# Planning Board Agenda

The regular meeting of the Livingston Planning Board is scheduled for August 16, 2023 at 5:30 PM in the Community Room of the City/County Building at 414 E. Callender Street. The meeting will be facilitated by Chair Stacy Jovick.

A virtual option will also be available:
**Join Zoom Meeting**
https://us02web.zoom.us/j/88152553941?pwd=MXBQaEZwYW9HOU9ZZGZGazNwa2tsZz09

**Meeting ID:** 881 5255 3941
**Passcode:** 906560
**Call in:** (669) 900-9128

1. **Call to Order**

2. **Roll Call**

3. **Approval of Minutes**
   A. Approve April 19, 2023 minutes

4. **General Public Comments**

5. **New Business**
   A. Public Hearing for Mountain View Subdivision

6. **Old Business**

7. **Board Comments**

8. **Adjournment**

## File Attachments for Item:

### A. APRIL 19, 2023 MEETING MINUTES

# Planning Board Minutes

The regular meeting of the Livingston Planning Board was held April 19, 2023 at 5:30 PM in the Community Room of the City/County Building at 414 E. Callender Street. This meeting was facilitated by Chair Stacy Jovick.

1. **Call to Order (5:37 pm)**

2. **Roll Call (recording 0:13 mins)**
   In attendance: Board Members Stacy Jovick, Torrey Lyons, Mija Hamilton; Taya Cromley, Jessie Wilcox and Shannon Holmes (via zoom); Staff: Jennifer Severson.

3. **Approval of March 15, 2023 Minutes (0:53 mins)**
   - **Motion to approve by Barrett; second by Hamilton (3:33 mins)**
   - **Motion passes 8-0**
   - Jovick requested additional discussion details be included in minutes, not just listing speaker names.

4. **General Public Comments**
   - None

5. **New Business**
   A. **Review and Discussion of Draft PUD Ordinance (Informational; no action required) (3:14 mins)**
   - Severson requested Board feedback on draft ordinance details

   - Board discussed: minimum lot size for PUD 1.0 acre? should this be set in the ordinance or should there be no minimum size and let the market determine whether or not a PUD is worth it to a developer? potential for the City to re-evaluate and change PUD ordinance in the future; suggested 0.5 acre PUD size in zoning districts that allow most intensive development (Highway Commercial, CBD, Mixed Use) but 1 acre minimum lot size for other districts where less intensive development is allowed under zoning code such as RII-Medium Residential; tie increased PUD density allowance/ bonus to density allowed in base zoning district instead of superseding base zoning; administrative burden to process PUDs on smaller lot sizes; infrastructure challenges to development on larger vacant parcels on outskirts of the city; residential-only PUDs vs. requirement for mixed use in all PUDs? Policy to require PUD Ordinance to come back before advisory boards and City Commission in 1 year to review effectiveness/ what works/ what doesn't; developer incentives- density bonus; height bonus vs. viewshed impacts; reduced impact fees; deed restrictions for developer bonuses; Potential formulas for public benefit vs. incentives to developer; tying development bonuses to base zoning; purview of planning board vs. zoning commission review; utility infrastructure demands of new development; traffic impacts and studies; City of Livingston development standards; calculated PUD demands vs City infrastructure capacity; PUD phasing;

**6. Old Business**

- None

**7. Board Comments (1:42:20 mins)**

- Public Works Project List
- Jovick asked about possibility of Major City Subdivisions/ Names can be added to City Street Sweeping Map
- Next Planning Board Meeting will be May 17, 2023

**8. Adjournment (7:23 pm)**

## File Attachments for Item:

### A. PUBLIC HEARING FOR MOUNTAIN VIEW SUBDIVISION

**STAFF REPORT**
**Mountain View Subdivision**

## PROPOSAL SUMMARY

Livingston West, LLC, owner of the property described as Parcel 1A of Certificate of Survey No. 2748RB (see Development Plan in Figure 1 below), located on the west end of Livingston near the Highway 10 West on-ramp at Interstate 90, is proposing to divide the subject property into 24 lots. The property surrounds the Printing for Less and FedEx facilities.

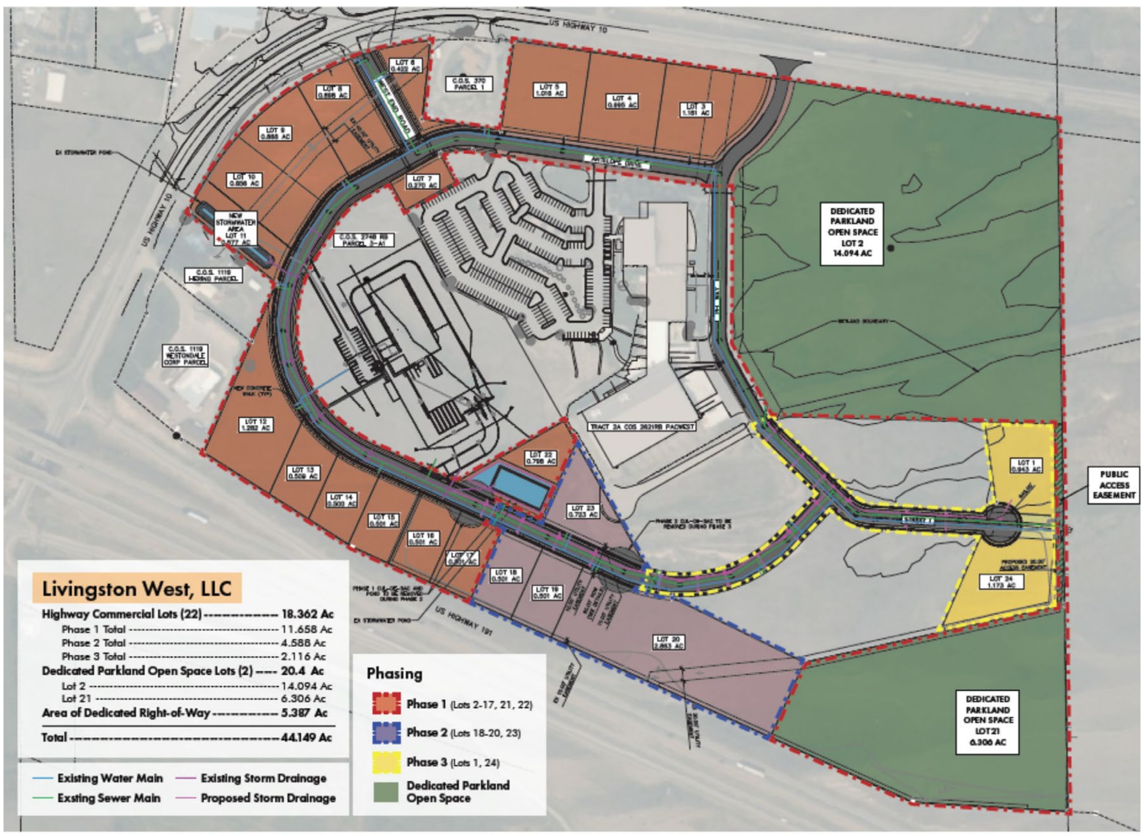



**Figure 1. Development Plan**

## BACKGROUND

The subject property was annexed by the City of Livingston in 2004 and is zoned Highway Commercial. As defined in the Livingston Municipal Code Art II, Sec 30.30, the Highway Commercial zoning district is intended to provide areas for residential structures, commercial and service enterprises which serve the needs of the tourist, traveler, recreationalist or the general traveling public. Areas designated as Highway Commercial should be located in the vicinity of freeway interchanges, intersections on limited access highways, or adjacent to primary and secondary highways. The subject property is also located in an area designated as Community Commercial on the Future Land Use Map included in the 2021 Growth Policy (see Figure 2 below). Community Commercial land use designation accommodates medium to large scale wholesale, retail, lodging, offices, and service establishments typically located along major corridors that can function independent of adjoining development and/or require individual access to public rights-of-way.

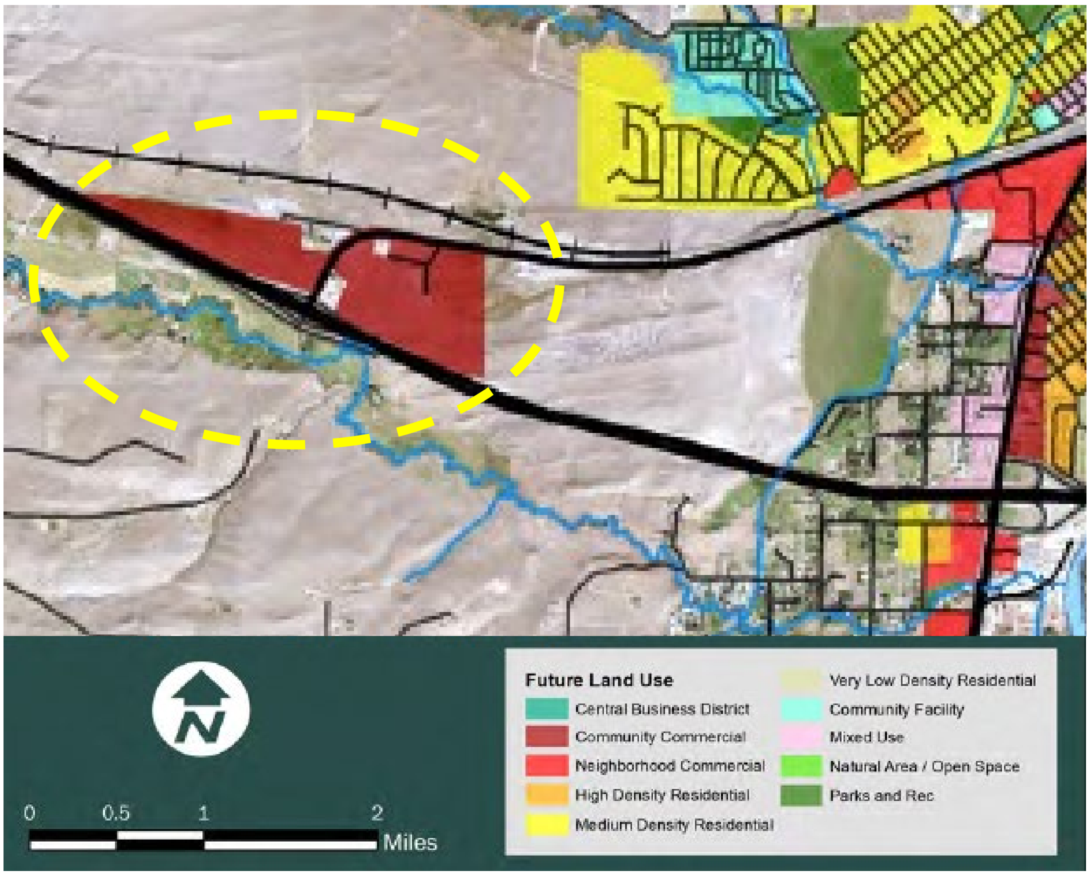



**Figure 2. Future Land Use Map**

**<u>REFERRAL AGENCY RESPONSES</u>**

**Livingston Public Works**- comments were provided about the following: additional costs to the City associated with the proposed subdivision; street improvements and temporary safety measures between phase development; erosion control; water and sewer connection requirements for each subdivided lot; ownership and maintenance responsibilities for new public facilities; and staff review of stormwater and street plans for phases 2 and 3. Recommendations were made for: a new sewer main near Kenyon Noble as recommended in the Wastewater Preliminary Engineering Report;

POA covenant revisions; a water and sewer easement across Lot 12 for future services to an adjacent parcel.

**Livingston Fire and Rescue**- no concerns; approve of the new line extensions for many of the hydrants shown on the plans.

**Northwestern Energy**- comments confirmed their ability to provide electric and natural gas services to the proposed subdivision and requested the applicant initiate contact to plan utility design and locates before finalizing lot development.

**Montana State Historic Preservation Office (SHPO)**- comments confirmed the absence of previously recorded cultural resource sites within the designated area and, provided there is no disturbance to structures over 50 years of age, there is a low likelihood cultural resources will be impacted by the proposed subdivision and a cultural resource inventory is unwarranted at this time.

**No Concerns**- Livingston Building and Police Departments

**No Responses to Developer Inquiry Received**- MT Fish, Wildlife and Parks; MT Department of Transportation; Windrider Transit; Park Electric Cooperative; Lumen; and the US Postal Service

## FINDINGS OF FACT

The Montana Code Annotated (MCA) Section 76-3-608 requires the decision by a governing body to approve, conditionally approve or deny a proposed subdivision to be based on the specific, documentable, and clearly defined impact on the following primary criteria.

(Staff Responses in *italics*)

**A. Effect on Agriculture**

Agriculture is defined as the production of food, feed, and fiber commodities, livestock and poultry, bees, fruits and vegetables, and sod, ornamental, nursery, and horticultural crops that are raised, grown, or produced for commercial purposes.

1) Would the subdivision remove agricultural or timberlands with significant existing or potential production capacity?
*No. Staff has not identified existing agricultural or timberland resources on this site.*

2) Would the subdivision remove from production agricultural lands that are critical to the area's agricultural operations?
*No. Staff has not identified any current or previous agricultural production on the subject property.*

3) Would the subdivision create significant conflict with nearby agricultural operations (e.g. creating problems for moving livestock, operating farm machinery, maintaining water supplies, controlling weeds, applying pesticides or would the subdivision generate nuisance complaints due to nearby agricultural operations)?
*Staff has not identified or been notified of any intensive agricultural activities in the immediate area.*

**B. <u>Effect on Agricultural Water User Facilities</u>**
Agricultural water user facilities are defined as any part of an irrigation system used to produce an agricultural product on property used for agricultural purposes.

1) Would the subdivision create a significant conflict with agricultural water user facilities (e.g. creating problems for operating and maintaining irrigation systems or creating nuisance complaints due to safety concerns, noise, etc.)?
*No. Staff has not identified any agricultural water user facilities on the subject property and no conflict is anticipated.*

**C. <u>Effect on Local Services</u>**
Local services are defined as all services provided by any local government unit having jurisdiction over the subdivision as well as those commonly provided by private entities to similar properties in the vicinity.

1) What additional or expanded public services and facilities would be demanded to serve this subdivision?
*The following additional or expanded public services and utilities would be necessary to serve the proposed subdivision: water, sanitary sewer, garbage collection, streets and sidewalks, street lights, stormwater facilities, police, fire, and emergency medical services (EMS).*

a) What additional costs would result for services such as streets, law enforcement, parks and recreation, fire protection, water, sewer and solid waste, schools and busing (including additional personnel, equipment, construction and maintenance costs)?
*The cost of fire and police services will increase proportionally to population growth in the City; however, the amount attributed to this development is integrated into the City's current Impact Fee Schedule, which was updated in 2021. New and expanded public infrastructure associated with the proposed subdivision will be constructed and paid for by private parties. Ownership and maintenance of public infrastructure dedicated to the City will be the responsibility of the City. As stated in the Public Works referral dated July 19, 2023 (attached), the developer covenants must be updated to indicate developer responsibility for sidewalk construction costs.*

*Until the proposed subdivision lots are developed, it is unknown whether the proposed subdivision will have residential development. Similarly, it is unknown whether future housing would include residents with school age children requiring busing for school.*

b) Who would bear these costs?

*Taxes on new construction will be paid into the City's General Fund and Impact Fees will be charged at the time building permit(s) are issued for new development on the subdivided lots. The applicant is required to improve PFL Way from the fire hydrant at the end of the existing pavement past Antelope Drive, and must bear the cost of constructing these improvements. Once construction is complete, the City will assume responsibility for maintenance of water and sewer infrastructure, streets, streetlights, and sidewalks.*

*As noted in the Public Works referral, the City will absorb additional costs associated with the Starlo Booster Station for pumping water and providing fire flows to new development in the proposed subdivision.*

*The applicant has proposed to dedicate stormwater facilities and open space associated with the new subdivision; however, the Public Works Director has requested- and staff recommends- that the Property Owners Association (POA) maintain ownership and maintenance responsibilities for stormwater facilities. The Public Works Director and staff also recommend the applicant be required to deed restrict the subdivision open space/ parklands for public use but have the POA assume ownership and maintenance responsibilities.*

*Garbage Service will be paid by user fees incurred by the individual lot owners when contracting for service.*

c) Can the service providers meet the additional costs given legal and other constraints?

*Yes. The City's impact fees are designed to off-set the increase in capital expenditures for public services and will be paid as each subdivided lot is developed. Increased tax revenue generated by new development on the lots will also be directed into the City's General Fund.*

2) Would the subdivision allow existing services, through expanded use, to operate more efficiently or make the installation or improvement of services feasible?

*The adjacent FedEx facility recently extended water and sewer mains to the edge of Hwy 10 that could accommodate future service to additional annexed property across the Highway as well as the proposed subdivision lots as they are developed.*

*As stated in the Public Works referral letter, the sewer main near Kenyon Noble is a high-risk area with clay tile and capacity issues for future flows. A 15-inch main replacement is recommended in the Wastewater Collection Preliminary Engineering Report (PER).*

3) What are the present tax revenues received from the unsubdivided land by the County, City and Schools?
*The 2022 tax bills for the subject property totaled $17,614.*

4) What would be the approximate revenues received by each above taxing authority when the subdivision is improved and built upon?
*It is impossible to estimate future tax revenue on developed lots without knowing the types and scale of that development. However, the applicant has estimated that annual tax revenues to the City of Livingston could be as much as $200,000 at full build out of the subdivision. This estimate was calculated using the State of Montana tax rate of 1.35% and the City of Livingston mill rate of 0.58606 as applied to the acreage and estimated taxable value of potential development for each lot. Furthermore, based on that estimate of the City's potential tax revenue, the additional potential tax revenues for the County and School District could be upwards of $300,000.*

5) Would new taxes generated from the subdivision cover additional public costs?
*Because the subject property is zoned Highway Commercial, with the potential for both higher density residential development as well as commercial uses, staff anticipates it is likely that the property tax revenue generated by new development will cover additional public costs. Impact fees will apply to new development in the subdivision and the developed lots must also pay into the City's street and light maintenance districts.*

6) Would any special improvement districts be created which would obligate the City fiscally or administratively?
*No. Staff does not anticipate the creation of a special improvement district for the area within the subdivision. However, staff is recommending a waiver of protest requirement for an SID for the subdivided lots. This waiver will apply to a future project to create pedestrian/bicycle connectivity from this subdivision to the City's existing trail system to the east.*

**D. <u>Effect on the Natural Environment</u>**
The natural environment is defined as the physical conditions that exist within a given area.

1) How would the subdivision affect surface and groundwater, soils, slopes, vegetation, historical or archaeological features, and visual features within the subdivision or on adjacent lands?

   a) Would any stream banks be altered, streams rechanneled or any surface water contaminated from run-off carrying sedimentation or other pollutants?
   *No streams exist within the area proposed for subdivision. Erosion Control installed in accordance with the MT Stormwater Pollution Prevention Plan (SWPPP) will help prevent sediment migration during runoff.*

b) Would groundwater supplies likely be contaminated or depleted as a result of the subdivision?
*Future development on the proposed subdivision lots will supplied by City water mains and is not anticipated to affect groundwater quantity. A Geotechnical Report was prepared by Terracon in May 2021 on the adjacent FedEx property (see pages 83-153 in the application materials PDF) that confirmed groundwater depth is between 6 and 15 feet below pre-development site grades. Although the report does not include the area proposed for subdivision, it is likely similar conditions may exist as on the adjacent FedEx site. The report recommends that individual contractors should be made aware of the possibility of encountering groundwater during construction.*

c) Would construction of streets or building sites result in excessive cuts and fills on steep slopes or cause erosion on unstable soils?
*No. The Stormwater Management Plan was designed to comply with the City's Public Works and MT DEQ standards. As stated above, erosion control must be installed as required per the MT Stormwater Pollution Prevention Plan (SWPPP).*

d) Would significant vegetation be removed causing soil erosion or bank instability?
*No. As noted above, Erosion Control is required per the SWPPP and proper construction techniques, per the City's Public Works Design Standards, are expected to mitigate potential erosion and soil migration caused by runoff.*

e) Would significant historical or archaeological features be damaged or destroyed by the subdivision?
*Based on the attached letter from the Montana State Historic Preservation Office dated June 8, 2023, although there have been a few previously conducted cultural resource inventories in the area, there have been no previously recorded cultural resource sites in the area. Therefore, staff does not anticipate any significant historical or archaeological features will be impacted by the proposed subdivision.*

f) Would the subdivision be subject to natural hazards such as flooding, rock, snow or land slides, high winds, severe wildfires or difficulties such as shallow bedrock, high water table, unstable or expansive soils, or excessive slopes?
*None of the listed hazards have been identified within the area proposed for subdivision and staff does not anticipate the proposed subdivision will be subject to these hazards. Building permits are required for structures built during future development, ensuring all buildings conform to the International Building Code.*

**E. <u>Effect on Wildlife and Wildlife Habitat</u>**

Wildlife and Wildlife Habitat are defined as living things that are neither human nor domesticated and the physical surroundings required for their existence.

1) How would the subdivision affect critical wildlife areas such as big game wintering range, migration routes, nesting areas, wetlands or other important habitat?

*The proposed subdivision contains wetland areas, as shown on the preliminary plat, that will be protected during and after construction of the subdivision. A Wetland Delineation Study was conducted in September 2019 by Sundog Ecological, Inc. (Appendix E in the application materials) for the eastern half of the proposed subdivision that delineates the wetland and surface water areas that exist on the eastern half of the subject property. Effects on the quality and quantity of wetland and surface water will be mitigated by designing around these areas to the greatest extent possible and as required by local, State, and Federal regulations and adherence to the SWPPP.*

*The proposed subdivision has not been previously formally identified as big game wintering range or migration routes. The applicant has solicited comments from Montana Fish Wildlife and Parks, but none have been received at this time; however, the Wetland Delineation Study confirmed that no critical habitats for federally listed Threatened and Endangered Species exist in the area delineated as wetlands on the subject property.*

*The application states the Mountain View Subdivision will comply with Park County Weed Control District requirements. Following preliminary plat approval, a weed management plan application and 3-year monitoring contract will be submitted to the district and a noxious weed management plan will be developed with the Park County Weed Control Board to prevent invasive weeds from adversely affecting native vegetation.*

2) How would pets or human activity affect wildlife?
*Although the potential for human/ wildlife interaction may exist if future development includes residential uses, staff anticipates potential conflicts would likely be minimal and limited to the open space areas. The applicant has included a suggestion for pets to be leashed while in these areas.*

**F. <u>Effect on Public Health and Safety</u>**

Public Health and Safety is defined as a condition of well-being wherein risk of injury to the community at large is minimized.

1) Would the subdivision be subject to hazardous conditions due to high voltage lines, airports, highways, railroads, high-pressure gas lines, or adjacent industrial uses?
*No new access points to Highway 10 are proposed and nearby active rail lines are located more than 300 feet away and across the highway from the proposed subdivision.*

2) What existing uses may be subject to complaints from residents of the subdivision?
*There are no existing uses on the subject property as it is currently vacant.*

3) What public health or safety hazards, such as dangerous traffic or fire conditions, would be created by the subdivision?

*An all-weather access road between Antelope Drive and PFL Way must be constructed as part of Phase 1 improvements to provide maintenance and emergency access until future phases and streets are constructed to complete the internal road network. The Public Works director has requested the applicant provide dead end barricades at the cul de sacs for each phase of development to prevent the public from accessing the all-weather road.*

*A Traffic Study was prepared by Sanderson Stewart in May 2023 (Application Materials Appendix D) to determine impacts of the proposed subdivision on the surrounding transportation network. Because the exact nature of future development on subdivided lots is unknown, the study looked at various types of uses that may be expected to determine trip generation estimates. The study notes that at full buildout, the subdivision is projected to generate a total of 9,991 gross average weekday trips with 866 trips generated during the AM peak hour and 754 trips generated during the PM peak hour. Based on the analysis in the traffic study, it is anticipated the high volume of trips added to the network by the proposed Mountain View Subdivision are projected to trigger the warrants for turn lanes into the site access intersections from Highway 10; however, the final decision to install any turn lanes shall be made by MDT after evaluation of impacts to other aspects of the intersections or adjacent intersections.*

As stated in MCA Section 76-3-608.1, a governing body may not deny approval of a proposed subdivision based solely on the subdivision's impacts on educational services or based solely on parcels within the subdivision having been designated as wildland-urban interface parcels. The governing body shall issue written findings of fact that weigh the criteria A-F discussed above

## STAFF RECOMMENDATION

Based upon the Findings of Fact as evaluated above, staff recommends that the Planning Board recommend **conditional approval** of the Mountain View Subdivision to the City Commission. The following conditions of approval are recommended:

1. The subdivider will sign a waiver of protest of SID for all lots in this subdivision. This waiver will apply to a future project to create pedestrian/bicycle connectivity from this subdivision to the City's existing trail system.

2. All infrastructure will comply with the City of Livingston Public Works Design Standards and Specifications.

3. Street lights will be required within this development. Type and spacing will be per existing City specifications.

4. All outdoor lighting in this development must be night-sky friendly and must be approved by the City prior to installation.

5. The developer covenants must be updated to indicate developer responsibility for sidewalk construction costs.

6. Storm water design will meet all applicable DEQ standards. The Property Owners Association (POA) must maintain ownership and maintenance responsibilities for stormwater facilities once constructed.

7. The applicant is required to deed restrict the subdivision open space/ parklands for public use and the POA must assume ownership and maintenance responsibilities.

8. Erosion Control must be installed in accordance with the MT Stormwater Pollution Prevention Plan (SWPPP).

9. Development must comply with Park County Weed Control District requirements.

10. The subdivider will be responsible for all required street signing to include traffic control signs as well as street name signs. All signs will be built and installed according to City specifications. Painting of curbs at fire hydrants will also be required.

11. The applicant is required to improve PFL Way from the fire hydrant at the end of the existing pavement past Antelope Drive, and must bear the cost of constructing these improvements.

12. The applicant must install provide dead end barricades at the cul de sacs for each phase of development to prevent the public from accessing the all-weather road.

13. An all-weather access road between Antelope Drive and PFL Way must be constructed as part of Phase 1 improvements to provide maintenance and emergency access until future phases and streets are constructed to complete the internal road network.

14. Building permits are required for structures built during future development, ensuring all buildings conform to the International Building Code.

15. A Montana licensed engineer, or his supervised representative, will be required to be on site during utility construction.

16. If a utility reimbursement plan is requested by the developer, it must be submitted to, and approved by, the City prior to beginning construction.

17. Any improvement agreement(s) for deferred infrastructure construction need to be reviewed and approved by the City prior to the beginning of construction.

***FOR YOUR INFORMATION:*** the sewer main near Kenyon Noble is a high-risk area with clay tile and capacity issues for future flows. A 15-inch main replacement is recommended in the Wastewater Collection PER.

SANDERSON STEWART

# LETTER OF TRANSMITTAL

| | | | |
|---|---|---|---|
| **To:** | Jennifer Severson | **Date:** | June 21, 2023 |
| | Planning Director | **Project No:** | 18005.05 |
| | City of Livingston | **Project:** | Mountain View Subdivision |
| | | **Reference:** | **Preliminary Plat Application** |

☐ By Mail ☐ Next Day Air ☒ Delivered By Hand ☐ To Pick Up

**Attachments:**

| | | |
|---|---|---|
| ☐ SID Pre-Creation Exhibits | ☐ Contract Documents | ☐ Prints |
| ☐ Plans/Specifications | ☐ Change Order | ☒ Plat Submittal |
| ☐ Shop Drawings | ☐ Estimate | ☐ Other |

**MESSAGES:**

The following materials are for the Mountain View Major Subdivision Preliminary Plat application:

1. Application Binder
2. Civil Sheets
3. Preliminary Plat
4. Flash Drive with digital copies of all plans and documents

*Signed:* Sumner Anacker

Sumner Anacker, PE
Project Engineer

106 East Babcock, Suite L1 | Bozeman, Montana 59715| Phone 406.522.9876 | Fax 406.922.2768 | SandersonStewart.com

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

Livingston West LLC
Box 500
Emigrant, MT 59027

Placemaking

Infrastructure Engineering

Surveying + Mapping

Community Planning

Landscape Architecture

Branding + Visualization

**June 21, 2023**

SANDERSON STEWART
ENDURING COMMUNITY DESIGN

# MOUNTAIN VIEW
# MAJOR SUBDIVISION
# PRELIMINARY PLAT APPLICATION
# TABLE OF CONTENTS

## PLANS & PLAT

Civil Engineering Plans

- C1.1 Cover
- C1.2 Legend
- C2.1 Exiting Conditions
- C3.1 Overall Site Plan
- C4.1 Utility Plan
- C5.1 Stormwater & Drainage Plan
- C6.1 Details

Preliminary Plat

- Sheet 1 of 2 Cover & Certificates
- Sheet 2 of 2 Lot Layout

## APPENDICES

A. Preliminary Stormwater Report
B. Preliminary Sewer & Water Design Report
C. Subdivision Improvements
D. Mountain View Subdivision Traffic Impact Study
E. Wetland Delineation Report
F. Public Agency Review
G. Private Service Providers Review
H. Covenants, Conditions, and Restrictions Summary

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 21, 2023

Jennifer Severson
Planning Director
City of Livingston
220 E. Park Street
Livingston, MT 59047

Reference: Mountain View Subdivision
Preliminary Plat Submittal
Project No. 18005.05

Jennifer:

On behalf of Andrew Field and Livingston West LLC, attached is a Preliminary Plat application for the Mountain View Subdivision. The proposed subdivision includes 24 lots, including two open space lots, and public right-of-way for subdivision streets and utilities.

We are submitting one printed copy and digital copy of the preliminary plat application for your review. The following documentation is included in the application:

1. Cover Letter
2. Completed Preliminary Plat Application
3. Checklist of Submittal Materials
4. Application Review Fee
5. Application Narrative
6. Vicinity Map
7. Overall Development Plan
8. Active Transportation Plan
9. Preliminary Civil Plan Set
10. Preliminary Plat
11. Stormwater Overview
12. Water & Sewer Overview
13. Subdivision Improvements
14. Traffic Trip Generation Analysis
15. Summary of Probable Impacts
16. Wetlands Report
17. Public Agency Review
18. Private Service Providers Review
19. Covenants, Conditions & Restrictions Summary

Please let me know if you have any questions or need additional information, please feel free to contact me at (406) 922-4311 or cnaumann@sandersonstewart.com.

Sincerely,

Chris Naumann
Associate | Senior Planner
Sanderson Stewart
106 East Babcock Street Suite L1
Bozeman MT 59715
cnaumann@sandersonstewart.com
406-922-4311 (d)
406-570-5758 (m)

City of Livingston
Department of Planning
220 E. Park St.
Livingston, MT 59047
(406)222-4903
planning@livingstonmontana.org

## City of Livingston Subdivision Preliminary Plat Instructions

Subdivision review is required to divide any parcel of land within the City of Livingston that does not meet the criteria for a subdivision exemption as listed in 76-3-2 MCA. Subdivisions require a three-step application process prior to final approval:

- Pre-Application
- Preliminary Plat Application
- Final Plat Application

Preliminary Plats require a public hearing before the Planning Board for a recommendation to the City Commission, and are approved or denied by the City Commission. All subdivision applications are evaluated by the Planning Board and City Commission based upon the following criteria listed in Section III.B.6 of the Subdivision Regulations for major subdivisions or Section IV.B.6 for minor subdivisions:

- Provides easements for the location and installation of any planned utilities.
- Provides legal and physical access to each parcel within the subdivision and the notation of that access on the applicable plat and any instrument transferring the parcel.
- Assures that all required public improvements will be installed before final plat approval, or that their installation after final plat approval will be guaranteed.
- Complies with the requirements of 76-3-504 MCA, regarding the disclosure and disposition of water rights.
- Complies with the Subdivision Regulations.
- Complies with the applicable Zoning Regulations.
- Complies with the Montana Subdivision and Platting Act.

The Preliminary Application shall be submitted to the Planning Department. The Planning Department may forward the application to local, state, and federal agencies as necessary to ensure a comprehensive review of the project. **It is required that you submit and receive an approved Subdivision Pre-Application prior to submitting a Preliminary Plat Application.**

**Submittal Requirements (listed in Section III.B.1 of the Subdivision Regulations for major subdivisions or Section IV.B.1 for minor subdivisions):**

☑ Two (2) copies of the Completed Application Form.

☑ Three (3) copies of the Preliminary Plat, which:
  - Contains the required information for preliminary plats..
  - Conforms to the Design and Improvement Standards in Section VI of the Subdivision Regulations.
  - Conforms to the requirements of the Zoning Regulation.

- Conforms to the requirements of the Public Works Design Standards and Specifications Policy.

☑ A summary of probable impacts of the Subdivision.

☑ Proof that the subdivider has submitted for review copies of the subdivision application and environmental assessment, if applicable, to the public utilities and agencies of local, state, and federal government identified during the pre-application meeting or subsequently identified as having a substantial interest in the proposed subdivision.

☑ Additional relevant and reasonable information as identified by the Development Review Committee during the pre-application meeting:

☑ The Preliminary Plat Application Review Fee.

All documents other than the preliminary plat shall be submitted on either 8 ½" x 11" or 11" x 17" paper. Additionally, digital copies of the submittal in PDF file format are required.

City of Livingston

City of Livingston
Department of Planning
220 E. Park St.
Livingston, MT 59047
(406)222-4903
planning@livingstonmontana.org

## City of Livingston Subdivision Preliminary Plat Application

1. **Property Owner Name:** Livingston West, LLC (c/o Andrew Field)

2. **Location of Property**

   General Location: Northeast of the intersection of I-90 and Highway 10

   Address: TBD Antelope Drive and TBD PFL Way

   Subdivision: N/A Lot: N/A Block: N/A

   Zoning District: HC

3. **Contact Information**

   *Property Owner*

   Home Address: Andrew Field PO Box 500
   Emigrant, MT 59027

   Phone Number: 406-223-7077

   Email Address: asfield@gmail.com

   *Primary Contact/ Applicant*

   Name: Sumner Anacker, PE Sanderson Stewart

   Address: 106 E Babcock Street, Suite L1
   Bozeman, MT 59715

   Phone Number: 406-922-4314

   Email Address: sanacker@sandersonstewart.com

   *Secondary Contact*

   Name: Richard Smith

   Address:

   Phone Number:

   Email Address: resmith@rj-development.net

**4. Project Information**

Type of Subdivision: ■ Major ☐ Subsequent Minor ☐ Minor

Proposed Subdivision Name: Mountain View Subdivision

Brief Description of Project: Subdivision of Tract 1-A of COS 2748RB into 24 lots (including dedicated parkland open space) with street, storm, water, and sanitary sewer improvements

Proposed Use(s): Highway Commercial

Number of Lots: 24 Number of Phases: 3

**I hereby certify that the information included in this application is true and accurate.**

Applicant's Signature

6/21/23
Date

# APPENDIX B

## LIST OF SUBMITTAL MATERIAL
(Based on City of Livingston Subdivision Regulations)

### PRELIMINARY PLAT

The following materials shall be submitted with all applications for Preliminary Plat approval:

| | Attached (Check) |
|---|---|
| 1. Three (3) copies of the preliminary plat in 24" x 36" format. | ✓ |
| 2. Eight (8) copies of the preliminary plat in 11" x 17" format. | ✓ |
| 3. The required review fee. | ✓ |
| 4. A vicinity sketch showing conditions on adjacent land including: | |
| a. Approximate locations, size and depth of existing or proposed sanitary and storm sewers, water mains, fire hydrants, gas, electric, telephone lines and streetlights. | ✓ |
| b. Ownership of lands immediately adjacent the subdivision and all public and private streets leading to the subdivision. | ✓ |
| c. Locations of buildings, structures, power lines and other improvements and nearby land uses. | ✓ |
| d. The existing zoning of the subdivision and of adjacent lands within 500 feet. | ✓ |
| 5. A complete grading and drainage plan designed to handle runoff from a 10 year, 6 hour storm and containing the following: | |
| a. Location and details, accurately dimensioned, of all existing and proposed drainage structures to include courses, elevations, grades and cross sections of streets, bridges, ditches, culverts, retention areas and other drainage improvement. | ✓ |

a. Ground contours with intervals of 2 feet where the average slope is under 10% and 5 feet where average slope is 10% or greater. ✓

b. Information describing the ultimate destinations of storm water from the subdivision and the effect of the runoff on down-slope drainage structures. ✓

c. Describe construction procedures, slope protection and reseeding methods to minimize erosion. ✓

6. A list of the proposed subdivision improvements shall be submitted and shall include the following items:

   a. Provide design specifications for all streets and alleys. Include information on all drainage structures, street signs, sidewalks, and street lights. ✓

   b. Indicate the solid waste collection and disposal facilities proposed for the subdivision. ✓

   c. Show fire hydrant locations and spacing. ✓

   d. Describe all utilities to be installed and which entities will be providing the services. ✓

   e. Indicate parkland to be dedicated or amount of cash-in-lieu of land to be donated, if applicable. ✓

   f. Indicate how mail delivery will be handled within the subdivision. ✓

7. Overall Development Plan: When a tract of land is to be subdivided in phases, the subdivider must provide an overall development plan indicating the intent for the entire development. The preliminary plat submission and other supplements must include the entire development and be in compliance with the procedures and standards contained in the Livingston Subdivision Regulations. Plat review will be based on the overall development. ✓

(iii) Unless the subdivision will be served by a community sewer or water system, each lot in the cluster must be a minimum of one acre in size.

(iv) Multiple adjacent tracts of record may be aggregated to create a single parcel for the purpose of creating a cluster development.

b. Park dedication requirements are waived for clustered subdivisions created under this section.

## X. ADMINISTRATIVE PROVISIONS

### X-A. Fee Schedule

To cover costs of reviewing plans, advertising, holding public hearings, and other activities associated with the review of a subdivision proposal, the subdivider shall pay a non-refundable fee at the time of application for preliminary plat approval. The fees, payable to the City, are as follows:

Minor Subdivisions

| | |
|---|---|
| Preliminary Plat | $600.00 plus $20 per lot |
| Final Plat/Summary review | $400.00 |
| Subsequent Minor | $800.00 plus $40 per lot |

Major Subdivisions

| | |
|---|---|
| Preliminary Plat | $800.00 plus $40 per lot |
| Final Plat | $400.00 plus $20 per lot |

Subdivision by Rent or Lease and Condominiums

| | |
|---|---|
| Preliminary Review (five or fewer units) | $600.00 plus $20 per unit |
| Final Review | $400.00 |
| Preliminary Review (over five units) | $800.00 plus $20 per unit |
| Final Review | $400.00 plus $20 per unit |

$800
+
$40/lot *24 lots
$1,760.00

### X-B. Variances

### X-B-1. Variances Authorized

The governing body may grant variances from Section VI, Design and Improvement Standards, of these regulations when, due to the characteristics of land proposed for subdivision, strict compliance with these standards would result in undue hardship and

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 21, 2023
Project No. 18005.05

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION APPLICATION NARRATIVE

## INTRODUCTION

On behalf of Livingston West, LLC, Sanderson Stewart is submitting this Preliminary Plat Application for the proposed Mountain View Subdivision. This highway commercial subdivision is within the City of Livingston. The project would create 24 lots including dedicated parkland open space and public right-of-way totaling 43.879 acres. These new lots are currently served by the City of Livingston water and sanitary sewer systems.

