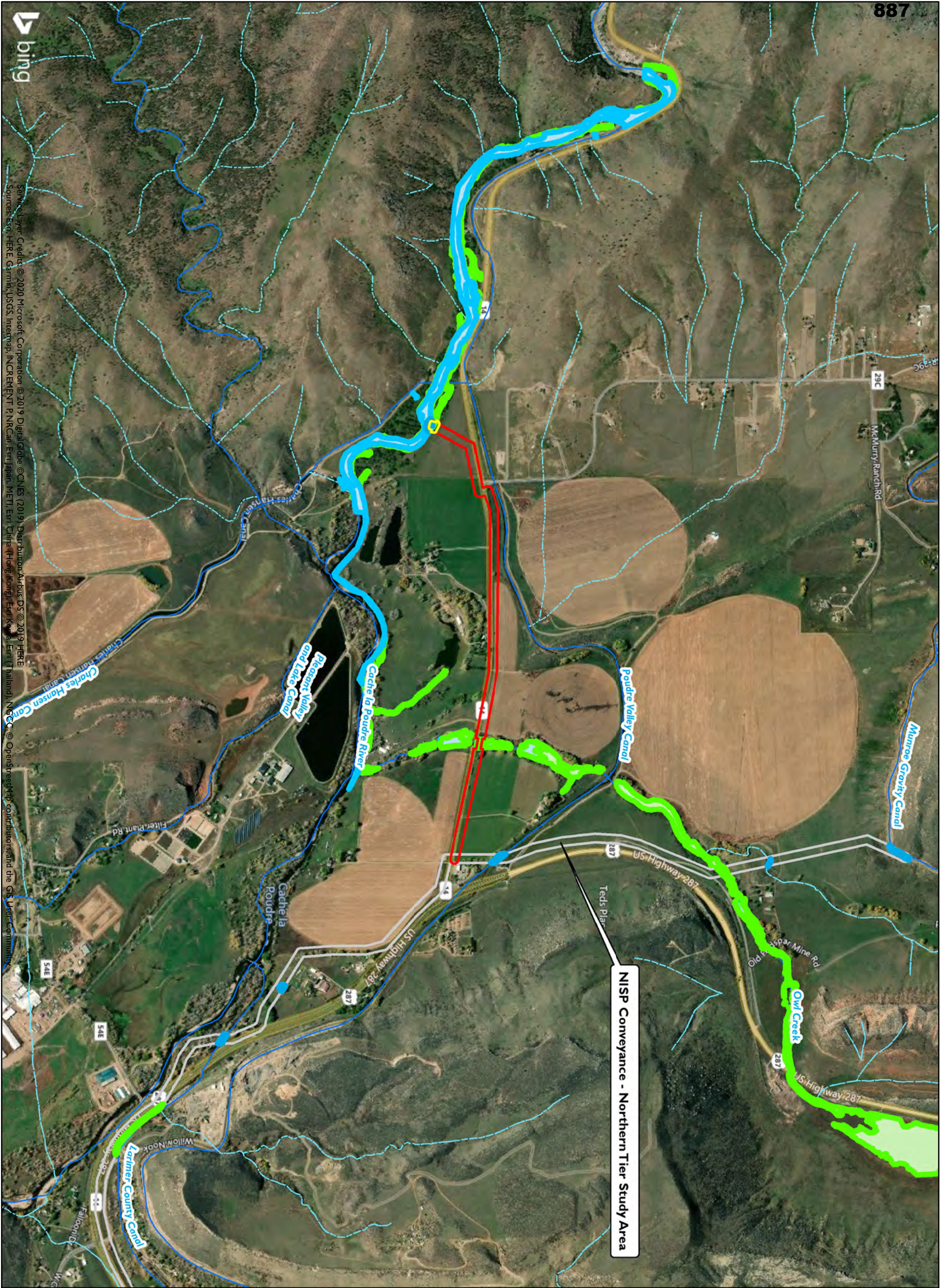
Drawn By: MJS

Figure 5

Reviewed By: KKM

Date: 1/23/2020

**BCC 08/17/20**



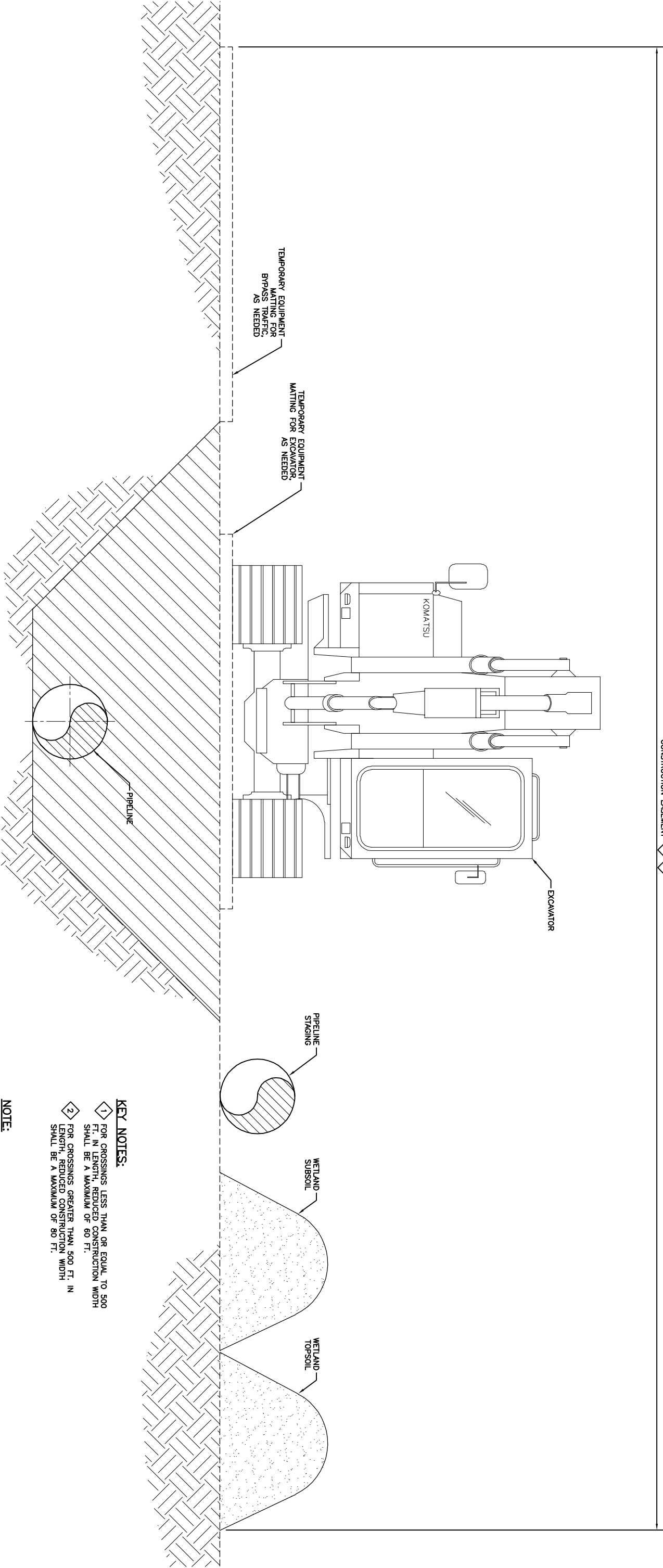
Site Location: Larimer County, Colorado

Pinyon Project Number: I 1881402

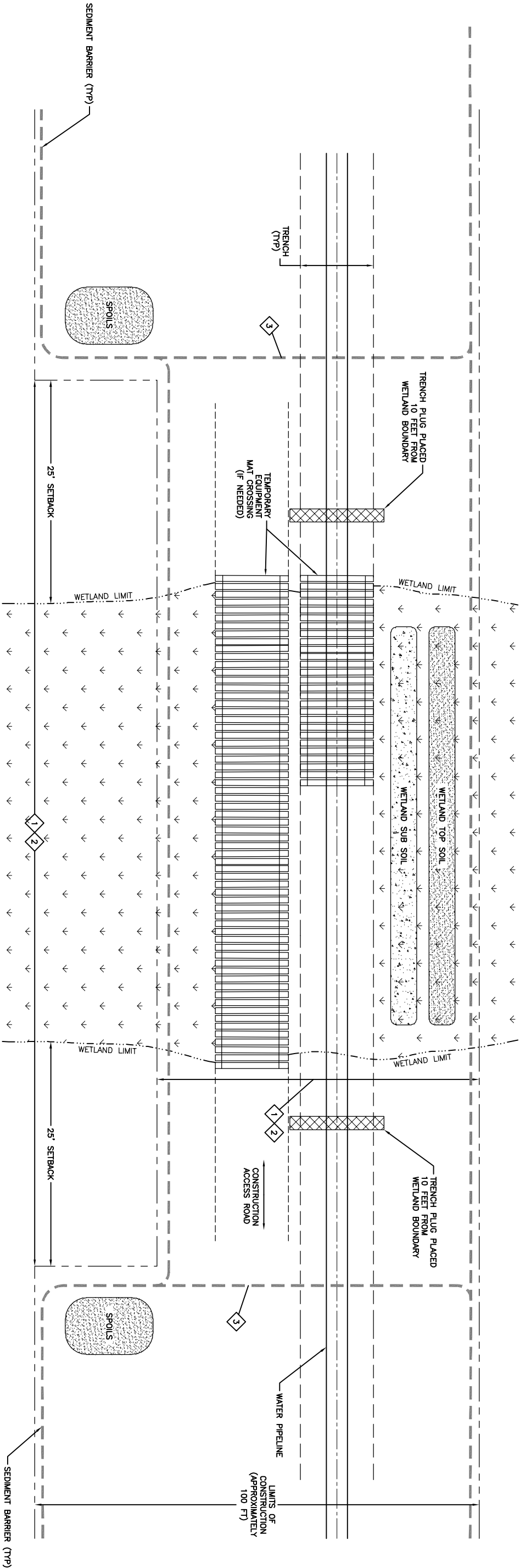


## Dewberry Typical Wetland Crossing and Stream Crossing Details

CONSTRUCTION EASEMENT 1 2

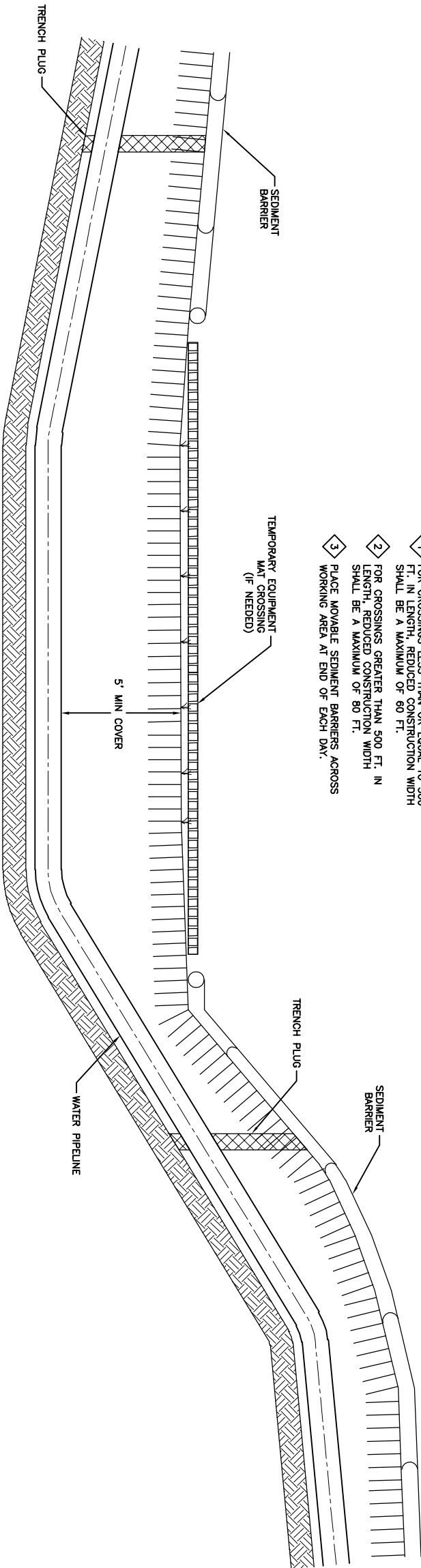


RESTRICTED CONSTRUCTION CORRIDOR  
NOT TO SCALE



**EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES**

1. MARK THE LIMITS OF THE WETLAND WITH HIGH VISIBILITY FLAGGING. LIMITS OF CONSTRUCTION FENCING AND ALL INITIAL EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO GROUND DISTURBANCE AT ALL WETLAND CROSSINGS.
2. INSTALL DELINEATION FENCE BETWEEN LIMITS OF DISTURBANCE (LOD) AND ADJACENT WETLANDS.
3. STABILIZE CONSTRUCTION ACCESS ROAD APPROACH TO WETLAND AREAS AS REQUIRED TO REDUCE RUTTING.
4. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET FROM WETLAND BOUNDARIES.
5. PRIOR TO COMMENCING WORK IN WETLAND AREAS, TOPOGRAPHIC ELEVATIONS SHALL BE SURVEYED SO THAT ORIGINAL CONTOURS CAN BE ACHIEVED DURING RESTORATION.
6. UNNATURAL FEATURES AND UNSTABLE GRADES SHALL BE NOTED BY THE CONTRACTOR.
7. IF STREAMS ARE PRESENT, IMPLEMENT APPLICABLE CROSSING METHODS.
8. MINIMIZE CLEARING TO ONLY WHAT IS NECESSARY TO SAFELY CONSTRUCT THE PIPELINE. LIMIT GROUND DISTURBANCE TO THE AREAS DIRECTLY OVER THE TRENCH LINE, EXCEPT WHERE TOPOGRAPHY REQUIRES ADDITIONAL GRADING FOR SAFETY REASONS. WHEN GRADING IS REQUIRED, TOPSOIL WITH THE VEGETATIVE ROOT MASS WILL BE STRIPPED, SEPARATED AND RETURNED AS AN EVEN LAYER TO ALL GRADED AREAS.
9. INSTALL TEMPORARY EQUIPMENT MATS ALONG CONSTRUCTION ACCESS ROAD (IF NEEDED).
10. TO REDUCE RUTTING, PIPE FOR INSTALLATION IN UPLAND AREAS UNLESS WETLAND IS DRY AND FIRM. INSTALLED TEMPORARY SUPPORT SKIDS AND PIPE TRENCHING THROUGH WETLANDS MAY PROCEED WHEN THE PIPE SECTION IS FABRICATED AND ON-SITE READY TO INSTALL.
11. SEGREGATE WETLAND TOPSOIL FROM SUBSOILS WITHIN THE AREA DISTURBED BY TRENCHING WITHIN WETLAND AREAS.
12. ADDITIONAL TRENCH PLUGS SHALL BE INSTALLED FOR LONG OPEN-CUT WETLAND CROSSINGS.
13. ANY EXCESS SPOIL MATERIALS MUST BE REMOVED AND NOT SPREAD WITHIN THE WETLAND AREA.
14. RESTORE WETLANDS TO THE ORIGINAL CONTOURS AND SURFACE FLOW.
15. NO SOIL AMENDMENTS SUCH AS AGRICULTURAL LIME OR FERTILIZER WILL BE USED WITHIN WETLAND AREAS.
16. CONTRACTOR SHALL PERMANENTLY STABILIZE UPLAND AREAS NEAR WETLANDS AS SOON AS POSSIBLE AFTER BACKFILLING.



**TYPICAL PIPELINE INSTALLATION WETLAND CROSSING DETAIL**

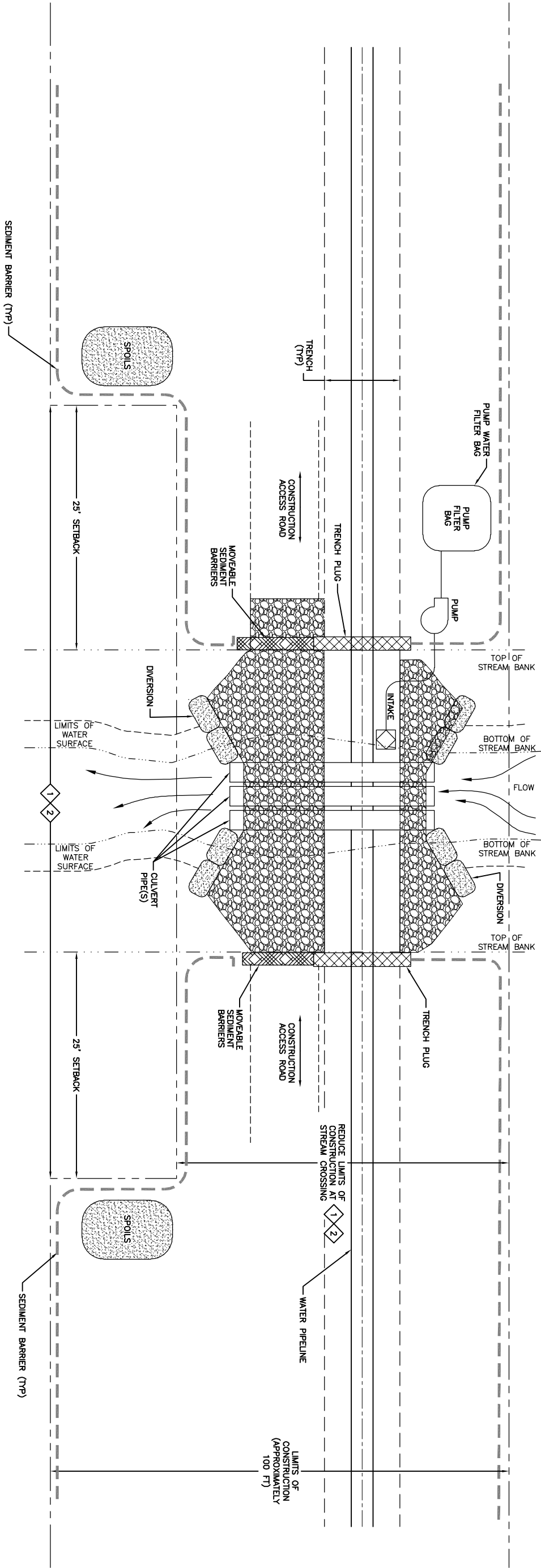
NOT TO SCALE



**Dewberry Engineers Inc.**

990 S. BROADWAY, SUITE 400  
Denver, Colorado 80209  
(303) 825-1802



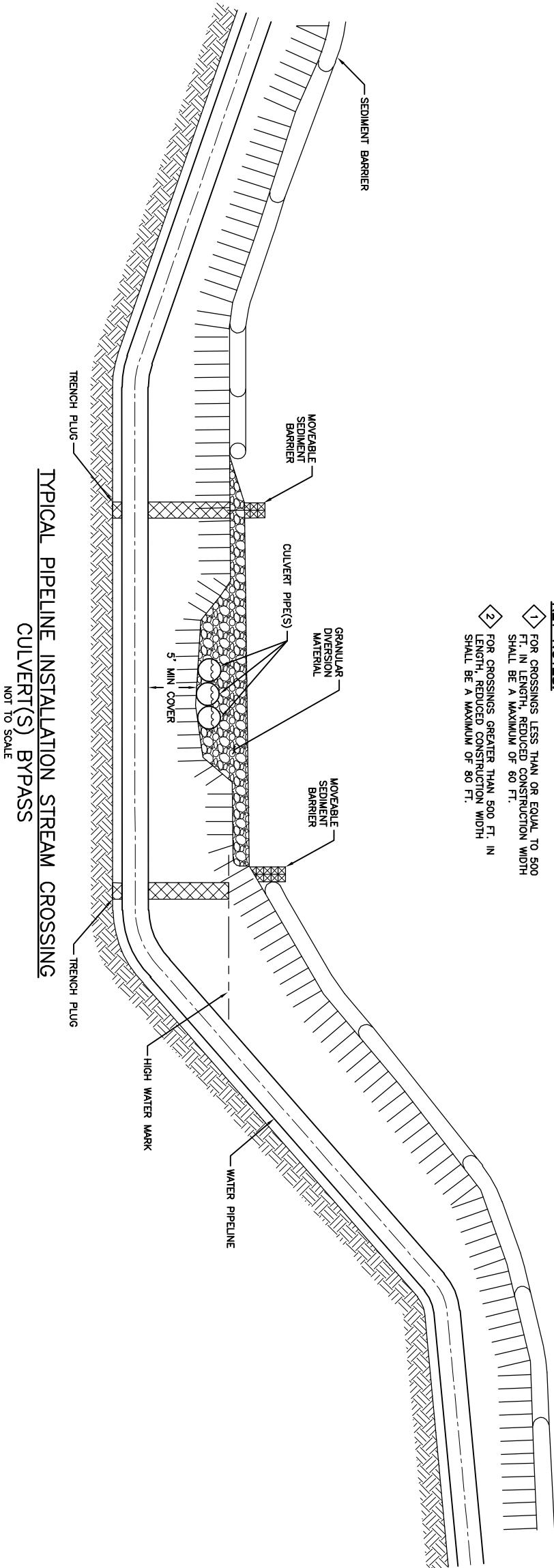


**EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES**

1. THE CULVERT(S) SHOULD BE OF SUFFICIENT SIZE TO CONVEY NORMAL STREAM FLOW OVER THE OPEN TRENCH.
2. CULVERT PIPE MUST BE ONE CONTINUOUS PIPE LONG ENOUGH TO ACCOUNT FOR THE POSSIBILITY OF THE TRENCH WIDENING UNEXPECTEDLY DURING THE EXCAVATION (DUE TO SLOUGHING).
3. CULVERT(S) SHALL BE INSTALLED PRIOR TO TRENCH EXCAVATION.
4. AN EFFECTIVE SEAL MUST BE CREATED AROUND THE CULVERT(S). ONCE IN PLACE, THE CULVERTS ARE NOT REMOVED UNTIL THE PIPELINE HAS BEEN INSTALLED AND THE STREAM BED AND BANKS HAVE BEEN RESTORED.
5. MARK THE TOP OF STREAM BANK WITH HIGH VISIBILITY FLAGGING.
6. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AND REFUELING AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM TOP OF STREAM BANK.
7. CONSTRUCT DAMS WITH SAND BAGS OR GRANULAR MATERIAL EXTENDED TO THE STREAM BOTTOM, MAINTAIN AMBIENT DOWNSTREAM FLOW RATES.
8. NATURAL STREAM BED MATERIAL TO BE STRIPPED AND SEPARATED FROM SUBSURFACE MATERIAL FOR FUTURE STREAM BEDS COMPOSED OF ROCK, COBBLE OR GRAVEL ARE TO BE STRIPPED AND SEGREGATED AND USED DURING STREAM RESTORATION.
9. REMOVE ALL CONSTRUCTION MATERIAL AND STRUCTURES FROM THE WATER BODY AFTER CONSTRUCTION.
10. RESTORE STREAM CHANNELS AND BOTTOMS TO THEIR PRECONSTRUCTION CONTOURS, AND STABILIZE THE STREAM CHANNEL PRIOR TO REESTABLISHING FLOW.
11. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE STREAM FLOODWAY PRIOR TO PERMANENTLY STABILIZING STREAM BANKS.
12. KEEP ALL CHEMICALS AND FERTILIZERS OUT OF STREAM.
13. TEMPORARY CROSSINGS SHALL STAY IN PLACE FOR THE MINIMUM AMOUNT OF TIME REQUIRED TO INSTALL PIPE THROUGH THE STREAM CROSSING.
14. PRIOR TO COMMENCING WORK FOR STREAM CROSSING AREAS, TOPOGRAPHIC ELEVATIONS AT THE CROSSING WITHIN THE CONSTRUCTION LIMITS (INCLUDING THE BOTTOM OF THE STREAM CHANNEL) SHALL BE SURVEYED SO THAT ORIGINAL CONTOURS CAN BE ACHIEVED DURING RESTORATION.

**KEY NOTES:**

1. FOR CROSSINGS LESS THAN OR EQUAL TO 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 60 FT.
2. FOR CROSSINGS GREATER THAN 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 80 FT.



**TYPICAL PIPELINE INSTALLATION STREAM CROSSING CULVERT(S) BYPASS**

NOT TO SCALE



**Dewberry Engineers Inc.**

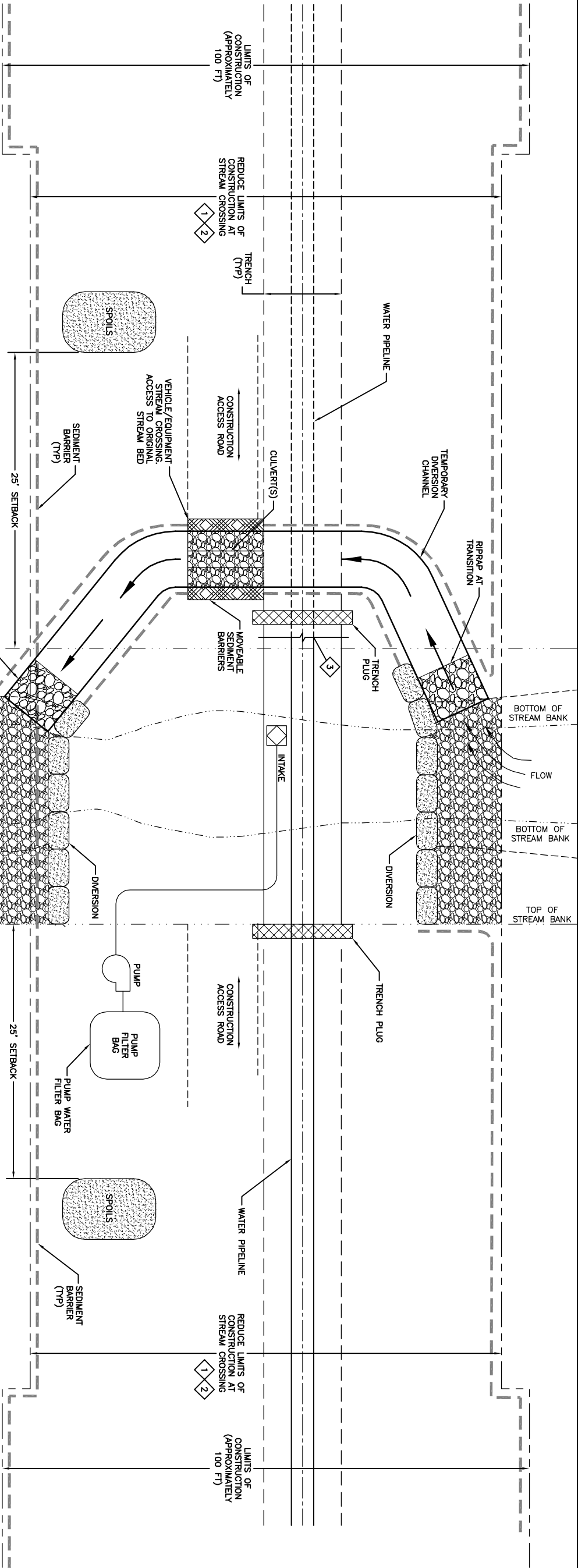
990 S. BROADWAY, SUITE 400  
Denver, Colorado 80209  
(303) 825-1802



**NORTHERN COLORADO WATER CONSERVANCY DISTRICT  
NORTHERN INTEGRATED SUPPLY PROJECT  
CONVEYANCE**

**FIGURE 3**



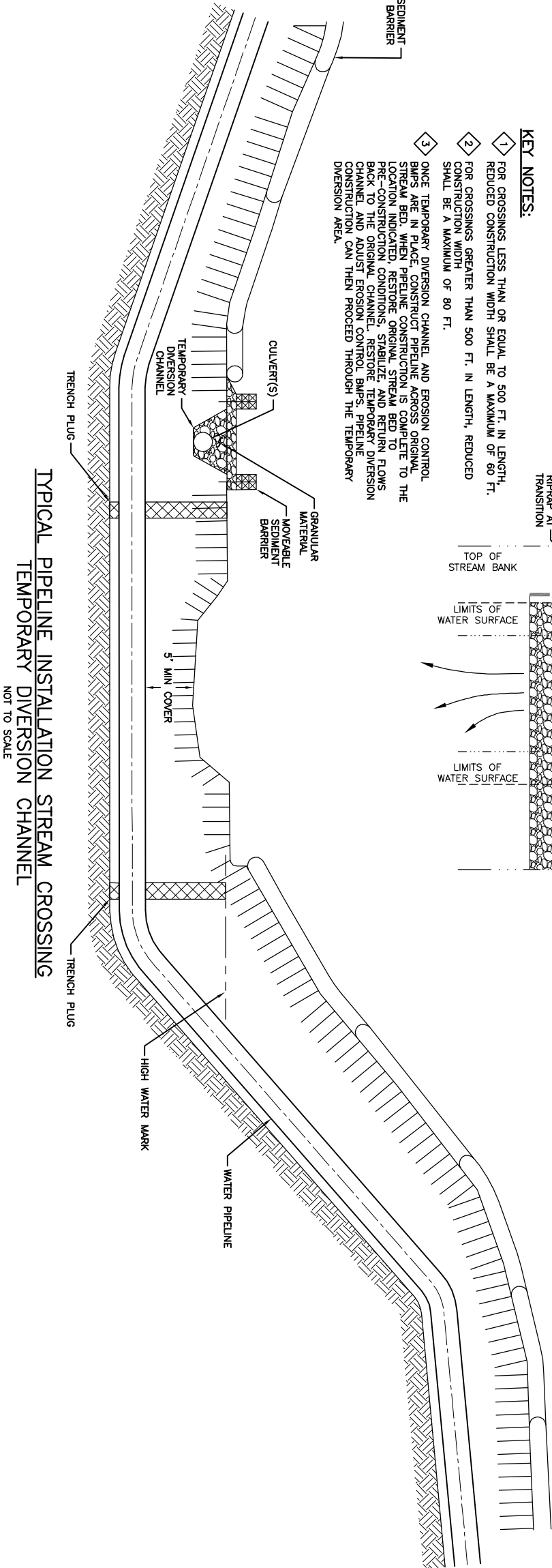


**EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES**

1. THE TEMPORARY DIVERSION CHANNEL SHOULD BE OF SUFFICIENT SIZE TO CONVEY NORMAL STREAM FLOW AROUND THE CONSTRUCTION AREA. TEMPORARY DIVERSION CHANNEL MAY REQUIRE LINING WITH PLASTIC OR GRANULAR MATERIAL, DEPENDING ON NATIVE SOIL CHARACTERISTICS.
2. TEMPORARY DIVERSION CHANNEL SHALL BE INSTALLED PRIOR TO TRENCH EXCAVATION.
3. AN EFFECTIVE SEAL MUST BE CREATED AT THE DIVERSION, ONCE IN PLACE, THE TEMPORARY DIVERSION CHANNEL IS NOT TO BE REMOVED UNTIL THE PIPELINE HAS BEEN INSTALLED AND THE ORIGINAL STREAM BED AND BANKS HAVE BEEN RESTORED.
4. MARK THE TOP OF STREAM BANK WITH HIGH VISIBILITY FLAGGING.
5. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AND REFUELING AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM TOP OF STREAM BANK.
6. CONSTRUCT DAMS WITH SAND BAGS OR GRANULAR MATERIAL EXTENDED TO THE STREAM BOTTOM. MAINTAIN AMBIENT DOWNSTREAM FLOW RATES.
7. NATURAL STREAM BED MATERIAL TO BE STRIPPED AND SEGREGATED FROM SUBSURFACE MATERIAL FOR FINAL STREAM BEDS RESTORATION. EXCAVATION PORTION OF NATIVE STREAM BEDS COMPRISED OF ROCK, COBBLE, OR GRAVEL ARE TO BE STRIPPED AND SEGREGATED AND USED DURING STREAM RESTORATION.
8. REMOVE ALL CONSTRUCTION MATERIAL AND STRUCTURES FROM THE WATER BODY AFTER CONSTRUCTION.
9. RESTORE STREAM CHANNELS AND BOTTOMS TO THEIR PRECONSTRUCTION CONTOURS, AND STABILIZE THE STREAM CHANNEL PRIOR TO REESTABLISHING FLOW.
10. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE STREAM FLOODPLAIN PRIOR TO PERMANENTLY STABILIZING STREAM BANKS.
11. KEEP ALL CHEMICALS AND FERTILIZERS OUT OF STREAM.
12. TEMPORARY CROSSINGS SHALL STAY IN PLACE FOR THE MINIMUM AMOUNT OF TIME REQUIRED TO INSTALL PIPE THROUGH THE STREAM CROSSING.
13. PRIOR TO COMMENCING WORK FOR STREAM CROSSING AREAS, TOPOGRAPHIC ELEVATIONS AT THE CROSSING WITHIN THE CONSTRUCTION LIMITS (INCLUDING THE BOTTOM OF THE STREAM CHANNEL) SHALL BE SURVEYED SO THAT ORIGINAL CONTOURS CAN BE ACHIEVED DURING RESTORATION.

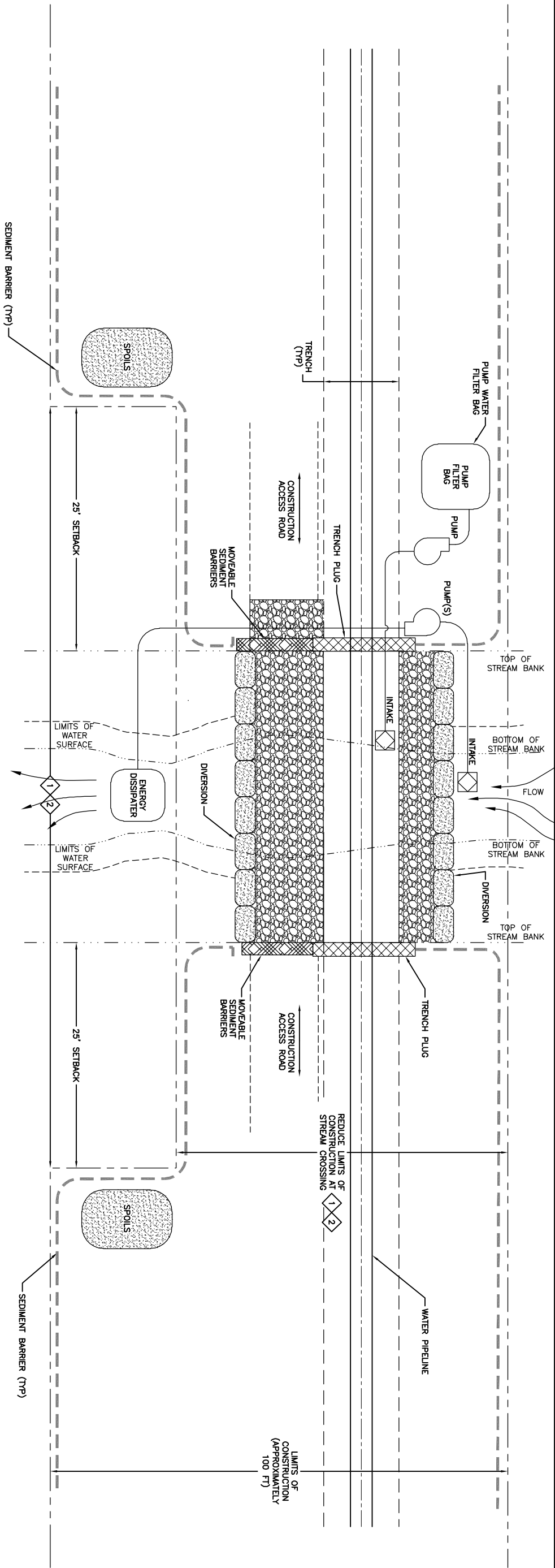
**KEY NOTES:**

1. FOR CROSSINGS LESS THAN OR EQUAL TO 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 60 FT.
2. FOR CROSSINGS GREATER THAN 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 80 FT.
3. ONCE TEMPORARY DIVERSION CHANNEL AND EROSION CONTROL BMPs ARE IN PLACE, CONSTRUCT PIPELINE ACROSS ORIGINAL STREAM BED. WHEN PIPELINE CONSTRUCTION IS COMPLETE TO THE LOCATION INDICATED, RESTORE ORIGINAL STREAM BED TO PRE-CONSTRUCTION CONDITIONS, STABILIZE, AND RETURN FLOWS BACK TO THE ORIGINAL CHANNEL. RESTORE TEMPORARY DIVERSION CHANNEL AND ADJUST EROSION CONTROL BMPs. PIPELINE CONSTRUCTION CAN THEN PROCEED THROUGH THE TEMPORARY DIVERSION AREA.



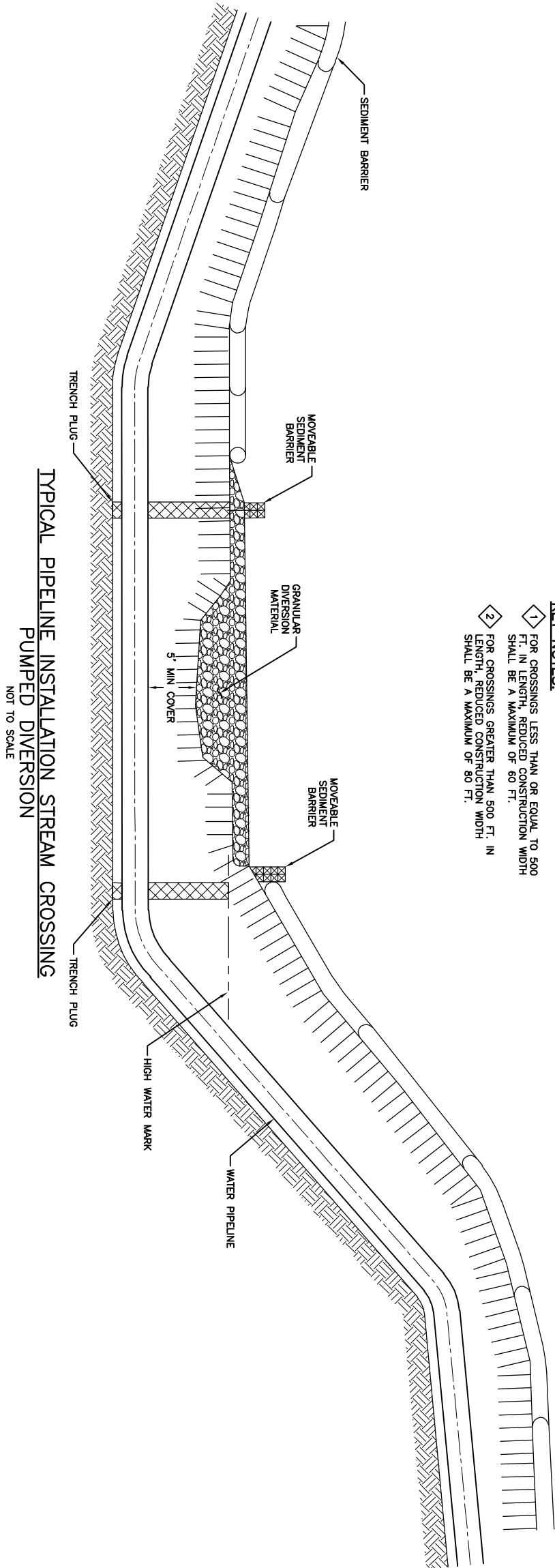
**TYPICAL PIPELINE INSTALLATION STREAM CROSSING**

NOT TO SCALE



**EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES**

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2. PUMPED DIVERSION SHALL BE INSTALLED PRIOR TO TRENCH EXCAVATION.
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# **Larimer County Analysis – Technical Memorandum No. 11 Floodplain Report**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**





## MEMORANDUM

Northern Integrated Supply Project  
Glade Reservoir  
Floodplain Report

B&V Project Number 403758  
B&V File 188754/34.3000  
February 14, 2020

To: Larimer County Planning Department  
From: Mike Johnson and Tim Engemoen, Black & Veatch

## Introduction

This technical memorandum is written in support of Larimer County Planning Department's 1041 Permit for the Glade Unit construction, and documents impacts to the floodplain of the Poudre River with this new development.

## Project Background

The Northern Integrated Supply Project (NISP) will provide a new raw water supply to several municipal water providers in Northern Colorado. NISP includes the following facilities located in Larimer County: the Glade Unit; the Glade Pump Station; raw water distribution piping; and the relocation of U.S. Highway 287. The Glade Unit features the Glade Reservoir Dam, which is an earthen embankment that will impound an off-channel reservoir complete with the hydraulic structures required by the State Engineer's Office: the High Level Outlet Works (HLOW); Low Level Outlet Works (LLOW); and spillway. Glade Reservoir Dam is located just to the north of the junction of U.S Highway 287 and State Highway 14, about 10 miles northwest of Fort Collins. The Glade Unit includes an expansion of the existing Poudre Valley Canal (PVC) and a new forebay constructed downstream of the dam at an elevation that will allow delivery of water from the PVC by gravity. A Control Gate structure will be constructed to control flow to the existing portion of the PVC downstream of the forebay. The existing PVC Diversion Structure will be demolished and rebuilt to allow increased diversion of flow from the Poudre River. A portion of the existing Munroe Gravity Canal alignment will be inundated by Glade Reservoir, this open canal will be replaced by the Munroe Canal Bypass (MCB), a conduit and several control structures that will convey flow beneath the reservoir. The Glade Unit also includes: the Glade Pump Station, which will pump water from the forebay into Glade Reservoir; the Electrical/Control building that will distribute power throughout the site and provide control of the various hydraulic features; the Surge Building that will house surge tanks to protect the pump station discharge conduit; and numerous buried conduits with control valve vaults that connect these facilities. Raw water will be conveyed off site via several buried conduits that are being constructed under different NISP contracts. The Glade Unit will include recreational amenities for the general public, including a Visitor Center, campgrounds, a boat ramp, trails and restroom facilities.

Glade Reservoir will submerge a portion of the existing U.S. Highway 287 alignment which will be relocated to the east of the reservoir. An existing power transmission line and several power

distribution lines will be inundated by the reservoir which will be relocated as part of the Glade Unit construction. A general location map of the Glade Unit facilities is presented on Figure 1.

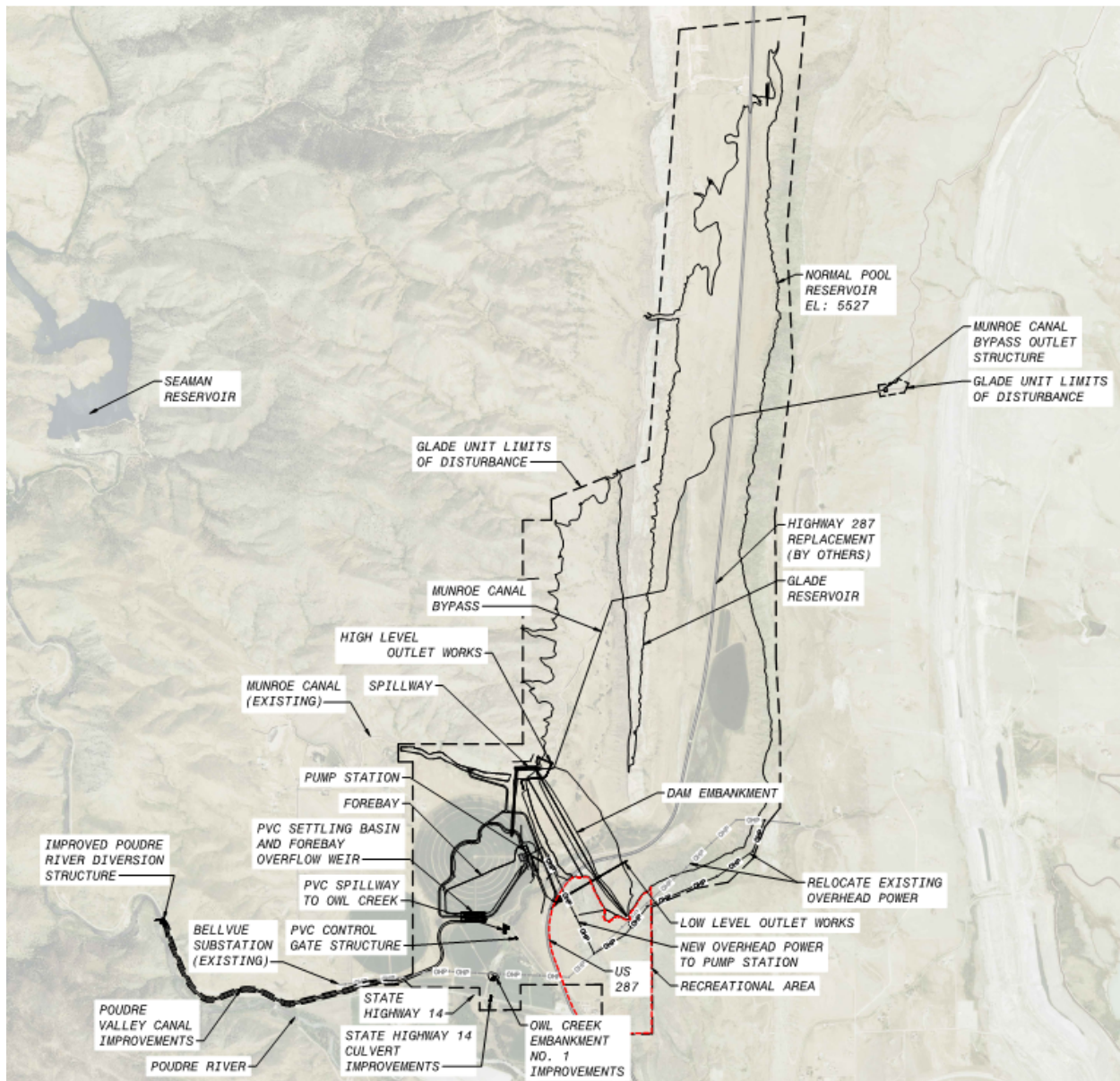


Figure 1 - Glade Unit Overview

## Impacts to Existing Floodplain

The existing 100-year floodplain for the Poudre River is shown below in Figure 2 (also included as Figure 2 of Attachment C to the 1041 Permit Project Description). The only facilities that are part of the Glade Unit that will be constructed within the Poudre River flood plain is the PVC Diversion Structure. The existing diversion structure consists of a check dam and gate structure that has a capacity of

approximately 350 cubic feet per second (cfs). This structure will be demolished and replaced with a new structure that has a capacity of 1,300 cfs.

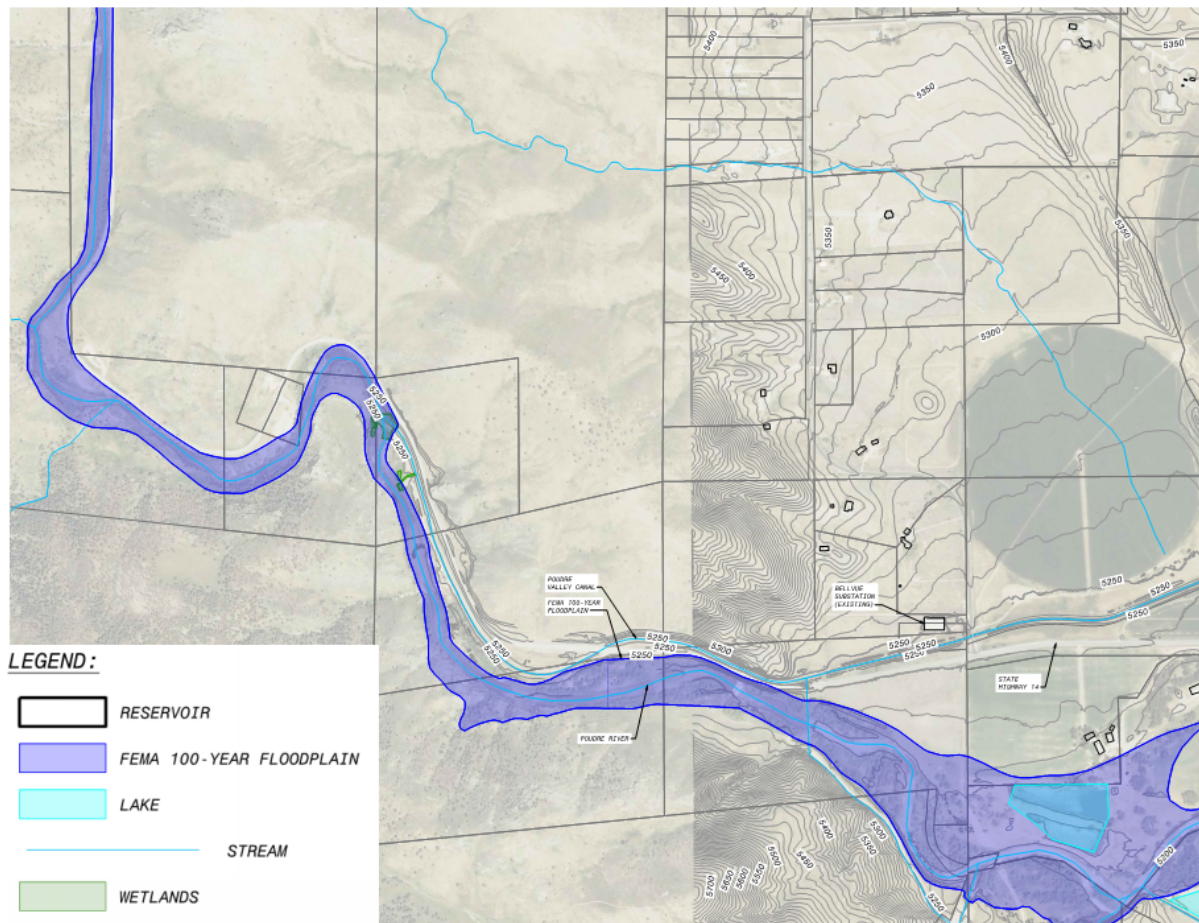


Figure 2 - Poudre River 100-Year Floodplain

## Hydrology and Hydraulics

Based on the Flood Insurance Rate Map Panel 0750F, the Special Flood Hazard Area at this location is designated Zone A, with no base flood elevations determined. To establish the flood flow with a 1% Annual Exceedance Probability, stream gage mean daily flow data and historical peaks were analyzed to develop a flow duration curve and to perform a flood frequency analysis, respectively. Specifically, the Cache La Poudre River USGS Gage No. 06752000 was used for the analysis. Figure 2 shows the flow-duration curve for this gage. The 100-year flood discharge was estimated to be 7,400 cfs. A HEC-RAS model was set up to determine water levels upstream and downstream of the weir. The corresponding water surface elevations are approximately 5,254.95 feet and 5,251.55 feet, respectively.



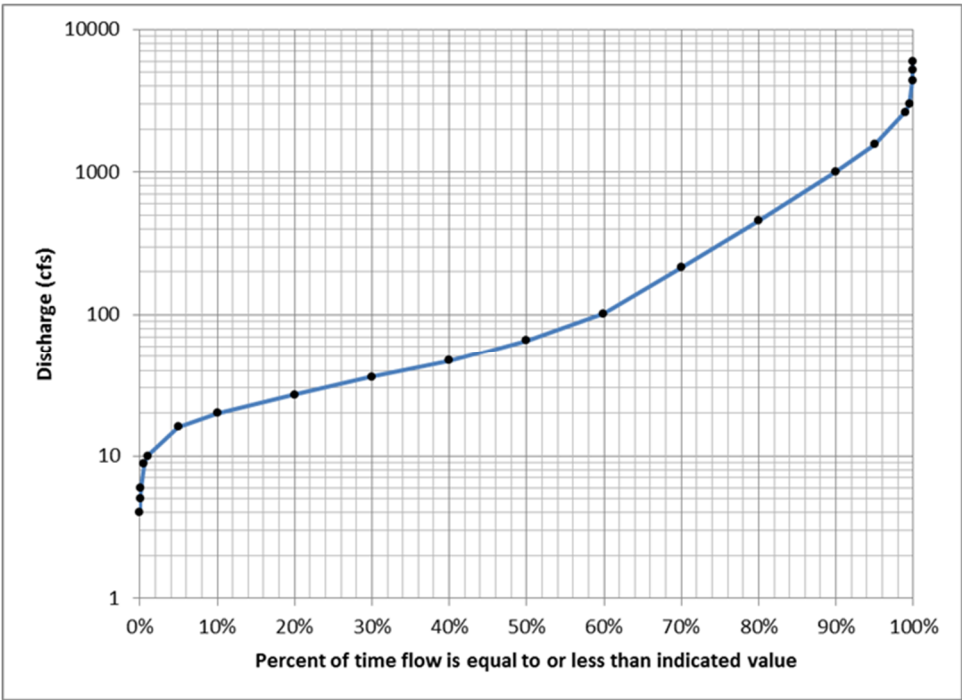


Figure 3 – Flow-Duration Curve for USGS Gage No. 06752000

## Existing Diversion Structure

The existing diversion structure is shown in Figure 3. The structure consists of a check dam across the Poudre River and a gated diversion structure that is used to divert flow into the PVC. The elevation of the crest of the existing check dam is El 5249.1 and the existing length of this check dam is approximately 190 feet. The diversion structure is a concrete structure equipped with radial gates. Sluicing of solids that are diverted into the canal is accomplished via an existing sluiceway located approximately 450 feet downstream from the existing diversion structure. The existing check dam, diversion structure and sluiceway will all be demolished and replaced with new construction.

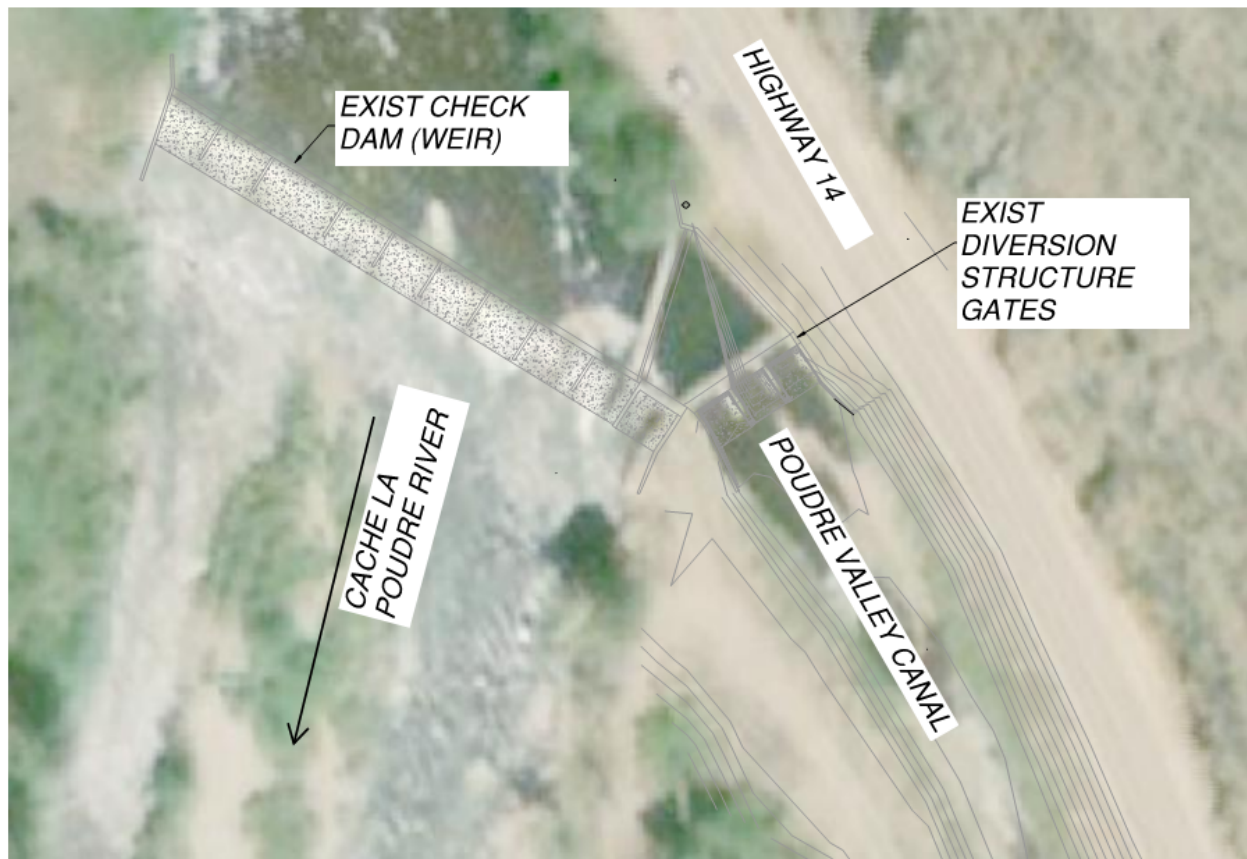


Figure 4 – Existing Facilities within the Poudre River Floodplain

## Proposed Improvements

As previously stated, the upgraded diversion structure is the only facility associated with the Glade Unit that will be constructed within the Poudre River floodplain. A new weir will be constructed across the Poudre River with the same crest elevation and length as the existing check dam. Riprap will be placed on the downstream side of the weir at a 10:1 slope to ensure safe passage of small boats. The new diversion structure will be constructed with gates and top of concrete walls set at approximately El. 5256.0 to allow approximately 1 foot of freeboard during the 100-year event. The invert of the gates will be at approximately El. 5241.0 to correspond to the invert elevation at the upstream end of the PVC. The water surface in the PVC must be approximately El. 5249.3 to convey 1,300 cfs to the Forebay, and the new gates will be designed to open to this elevation to allow free-flow through the gate structure. Trash racks will be installed on the upstream side of the gate structure.

High velocities are expected downstream of the gates under certain operating conditions of the gates; therefore, an energy dissipation structure will be incorporated into the Diversion Structure downstream of the gates to prevent damage to the canal. The energy dissipation structure has been designed to handle high velocity flow that can occur at the gate structure, assuming up to a 100-year level upstream of the gate and a low tailwater on the downstream end of the dissipation basin. Under these conditions,

velocities can be higher than 29 feet per second (ft/s), with Froude numbers of more than 6. Based on the design range of velocities and Froude numbers expected downstream of the gate, a Reclamation Type III dissipation basin was selected for this application to fully dissipate energy in the flow stream.

The Diversion Structure will include a fish ladder to facilitate adequate fish passage around the diversion weir structure. Design criteria are based on two parameters: maximum flow velocity and energy dissipation factor (EDF) rates.

A sluiceway will be constructed on the upstream end of the structure. The sluiceway will be separated from the rest of the structure by a short wall; the top of this wall will be located at approximately El. 5245.50. The short wall will allow trapping large sediment, rocks, and debris on the sloped apron located upstream of the wall. The apron is sloped toward the sluice gate to facilitate the removal of the accumulated material. A 14-feet-wide by 10-feet-high slide gate will be used for this to allow diverting of material through the sluiceway. A sloped apron will be constructed downstream of the gate to direct the sluiced material toward the Poudre River allowing the continued movement of sediment through this section of the river.

Larimer County floodplain permitting, and evaluation of compliance with all floodplain regulations, will be completed as design progresses to the point where complete evaluation of all effects is possible. Preliminary modeling indicates, and the design intent is, that the new Diversion Structure is not anticipated to cause any rise in the existing floodplain elevation.

Figures 4, 5, and 6 depict the new weir and diversion structure.

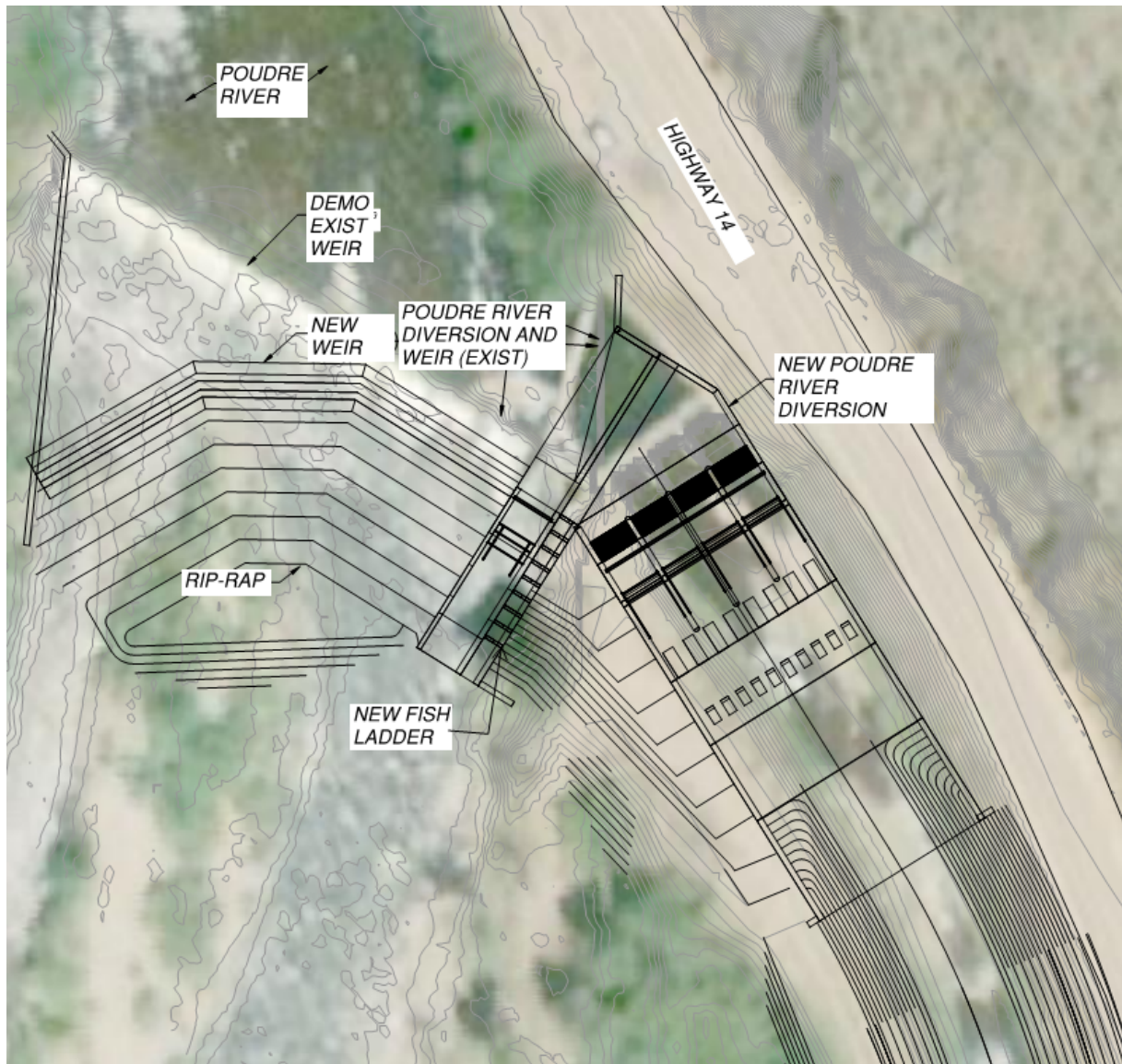
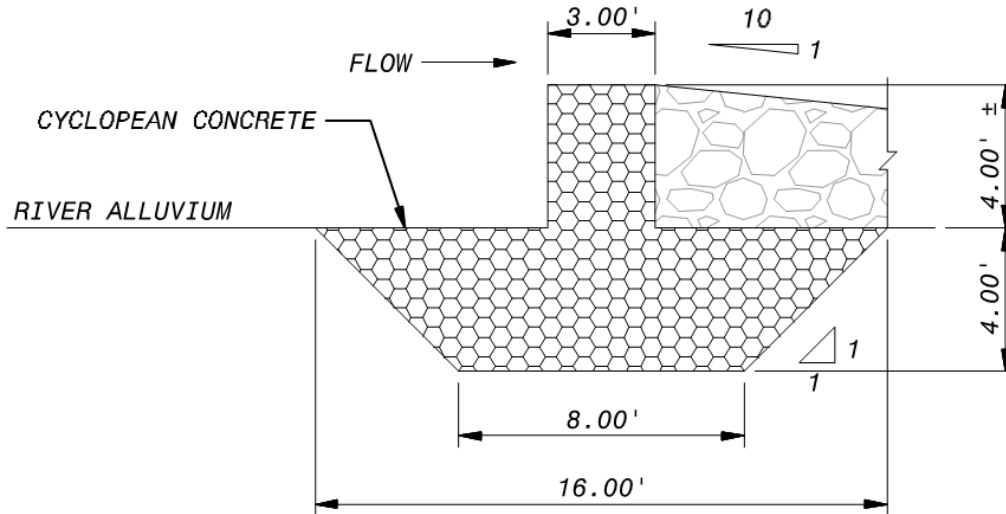


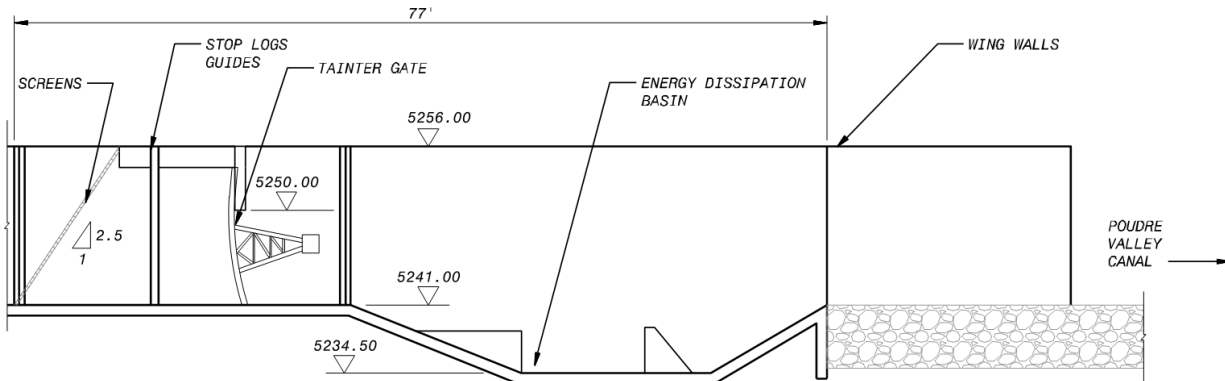
Figure 5 – Site Plan of Proposed Weir and Diversion Structure





**WEIR - SECTION**  
1" = 5'-0"

Figure 6 – Section Through New Weir



**PVC DIVERSION SECTION**  
1" = 10'-0"

Figure 7 – Section Through New Diversion Structure

**Date:** February 5, 2020

**To:** Larimer County Planning Department

**From:** Randy Parks and Derek Nelson - Dewberry Engineers Inc.

**Subject:** Northern Integrated Supply Project - Conveyance Pipeline Floodplain Report



The Northern Integrated Supply Project has four (4) pipeline reaches that run through Larimer County. The reaches are known as the County Line, Poudre Intake, Glade Release Pipeline, and Northern Tier Pipelines.

## Floodplain Crossings

Where the pipelines need to cross wetlands or open waters, or where work would impact wetlands or open waters, the construction limits will be reduced from the typical 120 feet width. At the majority of wetland and open water features, the reduced impact width will be 60 feet wide (30 feet on either side of center) (**Figure 1**). However, where wetlands or open water features are over 500 feet in length, the reduced impact width will be 80 feet wide (40 feet on either side of center) (**Figure 1**). Additional BMPs, such as using equipment mats and implementing erosion control measures, will be used to further minimize impacts (**Figure 2**).