The subdivision will be accessed from Highway 10 via PFL Way, Antelope Drive, and West End Road. It is generally located on Section 22 of Township 02 South Range 09 East. See Exhibit A: Vicinity Map.

## SITE LOCATION

The proposed Mountain View Subdivision is located on 43.879 acres of land to the east of the interchange of Interstate 90 and Highway 10. More specifically, the project is located on Parcel 1-A of COS 2748RB, situated in the NW ¼ of Section 22, Township 02 South, and Range 09 East in the City of Livingston, Park County, Montana. See Exhibit A: Vicinity Map.

## EXISTING CONDITIONS

### Structures

There are no existing structures within Parcel 1-A of COS 2748RB.

### Public Infrastructure

Mountain View Subdivision includes the existing paved roadway on Antelope Drive and PFL Way.

There is a completed 10-inch public sewer main which follows the roadways along its entire length, continuing to the southeast where the sewer main leaves the subdivision. There is a 12-inch public water main that follows the existing roadways. A 12-inch public water main is also now complete, paid for with private funds, and follows the new roadway within the subdivision with the associated water services, valves, and hydrants. Storm drainage is generally collected in the roadway gutters and conveyed through storm drainage infrastructure to a temporary on-site detention pond located on Antelope Drive. All existing public infrastructure is shown on the Civil Engineering Plans and the Preliminary Plat.

### Private Utilities
There is an existing overhead power line with a 30' wide easement at the southern corner of the subdivision. In addition, there are several underground utility lines with 10' easements running through multiple lots of the subdivision. All existing private utility easements are shown on the Civil Engineering Plans and the Preliminary Plat.

### Private Utility Easement
There are two existing 20' underground electric easements shown on the existing Certificates of Survey with "exact location undetermined". One is on Tract 3-A1 of COS 2748RB per Recorded Document No. 426785 and the other is on Tract 2-A of COS 2621RB per Recorded Document Nos. 333214 and 406962. Neither of these easements are part of this subdivision.

There is an existing 40' utility easement bisecting Lots 6, 8-11 for overhead power and communication lines on Tract 1-A of COS 2748RB per Recorded Document No. 87649.

There is an existing 30' utility easement for overhead power and communication lines running along Lots 20, 21, and 24 on Tract 1-A of COS 2748RB per Recorded Document No. 335670.

There is one existing 60' public access and utility easement shown on Tract 1-A of COS 2748RB and proposed Mountain View Subdivision Lot 3 per Roll 219, Page 1501 and Roll 223, Page 56 as originally located on COS 1941. It is the intent of the applicant to verify this easement is no longer in use and vacate the easement prior to Final Plat.

### Topography
The land is primarily characterized by rolling hills and grassland, with a large wetland area located in the northeast quadrant of the subdivision and steeper hill areas located in the southeast corner of the subdivision.

## ZONING & LAND USE

### Highway Commercial
All the land in the proposed subdivision is currently zoned as Highway Commercial within the City of Livingston city limits. Therefore, all the proposed subdivision lots are subject to the Highway Commercial zoning designation. Highway Commercial is defined by the City of Livingston as:

"a district intended to provide areas for residential structures, commercial and service enterprises which serve the needs of the tourist, traveler, recreationalist or the general traveling public. Areas designated as Highway Commercial should be located in the vicinity of freeway interchanges, intersections on limited access highways, or adjacent to primary and secondary highways."

Future development within Mountain View subdivision will be required to meet the Highway Commercial zoning requirements. Zoning designations can be seen on Exhibit B: Overall Development Plan.

## OVERALL DEVELOPMENT PLAN

### General Description

All future lot developments will be subject to the Property Owners Association design review process, be held to the Highway Commercial zoning requirements, and submitted to the City for formal site plan review and approval.

### Current Ownership

Livingston West, LLC owns the land comprising the proposed Mountain View Subdivision is as shown on the attached Exhibit B.

### Lot Layout

Mountain View Subdivision will be subdivided into 24 lots that will range from 0.27 acres to 14.1 acres. Two of the lots, totaling approximately 20.4 acres, will be designated as open space parkland and dedicated to the City of Livingston. The remaining lots will range from 0.270 acres to 1.230 acres.

### Final Plat Phasing

The subdivision will be final platted in three phases. The first final plat phase will consist of lots 2-17, 21, and 22. Phase two will consist of lots18-20 and 23. Phase three will consist of lots 1 and 24. The lot layout and phasing can be seen in Exhibit B: Overall Development Plan and the Preliminary Plat.

### Dedicated Open Space Parkland

Lots 2 and 21, totaling approximately 20.4 acres, will be designated as open space parkland, which equates to 47% of the entire subdivision. Lot 2 is in the northeast corner of the subdivision and includes a substantial amount of wetland area. Lot 21 is in the southeastern corner of subdivision and primarily consists of hilly grassland. The proposed dedicated open space parkland lots can be seen in Exhibit B: Overall Development Plan and on the Preliminary Plat.

## GRADING & DRAINAGE PLAN

**General Description**
The roadway extensions will generally follow the existing drainage patterns and slope towards the southeast to the existing wetlands. Roadways will be sloped to drain to the associated gutters and conveyed through storm drainage infrastructure toward the proposed detention pond. The proposed lots will drain towards the new streets and will be conveyed along swales following the proposed roadways. These swales will convey the runoff towards the proposed detention pond. As development occurs on the lots, the swales will be filled as the property owners will be required to mitigate runoff within their site. With Phase 3, a new detention basin will be constructed to store and convey the pre-development peak flows. The proposed grading and drainage are shown on the Civil Engineering Plans. For more drainage information see Appendix A: Preliminary Stormwater Report.

## PROPOSED SUBDIVISION IMPROVEMENTS

**General Improvements**
The proposed general improvements of the Mountain View Subdivision, most of which have already been completed, include streets, street signage, boulevards, sidewalks, and street lighting. All these improvements will be designed to meet the requirements established in the City of Livingston Public Works Design Standards and Specifications Policy including the corresponding Modifications to Montana Public Works Standards. As such all sidewalks will be ADA compliant and all street lighting will meet the requirements of the Night Sky Protection Act. All the proposed subdivision improvements are listed in Appendix C: Subdivision Improvements.

**Streets**
The proposed street improvements for the Mountain View Subdivision includes a 1,100 LF extension of Antelope Drive, a 740 LF extension of PFL Way, and an additional 320 LF roadway (Street 1) to provide access to the remaining lots within the subdivision. The proposed street improvements are shown on the Civil Engineering Plans and the Preliminary Plat.

**Potential Alley Access**
Due to the proposed small lot layout of this highway commercial subdivision and applicant's not knowing the precise usage of each lot, the applicability of alleyways cannot be determined at this time. If multiple lots were used for a single development a common drive and/or alleyways could possibly be incorporated into the site plan design.

Streets and Roads Improvements
"VI-A-8.b. Alleys, designed in accordance with Table 1, shall be provided in all residential subdivisions. Alleys will also be the preferred method for providing utility and garbage pick-up access in non-residential subdivisions."

While alleys are preferred in non-residential subdivisions, they are likely not feasible due to the narrow lot configuration. In lieu of alleys, utility easements have been proposed along the front of each lot adjacent to the existing and proposed streets. Adequate garbage collection access will be proposed as part of the future site planning process as each lot prepares for development.

**Stormwater**

A preliminary drainage report summarizing the design of the future stormwater system associated with the Mountain View Major Subdivision is provided in Appendix A: Preliminary Stormwater Report. The report presents a summary of calculations performed to quantify the necessary storm drainage improvements. The storm drain system has been and will continue to be designed to meet the requirements in The City of Livingston Design Standards and Specification Policy (DSSP) of February 2021.

There will be one (1) stormwater detention pond in the southeast portion of the subdivision to treat runoff from the street network. There will be one (1) stormwater detention pond located on Lot 11 near Highway 10 to treat existing predevelopment storm flows from Jesson property to the west northwest. The proposed stormwater facility easements are shown on the Civil Engineering Plans and the Preliminary Plat. For more stormwater information see Appendix A: Preliminary Stormwater Report.

**Sewer & Water**

A preliminary report summarizing the design of the existing sanitary sewer and water main installations associated with the Mountain View Major Subdivision is provided in Appendix B: Preliminary Sewer & Water Report. The project will utilize existing sanitary sewer and water, as well as provide water service stubs and sanitary stubs to serve future developments within a portion of the subdivision. The provided report summarizes the water and sewer main design and capacity calculations for the water and sewer services to the theoretical future development.

**Parkland Dedication**

The proposed Mountain View subdivision includes over 20 acres of open space to be dedicated to the City of Livingston as parkland. The proposed parkland is characterized by rolling grassland and a large wetland area that merit being preserved and made available for public use and enjoyment.

Dedicated parkland is included in the proposed subdivision as Lots 2 and 21. The proposed dedication equates to parkland per Ordinance No. 2069 Sec. VI-A-16.b. - “Standards for Parkland Dedication – provides for the preservation of a physical amenity such a as a meadow, stand of trees, significant wildlife habitat or a wildlife corridor, a scenic hillside with slopes less than 25%, a stream or significant water body, an area of riparian resource.”

As such, the proposed open space parkland dedication meets the requirements established in MCA 76-3-621.

## GROWTH POLICY ALIGNMENT

The proposed development aligns with many elements of the Growth Policy.

# Population & Community Character

### Land Use

***Goal 3.1: Prioritize infill over expansion by taking advantage of existing and planned infrastructure, such as transportation, energy, water, and sewer facilities.***

The proposed Mountain View Subdivision represents the continuation of infill of this property that was annexed into the City of Livingston over 15 years ago. This subdivision will take advantage of the existing water, sewer, and transportation infrastructure that is sized to accommodate this anticipated growth.

### Natural Resources

***Goal 4.3: Protect and manage natural resources, open spaces, and wildlife.***

The proposed Mountain View preliminary plat proposes to formally dedicate over 20 acres of open space parkland, over half of which contains important wetland habitat for a variety of flora and fauna.

### Housing

**Goal 5.1: Provide housing options to meet the needs of all residents.**

Mountain View subdivision will provide the opportunity for housing development should the subsequent owners choose to develop that type of use.

### Economy

***Goal 6.1: Strengthen and diversify Livingston's economy by supporting industries and initiatives that increase employment opportunities and personal income.***

The Highway Commercial zoning will allow Mountain View subdivision to be developed with a variety of businesses that will not only create a diversity of new jobs but also service Livingston's tourism economy.

# Local Services

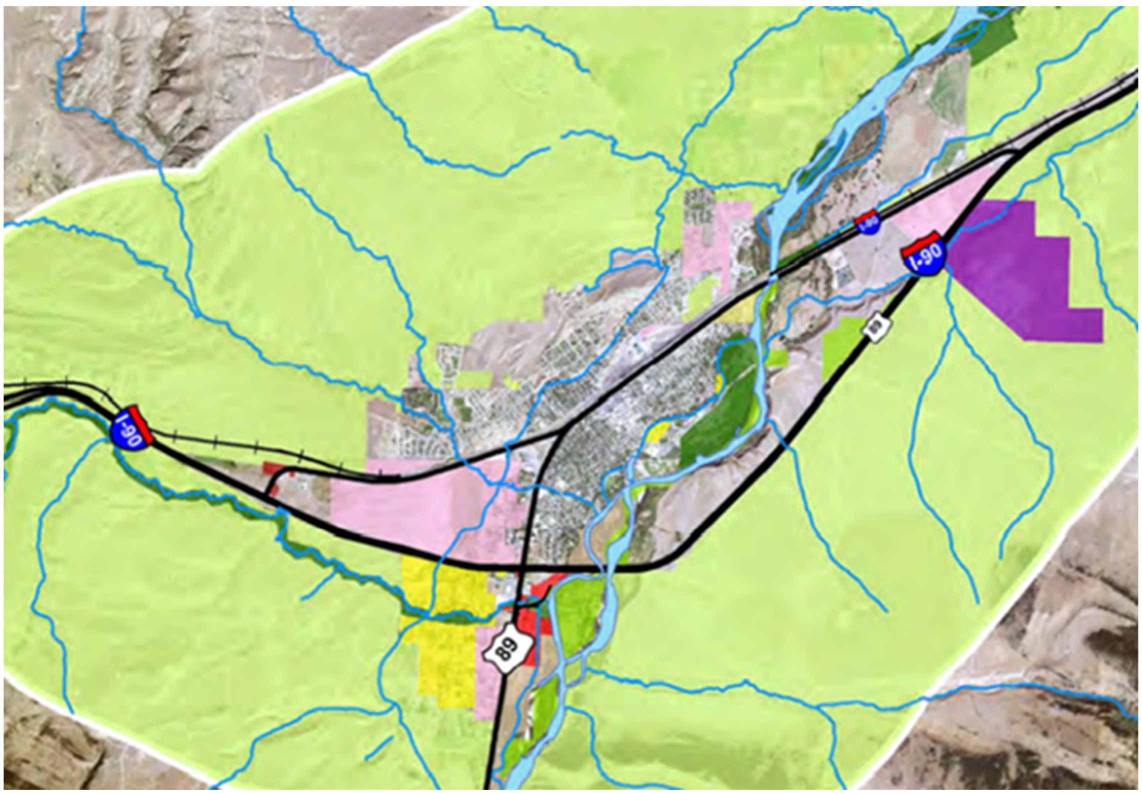
### Transportation

***Goal 8.2: Create a complete and well-maintained transportation network within the City.***

The Mountain View preliminary plat application identifies opportunities to enhance the City's multimodal active transportation network with potential bus route service, internal sidewalks and trails, and a shared use path connection leading east.

**Public Facilities**
***Goal 9.1: Develop infrastructure to enhance community services and improve public safety for Livingston residents.***

The impact fees paid by future development of the proposed subdivision lots will provide revenues to fund offsite community infrastructure improvements.
The 2021 City of Livingston Growth Policy prescribes a future land use of "Mixed Use" for the undeveloped properties between the proposed subdivision and Highway 89. This designation indicates that continued development in the area is planned and supported.



*2021 Livingston Growth Policy | Appendix A: Extra-Territorial Jurisdiction Plan | Exhibit 2.9*

## DRC ADDITIONAL INFORMATION

### <u>Active Transportation</u>
At the request of the City of Livingston staff, active transportation and transit locations are conceptually proposed in the Mountain View Subdivision plan. A future bus route is anticipated to circumnavigate the subdivision along Antelope Drive and PFL Way to serve the public transportation needs of PFL, FedEx, and any future development within the subdivision. There could be multiple bus stops along the route on Antelope Drive and one bus shelter on PFL Way. Conceptually, a shared use path designed for cyclists and pedestrians will be located along Highway 10 and will extend into Mountain View Subdivision along PFL Way. Sidewalks will

border all new streets in the subdivision to complete the pedestrian network. A natural surface trail could be extend into Lot 2 to access the wetlands and open space. These multimodal facilities can be seen in Exhibit C: Active Transportation Plan.

**Traffic Trip Generation**

At the request of the City of Livingston staff, a preliminary traffic trip generation analysis was produced for the proposed Mountain View subdivision. The analysis concluded:

> *"The preceding analysis has shown that construction of the facility will generate a modest volume of new traffic demand for area streets and intersections. . . Future (2027) scenario capacity results are projected to be similar to existing conditions (2022 results)" With that, the West Park Street/US 10 intersection observes the biggest difference in projected 95th percentile vehicle queuing. Under current conditions, the AM peak hour projected 95th percentile queuing is up to 7 vehicles and the PM peak hour projected queuing is up to 13 vehicles. At full buildout (2027) conditions, the AM peak projected 95th percentile queuing is up to 9 vehicles and the PM peak hour projected queuing is up to 19 vehicles.*

The complete analysis is included in Appendix D: Traffic Trip Generation Analysis

**Covenants, Conditions, and Restrictions**

Although not required to be submitted until Final Plat, the applicant has provided a summary of the draft Covenants, Conditions, and Restrictions (CC&R), at the request of City of Livingston staff. In addition to standard CC&R provisions, those for the proposed subdivision include wildlife-friendly fencing, wildlife-proof trash storage, and an Owners Association Design Review Committee.

A summary of the Mountain View Subdivision Covenants, Conditions, and Restrictions are included in Appendix H.

## PUBLIC AGENCY REVIEW

At request of City of Livingston staff, formal letters were sent to three public agencies to solicit their review and comments on the proposed Mountain View Subdivision. The three public agencies included Montana Department of Transportation, Montana Fish, Wildlife, and Parks, and the State Historic Preservation Officer. These letters and any received comments are included as Appendix F: Public Agency Review.

## PRIVATE SERVICE PROVIDER REVIEW

Letters were sent to five private service providers to solicit their review and comments on the proposed Mountain View Subdivision on request of City of Livingston staff. The five service providers included NorthWestern Energy, Park Electric Cooperative, CenturyLink, Windrider public bus Service provider, and the United States Postal Service. These letters and any received comments are included as Appendix G: Private Service Provider Review.

## SUMMARY OF PROBABLE IMPACTS & MITIGATION

As required by the City of Livingston Subdivision Regulations Section III B-6 this application includes a summary of probable impact. The impacts addressed include Agriculture, Ag Water, Local Services, Natural Environment, Wildlife & Habitat, and Public Health & Human Safety.

### 1. IMPACTS ON AGRICULTURE

**A. Would the subdivision remove agricultural or timberlands with significant existing or potential production capacity?**

No. There are no current agricultural or timberland resources on this site.

**B. Would the subdivision remove from production agricultural lands that are critical to the area's agricultural operations?**

No. There is no agricultural production on this site now or in the past. There are no agricultural water user facilities on this site.

**C. Would the subdivision create significant conflict with nearby agricultural operations (e.g. creating problems for moving livestock, operating farm machinery, maintaining water supplies, controlling weeds, applying pesticides or would the subdivision generate nuisance complaints due to nearby agricultural operations)?**

No. The proposed subdivision would not create conflicts with nearby agricultural operations.

### 2. IMPACT ON AGRICULTURAL WATER USER FACILITIES

**A. Would the subdivision create a significant conflict with agricultural water user facilities (e.g. creating problems for operating and maintaining irrigation systems or creating nuisance complaints due to safety concerns, noise, etc.)?**

No. The subdivision would not create conflicts with agricultural water user facilities.

## 3. IMPACT ON LOCAL SERVICES

### A. What additional or expanded public services and facilities would be demanded to serve this subdivision?

#### i. What additional costs would result for services such as streets, law enforcement, parks and recreation, fire protection, water, sewer and solid waste, schools and busing (including additional personnel, equipment, construction, and maintenance costs)?

All the public infrastructure associated with the proposed subdivision has or will be constructed and paid for by private parties. Once dedicated to the City, maintenance requirements would fall upon the City of Livingston. Public infrastructure will include streets, street lighting, sidewalks, water mains, sewer mains, stormwater mains and ponds.
See Appendix C: Subdivision Improvements for more detailed information.

Law enforcement and fire protection services have been provided to the area of the proposed subdivision by the City of Livingston since it was annexed nearly 20 years ago. Therefore, no additional costs or personnel should be required to continue these services.

The proposed open space parkland to be dedicated would need to be managed by the City. As established in Ordinance No. 2069, open space parklands "shall be managed to remain in a near natural state when it has been dedicated for preservation or conservation purposes." As such, the maintenance costs should be nominal.

Solid waste services are paid for by user 'tipping' fees that would be incurred by the property owners contracting for service.

It is unknown at this time whether the proposed subdivision will have any residential development. It is also unknown whether any future housing would include residents with school age children requiring busing for school.

#### ii. Who would bear these costs?

See responses above.

#### iii. Can the service providers meet the additional costs given legal and other constraints?

Yes. The additional public service maintenance costs will be covered by the impact fees paid by each developed site and the new additional tax revenue generated by future development.

**B. Would the subdivision allow existing services, through expanded use, to operate more efficiently or make the installation or improvement of services feasible?**

Yes. The new sewer and water mains are designed to accommodate future development to the northwest and to be tied into the City's long term expansion plans to connect to the City's large tank reservoir to the north upon future construction of the West End Loop.

**C. What are the present tax revenues received from the unsubdivided land by the County, City and Schools?**

The current tax bills for the subject property is $17,613.62 for the 2022 calendar year per the Park County Treasurer.

**D. What would be the approximate revenues received by each above taxing authority when the subdivision is improved and built upon?**

At full build out of the proposed subdivision, the estimated annual tax revenues to the City of Livingston would be nearly $200,000. This estimate was calculated using the State of Montana tax rate of 1.35% and the City of Livingston mill rate of 0.58606 as applied to the acreage and estimated taxable value of potential development for each lot.

**E. Would new taxes generated from the subdivision cover additional public costs?**

Yes.

**i. Would any special improvement districts be created which would obligate the City fiscally or administratively?**

No. There is currently a TIF District on this property that is scheduled to expire in 2024.

**F. Other Impacts on Local Services—Water Rights**

Regarding the disclosure and disposition of water rights as required by 76-3-504, the current property and property owners, thus subdividers, do not own any surface water rights.

## 4. IMPACT ON NATURAL ENVIRONMENT

### A. How would the subdivision affect surface and groundwater, soils, slopes, vegetation, historical or archaeological features, and visual features within the subdivision or on adjacent lands?

i. **Would any streambanks be altered, streams rechanneled or any surface water contaminated from run-off carrying sedimentation or other pollutants?**

No. There are no streams on the proposed subdivision. Road drainage in the subdivision will be controlled by paved streets with concrete curb and gutter. Storm runoff will be collected by the gutters and transported to stormwater inlets. From the inlets, the stormwater will be conveyed to onsite stormwater detention ponds. Erosion of the road will be prevented due to the impervious paved surface. Erosion of the nonpaved right-of-way areas impacted during construction will be mitigated through reseeding affected areas after construction is complete. All phases of construction (public infrastructure and private development) will require DEQ Stormwater Pollution Prevention Plans to be approved and administered.

**ii. Would groundwater supplies likely be contaminated or depleted as a result of the subdivision?**

No. Groundwater supplies would not be depleted as the proposed lots will be connected to City of Livingston water mains. Contamination of groundwater is not expected with the uses allowed by Highway Commercial zoning and applicable City and DEQ water quality regulations.

**iii. Would construction of streets or building sites result in excessive cuts and fills on steep slopes or cause erosion on unstable soils?**

No. Grading in areas that will be affected during construction will be done as to not adversely affect adjacent lands with stormwater runoff from the subdivision. The stormwater management plan for the subdivision has been designed in accordance with the standards of the City of Livingston and the Montana Department of Environmental Quality Design Circular DEQ-8.

**iv. Would significant vegetation be removed causing soil erosion or bank instability?**

No. The soils located within the proposed subdivision are lean clay with sand and clayey sand. Historically, the area receives between 14 and 16 inches of rain per year. The effect on native dryland vegetation will be limited to the developed areas. Revegetation of affected areas will be done as development occurs.

**v. Would significant historical or archaeological features be damaged or destroyed by the subdivision?**

No. The State Historical Preservation Office previously reviewed the proposed subdivision and concluded:

> "Based on previous survey within the project area we feel that there is a low likelihood cultural properties will be impacted. We, therefore, feel that a recommendation for a cultural resource inventory is unwarranted at this time."

The full response from the State Historical Preservation Office and a cultural assessment from 2004 prior to the construction of the Printing for Less building are provided in Appendix F: Public Agency Review.

**vi. Would the subdivision be subject to natural hazards such as flooding, rock, snow or land slides, high winds, severe wildfires or difficulties such as shallow bedrock, high water table, unstable or expansive soils, or excessive slopes?**

No.

The subdivision is not located within a floodplain. The nearest floodplain designation is along Billman Creek south of Interstate 90 and poses no hazard to the proposed subdivision.

The subject area does not have a history of rock, snow, or landslides.

All the structures built in the subdivision will conform to building standards which will prevent hazards caused by high winds that frequently occur in the area.

Wildfire in the area is not a high risk due to the lack of natural fuel and the availability of fire protection added by the development of the subdivision including the paved road that will serve as a fire break and the completed installation of numerous fire hydrants.

The geotechnical work performed in May 2021 by Terracon Consultants, Inc. for the FedEx project constructed by Ruedebusch Development & Construction identified soil depths ranging between 8 and 21 feet and water depths ranging from 6 to 15 feet below existing site grades.

The soils present are typical of the area and predominantly lean clay with sand. This soil type is not characterized as unstable or expansive in nature.

Although moderately sloping in some areas, the topography of the site is not conducive to snow or rockslides. There are no excessive slopes on the property that may be a potential hazard.

### vii. Other Natural Environment Impacts—Weed Management Plan

Mountain View subdivision will comply with Park County Weed Control District requirements. Following preliminary plat approval, a weed management plan application and 3-year monitoring contract will be submitted to the district and a noxious weed management plan will be developed with the Park County Weed Control Board. The subdivision will abide by the Montana County Weed Act (Title 7, Chapter 22, Sections 7-22-2101 through 7-22-2153).

## 5. IMPACTS ON WILDLIFE AND HABITAT

### A. How would the subdivision affect critical wildlife areas such as big game wintering range, migration routes, nesting areas, wetlands or other important habitat?

The proposed subdivision contains wetland areas, as shown on the preliminary plat, that will be protected during and after construction of the subdivision. A wetland study was conducted by Sundog Ecological, Inc. and is contained in Appendix E: Wetland Delineation Report. This study delineates the wetland and surface water areas that exist on the development. Effects on the quality and quantity of wetland and surface water will be mitigated by designing around these areas to the greatest extent possible and as required by local, State, and Federal regulations.

The proposed subdivision has not been previously formally identified as big game wintering range or migration routes. The applicant has solicited comments from Montana Fish Wildlife and Parks, but none have been received at this time. See Appendix F: Public Agency Review for agency request for review documentation.

### B. How would pets or human activity affect wildlife?

Pets and their owners will have access to the subdivision's private property, public sidewalks, any future trails, and the proposed dedicated open space parkland. It is suggested that pets be kept on leashes while in these areas. Wildlife will continue to be allowed access to proposed open spaces totaling approximately 20 acres.

# 6. IMPACTS ON PUBLIC HEALTH AND SAFETY

**A. Would the subdivision be subject to hazardous conditions due to high voltage lines, airports, highways, railroads, high-pressure gas lines, or adjacent industrial uses?**

No. The proposed Mountain View Subdivision Lots 12 – 21 are adjacent to the Montana Department of Transportation (MDT) Right of Way for Interstate 90. The proposed subdivision Lots 2 – 11 are adjacent to MDT Right of Way for State Highway 10. The proposed subdivision Lots 2 – 5 are approximately 500 feet from the Montana Rail Link railroad tracks to the north of Highway 10.
Despite the proximity of the proposed subdivision to the infrastructure referenced above, and because all the applicable setbacks are in place, the proposed Mountain View Subdivision would not be subject to hazardous conditions due to the adjacent infrastructure.
Some of the proposed subdivision lots will be adjacent to the Printing for Less facility and the FedEx Ground facility. These light industrial uses do not pose any hazardous conditions and have been constructed and will operate in accordance with the City of Livingston regulations that mitigate any hazards including noise.

**B. What existing uses may be subject to complaints from residents of the subdivision?**

In theory any of the existing uses, public and private, may be subject to complaints from tenants or users of the proposed subdivision. The uses of potential concern, such as the highways and railroad, predate any development in the area and the characteristics of these uses are generally recognized and accepted. The CC&Rs will include a notice to possible purchasers of adjacent activities.

**C. What public health or safety hazards, such as dangerous traffic or fire conditions, would be created by the subdivision?**

The Mountain View Subdivision will not create any public health or safety hazards.

SANDERSON STEWART

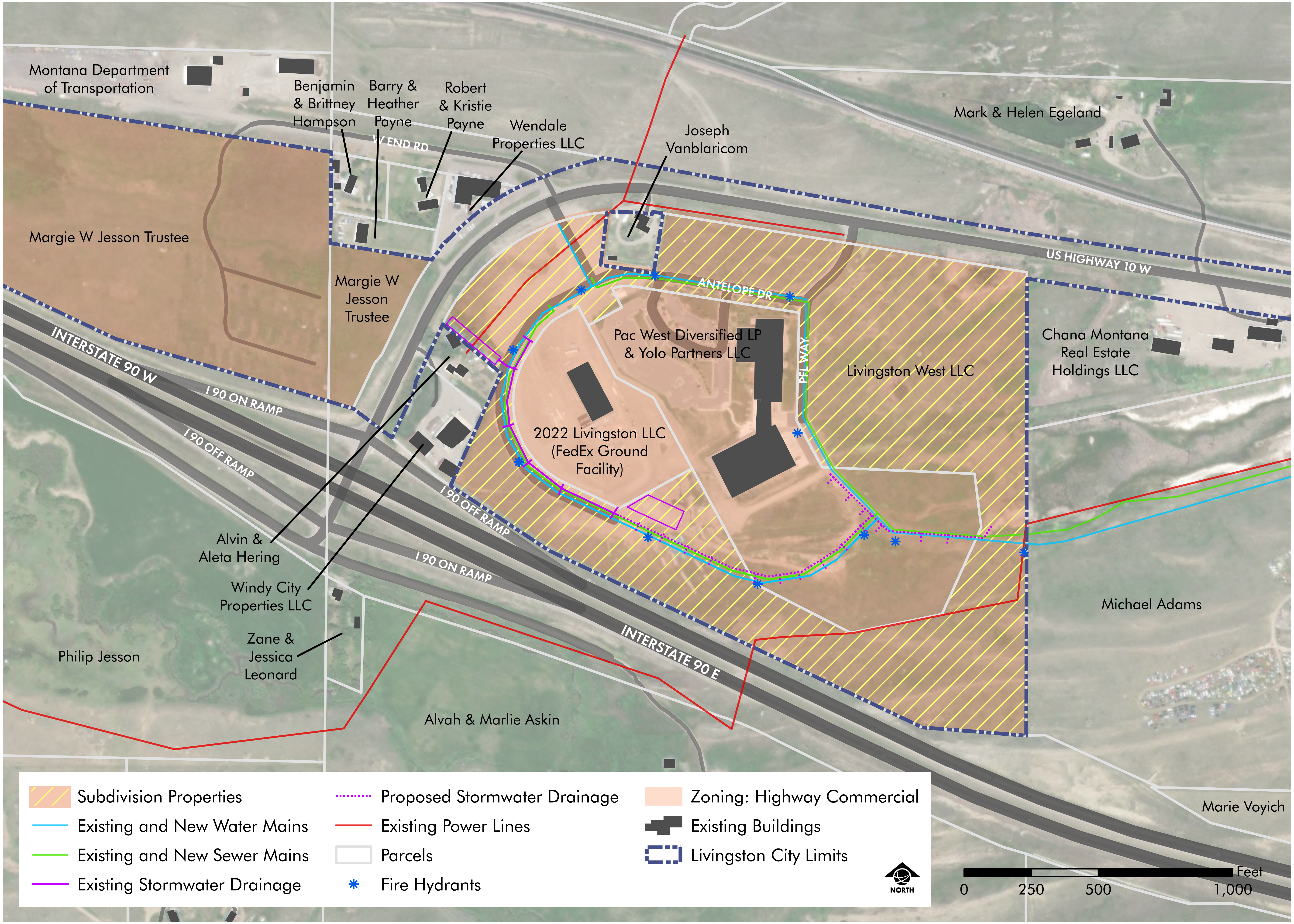
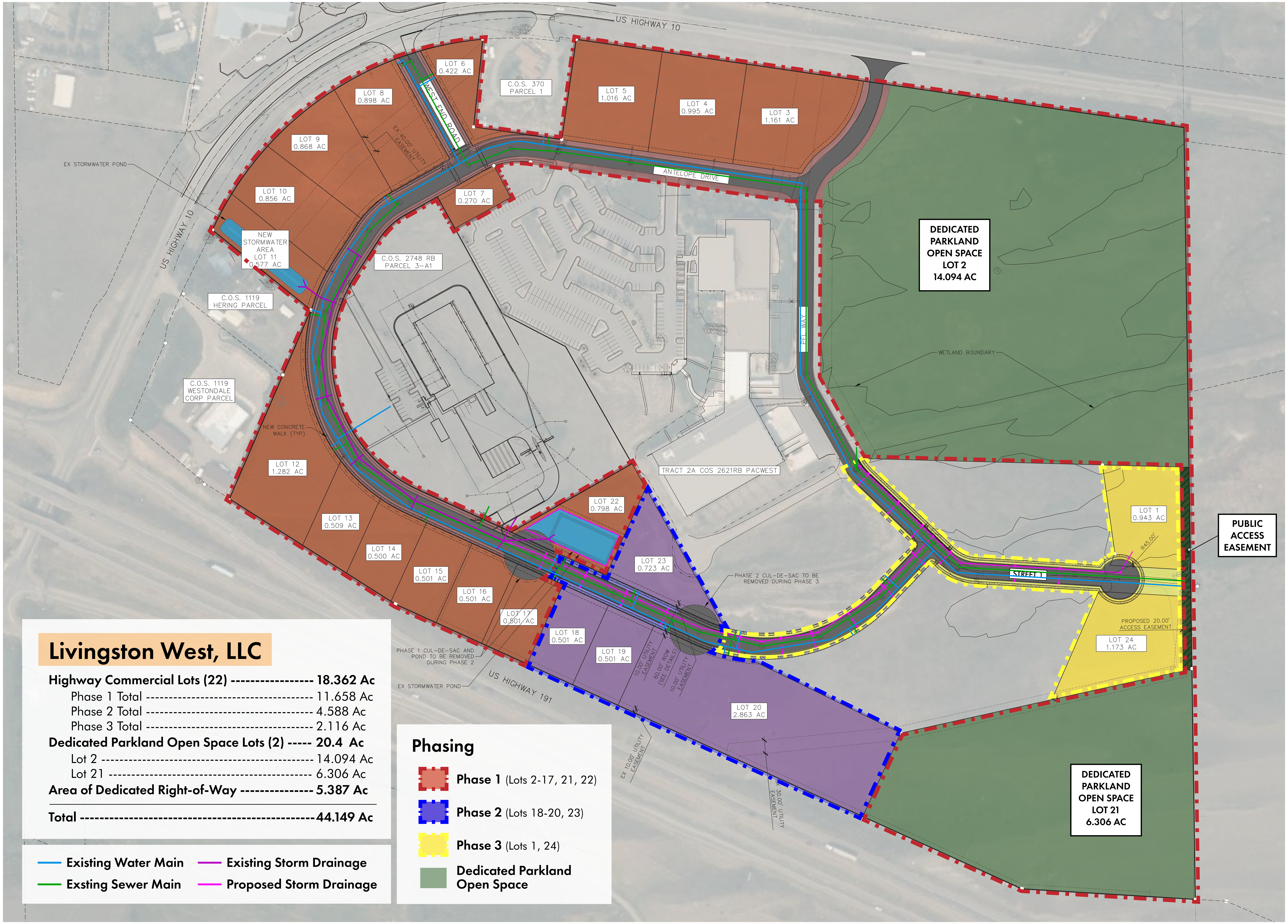



**EXHIBIT A**

# Mountain View Subdivision

## Vicinity Map




SANDERSON STEWART

**EXHIBIT B**

# Mountain View Subdivision

## Overall Development Plan


# EXHIBIT C
# Mountain View Subdivision
## Active Transportation Circulation

# MOUNTAIN VIEW SUBDIVISION

## PROPOSED SITE & UTILITY IMPROVEMENTS

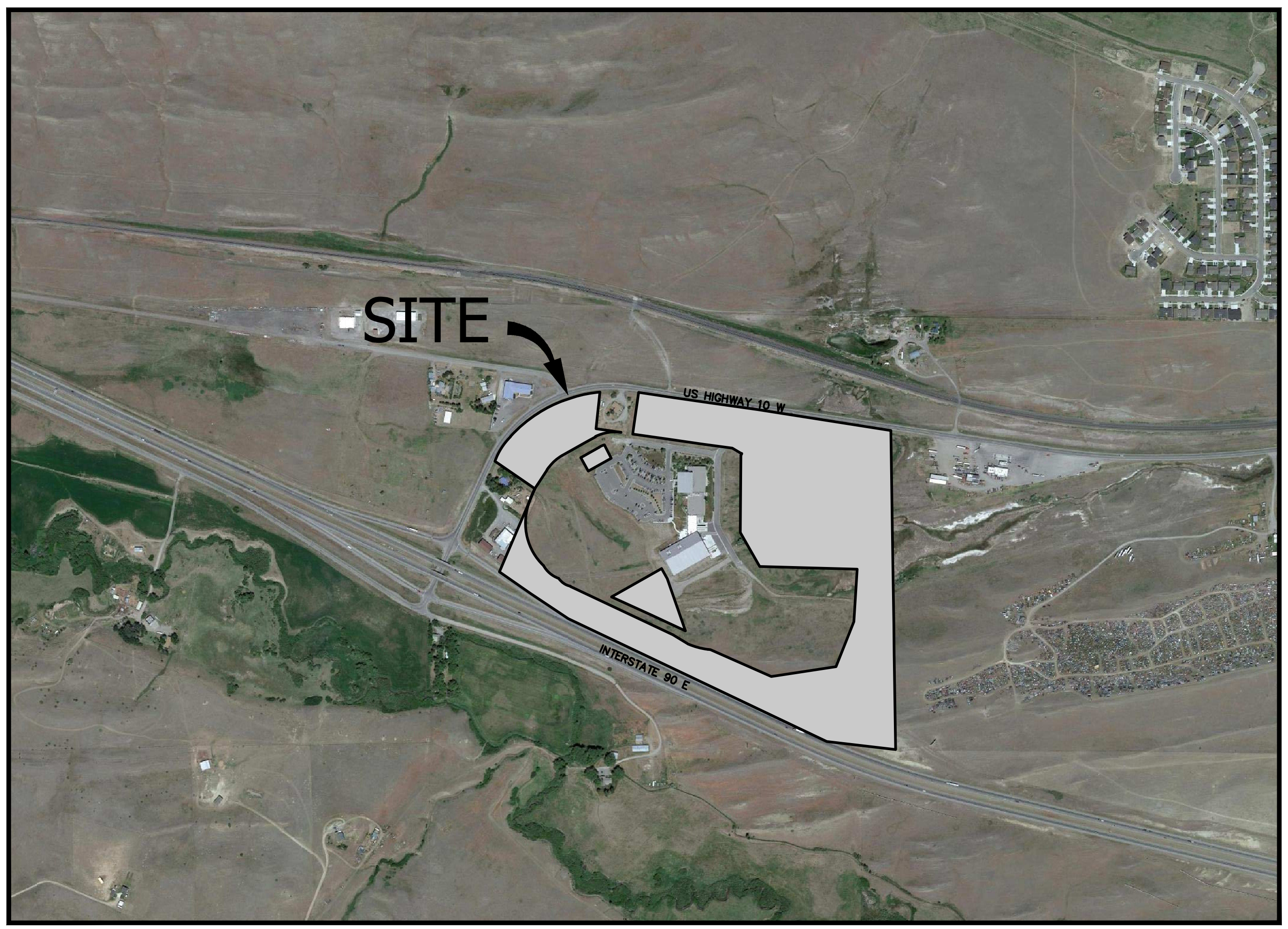
## FOR TRACT 1-A OF COS 2748RB

## LIVINGSTON, MONTANA

**PREPARED FOR:**

**LIVINGSTON WEST, LLC**
PO BOX 500
EMIGRANT, MT 59027






NORTH

**VICINITY MAP**
NOT TO SCALE

FILE: 18005_05_COVER_PROD.DWG
PROJECT NO: 18005.05
CAD: NAH
QUALITY ASSURANCE: -

DRAWING HISTORY

| DATE | DESCRIPTION |
|---|---|
| 06/20/23 | PRELIMINARY |
| - | - |
| - | - |
| - | - |
| - | - |
| - | - |
| - | - |
| - | - |