Using data obtained from the Larimer County GIS website it was determined where the anticipated floodplain crossings are expected. Below, this section breaks down the four conveyance reaches and where the alignment crosses the floodplain and whether it is in unincorporated Larimer County. All floodplain crossings that occur in unincorporated Larimer County will be subject to the county's floodplain regulations and permitting. Additionally, for pipeline crossings in unincorporated Larimer County the required floodplain permits for those crossings will be acquired prior to construction in those floodplains.

- Northern Tier Pipeline
  - Adjacent to West State Highway 14 near Glade Reservoir (unincorporated)
  - Northwest of Kluver Reservoir (unincorporated)
  - East of Interstate 25 between County Road 54 and County Road 52 (unincorporated)
- Glade Release Pipeline
  - South of West State Highway 14, approximately 1,300 feet west of the intersection of West State Highway 14 and North County Road 29C (unincorporated)
- Poudre Intake Pipeline
  - From the intake structure off of the Poudre River to Mulberry Street (Fort Collins)
  - South of Mulberry Street between South Lemay Ave and South Timberline Road (unincorporated)
  - East of South Timberline Drive until just west of South Summit View Drive (Fort Collins)
  - East of I-25 and north of the canal between Sherry Drive and I-25 (Fort Collins)

- West of I-25 and south of the canal between I-25 and McLaughlin Lane (Fort Collins)
- County Line Pipeline
  - Along County Road 13 from just north of Larimer County Road 32E/ Weld County Road 68 1/2 to the Poudre River (Windsor)

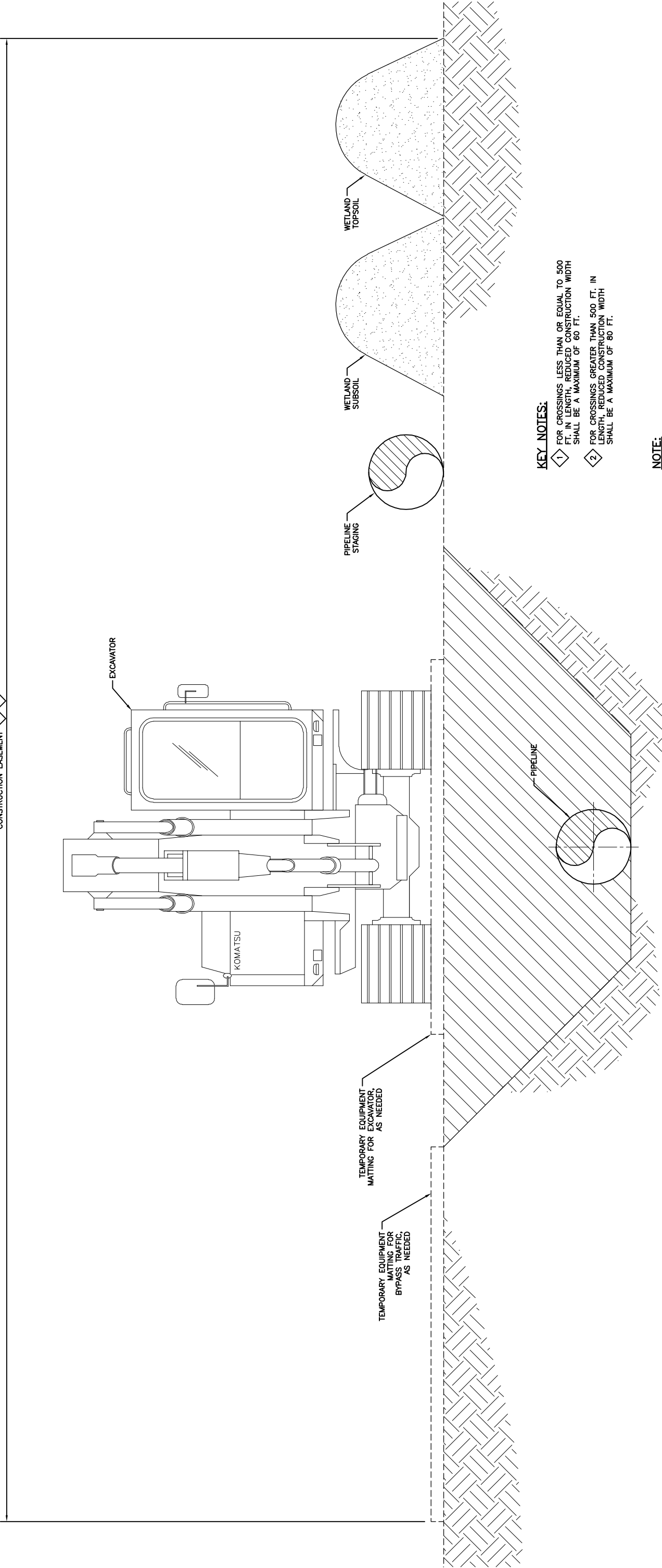
While floodplains can pose risks to any conveyance system (pipelines, roadways, conduits and even supports for aerial systems) they are frequently unavoidable and must be a major consideration in design. Several approaches to crossing active channels are conceptually depicted in **Figures 3, 4, and 5**. Floodplains are not considered a significant risk to this pipeline due to the following practices:

- Use of double-lap-welded steel pipelines, which increases pipeline strength and provides a double seal at the joint
- Performance of a scour analysis for each major crossing to ensure that pipeline burial depth is adequate
- Siting of critical appurtenances outside of floodplains
- Restoring to existing grades after pipeline construction to avoid any changes to the floodplain to obtain a “no rise” finding

It is important to note that Northern Water’s welded-steel Southern Water Supply Pipeline (SWSP) remained operational throughout and after the September 2013 floods even though it traversed four of the major affected floodplains (Big Thomson, St Vrain, Left Hand Creek, and Boulder Creek). Additionally, of the City of Longmont’s five raw water delivery systems (3 pipelines and 2 canals), the SWSP was their only operational supply following the September 2013 floods.



CONSTRUCTION EASEMENT 1 2



**KEY NOTES:**

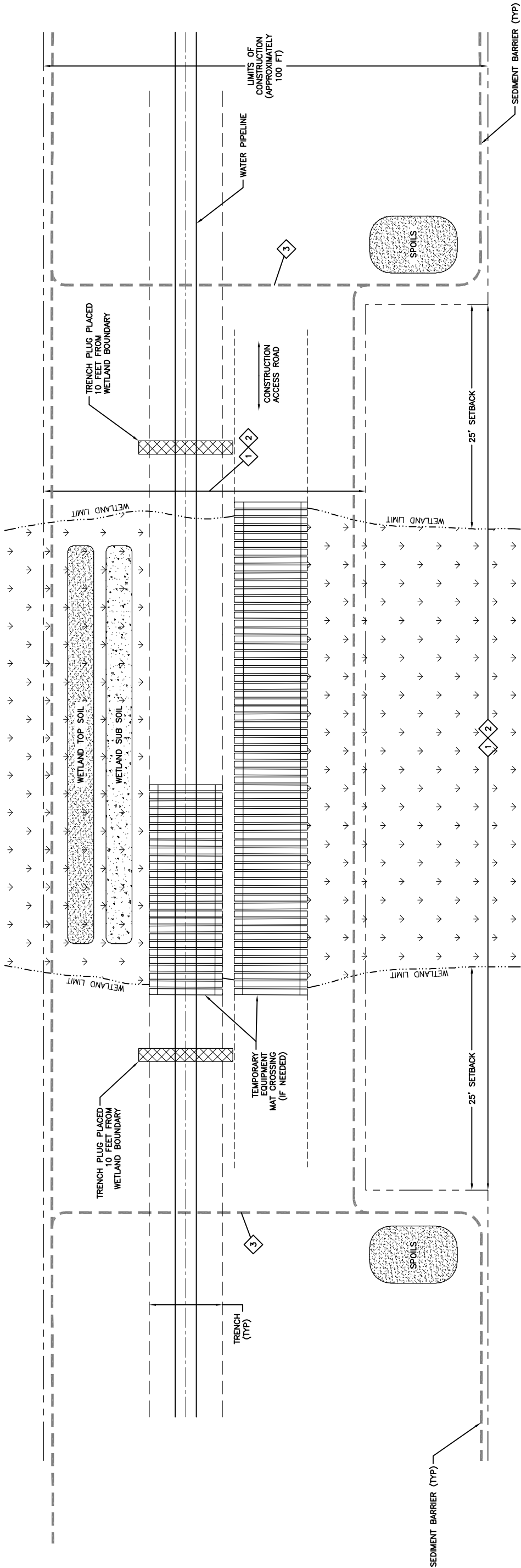
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**NOTE:**

- 1. WETLAND TOPSOIL TO BE STORED IN CLOSE PROXIMITY TO TRENCH.

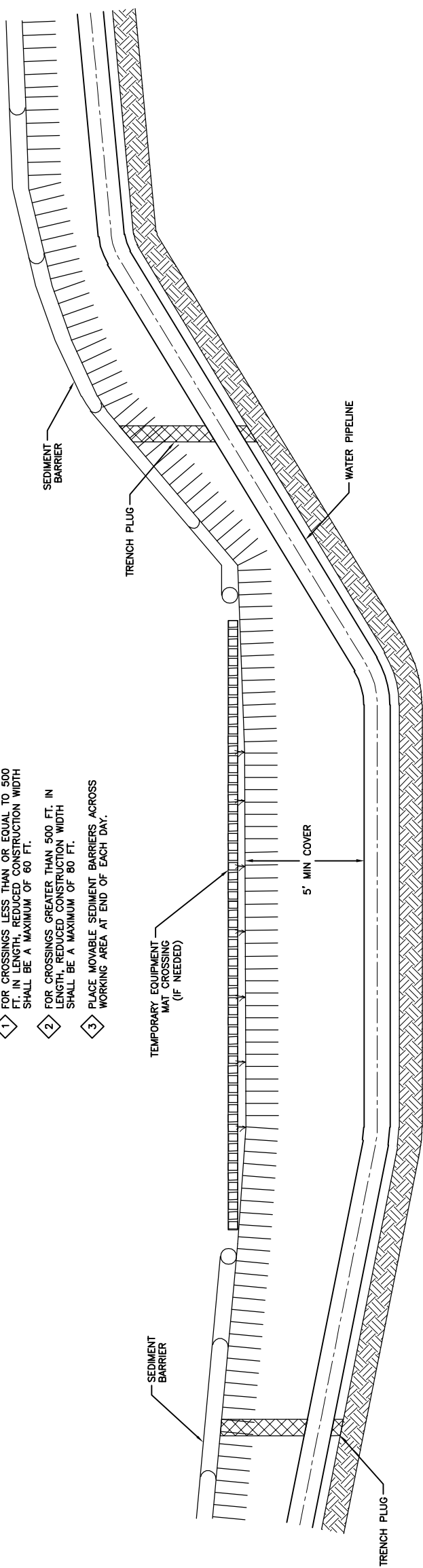
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KEY NOTES:

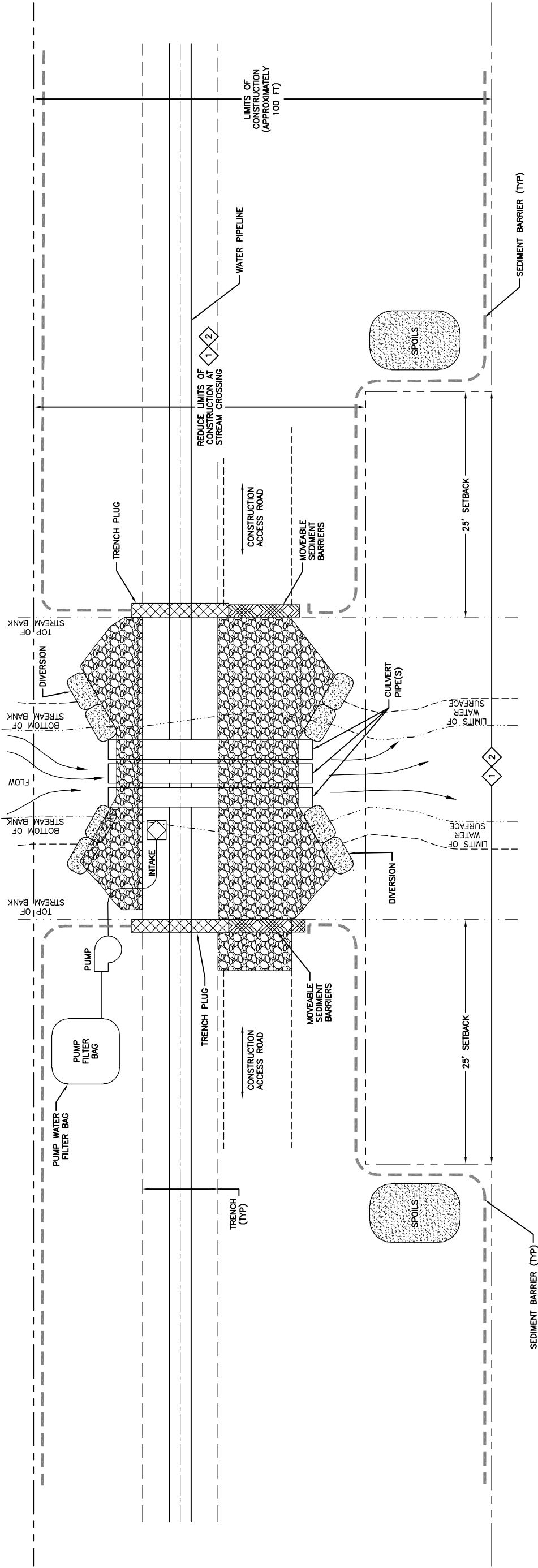
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- 3 PLACE MOVABLE SEDIMENT BARRIERS ACROSS WORKING AREA AT END OF EACH DAY.



TYPICAL PIPELINE INSTALLATION WETLAND CROSSING DETAIL  
NOT TO SCALE

EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES

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- 2. INSTALL DELINEATION FENCE BETWEEN LIMITS OF DISTURBANCE (LOD) AND ADJACENT WETLANDS.
- 3. STABILIZE CONSTRUCTION ACCESS ROAD APPROACH TO WETLAND AREAS AS REQUIRED TO REDUCE RUTTING.
- 4. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET FROM WETLAND BOUNDARIES.
- 5. PRIOR TO COMMENCING WORK IN WETLAND AREAS, TOPOGRAPHIC ELEVATIONS SHALL BE SURVEYED SO THAT ORIGINAL CONTOURS CAN BE ACHIEVED DURING RESTORATION.
- 6. UNNATURAL FEATURES AND UNSTABLE GRADES SHALL BE NOTED BY THE CONTRACTOR.
- 7. IF STREAMS ARE PRESENT, IMPLEMENT APPLICABLE CROSSING METHODS.
- 8. MINIMIZE CLEARING TO ONLY WHAT IS NECESSARY TO SAFELY CONSTRUCT THE PIPELINE. LIMIT GROUND DISTURBANCE TO THE AREAS DIRECTLY OVER THE TRENCH LINE, EXCEPT WHERE TOPOGRAPHY REQUIRES ADDITIONAL GRADING FOR SAFETY REASONS. WHEN GRADING IS REQUIRED, TOPSOIL WITH THE VEGETATIVE ROOT MASSES WILL BE STRIPPED, SEGREGATED AND RETURNED AS AN EVEN LAYER TO ALL GRADED AREAS.
- 9. INSTALL TEMPORARY EQUIPMENT MATS ALONG CONSTRUCTION ACCESS ROAD (IF NEEDED) TO REDUCE RUTTING.
- 10. REMOVE PRELIMINARY PIPE FOR INSTALLATION IN UPLAND AREAS UNLESS WETLAND IS DRY ENOUGH TO ADEQUATELY SUPPORT SKIDS AND PIPE.
- 11. TRENCHING THROUGH WETLANDS MAY PROCEED WHEN THE PIPE SECTION IS FABRICATED AND ON-SITE READY TO INSTALL.
- 12. SEGREGATE WETLAND TOPSOIL FROM SUBSOILS WITHIN THE AREA DISTURBED BY TRENCHING WITHIN WETLAND AREAS.
- 13. ADDITIONAL TRENCH PLUGS SHALL BE INSTALLED FOR LONG OPEN-CUT WETLAND CROSSINGS.
- 14. ANY EXCESS SPOIL MATERIALS MUST BE REMOVED AND NOT SPREAD WITHIN THE WETLAND AREA.
- 15. RESTORE WETLANDS TO THE ORIGINAL CONTOURS AND SURFACE FLOW.
- 16. NO SOIL AMENDMENTS SUCH AS AGRICULTURAL LIME OR FERTILIZER WILL BE USED WITHIN WETLAND AREAS.
- 17. CONTRACTOR SHALL PERMANENTLY STABILIZE UPLAND AREAS NEAR WETLANDS AS SOON AS POSSIBLE AFTER BACKFILLING.

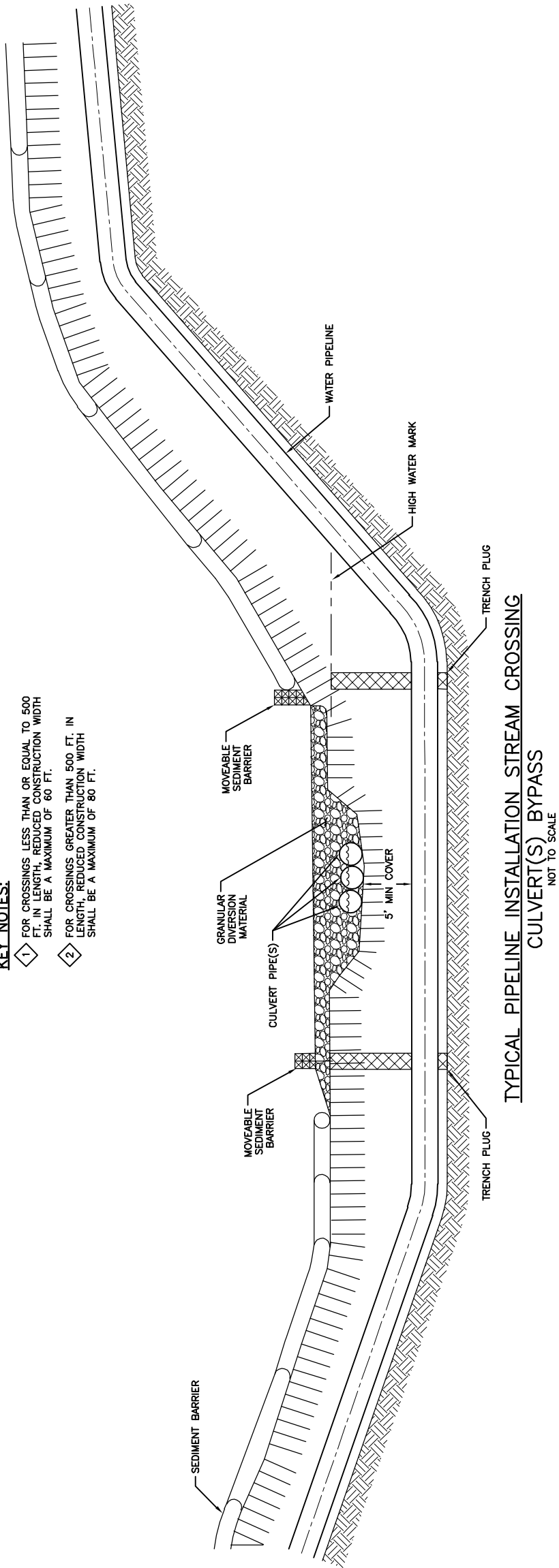


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- 2. CULVERT PIPE MUST BE ONE CONTINUOUS PIPE LONG ENOUGH TO ACCOUNT FOR THE POSSIBILITY OF THE TRENCH WIDENING UNEXPECTEDLY DURING THE EXCAVATION (DUE TO SLOUGHING).
- 3. CULVERT(S) SHALL BE INSTALLED PRIOR TO TRENCH EXCAVATION.
- 4. AN EFFECTIVE SEAL MUST BE CREATED AROUND THE CULVERT(S). ONCE IN PLACE, THE CULVERTS ARE NOT REMOVED UNTIL THE PIPELINE HAS BEEN INSTALLED AND THE STREAM BED AND BANKS HAVE BEEN RESTORED.
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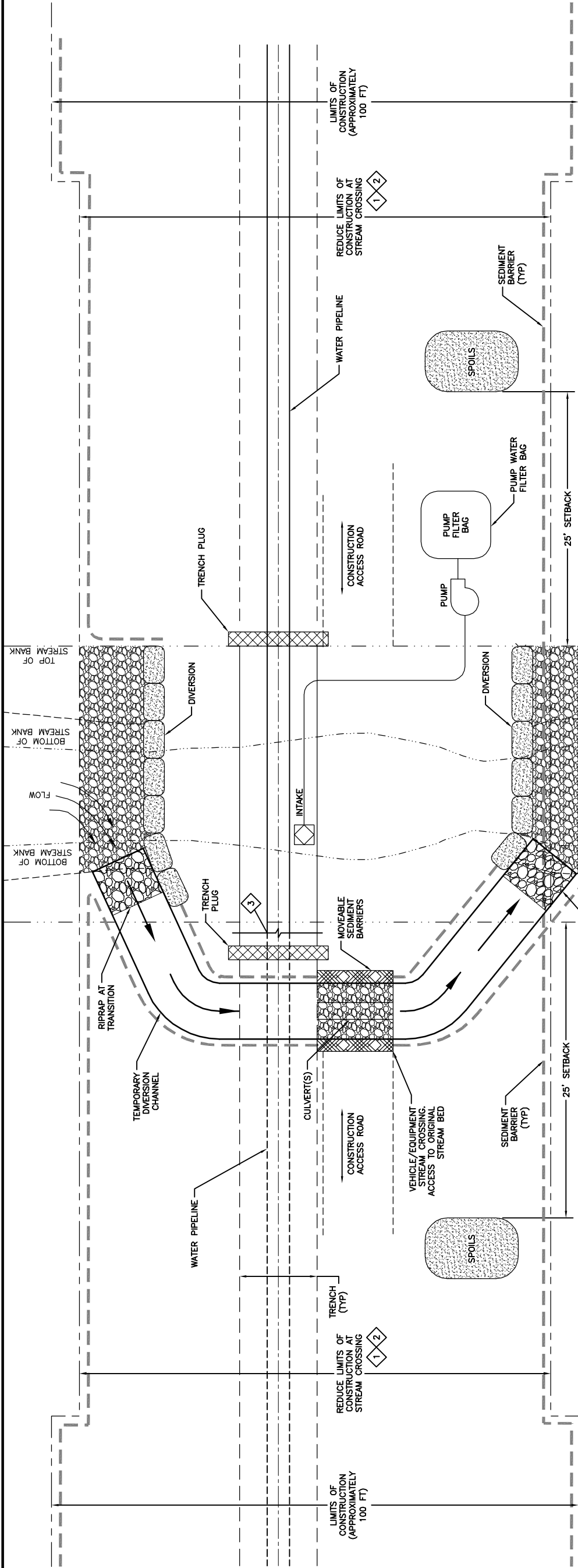
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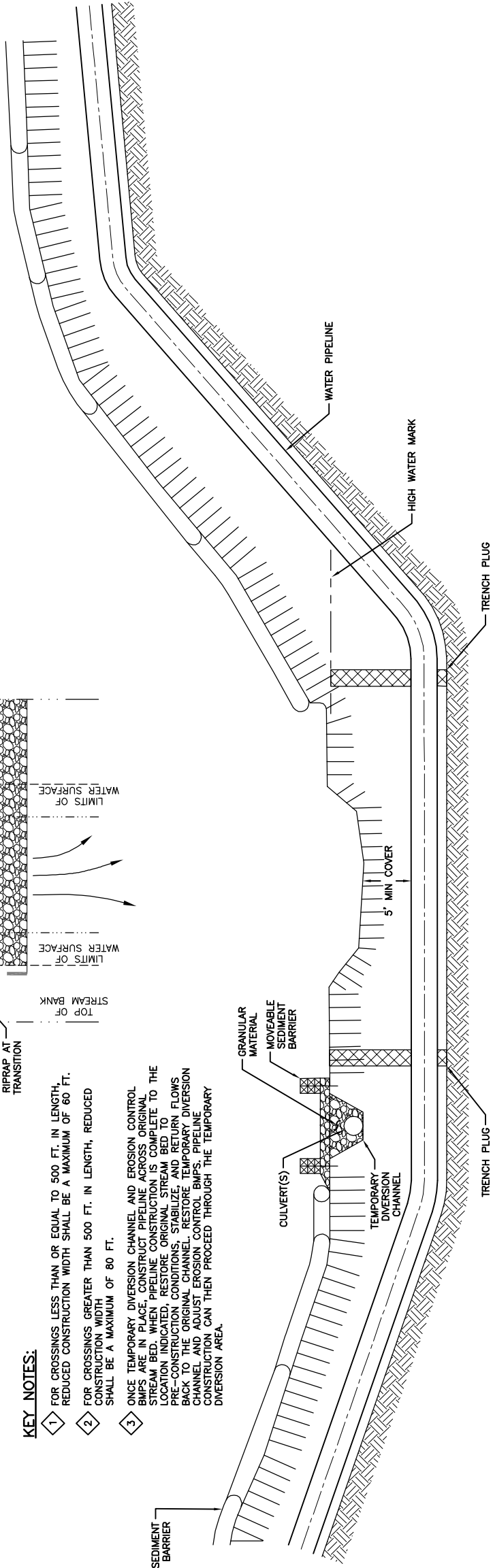


EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES

1. THE TEMPORARY DIVERSION CHANNEL SHOULD BE OF SUFFICIENT SIZE TO CONVEY NORMAL STREAM FLOW AROUND THE CONSTRUCTION AREA. TEMPORARY DIVERSION CHANNEL MAY REQUIRE LINING WITH PLASTIC OR GRANULAR MATERIAL, DEPENDING ON NATIVE SOIL CHARACTERISTICS.
2. TEMPORARY DIVERSION CHANNEL SHALL BE INSTALLED PRIOR TO TRENCH EXCAVATION.
3. AN EFFECTIVE SEAL MUST BE CREATED AT THE DIVERSION. ONCE IN PLACE, THE TEMPORARY DIVERSION CHANNEL IS NOT TO BE REMOVED UNTIL THE PIPELINE HAS BEEN INSTALLED AND THE ORIGINAL STREAM BED AND BANKS HAVE BEEN RESTORED.
4. MARK THE TOP OF STREAM BANK WITH HIGH VISIBILITY FLAGGING.
5. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AND REFUELING AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM TOP OF STREAM BANK.
6. CONSTRUCT DAMS WITH SAND BAGS OR GRANULAR MATERIAL EXTENDED TO THE STREAM BOTTOM. MAINTAIN AMBIENT DOWNSTREAM FLOW RATES.
7. NATURAL STREAM BED MATERIAL TO BE STRIPPED AND SEGREGATED FROM SUBSURFACE MATERIAL FOR FINAL STREAMBED RESTORATION. EXCAVATION PORTION OF NATIVE STREAM BEDS COMPRISED OF ROCK, COBBLE, OR GRAVEL ARE TO BE STRIPPED AND SEGREGATED AND USED DURING STREAM RESTORATION.
8. REMOVE ALL CONSTRUCTION MATERIAL AND STRUCTURES FROM THE WATER BODY AFTER CONSTRUCTION.
9. RESTORE STREAM CHANNELS AND BOTTOMS TO THEIR PRECONSTRUCTION CONTOURS, AND STABILIZE THE STREAM CHANNEL PRIOR TO REESTABLISHING FLOW.
10. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE STREAM BEDS PRIOR TO PERMANENTLY STABILIZING THE STREAM BANKS.
11. KEEP ALL CHEMICALS AND FERTILIZERS OUT OF STREAM.
12. TEMPORARY CROSSINGS SHALL STAY IN PLACE FOR THE MINIMUM AMOUNT OF TIME REQUIRED TO INSTALL PIPE THROUGH THE STREAM CROSSING.
13. PRIOR TO COMMENCING WORK FOR STREAM CROSSING AREAS, TOPOGRAPHIC ELEVATIONS AT THE CROSSING WITHIN THE CONSTRUCTION LIMITS (INCLUDING THE BOTTOM OF THE STREAM CHANNEL) SHALL BE SURVEYED SO THAT ORIGINAL CONTOURS CAN BE ACHIEVED DURING RESTORATION.

KEY NOTES:

- 1 FOR CROSSINGS LESS THAN OR EQUAL TO 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 60 FT.
- 2 FOR CROSSINGS GREATER THAN 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 80 FT.
- 3 ONCE TEMPORARY DIVERSION CHANNEL AND EROSION CONTROL BMPs ARE IN PLACE, CONSTRUCT PIPELINE ACROSS ORIGINAL STREAM BED. WHEN PIPELINE CONSTRUCTION IS COMPLETE TO THE LOCATION INDICATED, RESTORE ORIGINAL STREAM BED TO PRE-CONSTRUCTION CONDITIONS, STABILIZE, AND RETURN FLOWS BACK TO THE ORIGINAL CHANNEL. RESTORE TEMPORARY DIVERSION CHANNEL AND ADJUST EROSION CONTROL BMPs. PIPELINE CONSTRUCTION CAN THEN PROCEED THROUGH THE TEMPORARY DIVERSION AREA.

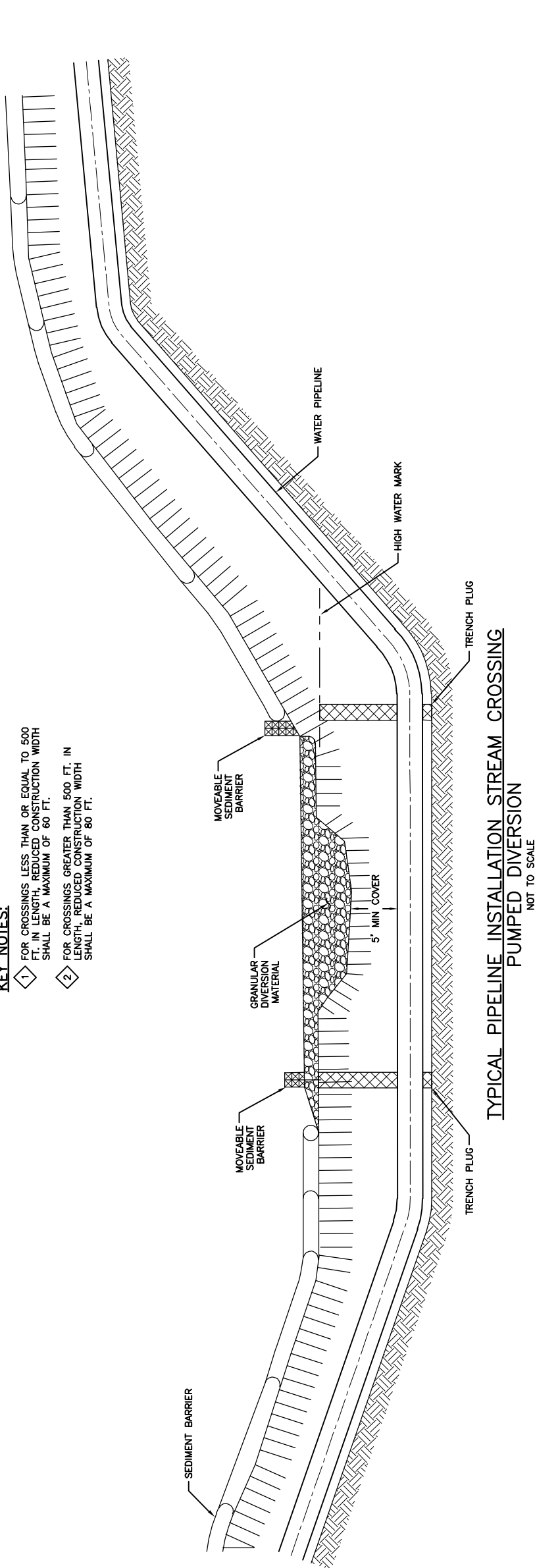


TYPICAL PIPELINE INSTALLATION STREAM CROSSING  
TEMPORARY DIVERSION CHANNEL  
NOT TO SCALE



**Dewberry®**  
**Dewberry Engineers Inc.**  
990 S. BROADWAY, SUITE 400  
Denver, Colorado 80209  
(303) 825-1802





- 1 FOR CROSSINGS LESS THAN OR EQUAL TO 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 60 FT.
- 2 FOR CROSSINGS GREATER THAN 500 FT. IN LENGTH, REDUCED CONSTRUCTION WIDTH SHALL BE A MAXIMUM OF 80 FT.