SANDERSON STEWART
Enduring Community Design

106 East Babcock, Suite L1 | Bozeman, Montana 59715 | 406.522.9876 | sandersonstewart.com

## LINETYPES

| | EXISTING | PROPOSED |
|---|---|---|
| SANITARY SEWER | SS | SS |
| STORM DRAIN | SD | SD |
| WATER | W | W |
| CURB AND GUTTER | | |
| EDGE OF ASPHALT | EDGE OF EX ASPHALT | |
| EDGE OF GRAVEL | EDGE OF EX GRAVEL | |
| FENCE - BARBWIRE | X | X |
| FENCE - CHAINLINK/ WOVEN WIRE | | |
| FENCE - VINYL | V | V |
| FENCE - WOOD | | |
| FIBER OPTIC | FO | FO |
| GAS PIPELINE | G | G |
| OIL PIPELINE | OIL | OIL |
| UNDERGROUND POWER | P | P |
| OVERHEAD POWER | OHP | OHP |
| TELEPHONE | T | T |
| TELEVISION/CABLE | TV | TV |
| CONTOUR | 3157 | 3157 |
| DEMO AREA | | |
| PROPOSED ASPHALT | | |
| PROPOSED CONCRETE | | |
| PROPOSED GRAVEL | | |

## ABBREVIATIONS

AC = FINISHED GRADE AT ASPHALT
BC = FINISHED GRADE AT BUILDING CORNER
BRK = GRADE BREAK
BFV = BUTTERFLY VALVE
BVC = BEGIN VERTICAL CURVE
CS = CURB STOP
EA = FINISHED GRADE AT EDGE OF ASPHALT
EC = FINISHED GRADE AT EDGE OF CONCRETE
EVC = END VERTICAL CURVE
EW = FINISHED GRADE AT EDGE OF WALK
EX = APPROXIMATE EXISTING ELEVATION
FL = FINISHED GRADE AT FLOWLINE
FT = FEET
FG = FINISHED GRADE
GR = EXISTING GRADE AT GROUND
GV = GATE VALVE
HP = HIGH POINT
LF = LINEAL FOOT
LT = LEFT

PC = POINT OF CURVATURE
PI = POINT OF INTERSECTION
POC = POINT ON CURVE
PRC = POINT OF REVERSE CURVE
PT = POINT OF TANGENCY
PVI = POINT OF VERTICAL INTERSECTION
RED = REDUCER
RT = RIGHT
SD = STORM DRAIN
SDI = STORM DRAIN INLET
SDMH = STORM DRAIN MANHOLE
SRVC = SERVICE
SS = SANITARY SEWER
SSMH = SANITARY SEWER MANHOLE
TC = FINISHED GRADE AT TOP BACK OF CURB
TW = FINISHED GRADE AT TOP OF WALL
WTR = WATER
(TYP.) = TYPICAL

# KEYNOTE CALL OUT
(SEE KEYNOTE LEGEND)

## SYMBOLS

EXISTING WATER REDUCER
PROPOSED WATER REDUCER
EXISTING WATER VALVE
PROPOSED WATER VALVE
EXISTING FIRE HYDRANT
PROPOSED FIRE HYDRANT
EXISTING CURB STOP
PROPOSED CURB STOP
FIRE DEPT. CONNECTION
WELL
EXISTING WATER MANHOLE

WATER METER
YARD HYDRANT
EXISTING SANITARY SEWER MANHOLE
PROPOSED SANITARY SEWER MANHOLE
SANITARY SEWER CLEAN OUT
EXISTING STORM DRAIN MANHOLE
PROPOSED STORM DRAIN MANHOLE
EXISTING CATCH BASIN
PROPOSED CATCH BASIN
ROOF DRAIN
TELEPHONE BOX

TELEPHONE MANHOLE
TELEPHONE PEDESTAL
COMMUNICATIONS MANHOLE
COMMUNICATIONS PEDESTAL
FIBER OPTIC PEDESTAL
GAS MANHOLE
GAS METER
GAS WELL
GAS VALVE
ELECTRIC JUNCTION BOX
ELECTRIC PEDESTAL

TRANSFORMER
POWER MANHOLE
POWER METER
POWER POLE
GUYWIRE
LIGHT POLE
SIGN
BOLLARD
EXISTING MONUMENT BOX
PROPOSED MONUMENT BOX
IRRIGATION BOX

IRRIGATION VALVE
BUSH
CONIFEROUS TREE
DECIDUOUS TREE
SIGNAL POLE
FOUND CORNER MONUMENT AS NOTED
SET CORNER MONUMENT, REBAR WITH CAP
BENCHMARK
SECTION QUARTER CORNER
SECTION CORNER

NOTE:

-EXISTING UNDERGROUND INSTALLATIONS & PRIVATE UTILITIES SHOWN ARE INDICATED ACCORDING TO THE BEST INFORMATION AVAILABLE TO THE ENGINEER. THE ENGINEER DOES NOT GUARANTEE THE ACCURACY OF SUCH INFORMATION. SERVICE LINES (WATER, POWER, GAS, STORM, SEWER, TELEPHONE & TELEVISION) MAY NOT BE STRAIGHT LINES OR AS INDICATED ON THE PLANS. STATE LAW REQUIRES CONTRACTOR TO CALL ALL UTILITY COMPANIES BEFORE EXCAVATION FOR EXACT LOCATIONS.

-ALL IMPROVEMENTS SHALL BE PERFORMED IN ACCORDANCE WITH MONTANA PUBLIC WORKS STANDARD SPECIFICATIONS 6TH EDITION, APRIL, 2010, AND THE CITY OF LIVINGSTON STANDARD MODIFICATIONS, APPROVED MAY 2014.

-UNLESS OTHERWISE SPECIFIED, ALL CONSTRUCTION LAYOUT AND STAKING SHALL BE PERFORMED UNDER THE RESPONSIBLE CHARGE OF A LAND SURVEYOR LICENSED IN THE STATE WHERE THE PROJECT IS LOCATED AND BY A PARTY CHIEF OR ENGINEERING TECHNICIAN EXPERIENCED IN CONSTRUCTION LAYOUT AND STAKING TECHNIQUES AS ARE REQUIRED BY THE SPECIFIC TYPE OF WORK BEING PERFORMED.

SANDERSON STEWART
Enduring Community D

PRELIMINARY - FOR REVIEW

DRAWING HISTORY

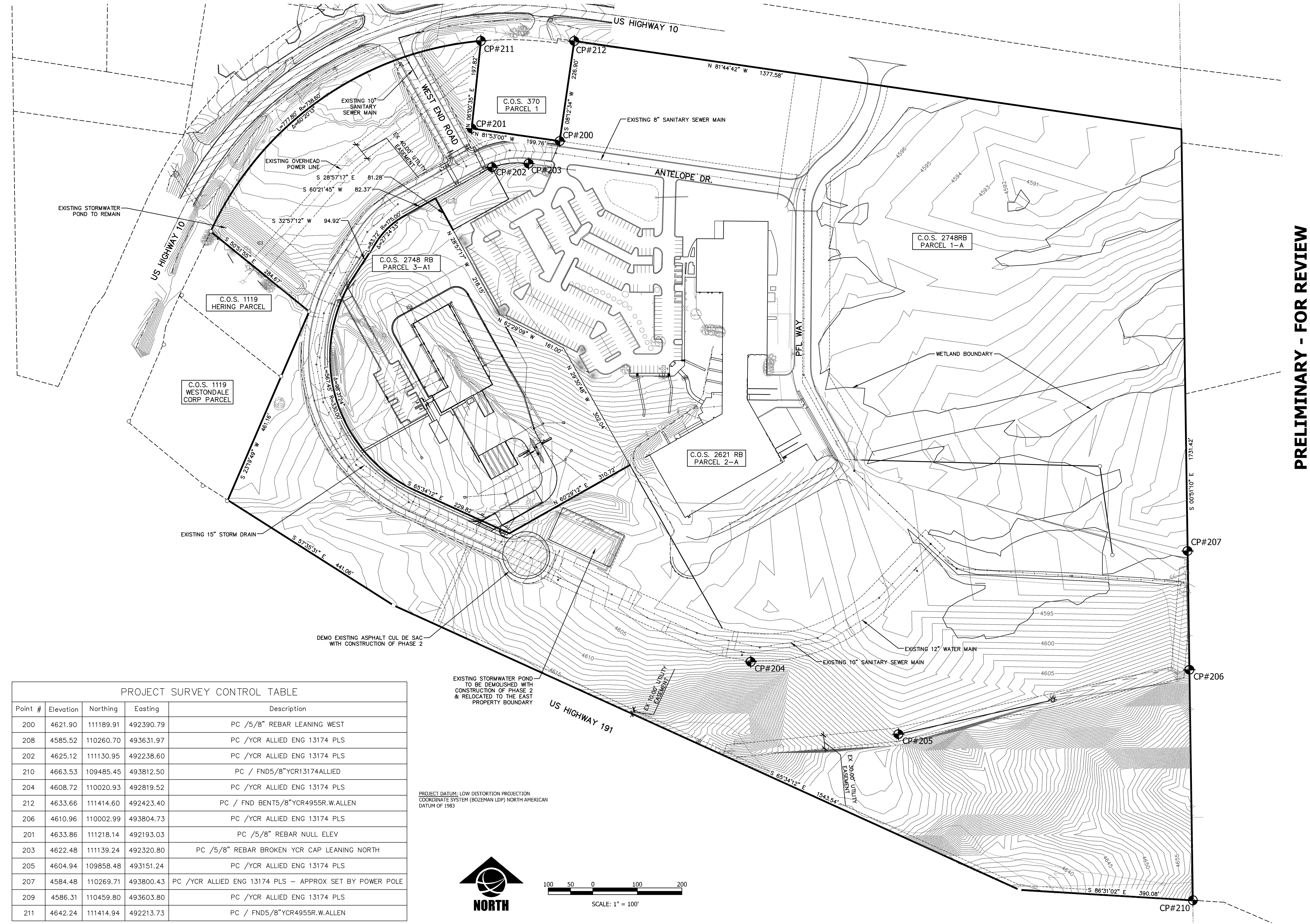
| DATE | DESCRIPTION |
|---|---|
| 06/20/23 | PRELIMINARY |

FILE: 18005_05_COVER_PROD.DWG
PROJECT NO: 18005.05
CAD: NAH
QUALITY ASSURANCE: -

# MOUNTAIN VIEW SUBDIVISION

PROPOSED SITE & UTILITY IMPROVEMENTS
FOR TRACT 1-A OF COS 2748RB
LIVINGSTON, MONTANA
LEGEND, NOTES & ABBREVIATIONS

C1.2




| PROJECT SURVEY CONTROL TABLE | | | | |
|---|---|---|---|---|
| Point # | Elevation | Northing | Easting | Description |
| 200 | 4621.90 | 111189.91 | 492390.79 | PC /5/8" REBAR LEANING WEST |
| 208 | 4585.52 | 110260.70 | 493631.97 | PC /YCR ALLIED ENG 13174 PLS |
| 202 | 4625.12 | 111130.95 | 492238.60 | PC /YCR ALLIED ENG 13174 PLS |
| 210 | 4663.53 | 109485.45 | 493812.50 | PC / FND5/8"YCR13174ALLIED |
| 204 | 4608.72 | 110020.93 | 492819.52 | PC /YCR ALLIED ENG 13174 PLS |
| 212 | 4633.66 | 111414.60 | 492423.40 | PC / FND BENT5/8"YCR4955R.W.ALLEN |
| 206 | 4610.96 | 110002.99 | 493804.73 | PC /YCR ALLIED ENG 13174 PLS |
| 201 | 4633.86 | 111218.14 | 492193.03 | PC /5/8" REBAR NULL ELEV |
| 203 | 4622.48 | 111139.24 | 492320.80 | PC /5/8" REBAR BROKEN YCR CAP LEANING NORTH |
| 205 | 4604.94 | 109858.48 | 493151.24 | PC /YCR ALLIED ENG 13174 PLS |
| 207 | 4584.48 | 110269.71 | 493800.43 | PC /YCR ALLIED ENG 13174 PLS – APPROX SET BY POWER POLE |
| 209 | 4586.31 | 110459.80 | 493603.80 | PC /YCR ALLIED ENG 13174 PLS |
| 211 | 4642.24 | 111414.94 | 492213.73 | PC / FND5/8"YCR4955R.W.ALLEN |

PROJECT DATUM: LOW DISTORTION PROJECTION COORDINATE SYSTEM (BOZEMAN LDP) NORTH AMERICAN DATUM OF 1983

SANDERSON STEWART
Enduring Community Design

PRELIMINARY - FOR REVIEW

DRAWING HISTORY

| DATE | DESCRIPTION |
|---|---|
| 06/20/23 | PRELIMINARY |

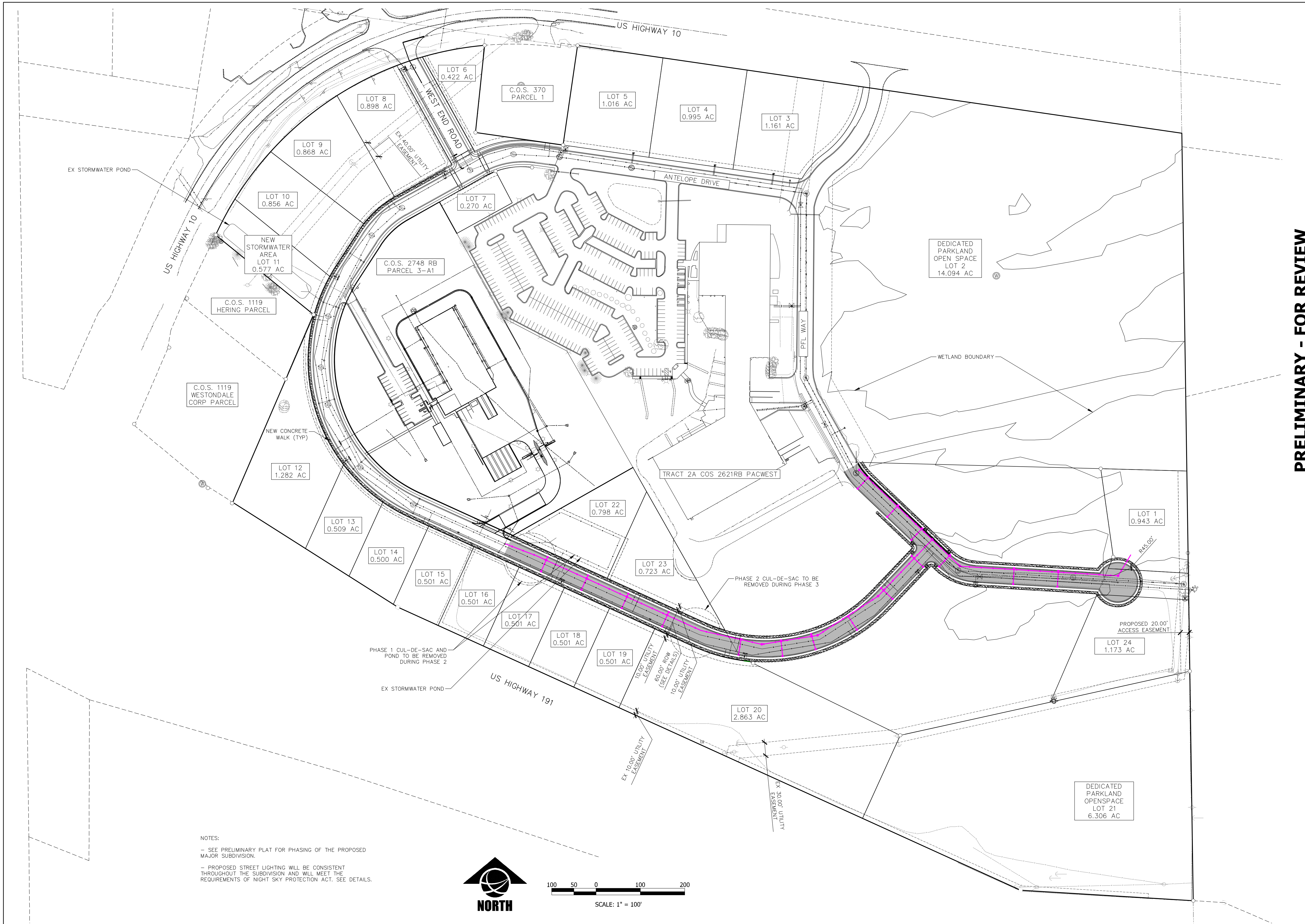
FILE: 18005_05_EX_PROD.DWG
PROJECT NO: 18005.05
CAD: NAH
QUALITY ASSURANCE:

# MOUNTAIN VIEW SUBDIVISION

PROPOSED SITE & UTILITY IMPROVEMENTS FOR TRACT 1-A OF COS 2748RB
LIVINGSTON, MONTANA

EXISTING SITE & DEMOLITION PLAN

C2.1




SANDERSON STEWART

Enduring Community D

PRELIMINARY - FOR REVIEW

| DRAWING HISTORY | |
|---|---|
| DATE | DESCRIPTION |
| 06/20/23 | PRELIMINARY |

FILE: 18005_05_SITE_PROD.DWG

PROJECT NO: 18005.05

CAD: NAH

QUALITY ASSURANCE:

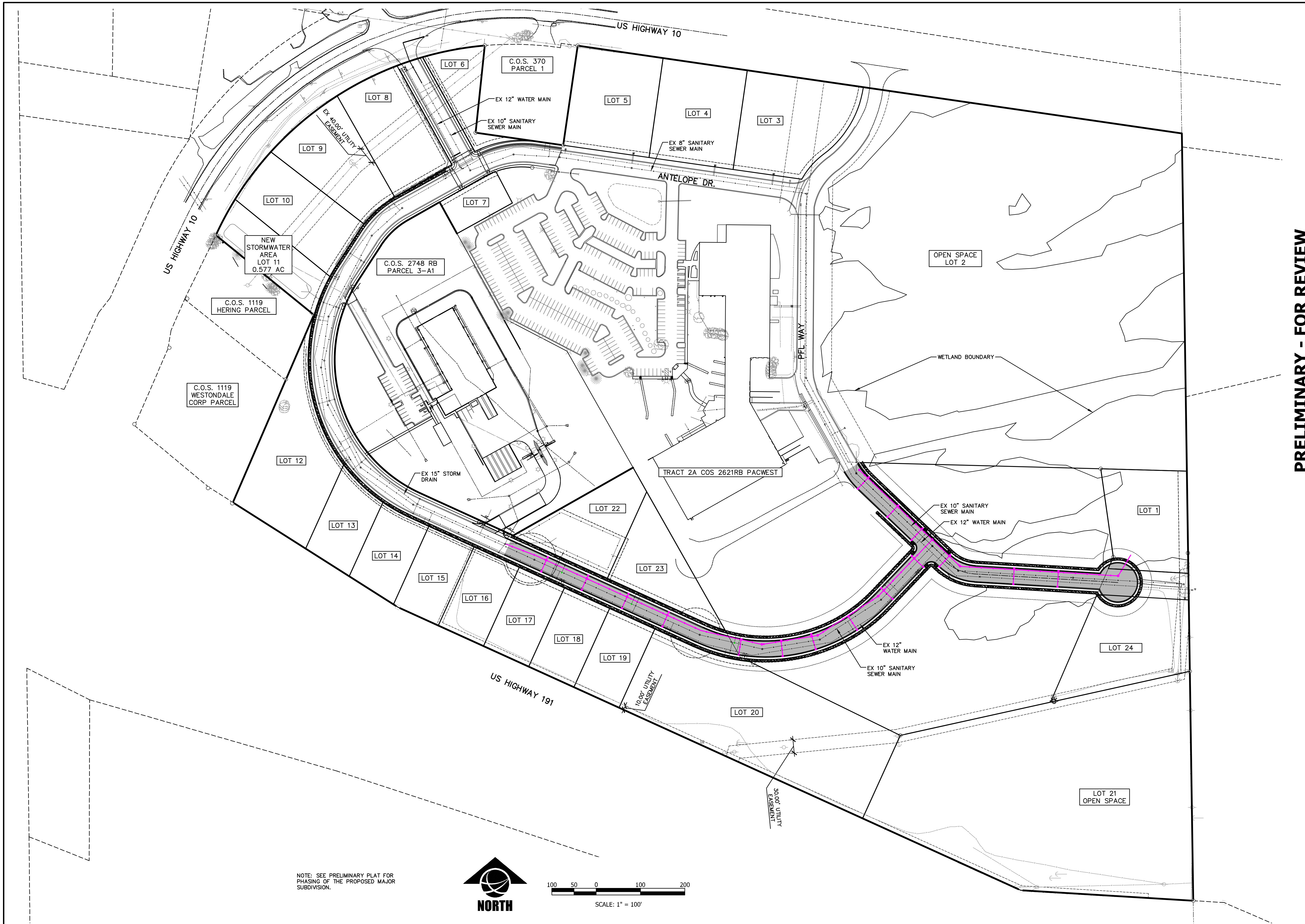
# MOUNTAIN VIEW SUBDIVISION

PROPOSED SITE & UTILITY IMPROVEMENTS FOR TRACT 1-A OF COS 2748RB

LIVINGSTON, MONTANA

SITE PLAN

# C3.1




SANDERSON STEWART

Enduring Community D

PRELIMINARY - FOR REVIEW

DRAWING HISTORY

| DATE | DESCRIPTION |
|---|---|
| 06/20/23 | PRELIMINARY |

FILE: 18005_05_UTILITY_PROD.DWG

PROJECT NO: 18005.05

CAD: NAH

QUALITY ASSURANCE:

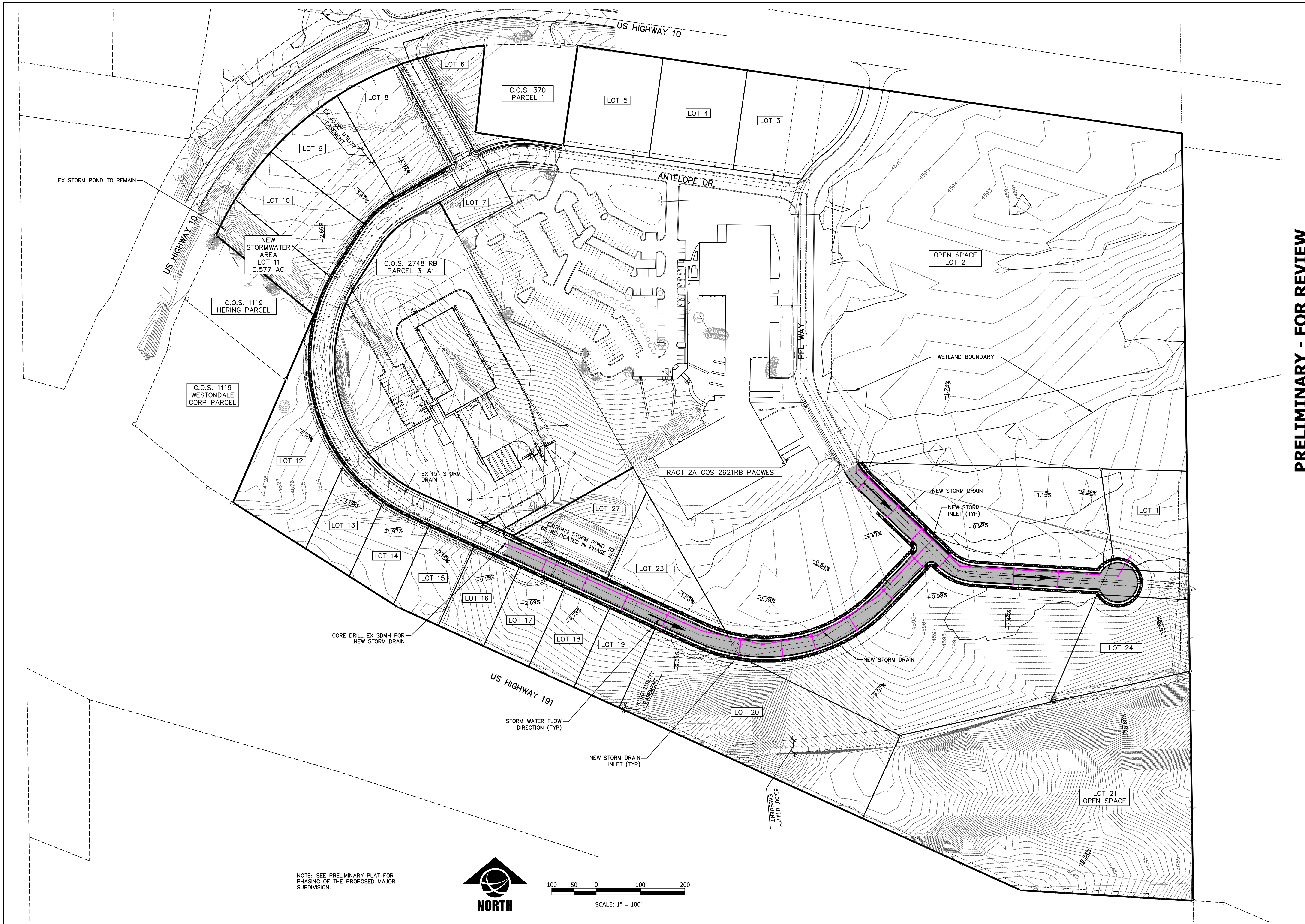
# MOUNTAIN VIEW SUBDIVISION

PROPOSED SITE & UTILITY IMPROVEMENTS
FOR TRACT 1-A OF COS 2748RB

LIVINGSTON, MONTANA

UTILITY PLAN

**C4.1**




**PRELIMINARY - FOR REVIEW**

SANDERSON STEWART
Enduring Community Design

DRAWING HISTORY

| DATE | DESCRIPTION |
|---|---|
| 06/20/23 | PRELIMINARY |

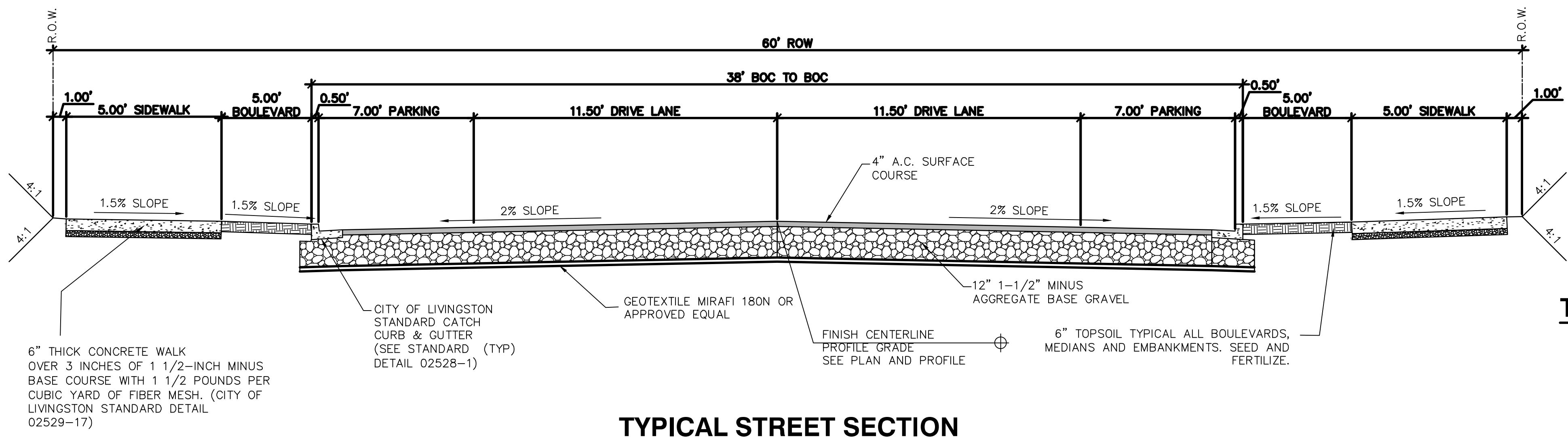
FILE: 18005_05_STORM_PROD.DWG
PROJECT NO: 18005.05
CAD: NAH
QUALITY ASSURANCE:

# MOUNTAIN VIEW SUBDIVISION

PROPOSED SITE & UTILITY IMPROVEMENTS FOR TRACT 1-A OF COS 2748RB
LIVINGSTON, MONTANA

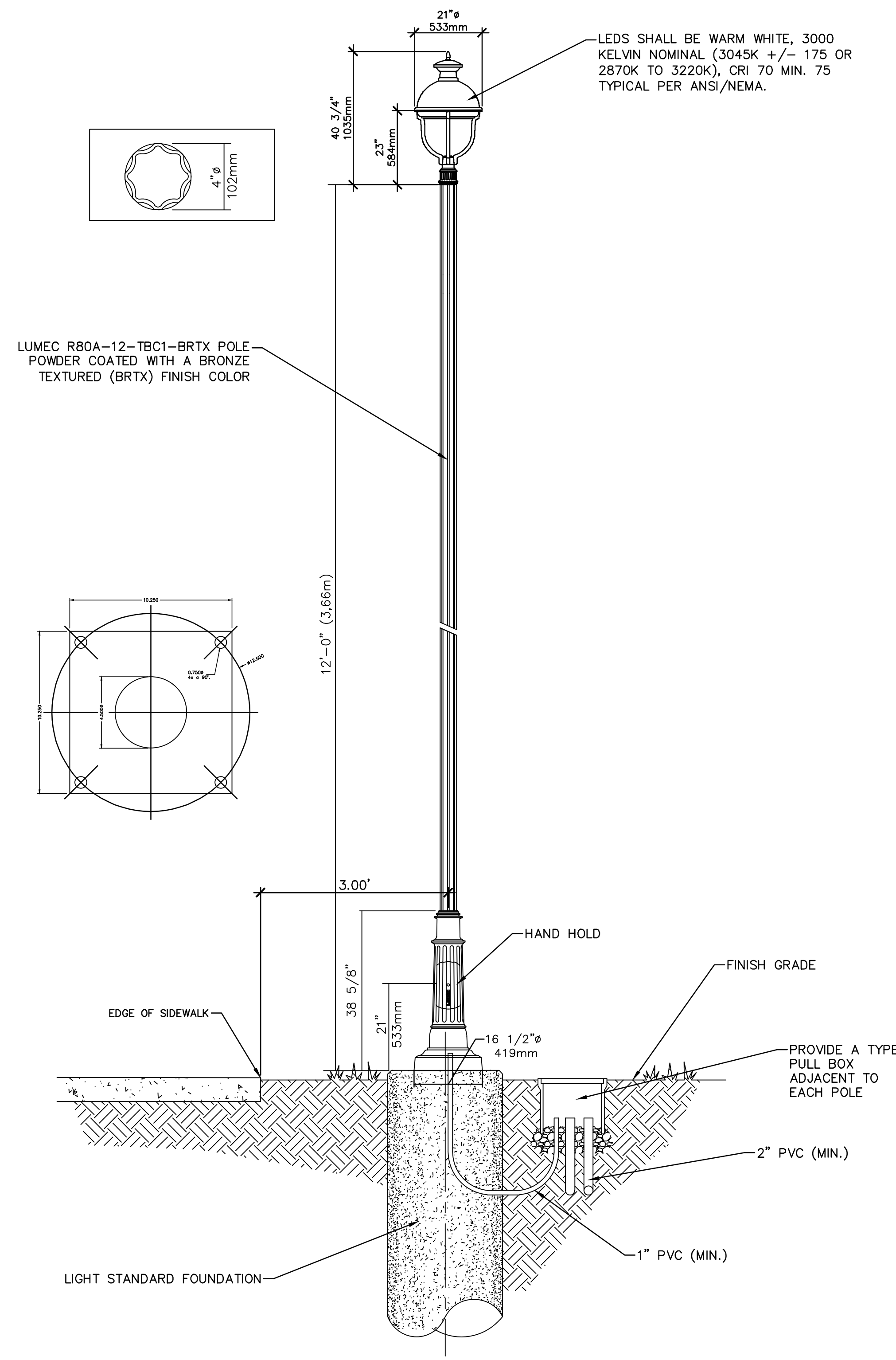
GRADING & STORM DRAINAGE PLAN

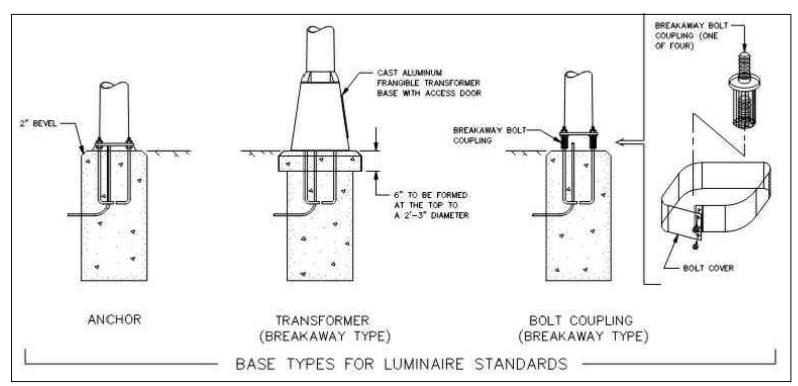
**C5.1**




## TYPICAL STREET SECTION
NOT TO SCALE

## TYPICAL STREET LIGHT STANDARD DETAIL
NOT TO SCALE




**PRELIMINARY - FOR REVIEW**

SANDERSON STEWART
Enduring Community D...

DRAWING HISTORY

| DATE | DESCRIPTION |
| --- | --- |
| 06/20/23 | PRELIMINARY |

FILE: 18005_05_DETAILS.DWG
PROJECT NO: 18005.05
CAD: NAH
QUALITY ASSURANCE:

**MOUNTAIN VIEW SUBDIVISION**
PROPOSED SITE & UTILITY IMPROVEMENTS
FOR TRACT 1-A OF COS 2748RB
LIVINGSTON, MONTANA

DETAILS

**C6.1**

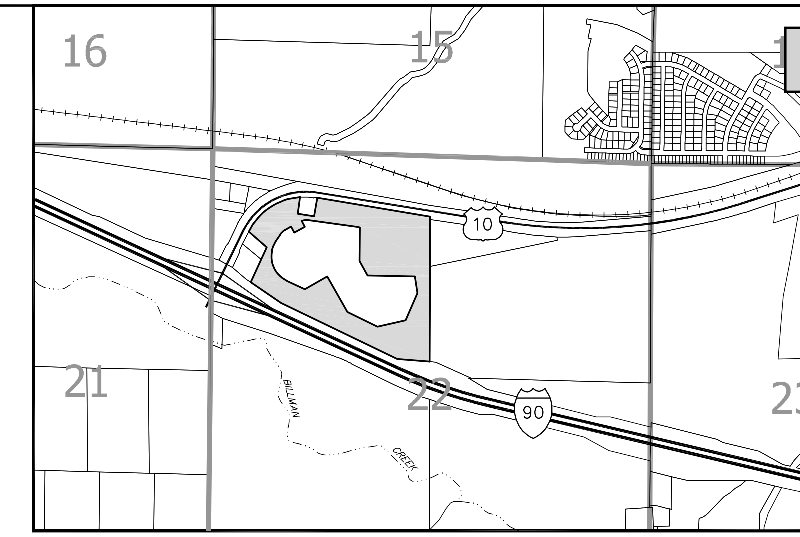
PRELIMINARY PLAT OF

# MOUNTAIN VIEW SUBDIVISION, PHASES 1, 2, & 3

## BEING TRACT 1–A OF COS 2748RB, SITUATED IN THE NW1/4 OF SECTION 22, T. 2 S., R. 9 E., P.M.M., CITY OF LIVINGSTON, PARK COUNTY, MONTANA

PREPARED FOR : LIVINGSTON WEST, LLC — JUNE 2023

PREPARED BY : SANDERSON STEWART — BOZEMAN, MONTANA




VICINITY MAP
NOT TO SCALE



**CERTIFICATE OF SURVEYOR**

The undersigned, a professional land surveyor licensed in the State of Montana, does hereby certify that between ____________ and ____________ , a survey was performed under their direct supervision for MOUNTAIN VIEW SUBDIVISION, PHASES 1, 2, and 3, and described the same as shown on the accompanying plat and platted in accordance with the provisions of the Montana Subdivision and Platting Act, Section 76–3–101 through 76–3–625, MCA, and the City of Livingston Subdivision Regulations.

DATED this ____ day of ________________ , 2023.

SANDERSON STEWART

By: ______________________________
Montana Registration No. ___________

**CERTIFICATE OF COUNTY TREASURER**

I, Kevin J. Larkin, Treasurer of Park County, Montana, do hereby certify that the accompanying Plat has been duly examined and that all real property taxes and special assessments assessed and levied on the land to be subdivided are paid.

DATED this ____ day of ________________ , 2023.

By: ______________________________
Treasurer, Park County, Montana

**CERTIFICATE OF GOVERNING BODY**

The Chair of the City Commission of the City of Livingston, Montana, does hereby certify that the accompanying Plat has been duly reviewed, and has been found to conform to the requirements of the Subdivision and Platting Act, Section 76–3–101 et. seq. MCA, and the City of Livingston Subdivision Regulations, approves it, and hereby accepts the dedication to public use.

DATED this ____ day of ________________ , 2023.

______________________________
Chair of the City Commission
City of Livingston, Montana

**CERTIFICATE OF CLERK AND RECORDER**

I, Maritza H. Reddington, Clerk and Recorder of Park County, Montana, do hereby certify that the foregoing instrument was filed in my office at _______ o'clock, (a.m., or p.m.), this ________ day of ________________ , 2023, and recorded under Document No. ________________ , Records of the Clerk and Recorder, Park County, Montana.

By: ______________________________
Clerk and Recorder, Park County, Montana

**CERTIFICATE OF DEDICATION**

We, the undersigned property owners, do hereby certify that they have caused to be surveyed, subdivided and platted into lots, blocks, roads and parks, as shown on the accompanying plat hereunto annexed, the following described tract of land, to wit:

LEGAL DESCRIPTION:

Tract 1–A of Certificate of Survey No. 2748RB, as recorded in the office of the Clerk and Recorder of Park County, Montana, under Document No. 426634, situated in the NW1/4 of Section 22, T. 2 S., R. 9 E., P.M.M., in the City of Livingston, Park County, Montana.

The above described tract of Land is to be known and designated as MOUNTAIN VIEW SUBDIVISION, PHASES 1, 2, and 3, City of Livingston, Park County, Montana; and the lands included in all roads, avenues, rights–of–way, parks, and common areas shown on said plat are hereby granted and donated to the use of the public forever.

**CERTIFICATE OF GRANT OF UTILITY EASEMENTS**

The undersigned hereby grants unto each and every person or firm, whether public or private, providing or offering to provide telephone, electric, power, gas, cable television, water or sewer service to the public, the right to joint use of an easement for the construction, maintenance, repair and removal of their lines and other facilities, in, over, and under and across each area designated on this plat as "Utility Easement" to have and hold forever.

**CERTIFICATE OF WAIVER**

We, the undersigned property owners, do hereby waive the right to protest the creation of Special Improvement Districts. In doing so, we do not waive any right to comment on, protest, and/or appeal any assessment formula which may be imposed, if we believe it to be inequitable. This waiver shall be binding upon the heirs, assigns and purchasers of all lots within this Subdivision.

Dated this _____ day of ________________ , 2023.

LIVINGSTON WEST, LLC

By: ______________________________

Title: ______________________________

STATE OF MONTANA )
:ss
County of ____________)

This instrument was acknowledged before me on ________________ , 2023, by ________________ as of LIVINGSTON WEST, LLC.

______________________________
Notary Public in and for the State of Montana

**NOTES**

1. A ten foot (10') wide public utility easement exists on the property side of the public right–of–way, to provide for installation of gas, electric, phone, TV cable, and other utilities, as required. No trees are allowed within the utility easement.

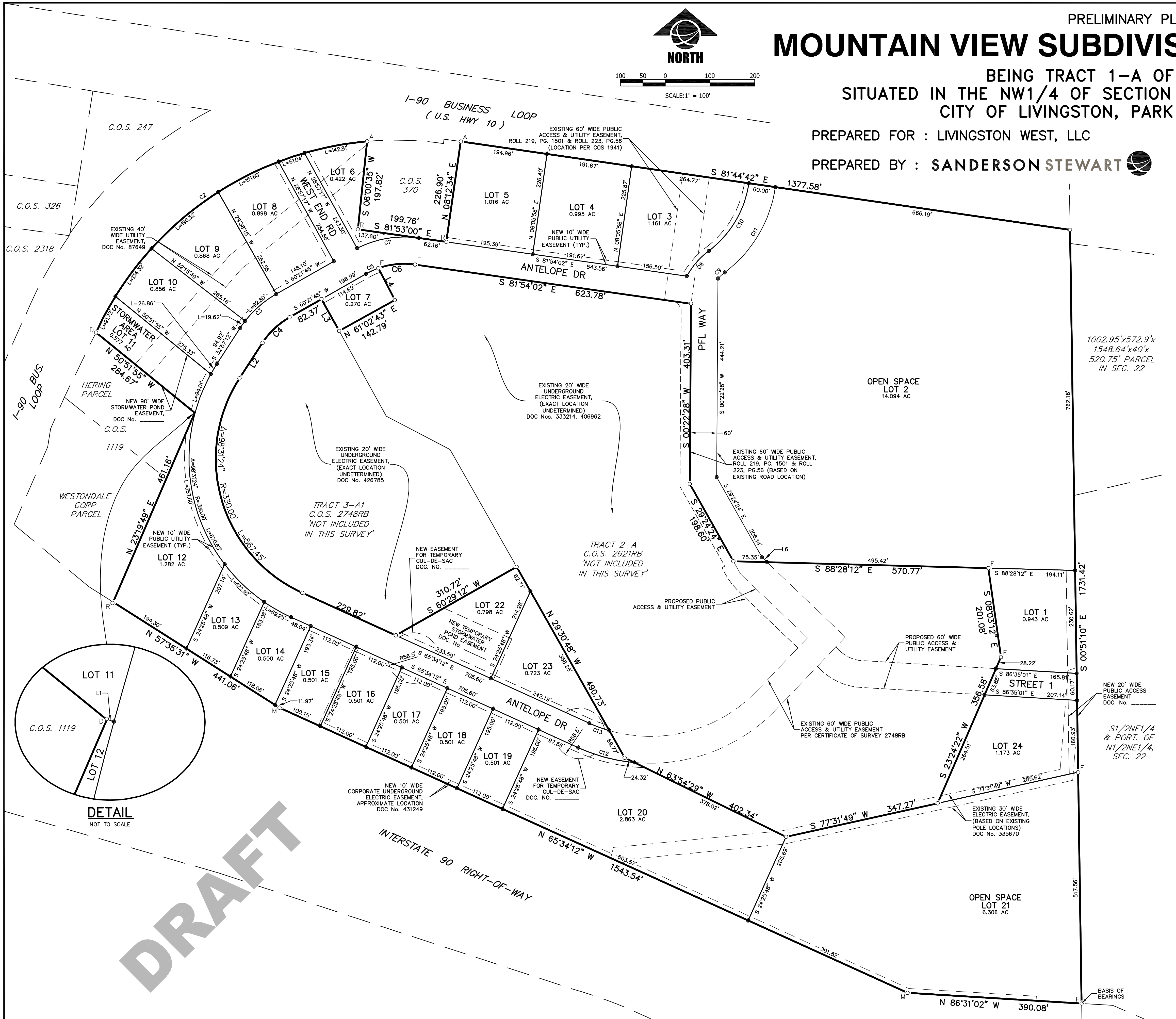
PRELIMINARY PLAT OF

# MOUNTAIN VIEW SUBDIVISION, PHASES 1, 2, & 3

## BEING TRACT 1-A OF COS 2748RB, SITUATED IN THE NW1/4 OF SECTION 22, T. 2 S., R. 9 E., P.M.M., CITY OF LIVINGSTON, PARK COUNTY, MONTANA

PREPARED FOR : LIVINGSTON WEST, LLC — JUNE 2023

PREPARED BY : SANDERSON STEWART — BOZEMAN, MONTANA




**BASIS OF BEARINGS:** THE BASIS OF BEARINGS FOR THIS SURVEY HAS BEEN DERIVED FROM GPS OBSERVATIONS AND IS BASED ON A NAD 83, LAMBERT CONFORMAL CONIC, SINGLE PARALLEL, LOW DISTORTION PROJECTION FOR THE CITY OF BOZEMAN; HAVING A POINT OF ORIGIN AT 46°15'00"N LATITUDE AND 111°15'00"W LONGITUDE WITH A SCALE FACTOR OF 1.000185.

THE GRID TO GROUND COMBINED SCALE FACTOR AT THE SOUTHEAST CORNER OF TRACT 3 OF C.O.S. No. 1941, BEING A REBAR WITH YELLOW CAP MARKED "ALLIED ENG 13174PLS", IS 1.0000188289; THE CONVERGENCE ANGLE IS 0°28'05". DISTANCES ARE INTERNATIONAL FEET. FOR THIS SURVEY, GRID DISTANCE IS ESSENTIALLY EQUAL TO GROUND DISTANCE.

- ○ FOUND SURVEY MONUMENT, REBAR WITH YELLOW CAP '15273'
- ○A FOUND SURVEY MONUMENT, REBAR WITH YELLOW CAP '4955'
- ○D FOUND SURVEY MONUMENT, REBAR WITH YELLOW CAP '10010'
- ○F FOUND SURVEY MONUMENT, REBAR WITH YELLOW CAP '13174'
- ○M FOUND SURVEY MONUMENT, 4"x4" CONCRETE ROW MONUMENT
- ○R FOUND SURVEY MONUMENT, 5/8" REBAR
- ● SET 5/8" X 18" REBAR WITH YELLOW CAP MARKED WITH THE LICENSE NUMBER OF THE UNDERSIGNED LAND SURVEYOR AND "SANDERSON STEWART"

**NOTE:** ALL CURVES ARE TANGENT AND ALL PROPERTY LINES INTERSECTING CURVES ARE RADIAL UNLESS OTHERWISE NOTED.

| | |
|---|---|
| DEVELOPED LOTS (21): | 17.785 ACRES |
| STORMWATER AREA LOTS (1): | 0.577 ACRES |
| OPEN SPACE LOTS (2): | 20.400 ACRES |
| AREA OF DEDICATED R.O.W.: | 5.387 ACRES |
| TOTAL AREA: | 44.149 ACRES |

## FINAL PLAT PHASES

PHASE 1 (LOTS 2 – 17, 21 – 22)
PHASE 2 (LOTS 18 – 20, 23)
PHASE 3 (LOTS 1, 24)

CURVE TABLE

| Curve # | Delta | Radius | Length | Chord Bearing | Chord Distance |
|---|---|---|---|---|---|
| C2 | 60°20'13" | 738.60' | 777.80' | N 54°48'47" E | 742.36' |
| C3 | 27°24'33" | 235.00' | 112.42' | N 46°39'29" E | 111.35' |
| C4 | 27°24'33" | 175.00' | 83.72' | N 46°39'29" E | 82.92' |
| C5 | 10°01'30" | 172.43' | 30.17' | N 65°22'30" E | 30.13' |
| C6 | 27°42'42" | 172.43' | 83.40' | N 84°14'36" E | 82.59' |
| C7 | 34°59'46" | 232.43' | 141.97' | S 80°36'05" W | 139.77' |
| C8 | 23°57'58" | 180.00' | 75.29' | S 41°09'43" W | 74.74' |
| C9 | 9°51'41" | 120.00' | 20.65' | S 48°12'51" W | 20.63' |
| C10 | 44°58'38" | 230.00' | 180.55' | S 30°39'23" W | 175.95' |
| C11 | 44°57'48" | 290.00' | 227.58' | S 30°39'47" W | 221.79' |
| C12 | 17°14'40" | 390.00' | 117.38' | S 74°11'32" E | 116.94' |
| C13 | 8°15'46" | 330.00' | 47.59' | S 69°42'05" E | 47.55' |

LINE TABLE

| Line # | Bearing | Distance |
|---|---|---|
| L1 | N 74°48'11" W | 0.82' |
| L2 | N 32°57'12" E | 94.92' |
| L3 | S 28°57'17" E | 81.28' |
| L4 | N 27°37'25" W | 80.40' |
| L6 | S 46°18'47" E | 15.93' |

SHEET 2 OF 2

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX A

Preliminary Stormwater Report

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

SANDERSON STEWART

Billings
Bozeman
Denver
Fort Collins

May 3, 2023
Project No. 18005.05

# PRELIMINARY STORMWATER REPORT FOR THE MOUNTAIN VIEW SUBDIVISION LIVINGSTON, MONTANA

## OVERVIEW NARRATIVE

The purpose of this preliminary drainage report is to present a summary of calculations performed to quantify storm drainage improvements required for the Mountain View Major Subdivision in Livingston, Montana. The project is located in the City of Livingston within Park County, Montana. This site is located between Hwy 10 and Hwy 191. The existing area consists of an access roadway, two (2) commercial facilities, grasslands, and the associated utilities. The storm drain system will be designed to meet the requirements in *The City of Livingston Design Standards and Specification Policy* (DSSP) of August 2022. The "Storm Drainage Report Ruedebusch Offsite Street and Utility" dated May 24, 2022 is referenced in this report, which is located in Appendix C.

## EXISTING CONDITIONS

The existing topography of the subdivision flows to the southeast to the existing wetland area. There is a temporary detention pond at the end of the asphalt cul-de-sac as shown in the report previously mentioned. This detention pond will be removed and a new detention pond will be constructed as part of the remaining infrastructure proposed. There is also an existing detention pond to the southeast of the Printing for Less facility that treats a portion of their runoff. The remaining land cover surrounding the proposed roadway is generally vacant grassland. Runoff is generally conveyed into the existing shallow ditches and depressions and directed towards the existing wetland to the east of the site. The new development area is hydrologically divided into five watershed areas in its existing state, Existing Watershed 1, 2, 3, 4, and 5 as shown on Exhibit A in Appendix A. Preliminary hydrologic calculations for these watersheds can be found in Appendix B.

## PROPOSED CONDITIONS

The proposed improvements of the Mountain View Subdivision include roads, sidewalks, open lots and open space that will house the stormwater facilities. There will be the removal of two (2) temporary basins as part of the full build out of the subdivision. The temporary detention pond was constructed as a part of the Ruedebusch Offsite Street and Utility project.

The new development area of the subdivision has been broken into seven (7) total basins as shown on Exhibit B in Appendix A. Preliminary hydrologic calculations for these watersheds can be found in Appendix B.

Basin A includes the proposed roadways and sidewalks throughout the southeast side of the subdivision. All other basins include the parcels adjacent to the proposed roadway as seen in Appendix A.

Basin A runoff will be collected in the gutters and conveyed through storm drainage infrastructure toward the proposed detention pond.

Basins B, C, and D runoff will generally drain toward the new street and will be conveyed along swales following the proposed roadway. These swales will convey the runoff towards the proposed detention pond. As development occurs on the lots, the swales will be filled as the developments will be required to mitigate runoff within their site. The new detention basin at the end of the asphalt cul-de-sac will be designed to store and convey the pre-development peak flows from each of these basins.

Basin E and F is generally “open space” that will remain undeveloped. The runoff will follow existing drainage patterns and diverted to the wetland on the eastern edge of the subdivision.

Basin G runoff will drain to an existing culvert under Antelope Drive then to PFL Way to be directed to existing drainage patterns and diverted to the wetlands on the eastern edge of the subdivision.

For the remaining areas of the Mountain View Subdivision, reference the previously approved Ruedebusch Offsite Street and Utility Storm Drainage Report located in Appendix C.

None of the drainage basins in the subdivision will drain into the MDT right of way. There is an existing culvert under Interstate 90 that flows to the north into the subdivision near Basin C. As development occurs, it will be the responsibility of the associated developments to mitigate the additional flow from the MDT right of way.

## INLETS

Inlet locations will be designed to capture runoff from the right-of-way area and limit the spread width to less than 9.5-feet for this project’s typical section. Bentley’s FlowMaster program, which uses the methodology of the FHWA HEC-22 Manual, will be utilized to calculate inlet spacing. This program will be used to calculate the spread width and gutter flow depth at each of the inlets using the calculated peak post-development flow rate from the 25-year storm event, inlet dimensions, and road parameters. The allowable limit for the depth of flow in the curb line is 0.15-feet below the top of curb, but the design will provide at least 0.3-feet. The inlets will be analyzed with a 50% clogging factor.

**PIPES**

The Manning's equation will be used to analyze and design the storm drain pipes throughout the project. Pipe slopes will be set to maintain a minimum depth of cover of two feet below final grade and the minimum velocity of 3-fps when flowing full. The storm drain pipes will be designed to convey the peak flow from the 25-year storm event. When the depth of flow in the pipe exceeds full flow capacity, the next larger size pipe will be used.

**BASIN/UNDERGROUND DETENTION FACILITY**

As mentioned above, a new detention basin is proposed to the northeast of the proposed asphalt cul-de-sac at the end of the street. The proposed detention basin will treat the runoff and limit the discharge flow rate to the 2-year pre-development flow rate from the existing watershed.

The new detention basin will have a maximum side slope steepness of 4:1. Site detention will be calculated using the 10-year design storm allowing for the discharge of the 2-year pre-development flow rate.

**MAJOR STORM EVENTS**

In the event of a 100-year storm event, the proposed detention basin will overtop and flow to the east with shallow concentrated flow.

**Appendices**

Appendix A – Watershed Exhibits
Appendix B – Preliminary Hydrology Calculations
Appendix C – Storm Drainage Report Ruedebusch Offsite Street and Utility
Appendix D – 2019 Wetlands Report

# Mountain View Subdivision Stormwater Report

18005.05

# APPENDIX A
## Watershed Exhibits

ENDURING
COMMUNITY
**DESIGN**

SANDERSON STEWART

# EXHIBIT A

PRE-DEVELOPMENT
WITHIN
MOUNTAIN VIEW SUBDIVISION

NORTH

150 75 0 150 300
SCALE:1" = 150'

PREPARED FOR : LIVINGSTON WEST, LLC.

PREPARED BY : SANDERSON STEWART

SEPTEMBER 2022

LIVINGSTON, MONTANA

# EXHIBIT B

POST–DEVELOPMENT
WITHIN
MOUNTAIN VIEW SUBDIVISION

NORTH

150 75 0 150 300
SCALE:1" = 150'

PREPARED FOR : LIVINGSTON WEST, LLC.

PREPARED BY : SANDERSON STEWART

MAY 2023

LIVINGSTON, MONTANA

Mountain View Subdivision
Stormwater Report
18005.05

# APPENDIX B
## Preliminary Hydrology Calculations

ENDURING
COMMUNITY
DESIGN

SANDERSON STEWART

# HYDROLOGY WORKSHEET

Project: Mountain View Subdivision
Project No.: 18005.05
Date: 05/2/2023

SANDERSON STEWART

## PRE DEVELOPMENT/EXISTING BASINS

| WS | Tc (hours) | Area (sf) | Area (ac.) | Area Impervious (sf) | Area Gravel (sf) | Area Pervious (sf) | RC | % IC | $I_2$ (in/hr) | $I_{10}$ (in/hr) | $I_{25}$ (in/hr) | $Q_2$ Peak Flow (cfs) | $Q_{10}$ Peak Flow (cfs) | $Q_{25}$ Peak Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.350 | 804,928 | 18.48 | 0 | 0 | 804,928 | 0.20 | 0% | 0.940 | 1.583 | 1.840 | 3.47 | 5.85 | 6.80 |
| 2 | 0.450 | 187,231 | 4.30 | 0 | 0 | 187,231 | 0.20 | 0% | 0.796 | 1.344 | 1.567 | 0.68 | 1.16 | 1.35 |
| 3 | 0.292 | 152,213 | 3.49 | 0 | 0 | 152,213 | 0.20 | 0% | 1.060 | 1.782 | 2.068 | 0.74 | 1.25 | 1.45 |
| 4 | 0.692 | 518,145 | 11.89 | 0 | 0 | 518,145 | 0.20 | 0% | 0.599 | 1.017 | 1.190 | 1.43 | 2.42 | 2.83 |
| 5 | 0.283 | 138,157 | 3.17 | 0 | 0 | 138,157 | 0.20 | 0% | 1.080 | 1.816 | 2.107 | 0.69 | 1.15 | 1.34 |

## POST DEVELOPMENT/PROPOSED BASINS

| WS | Tc (hours) | Area (sf) | Area (ac.) | Area Impervious (sf) | Area Gravel (sf) | Area Pervious (sf) | RC | % IC | $I_2$ (in/hr) | $I_{10}$ (in/hr) | $I_{25}$ (in/hr) | $Q_2$ Peak Flow (cfs) | $Q_{10}$ Peak Flow (cfs) | $Q_{25}$ Peak Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.083 | 111,236 | 2.55 | 83,558 | 0 | 27,679 | 0.73 | 75% | 2.423 | 4.023 | 4.611 | 4.49 | 7.46 | 8.55 |
| B | 0.283 | 127,336 | 2.92 | 0 | 0 | 127,336 | 0.20 | 0% | 1.080 | 1.816 | 2.107 | 0.63 | 1.06 | 1.23 |
| C | 0.217 | 681,016 | 15.63 | 0 | 0 | 681,016 | 0.20 | 0% | 1.290 | 2.162 | 2.502 | 4.03 | 6.76 | 7.82 |
| D | 0.317 | 103,834 | 2.38 | 0 | 0 | 103,834 | 0.20 | 0% | 1.004 | 1.689 | 1.962 | 0.48 | 0.81 | 0.94 |
| E | 0.300 | 120,848 | 2.77 | 0 | 0 | 120,848 | 0.20 | 0% | 1.040 | 1.750 | 2.031 | 0.58 | 0.97 | 1.13 |
| F | 0.692 | 518,145 | 11.89 | 0 | 0 | 518,145 | 0.20 | 0% | 0.599 | 1.017 | 1.190 | 1.43 | 2.42 | 2.83 |
| G | 0.283 | 138,157 | 3.17 | 0 | 0 | 138,157 | 0.20 | 0% | 1.080 | 1.816 | 2.107 | 0.69 | 1.15 | 1.34 |

# Mountain View Subdivision
# Stormwater Report

18005.05

## APPENDIX C
## Storm Drainage Report
## Ruedebusch Offsite Street and Utility

ENDURING
COMMUNITY
**DESIGN**

SANDERSON
STEWART

# STORM DRAINAGE REPORT

## RUEDEBUSCH OFFSITE STREET AND UTILITY

21098.01

CITY OF LIVINGSTON

Community Planning

Landscape and Placemaking

Infrastructure Engineering

Surveying and Mapping

Branding

**May 24th, 2022**

SANDERSON STEWART

ENDURING COMMUNITY DESIGN

# RUEDEBUSCH OFFSITE STREET AND UTILITY IMPROVEMENTS

## STORM DRAINAGE REPORT

### LIVINGSTON, MONTANA

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### CERTIFICATION

I hereby state that this Storm Drainage Report has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community of professional engineers. The analysis has been prepared utilizing procedures and practices specified by the City of Livingston and within the standard accepted practices.

MONTANA
STEPHANIE N.
HUDOCK
NO. 51157PE
LICENSED
PROFESSIONAL ENGINEER

Steph Hudock

Steph Hudock, P.E.

05/24/2022

Date

SANDERSON STEWART

Billings
Bozeman
Denver
Fort Collins

November 24, 2021
Revised: January 25, 2022
Revised: May 24, 2022
Project No. 21098

# STORM DRAINAGE REPORT FOR RUEDEBUSCH OFFSITE STREET AND UTILITY IMPROVEMENTS LIVINGSTON, MONTANA

## OVERVIEW NARRATIVE

The purpose of this drainage report is to describe the drainage design associated with the improvements to the Ruedebusch Off-site Public Infrastructure Improvements project. The project is located in the City of Livingston within Park County, Montana. This site is located between Hwy 10 and Hwy 191. The existing area consists of 16.8 acres of grassland with no existing infrastructure or structures. The proposed improvements will consist of a new roadway within a new 60 foot right-of-way and will include drive lanes, curb and gutter, boulevards, and sidewalk on both sides of the road. The project will extend 1,550-feet from Antelope Drive to the West and the road will curve to the SE ending in an asphalt bulb. The storm drain system will be designed to meet the requirements in *The City of Livingston Design Standards and Specification Policy* (DSSP) of February 2021.

## HYDROLOGY

The Rational Method and rainfall data provided was used to calculate the runoff volumes for the 10-year storm event for the runoff storage facilities and the 25-year storm event for the storm drain conveyance facilities. The site stormwater improvements have been designed with the intent to meet the current City of Livingston drainage regulations for the entire site to the extent feasible. Watersheds were delineated for both existing and proposed conditions and are shown in Exhibits A and B in Appendix A. The weighted runoff coefficient "C" was calculated for each contributing area using 0.9 for impervious areas, 0.8 for gravel areas, 0.2 for undeveloped areas(grassland), and 0.3 for the landscaped boulevard and adjacent pervious area. The results of the hydrologic analysis for the storm events described above are shown in Appendix B.

Hydrologic Equations

$$C_{wd} = \text{Weighted Runoff Coefficient}$$
$$A = \text{Area (acres)}$$
$$I = \text{Rainfall Intensity (in/hr)}$$
$$Q = \text{Peak Runoff (cfs)}$$
$$Q = C_{wd} \times I \times A$$

Water Quantity Volume

$$Q\ (cfs) = C \times 0.51\ in/hr \times A\ (acre)$$
$$V\ (cf) = 7200\ sec \times Q\ (ft^3)$$

Water Quality Volume

$$V\ (cf) = 0.5\ in \div 12\ in \times A\ (sf)$$

## EXISTING CONDITIONS

The existing topography of the site flows to the southeast to the existing wetland area. There are no existing stormwater facilities in the area. Surficial soils are a topsoil or fill which was encountered in all borings. The underlying soils were a clay with varying amounts of sand and silt ranging from 0.5-feet to 21.5-feet below ground surface. Sand with varying amounts of clay and gravel were present in some borings ranging from 1.5-feet to 6.5 feet below ground surface. Sandstone and claystone were encountered depths below ground surface ranging from 5-feet to 41.5-feet. Groundwater was encountered at ranging depths from 6 to 15 feet below existing site elevations. The Geotechnical Report is attached in Appendix D. The land cover surrounding the corridor is generally vacant grassland. Runoff is generally conveyed into the existing shallow ditches and depressions.

The project area is hydrologically divided into three watershed areas, Existing Watershed 1, 2 and 3 as shown on Exhibit A in Appendix A. Runoff from Existing Watershed 1 overland flows to existing Antelope Drive to the east. This area is captured by an existing culvert which is then routed under an existing approach to a detention basin on COS 2621RB Parcel 2-A.

Runoff from Existing Watershed 3 overland flows to the south and then east eventually draining into the existing wetland to the east of PFL Way. Runoff within Existing Watershed 3 discharges to the outfall location for the proposed drainage system. Therefore, the peak flows from this watershed were compared against the proposed peak flows.

Existing Watershed 3:

Area = 13.06 acres
Runoff Coefficient = 0.2
Time of Concentration = 17.10 min
2-Year Peak Flow = 2.81 cfs
10-Year Peak Flow = 4.72 cfs
25-Year Peak Flow = 5.48 cfs

Runoff from Existing Watershed 3 flows to the existing ditch located on the western edge of the property as shown on Exhibit A in Appendix A. This ditch functions more like a retention area since it is relatively flat with little positive flow and the end of the ditch is filled in.
This ditch not only receives runoff from the adjacent land but also from dual 36-inch crossing culverts under Highway 10. These culverts primarily convey runoff from west of the project area but might also convey irrigation waste water It is unknown how much water is conveyed through these culverts. The water that enters the existing ditch is generally conveyed to the south but the ditch terminates and water is retained within the ditch. There are two overtopping locations of the ditch. The first is at elevation 4626.0' where runoff would overtop into the Highway 10 roadside ditch at the exit of the culverts. There is also an overtopping elevation point at the end of the ditch where it terminates at elevation 4623.00'. For water to enter the end of the ditch, it must first overtop the intermediate high points with in the ditch at elevation 4625.0'. Based on a visual inspection of the ditch and a desktop review, it does not appear that water is conveyed to the end of the ditch. As shown image below taken June 17th, 2021 (Figure 4), most of the runoff that is conveyed to the ditch is blocked by West End Road to the west. Areas of high water retention are characterized by green grass, this ditch does not show the characterizations of high water retention.

Figure 1: Dual 36" Culverts Looking West (exit of culverts)

Figure 2: Entrance to Ditch Looking East (exit of culverts behind photographer)

Figure 3: Center of the Ditch Looking West

Figure 4: End of Ditch Looking East


Figure 5: Aerial Image of Ditch

## PROPOSED CONDITIONS

The storm drain design associated with the new road improvements will consist of new curb and gutter, curb inlets and storm drain trunkline. The proposed design is also hydrologically split into two Major Watersheds based on their discharge locations, Proposed Watershed A and Proposed Watershed B as shown on Exhibit B in Appendix A.

Proposed Watershed A is hydrologically split into two sections, Proposed Watershed A1 and A2. Runoff from Proposed Watershed A2 will match existing drainage patterns. Runoff from Proposed Watershed A1 will flow into Antelope Drive east towards the intersection with PFL Way. Runoff will flow in the gutter of PFL Way until the end of the curb where runoff is diverted into the existing wetland to the east. No new inlets and pipes are proposed for Proposed Watershed A.

Runoff from Proposed Watershed B is split into three separate basins as Shown on Exhibit B in Appendix A. Proposed Watershed B1 is the area west of the new Street B, Proposed Watershed B2 is the area east of the new Street B and Proposed Watershed B3 is the area that drains into the proposed retention area to matching the existing retention area.

Proposed Watershed B1: The grade of the new Street B is set above existing grade and therefore a ditch is formed at the edge of the road to tie the new road into existing ground. This ditch will collect a small amount of runoff from the undeveloped land from Proposed Watershed B1 to the west of the road. The peak flow rates from this undeveloped land are relatively small. The ditch conveys runoff to the new detention pond. The ditch is temporary and will be filled in as development occurs on the lots. The alternative would have been to install the road below adjacent grade forcing runoff to drain onto the road, which would have significantly increase the storm drain infrastructure. The temporary ditch cross section side slopes varies depending on how the new road fill slope ties into the existing ground. The minimum ditch capacity was calculated using Bentley's FlowMaster, which applies the Manning's Equation to determine the capacity of the ditch based off the longitudinal slope, side slopes, Manning's Roughness, and depth. A Manning's Roughness coefficient of 0.03 was used to determine the ditch capacity. The smallest ditch capacity for each watershed was compared to the 25-year, 5-minute peak flow to determine if the ditch can adequately convey the runoff. Watershed B1 has a 25-year peak flow of 3.25 cfs, which can be conveyed with the smallest ditch capacity of 7.01 cfs.

As proposed development moves in adjacent to the road, the ditch will be removed as the developments will be required to mitigate runoff within their site. When this adjacent land is developed, the new trunkline has the capacity to carry the 2-year pre development flow rate from the undeveloped plans. The new detention basin at the end of the asphalt bulb has capacity to store and convey the pre-development peak flow from Watershed B1 and B2.

Proposed Watershed B2: This watershed will soon be developed into a new FedEx facility. This area is included in the calculations of the off-site improvements to ensure that the proposed storm drain facilities have the capacity to convey the 2-year pre-development flow rate from the site.

Proposed Watersheds B3: To match existing conditions, the existing capacity of the ditch/retention area was calculated. This volume was estimated to be 4,172 CF. A new retention area is proposed in the same location with a volume of 15,462 CF. In the event that the volume of water to the pond exceeds the available storage capacity, water will be able to overtop into a new 12-inch outlet pipe at an elevation of 4925.50' is also proposed at the east end of the pond and connects into the proposed storm drain system (Inlet D-1) within Street A. However, it is anticipated that the new retention pond has the capacity to retain all of the water diverted to the pond.

## INLETS

Inlet locations were designed to capture runoff from the right-of-way area and limit the spread width to less than 9.5-feet for this project's typical section. Bentley's FlowMaster program, which uses the methodology of the FHWA Hec-22 Manual, was used to calculate the spread width and gutter flow depth at each of the inlets using the calculated peak post-development flow rate from the 25-year storm event, inlet dimensions, and road parameters. The allowable limit for the depth of flow in the curb line is 0.15-feet below the top of curb, but the design provides at least 0.3-feet. The inlets were analyzed with a 50% clogging factor. The bypass flow to the bulb is less than the pre-development flow rate and will dissipate into the existing ground conditions to the west. The table in Appendix C summarizes the calculations for each inlet and verifies that they meet design requirements.

## PIPES

The Manning's equation was used to analyze and design the storm drain pipes throughout the project. Pipe slopes are set to maintain a minimum depth of cover of two feet below final grade and the minimum velocity of 3-fps when flowing full. The storm drain pipes were designed to convey the peak flow from the 25-year storm event. When the depth of flow in the pipe exceeds full flow capacity, the next larger size pipe was used. The main trunkline was sized to account for the pre-development flow rates from adjacent lots (B1 & B3) in anticipation for future development. Storm drain pipe design analysis is summarized in Appendix C.

## BASIN/UNDERGROUND DETENTION FACILITY

As mentioned above, a new detention basin is proposed to the northeast of the proposed asphalt bulb at the end of Street A. The proposed detention basin will treat the runoff and limit the discharge flow rate to the 2-year pre-development flow rate from Existing Watershed 3.

The new detention basin will have a maximum side slope steepness of 4:1. Site detention was calculated using the 10-year design storm allowing for the discharge of the 2-year pre-development flow rate. The proposed design will keep the water depth at a maximum of 1.5 feet.

Because the runoff from Post-development Watershed A1 isn't treated before leaving the project site, the proposed detention basin is designed to treat the equivalent 0.5-inch runoff volume and limit the pre-development flow rate to account for the increase in the 10-year peak flow rate from Post-development Watershed A1. The final discharge location for both Post-development Watershed A1 and new detention pond is the existing wetland to the east at the same location. Watershed A1 sheet flows through Antelope Drive to the south, runoff flows in the gutter to PFL

Way. At the intersection of PFL Way, runoff flows south down the curb and gutter to the end of the Printing for Less Development This is the same general location that the existing water from Watershed B discharges. The time of concentration for Watershed A1 is 13.70 minutes and was used to calculate the peak flows.

Proposed Watershed A1
2-Year Peak Flow Rate = 0.84 cfs
10-Year Peak Flow Rate = 1.41 cfs

Existing Watershed 3
2-Year Peak Flow Rate = 2.81 cfs
10-Year Peak Flow Rate =4.72 cfs

The discharge rate for the detention basin is calculated by subtracting the 10-year post development peak runoff rate from Watershed A1 which flows unrestricted to the existing wetland, from the 2-year predevelopment flow rate to the wetland from existing Watershed 3. A proposed 6-inch outlet pipe will restrict the peak flow leaving the detention pond to 0.92 cfs. This method was used to calculate the allowable outflow from the detention pond because it ensures that during the 10-year storm event the peak flow rate to the wetland is still limited to the 2-year pre-development flow rate from Existing Watershed 3 (2.81 cfs).

Design Flow Rates
2-Year Pre Development Peak Flow Rate from Watershed 3 = 2.81 cfs
10-Year Post Development Peak Flow Rate from Watershed A1 =1.41 cfs

2.81 cfs – 1.41 cfs = 1.40 cfs = Calculated Detention Basin Discharge Rate
Required Detention Discharge Rate = 1.40 cfs
Provided Detention Discharge Rate = 0.92 cfs with 6-inch outlet pipe
Proposed 2-Year Peak Flow Rate to Wetlands = 0.84 cfs + 0.92 cfs = 1.76 cfs
Proposed 10-Year Peak Flow Rate to Wetlands = 1.41 cfs + 0.92 cfs = **2.33 cfs < 2.81 cfs**

If the design were to just compare the 2-year and 10-year flows against eachother, then the peak flow rate during the 10-year storm event would exceed the 2-year pre-development flow rate to the wetlands.

2-Year Storm Event
2.81 cfs – 0.84 cfs = 1.97 cfs

10-Year Storm Event
4.72 cfs – 1.41 cfs = 3.31 cfs

Watershed A through I Required 10-Year Storage Volume = 10,808 CF
Watershed A, C, D, F, G, H, I Required 0.5-inch Treatment Volume = 5,577 CF
Provided Storage Volume = 12,496 CF

The basin is design with a bottom area length of 120 LF, a width of 60 LF, and basin bottom area of 7,200 SF. The basin has a depth of 1.5-feet. The bottom of the basin is at an elevation of 4,603.5-

feet and at this location a borehole of 6.5-feet from existing surface encountered no groundwater. The existing elevation of the borehole is 4602-feet. This gives more than three feet of cover between the stormwater basin and the potential ground water. The 6-inch outlet pipe capacity was estimated to be 0.92 cfs using HY-8 to model the outlet pipe as a culvert. The maximum capacity (0.92 cfs) was determined by finding the capacity of the culvert at the maximum headwater depth of 1.5 feet (maximum pond depth). Calculations have been provided in the Appendix.

The basin area was calculated to release the runoff at a rate less than 145-square feet per 1-cfs for sediment control to treat the runoff. The settling velocity of 40 micron particles is 0.0069 fps allowing sediment to settle and treat the runoff before discharge. This is shown in the post-development basin sizing table in Appendix C. This reduces the total project peak outflow to below that of the pre-development flow rate and post-development flow rate from Watershed A1 discussed below.

Minimum Pond Area for Water Quality Treatment according to Section 2.C.4 of the DSSP and the Sizing Detention Basins Sample Problem on page 74 of the DSSP.

Settling velocity of 40-micron particles = 0.0069 ft/sec
Design Release Rate = 0.92 cfs
Minimum Area Required: 0.92 cfs ÷ 0.0069 ft/sec = 133.3 SF < proposed 7,200 SF

## MAJOR STORM EVENTS

In the event of a 100-year storm event, the detention basin to the northeast of the bulb will overtop and flow to the east with shallow concentrated flow. During large storm events runoff will pond at inlets D1 and D2, which are located at a sag in Street A. Once the storm drain drainage facilities are at capacity, runoff will overtop the sidewalks to adjacent properties at the sag location. There are no properties to the west that will be impacted. To the east, if the runoff overtops the sidewalk, it will be captured in the proposed drainage swale before reaching the proposed building, resulting in no anticipated property damage.

In the event that the volume of water directed to the proposed retention basin used capture the water exiting the dual 36-inch culverts, water will be able to overtop in two locations. The first location would be at the exit of the dual 36-inch culverts, where runoff can overtop to the south and flow in the west roadside ditch of Highway 10. The second location would be at the western edge of the pond where runoff would overtop and flow along the toe of slope of the road (the temporary ditch).