# **EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN NOTES**

1. THE PUMPED DIVERSION SHOULD BE OF SUFFICIENT SIZE AND CAPACITY TO CONVEY NORMAL STREAM FLOW OVER THE OPEN TRENCH.
2. PUMPED DIVERSION SHALL BE INSTALLED PRIOR TO TRENCH EXCAVATION.
3. AN EFFECTIVE SEAL MUST BE CREATED AT THE DIVERSION. ONCE IN PLACE, THE PUMPED DIVERSION IS NOT REMOVED UNTIL THE PIPELINE HAS BEEN INSTALLED AND THE STREAM BED AND BANKS HAVE BEEN RESTORED.
4. MARK THE TOP OF STREAM BANK WITH HIGH VISIBILITY FLAGGING.
5. AREAS OF SOILS OR POLLUTANT MATERIAL STORAGE AND REFUELING SHALL BE LOCATED AT LEAST 100 FEET BACK FROM TOP OF STREAM BANK.
6. CONSTRUCT DAMS WITH SAND BAGS OR GRANULAR MATERIAL EXTENDED TO STREAM BOTTOM. MAINTAIN AMBIENT DOWNSTREAM FLOW RATES.
7. NATURAL STREAM BED MATERIAL TO BE STRIPPED AND SEGREGATED FROM SUBSURFACE MATERIAL FOR FINAL STREAMBED RESTORATION. EXCAVATION PORTION OF NATIVE STREAM BEDS COMPRISED OF ROCK, COBBLE, OR GRAVEL ARE TO BE STRIPPED AND SEGREGATED AND USED DURING STREAM RESTORATION.
8. REMOVE ALL CONSTRUCTION MATERIAL AND STRUCTURES FROM THE WATER BODY AFTER CONSTRUCTION.
9. RESTORE STREAM CHANNELS AND BOTTOMS TO THEIR PRECONSTRUCTION CONTOURS, AND STABILIZE THE STREAM CHANNEL PRIOR TO REESTABLISHING FLOW.
10. ALL EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE PROJECT FOOTPRINT PRIOR TO PERMANENTLY STABILIZING STREAM BANKS.
11. KEEP ALL CHEMICALS AND FERTILIZERS OUT OF STREAM.
12. TEMPORARY CROSSINGS SHALL STAY IN PLACE FOR THE MINIMUM AMOUNT OF TIME REQUIRED TO INSTALL PIPE THROUGH THE STREAM CROSSING.
13. PRIOR TO COMMENCING WORK FOR STREAM CROSSING AREAS, TOPOGRAPHIC LIMITATIONS AT THE CROSSING WITHIN THE CONSTRUCTION LIMITS (INCLUDING THE BOTTOM OF THE STREAM CHANNEL) SHALL BE SURVEYED SO THAT ORIGINAL CONTOURS CAN BE ACHIEVED DURING RESTORATION.

**NOT TO SCALE**





# **Larimer County Analysis – Technical Memorandum No. 12 Groundwater Modeling Report**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**

**Date:** February 5, 2020

**To:** Larimer County Planning Department

**From:** Randy Parks and Derek Nelson - Dewberry Engineers Inc.

**Subject:** Northern Integrated Supply Project - Groundwater Modeling



The Northern Integrated Supply Project has four (4) pipeline reaches that run through Larimer County. The reaches are known as the County Line, Poudre Intake, Glade/Poudre Release Pipeline, and Northern Tier Pipelines.

Detailed geotechnical exploration and site-specific groundwater issues will be addressed during final design. This report presents an overview of the anticipated groundwater levels, construction methodologies, and best management practices to mitigate impacts to groundwater.

## Overview of Groundwater Levels

The NISP conveyance facilities all fall within the South Platte River Basin, with the Cache la Poudre sub-basin the principal aquifer within Larimer County. Depth to groundwater levels vary along the conveyance corridors from near ground surface to over 25 feet. As would be expected, the higher groundwater levels are near surface water sources consisting of ditches, reservoirs, rivers, and streams.

Data was gathered from Colorado Division of Water Resources Well Permit Applications and was utilized to generate **Figures 1** through **3**. These figures depict approximate groundwater depth contours and serve as an approximation of anticipated groundwater levels at this preliminary stage, and are summarized below:

- **Glade/Poudre Release Pipeline (Figure 1)**
  - Groundwater at the Glade site is currently being monitored
  - Geotechnical investigation for these pipe routes will include data from groundwater monitoring wells
- **Northern Tier Pipeline (Figure 1)**
  - Westernmost 2 miles – Groundwater between 15 feet and 25 feet
  - Middle 5 miles - Groundwater between 5 feet and 15 feet
  - Easternmost 8 miles – Groundwater between 5 feet and 20 feet
- **Poudre Intake Pipeline (Figure 2)**
  - Westernmost 2 miles – Groundwater between 5 feet and 10 feet
  - Middle 3 miles - Groundwater between 5 feet and 15 feet
  - Easternmost 2 miles – Groundwater between 10 feet and 20 feet



- County Line Pipeline (**Figure 3**)
  - Northernmost 10 miles – Groundwater between 10 feet and 30 feet
  - Middle 12 miles - Groundwater between 5 feet and 10 feet
  - Southernmost 8 miles – Groundwater between 10 feet and 20 feet

During final design, the groundwater depths will be determined and monitored in conjunction with the geotechnical investigations.

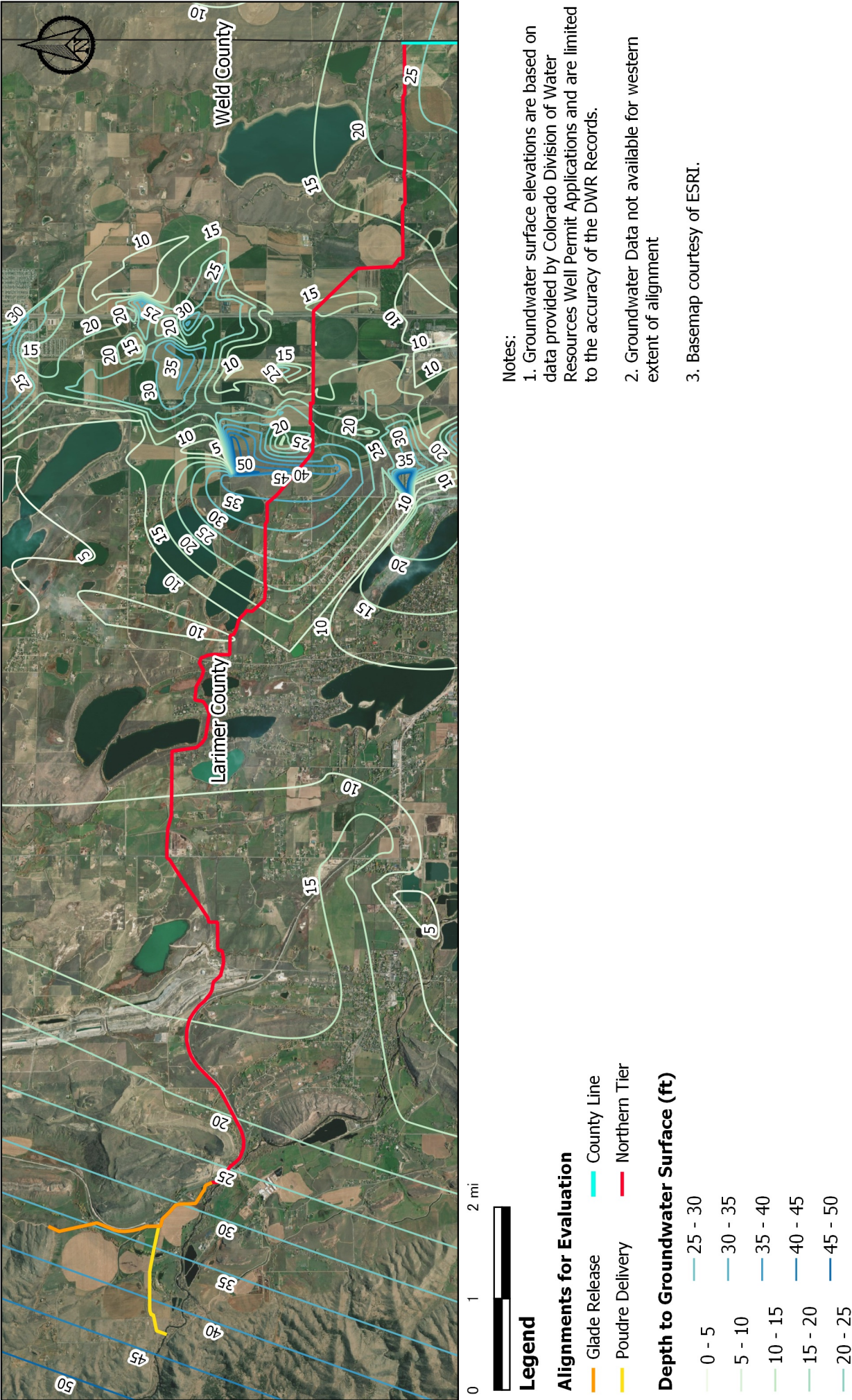
### **Mitigation of Impacts**

There are a range of mitigation practices anticipated to mitigate construction impacts and long-term effects of the pipeline construction including:

- Use of an imported granular pipe bedding around the pipe, to allow transverse transmission of groundwater around the linear pipeline feature
- Construction of low-permeability trench plugs along the pipeline to prevent longitudinal transmission of groundwater. These trench plugs are typically made of bentonite or flowfill and are designed to intercept longitudinal groundwater flows that can occur in the permeable bedding to avoid inadvertent draining or collection of groundwater in a manner that had not previously occurred.
- Utilizing best management practices (BMP's) in accordance with Larimer County and Colorado Department of Public Health and Environment (CDPHE) regulations in conjunction with:
  - Dewatering of trenches or tunnel shafts
  - Collection and sediment control, treatment (if required), and discharging

CDPHE construction dewatering permits will be acquired and contractors will be required to meet all requirements.

Figure 1 - Depth to Groundwater Analysis for Northern Tier, Glade Release, and Poudre Release Alignment

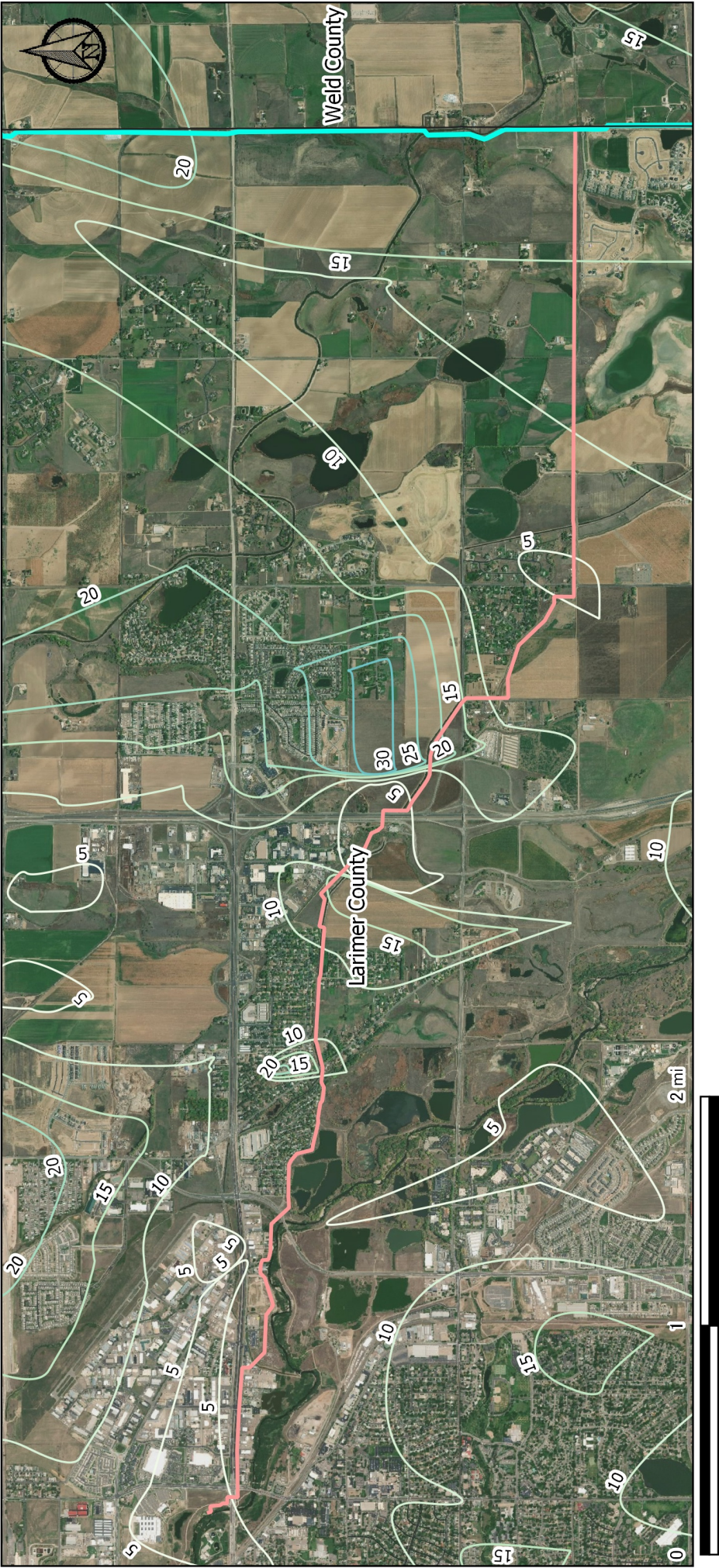


- Notes:
1. Groundwater surface elevations are based on data provided by Colorado Division of Water Resources Well Permit Applications and are limited to the accuracy of the DWR Records.
  2. Groundwater Data not available for western extent of alignment
  3. Basemap courtesy of ESRI.

Author: A. Ristuccia  
Date: 02/05/2020  
CRS: WGS 84



Figure 2 - Depth to Groundwater Analysis for Poudre Intake Alignment



**Legend**

**Alignments for Evaluation**

- County Line
- Poudre Intake

**Depth to Groundwater Surface (ft)**

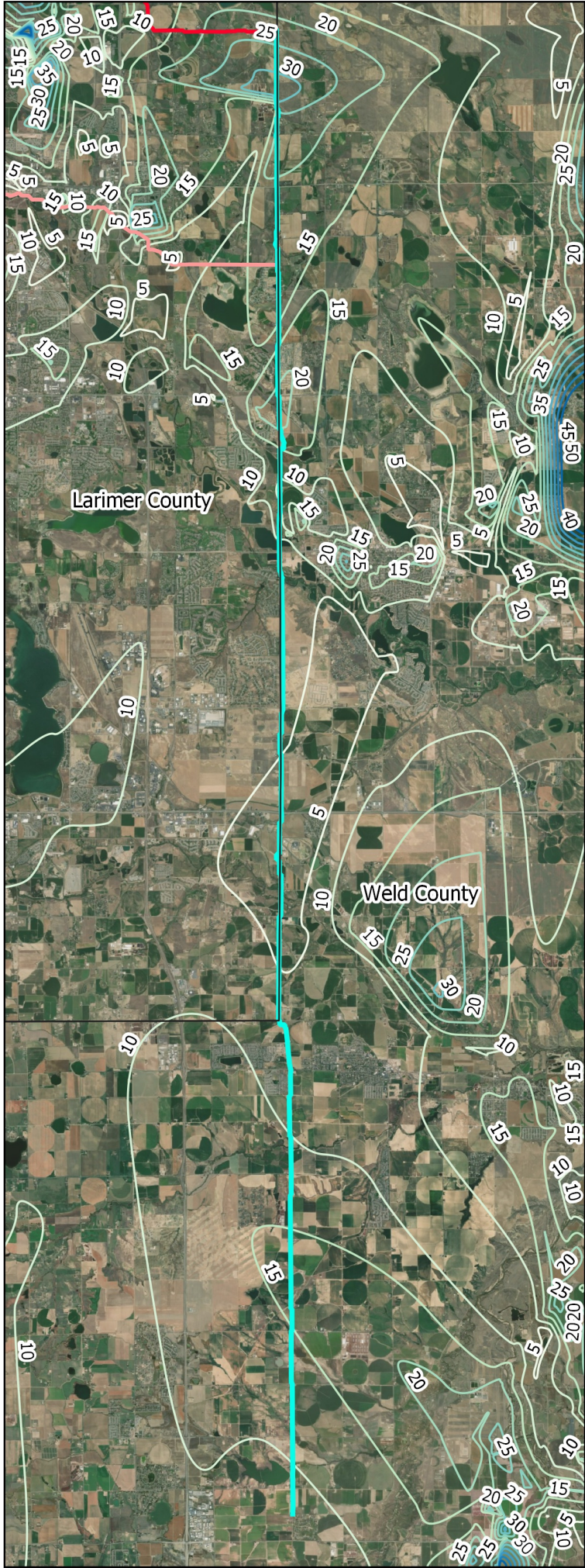
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50

**Notes:**

1. Groundwater surface elevations are based on data provided by Colorado Division of Water Resources Well Permit Applications and are limited to the accuracy of the DWR Records.
2. Basemap courtesy of ESRI.



Figure 3 - Depth to Groundwater Analysis for County Line Alignment



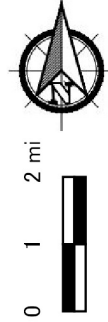
**Legend**

**Alignments for Evaluation**

- County Line
- Poudre Intake
- Northern Tier

**Depth to Groundwater Surface (ft)**

- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50



**Notes:**

1. Groundwater surface elevations are based on data provided by Colorado Division of Water Resources Well Permit Applications and are limited to the accuracy of the DWR Records.
2. Basemap courtesy of ESRI.





# **Larimer County Analysis – Technical Memorandum No. 13 Glade Dam Appearance Simulation**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**

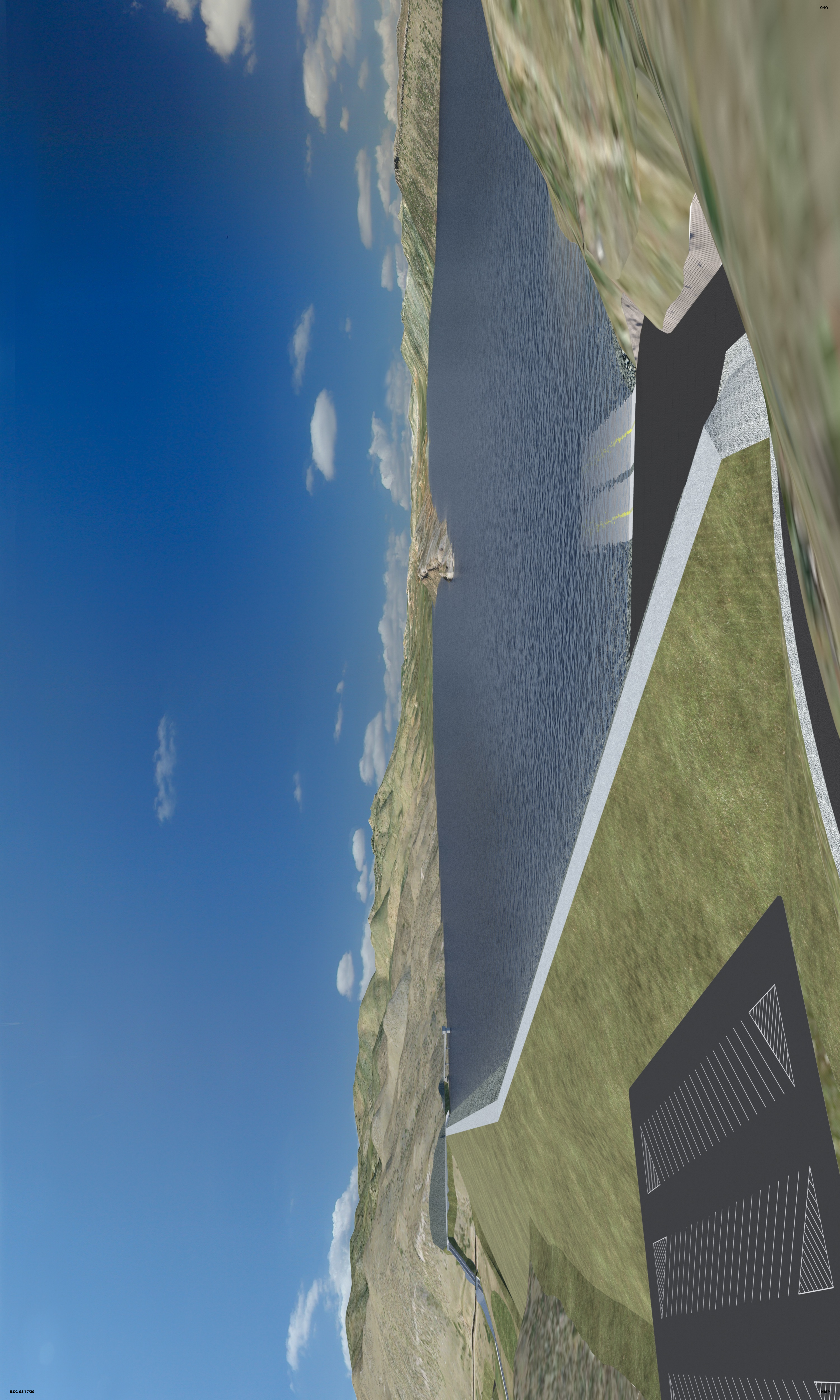
For the simulation-of-the-appearance-of-the-facility item in the check list:

- For Glade Reservoir
  - Include the fly-over video: <https://www.youtube.com/watch?v=kCEol8NujxE>
  - Include the three flat images of the dam
- For Conveyance Pipelines
  - No need for visual simulation because nothing will be 40 feet or greater in height

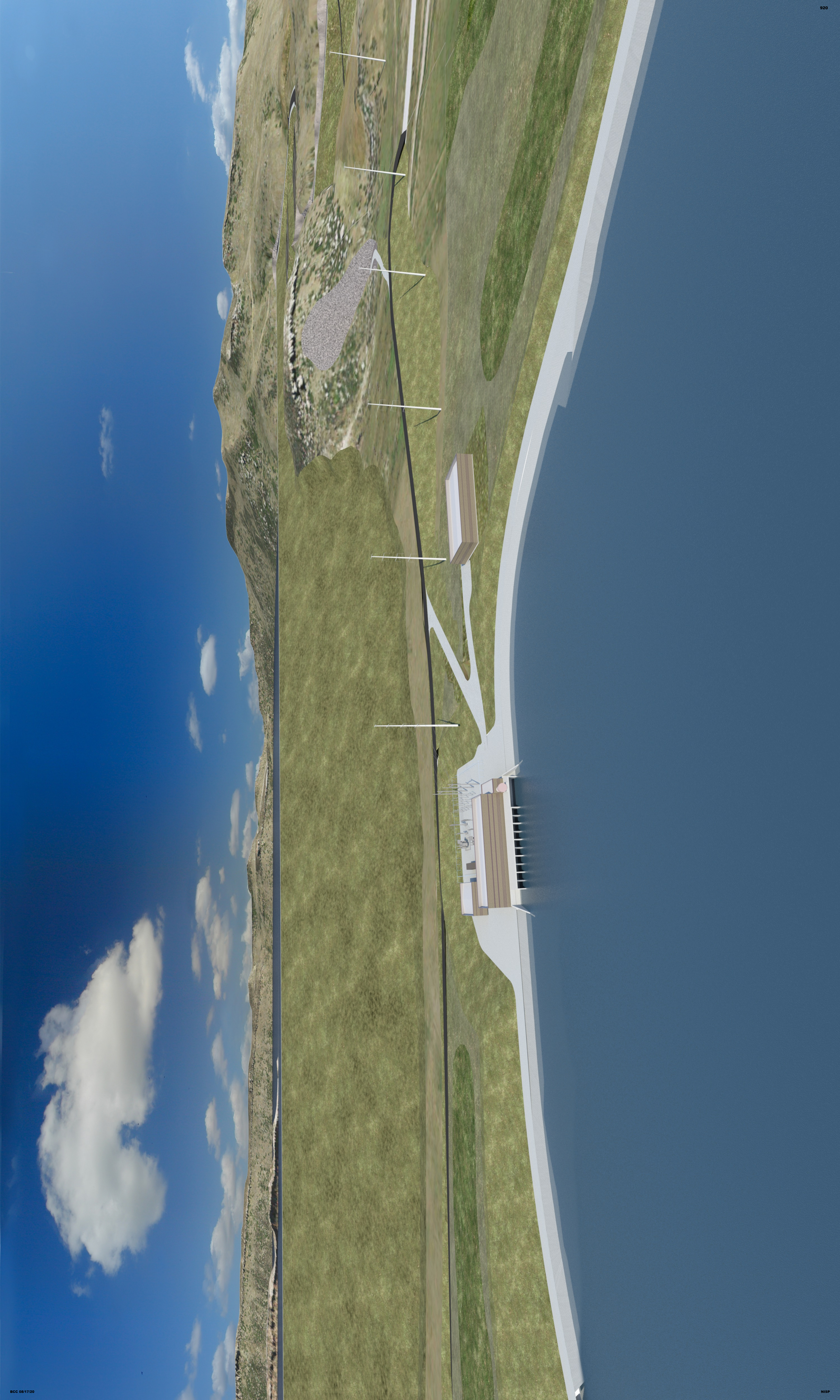
















# **Larimer County Analysis – Technical Memorandum No. 14 Conveyance Pipeline Noise Analysis**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**



This analysis addresses requirements of the 1041 Permit noise analysis for conveyance pipelines being proposed as part of the Northern Integrated Supply Project (NISP). It discusses the anticipated noise impacts related to the NISP conveyance facilities that are within unincorporated parts of Larimer County. Such facilities include:

- Northern Tier Pipeline
- Poudre Delivery Pipeline (including the Glade Release)
- Poudre Diversion Pipeline
- County Line Pipeline
- Glade Reservoir Pump Station
- Poudre Diversion Pump station

#### **Larimer County Code:**

Per Larimer County's current Noise Level Policy (Larimer county Code of Ordinances Article V) construction projects shall limit construction noise to the following maximum permissible noise levels for daytime and nighttime activity:

Maximum Noise [db(A)] 7:00 a.m. to next 7:00 p.m.	Maximum Noise [db(A)] 7:00 p.m. to next 7:00 a.m.
80 db(A)	75 db(A)

And the noise levels permitted for long-term residential property land uses are limited to the following maximum permissible noise levels for daytime and nighttime activity:

Maximum Noise [db(A)] 7:00 a.m. to next 7:00 p.m.	Maximum Noise [db(A)] 7:00 p.m. to next 7:00 a.m.
55 db(A)	50 db(A)

Larimer County's policy indicates that noise occurring within the county shall be measured at a distance of at least 25-feet from the source located within the public right-of-way, and if the noise source is located on private property or public property other than the public right-of-way, the noise shall be measured at or within the property boundary of the residential property where the measurement is taken.

#### **NISP Construction**

The noise effects from construction of the NISP conveyance systems would be minimal because the noise increase would only be temporary and construction activities would be subject to the

county noise ordinance. Permanent increases in noise from pump stations would also be minimal because the building design would maintain noise levels below noise standards. As such, the NISP conveyance facilities are expected to have only short-term unavoidable adverse impacts from construction noise. No long-term (permanent) adverse noise impacts will result from this project for residential and commercial properties adjacent to the pipe alignment and pump station locations. Monitoring of construction noise and coordination with Larimer County would ensure that noise levels are within the limits of the ordinance.

Work hours shall be limited to 7:00 a.m. to 7:00 p.m. unless prior authorization from Larimer County is granted. Such times may include extending work hours to minimize impacts to traffic, minimize business impacts, or specific tasks that cannot be interrupted.





# **Larimer County Analysis – Technical Memorandum No. 15 Air Quality Impact and Mitigation Report**

Prepared for:  
**Larimer County**

Prepared by:  
**Northern Integrated Supply Project  
Water Activity Enterprise**

**February 2020**

## Memorandum

**Date:** February 17, 2020

**To:** Christie Coleman, Northern Colorado Water Conservancy District

**From:** Dustin Collins, Technical Group Manager Air Quality – Pinyon Environmental, Inc.

**Project:** Northern Integrated Supply Project

**Subject:** Larimer County 1041 Permit: Air Quality Management Plan

---

### Introduction

The memorandum (memo) presents the Air Quality Management Plan (Plan) developed for the Northern Integrated Supply Project's (NISP or the Project) use in the NISP Water Activity Enterprise's (WAE) 1041 Permit application. In accordance with Larimer County Land Use Code requirements, the purpose of this Plan is to document the potential sources of air emissions, identify strategies for minimizing emissions, propose a plan to implement those strategies, and confirm all applicable state and federal requirements will be followed.

### Project Overview

Northern Colorado Water Conservancy District (Northern Water), acting by and through the NISP WAE, has contracted Pinyon Environmental, Inc. (Pinyon), to provide environmental compliance services during the pre-construction phase of the Project. The Project will provide a new reliable water supply to Northern Colorado and consists of constructing the following in Larimer County:

- Glade Reservoir Complex, which includes Poudre Valley Canal improvements, and construction of the forebay area, the dam structure (including intake and release structures), a pump station, and recreation areas located adjacent to the new reservoir
- A realigned portion of U.S. Highway 287
- New pipeline conveyance systems, which include the Northern Tier, Poudre Intake, Glade Release, and County Line Alignments

The purpose of the Project is to meet a portion of the NISP Participants' (15 towns and water districts in Larimer, Weld, Morgan, and Boulder counties) current and projected future water supply needs. The overall goal of the Project is to provide 40,000 acre-feet of new, annual water to the NISP Participants.

This Plan only covers work associated with Glade Reservoir and NISP conveyance system in unincorporated Larimer County (Figure 1). Larimer County 1041 Permit Requirements do not apply to Colorado Department of Transportation (CDOT) highway relocations. As a result, the scope and effects of the realignment of U.S. Highway 287 will be evaluated per Larimer County requirements as a separate process.

#### 8.11.1 - Applicability

The Larimer County, Land Use Code, 8.11 Standards for All Development – Air Quality Standards states that:

*A. "All subdivisions, conservation developments, planned land divisions, minor land divisions, special exceptions, special reviews, and site plan reviews must comply with air quality standards in this section."*



*B. “The county planning and health and environment departments will review air quality mitigation plans and recommend they be accepted or rejected prior to the public hearing process.”*

For reasons described below under 8.11.3, an air quality mitigation plan is not required to be developed.

### **8.11.2 – General**

Section 8.11.2 General states:

*“Developments must comply with all county, state, and federal air quality standards and must reduce potential emissions where feasible.”*

The Project will be required to comply with state and federal air quality standards, the extent to which will be determined by the equipment used and activities during the construction and operations phases, along with the potential to emit that is expected to be calculated during both phases.

For example, the Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division (APCD) will require submittal of Air Pollutant Emission Notices (APENs) to disclose potential emissions. The APEN emission levels will determine if permit applications are required to be submitted and issued permits are required to be maintained. Permit applications that could be applicable may require the Mining Operations APEN (Form APCD – 222), the General Permit 03 (GP 03) for Land Development Projects, the Engine APEN (Form 201), or some combination thereof. NISP will communicate with CDPHE APCD prior to and throughout the permit application process to be sure the applicable forms and required permit application package are completed for proper authorization.

Federal requirements may be applicable depending on equipment types, sizes, construction dates, and other parameters. For example, New Source Performance Standards (NSPS) Subpart JJJJ may be applicable if there are stationary internal combustion engines planned that are constructed after June 12, 2006. In that case the Project would follow required emissions limitations, stack testing requirements, and reporting specifications for any and all applicable engines.

This full state and federal applicability analysis will be completed as the dates of construction become closer and the full Project parameters are known.

### **8.11.3 – Minimizing Air Quality Impacts**

Section 8.11.3.A specifies that an air quality mitigation plan is required for applicants for projects “...involving more than 200 dwelling units, or more than 2,000 projected vehicle trips per day...”

An air quality impact analysis was completed for the Project’s Final Environmental Impact Statement (FEIS) in June of 2018 to present potential to emit for applicable pollutants. The impact analysis includes expected Project parameters such as equipment types and Project phase durations. Predicted vehicle trips per day that will be needed during construction and operation were also included. Based on the values presented, the maximum amount of vehicle trips per day for the proposed Project is estimated to be 1,126 which is well below the 2,000 trip threshold for requiring the air quality mitigation plan. That value is considered a conservative estimate because it is unlikely all areas and phases of construction could potentially have maximum truck trips occurring on the same single day. Additionally, some of those truck trips would take place outside of Larimer County, but are included here for simplicity of the analysis.

Based on that information, this submittal does not include the development of a separate air quality mitigation plan.

Section 8.11.3.B requires that this “*air quality management plan must identify potential sources of air emissions, identify possible strategies for minimizing emissions and propose a plan for implementing those strategies. The strategies must include those methods that are available, feasible, and economically reasonable.*”

### **Potential Sources of Air Emissions**

Potential air emissions will result from construction activities, with sources such as:

- On road vehicle traffic exhaust
- On road vehicle traffic fugitive dust
- Construction vehicle equipment exhaust
- Construction vehicle equipment fugitive dust
- Wind erosion

Potential air emissions will also result from long-term operation of the Project, with sources such as:

- Biogenic sources from microbial decomposition
- Fugitive dust from exposed shoreline
- Exhaust from recreational activities, including travel to and from the Project site
- Indirect emissions from electrical pumping sources

### **Strategies for Minimizing Emissions**

Emissions minimization and control measures are required by CDPHE for various equipment and phases of construction activity. The Project will comply with CDPHE emissions requirements that are applicable to the Project.

Examples of fugitive dust control measures include:

- Watering or treating with chemical dust suppressant roadways, storage piles, and loaded trucks
- Covering loaded haul trucks
- Limiting size of both loaded and unloaded haul vehicles
- Limiting speed traveled for all vehicles traveling unpaved roads
- Washing and/or treating the exterior of haul trucks

CDPHE requires methods to limit fugitive dust from surfaces that have had land disturbance on them. Practices include planting vegetation cover, installing synthetic cover, compacting soil, and watering or chemically suppressing loose dirt.

The Project will minimize non-road vehicle (construction vehicle) exhaust by using or converting portions of the construction vehicle fleet to newer model engines that are expected to be more fuel efficient and require less overhauling and maintenance. Some of the engines in the construction fleet would be expected to meet Environmental Protection Agency (EPA) nonroad Tier 4 standards. As stated in the FEIS, Nitrogen Oxides (NO<sub>x</sub>) emissions can be reduced significantly if even a portion of the construction vehicles meet Tier 4 standards. The FEIS emission calculations make the assumption that there will be a 75% NO<sub>x</sub> reduction from vehicle exhaust emissions.

### **Strategy Implementation**

Implementation of the above control measures will be done at various phases of the Project. The main strategy is for the Project to develop air management plans that will be followed where appropriate. For example, the fugitive dust control plan will present the control measures to reduce fugitive dust, the timing for implementation of those measures, and the methodology for how they will be done. All personnel working on the Project will be required to follow the fugitive dust control plan throughout the duration of the Project.



Compliance with vehicle exhaust standards will be done through informing those involved with the planning of vehicles on-site of those standards. For example, when requests for proposals (RFP) are issued to those working on the Project, the RFP will require any responders to confirm with their scope submitted that they understand how to comply with exhaust standards.

#### **8.11.4 – Fugitive Dust During Construction**

Section 8.11.4.B states *“Developments must comply with the following standards: 2. If a development disturbs more than 25 acres or exceeds six months in duration, state air quality regulations require a fugitive dust control plan; an air pollution emissions notice; and a permit from the CDPHE. For proposals in this category, a fugitive dust control plan must be submitted with the final plat or site plan application, and a state permit must be obtained prior to construction activity.”*

As identified in 8.11.2 above, it is expected that the Project will be required to submit APENs and evaluate permitting thresholds for CDPHE APCD compliance prior to any construction activity. It is also expected that the Project will exceed CDPHE thresholds of 25 acres and the six-month duration requiring the development of a fugitive dust control plan. The fugitive dust control plan will be developed under the timing required by CDPHE, which is expected to be during the permit application process. In accordance with the requirements under this standard, the fugitive dust control plan will be submitted to Larimer County to have on file.

#### **8.11.5 – Compliance with Air Pollution Control Regulations**

Section 8.11.5.A states *“In Colorado, land uses with the potential to emit air pollutants above certain defined thresholds must report those potential emissions and obtain an air emission permit...”*

Section 8.11.5.B states *“Developments that have emission sources regulated under state regulations must submit the following documentation regarding control of air emissions: 1. An air pollutant emission notices..., and 2. A Colorado Air Emissions Permit. This permit must be submitted prior to operating the facility.”*

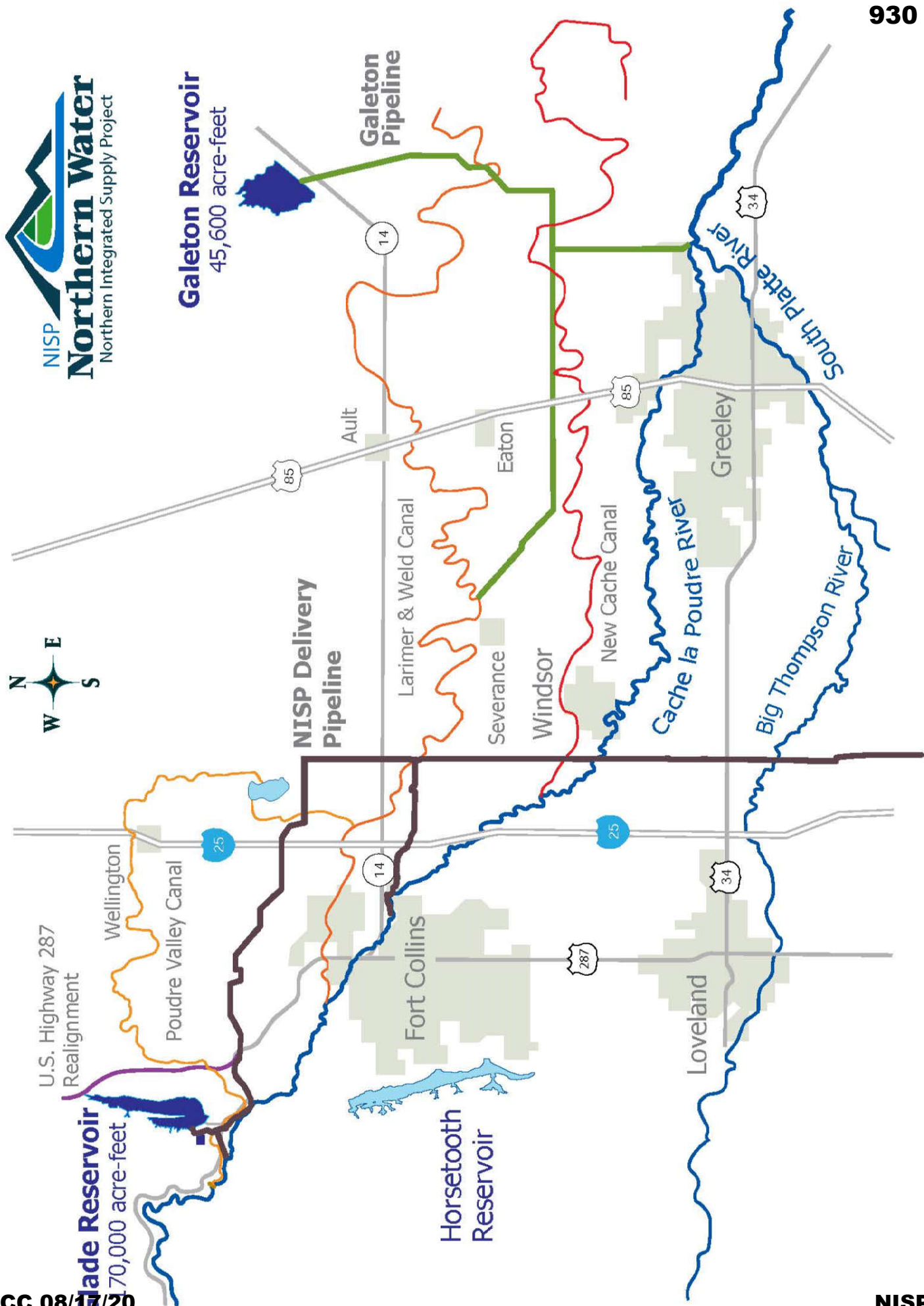
As discussed in sections above, the Project will comply with all applicable CDPHE APCD air quality regulations in a manner consistent with state guidelines prior to the construction and operation of the Project. Any air permit that is obtained through CDPHE APCD would be submitted to Larimer County to have on file prior to operations.

#### **Conclusions**

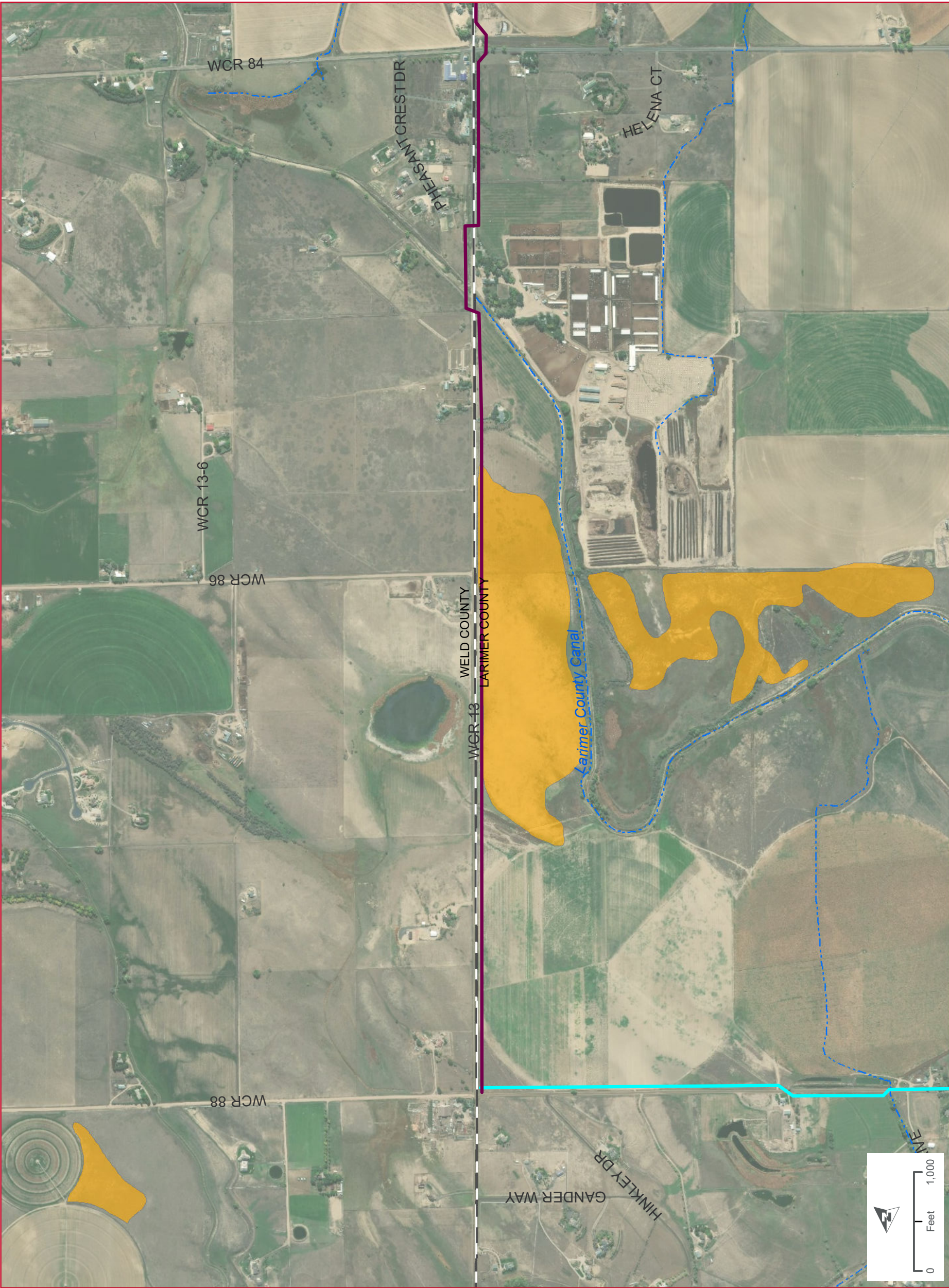
The efforts summarized in this Plan have been designed to inform the County of potential air quality impacts from the Project, and detail how air quality emissions will be managed. NISP will comply with all applicable air quality standards and will follow through with all mitigation commitments provided herein and in other relevant Project documents.

Figure 1







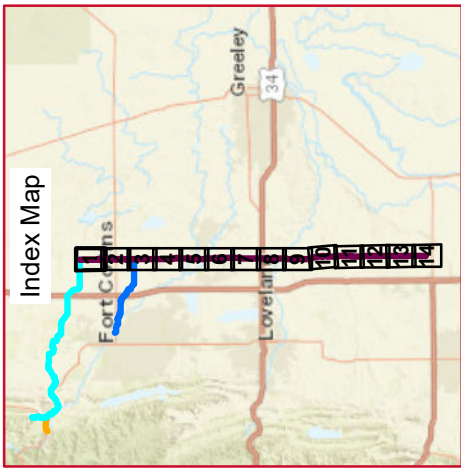


COUNTY LINE PIPELINE  
SHEET 1 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 10/2018  
DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife



COUNTY LINE PIPELINE  
SHEET 2 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

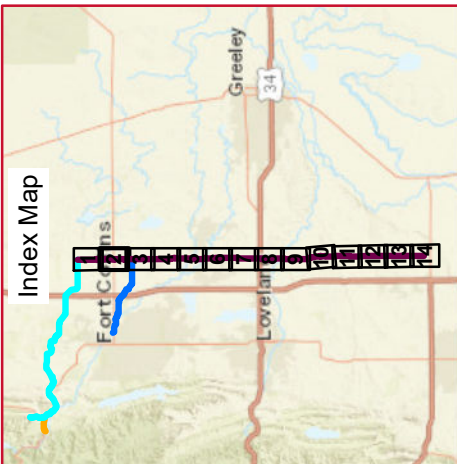
Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

For information about historic/cultural resources, please view the Final Environmental Impact Statement.

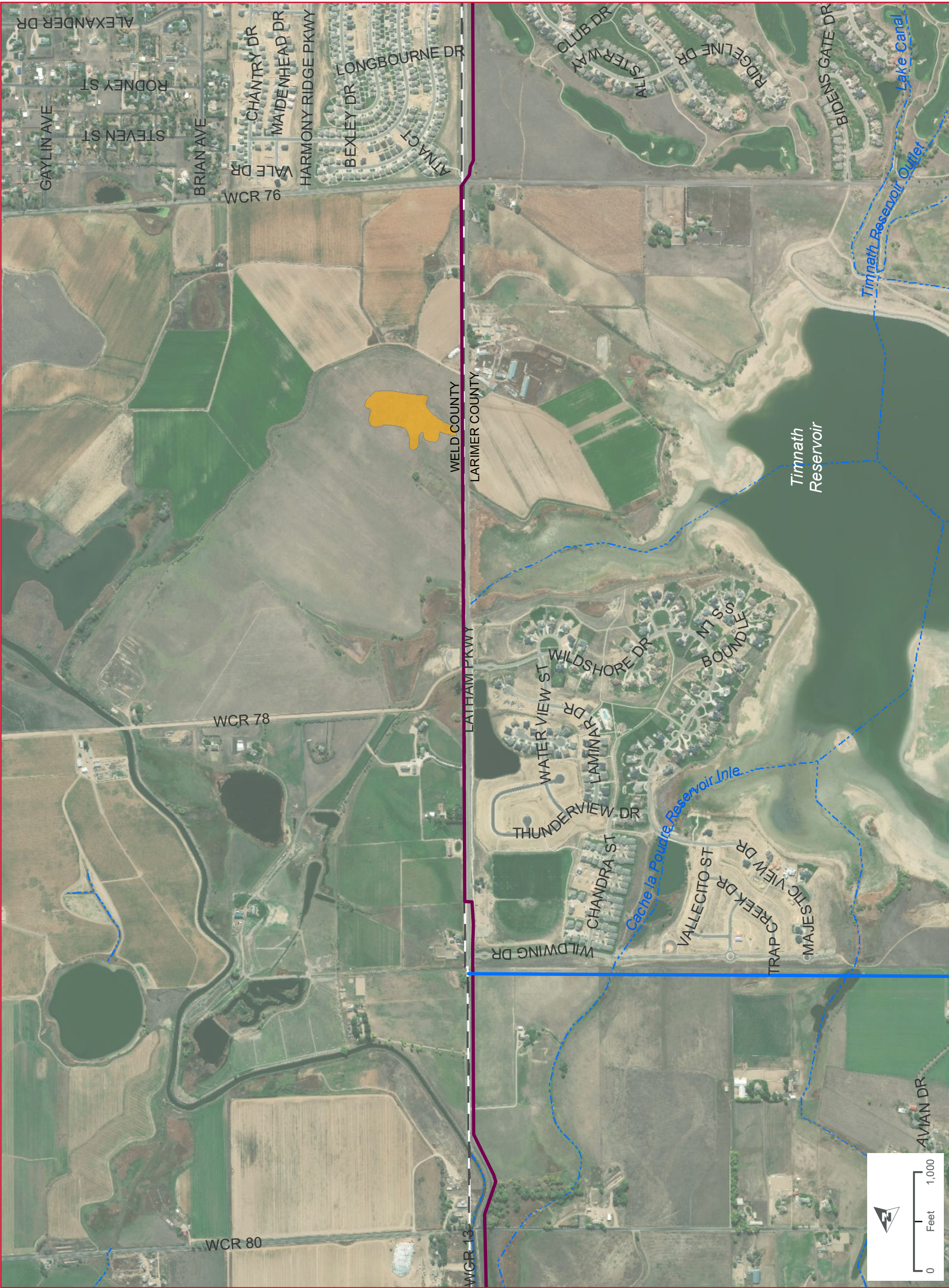


Imagery Date: 10/2018



DATA SOURCES: Northern Water, Larimer County, HDR



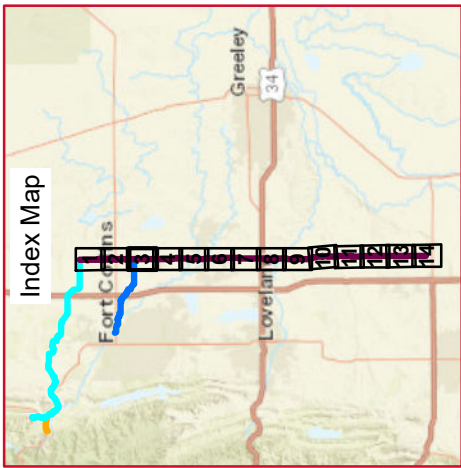


COUNTY LINE PIPELINE  
SHEET 3 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

For information about historic/cultural resources, please view the Final Environmental Impact Statement.

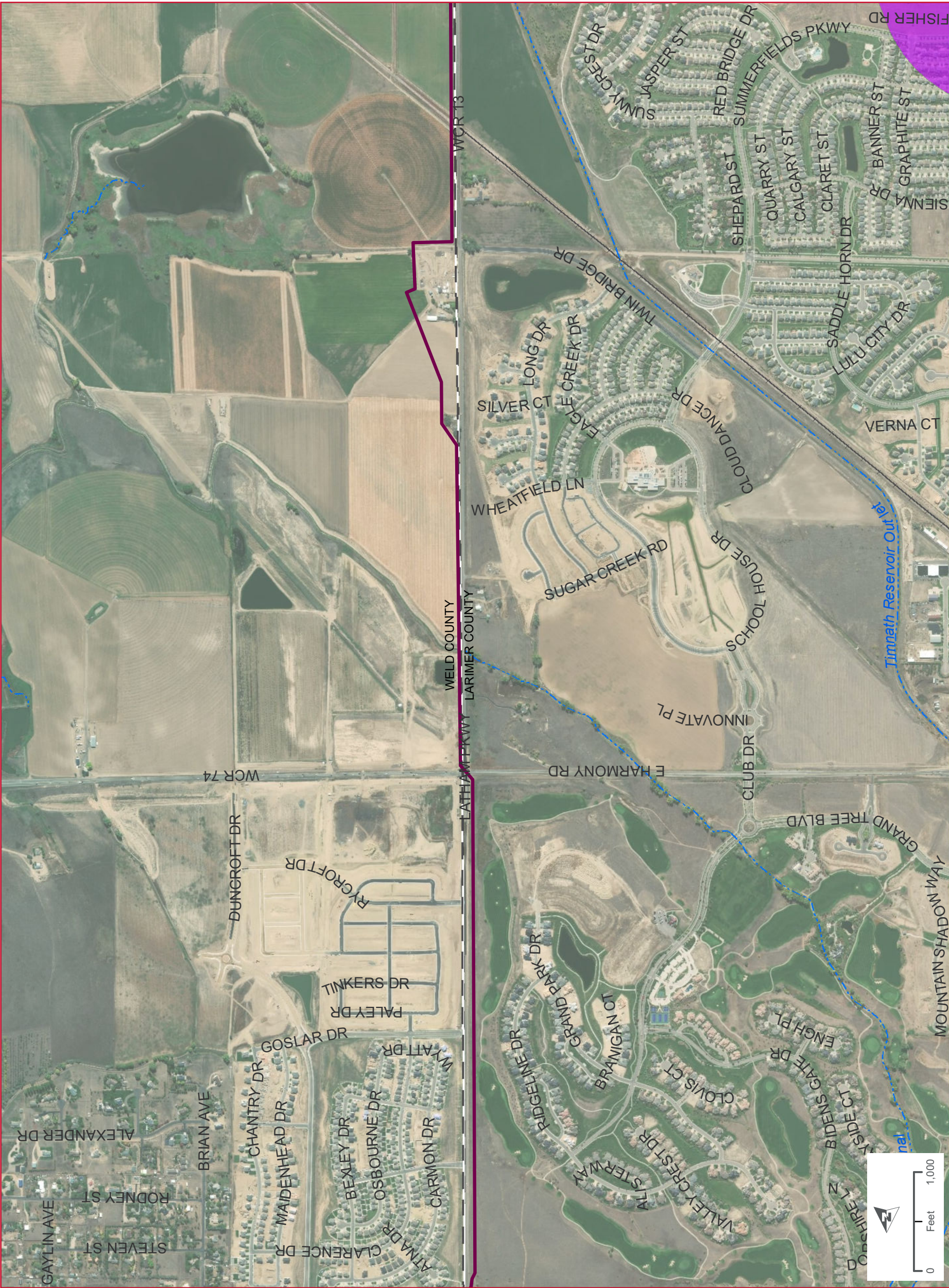


Imagery Date: 10/2018

DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife





COUNTY LINE PIPELINE  
SHEET 4 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

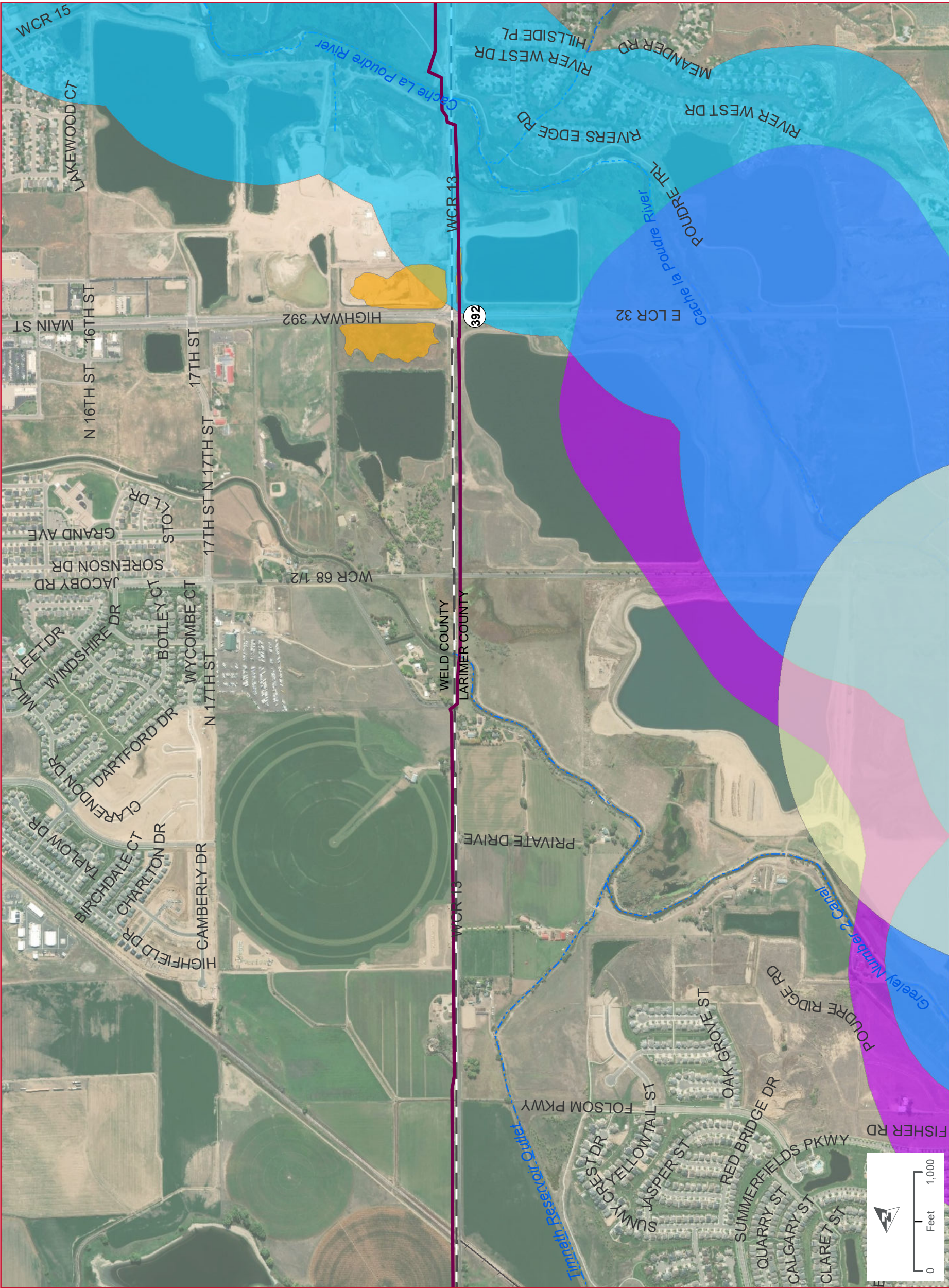
For information about historic/cultural resources, please view the Final Environmental Impact Statement.

Imagery Date: 10/2018

DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife



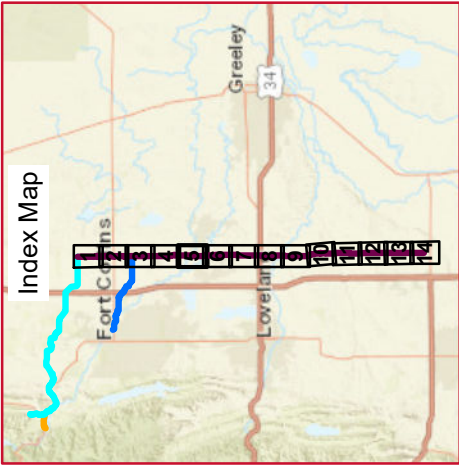


COUNTY LINE PIPELINE  
SHEET 5 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

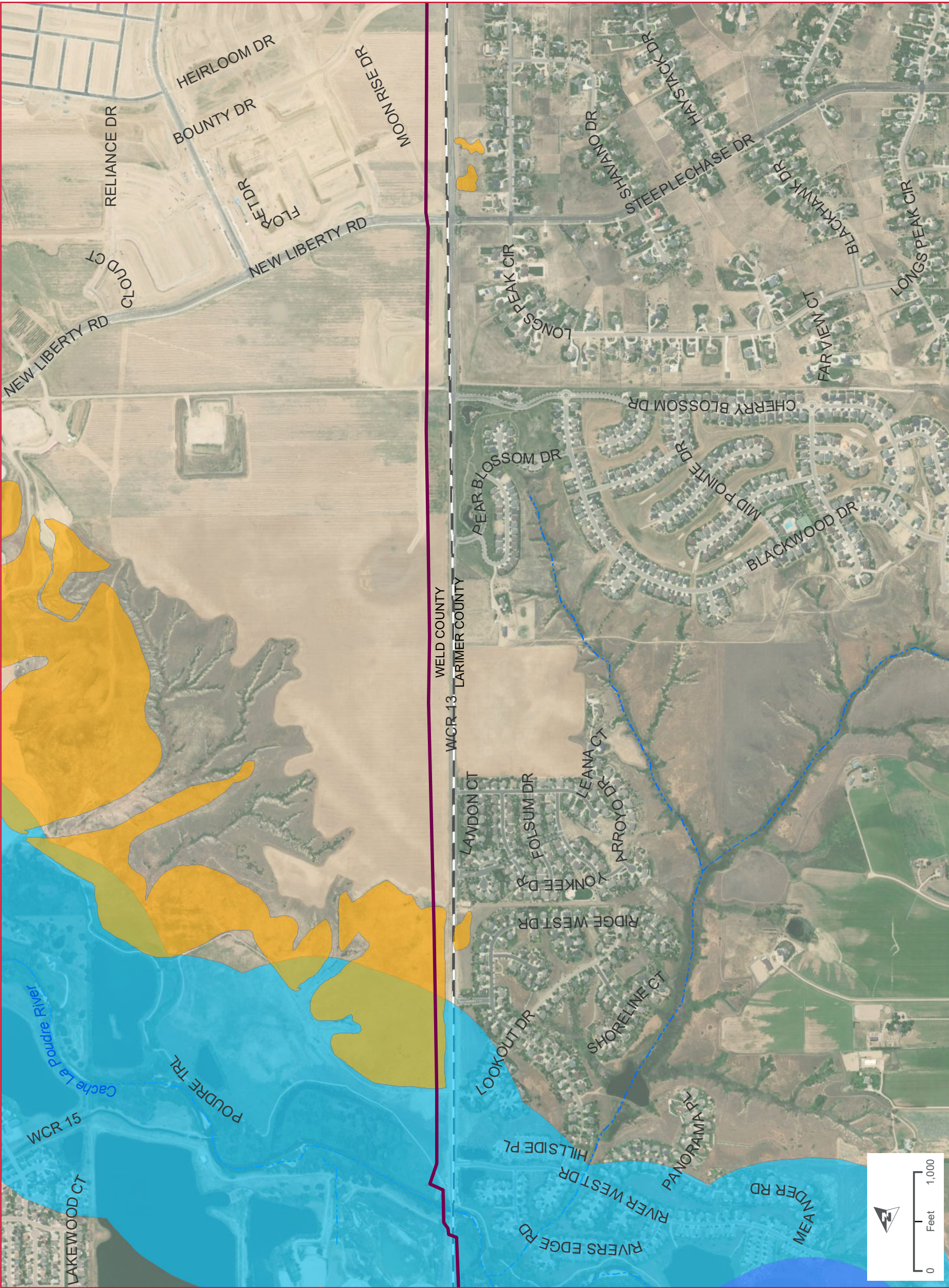
For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 06/2018, 10/2018

DATA SOURCES: Northern Water, Larimer County, HDR





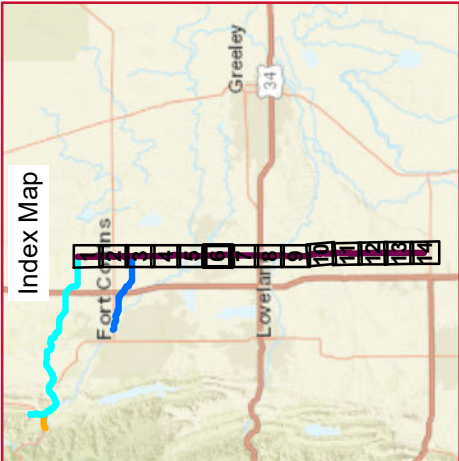
COUNTY LINE PIPELINE  
SHEET 6 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

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- Poudre Intake Pipeline
- County Boundary
- Railroad
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- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

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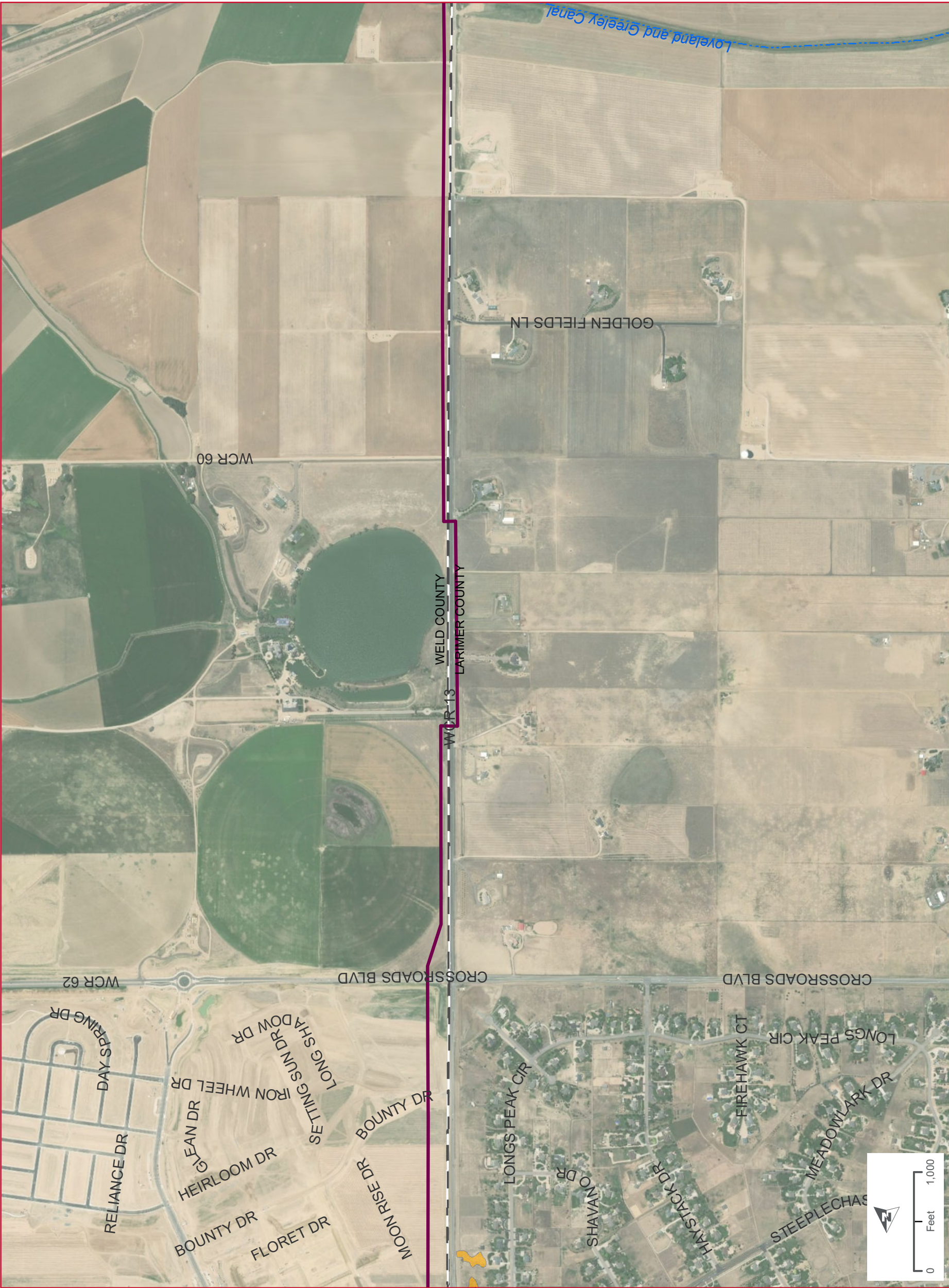
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DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife



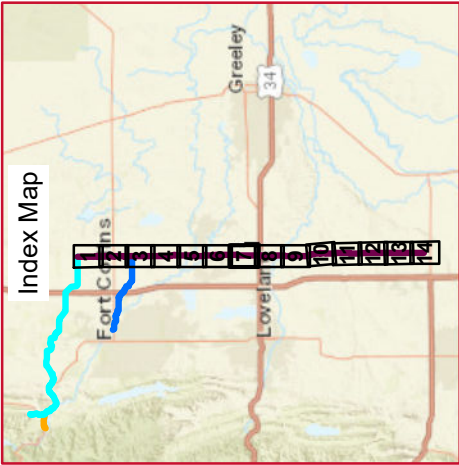


COUNTY LINE PIPELINE  
SHEET 7 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