**Appendices**

Appendix A – Watershed Exhibits *(include both existing and proposed in two separate exhibits – A & B)*
Appendix B – Pre-Development Calculations
Appendix C – Post-Development Calculations
Appendix D – Geotechnical Investigation Report

# Appendix A

STORMWATER BASINS

# EXHIBIT A

EXISTING WATERSHEDS
WITHIN
SUBDIVISION OF S22, T02 S, R09 E, C.O.S. 2621RB
RUEDEBUSCH OFF–SITE STREET AND UTILITY IMPROVEMENTS

NORTH

100 50 0 100 200
SCALE:1" = 100'

PREPARED FOR : RUEDEBUSCH DEVELOPMENT & CONSTRUCTION INC. MAY, 2022

PREPARED BY : SANDERSON STEWART BOZEMAN, MONTANA


21098_01_STORM_BASE.DWG 21098.01 05/23/22 SNH/RRB

# EXHIBIT B

## PROPOSED WATERSHEDS
WITHIN
SUBDIVISION OF S22, T02 S, R09 E, C.O.S. 2621RB
RUEDEBUSCH OFF–SITE STREET AND UTILITY IMPROVEMENTS

NORTH

100 50 0 100 200
SCALE:1" = 100'

PREPARED FOR : RUEDEBUSCH DEVELOPMENT & CONSTRUCTION INC. MAY, 2022

PREPARED BY : SANDERSON STEWART BOZEMAN, MONTANA

# Appendix B

EXISTING CALCULATIONS

HYDROLOGY WORKSHEET

Project: Reudebush
Project No.: 21098
Date: 05/20/2022

SANDERSON STEWART

## PRE DEVELOPMENT/EXISTING BASINS

| WS | Tc (hours) | Area (sf) | Area (ac.) | Area Impervious (sf) | Area Gravel (sf) | Area Pervious (sf) | RC | % IC | $I_2$ (in/hr) | $I_{10}$ (in/hr) | $I_{25}$ (in/hr) | $Q_2$ Peak Flow (cfs) | $Q_{10}$ Peak Flow (cfs) | $Q_{25}$ Peak Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.083 | 139,527 | 3.20 | 0 | 0 | 139,527 | 0.20 | 0% | 2.423 | 4.023 | 4.611 | 1.55 | 2.58 | 2.95 |
| 2 | 0.167 | 196,992 | 4.52 | 22,510 | 0 | 174,482 | 0.28 | 11% | 1.533 | 2.564 | 2.959 | 1.94 | 3.25 | 3.75 |
| 3 | 0.285 | 568,766 | 13.06 | 0 | 0 | 568,766 | 0.20 | 0% | 1.076 | 1.809 | 2.099 | 2.81 | 4.72 | 5.48 |

# HYDROLOGY WORKSHEET

Project: Ruedebusch
Project No.: 21098
Date: 5/20/2022

## Time of Concentration

| Watershed 3 | Sheet Flow | | | | | Shallow Concentrated Flow | | | | Channel Flow | | | | | | Tc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L (ft) | n | P (in) | s (ft/ft) | Tsf (min) | s (ft/ft) | V (ft/s) | L (ft) | Tscf (min) | r (ft) | s (ft/ft) | n | V (ft/s) | L (ft) | Tch (min) | Total (min) |
| Flow Path 1 | 275 | 0.035 | 1.385 | 0.0252 | 9.52 | | | | | | | | | | | 9.52 |
| Flow Path 2 | 88 | 0.035 | 1.385 | 0.0766 | 2.45 | | | | | | | | | | | 2.45 |
| Flow Path 3 | | | | | | 0.0279 | 2.70 | 218 | 1.35 | | | | | | | 1.35 |
| Flow Path 4 | | | | | | 0.0313 | 2.85 | 404 | 2.36 | | | | | | | 2.36 |
| Flow Path 5 | | | | | | 0.0136 | 1.88 | 160 | 1.42 | | | | | | | 1.42 |
| Flow Path 6 | | | | | | | | | | | | | | | | |

Total 17.10

USDA *Urban Hydrology for Small Watersheds TR-55 Manual.*

### Sheet Flow Equations

Eq. 3-3

$$T_{sf} = \frac{0.007(nL)0.8}{P_2^{0.5} s^{0.4}}$$

L = Length of overland sheet flow (ft)
n = Manning's roughness
P = 2-year, 24-hour rainfall, in
s = Slope (ft/ft)

### Shallow Concentrated Flow Equations

$V = 16.135(s)^{0.5}$ for Grassed Waterways
$V = 6.962(s)^{0.5}$ for Short-grassed pasture
$V = 20.328(s)^{0.5}$ for Pavement

$$T_{scf} = \frac{L}{60V}$$

s = Slope (ft/ft)
L = Length of overland sheet flow (ft)

### Channel/Pipe Flow Equations

$$V = \frac{1.49(r^{0.67}s^{0.5})}{n}$$

$$T_{ch} = \frac{L}{60V}$$

L = Length of overland sheet flow (ft)
n = Manning's roughness
s = Slope (ft/ft)
r = hydraulic radius (ft)

# Appendix C

PROPOSED CALCULATIONS

# HYDROLOGY WORKSHEET

Project: Reudebush
Project No.: 21098
Date: 05/20/2022

SANDERSON STEWART

## POST DEVELOPMENT/PROPOSED BASINS

Time of Concentration= 5 mins

| WS | Structure | Area (sf) | Area (ac.) | Area Impervious (sf) | Area Pervious (sf) | Weighted RC | % IC | $V_{0.5\text{-in}}$ (cf) |
|---|---|---|---|---|---|---|---|---|
| C1 | C1 | 2,716 | 0.06 | 2,241 | 475 | 0.84 | 83% | 113.17 |
| C2 | C2 | 2,561 | 0.06 | 2,126 | 435 | 0.84 | 83% | 106.71 |
| D1 | D1 | 6,551 | 0.15 | 5,404 | 1,147 | 0.84 | 82% | 272.96 |
| D2 | D2 | 6,137 | 0.14 | 5,339 | 798 | 0.87 | 87% | 255.71 |
| F1 | F1 | 3,745 | 0.09 | 3,087 | 658 | 0.84 | 82% | 156.04 |
| F2 | F2 | 3,458 | 0.08 | 2,874 | 584 | 0.84 | 83% | 144.08 |
| G1 | G1 | 4,884 | 0.11 | 4,033 | 851 | 0.84 | 83% | 203.50 |
| G2 | G2 | 4,459 | 0.10 | 3,706 | 753 | 0.84 | 83% | 185.79 |
| H1 | H1 | 4,865 | 0.11 | 4,011 | 854 | 0.84 | 82% | 202.71 |
| H2 | H2 | 4,492 | 0.10 | 3,733 | 759 | 0.84 | 83% | 187.17 |
| I1 | I1 | 6,053 | 0.14 | 4,993 | 1,060 | 0.84 | 82% | 252.21 |
| I2 | I2 | 6,368 | 0.15 | 5,635 | 733 | 0.88 | 88% | 265.33 |
| | | | | | | | Sub Totals | 2,345.38 CF |

| WS | TOC (min) | Area (sf) | Area (ac.) | Area Impervious (sf) | Area Pervious (sf) | RC | % IC | $V_{0.5\text{-in}}$ (cf) | $Q_2$ Peak Flow (cfs) | $Q_{10}$ Peak Flow (cfs) | $Q_{25}$ Peak Flow (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A1** | 13.70 | 58,921 | 1.35 | 25,052 | 33,869 | 0.50 | 43% | 2,455.04 | 0.84 | 1.41 | 1.63 |
| **A2** | 5 | 18,627 | 0.43 | 0 | 18,627 | 0.20 | 0% | 776.13 | 0.21 | 0.34 | 0.39 |
| **B1** | 16 | 323,631 | 7.43 | 0 | 323,631 | 0.20 | 0% | 0.00 | 1.67 | 2.81 | 3.25 |
| **B2** | 7 | 291,232 | 6.69 | 22,510 | 268,722 | 0.25 | 8% | 0.00 | 3.30 | 5.49 | 6.32 |
| **B3** | 7 | 147,065 | 3.38 | 0 | 147,065 | 0.20 | 0% | 0.00 | 1.31 | 2.18 | 2.51 |
| | | | | | | | Sub Totals | 3,231.17 CF | | | |
| | | | | | | | Total | 5,576.54 CF | | | |

# HYDROLOGY WORKSHEET

Project: Ruedebusch
Project No.: 21098
Date: 1/25/2022

## Time of Concentration

| Watershed A1 | Sheet Flow | | | | | Shallow Concentrated Flow | | | | Channel Flow | | | | | | Tc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L (ft) | n | P (in) | s (ft/ft) | Tsf (min) | s (ft/ft) | V (ft/s) | L (ft) | Tscf (min) | r (ft) | s (ft/ft) | n | V (ft/s) | L (ft) | Tch (min) | Total (min) |
| Flow Path 1 | | | | | | | | | | 0.058 | 0.024 | 0.015 | 2.31 | 1896 | 13.698 | 13.70 |
| | | | | | | | | | | | | | | | | 0.00 |
| | | | | | | | | | | | | | | | | 0.00 |
| | | | | | | | | | | | | | | | | 0.00 |
| | | | | | | | | | | | | | | | | 0.00 |
| | | | | | | | | | | | | | | | | 0.00 |

Total 13.70

USDA *Urban Hydrology for Small Watersheds TR-55 Manual.*

### Sheet Flow Equations

Eq. 3-3

$$T_{sf} = \frac{0.007(nL)0.8}{P_2^{0.5}s^{0.4}}$$

L = Length of overland sheet flow (ft)
n = Manning's roughness
P = 2-year, 24-hour rainfall, in
s = Slope (ft/ft)

### Shallow Concentrated Flow Equations

$V = 16.135(s)^{0.5}$ for Grassed Waterways
$V = 6.962(s)^{0.5}$ for Short-grassed pasture
$V = 20.328(s)^{0.5}$ for Pavement

$$T_{scf} = \frac{L}{60V}$$

s = Slope (ft/ft)
L = Length of overland sheet flow (ft)

### Channel/Pipe Flow Equations

$$V = \frac{1.49(r^{0.67}s^{0.5})}{n}$$

$$T_{ch} = \frac{L}{60V}$$

L = Length of overland sheet flow (ft)
n = Manning's roughness
s = Slope (ft/ft)
r = hydraulic radius (ft)

# PIPE SIZING WORKSHEET - RATIONAL METHOD

Design Storm = 25-yr
Intensity = 4.61 in/hr
Time of Concentration = 5-min

SANDERSON STEWART

**Pipe Run - STREET A**

| Pipe # | Included Areas | Runoff Coeff. | Total Area (acres) | Peak Flow (cfs) | Added Flow (cfs) | Q Total Flow (cfs) | Pipe Length (ft) | Pipe Slope (ft/ft) | Pipe Size (in) | Qf Flow Full Capacity (cfs) | Vf Flow Full Velocity (fps) | Q/Qf | d/D | V/Vf | d (in) | V Actual (fps) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | C | 0.84 | 0.12 | 0.47 | 0.00 | 0.47 | 119 | 0.02770 | 15 | 10.78 | 8.78 | 0.043 | 0.16 | 0.42 | 2.45 | 3.68 |
| 21 | C-D | 0.85 | 0.41 | 1.62 | 0.87 | 2.49 | 124 | 0.02000 | 15 | 9.16 | 7.46 | 0.271 | 0.41 | 0.72 | 6.10 | 5.35 |
| 22 | C-E | 0.84 | 0.58 | 2.23 | 0.00 | 2.23 | 91 | 0.02040 | 15 | 9.25 | 7.54 | 0.241 | 0.38 | 0.69 | 5.77 | 5.23 |
| 23 | C-E | 0.84 | 0.58 | 2.23 | 0.46 | 2.70 | 156 | 0.02000 | 15 | 9.16 | 7.46 | 0.294 | 0.42 | 0.73 | 6.35 | 5.46 |
| 24 | C-G | 0.84 | 0.79 | 3.06 | 0.00 | 3.06 | 158 | 0.01270 | 15 | 7.30 | 5.95 | 0.420 | 0.51 | 0.81 | 7.70 | 4.82 |
| 25 | C-H | 0.84 | 1.01 | 3.89 | 0.79 | 4.68 | 217 | 0.01500 | 15 | 7.93 | 6.46 | 0.590 | 0.63 | 0.90 | 9.38 | 5.80 |
| 26 | C-I | 0.84 | 1.29 | 4.99 | 1.86 | 6.85 | 101 | 0.01680 | 15 | 8.40 | 6.84 | 0.816 | 0.77 | 0.99 | 11.50 | 6.77 |
| 12 | C-I | NA | NA | 2.58 | 0.00 | 2.58 | 14 | 0.01000 | 12 | 3.57 | 4.55 | 0.722 | 0.71 | 0.95 | 8.49 | 4.34 |

INLET WORKSHEET 25-YEAR

Project: Ruedebusch
Project No.: 21098
Date: 01/25/2022

SANDERSON STEWART

| Structure Info | | Roadway Inputs | | Peak Flow | | Gutter Spread | | | Intercepted | Bypass |
|---|---|---|---|---|---|---|---|---|---|---|
| Structure Name | Type | Cross Slope (ft/ft) | Long. Slope (ft/ft) | Q (cfs) | Q + Bypass (cfs) | Spread Width (ft) | Depth (in) | Depth (ft) | Qint | Qb (cfs) |
| **High Point** | | | | | | | | | | |
| C1 | On Grade | 2.00% | 2.75% | 0.24 | 0.24 | 3.5 | 0.8 | 0.07 | 0.20 | **0.04** |
| D1 | Sag | 2.00% | 2.45% | 0.58 | 0.62 | 7.7 | 1.8 | 0.15 | 0.62 | **0.00** |
| F1 | On Grade | 2.00% | 1.13% | 0.33 | 0.33 | 4.6 | 1.1 | 0.09 | 0.26 | **0.07** |
| G1 | On Grade | 2.00% | 1.85% | 0.43 | 0.50 | 5.0 | 1.2 | 0.10 | 0.36 | **0.14** |
| H1 | On Grade | 2.00% | 2.77% | 0.43 | 0.57 | 4.8 | 1.2 | 0.10 | 0.41 | **0.16** |
| I1 | On Grade | 2.00% | 4.35% | 0.54 | 0.70 | 4.8 | 1.1 | 0.09 | 0.49 | **0.21** |

| Structure Info | | Roadway Inputs | | Peak Flow | | Gutter Spread | | | Intercepted | Bypass |
|---|---|---|---|---|---|---|---|---|---|---|
| Structure Name | Type | Cross Slope (ft/ft) | Long. Slope (ft/ft) | Q (cfs) | Q + Bypass (cfs) | Spread Width (ft) | Depth (in) | Depth (ft) | Qint | Qb (cfs) |
| **High Point** | | | | | | | | | | |
| C2 | On Grade | 2.00% | 2.75% | 0.23 | 0.23 | 2.2 | 0.5 | 0.04 | 0.22 | **0.01** |
| D2 | On Grade | 2.00% | 2.45% | 0.56 | 0.57 | 7.3 | 1.8 | 0.15 | 0.57 | **0.00** |
| F2 | On Grade | 2.00% | 1.13% | 0.31 | 0.31 | 4.5 | 1.1 | 0.09 | 0.25 | **0.06** |
| G2 | On Grade | 2.00% | 1.85% | 0.40 | 0.45 | 4.8 | 1.1 | 0.09 | 0.35 | **0.10** |
| H2 | On Grade | 2.00% | 2.77% | 0.40 | 0.50 | 4.6 | 1.1 | 0.09 | 0.37 | **0.13** |
| I2 | On Grade | 2.00% | 4.35% | 0.59 | 0.72 | 4.8 | 1.2 | 0.10 | 0.50 | **0.22** |

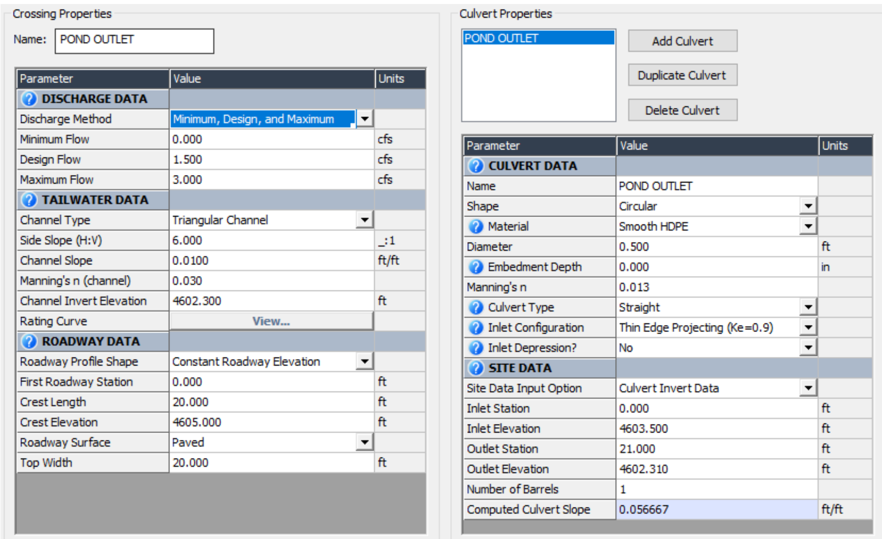
# RATIONAL METHOD FOR WATER QUANTITY VOLUME CALCULATIONS
## BASIN SIZING

Design Storm Frequency = 10 yrs.
Discharge Rate, d = 0.92 cfs

| Surface Type | Area A ($ft^2$) | Area (acres) | Runoff Coefficient C | Frequency Factor Cf | C x $C_f$ |
|---|---|---|---|---|---|
| Impervious | 72,234 | 1.66 | 0.9 | 1 | 0.90 |
| Landscape | 61,603 | 1.41 | 0.3 | 1 | 0.30 |
| Undeveloped (B1 & B2) | 614,863 | 14.12 | 0.2 | 1 | 0.20 |
| **Totals** | **748,700** | **17.19** | **0.28** | **1** | **0.276** |

| Rainfall Duration, t (min) | Rainfall Intensity, i (in/hr) | Runoff Volume = $C_{wd}$ x A x i x t ($ft^3$) | Discharge Volume = d x t ($ft^3$) | Site Detention = Runoff Volume - Discharge Volume ($ft^3$) |
|---|---|---|---|---|
| 1 | 11.45 | 3256.84 | 55.20 | 3201.64 |
| 5 | 4.02 | 5720.52 | 276.00 | 5444.52 |
| 10 | 2.56 | 7291.15 | 552.00 | 6739.15 |
| 15 | 1.97 | 8402.88 | 828.00 | 7574.88 |
| 20 | 1.63 | 9293.02 | 1104.00 | 8189.02 |
| 25 | 1.41 | 10047.90 | 1380.00 | 8667.90 |
| 30 | 1.26 | 10709.98 | 1656.00 | 9053.98 |
| 35 | 1.14 | 11303.68 | 1932.00 | 9371.68 |
| 40 | 1.04 | 11844.51 | 2208.00 | 9636.51 |
| 45 | 0.96 | 12342.99 | 2484.00 | 9858.99 |
| 50 | 0.90 | 12806.65 | 2760.00 | 10046.65 |
| 60 | 0.80 | 13650.52 | 3312.00 | 10338.52 |
| 75 | 0.69 | 14759.36 | 4140.00 | 10619.36 |
| 80 | 0.66 | 15096.55 | 4416.00 | 10680.55 |
| 90 | 0.61 | 15731.89 | 4968.00 | 10763.89 |
| 100 | 0.57 | 16322.86 | 5520.00 | 10802.86 |
| 103 | 0.56 | 16492.60 | 5685.60 | 10807.00 |
| 104 | 0.56 | 16548.47 | 5740.80 | 10807.67 |
| **105** | **0.56** | **16603.99** | **5796.00** | **10807.99** |
| 106 | 0.55 | 16659.16 | 5851.20 | 10807.96 |
| 180 | 0.39 | 20051.25 | 9936.00 | 10115.25 |
| 360 | 0.25 | 25556.54 | 19872.00 | 5684.54 |
| 720 | 0.16 | 32573.36 | 39744.00 | ----- |
| 1440 | 0.10 | 41516.72 | 79488.00 | ----- |

# POND OUTFALL PIPE CALCULATIONS



Crossing Properties

Name: POND OUTLET

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 0.000 | cfs |
| Design Flow | 1.500 | cfs |
| Maximum Flow | 3.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Triangular Channel | |
| Side Slope (H:V) | 6.000 | _:1 |
| Channel Slope | 0.0100 | ft/ft |
| Manning's n (channel) | 0.030 | |
| Channel Invert Elevation | 4602.300 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 20.000 | ft |
| Crest Elevation | 4605.000 | ft |
| Roadway Surface | Paved | |
| Top Width | 20.000 | ft |

Culvert Properties

POND OUTLET

Add Culvert

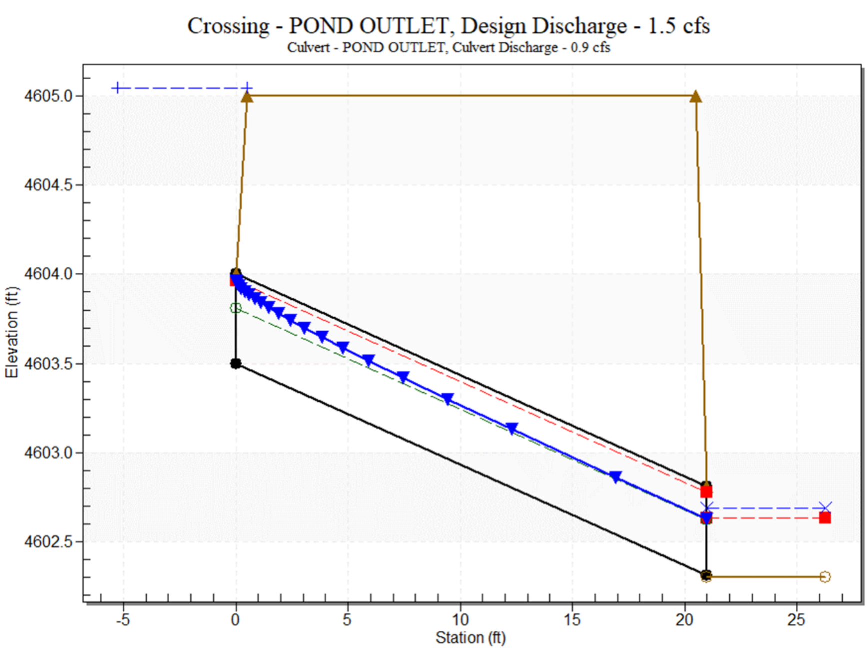
Duplicate Culvert

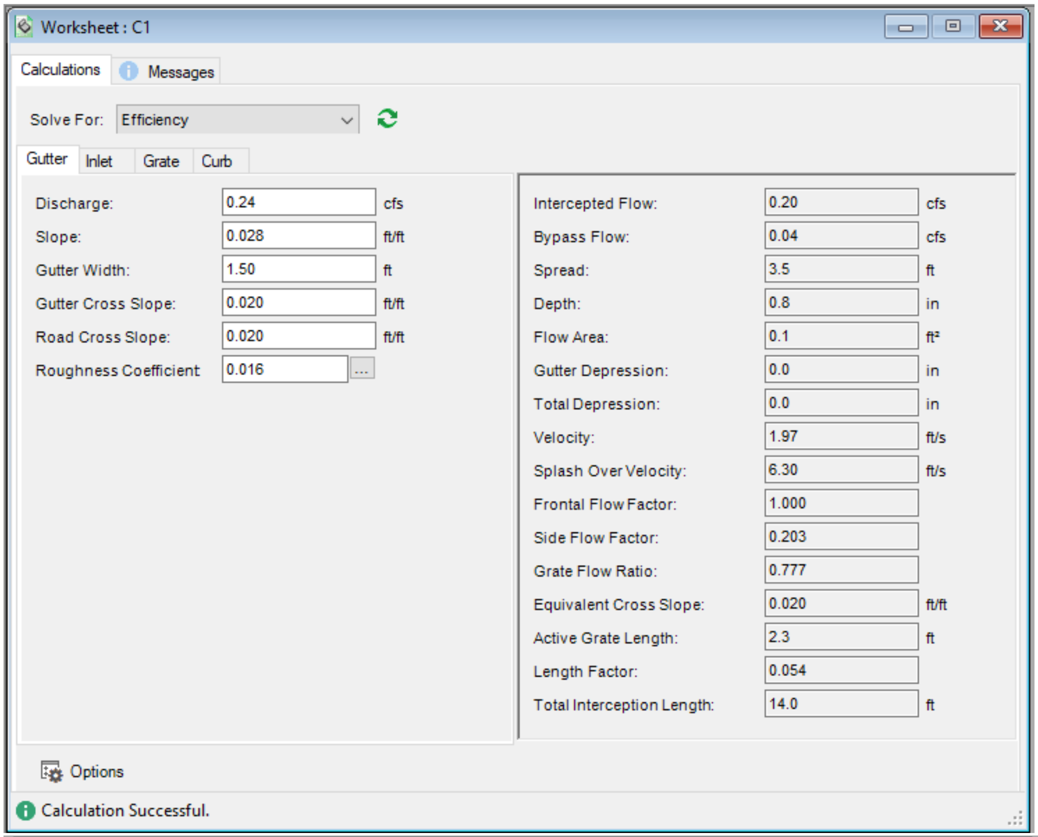
Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | POND OUTLET | |
| Shape | Circular | |
| Material | Smooth HDPE | |
| Diameter | 0.500 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.013 | |
| Culvert Type | Straight | |
| Inlet Configuration | Thin Edge Projecting (Ke=0.9) | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 4603.500 | ft |
| Outlet Station | 21.000 | ft |
| Outlet Elevation | 4602.310 | ft |
| Number of Barrels | 1 | |
| Computed Culvert Slope | 0.056667 | ft/ft |

**Table 1 - Summary of Culvert Flows at Crossing: POND OUTLET**

| Headwater Elevation (ft) | Total Discharge (cfs) | POND OUTLET Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 4603.50 | 0.00 | 0.00 | 0.00 | 1 |
| 4603.93 | 0.30 | 0.30 | 0.00 | 1 |
| 4604.31 | 0.60 | 0.60 | 0.00 | 1 |
| 4604.94 | 0.90 | 0.90 | 0.00 | 1 |
| 4605.03 | 1.20 | 0.93 | 0.26 | 9 |
| 4605.04 | 1.50 | 0.94 | 0.55 | 4 |
| 4605.06 | 1.80 | 0.94 | 0.85 | 4 |
| 4605.07 | 2.10 | 0.95 | 1.14 | 3 |
| 4605.08 | 2.40 | 0.95 | 1.44 | 3 |
| 4605.10 | 2.70 | 0.96 | 1.74 | 3 |
| 4605.11 | 3.00 | 0.96 | 2.02 | 2 |
| 4605.00 | 0.92 | 0.92 | 0.00 | Overtopping |





Worksheet : C1

Calculations | Messages

Solve For: Efficiency

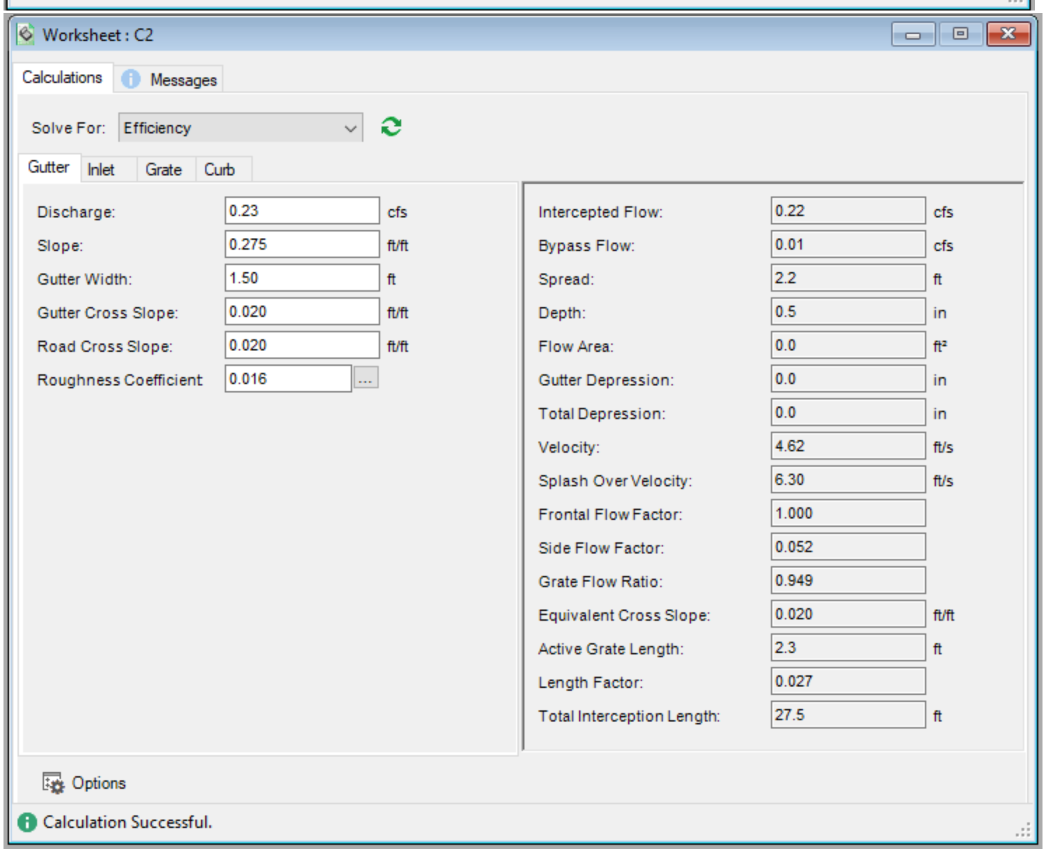
Gutter | Inlet | Grate | Curb

| | | |
|---|---|---|
| Discharge: | 0.24 | cfs |
| Slope: | 0.028 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.20 | cfs |
| Bypass Flow: | 0.04 | cfs |
| Spread: | 3.5 | ft |
| Depth: | 0.8 | in |
| Flow Area: | 0.1 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 1.97 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.203 | |
| Grate Flow Ratio: | 0.777 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.054 | |
| Total Interception Length: | 14.0 | ft |

Options

Calculation Successful.



Worksheet : C2

Calculations | Messages

Solve For: Efficiency

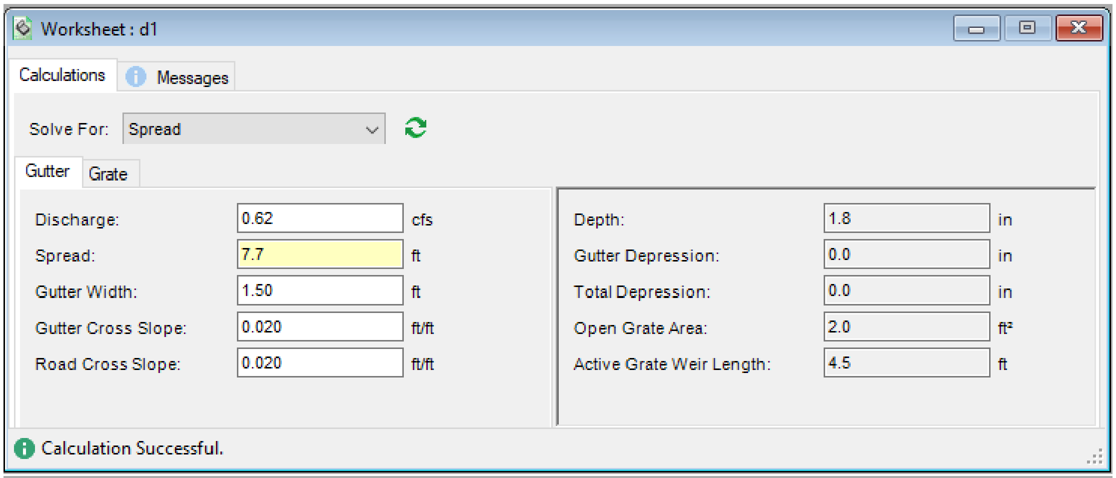
Gutter | Inlet | Grate | Curb

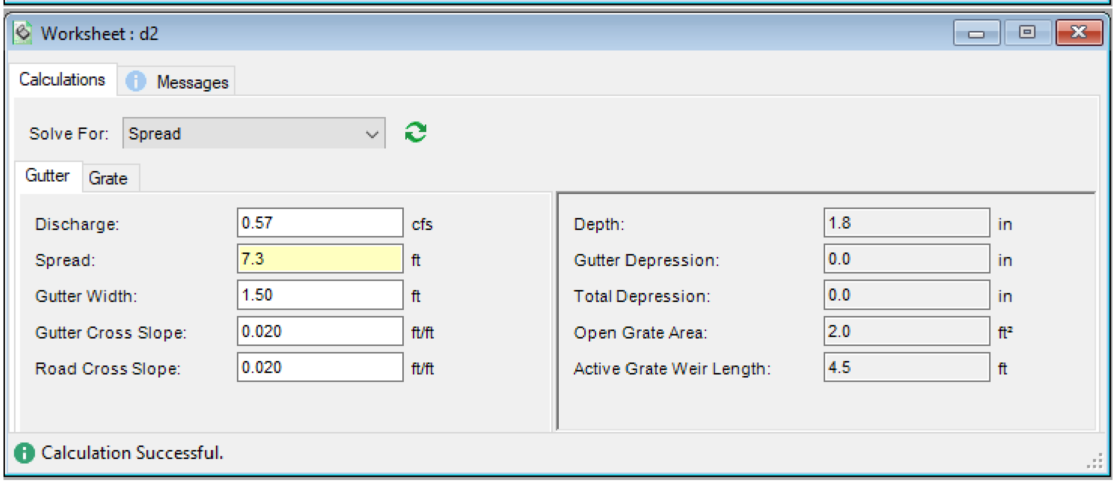
| | | |
|---|---|---|
| Discharge: | 0.23 | cfs |
| Slope: | 0.275 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

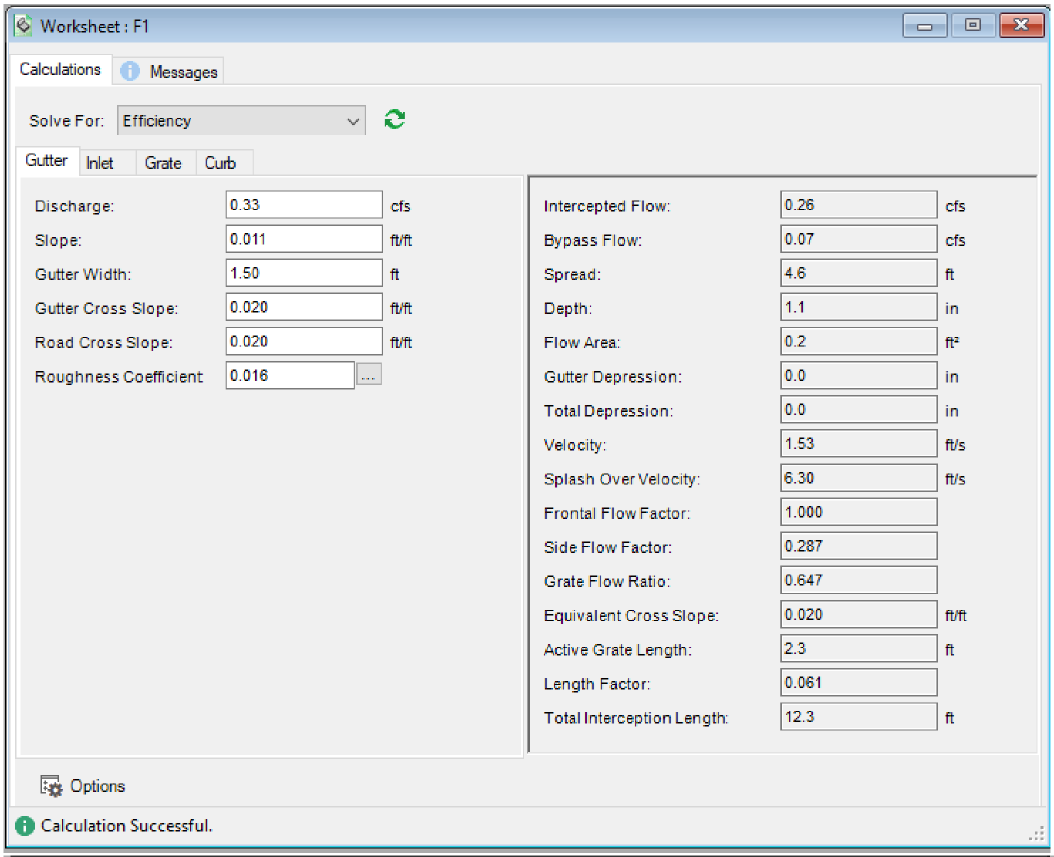
| | | |
|---|---|---|
| Intercepted Flow: | 0.22 | cfs |
| Bypass Flow: | 0.01 | cfs |
| Spread: | 2.2 | ft |
| Depth: | 0.5 | in |
| Flow Area: | 0.0 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 4.62 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.052 | |
| Grate Flow Ratio: | 0.949 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.027 | |
| Total Interception Length: | 27.5 | ft |

Options

Calculation Successful.


Worksheet : d1
Calculations
Messages
Solve For: Spread
Gutter
Grate
Discharge: 0.62 cfs
Spread: 7.7 ft
Gutter Width: 1.50 ft
Gutter Cross Slope: 0.020 ft/ft
Road Cross Slope: 0.020 ft/ft
Depth: 1.8 in
Gutter Depression: 0.0 in
Total Depression: 0.0 in
Open Grate Area: 2.0 ft²
Active Grate Weir Length: 4.5 ft
Calculation Successful.


Worksheet : d2
Calculations
Messages
Solve For: Spread
Gutter
Grate
Discharge: 0.57 cfs
Spread: 7.3 ft
Gutter Width: 1.50 ft
Gutter Cross Slope: 0.020 ft/ft
Road Cross Slope: 0.020 ft/ft
Depth: 1.8 in
Gutter Depression: 0.0 in
Total Depression: 0.0 in
Open Grate Area: 2.0 ft²
Active Grate Weir Length: 4.5 ft
Calculation Successful.



Worksheet : F1

Calculations | Messages

Solve For: Efficiency

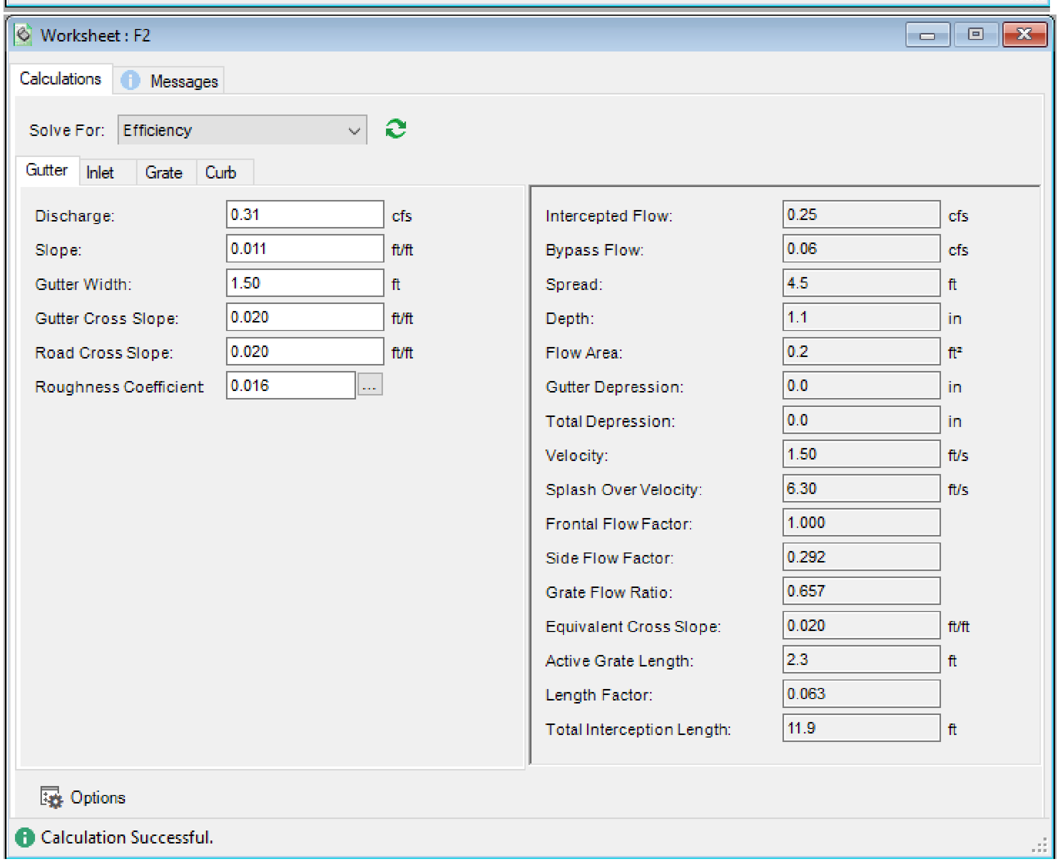
Gutter | Inlet | Grate | Curb

| | | |
|---|---|---|
| Discharge: | 0.33 | cfs |
| Slope: | 0.011 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.26 | cfs |
| Bypass Flow: | 0.07 | cfs |
| Spread: | 4.6 | ft |
| Depth: | 1.1 | in |
| Flow Area: | 0.2 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 1.53 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.287 | |
| Grate Flow Ratio: | 0.647 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.061 | |
| Total Interception Length: | 12.3 | ft |

Options

Calculation Successful.