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- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

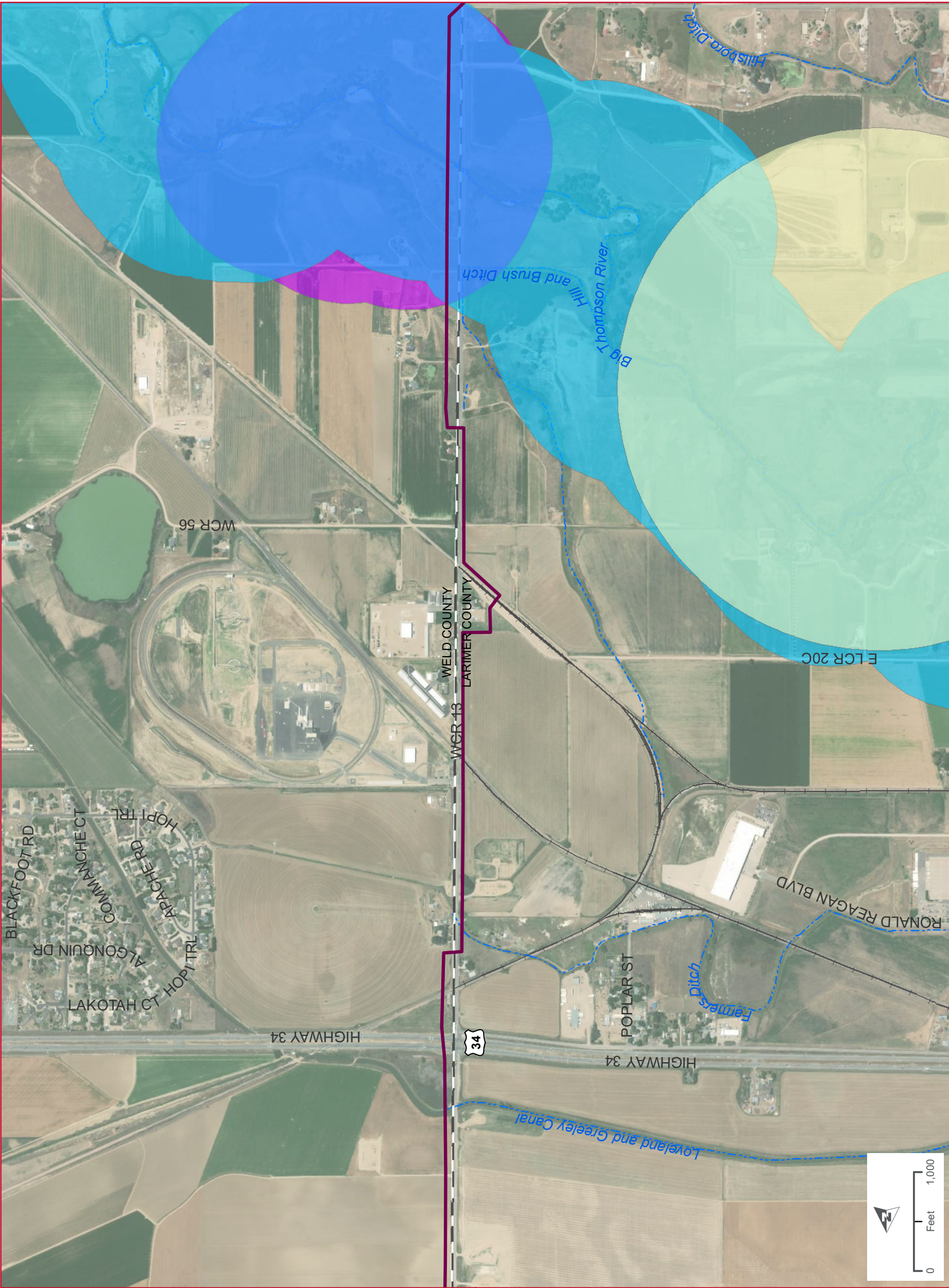
For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 07/2018  
DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife



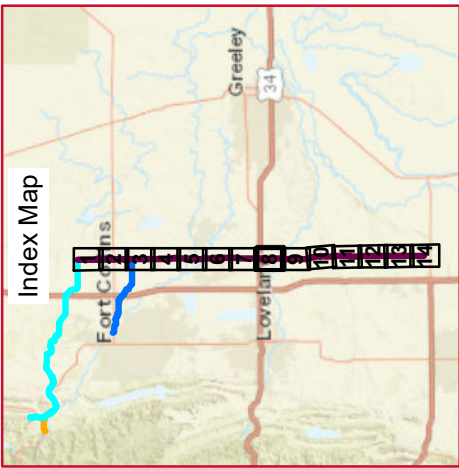


COUNTY LINE PIPELINE  
SHEET 8 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

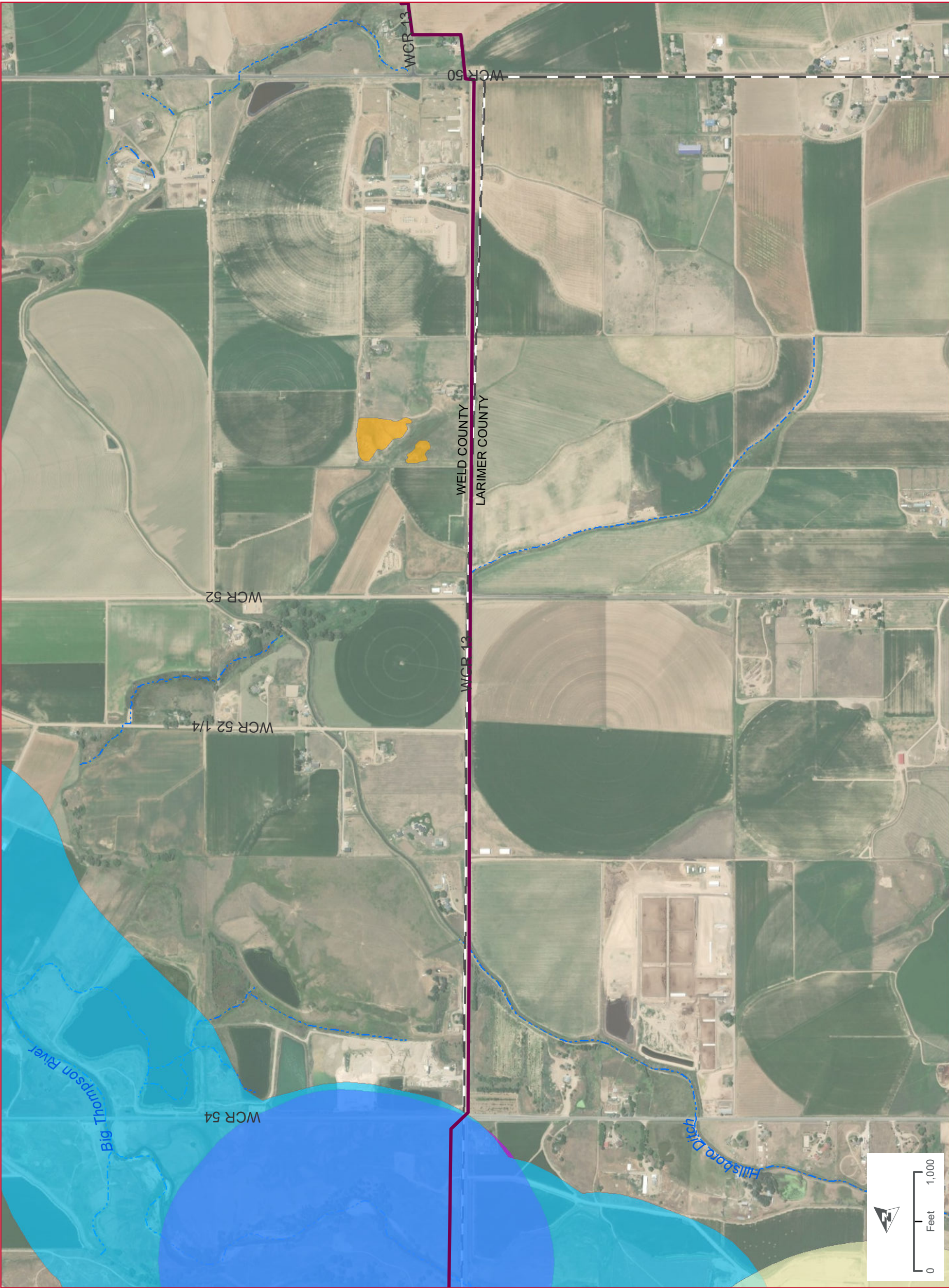
For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 07/2018  
DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife





COUNTY LINE PIPELINE  
SHEET 9 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

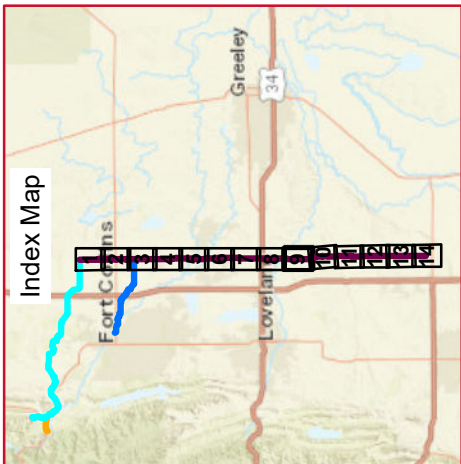
Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
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- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

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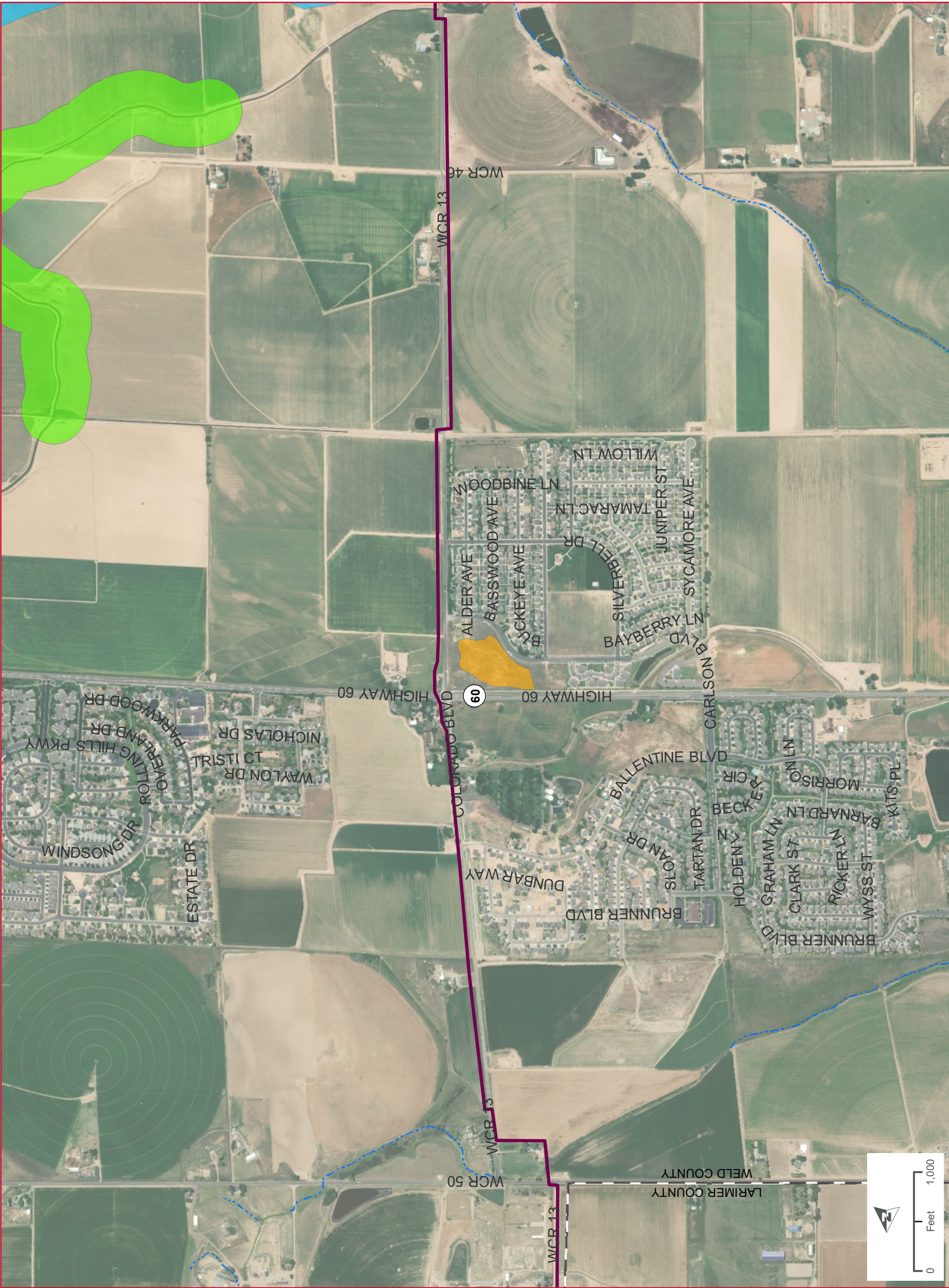
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DATA SOURCES: Northern Water, Larimer County, HDR



Wildlife Data Source: USACE and Colorado Parks and Wildlife





COUNTY LINE PIPELINE  
SHEET 10 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

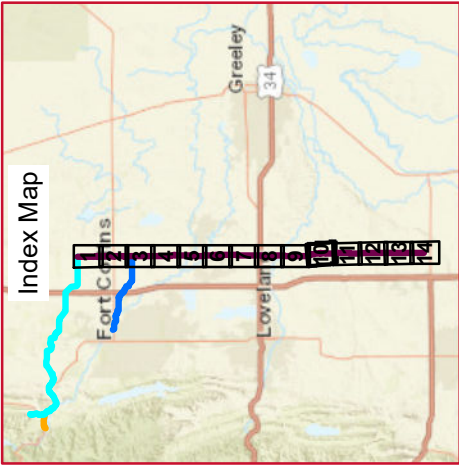
Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

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Imagery Date: 06/2018, 07/2018

DATA SOURCES: Northern Water, Larimer County, HDR



Wildlife Data Source: USACE and Colorado Parks and Wildlife

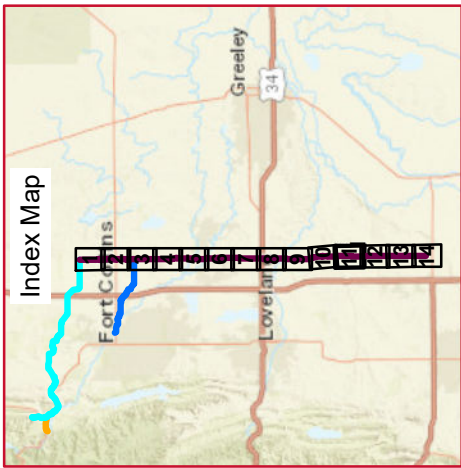




## Legend

- County Line Pipeline  
Northern Tier Pipeline  
Poudre Intake Pipeline  
County Boundary  
Railroad  
Stream/Ditch  
Prairie Dog Colony  
Preble's Meadow Jumping Mouse  
Occupied Habitat  
Bald Eagle Active Nest Buffer  
Bald Eagle Winter Concentration Area  
Bald Eagle Roost Sites

For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 06/2018

**DATA SOURCES:** Northern Water, Larimer County, HDR

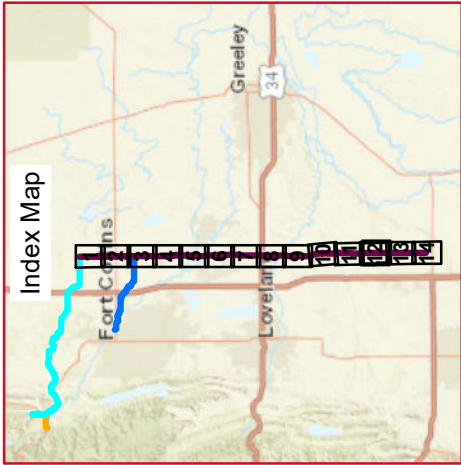


COUNTY LINE PIPELINE  
SHEET 12 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Prairie Dog Colony
- Preble's Meadow Jumping Mouse Occupied Habitat
- Bald Eagle Active Nest Buffer
- Bald Eagle Winter Concentration Area
- Bald Eagle Roost Sites

For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 06/2018, 08/2018

DATA SOURCES: Northern Water, Larimer County, HDR

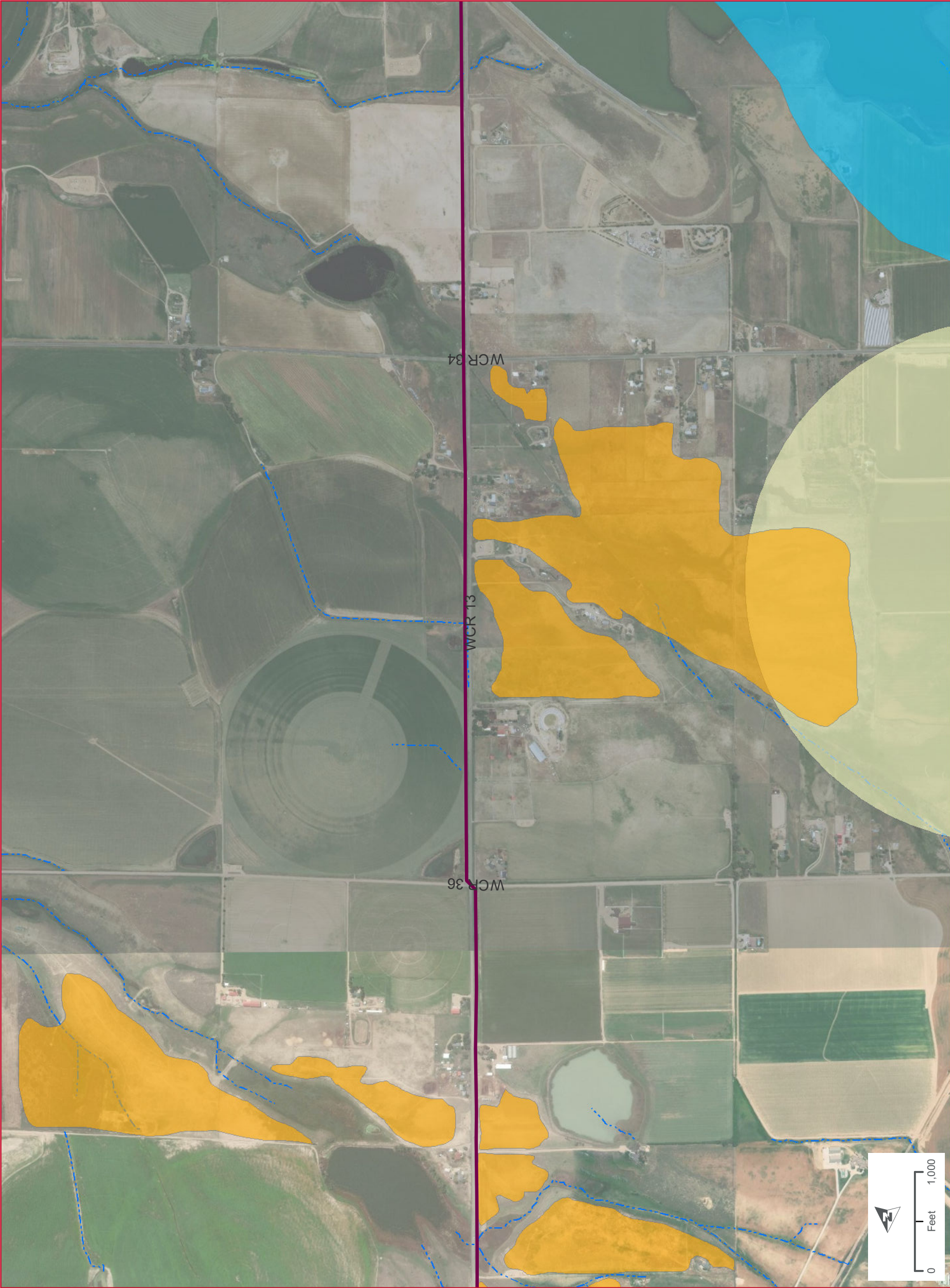


COUNTY LINE PIPELINE  
SHEET 13 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
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For information about historic/cultural resources, please view the Final Environmental Impact Statement.



Imagery Date: 06/2018

DATA SOURCES: Northern Water, Larimer County, HDR

Wildlife Data Source: USACE and Colorado Parks and Wildlife

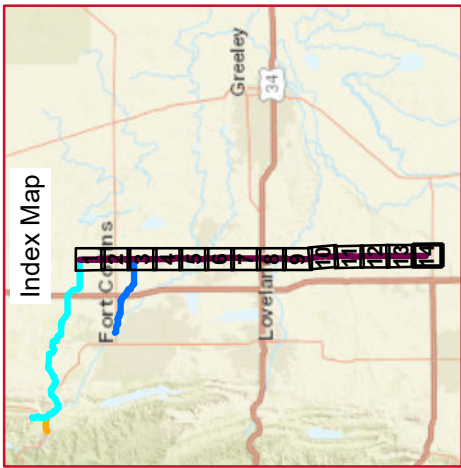
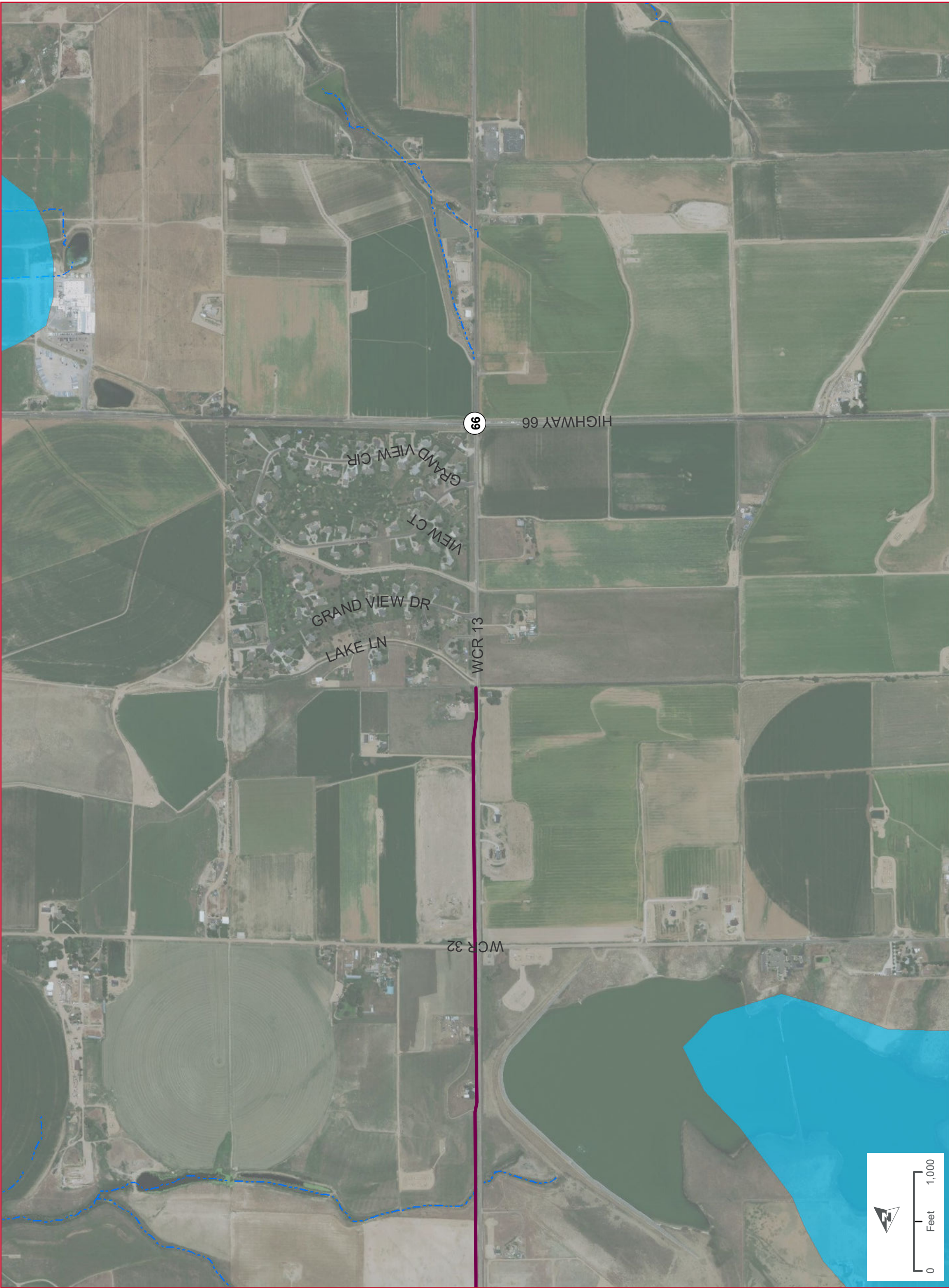


COUNTY LINE PIPELINE  
SHEET 14 OF 14  
MAP SERIES 5C:  
WILDLIFE (OTHER)

Legend

- County Line Pipeline
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Imagery Date: 06/2018

DATA SOURCES: Northern Water, Larimer County, HDR





# **GLADE RESERVOIR - RECREATION CONCEPT MASTER PLAN**

Northern Integrated Supply Project

**PREPARED FOR**

**Northern Water**

**17 FEBRUARY 2020**





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## A UNIQUE RECREATIONAL OPPORTUNITY

Recreation at Glade Reservoir will be a phenomenal asset and opportunity for locals and visitors, connecting people with nature through a full sensory experience. Enjoyment can be experienced from the ground under your feet, to gliding across water, to the breeze blowing the native meadow fragrance, to the sun and shadow play from rock outcroppings, and finally to the boundless starlit sky as night unfolds.



Fundamental to the goals and vision for recreation within Glade Reservoir is the concept of Thoughtful Recreation. This means that recreation programs and operation can encourage stewardship, ecological responsibility, and passive recreation, while also allowing for programmed activity that is increasingly sought after in the region as growing families and growing communities seek to enjoy the outdoors. This enjoyment and experience of the outdoors is what we deeply cherish about Larimer County, what draws people to visit or move here, and can be exemplified in the successful development of the Glade Reservoir Recreation Area.



## RECREATION CONCEPT MASTER PLAN

The recreation planning team has developed a Recreation Concept Master Plan for the recreation area that utilizes the information gained from site visits, outreach efforts, and early engineering analysis. Based upon coordination and site visits over past years with Larimer County staff, the plan provides a description of the major recreation components discussed in those conversations that are being included as voluntary commitments as part of the project's 1041 Permit application and provides conceptual layout and details for how those components can be integrated at Glade Reservoir for review and consideration in the NISP 1041 Permit. The exact layout of and design of the recreation program will be completed in a future Recreation Development Plan with coordination between Larimer County staff, the public, and NISP Participants. This plan provides one possible depiction of the program options under consideration. Future design efforts are anticipated to include ongoing efforts in outreach, user engagement, program development, planning, and site design.

## COORDINATION WITH LARIMER COUNTY

The development of program elements, from their earliest concepts, takes inspiration and guidance from the 2017 Reservoir Parks Master Plan (Larimer County Department of Natural Resources, Final Draft December 2017) and the Open Lands Master Plan (Larimer County Department of Natural Resources, June 2015). These guiding documents, along with direction from Larimer County Staff, are helping to shape early options considered for recreation at Glade. As these components are refined with the Recreation Development Plan, coordination with the County will be fundamental.



## OPEN SPACE CONSERVATION

The experience of preserved open space at the Glade Reservoir Recreation Area intends to be one that seamlessly stretches from the immediate experience of exploring its network of trails, to broad vistas across the water, and into the horizon of the foothills beyond. This land, with its unique character of rolling hills and rock outcroppings, will have the protection and operation to preserve its character and welcome exploration for generations to come.



Supporting the Open Lands Master Plan values and initiatives, Glade Reservoir can exemplify these values to:

- Protect lakes, rivers, streams, and preserve water quality.
- Protect natural resources, wildlife habitat, and rare species.
- Provide more outdoor recreation opportunities.
- Create greenways or trail corridors that connect communities and parks.
- Conserve regional lands.
- Invest in additional paved and natural surface trails...trailheads, parking, shelters, and facilities.
- Conserve land with proximity to existing open space.
- Anticipate the future.
- Ensure a nationally-recognized park system.
- Provide a diversity of recreational experiences.
- Celebrate the natural environment.
- Integrate with a larger recreational network.
- Manage resources in an economically and environmentally sustainable manner.



## COMPLEMENTARY AMENITIES

The recreation amenities provided by the Recreation Concept Master Plan commitments will be further complemented by areas along the west side of the reservoir. Mitigation requirements from the State aim to protect and preserve fish and wildlife resources and conceived of open space conservation planning efforts. Early planning efforts related to public lands surrounding Glade Reservoir included coordination with Colorado Parks and Wildlife (CPW) and the US Fish and Wildlife Service (USFWS). The 2017 CPW Fish and Wildlife Mitigation and Enhancement Plan (FWMEP), the 2007 USFWS Biological Opinion (BO) and the 2018 NISP Final Environmental Impact Statement (FEIS) Conceptual Mitigation Plan (CMP) establish both physical and operational considerations. Enhancements along the west side of Glade Reservoir noted in both the FWMEP and the CMP include establishing and conserving wildlife and big game habitat, and allowing access for big game, small game, turkey, and waterfowl hunting.

Although separate from the Recreation Concept Master Plan funding commitments, the habitat preservation areas and hunting and fishing opportunities along the west side of the reservoir will beneficially enhance the overall visitor experience at Glade Reservoir.

## UNIVERSAL ACCESS AND EQUITY

The benefits and experiences at Glade Reservoir are intended for the use and enjoyment of all visitors and members of the community. Careful consideration will be made for Americans with Disabilities Act (ADA) access to and within the recreation area.



The Glade Reservoir Recreation Area will be located near the mouth of the Poudre River Canyon, a very popular outdoor recreation destination and one known for river rafting, kayaking, fishing, and many other outdoor activities. There are several commercial river rafting operators that work the Poudre



River Canyon. In past discussions with commercial rafting operators, as well as public comments received during the environmental permitting and development of the project's Fish and Wildlife Mitigation and Enhancement Plan, there is a desire for a sizable parking area designated for Poudre River commercial operators and other recreators to be located within 1/2 mile of the U.S. Highway 287 and State Highway 14 intersection and Ted's Place. This parking area will be located at a public access location near the intersection, to serve as a gathering and carpool lot, as well as provide options for public transit and other mobility access.



Elements designed for ADA and wheelchair access could include dedicated interpretive trail areas at and around the Visitor Center, campsite areas, and waterfront enjoyment areas. NISP Participants understand that great advances will likely be made during the recreation development planning phases until eventual opening. With intentional considerations toward equity and access, Glade Reservoir has an opportunity to be a regional and state example for future recreation areas to follow.

## IMMERSIVE EXPERIENCE OF ECOLOGY AND WILDLIFE

Embodied within the value of Thoughtful Recreation, Glade Reservoir's commitment to the environment, sustainability, resiliency, and preservation will be part of every experience when visiting. From first arriving either to the public access parking lot or through the entry gate, the experience can be one that demonstrates this commitment in an immersive way. Educational narratives and descriptions can accompany any material communicated and be available to visitors, including maps, trail guides, resource brochures, and policy pamphlets. From the printed materials, to the friendly knowledgeable staff, to the facilities and amenities themselves, each element can reinforce this value set and not only preserve the quality and character of Glade Reservoir, but also advance the public's understanding, so as to benefit numerous other natural areas within the region.





Wildlife education unique to the Glade Reservoir Recreation Area could include sharing knowledge of the Preble's Meadow Jumping Mouse (PMJM) and other Special Status Species, that may include the bald eagle, golden eagle, and Townsend's big-eared bat, among others. Plant species education could include information highlighting such species as the Ute-ladies'-tresses orchid (*Spiranthes diluviales*).

Adjacent to and downstream of the new reservoir dam embankment, further native planting areas could help with species habitat restoration, stormwater infiltration, and plant biodiversity advancement. The Visitor Center can be uniquely positioned at and among such riparian areas, bringing this message into the experience of this facility, and showing how facilities and amenities can be envisioned to enhance an environmental message, becoming part of the system that restores and enhances ecological habitats.

Educational programs stemming from the interpretive Visitor Center and waterfront program facilities could have a broad range of topics and special initiatives to share with visitors. For example, wildlife observation, bird watching, pollinator exploration, and other activities could be conducted on many platforms and experiences. Sessions and tours could be provided on the water by boat, canoe, or paddleboard, while those sessions on land could vary from boardwalk strolls through riparian areas to exploration of the terrain on single track primitive trails, where one can be guided or self-guided through an educational experience.





Glade Reservoir will provide numerous opportunities for educational outreach to the community as well. Such opportunities could include recreation staff engaging local schools, groups, and communities, to visit and inform them of the experiences unique to visiting Glade Reservoir. Science and research initiatives could be integrated into partnered programs at any educational level from grade school students through University-level research.

## A RANGE OF RECREATIONAL OPPORTUNITIES

A 170-acre recreation area is planned adjacent to and south of the left abutment of Glade Reservoir which is comprised of undeveloped agricultural rangeland found within varied terrain including gently-sloping to moderately-steep terrain including several natural escarpments. The recreation area will provide a network of trails including an accessible trail with interpretive overlooks and primitive multi-purpose trails; several camping areas of varied use ranging from walk-in camping to car and recreational vehicle campgrounds; a visitor center; parking areas for day-use and trail access; as well as a boat ramp and boat specific parking.