Worksheet : F2

Calculations | Messages

Solve For: Efficiency

Gutter | Inlet | Grate | Curb

| | | |
|---|---|---|
| Discharge: | 0.31 | cfs |
| Slope: | 0.011 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.25 | cfs |
| Bypass Flow: | 0.06 | cfs |
| Spread: | 4.5 | ft |
| Depth: | 1.1 | in |
| Flow Area: | 0.2 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 1.50 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.292 | |
| Grate Flow Ratio: | 0.657 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.063 | |
| Total Interception Length: | 11.9 | ft |

Options

Calculation Successful.

**Worksheet : G1**

Calculations | Messages

Solve For: Efficiency

Gutter | Inlet | Grate | Curb

| | | |
|---|---|---|
| Discharge: | 0.50 | cfs |
| Slope: | 0.019 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.36 | cfs |
| Bypass Flow: | 0.14 | cfs |
| Spread: | 5.0 | ft |
| Depth: | 1.2 | in |
| Flow Area: | 0.2 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 2.04 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.193 | |
| Grate Flow Ratio: | 0.618 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.044 | |
| Total Interception Length: | 16.9 | ft |

Options

Calculation Successful.

**Worksheet : G2**

Calculations | Messages

Solve For: Efficiency

Gutter | Inlet | Grate | Curb

| | | |
|---|---|---|
| Discharge: | 0.45 | cfs |
| Slope: | 0.019 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.34 | cfs |
| Bypass Flow: | 0.11 | cfs |
| Spread: | 4.8 | ft |
| Depth: | 1.1 | in |
| Flow Area: | 0.2 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 1.99 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.200 | |
| Grate Flow Ratio: | 0.636 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.046 | |
| Total Interception Length: | 16.2 | ft |

Options

Calculation Successful.

**Worksheet : H1**

Calculations | Messages

Solve For: Efficiency

Gutter | Inlet | Grate | Curb

| | | |
|---|---|---|
| Discharge: | 0.57 | cfs |
| Slope: | 0.028 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.41 | cfs |
| Bypass Flow: | 0.16 | cfs |
| Spread: | 4.8 | ft |
| Depth: | 1.2 | in |
| Flow Area: | 0.2 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 2.45 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.146 | |
| Grate Flow Ratio: | 0.630 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.037 | |
| Total Interception Length: | 20.2 | ft |

Options

Calculation Successful.

**Worksheet : H2**

Calculations | Messages

Solve For: Efficiency

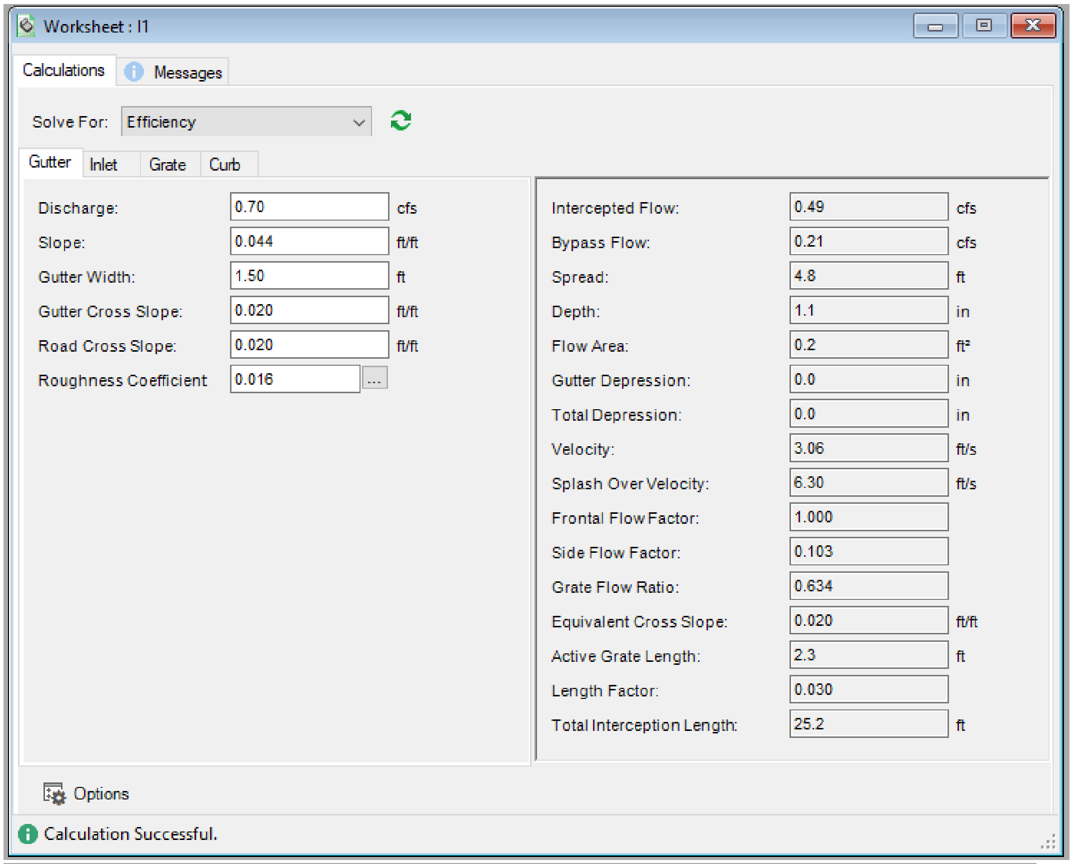
Gutter | Inlet | Grate | Curb

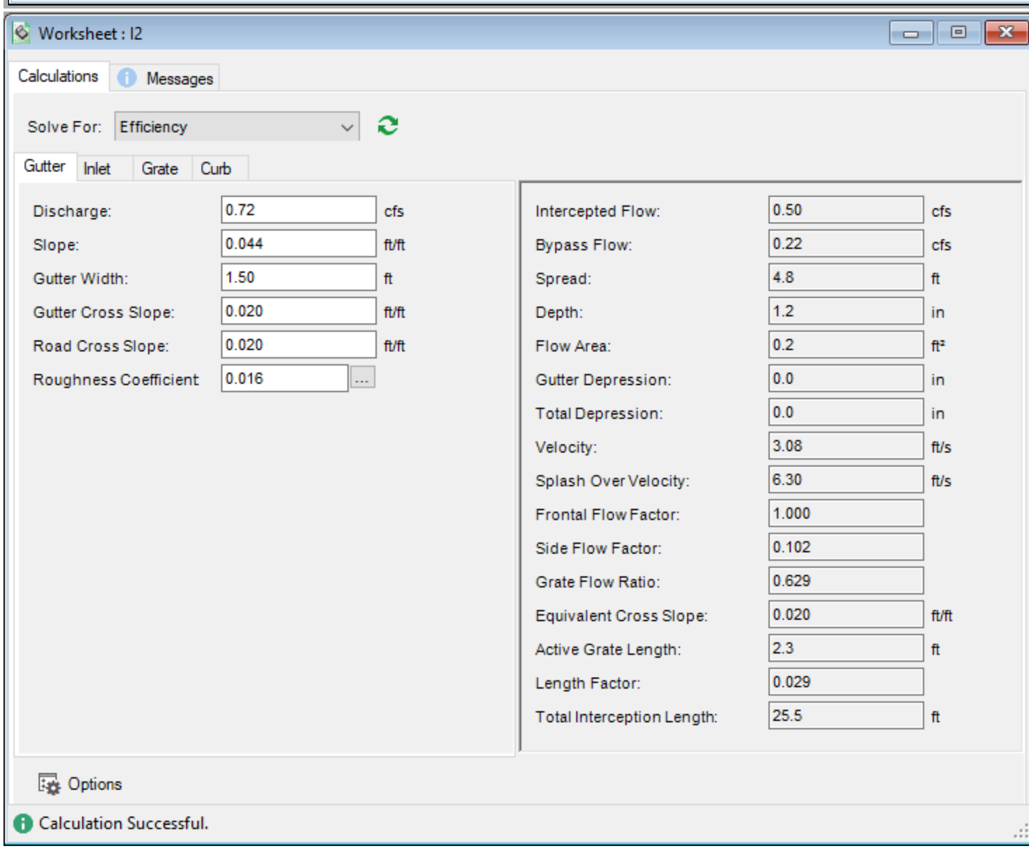
| | | |
|---|---|---|
| Discharge: | 0.50 | cfs |
| Slope: | 0.028 | ft/ft |
| Gutter Width: | 1.50 | ft |
| Gutter Cross Slope: | 0.020 | ft/ft |
| Road Cross Slope: | 0.020 | ft/ft |
| Roughness Coefficient | 0.016 | |

| | | |
|---|---|---|
| Intercepted Flow: | 0.37 | cfs |
| Bypass Flow: | 0.13 | cfs |
| Spread: | 4.6 | ft |
| Depth: | 1.1 | in |
| Flow Area: | 0.2 | ft² |
| Gutter Depression: | 0.0 | in |
| Total Depression: | 0.0 | in |
| Velocity: | 2.37 | ft/s |
| Splash Over Velocity: | 6.30 | ft/s |
| Frontal Flow Factor: | 1.000 | |
| Side Flow Factor: | 0.154 | |
| Grate Flow Ratio: | 0.652 | |
| Equivalent Cross Slope: | 0.020 | ft/ft |
| Active Grate Length: | 2.3 | ft |
| Length Factor: | 0.039 | |
| Total Interception Length: | 19.1 | ft |

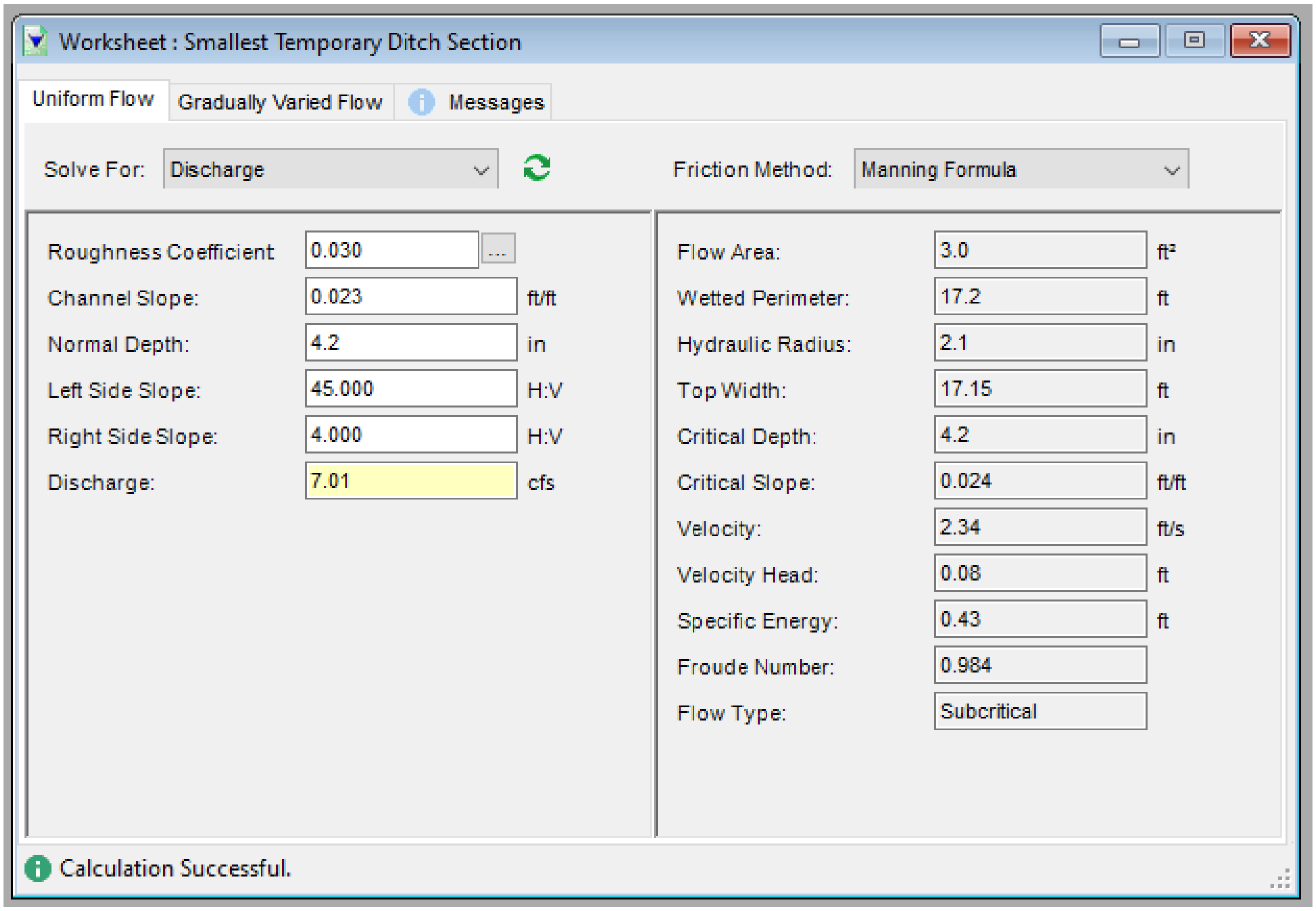
Options

Calculation Successful.


Worksheet : I1
Calculations
Messages
Solve For: Efficiency
Gutter
Inlet
Grate
Curb
Discharge: 0.70 cfs
Slope: 0.044 ft/ft
Gutter Width: 1.50 ft
Gutter Cross Slope: 0.020 ft/ft
Road Cross Slope: 0.020 ft/ft
Roughness Coefficient 0.016
Intercepted Flow: 0.49 cfs
Bypass Flow: 0.21 cfs
Spread: 4.8 ft
Depth: 1.1 in
Flow Area: 0.2 ft²
Gutter Depression: 0.0 in
Total Depression: 0.0 in
Velocity: 3.06 ft/s
Splash Over Velocity: 6.30 ft/s
Frontal Flow Factor: 1.000
Side Flow Factor: 0.103
Grate Flow Ratio: 0.634
Equivalent Cross Slope: 0.020 ft/ft
Active Grate Length: 2.3 ft
Length Factor: 0.030
Total Interception Length: 25.2 ft
Options
Calculation Successful.


Worksheet : I2
Calculations
Messages
Solve For: Efficiency
Gutter
Inlet
Grate
Curb
Discharge: 0.72 cfs
Slope: 0.044 ft/ft
Gutter Width: 1.50 ft
Gutter Cross Slope: 0.020 ft/ft
Road Cross Slope: 0.020 ft/ft
Roughness Coefficient 0.016
Intercepted Flow: 0.50 cfs
Bypass Flow: 0.22 cfs
Spread: 4.8 ft
Depth: 1.2 in
Flow Area: 0.2 ft²
Gutter Depression: 0.0 in
Total Depression: 0.0 in
Velocity: 3.08 ft/s
Splash Over Velocity: 6.30 ft/s
Frontal Flow Factor: 1.000
Side Flow Factor: 0.102
Grate Flow Ratio: 0.629
Equivalent Cross Slope: 0.020 ft/ft
Active Grate Length: 2.3 ft
Length Factor: 0.029
Total Interception Length: 25.5 ft
Options
Calculation Successful.

# Smallest Ditch Section of Temporary Ditch Along West Edge of Street B


Worksheet : Smallest Temporary Ditch Section

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Discharge

Friction Method: Manning Formula

| | | |
|---|---|---|
| Roughness Coefficient | 0.030 | |
| Channel Slope: | 0.023 | ft/ft |
| Normal Depth: | 4.2 | in |
| Left Side Slope: | 45.000 | H:V |
| Right Side Slope: | 4.000 | H:V |
| Discharge: | 7.01 | cfs |

| | | |
|---|---|---|
| Flow Area: | 3.0 | ft² |
| Wetted Perimeter: | 17.2 | ft |
| Hydraulic Radius: | 2.1 | in |
| Top Width: | 17.15 | ft |
| Critical Depth: | 4.2 | in |
| Critical Slope: | 0.024 | ft/ft |
| Velocity: | 2.34 | ft/s |
| Velocity Head: | 0.08 | ft |
| Specific Energy: | 0.43 | ft |
| Froude Number: | 0.984 | |
| Flow Type: | Subcritical | |

Calculation Successful.

# Appendix D

GEOTECHNICAL REPORT

# Geotechnical Engineering Report

**4.55 Acre Site Development**
**Livingston, MT**
May 7, 2021
Terracon Project No. 26215031

**Prepared for:**
Ruedebusch Development and Construction
Madison, WI

**Prepared by:**
Terracon Consultants, Inc.
Billings, Montana

May 7, 2021

Ruedebusch Development and Construction
4605 Dovetail Drive
Madison, WI 53704

Attn: Mr. Dave Hull
P: (608) 249-2012 ext. 232
E: DaveH@ruedebusch.com

Re: Geotechnical Engineering Report
4.55 Acre Site Development
PFL Way
Livingston, MT
Terracon Project No. 26215031

Dear Mr. Hull:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with revised Terracon Proposal No. P26215031 dated April 2, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
**Terracon Consultants, Inc.**

Jane O. Scott, E.I.T.
Staff Engineer

Gary W. Rome, P.E.
Senior Project Manager

## REPORT TOPICS



**Note:** This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

## ATTACHMENTS



**Note:** Refer to each individual Attachment for a listing of contents.

# Geotechnical Engineering Report

**4.55 Acre Site Development**
**PFL Way**
**Livingston, MT**
**Terracon Project No. 26215031**
**May 7, 2021**

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for development of the proposed 4.55 acre site to be located near PFL Way in Livingston, MT. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Site preparation and earthwork
- Excavation considerations
- Stormwater considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of fifteen test borings to depths ranging from approximately 6.5 to 41.5 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section.

## SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

| Item | Description |
|---|---|
| **Parcel Information** | The project is located near PFL Way in Livingston, Montana.<br>Latitude/Longitude (approximate): 45.6519° N, 110.6082° W<br>See **Site Location** |
| **Existing Improvements** | The site is currently undeveloped. |

| Item | Description |
|---|---|
| **Current Ground Cover** | Native grasses above an open pit location, including clay, sand, and gravel ground cover in pit area. |
| **Existing Topography** | The site is relatively flat, with a slight grade from the north/northwest toward the south/southeast with elevations ranging from 4.620 to 4,615 feet above mean sea level (MSL). |
| **Geology** | Subsurface conditions consist of near alluvium, mainly valley fill deposits consisting of clay, silt, sand and minor gravel with inclusions of glacial drift (cobbles/boulders). The alluvium is underlain by Upper Cretaceous claystone and interbedded sandstone of the Billman Creek Formation of the Livingston Group. |

# PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

| Item | Description |
|---|---|
| **Information Provided** | An email with supporting documents was received from Mr. Dave Hull on February 18, 2021 containing a site layout and a requested scope of services. Following delivery of the initial proposal, four (4) additional borings were requested by Mr. Hull on March 31, 2021. |
| **Proposed Structures** | The project includes:<br>■ A one-story, 18,540 square foot distribution building<br>■ Automobile parking, capacity 44 spaces to the west of the building<br>■ Van parking, capacity 6 spaces to the south of the building<br>■ 28-foot trailer parking, capacity 3 east of detention pond area<br>■ Tractor parking, capacity 2 north side of building<br>■ Dolly parking, capacity 3 east of detention pond<br>■ Loading/unloading spaces, capacity 3 north side of building<br>■ Potential fenced detention pond area, north of building |
| **Building Construction** | Proposed building construction not provided at time of report preparation. |
| **Maximum Loads** | Maximum column loads: 155 kips |
| **Below-Grade Structures** | None anticipated. |
| **Free-Standing Retaining Walls** | None specified at the time of report preparation |

| Item | Description |
|---|---|
| **Pavements** | Paved driveway and parking will be constructed on approximately 3 acres of the parcel.<br>Both rigid (concrete) and flexible (asphalt) pavement sections are considered.<br>Anticipated pavement types obtained from spreadsheet provided by Ruedebusch titled “Livingston SS CY21_202110227” dated April 21, 2021:<br>Type 1: all other pavement, heavy duty<br>■ Approx. 145,000 ESALs<br>Type 2: employee parking lot, light duty<br>■ Less than 100 ESALs<br>The pavement design period is assumed to be 10 years. |

# GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

| Model Layer | Layer Name | General Description |
|---|---|---|
| **1** | **Surficial Conditions** | Topsoil or fill encountered surficially in all borings. |
| **2** | **Clay** | Clay with varying amounts of sand and silt present in all borings except P-5. |
| **3** | **Sand** | Sand with varying amounts of clay and gravel present in P-5 and P-9. |
| **4** | **Sedimentary Bedrock** | Sandstone and/or claystone bedrock present in all borings except B-5. P-1, and P-3 through P-9. |

## Groundwater Conditions

The boreholes were observed while drilling for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results**, and are summarized on the following page.

| Boring Number | Approximate Depth to Groundwater while Drilling (feet) | Approximate Depth Bottom of Boring (feet) |
|---|---|---|
| B-1 | 6 | 21.5 |
| B-3 | 7 | 41.5 |
| B-5 | 7 | 21.5 |
| PD-1 | 15 | 26.5 |

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. Fluctuations in groundwater levels can best be determined by implementation of a groundwater monitoring plan. Such a plan would include installation of groundwater monitoring wells and periodic measurement of groundwater levels over a sufficient period of time.

### Laboratory Testing

Laboratory test results indicate that the clay soils tested exhibit swell potential ranging from approximately 0.2 to 0.8 percent when subjected to an applied load of 1,000 pounds per square foot (psf) at in-situ water contents. When exposed to increases in moisture content at an applied load of 1,000 psf, the clay soils exhibited swell potential ranging from 0.2 to 0.8 percent, followed by low to moderate compression at increased loadings up to 4 kips per square foot (ksf).

Laboratory test results indicate that a relatively undisturbed sample of the clay soil obtained from boring PD-1 at approximate depths of 5 to 7 feet exhibited a hydraulic conductivity of $1.85 \times 10^{-4}$ centimeters per second (cm/s) when placed under a confining pressure of approximately 500 psf.

The results of laboratory testing completed for this project can be found in the **Exploration Results** section of this report.

## GEOTECHNICAL OVERVIEW

Based on the results of our field investigation, laboratory testing program and geotechnical analyses, development of the site is considered feasible from a geotechnical viewpoint provided that the conclusions and considerations provided herein are incorporated into the design and construction of the project. We have identified the following geotechnical conditions that could impact design and construction of the proposed project.

The distribution building may be constructed on shallow foundations bearing on structural fill. Additional foundation and floor slab information pertaining to the structures can be found in the **Shallow Foundations** sections of this report. The **General Comments** section provides an understanding of the report limitations.

## Existing Fill Materials

Approximately 2 feet of existing fill material was encountered in Boring P-3. The fill material did not possess man-made debris to indicate fill, but was characterized as possible fill due to its texture. The fill depth presented in the boring log is approximate and the total depth, lateral extent, and composition of fill material present on the site may not become evident until construction and should be expected to vary across the site.

We do not possess any information regarding whether the fill encountered was placed under the observation of a geotechnical engineer. There is an inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered, resulting in movements that could cause distress to structures and pavements. Based on the results of our field exploration and laboratory testing, it is our opinion the fill materials should not be used to support foundations, floor slabs, or pavements without complete removal and replacement with compacted structural fill. Provided the owner is willing to accept an increased risk of movement, we have provided an option for partial removal and replacement of fill materials below pavements. After removal of existing fill, surfaces to receive structural fill should be prepared as recommended in the **Earthwork** section of this report.

To better characterize the extents of the fill material we recommend that test pits be excavated either before or during construction, and a representative of the geotechnical engineer be on site to observe test pit excavations to confirm that the existing fill is consistent with what was encountered in our borings. Additional removal and replacement may be required should unsuitable soils be encountered that differ from what was observed during our field exploration.

There exists the potential for construction debris and/or domestic trash to be encountered within the fill on some portions of the site. Because construction debris was not encountered in the borings drilled at this site, the potential for encountering construction debris and domestic trash is considered to be low. The fill materials should be observed for the presence of trash and debris during site grading and construction.

The existing fill materials can be reused as structural fill below foundations, floor slabs, and pavements provided it meets the requirements for structural fill in the **Earthwork** section. Further, some additional removal and replacement may be required if unsuitable or soft materials are exposed during removal of the fill materials.

### Low Strength Soils

Test boring data indicate that low strength soils may be locally present. Consequently, low strength soils could be encountered in excavations and these conditions may require some corrective work. Corrective work could involve removal and re-compaction or replacement, or the use of geotextiles. Lightweight equipment may be required to reduce subgrade pumping. In any event, Terracon should be contacted to observe excavations to evaluate conditions and to provide guidance concerning corrective work (if needed).

In addition, moisture infiltration to pavement subgrade combined with continued repetitive traffic may cause the on-site clay soils to become unstable and lead to premature pavement distress. To reduce the risk of pavement distress, we recommend that pavements be supported on a minimum of 6 inches of structural fill. We recommend that subgrade soils be designed and graded to provide positive drainage away from pavements.

### Groundwater

During our field exploration, groundwater was encountered in borings B-1, B-3, B-5, and PD-1 at depths ranging from 6 to 15 feet below existing site grades. Depending on site grading, groundwater could be encountered during construction, and if encountered, a temporary dewatering system consisting of well points or shallow trenches leading to a sump pit where the water could be removed by pumping will be necessary. The individual contractor(s) should be made aware of the possibility of encountering groundwater, and plan for dewatering during construction. If groundwater is encountered in foundation excavations, we recommend that a permanent foundation perimeter drain system be included in the design of the foundations.

## EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

### Site Preparation

Prior to placing fill, existing vegetation, root mat, and any deleterious material should be removed. Complete stripping of the topsoil should be performed within the limits of the proposed building and pavement areas.

Prior to the placement of fill, the subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Based on the results of laboratory testing, some of the clay soil has in-situ moisture contents in excess of the optimum moisture content. Mechanical mixing or air-drying of clay soils prior to placing and compacting as fill should be anticipated. If schedule does not allow time to moisture condition fill prior to placement, consideration should be given to importing structural fill.

### Existing Fill

As noted in **Geotechnical Characterization**, boring P-3 encountered existing fill to a depth of approximately 2 feet below existing grade. The fill appears to have been placed in a controlled manner, but we have no records to indicate the degree of control. Support of pavements, on or above existing fill soils, is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

If the owner elects to construct pavements on the existing fill, the following protocol should be followed. Once the planned subgrade elevation has been reached, the entire pavement area should be proofrolled. Areas of soft or otherwise unsuitable material should be undercut and replaced with either new structural fill or suitable, existing on site materials.

### Fill Material Types

Engineered fill required to achieve design grade should be classified as Structural Fill and general fill. Structural Fill is material used below, or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for Structural Fill and general fill should meet the following material property requirements:

| Soil Type [1] | USCS Classification | Acceptable Parameters |
|---|---|---|
| Granular | GW, GP, SW, SP (and dual symbols) | For Structural Fill: 100% passing 3-inch sieve, 30-60% passing No. 4 sieve; less than 10% passing No. 200 sieve |
| On-Site Soils [2] | CL, SP, SC, SM | The on-site sand and lean clay soils are suitable for use as general fill and structural fill including: site grading, utility trench and exterior foundation backfill of foundations, and pavement subgrade. |

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Significant moisture conditioning of the on-site clays may be necessary to meet compaction requirements; this will likely require mechanical mixing or air-drying to achieve proper moisture content and will be challenging during wet/cold seasons.

## Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

| Item | Structural Fill | General Fill |
|---|---|---|
| **Maximum Lift Thickness** | 8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used<br>4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used | Same as Structural Fill |
| **Minimum Compaction Requirements [1, 2, 3]** | 98% of max. below foundations<br>95% of max. foundation wall backfill, utility trench backfill, slab and pavement subgrades | Same as Structural Fill |
| **Water Content Range [1]** | Low plasticity cohesive: -2% to +2% of optimum<br>Granular: -3% to +3% of optimum | As required to achieve min. compaction requirements |

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D698).
2. Low and high plasticity cohesive fill should not be compacted to more than 100% of standard Proctor maximum dry density.
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison using local practices may be more appropriate. It should be noted that ASTM D698 allows for rock-correction of samples with up to 30% Retained on the 3/4” screen, but that this can lead to values not attainable in the field. ASTM allows for use of engineering judgement of field test strips.

## Utility Trench Backfill

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

## Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, roof leaks, and pavement distress.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure’s maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

## Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to construction.

The groundwater table could affect overexcavation efforts, especially for over-excavation and replacement of lower strength soils. A temporary dewatering system consisting of sumps with pumps could be necessary to achieve the recommended depth of over-excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

### Construction Observation and Testing

The earthwork efforts should be monitored under the direction of Terracon. Monitoring should include documentation of adequate removal of vegetation and topsoil, proof rolling, and mitigation of areas delineated by the proof roll to require mitigation.  Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by Terracon prior to placement of additional lifts.

In areas of foundation excavations, the bearing subgrade and exposed conditions at the base of the recommended over-excavation should be evaluated under the direction of Terracon. In the event that unanticipated conditions are encountered, Terracon should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of Terracon into the construction phase of the project provides the continuity to maintain Terracon's evaluation of subsurface conditions, including assessing variations and associated design changes.

## SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

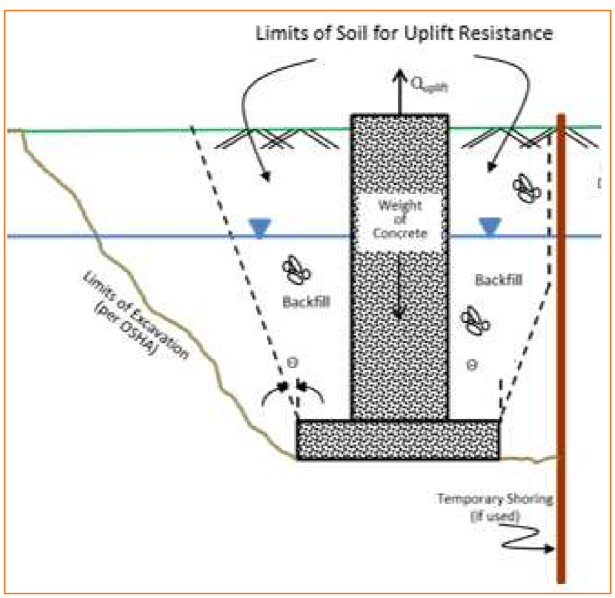
### Design Parameters – Compressive Loads

| Item | Description |
|---|---|
| **Maximum Allowable Bearing pressure** [1, 2] | 2,000 psf (foundations bearing on structural fill) |
| **Required Bearing Stratum** [3] | 2 feet of granular structural fill |
| **Minimum Foundation Dimensions** | Columns: 24 inches |
| **Ultimate Coefficient of Sliding Friction** [4] | 0.70 (granular structural fill) |
| **Minimum Embedment below Finished Grade** [5] | Exterior footings / unheated areas: 42 inches<br>Interior footings in heated areas: 24 inches |
| **Estimated Total Settlement from Structural Loads** [2] | Less than about 3/4 inch |
| **Estimated Differential Settlement** [2, 6] | About 1/2 of total settlement |

| Item | Description |
|---|---|
| 1. | Assumes proper preparation of bearing surface in accordance with **Site Preparation**. Based on a minimum factor of safety of 3. |
| 2. | Values provided are for maximum loads noted in **Project Description**. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, the quality of the earthwork operations, and maintaining uniform soil water content throughout the life of the structure. The estimated movements are based on maintaining uniform soil water content during the life of the structure. Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage and irrigation practices should be incorporated into the design and operation of the facility. Failure to maintain soil water content and positive drainage will nullify the movement estimates provided above. |
| 3. | Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in **Earthwork**. |
| 4. | Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. |
| 5. | Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure. |
| 6. | Differential settlement estimated for a column spacing of 50 feet. |

## Design Parameters - Uplift Loads

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, $\theta$, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 100 pcf should be used for the on-site soil backfill. This unit weight should be reduced to 38 pcf for portions of the backfill or natural soils below the groundwater elevation.

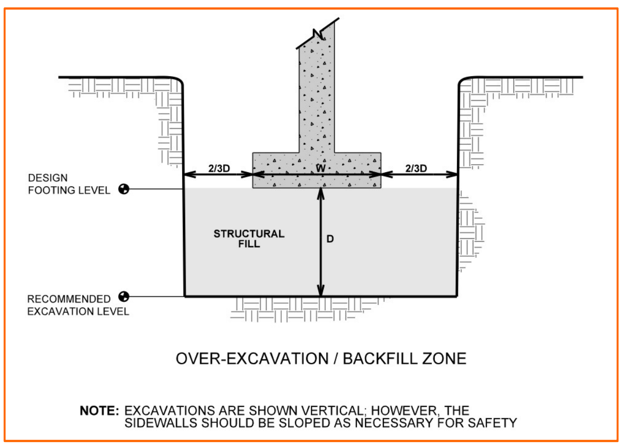


### Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with granular structural fill placed, as recommended in the **Earthwork** section.

To limit the intrusion of fines and improve constructability, we recommend a geotextile separator fabric, such as a Mirafi 180N or equivalent be placed at the granular structural fill/on-site clay soil interface. To limit the infiltration of surface water, we recommend exterior foundation walls be backfilled with the on-site clay materials.




## SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil and bedrock properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is C**. Subsurface explorations at this site were extended to a maximum depth of 41.5 feet. The site properties below the maximum boring depth of 41.5 feet to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

## FLOOR SLABS

Depending upon the finished floor elevation, unsuitable, weak, soft to medium stiff soils may be encountered at the floor slab subgrade level. These soils should be replaced with granular structural fill so the floor slab is supported on at least 1 foot of compacted granular structural fill.

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

### Floor Slab Design Parameters

| Item | Description |
|---|---|
| **Floor Slab Support** [1] | A minimum of 1 foot of granular structural fill, placed and compacted in accordance with the recommendations in **Earthwork**, |
| **Estimated Modulus of Subgrade Reaction** [2] | 200 pounds per square inch per inch (psi/in) for point loads |

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

### Floor Slab Construction Considerations

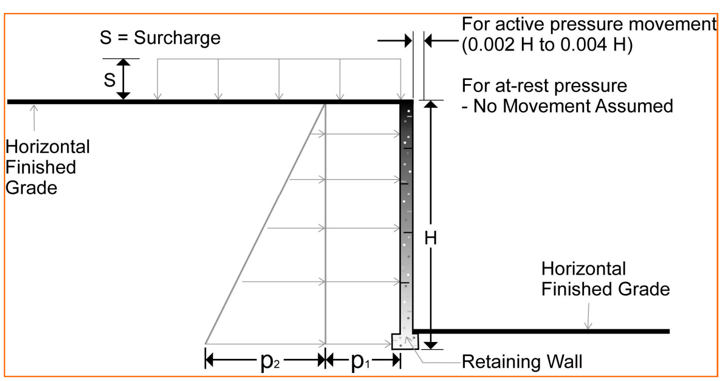
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

## LATERAL EARTH PRESSURES

### Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall rotation and is commonly used for below grade exterior walls and other walls restrained from movement. The recommended design lateral earth pressures below are applicable to cast-in-place concrete walls, do not include a factor of safety, and do not provide for possible hydrostatic pressure on the walls (unless stated). These recommendations are not applicable to the design of modular block – geogrid reinforced backfill walls and additional analyses and evaluation would be required.



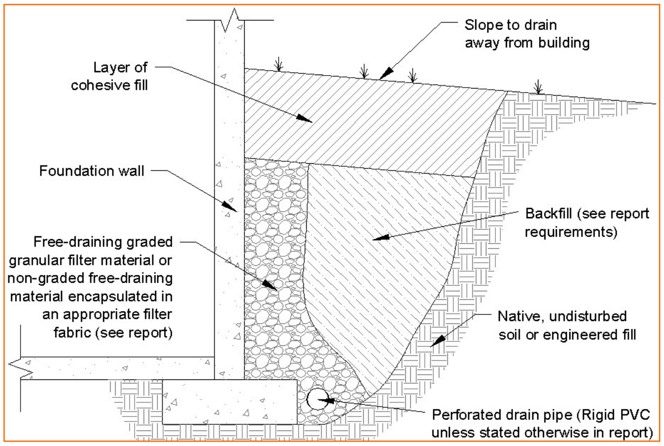
| Lateral Earth Pressure Design Parameters | | | | |
|---|---|---|---|---|
| Earth Pressure Condition [1] | Coefficient for Backfill Type[2] | Surcharge Pressure [3, 4, 5] $p_1$ (psf) | Effective Fluid Pressures (psf) [2, 4, 5] | |
| | | | Unsaturated [6] | Submerged [6] |
| Active (Ka) | Granular - 0.27 | (0.27)S | (35)H | (80)H |
| | Fine Grained - 0.49 | (0.49)S | (55)H | (85)H |
| At-Rest (Ko) | Granular - 0.43 | (0.43)S | (55)H | (90)H |
| | Fine Grained - 0.66 | (0.66)S | (70)H | (95)H |
| Passive (Kp) | Granular - 3.69 | --- | (480)H | (315)H |
| | Fine Grained - 2.04 | --- | (225)H | (160)H |

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95% of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 130 pcf and an angle of internal friction of 35° for granular structural fill, and a maximum unit weight of 110 pcf and an angle of internal friction of 20° for fine-grained on-site soils.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. To achieve “Unsaturated” conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. “Submerged” conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

## Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve, such as ASTM No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.