Glade Reservoir, through its varied recreational opportunities, will promote healthy living and enjoyment of Larimer County's outdoors. Whereas existing nearby reservoir facilities are seeing crowding during peak times that may deter visitors and decrease user experience and associated levels of service, Glade Reservoir expands options for outdoor enjoyment, exercise, and mindfulness. The



recreational facilities are intended to serve a variety of patrons, such that benefit can be gleaned by many.

Due to its being nearly equal in size to Horsetooth Reservoir west of Fort Collins, Glade Reservoir will provide another unique option for County residents for many types of recreation, including several available year-round. Glade Reservoir is especially important as it will provide a new sizable water body for boating, a rare resource in Colorado. Boaters and recreators living north of Fort Collins that now travel to Horsetooth Reservoir or beyond to recreate will have an option much closer to home, resulting in an increase of use by a wider cross section of County residents serving those that may not make routine visits to more distant recreational opportunities to the south.

A variety of recreational opportunities could be supported and developed at the Glade Reservoir Recreation Area including boating, camping, fishing, mountain biking, horseback riding, and hiking. Of the 32 activities listed in the County's Open Space Master Plan as "Desired Activities at the Reservoirs," Glade Reservoir could provide a majority of the potential recreational activities as listed in the below table.

POTENTIAL RECREATIONAL ACTIVITIES	
Mountain biking	Snowshoeing and cross-country skiing
Hiking	Youth Programs
Educational Programming	Horseback Riding
Kayaking and Canoeing	Backcountry and Boat-In Camping
Rock Climbing	Tent Camping
Road Biking	Picnicking
Stand Up Paddle Boarding	Guided Tours
Wildlife Viewing	Boat Ramps
Fishing	Festivals or Events
Jogging / Running	Developed / RV Camping
Sailing	Scuba Diving
Large Group Picnicking	Water Skiing
Power Boating	Jet Skiing



## RECREATION CONCEPT MASTER PLAN COMPONENTS

An illustrative site plan of the Recreation Concept Master Plan elements is provided in Appendix A. These recreation features are described in the following sections.

### TRAILS

Biking at Glade Reservoir will allow exploration of the recreational area and other natural areas. As the Recreation Concept Master Plan develops, internally networked looping trails can help differentiate trail use, to safely designate trails for bicycles and hiking. Management of the trails can allow for many technical abilities, from beginners on more ADA compliant less-steep trails, to experienced riders looking for challenges along steeper and more rocky terrain.



Hiking and trail running are gaining momentum worldwide as fitness and endurance sports are being embraced by today's younger generations. Colorado is a hotspot for this kind of activity, for athletes and physically-active hikers and runners to improve endurance with training at altitude. Glade Reservoir, at approximately 5 miles in length north to south, would offer exciting opportunities for longer trail running systems, which could be utilized for sporting events or half marathon trail endurance events.

Such activities could utilize the recreation area as a gathering and organizing point for such events. Additionally, the recreation area could offer families and children the opportunity to experience trail hiking and running in a smaller and safer context, with support amenities like bathrooms, water fill-up facilities, and stopping areas so that even beginners can practice and learn the sport. Stopping areas could include benches, area map exhibits, and interpretive kiosks.



The trail opportunities at the Glade Reservoir Recreation Area will be flexible and dynamic enough to offer a host of different trail uses, managed and operated safely to avoid conflict. As the trail use program is developed with the final design of the recreational area, existing operators and experts will be consulted to determine viability and requirements. Casual trail hiking, biking, or horseback riding could be an educational, instructor-led introduction to the trails. Programs could speak toward proper trail stewardship, management of conflicting trail uses, and historic precedents of mobility in the region.

Trail experiences are anticipated to be multi-seasonal at the Glade Reservoir Recreational Area. Such experiences in Colorado are often only able to be experienced by expert mountaineers or are long distances away into the mountains. Glade will offer a uniquely accessible and safe way for beginners and families to enjoy this experience, with the help and support of staff or instructors leading possible educational tours.



Extending beyond the recreational area, the East Shoreline Trail, an unpaved, primitive trail, will be developed along the east shoreline that could serve a variety of recreational uses such as hiking, snowshoeing, mountain biking, camping, rock climbing and fishing activities. The East Shoreline Trail will be approximately 5 miles in length and is intended to connect to a North Trailhead located at the northerly limit of Glade Reservoir. By vehicle, access to the North Trailhead will be available from the future section of U.S. Highway 287 being realigned as part of NISP.

In Appendix B, Exhibits B-1 and B-2 illustrate concepts for trails at Glade Reservoir.



## EDUCATIONAL VISITOR CENTER

The Glade Reservoir Recreational Area Visitor Center is envisioned to be a key amenity for the nearby community and the general public. This facility could provide information and exhibits related to the available recreational opportunities, historic and cultural education, endangered and protected native wildlife species, regional geology, water stewardship and conservation, agricultural interests including the preservation of irrigated lands, and reservoir operations.



This facility offers great potential for community learning and gathering. School groups, clubs, scouts, and families could all access potential programmed educational and exploration activities. In addition to interpretive exhibits, specialized educator-led programs are possible. Staffing and use of the Visitor Center will ideally be tied to recreational uses at the Glade Reservoir with Larimer County, the anticipated management agency, providing staffing. The NISP Participants recognize this facility and its program represent a strategic opportunity to align with partner agencies and public initiatives.

In Appendix B, Exhibit B-3 provides a vicinity enlargement for the concept Visitor Center with adjacent interpretative trails and parking.

## DIVERSE CAMPING OPTIONS

One of the most exciting activities for the recreation area will be camping. Campground use areas are being studied for diverse locations, to allow for a mix of camping experiences and programs. The NISP Participants are actively seeking to acquire the existing KOA Campground at the U.S. Highway 287 and State Highway 14 intersection for incorporation into the Recreation Concept Master Plan. This existing facility allows for a range of camping options, containing primary service hookups for larger scale and RV camping. Such services include water, power, and sewer, as well as an office and shop to serve those staying in this camping area.

As a visitor drives further into the recreational area, camping areas are intended to scale down in intensity, starting in the KOA Campground with RV and assorted uses, to, further along the access road, drive in trailer camping, then drive-in tent camping, and finally hike-in tent camping.



In Appendix B, Exhibits B-4 through B-8 illustrate typical layout concepts for a range of campsite types at Glade Reservoir.

The intent is to create an experience wherein the camping options are diverse, and generally scale from more intensive (RV and trailer) near the entry, to lesser and more passive forms of camping more inland into the recreational area. In this way, the trail systems are envisioned to be experienced as a hike through the vast rolling natural terrain and rock outcroppings, without the visual impact of vehicles, trailers, and the light and noise of more formalized camping arrangements.

A range of camping experiences will be accommodated by groups of campgrounds with vehicular access to include recreational vehicles, car/camping trailers, car camping, tent camping and limited walk-in camping. Each campground within the recreation area will be provided access from an improved one-way or two-way roadway as well as access to full-service restroom facilities and potentially shower facilities that will be serviced and maintained by the management agency.

The limits of the campground use areas will be defined to preserve as much existing native woody vegetation as possible. Campground limits will be positioned with consideration to rock fall setback/buffer zones. Camping closer to rock areas is anticipated to be desirable, largely due to the seasonal winds and summer sun exposure on the site. With additional analysis of these areas, and potential mitigation, campgrounds may be permitted closer to these zones.





Camping in view of Glade Reservoir, or even waterside, will be an incredible and highly-desirable activity. Whether this means hiking to access areas further north along the reservoir or accessing more remote areas by low-powered or non-motorized craft, the project anticipates high demand for this type of experience. The operation and organization of this program can be studied as part of the future Recreation Development Plan to understand the proper amount of program versus passive support for spontaneous activity of this kind. The opportunities for such program elements can range from simple laydown areas for tent camping, up to more formalized tent-cabin installations that would invite visitors that are perhaps not as accustomed to assembling tents and campsites themselves.





Campfire control and fire incident mitigation will be central to the campsite operational policy and program requirements. Working in close coordination and cooperation with the County, State, and Federal regulations on campsites and campfires, the Glade Reservoir Recreation Area will consistently strive to develop policies and best management practices to control and regulate fire burning, so that high wind conditions won't compromise fire control, and native brush surroundings do not fall victim to avoidable incident.

Other improvements under consideration with the campsite recreational program include planting and

growing vegetative buffers to screen large or more intensive camping areas, restrictions on large-scale camping vehicles away from areas upslope or nearing the reservoir, and the use of downcast, full cutoff light fixtures to meet Dark Sky criteria.

## WATER RECREATION OPPORTUNITIES

Without question, water recreation is anticipated to be the strongest draw for recreation and outdoor enthusiasts in the area. The demand for and use by visitors to Horsetooth Reservoir is a clear indicator that residents of the County and visitors have the ability, means, and desire to recreate on the water. For Glade Reservoir, this represents a sensitive challenge, that is under careful ongoing consideration in the development of its recreational program. What types of boating will the recreation program allow or limit? What about noise and light pollution on the water? How will the recreation program affect those wishing for quiet enjoyment of the conservation areas? How does the program affect the success of ecological and wildlife initiatives? How can we predict how water recreation trends will change in the decade, or decades, ahead?

These questions are all under consideration as the Recreation Concept Master Plan and Program take shape. Through public outreach and stakeholder engagement, NISP Participants understand that differing value sets and desires related to the type and extent of motorized boating exists, and yet Glade holds many opportunities to bring these values together in a place for recreation that can be successful across several, seemingly conflicting, interests.

One key component in managing the possible conflicts between motorized and non-motorized water recreation, as well as noise and light concerns associated with motorized boating, is in the effective management and program of boating areas within the reservoir. Advantages could be leveraged wherein portions of the reservoir, easily isolated, could be identified and controlled for specific types of



watercraft. Additionally, the natural topography that will one day be the reservoir floor, will naturally control boating possibilities. For instance, the northern extents of the reservoir will be considerably shallower and likely to recede from the northern limits occasionally while the reservoir is in use. This limitation, on its own, will limit boating to types that can operate in shallow water.

Additionally, as technology advances in the years before the reservoir's fill and start of boating access, it can be predicted that boat technology, sound mitigation, and advancement in electric boating will become more prevalent and available.



Boating options are being considered, from powered to low-powered and non-motorized watercraft. Additionally, low-wake activities such as paddle-boarding, bird watching, and fishing bring the opportunity for a quiet experience on the water, to reconnect with the area, wildlife, and preservation areas surrounding the reservoir.

In Appendix B, Exhibit B-9 illustrates a conceptual layout for reservoir water access with accessible fishing area at Glade Reservoir.

## FISHING

Fishing at Glade Reservoir is intended to provide universal access opportunities, where people of all skill levels and physical capabilities can learn to and participate in fishing activities. To strengthen ADA access, the entry road configuration is being studied to include accessible parking and drop-off at the boat launch area, with easy access to a boardwalk area, accessible to mobility wheelchairs or scooters, to experience waterfront enjoyment.





In partnership with Colorado Parks and Wildlife, and as defined in the 2017 CPW Fish and Wildlife Mitigation and Enhancement Plan (FWMEP) and the 2018 NISP FEIS Conceptual Mitigation Plan (CMP), NISP Participants have committed to establishing and maintaining a cool water fishery at Glade, similar to those at Horsetooth Reservoir and Carter Lake. Due to CPW fish hatchery production currently being near capacity, implementation of the cool water fishery will also require and include expansion of current CPW fishery facilities. A non-motorized/mechanized fishing access trail will also be provided along the west and north sides of Glade.

As with the possible educational programs of the Visitor Center and interpretive trail systems, water and boating educational programs could be provided from the facilities and staff of the recreational area. Here there are opportunities for partner programs to bring residents or school classes to teach responsible fishing, conscientious recreation, and how water affects ecology and wildlife. In the years to come, the project anticipates that these issues will become increasingly important to our communities, and Glade Reservoir can be poised to be a leading voice in responsible educational water recreation.





## BOAT RAMP

The Glade Reservoir Boat Ramp, at the south abutment of the Glade Reservoir dam, will provide controlled access to the reservoir for a range of watercraft. The expansive configuration of Glade Reservoir will allow for boating over a wide range of reservoir levels. During a typical recreation season (May to September), Glade Reservoir will provide 1,500 acres of boating water area. Even during drier times when the reservoir is around half full (about 5% of the time) 1,040 acres for boating is available. By comparison, when Glade Reservoir is full (about 10% of the time) there will be 1,640 acres of boating water.

The Recreation Concept Master Plan exhibit illustrates a four-lane boat ramp with two floating docks that will allow for fluctuating water levels. The boat ramp length is being evaluated to accommodate fluctuating water levels of the reservoir and allow for boating enjoyment. Lengths being considered include a 520-foot long boat ramp that will accommodate boating when the reservoir is half full or more (90% of the time), while a 370-foot long boat ramp option would serve boaters when the reservoir is at least 60% full (80% of the time). The length and orientation of the boat ramp will be optimized to maximize boating opportunities over time, while remaining reasonable on construction costs.



Additional boat ramp improvements could include short-term boat trailer parking and tie down areas, a restroom/shower building, a rental/concession building with parking, and an accessible fishing pier with accessible parking and trails.

### **ACCESS, SAFETY, AND SECURITY**

While the public parking lot at the lower portion of the site will allow for visitors to meet and access the Visitor Center, a controlled entry station to the extended Glade Reservoir Recreation Area will be located a short distance north of the U.S. Highway 287 and State Highway 14 intersection along the current alignment of U.S. Highway 287. This access point will help provide safety and control over vehicles, equipment, watercraft, and persons entering the area, while also providing an informational stopping point for visitors in search of camping, hiking, or boating access areas. The location for the entry station will allow for organized entry of vehicles and trailers in anticipation of above-average/holiday weekend usage of the recreation area.

The Glade Reservoir Recreation Area Access Road is a two-lane paved roadway engineered to allow for vehicular access into the campgrounds, Visitor Center parking lot, and boat ramp areas, as well as to accommodate a range of vehicles with or without camping/boat trailers. While the access road climbs nearly 300-feet vertically, it has been configured so the maximum road gradient will not exceed 9%, including reduced grades at access points in the campgrounds, Visitor Center, and parking areas. The horizontal alignment of the access road will make efforts to preserve significant natural landforms and vegetation and minimize site disturbance to preserve the natural character of the recreation area hillside.

At this stage, the Recreation Concept Master Plan provides a general description of the types and scale of recreation options, which will be refined as part of the development planning. The eventual operator of the recreation area, in cooperation with County policies, will be responsible for the safety and security of those enjoying Glade Reservoir. Such safety measures could include mobile security personnel, emergency call phones located near restrooms, cameras or announcement systems.





## **APPENDIX A**

### **GLADE RESERVOIR RECREATION AREA ILLUSTRATIVE SITE PLAN**











NOTE: Plan depicts a conceptual range of options and is subject to change.

# GLADE RESERVOIR RECREATION AREA - ILLUSTRATIVE SITE PLAN


JANUARY 2020

- 1 CAMPING AREA 1: 15-20 CAMPSITES
- 2 CAMPING AREA 2: 10-15 CAMPSITES
- 3 CAMPING AREA 3: 10-15 CAMPSITES
- 4 CAMPING AREA 4: 10-15 CAMPSITES
- 5 CAMPING AREA 5: 5-15 CAMPSITES

- A FULL SERVICE CAMPING AREA: 70-80 RENTAL UNITS
- B POUDRE CANYON PUBLIC PARKING: 125-145 SPACES
- C VISITOR CENTER: 8,000-10,000 SF BUILDING + 40-50 SPACES
- D BOAT RAMP PARKING - LONG TERM: 20-30 SPACES + 40-50 TRAILER SPACES
- E BOAT RAMP PARKING - SHORT TERM: 15 SPACES + 18 TRAILER SPACES



Northern Integrated Supply Project



0' 200' 400' 600'

SCALE  
1" = 200'

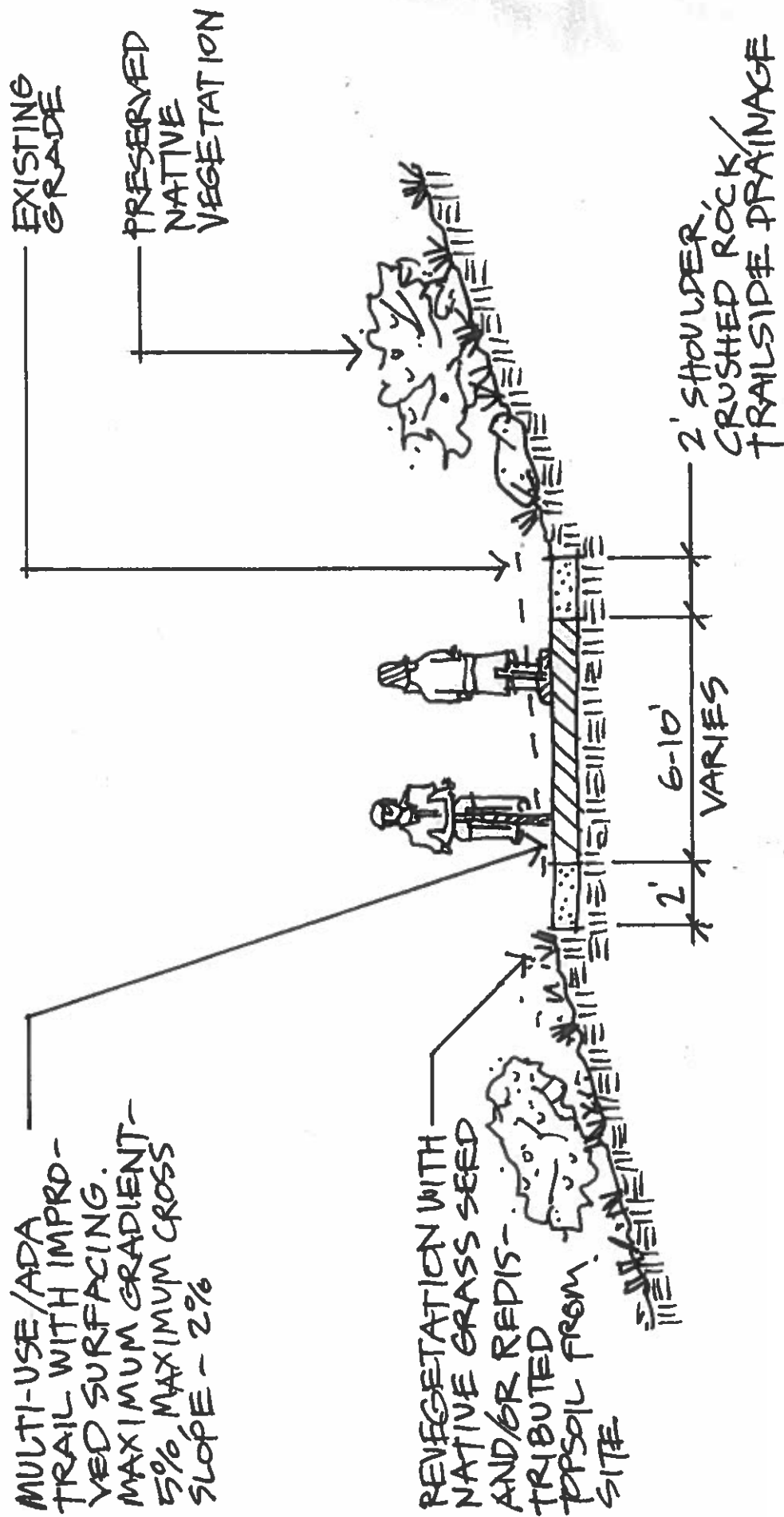




## **APPENDIX B**

### **GLADE RESERVOIR RECREATION AREA ENLARGEMENT EXHIBITS**

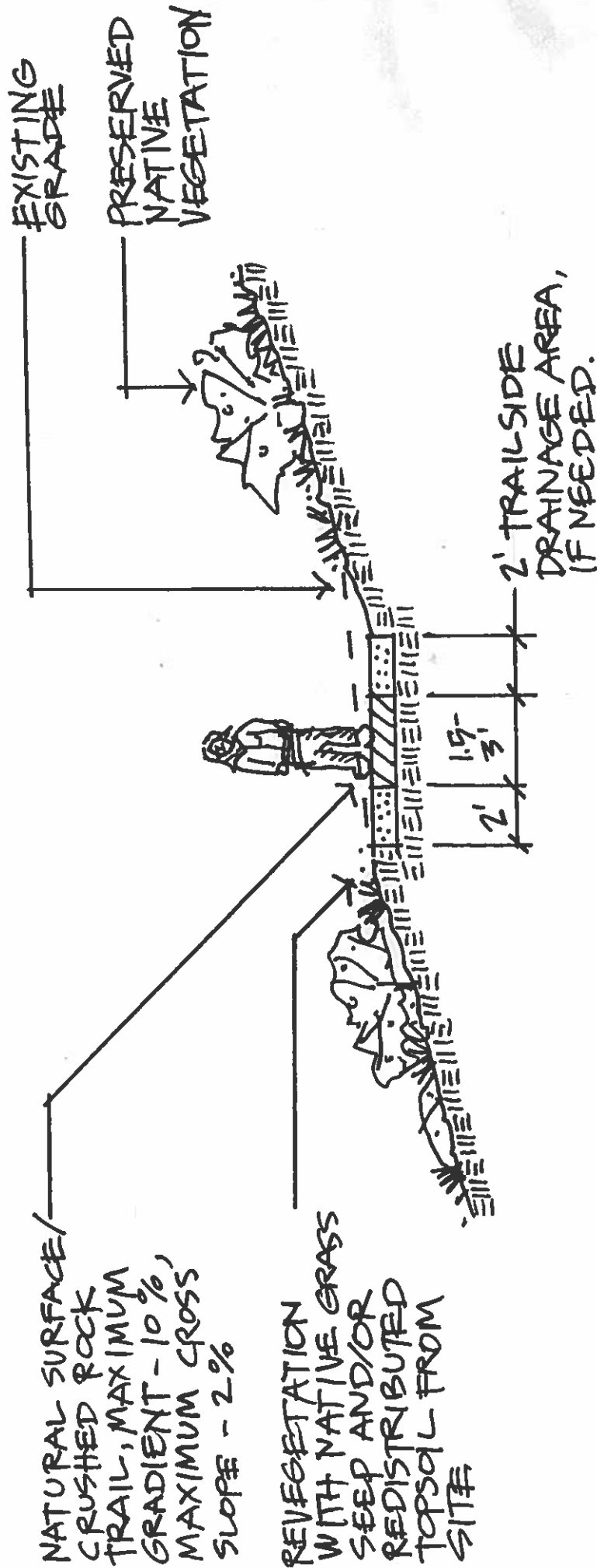




## MULTI-USE ADA TRAIL

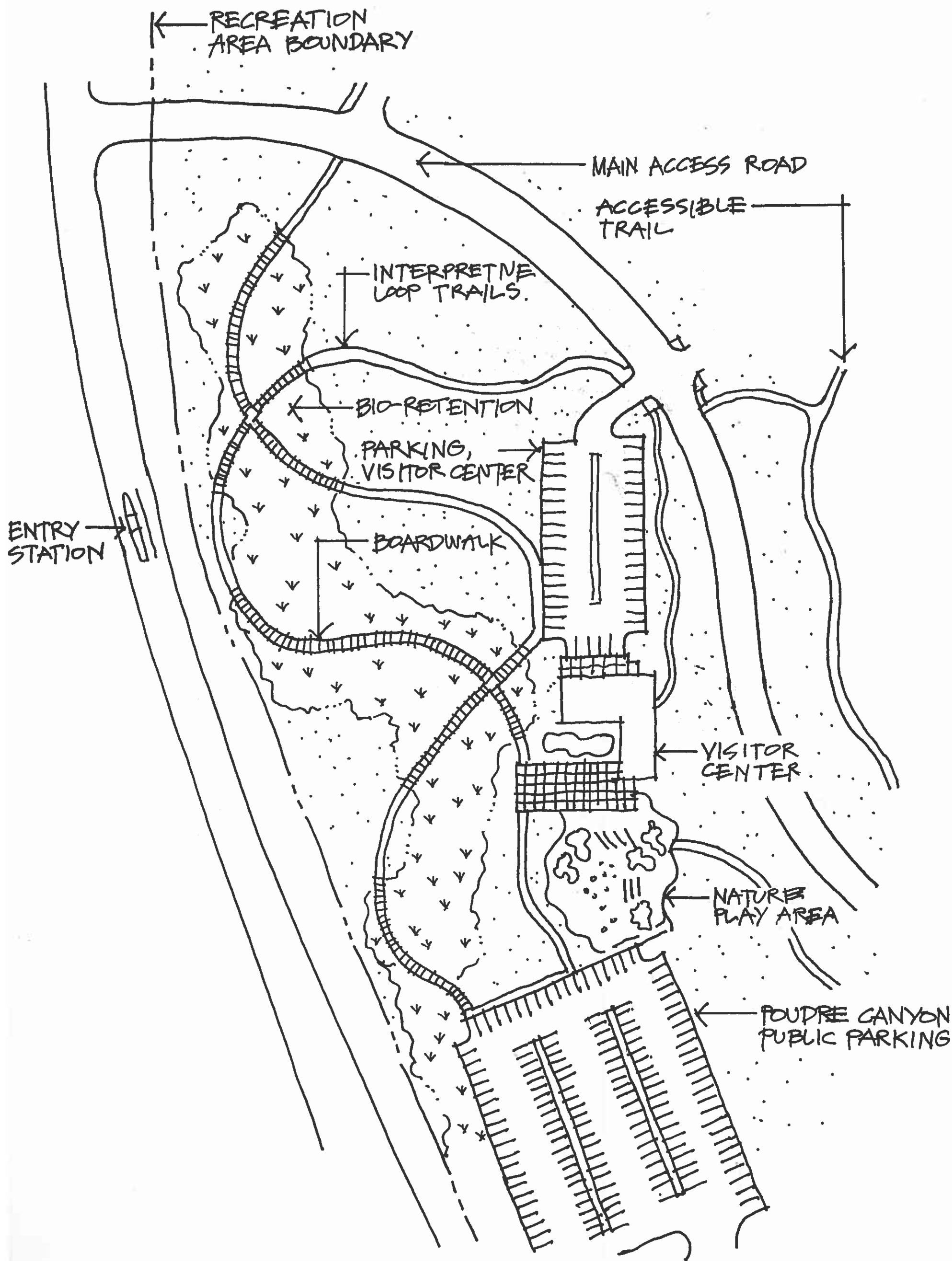
EXHIBIT B-1





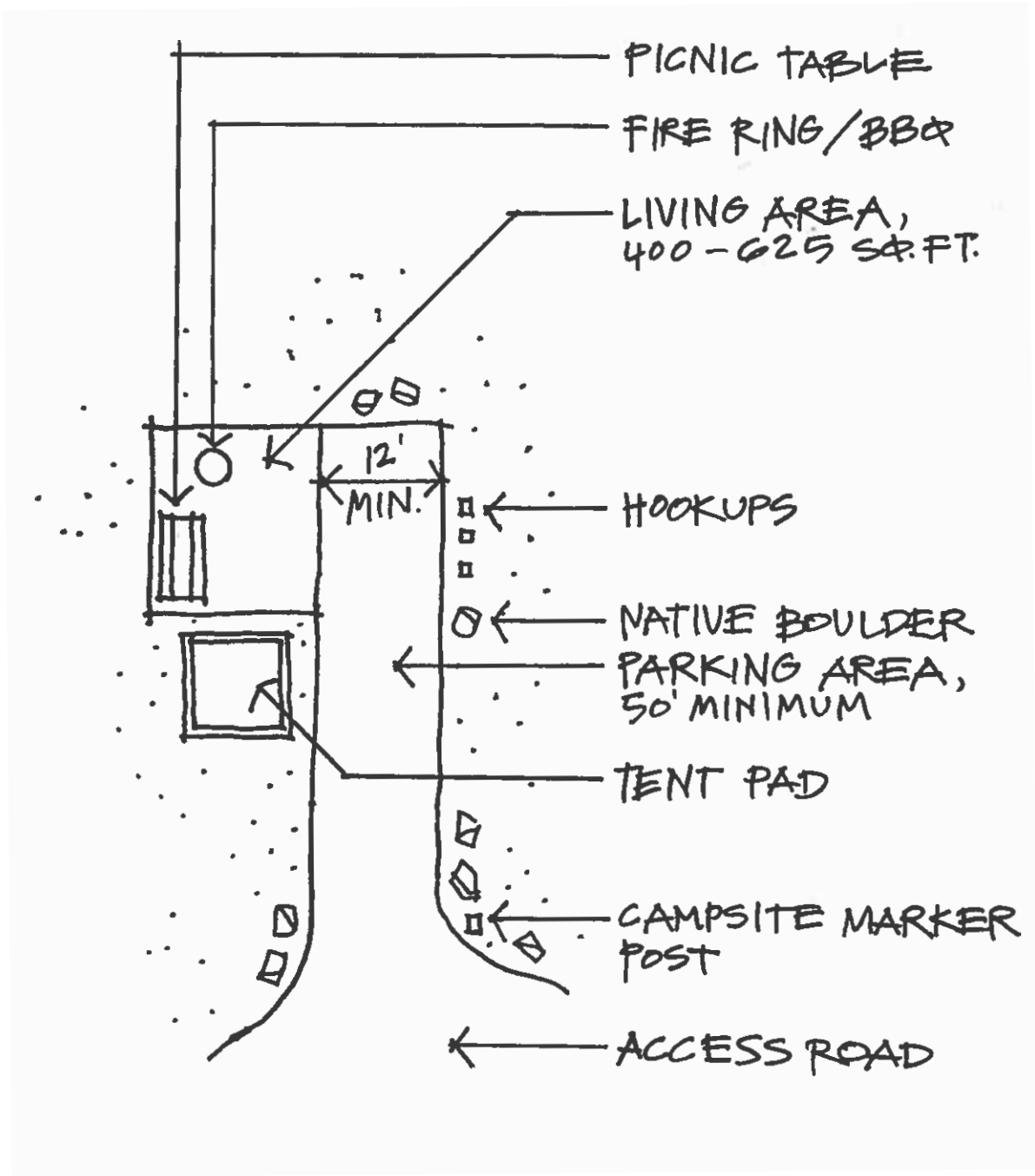
## PRIMITIVE TRAIL - SINGLE TRACK





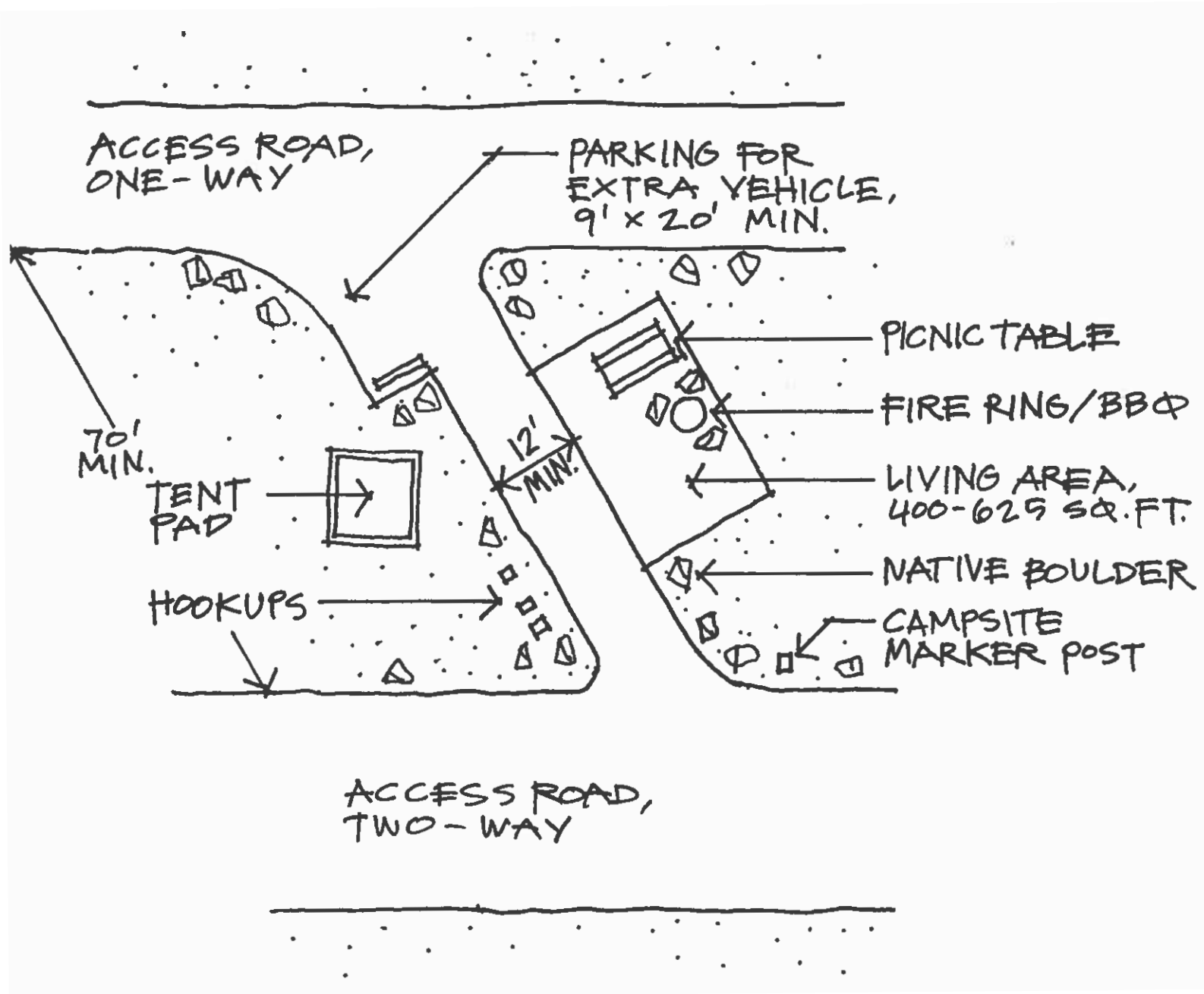
Visitor Center, Interpretive Trails, & Parking