As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

# PAVEMENTS

## General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Based on the planned grading, we anticipate the onsite soils will be utilized in subgrade construction. A California Bearing Ratio (CBR) test has been performed on a disturbed bulk sample of the clay subgrade obtained from boring P-7 at an approximate depth of 1 to 4 feet below existing grade. This material was compacted at about 95 percent of the standard proctor maximum dry density at approximately optimum moisture. The moisture-density relationship and CBR test results are presented in the **Exploration Results** section.

## Pavement Design Parameters

A subgrade CBR of 2 was used for the AC pavement designs, based on laboratory testing of the clay subgrade soils encountered on site. A modulus of subgrade reaction of 60 pci was used for the PCC pavement designs. A modulus of rupture of 580 psi was used for pavement concrete.

Design of pavements for the project is based on procedures outlined in the AASHTO Guide for Design of Pavement Structures, 1993, coupled with publications by the Asphalt Institute and the American Concrete Institute on the design of parking lots and our local experience. Pavement design input parameters and resulting pavement sections are provided in the following tables:

| Design Criteria | Value |
|---|---|
| Roadway Classification | Private parking areas and drive lanes |
| Estimated Growth Factor Percentage | 1.0 |
| Provided ESALs – Light Duty | < 100 |
| Provided ESALs – Heavy Duty | 145,000 |

The following design parameters were utilized for pavement thickness design:

| Pavement Thickness Design Parameters | | |
|---|---|---|
| **Input Parameter** | **Flexible (asphalt)** | **Rigid (concrete)** |
| Reliability | 90% | 90% |
| Serviceability Loss | 2.2 | 2.0 |
| Standard Deviation | 0.45 | 0.35 |
| Asphalt Layer Coefficient | 0.41 | N/A |
| Aggregate Base Coefficient | 0.14 | N/A |
| Concrete Elastic Modulus($E_c$) | N/A | 3,605,000 psi |
| Concrete Modulus of Rupture ($S_c$) | N/A | 580 psi |
| Load Transfer Coefficient (J) | N/A | 3.8[1] |

1. The Load Transfer Coefficient value provided is based on jointed plain concrete pavement with doweled longitudinal and expansion joints at a spacing interval no greater than 15 feet. Also, doweled into the concrete curb and gutter.

## Pavement Section Thicknesses

Based on the parameters presented above, we recommend the following pavement sections be considered:

| Asphaltic Concrete Design | | |
|---|---|---|
| **Layer** | **Thickness (inches)** | |
| | **Type 1: Heavy Duty** [1] | **Type 2: Light Duty** [1] |
| AC [2] | 4 | 3 |
| Aggregate Base [3] | 12 | 6 |
| **Total Thickness** | **16** | **9** |

| Asphaltic Concrete Design | | |
|---|---|---|
| Layer | Thickness (inches) | |
| | Type 1: Heavy Duty [1] | Type 2: Light Duty [1] |

1. See **Project Description** for more specifics regarding Light Duty and Heavy Duty traffic.
2. All materials should meet the current Montana Public Works Standard Specifications (MPWSS) Section 2510.
3. A 1.5-inch minus base course meeting the requirements of MPWSS Section 02235 is recommended.

Prior to proceeding with construction of the pavement section, a passing proofroll of the subgrade should be documented. A Mirafi 180N or equivalent geotextile fabric should be placed at the natural fine-grained soil/Structural Fill interface to limit the intrusion of fines into the base course and improve constructability.

Asphalt concrete should be composed of aggregate, filler, and additives (if required), with approved bituminous material. The asphalt concrete should conform to approved mix design which include volumetrics, Marshall Properties, optimum asphalt content, project mix formula, and recommended mixing and placing temperatures. The asphalt concrete should be consistent with an approved mix design conforming to MPWSS. Aggregate used in the asphalt should meet MPWSS for quality and gradation.

Asphalt material should be placed in lifts of not more than 3 inches and should be compacted to the minimum standards outlined in the MPWSS. In addition, the average of the density tests should be a minimum of 93 percent with no single test below 92 percent of the maximum theoretical maximum, as determined by ASTM D2041.

The recommended sections in this report are based on the selected parameters presented herein and Terracon's experience with similar projects and soil conditions. Parameters may vary with the specific project and material source. Variation of these parameters may change the thickness of the pavement sections presented. If traffic details differ substantially from those presented above, Terracon should be notified to re-evaluate the recommendations provided.

| Portland Cement Concrete Design | | |
|---|---|---|
| Layer | Thickness (inches) | |
| | Type 1: Heavy Duty [1] | Type 2: Light Duty [1] |
| PCC [2] | 7 | 5 |
| Aggregate Base [3] | 6 | 6 |
| **Total Thickness** | **13** | **11** |

| Portland Cement Concrete Design | | |
|---|---|---|
| Layer | Thickness (inches) | |
| | Type 1: Heavy Duty [1] | Type 2: Light Duty [1] |

1. See **Project Description** for more specifics regarding Light Duty and Heavy Duty traffic.
2. All materials should meet the current Montana Public Works Standard Specifications (MPWSS).
3. A 1.5-inch minus base course meeting the requirements of MPWSS Section 02235 is recommended.

Portland cement concrete should meet the requirements of MPWSS. It is recommended concrete for rigid pavements have a minimum 28-day compressive strength of 4,000 psi and be placed with a maximum slump of 4 inches. The pavement concrete slabs should be steel reinforced and sufficient joint provisions should be included in the design to prevent potential issues related to expansion and contraction of the concrete. Steel reinforcement and joint spacing should be assessed by the Structural Engineer for the project. Although not required for structural support, the minimum 6-inch thick base course layer recommended below concrete pavements will help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints.

Pavement design methods are intended to provide structural sections with adequate thickness over a subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of the clay subgrades such as the soils encountered in the borings. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to the shrink/swell related movement of the subgrade. It is, therefore, important to minimize moisture changes in the subgrade to reduce shrink/swell movements.

Openings in pavements, such as decorative landscape areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands and raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

## Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Based on the groundwater elevations encountered during the field investigation, we do not anticipate groundwater will affect long-term pavement performance. Therefore, installation of subdrains beneath the pavement footprint is not recommended.

### Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

## FROST CONSIDERATIONS

The fine-grained soils on this site are frost susceptible, and small amounts of water can affect the performance of the slabs on-grade, sidewalks, and pavements. Exterior slabs should be anticipated to heave during winter months. If frost action needs to be eliminated in critical areas, we recommend the use of non-frost susceptible (NFS) fill or structural slabs (for instance, structural stoops in front of building doors). Placement of NFS material in large areas may not be feasible; however, the following recommendations are provided to help reduce potential frost heave:

- Provide surface drainage away from the building and slabs, and toward the site storm drainage system.
- Install drains around the perimeter of the building, stoops, below exterior slabs and pavements, and connect them to the storm drainage system.
- Grade clayey subgrades, so groundwater potentially perched in overlying more permeable subgrades, such as sand or aggregate base, slope toward a site drainage system.
- Place NFS fill as backfill beneath slabs and pavements critical to the project.
- Place a 3 horizontal to 1 vertical (3H:1V) transition zone between NFS fill and other soils.
- Place NFS materials in critical sidewalk areas.

As an alternative to extending NFS fill to the full frost depth, consideration can be made to placing extruded polystyrene or cellular concrete under a buffer of at least 2 feet of NFS material.

## CORROSIVITY

The table below lists the results of laboratory soluble sulfate, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

**Corrosivity Test Results Summary**

| Boring | Sample Depth (feet) | Soil Description | Soluble Sulfate (%) | Electrical Resistivity [1] (Ω-cm) | pH |
|---|---|---|---|---|---|
| B-2 | 2.5 – 4.0 | CL | 0.03 | 1,620 | 8.1 |
| B-4 | 2.5 – 4.0 | CL | 2.00 | 328 | 7.5 |

1. Performed on a saturated sample of soil.

Results of water-soluble sulfate testing indicate that samples of the on-site soils have an exposure class of S2 when classified in accordance with Table 19.3.1.1 of the American Concrete Institute (ACI) Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 19.

To improve sulfate resistance of concrete in severe sulfate exposure when Type V cement is not available, the following should be considered:

- Use of Type I-II modified cement for sulfate resistance

- Cement should have a tricalcium aluminate content of not more than 8%.
- Concrete mixture should contain at least 20% Class F fly ash.
- Provide air-entrainment of 4% to 7% by volume.
- Lower the water to cement ratio to 0.4 to 0.45.

## GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

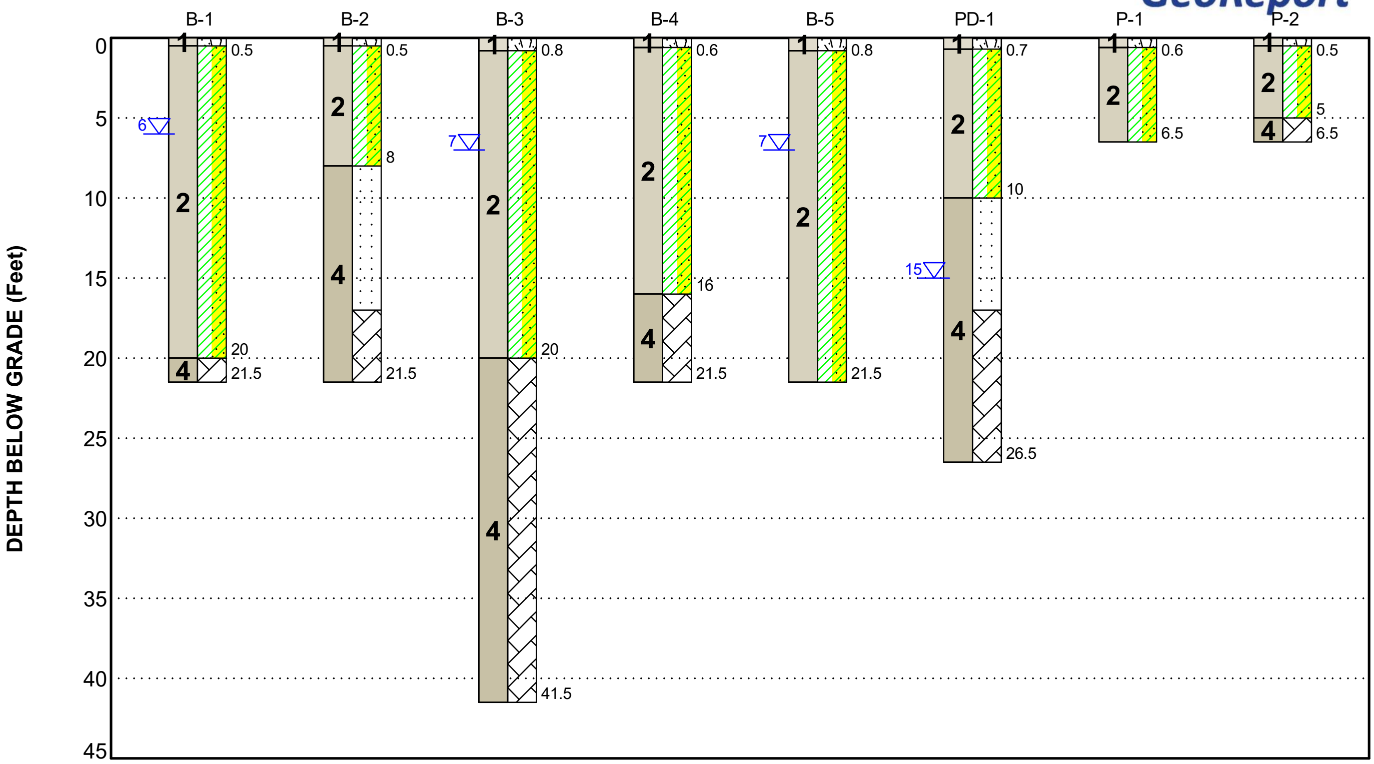
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

# FIGURES

**Contents:**

## GEOMODEL

**4.55 Acre Site ■ Livingston, MT**
**Terracon Project No. 26215031**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Surficial Conditions | Topsoil or fill encountered surficially in all borings. |
| 2 | Clay | Clay with varying amounts of sand and silt present in all borings except P-5. |
| 3 | Sand | Sand with varying amounts of clay and gravel present in P-5 and P-9. |
| 4 | Sedimentary Bedrock | Sandstone and/or claystone present in all borings except B-5, P-1, and P-3 through B-9. |

## LEGEND

Topsoil
Sandstone
Lean Clay with Sand
Claystone

First Water Observation

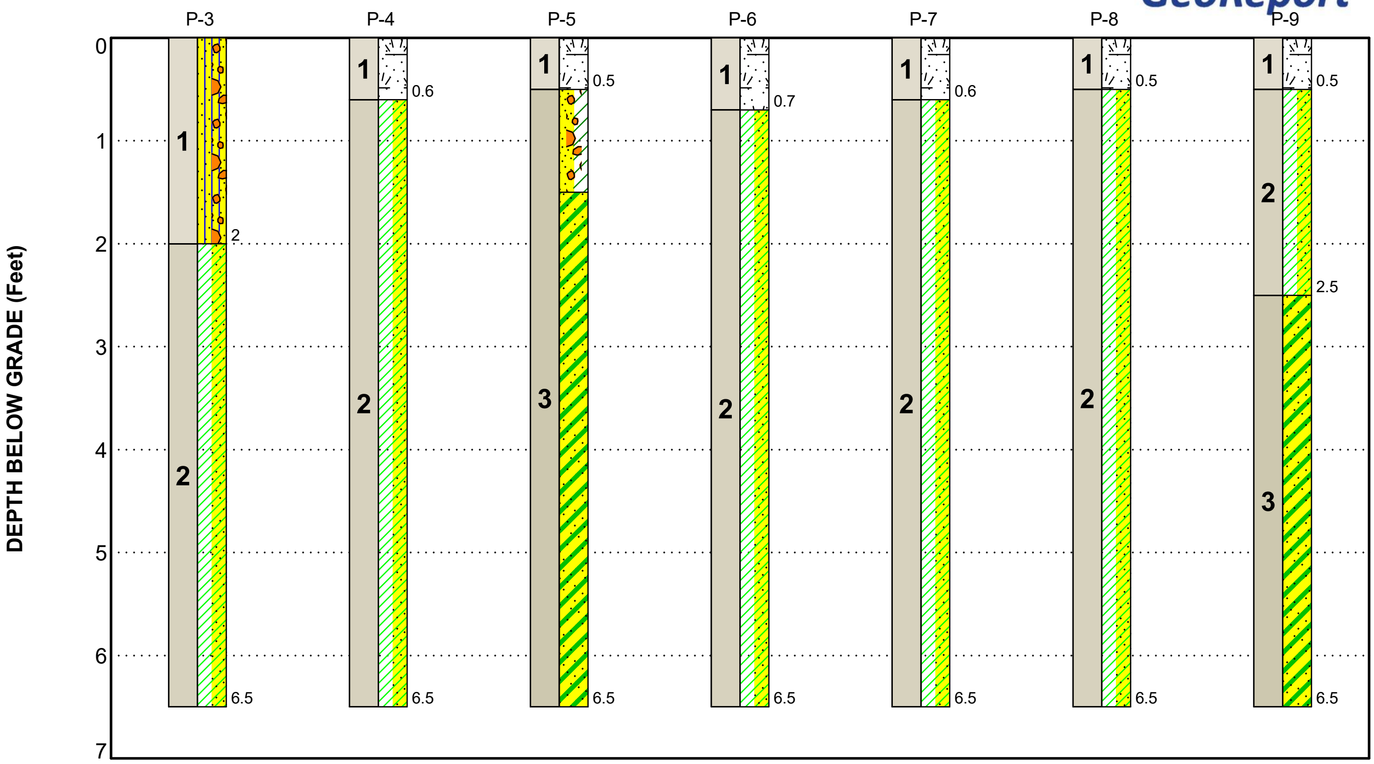
Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

## GEOMODEL

4.55 Acre Site ■ Livingston, MT
Terracon Project No. 26215031

Terracon GeoReport

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| 4 | Sedimentary Bedrock | Sandstone and/or claystone present in all borings except B-5, P-1, and P-3 through B-9. |

## LEGEND

Silty Sand with Gravel

Poorly-graded Sand with Clay and Gravel

Lean Clay with Sand

Clayey Sand

Topsoil

First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

# ATTACHMENTS

# EXPLORATION AND TESTING PROCEDURES

## Field Exploration

| Number of Borings | Boring Depth (feet) | Planned Location |
|---|---|---|
| 5 | 21.5 to 41.5 | Building Center and Corners |
| 1 | 26.5 | Detention Pond Area |
| 9 | 6.5 | Pavement Areas |

**Boring Layout and Elevations:** The locations of the borings were originally laid out by Terracon personnel using a handheld GPS unit (estimated horizontal accuracy of about ±10 feet). If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

**Subsurface Exploration Procedures:** We advanced the borings with a truck-mounted drill rig using continuous-flight, hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

## Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to better understand the engineering properties of the various soil and rock strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D2166 Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
- ASTM D2435 Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
- ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$ (600 kN-m/m$^3$))
- ASTM D1883 Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
- ASTM D5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- Resistivity, pH, and soluble sulfate content

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Rock classification was conducted using locally accepted practices for engineering purposes. Boring log rock classification was determined using the Description of Rock Properties.

# SITE LOCATION AND EXPLORATION PLANS

**Contents:**



Note: All attachments are one page unless noted above.

**SITE LOCATION**

4.55 Acre Site Development ■ Livingston, MT
May 7, 2021 ■ Terracon Project No. 26215031

Terracon GeoReport

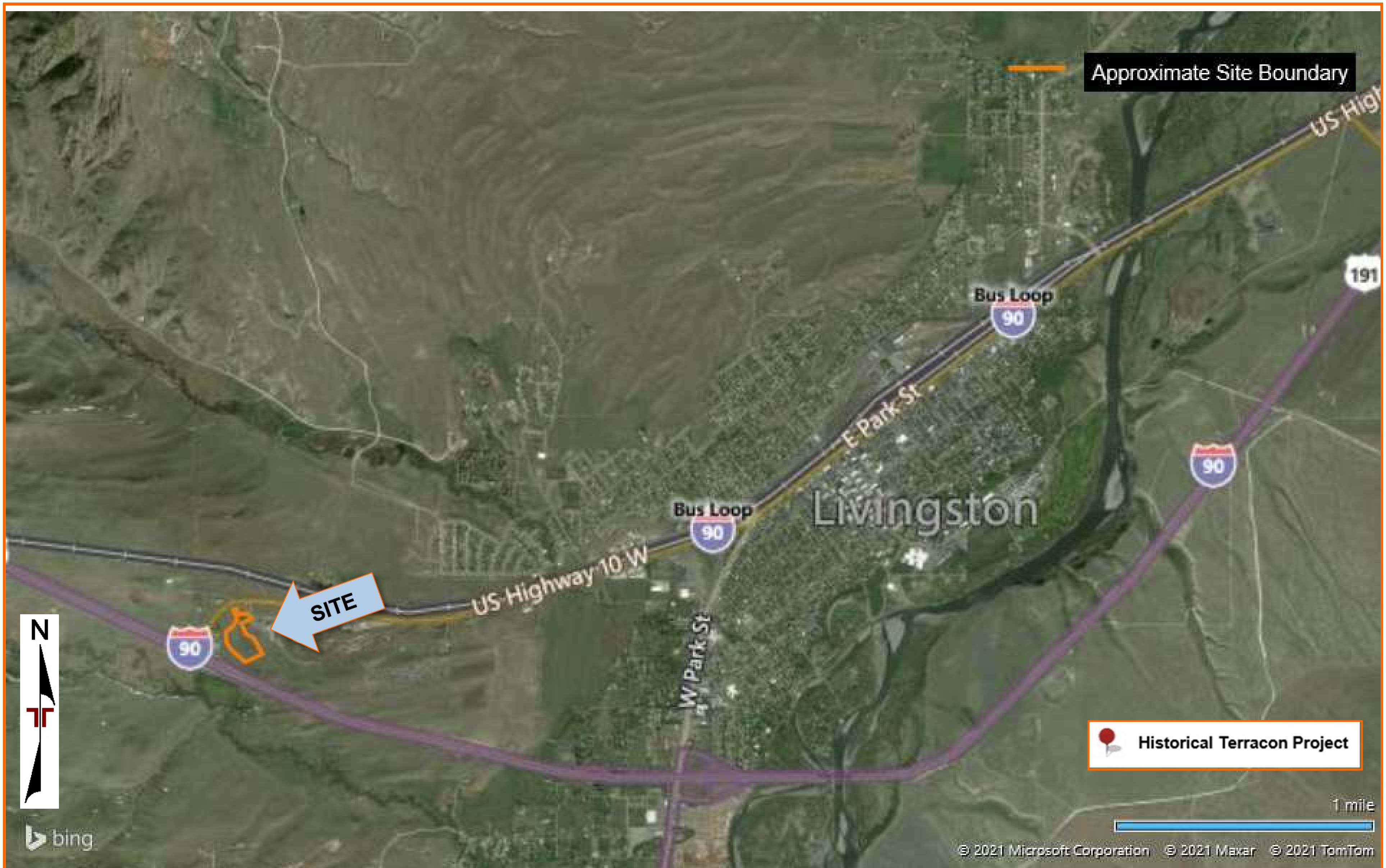



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

## EXPLORATION PLAN

4.55 Acre Site Development ■ Livingston, MT
May 7, 2021 ■ Terracon Project No. 26215031

Terracon GeoReport

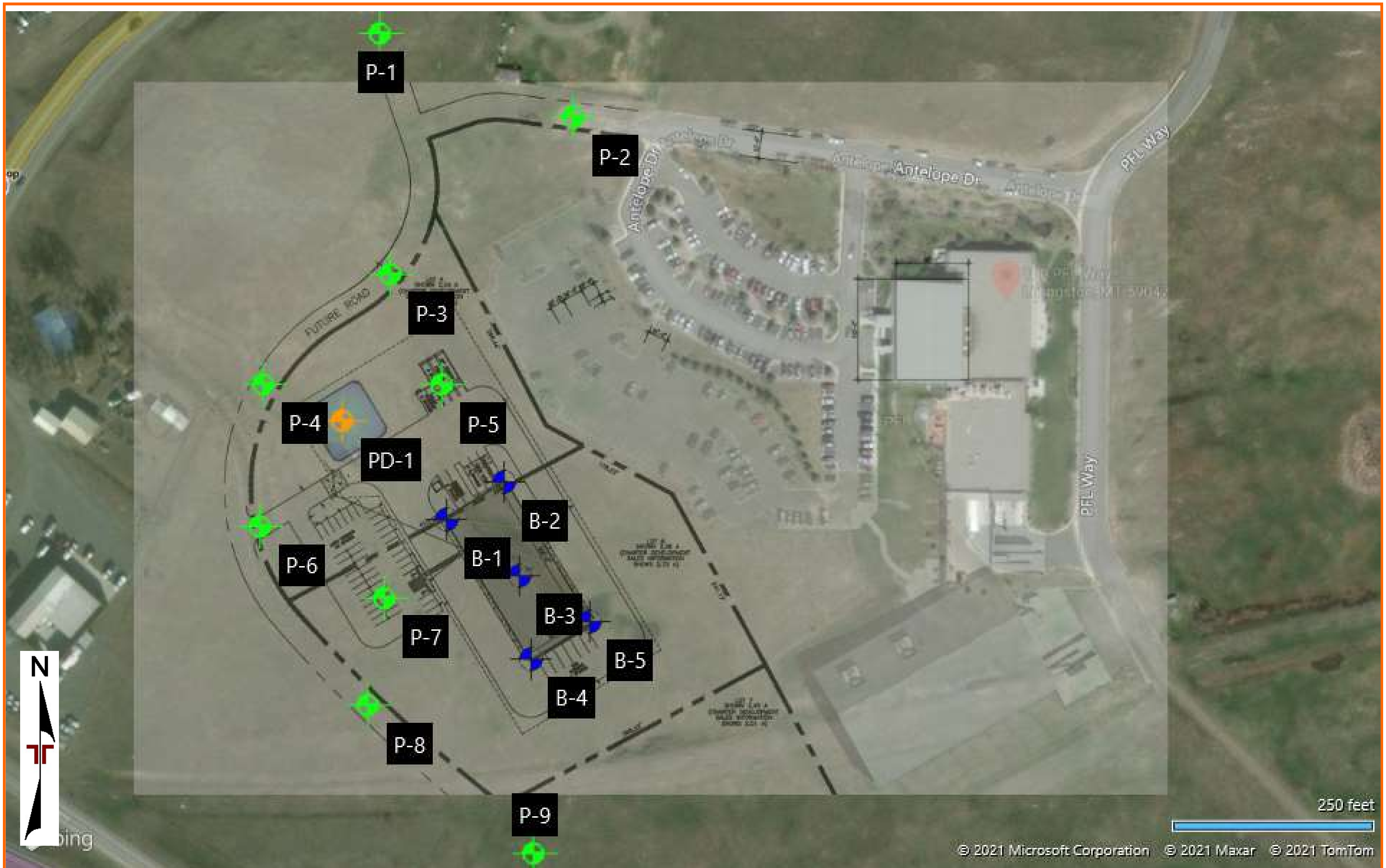



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

# EXPLORATION RESULTS

**Contents:**



Note: All attachments are one page unless noted above.

# BORING LOG NO. B-1



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction**
**Madison, WI**

**SITE: Near PFL Way**
**Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6521° Longitude: -110.6087°

| MODEL LAYER | DEPTH | DESCRIPTION |
|---|---|---|
| 1 | 0.5 | **TOPSOIL**, dark brown, moist |
| 2 | 20.0 | **LEAN CLAY WITH SAND (CL)**, brown to light purplish gray, moist to wet, medium stiff to very stiff |
| 4 | 21.5 | **SEDIMENTARY BEDROCK - CLAYSTONE**, dark purplish brown, wet |

***Boring Terminated at 21.5 Feet***

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|
| | | | 2-4-5 N=9 | | 23.9 | | | |
| | | | 4-5-5 N=10 | | 24.1 | | | |
| 5 | ∇ | | 3-2-3 N=5 | | 23.4 | | | |
| | | | 2-3-3 N=6 | | | | | |
| 10 | | | 2-2-6 N=8 | | | | | |
| 15 | | | 5-9-14 N=23 | | | | | |
| 20 | | | 25-22-40 N=62 | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 20' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

∇ *While drilling*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-12-2021 | Boring Completed: 04-12-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. B-2



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6522° Longitude: -110.6084°

| MODEL LAYER | DEPTH | Description | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5 | **TOPSOIL**, dark brown, moist | | | | | | | | | |
| 2 | 8.0 | **LEAN CLAY WITH SAND (CL)**, dark brown, moist, very stiff | | | | 4-6-9 N=15 | | 24.4 | | | |
| | | | | | | 5-7-8 N=15 | | 10.5 | | | |
| | | | 5 | | | | | | | | |
| 4 | 17.0 | **SANDSTONE**, light brown to light gray, moist | | | | 7-22-43 N=65 | | 11.1 | | | |
| | | | 10 | | | 50 | | 3.1 | | | |
| | | | 15 | | | 50/4" | | | | | |
| | 21.5 | **SEDIMENTARY BEDROCK - CLAYSTONE**, light gray to light purple, moist | 20 | | | 20-33-50/5" | | 15.4 | | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 20' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-12-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. B-3



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction**
**Madison, WI**

**SITE: Near PFL Way**
**Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6519° Longitude: -110.6083°

| MODEL LAYER | DEPTH | Description |
|---|---|---|
| 1 | 0.8 | **TOPSOIL**, dark brown, moist |
| 2 | 20.0 | **LEAN CLAY WITH SAND (CL)**, dark brown to light purplish gray, moist to wet, medium stiff to very stiff |
| 4 | | **SEDIMENTARY BEDROCK - CLAYSTONE**, light gray to light gray, wet |

Depth scale (Ft.): 5, 10, 15, 20, 25

| FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|
| 2-3-3 N=6 | | 23.4 | | | |
| 3-3-4 N=7 | | 27.2 | | | |
| | 250 | 31.5 | 100 | 46-23-23 | 79 |
| 4-4-5 N=9 | | | | | |
| 2-3-4 N=7 | | | | | |
| 3-7-10 N=17 | | | | | |
| 14-27-26 N=53 | | | | | |
| 19-39-50 N=89 | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 40' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *While drilling*

Terracon
2110 Overland Ave Ste 124
Billings, MT

Boring Started: 04-12-2021

Boring Completed: 04-12-2021

Drill Rig: BK-81

Driller: Haztech

Project No.: 26215031

# BORING LOG NO. B-3



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6519° Longitude: -110.6083°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | **SEDIMENTARY BEDROCK - CLAYSTONE**, light gray to light gray, wet *(continued)* | 30 | | | 29-50 | | | | | |
| | | | 35 | | | 12-22-49 N=71 | | | | | |
| | | 41.5 | 40 | | | 13-20-30 N=50 | | | | | |
| | | ***Boring Terminated at 41.5 Feet*** | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 40' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*While drilling*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-12-2021 | Boring Completed: 04-12-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 26215031 4.55 ACRE SITE.GPJ TERRACON_DATATEMPLATE.GDT 4/30/21

# BORING LOG NO. B-4



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6516° Longitude: -110.6082°

| MODEL LAYER | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.6 | **TOPSOIL**, light brown, moist | | | | | | | | | |
| 2 | | **LEAN CLAY WITH SAND (CL)**, light brown to brown, moist, medium stiff to very stiff | | | X | 3-2-3 N=5 | | 14.7 | | | |
| | | | | | X | 6-6-7 N=13 | | 16.4 | | | |
| | | | 5 | | X | 4-5-5 N=10 | | 21.2 | | | |
| | | | | | X | 3-4-4 N=8 | | 19.7 | | | |
| | | | 10 | | X | 7-10-9 N=19 | | 21.9 | | | |
| | 16.0 | | 15 | | X | 10-17-19 N=36 | | 19.3 | | | |
| 4 | | **SEDIMENTARY BEDROCK - CLAYSTONE**, gray with purple, moist | | | | | | | | | |
| | 21.5 | | 20 | | X | 18-27-29 N=56 | | 16.8 | | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 20' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-12-2021 | Boring Completed: 04-12-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. B-5



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6518° Longitude: -110.6080°

| MODEL LAYER | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.8 | **TOPSOIL**, dark brown, moist | | | Split spoon | 2-3-4 N=7 | | 21.9 | | | |
| 2 | | **LEAN CLAY WITH SAND (CL)**, dark brown to brown, moist to wet, medium stiff to very stiff | | | Split spoon | 4-5-5 N=10 | | 22.9 | | | |
| | | | 5 | ▽ | Shelby tube | | 850 | 32.8 | 88 | 46-22-24 | 74 |
| | | | | | Split spoon | 2-2-2 N=4 | | | | | |
| | | | 10 | | Split spoon | 2-3-4 N=7 | | | | | |
| | | | 15 | | Split spoon | 12-14-10 N=24 | | | | | |
| | 21.5 | | 20 | | Split spoon | 7-12-14 N=26 | | | | | |

***Boring Terminated at 21.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 20' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *While drilling*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-12-2021 | Boring Completed: 04-12-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 26215031 4.55 ACRE SITE.GPJ TERRACON_DATATEMPLATE.GDT 4/30/21

# BORING LOG NO. PD-1



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6524° Longitude: -110.6092°

| MODEL LAYER | DEPTH | Description | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.7 | **TOPSOIL**, dark brown, moist | | | 2-4-4 N=8 | | 15.9 | | | |
| 2 | 10.0 | **LEAN CLAY WITH SAND (CL)**, light brown, moist, medium stiff to stiff | | | 3-3-4 N=7 | | 17.8 | | | |
| | | | | | 4-4-8 N=12 | | 15.3 | | | |
| | 17.0 | **SANDSTONE**, light brown, moist to wet | 10 | | 15-19-50/4" | | 11.7 | | | |
| | | | 15 | ▽ | 50/2" | | | | | |
| 4 | 26.5 | **SEDIMENTARY BEDROCK - CLAYSTONE**, light gray to light brown, wet | 20 | | 34-50 | | | | | |
| | | | 25 | | 50 | | | | | |

***Boring Terminated at 26.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 25' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *While drilling*

Terracon
2110 Overland Ave Ste 124
Billings, MT

Boring Started: 04-13-2021

Boring Completed: 04-13-2021

Drill Rig: BK-81

Driller: Haztech

Project No.: 26215031

# BORING LOG NO. P-1



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6538° Longitude: -110.6090°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.6 **TOPSOIL**, light brown to light gray, moist | | | | | | | | | |
| 2 | | **LEAN CLAY WITH SAND (CL)**, light brown to light gray, moist, stiff to hard | | | | 3-4-6 N=10 | | 19.6 | | | |
| | | | | | | 11-14-17 N=31 | | 15.2 | | | |
| | | 6.5 | 5 | | | 17-25-26 N=51 | | 12.7 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-2



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction
Madison, WI**

**SITE: Near PFL Way
Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6535° Longitude: -110.6080°

| MODEL LAYER | DEPTH | Description | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5 | **TOPSOIL**, light brown, moist | | | | | | | | | |
| 2 | 5.0 | **LEAN CLAY WITH SAND (CL)**, light gray to light brown, moist, medium stiff to stiff | | | | 3-5-5 N=10 | | 14.6 | | | |
| | | | | | | 4-4-3 N=7 | | 14.5 | | | |
| 4 | 6.5 | **SEDIMENTARY BEDROCK - CLAYSTONE**, light gray to light brown, moist | 5 | | | 13-30-37 N=67 | | 10.8 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

Boring Started: 04-13-2021

Boring Completed: 04-13-2021

Drill Rig: BK-81

Driller: Haztech

Project No.: 26215031

# BORING LOG NO. P-3



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6529° Longitude: -110.6089°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **FILL - SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained, rounded, brown, moist, medium dense | | | | 10-7-4 N=11 | | | | | |
| | | 2.0 | | | | | | | | | |
| 2 | | **LEAN CLAY WITH SAND (CL)**, light brown, moist, very stiff | | | | 7-10-13 N=23 | | 13.6 | | | |
| | | | 5 | | | 11-13-13 N=26 | | 16.7 | | | |
| | | 6.5 | | | | | | | | | |
| | | ***Boring Terminated at 6.5 Feet*** | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-4



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6526° Longitude: -110.6095°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.6 **TOPSOIL**, dark brown, moist | | | | | | | | | |
| 2 | | **LEAN CLAY WITH SAND (CL)**, brown, moist, stiff | | | X | 2-5-6 N=11 | | 17.3 | | | |
| | | | | | X | 4-5-4 N=9 | | 10.7 | | | |
| | | 6.5 | 5 | | X | 5-5-5 N=10 | | 9.5 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-5



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6526° Longitude: -110.6087°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.5 | **TOPSOIL**, dark brown | | | | | | | | | |
| 3 | | 1.5 | **POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC)**, fine to coarse grained, rounded, brown, moist, medium dense | | | X | 6-7-8 N=15 | | 9.8 | | | |
| | | 6.5 | **CLAYEY SAND (SC)**, fine grained, light gray to light purple, moist, medium dense to very dense | | | X | 3-10-8 N=18 | | 11.3 | | | |
| | | | | 5 | | X | 8-16-40 N=56 | | 11.5 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-6



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6521° Longitude: -110.6096°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.7 | **TOPSOIL**, dark brown, moist | | | | | | | | | |
| 2 | | 6.5 | **LEAN CLAY WITH SAND (CL)**, brown, moist | | | X | 2-4-9 N=13 | | 19.4 | | | |
| | | | | | | X | 10-13-10 N=23 | | 22.4 | | | |
| | | | | 5 | | X | 6-5-6 N=11 | | 20.6 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-7



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6518° Longitude: -110.6090°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.6 | **TOPSOIL**, dark brown, moist | | | | | | | | | |
| 2 | | | **LEAN CLAY WITH SAND (CL)**, dark brown, moist, medium stiff to stiff | | | | 2-2-2 N=4 | | 20.5 | | | |
| | | | | | | | | | | | 43-18-25 | 81 |
| | | | | | | | 7-8-7 N=15 | | 17.9 | | | |
| | | 6.5 | | 5 | | | 4-4-5 N=9 | | 20.4 | | | |

***Boring Terminated at 6.5 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-8



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction**
**Madison, WI**

**SITE: Near PFL Way**
**Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6515° Longitude: -110.6090°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.5 | **TOPSOIL**, dark brown, moist | | | | 2-2-2 N=4 | | 21.8 | | | |
| 2 | | | **LEAN CLAY WITH SAND (CL)**, dark brown, moist | | | | 5-6-5 N=11 | | 11.4 | | | |
| | | 6.5 | | 5 | | | 4-7-9 N=16 | | 28.1 | | | |
| | | | ***Boring Terminated at 6.5 Feet*** | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

# BORING LOG NO. P-9



**PROJECT: 4.55 Acre Site**

**CLIENT: Ruedebusch Development & Construction Madison, WI**

**SITE: Near PFL Way Livingston, MT**

LOCATION See Exploration Plan

Latitude: 45.6510° Longitude: -110.6082°

| MODEL LAYER | GRAPHIC LOG | DEPTH | DESCRIPTION | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | UNCONFINED COMPRESSIVE STRENGTH (psf) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.5 | **TOPSOIL**, dark brown, moist | | | | | | | | | |
| 2 | | 2.5 | **LEAN CLAY WITH SAND (CL)**, dark brown, moist, medium stiff to stiff | | | X | 2-2-2 N=4 | | 18.9 | | | |
| 3 | | 6.5 | **CLAYEY SAND (SC)**, fine grained, light brown, moist, medium dense | | | X | 2-4-7 N=11 | | 12.1 | | | |
| | | | | 5 | | X | 7-8-8 N=16 | | 10.4 | | | |
| | | | ***Boring Terminated at 6.5 Feet*** | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 - 5' Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
2110 Overland Ave Ste 124
Billings, MT