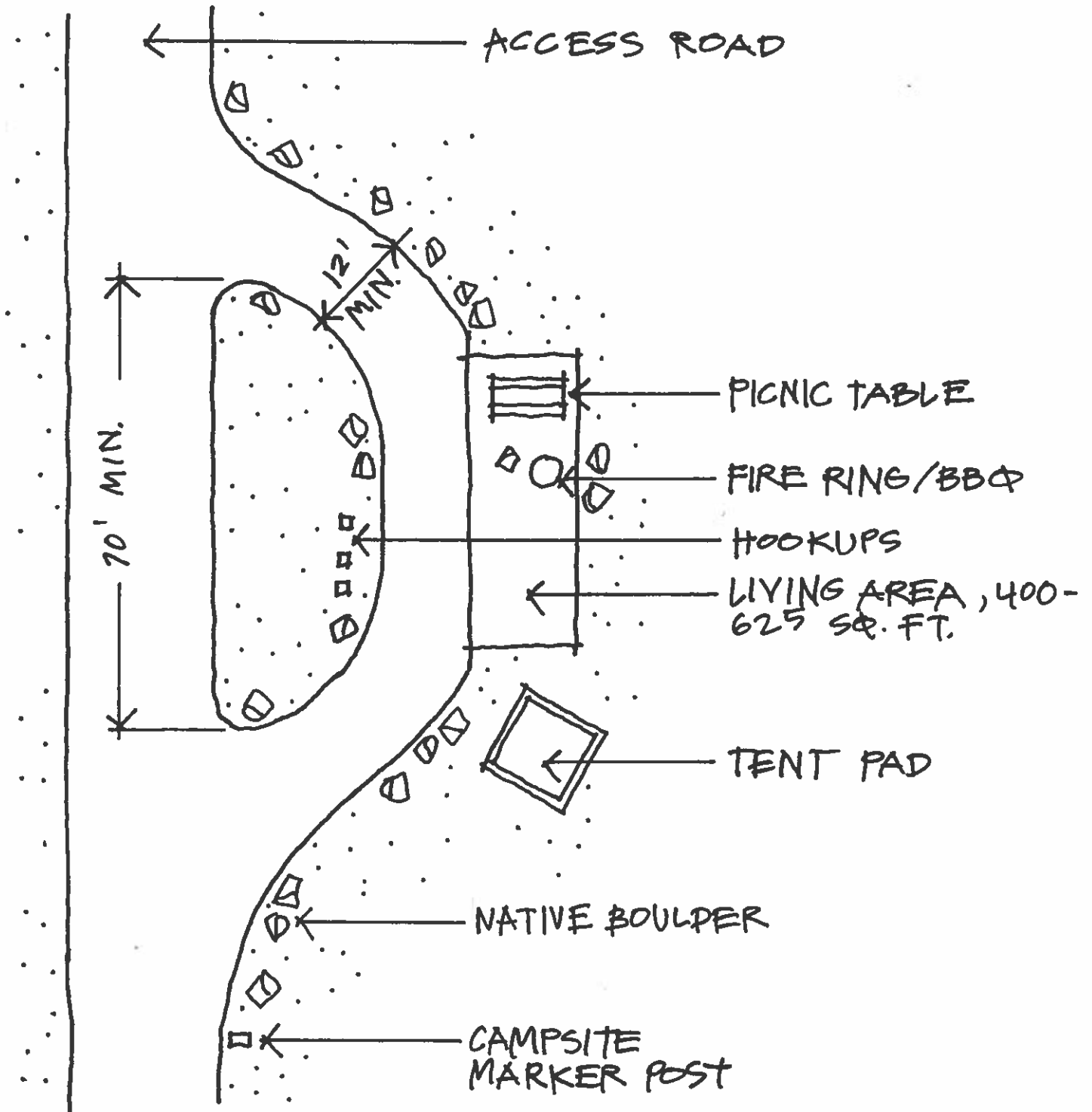
Campsite Typical Layout  
**RV Camping with Electric Hookup**





Campsite Typical Layout  
**Pull-Through Campsite**

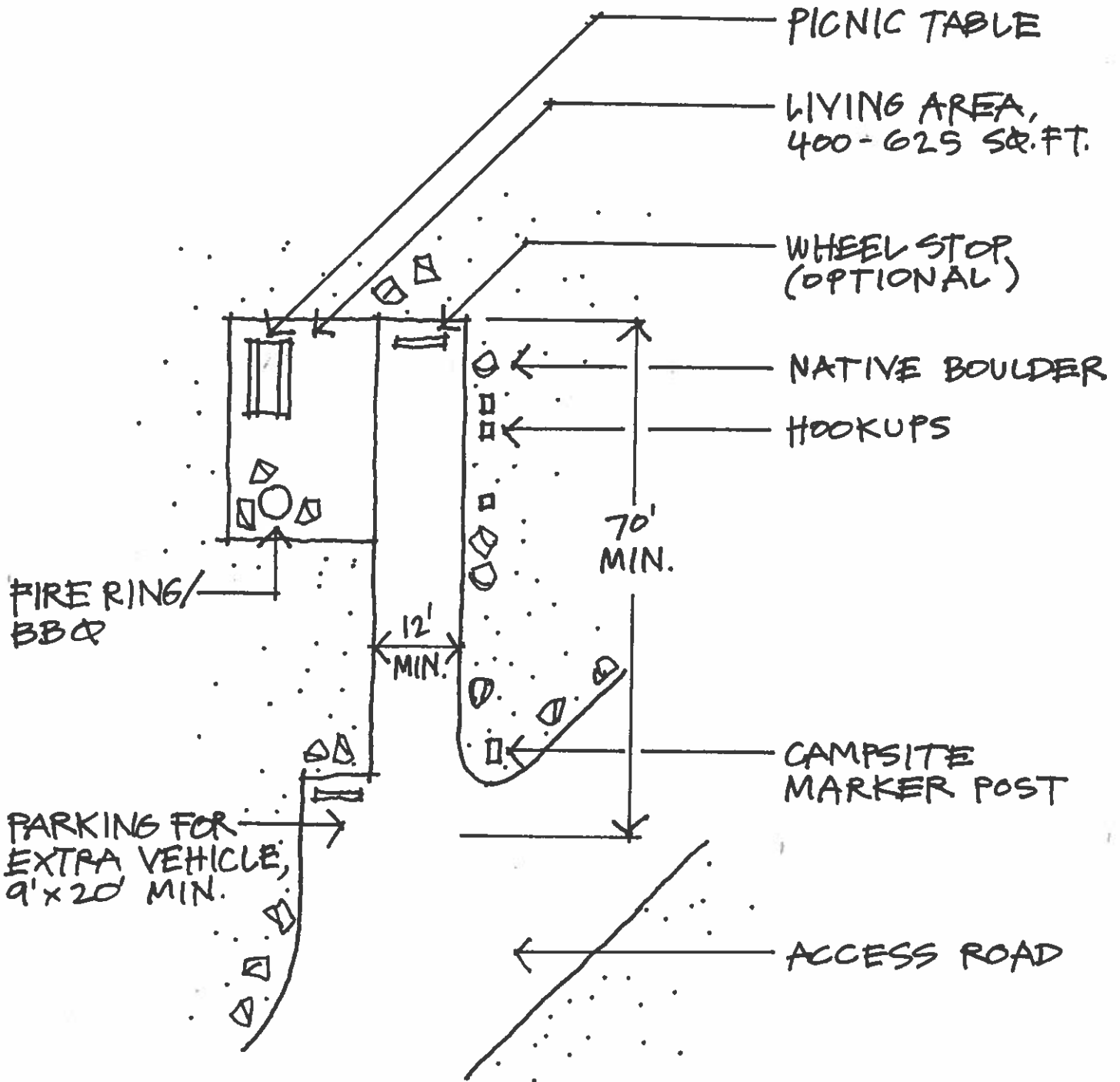




Campsite Typical Layout

## Pull-Through RV Campsite

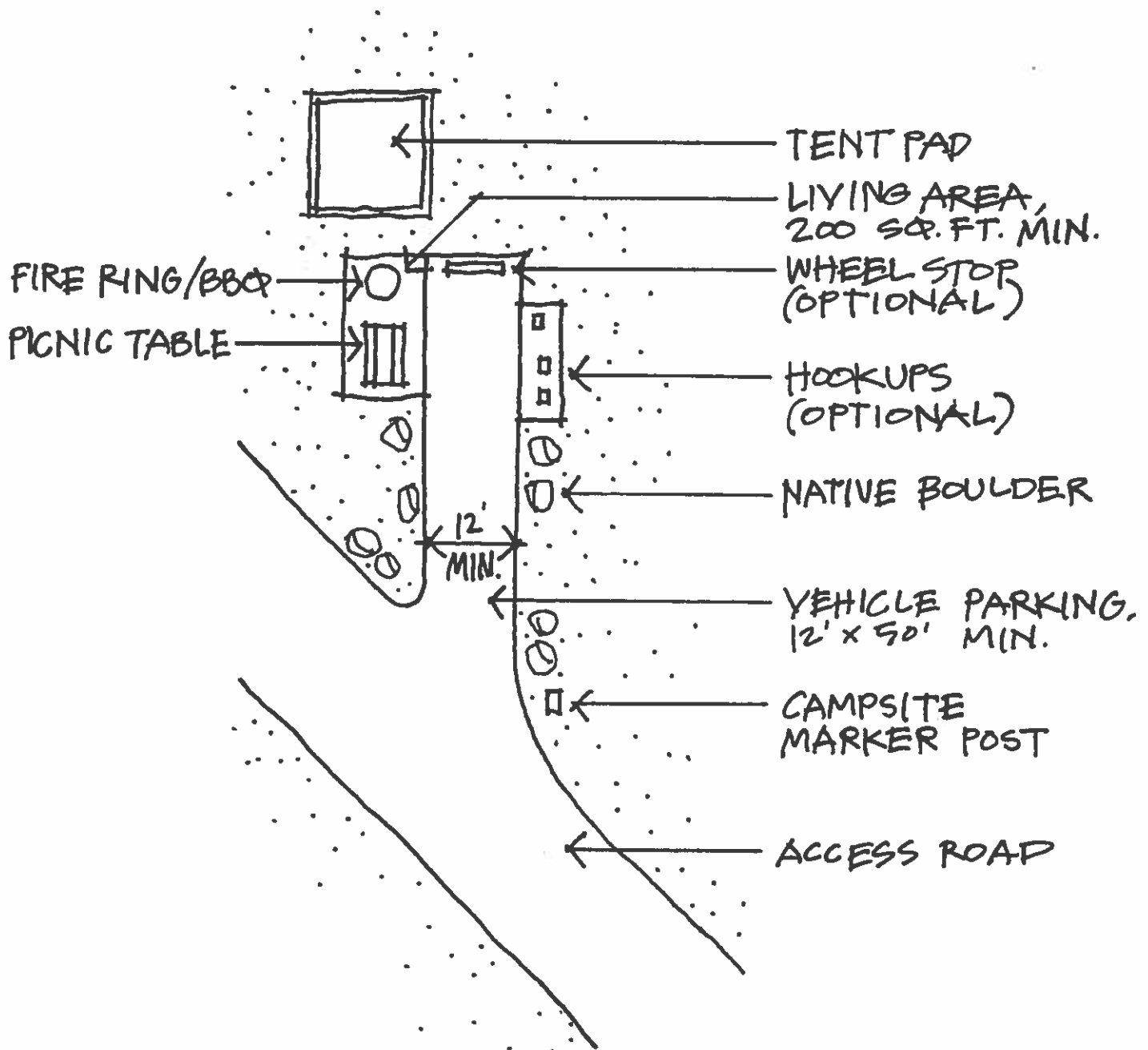




Campsite Typical Layout

## Back-In Campsite

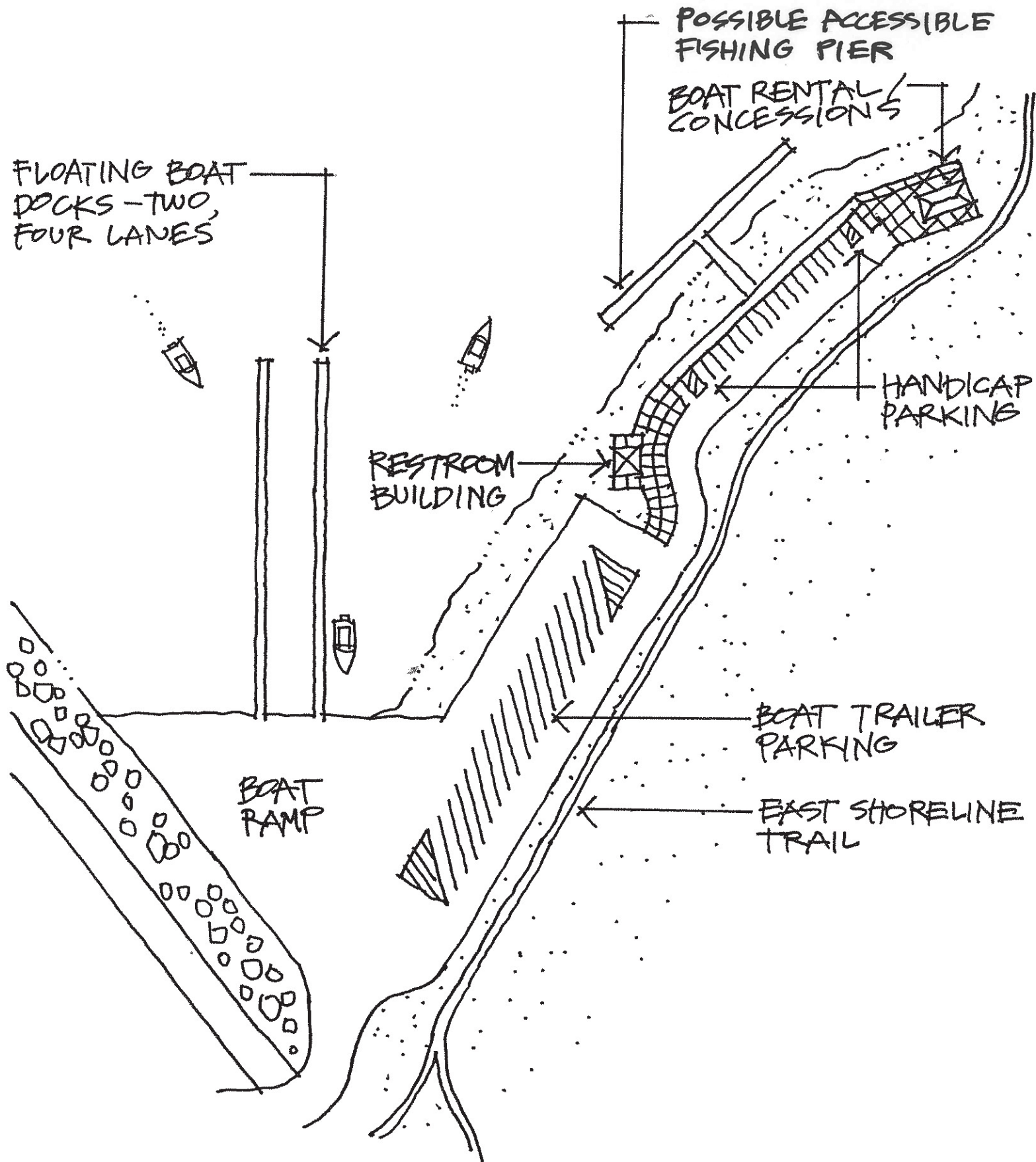




Campsite Typical Layout

## Pull-In Camp Spur: Tent/Car Camping





## Reservoir Water Access & Accessible Fishing Area

**GLADE RESERVOIR**

BCC 08/17/20  
Northern Integrated Supply Project

**EXHIBIT B-9**





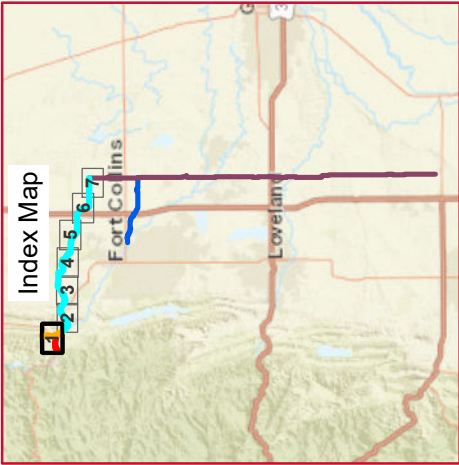
NORTHERN TIER  
SHEET 1 OF 7  
MAP SERIES 7B: WILDFIRE

Legend

- Glade Release/Poudre Release Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Line Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Glade Reservoir (future)

FIRE HAZARD LEVEL

- HIGH
- LOW
- LOWEST
- MODERATE
- VERY HIGH



DATA SOURCES: Northern Water, Larimer County, HDR





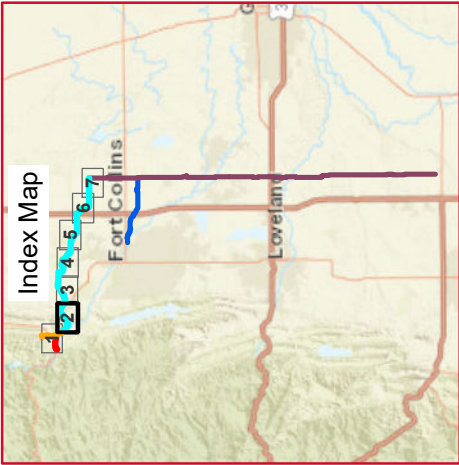
NORTHERN TIER  
SHEET 2 OF 7  
MAP SERIES 7B: WILDFIRE

Legend

- Glade Release/Poudre Release Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Line Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Glade Reservoir (future)

FIRE HAZARD LEVEL

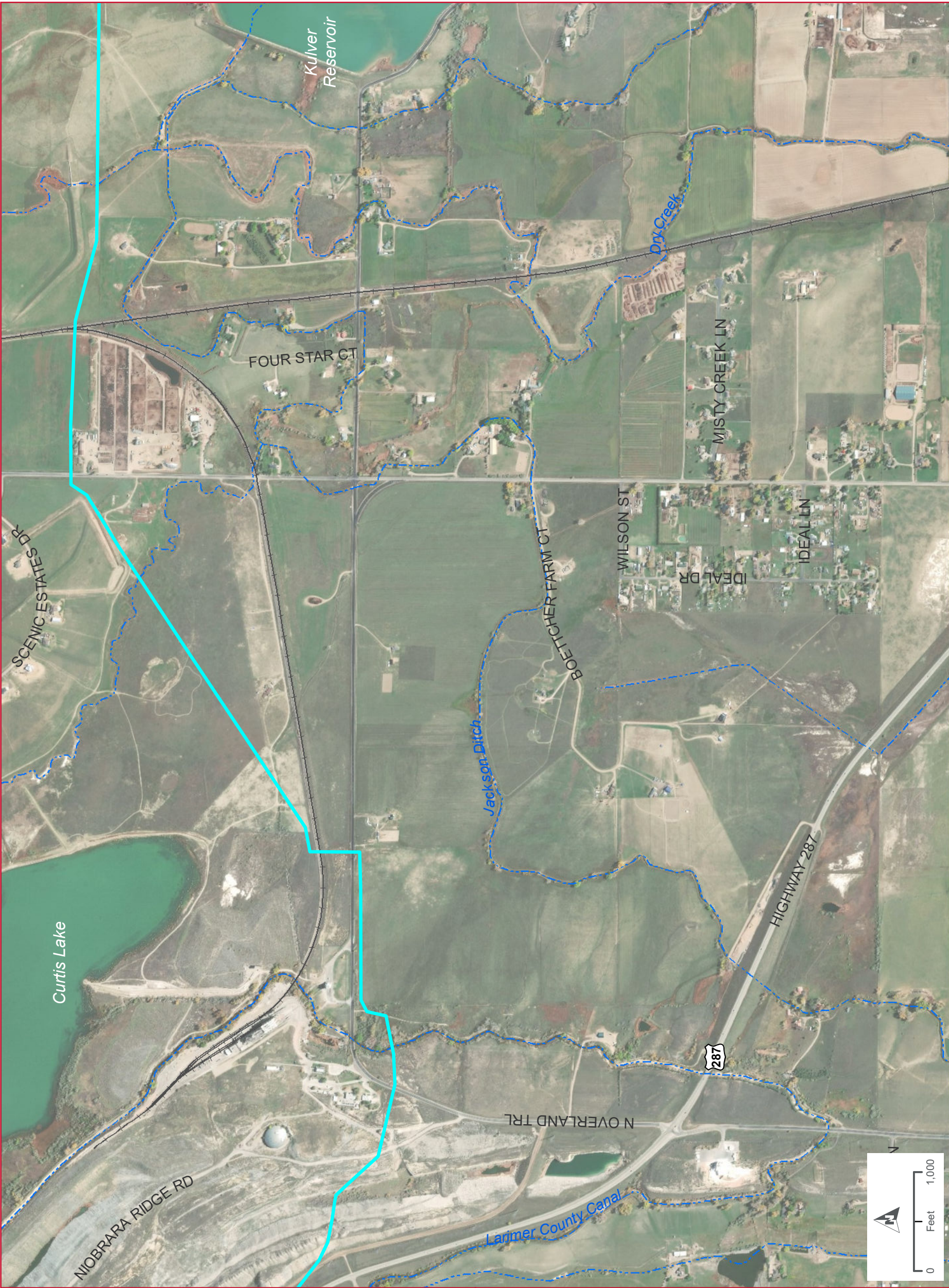
- HIGH
- LOW
- LOWEST
- MODERATE
- VERY HIGH



Imagery Date: 10/2017

DATA SOURCES: Northern Water, Larimer County, HDR





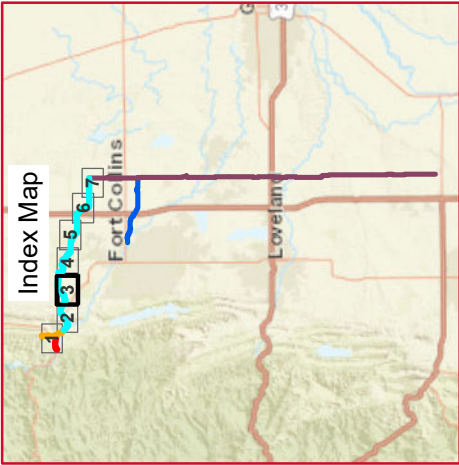
NORTHERN TIER  
SHEET 3 OF 7  
MAP SERIES 7B: WILDFIRE

Legend

- Glade Release/Poudre Release Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Line Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Glade Reservoir (future)

FIRE HAZARD LEVEL

- HIGH
- LOW
- LOWEST
- MODERATE
- VERY HIGH



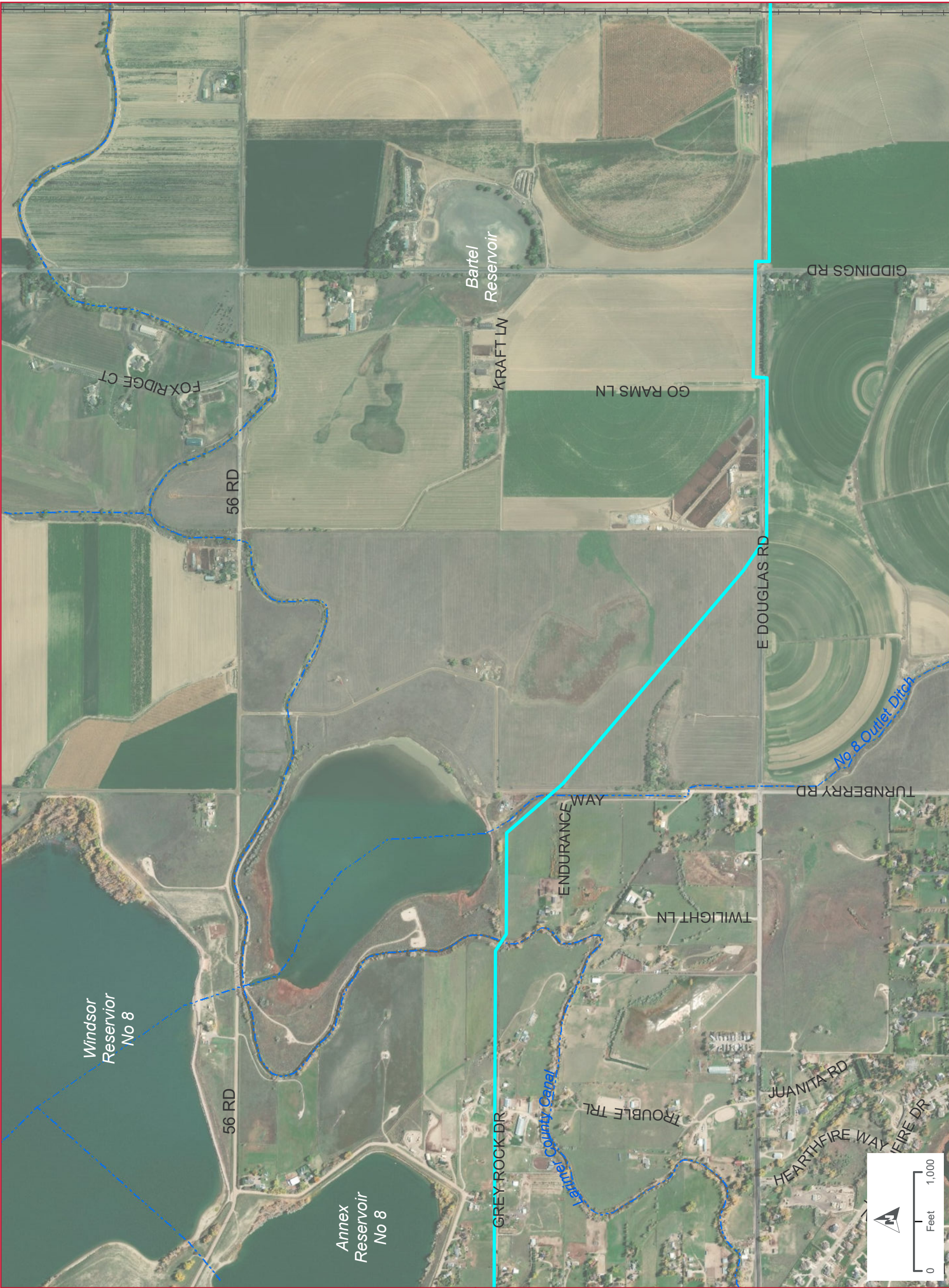
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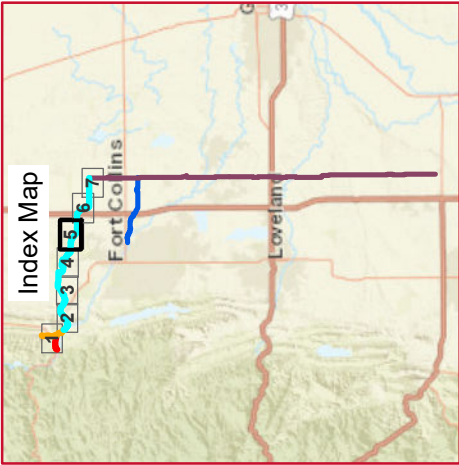
NORTHERN TIER  
SHEET 5 OF 7  
MAP SERIES 7B: WILDFIRE

Legend

- Glade Release/Poudre Release Pipeline
- Northern Tier Pipeline
- Poudre Intake Pipeline
- County Line Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Glade Reservoir (future)

FIRE HAZARD LEVEL

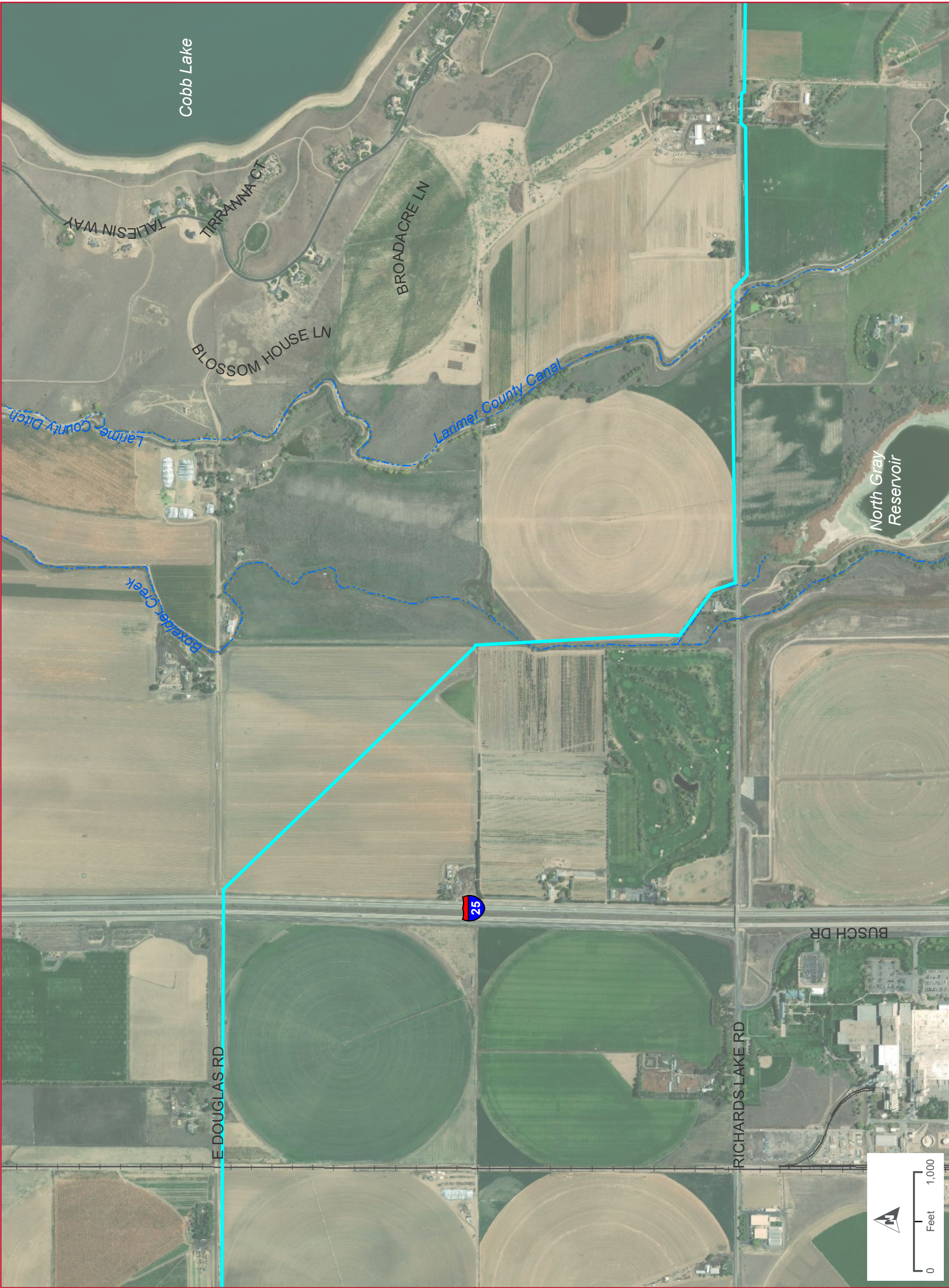
- HIGH
- LOW
- LOWEST
- MODERATE
- VERY HIGH



Imagery Date: 10/2017, 10/2018

DATA SOURCES: Northern Water, Larimer County, HDR





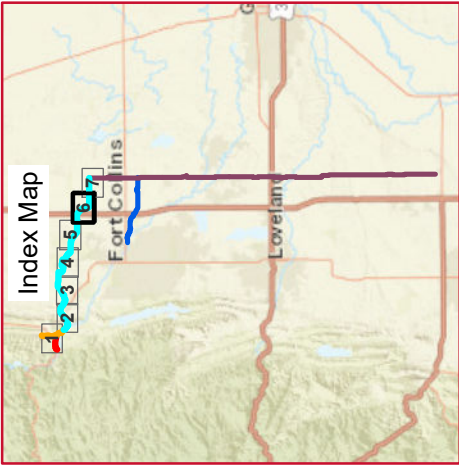
NORTHERN TIER  
SHEET 6 OF 7  
MAP SERIES 7B: WILDFIRE

Legend

- Glade Release/Poudre Release Pipeline
- Northern Tier Pipeline
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- County Line Pipeline
- County Boundary
- Railroad
- Stream/Ditch
- Glade Reservoir (future)

FIRE HAZARD LEVEL

- HIGH
- LOW
- LOWEST
- MODERATE
- VERY HIGH



Imagery Date: 10/2018

DATA SOURCES: Northern Water, Larimer County, HDR





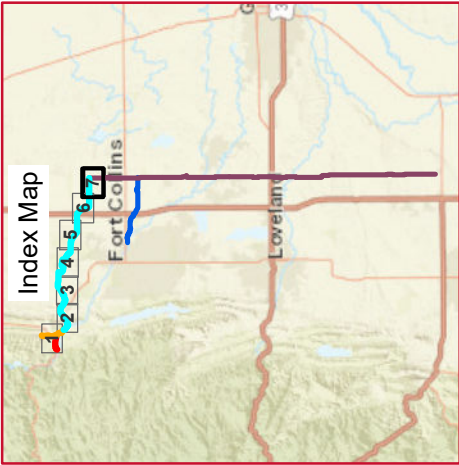
NORTHERN TIER  
SHEET 7 OF 7  
MAP SERIES 7B: WILDFIRE

Legend

- Glade Release/Poudre Release Pipeline
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FIRE HAZARD LEVEL

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Imagery Date: 10/2018

DATA SOURCES: Northern Water, Larimer County, HDR