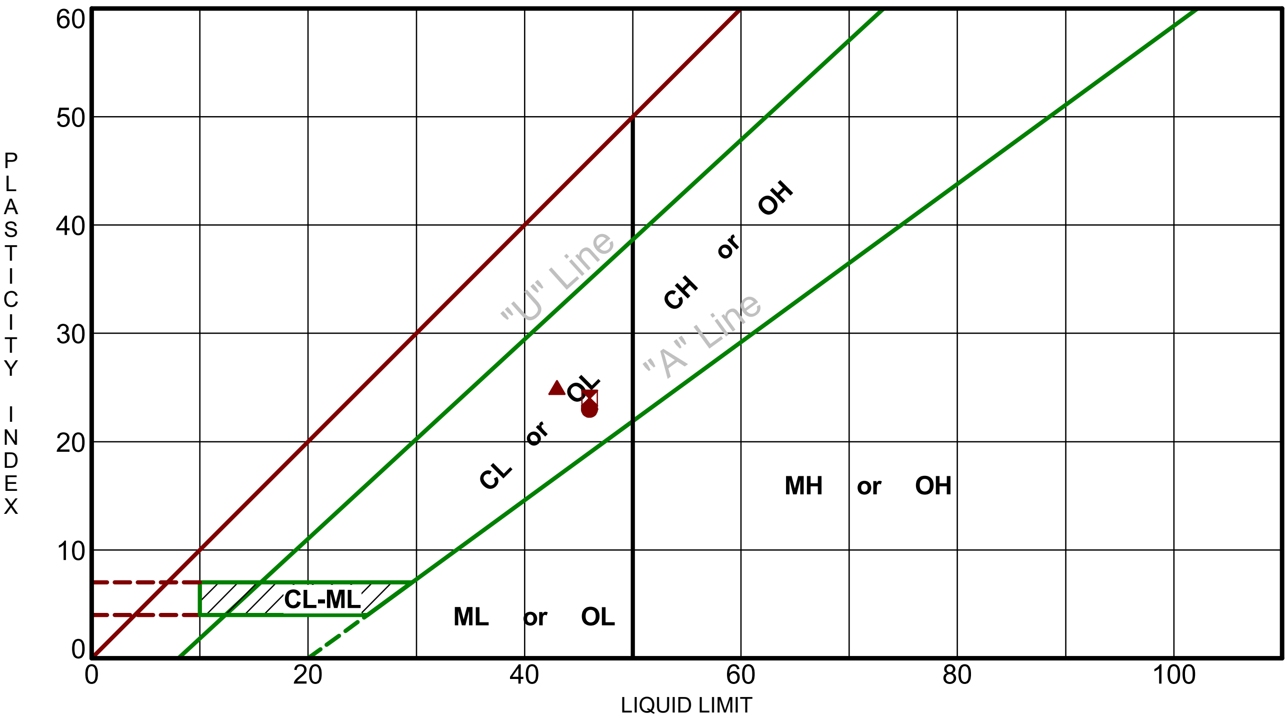
| | |
|---|---|
| Boring Started: 04-13-2021 | Boring Completed: 04-13-2021 |
| Drill Rig: BK-81 | Driller: Haztech |
| Project No.: 26215031 | |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 26215031 4.55 ACRE SITE.GPJ TERRACON_DATATEMPLATE.GDT 4/30/21

# ATTERBERG LIMITS RESULTS

ASTM D4318






| | Boring ID | Depth | LL | PL | PI | Fines | USCS | Description |
|---|---|---|---|---|---|---|---|---|
| ● | B-3 | 5 - 7 | 46 | 23 | 23 | 78.7 | CL | LEAN CLAY with SAND |
| ⊠ | B-5 | 5 - 7 | 46 | 22 | 24 | 74.2 | CL | LEAN CLAY with SAND |
| ▲ | P-7 | 1 - 4 | 43 | 18 | 25 | 81.2 | CL | LEAN CLAY with SAND |



PROJECT: 4.55 Acre Site

SITE: Near PFL Way
Livingston, MT

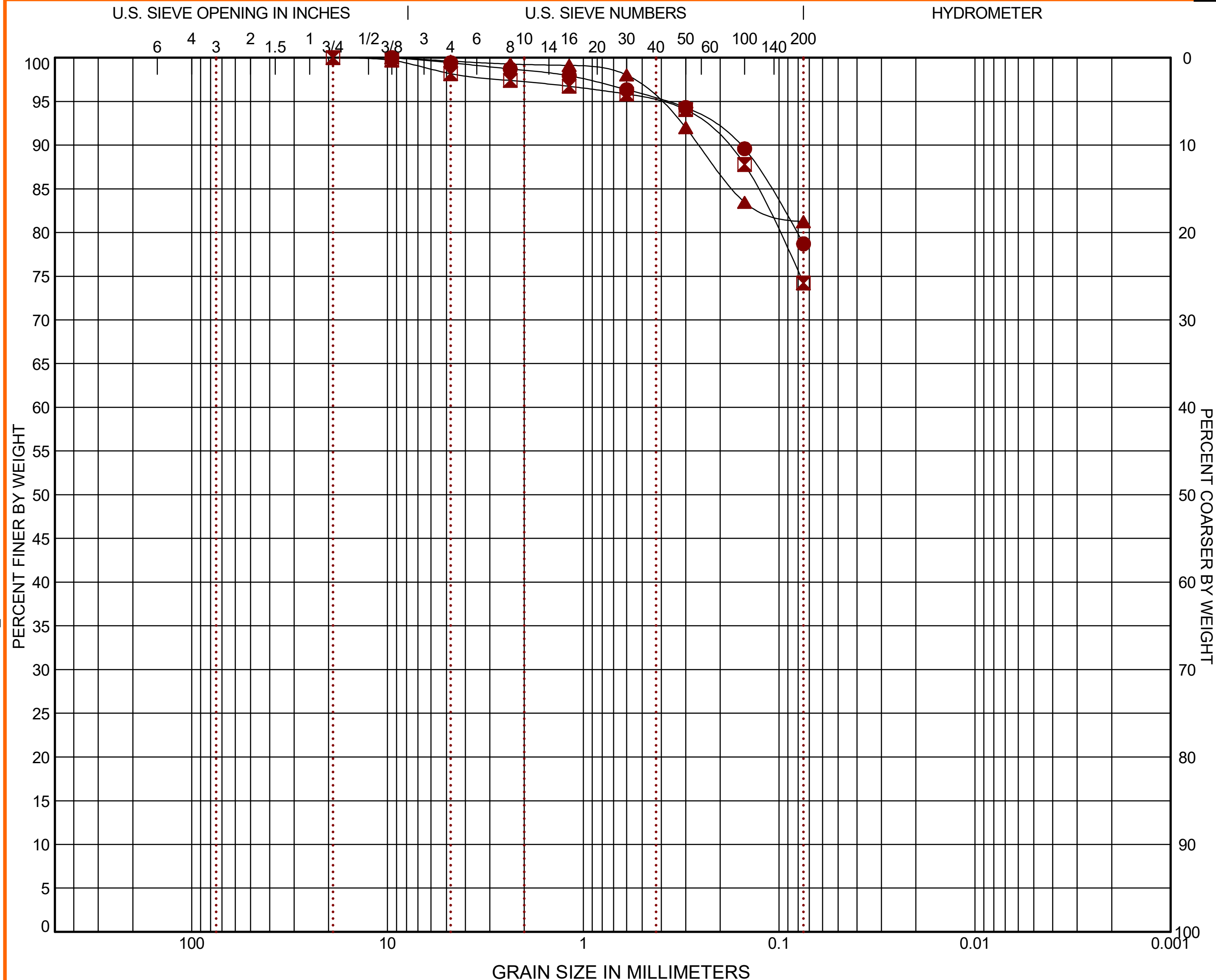
Terracon
2110 Overland Ave Ste 124
Billings, MT

PROJECT NUMBER: 26215031

CLIENT: Ruedebusch Development & Construction
Madison, WI

# GRAIN SIZE DISTRIBUTION

**ASTM D422**




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | BORING ID | DEPTH | % COBBLES | % GRAVEL | % SAND | % SILT | % FINES | % CLAY | USCS |
|---|---|---|---|---|---|---|---|---|---|
| ● | **B-3** | **5 - 7** | **0.0** | **0.6** | **20.7** | | **78.7** | | **CL** |
| ⊠ | **B-5** | **5 - 7** | **0.0** | **1.8** | **23.9** | | **74.2** | | **CL** |
| ▲ | **P-7** | **1 - 4** | **0.0** | **0.4** | **18.4** | | **81.2** | | **CL** |

| GRAIN SIZE | ● | ⊠ | ▲ |
|---|---|---|---|
| $D_{95}$ | **0.381** | **0.433** | **0.424** |
| $D_{60}$ | | | |
| $D_{50}$ | | | |
| $D_{30}$ | | | |
| $D_{10}$ | | | |
| COEFFICIENTS | | | |
| $C_C$ | | | |
| $C_U$ | | | |

| ● Sieve | ● % Finer | ⊠ Sieve | ⊠ % Finer | ▲ Sieve | ▲ % Finer |
|---|---|---|---|---|---|
| 3/8" | 100.0 | 3/4" | 100.0 | 3/8" | 100.0 |
| #4 | 99.42 | 3/8" | 99.71 | #4 | 99.6 |
| #8 | 98.71 | #4 | 98.16 | #8 | 99.26 |
| #16 | 97.93 | #8 | 97.39 | #16 | 99.11 |
| #30 | 96.33 | #16 | 96.72 | #30 | 98.01 |
| #50 | 94.3 | #30 | 95.83 | #50 | 92.0 |
| #100 | 89.58 | #50 | 94.06 | #100 | 83.45 |
| #200 | 78.7 | #100 | 87.76 | #200 | 81.24 |
| | | #200 | 74.23 | | |

| | SOIL DESCRIPTION |
|---|---|
| ● | LEAN CLAY with SAND (CL) |
| ⊠ | LEAN CLAY with SAND (CL) |
| ▲ | LEAN CLAY with SAND (CL) |

| | REMARKS |
|---|---|
| ● | |
| ⊠ | |
| ▲ | |

PROJECT: 4.55 Acre Site

SITE: Near PFL Way
Livingston, MT

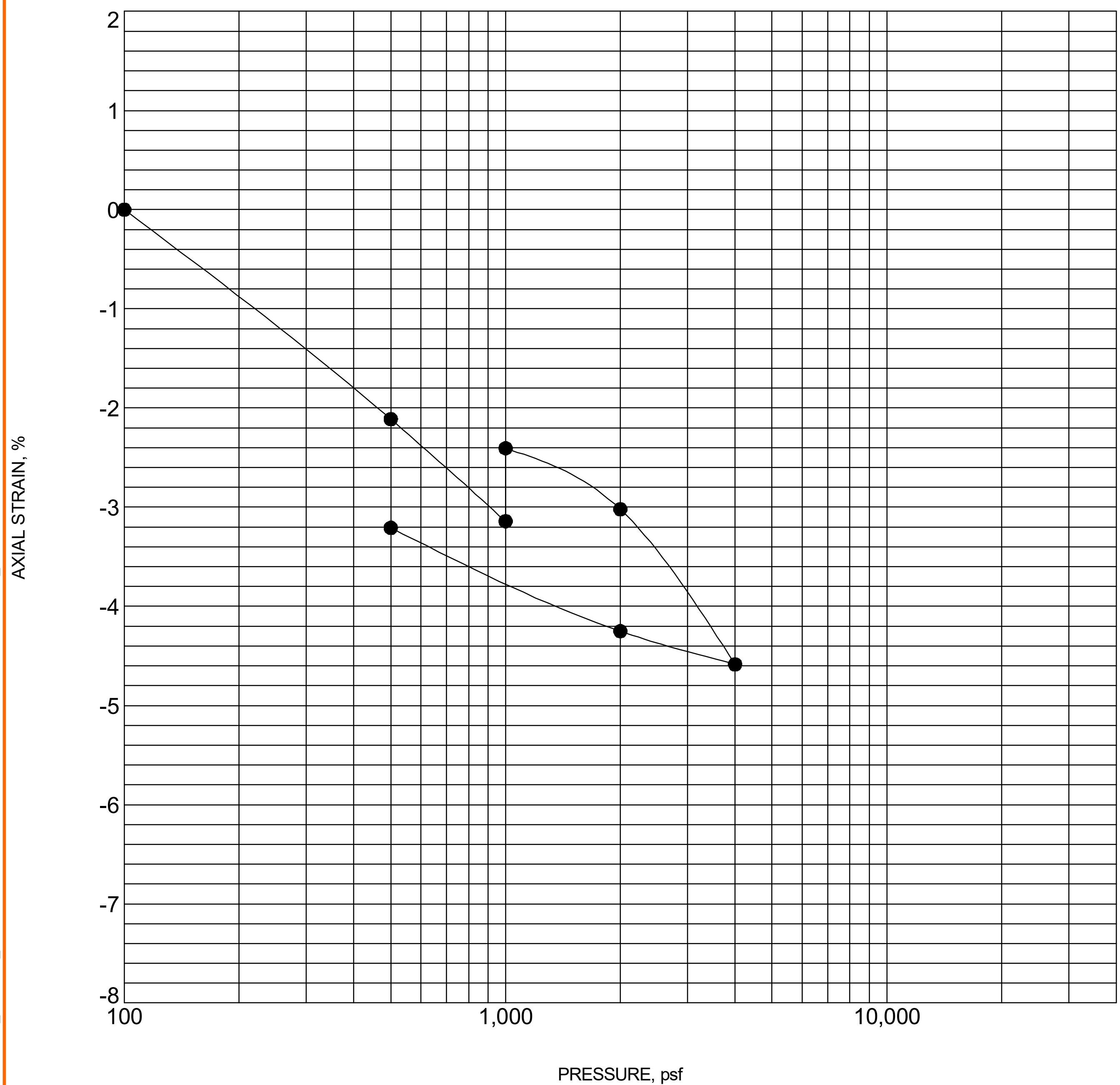
Terracon
2110 Overland Ave Ste 124
Billings, MT

PROJECT NUMBER: 26215031

CLIENT: Ruedebusch Development & Construction
Madison, WI

# SWELL CONSOLIDATION TEST

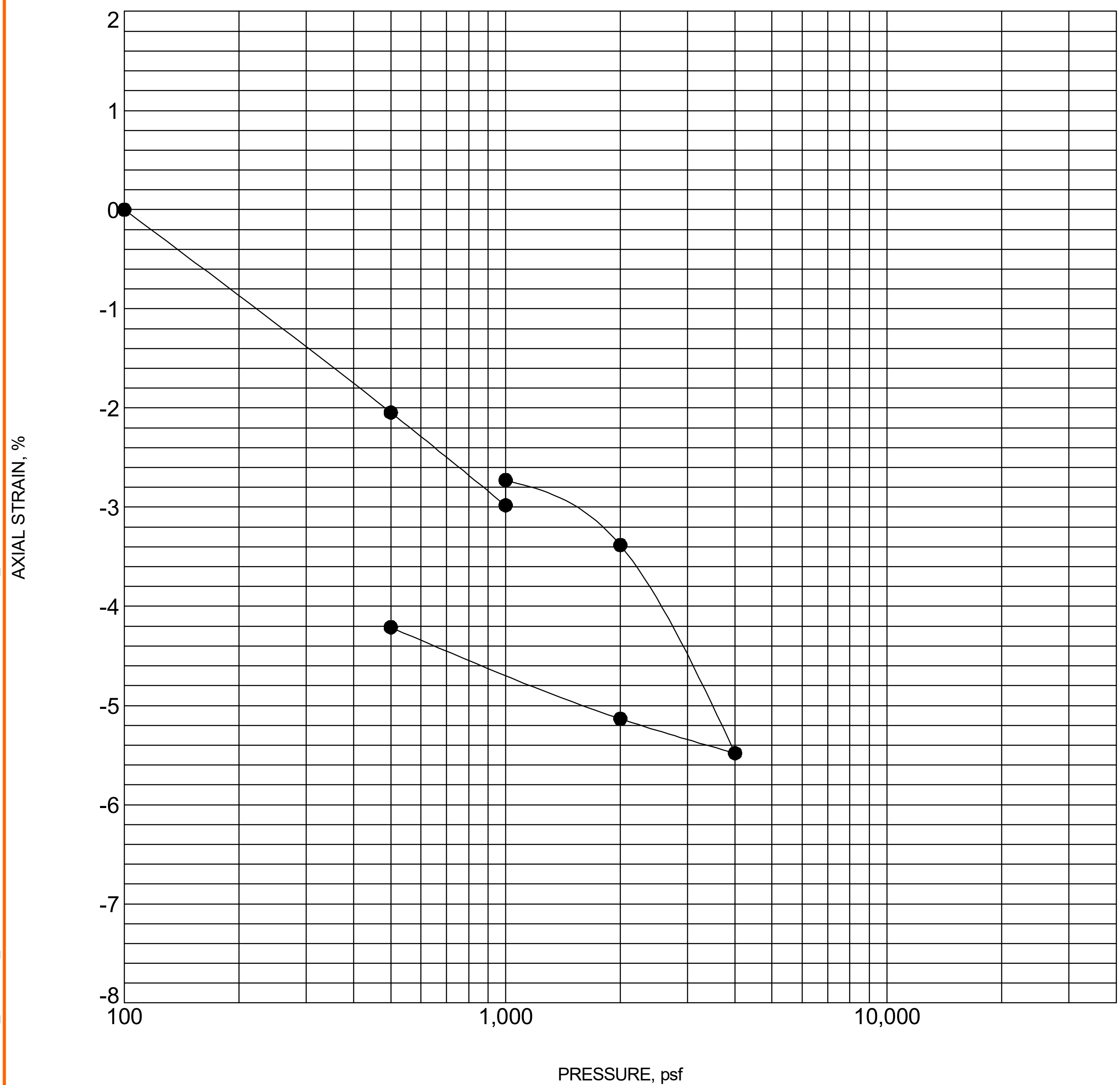
**ASTM D2435**




| Specimen Identification | | Classification | $\gamma_d$, pcf | WC, % |
|---|---|---|---|---|
| ● | B-3 5 - 7 ft | LEAN CLAY with SAND(CL) | 96 | 27.5 |

NOTES: Sample inundated with water at 1,000 psf.

# SWELL CONSOLIDATION TEST
## ASTM D2435




| Specimen Identification | | Classification | $\gamma_d$, pcf | WC, % |
|---|---|---|---|---|
| ● | B-5 5 - 7 ft | LEAN CLAY with SAND(CL) | 93 | 27.8 |

NOTES: Sample inundated with water at 1,000 psf.

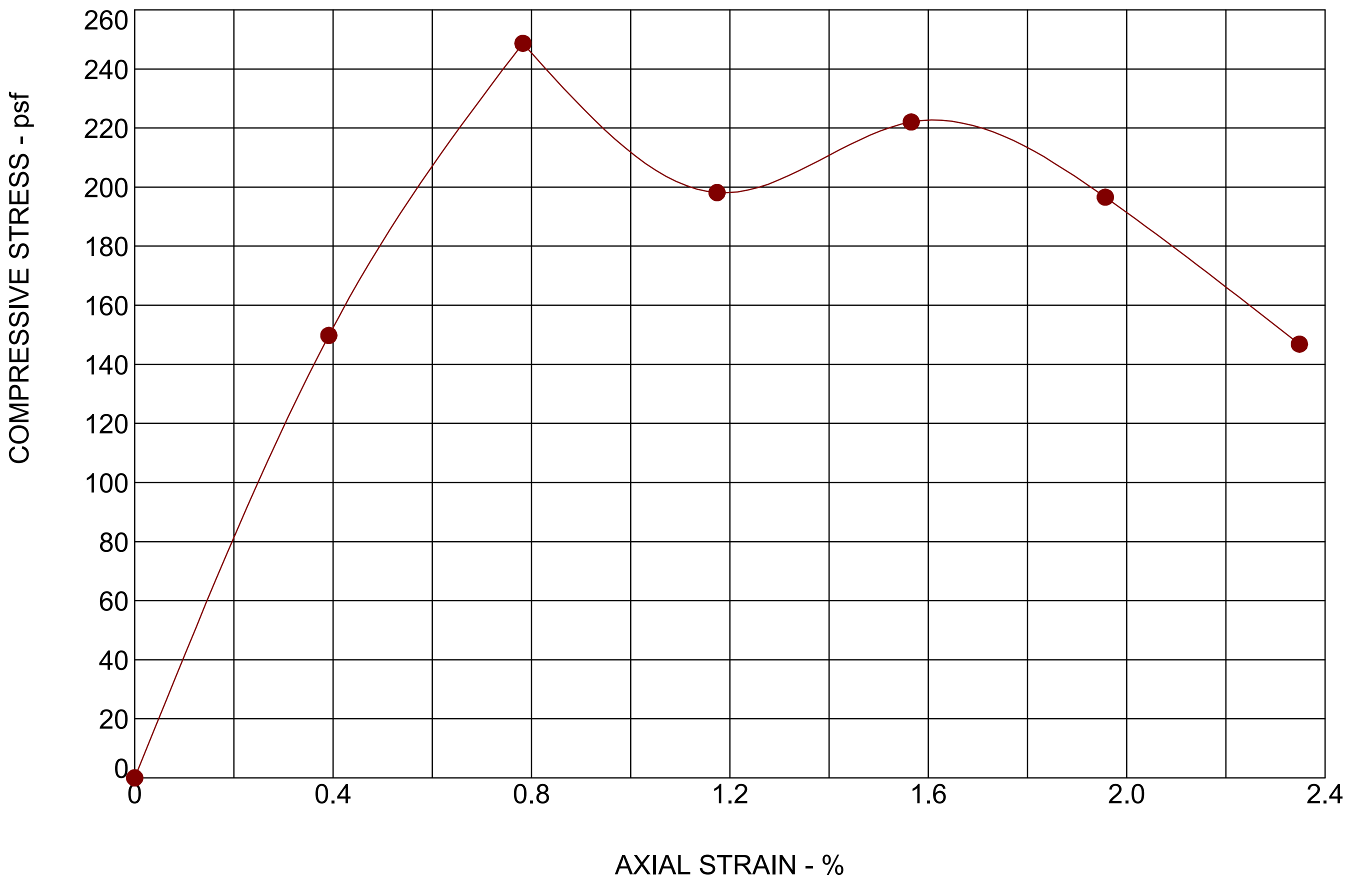


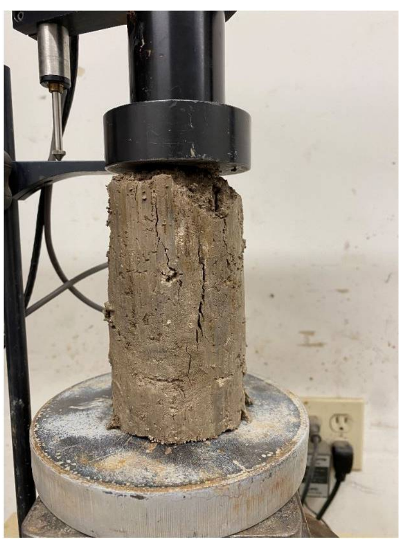
| | | |
|---|---|---|
| PROJECT: 4.55 Acre Site | Terracon<br>2110 Overland Ave Ste 124<br>Billings, MT | PROJECT NUMBER: 26215031 |
| SITE: Near PFL Way<br>Livingston, MT | | CLIENT: Ruedebusch Development & Construction<br>Madison, WI |

# UNCONFINED COMPRESSION TEST

**ASTM D2166**






| SPECIMEN FAILURE PHOTOGRAPH | SPECIMEN TEST DATA | | |
|---|---|---|---|
|  | Moisture Content: | % | 31.5 |
| | Dry Density: | pcf | 100 |
| | Diameter: | in. | 2.70 |
| | Height: | in. | 5.11 |
| | Height / Diameter Ratio: | | 1.89 |
| | Calculated Saturation: | % | |
| | Calculated Void Ratio: | | |
| | Assumed Specific Gravity: | | |
| | Failure Strain: | % | 0.78 |
| | Unconfined Compressive Strength | (psf) | 249 |
| | Undrained Shear Strength: | (psf) | 124 |
| | Strain Rate: | in/min | 0.0500 |
| | Remarks: | | |

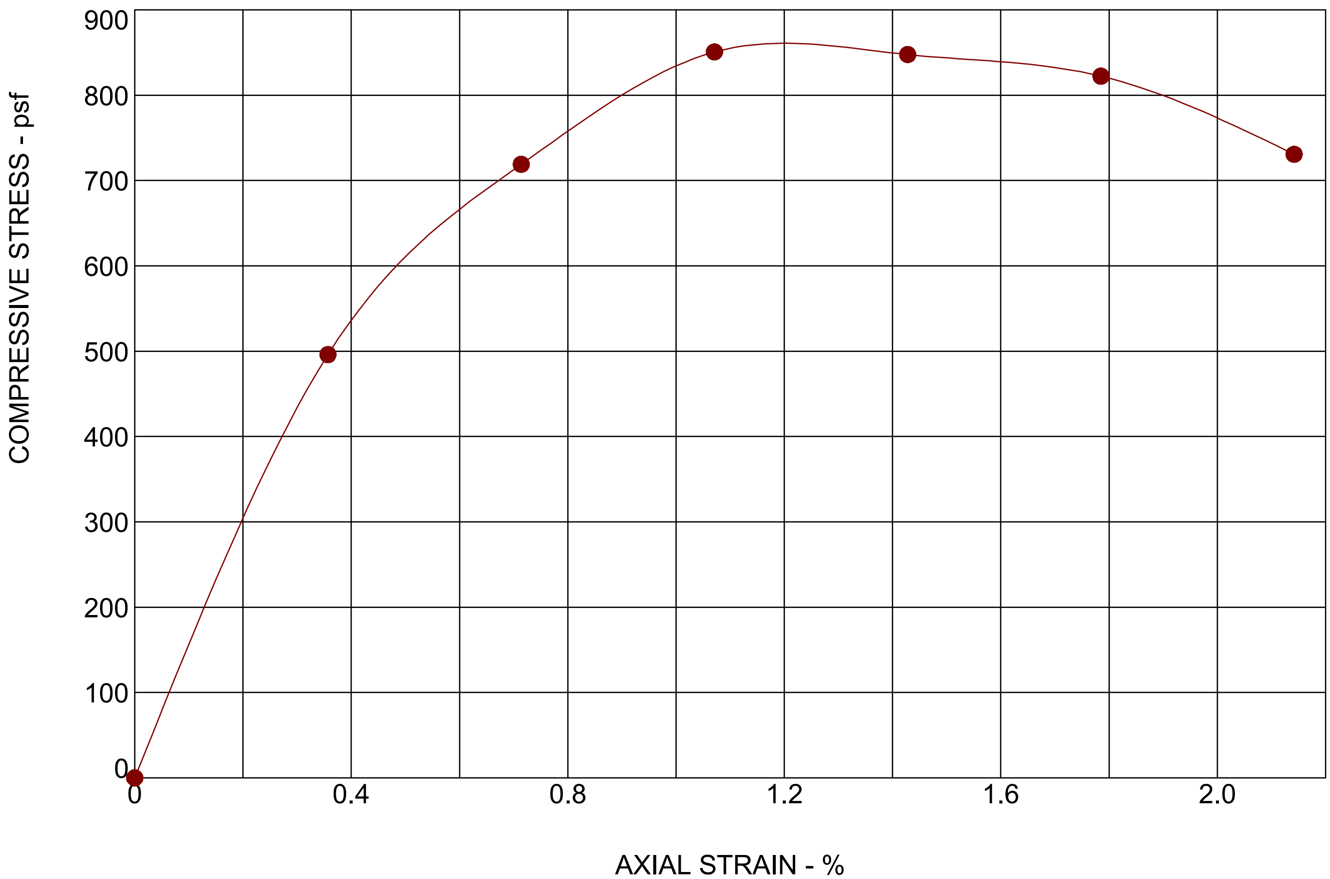
| SAMPLE TYPE: Shelby Tube | SAMPLE LOCATION: B-3 @ 5 - 7 feet | | | |
|---|---|---|---|---|
| DESCRIPTION: LEAN CLAY with SAND(CL) | LL | PL | PI | Percent < #200 Sieve |
| | 46 | 23 | 23 | 78.7 |

| | | |
|---|---|---|
| PROJECT: 4.55 Acre Site | Terracon<br>2110 Overland Ave Ste 124<br>Billings, MT | PROJECT NUMBER: 26215031 |
| SITE: Near PFL Way<br>Livingston, MT | | CLIENT: Ruedebusch Development & Construction<br>Madison, WI |

# UNCONFINED COMPRESSION TEST

**ASTM D2166**






**SPECIMEN FAILURE PHOTOGRAPH**

**SPECIMEN TEST DATA**

| | | |
|---|---|---|
| Moisture Content: | % | 32.8 |
| Dry Density: | pcf | 88 |
| Diameter: | in. | 2.85 |
| Height: | in. | 5.60 |
| Height / Diameter Ratio: | | 1.97 |
| Calculated Saturation: | % | |
| Calculated Void Ratio: | | |
| Assumed Specific Gravity: | | |
| Failure Strain: | % | 1.07 |
| Unconfined Compressive Strength | (psf) | 851 |
| Undrained Shear Strength: | (psf) | 425 |
| Strain Rate: | in/min | 0.0500 |
| Remarks: | | |

| | | | | |
|---|---|---|---|---|
| SAMPLE TYPE: Shelby Tube | SAMPLE LOCATION: B-5 @ 5 - 7 feet | | | |
| DESCRIPTION: LEAN CLAY with SAND(CL) | LL 46 | PL 22 | PI 24 | Percent < #200 Sieve 74.2 |

PROJECT: 4.55 Acre Site

SITE: Near PFL Way
Livingston, MT

Terracon
2110 Overland Ave Ste 124
Billings, MT

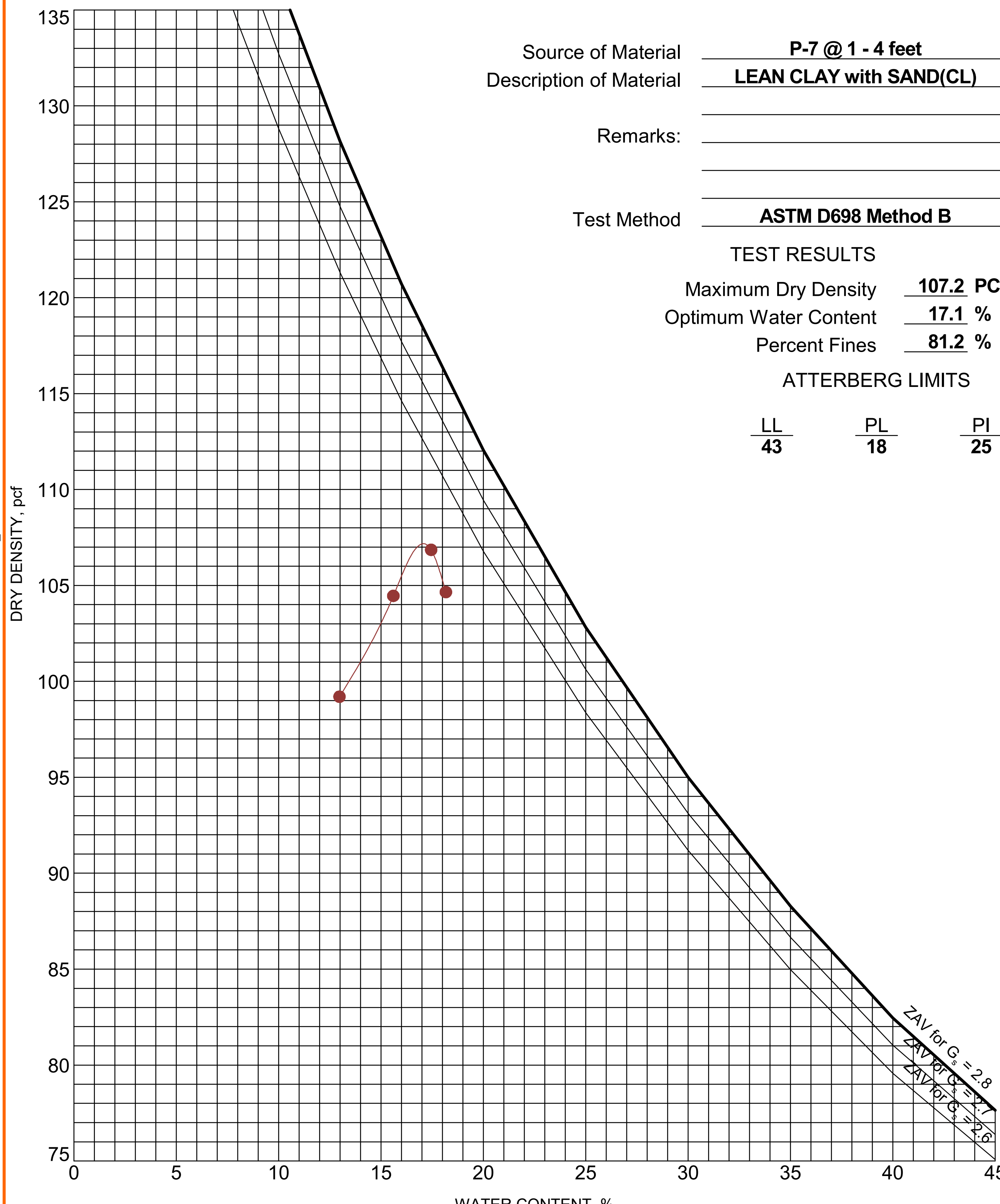
PROJECT NUMBER: 26215031

CLIENT: Ruedebusch Development & Construction
Madison, WI

# MOISTURE-DENSITY RELATIONSHIP

**ASTM D698/D1557**






| | |
|---|---|
| Source of Material | **P-7 @ 1 - 4 feet** |
| Description of Material | **LEAN CLAY with SAND(CL)** |
| Remarks: | |
| Test Method | **ASTM D698 Method B** |

TEST RESULTS

| | | |
|---|---|---|
| Maximum Dry Density | **107.2** | **PCF** |
| Optimum Water Content | **17.1** | **%** |
| Percent Fines | **81.2** | **%** |

ATTERBERG LIMITS

| LL | PL | PI |
|---|---|---|
| **43** | **18** | **25** |

PROJECT: 4.55 Acre Site

SITE: Near PFL Way
Livingston, MT

Terracon
2110 Overland Ave Ste 124
Billings, MT

PROJECT NUMBER: 26215031

CLIENT: Ruedebusch Development & Construction
Madison, WI

PROJECT: 4.55 Acre Site
PROJECT NO: 26215031
LOCATION: Livingston, Montana
MATERIAL: Lean Clay with Sand
SAMPLE SOURCE: P-7 @ 1 to 4 feet
DATE: 4/28/2021
REVIEWED BY: TG

**CBR (CALIFORNIA BEARING RATIO) OF LABORATORY-COMPACTED SOILS (ASTM D1883)**

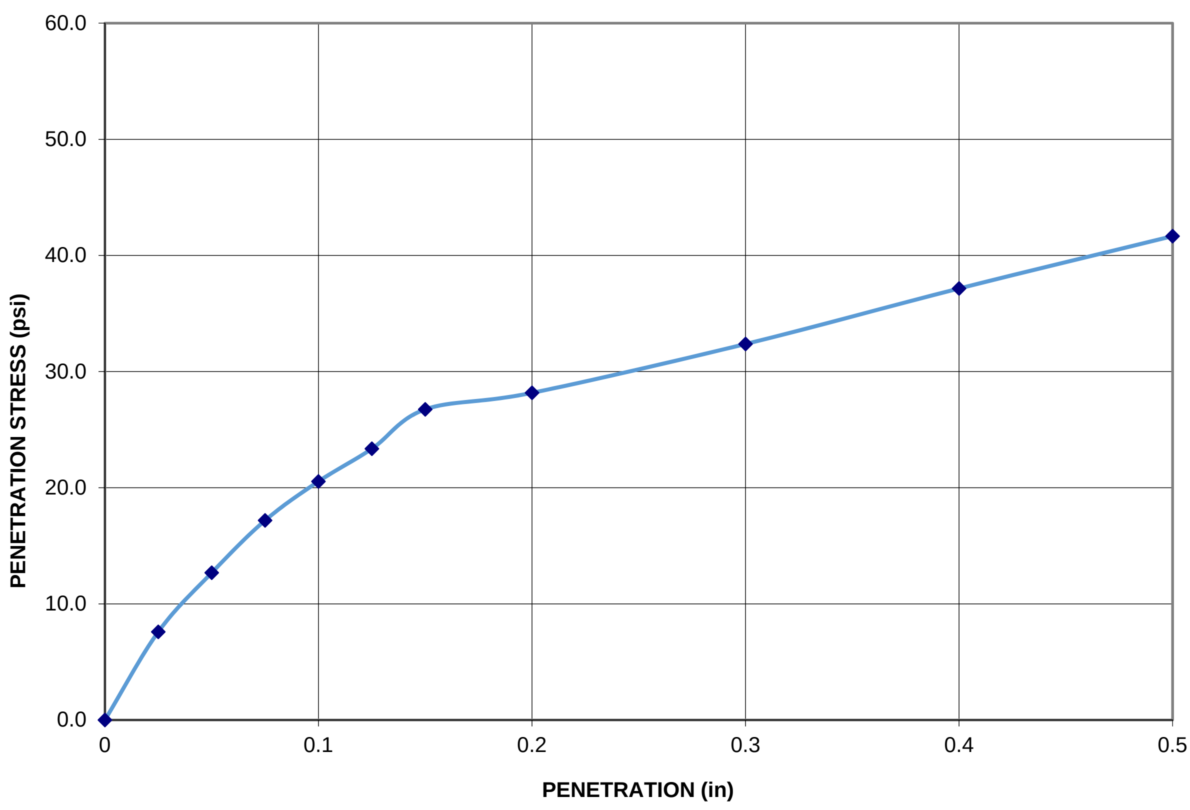
COMPACTION(%) 94.9%
COMPACTION: Recompacted at 95% MDD near optimum moisture
PERCENT SWELL 3.6%

| PENETRATION | CORRECTED C B R |
|---|---|
| 0.100 | 2.1% |
| 0.200 | 1.9% |

| | BEFORE SOAK | AFTER SOAK |
|---|---|---|
| DRY DENSITY | 101.8 lbs./cu.ft | 98.2 lbs./cu.ft |
| PERCENT MOISTURE | 17.1 % | 26.8 % |

D698 PROCTOR
DRY DENSITY(pcf) 107.2
MOISTURE(%) 17.1

SURCHARGE WEIGHT 10 lbs.



# HYDRAULIC CONDUCTIVITY DETERMINATION

(FLEXIBLE-WALL PERMEAMETER - FALLING-HEAD-ASTM D 5084 Method C)

Project : 4.55 Acre Site
Date: 4/28/2021
Project No. : 26215031
Boring No.: PD-1
Sample: -
Depth (ft): -

Other Location:
Tube Number : C1 Tube Capacity: 25.0 cm
Area (sq. centimeter): 0.8755 Factor (cm) = 1.14

Material Description : Lean Clay with Sand (CL)
Specimen Type: Shelby Tube

## SAMPLE DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wet Wt. sample + ring or tare : | | | 553.7 g | | | | |
| Tare or ring Wt. : | | | 0.0 g | | Before Test | | After Test |
| Wet Wt: of Sample : | | | 553.7 g | Tare No.: | Mr. T | Tare No.: | Bill |
| Diameter : | 2.862 in | | 7.26948 cm^2 | Wet Wt.+tare: | 156.62 | Wet Wt.+tare: | 772.21 |
| Length : | 2.771 in | | 7.03834 cm | Dry Wt.+tare: | 139.60 | Dry Wt.+tare: | 672.3 |
| Area: | 6.433 in^2 | | 41.505 cm^2 | Tare Wt: | 30.70 | Tare Wt: | 232.97 |
| Volume : | 17.826 in^3 | | 292.124 cm^3 | Dry Wt.: | 108.9 | Dry Wt.: | 439.33 |
| Unit Wt.(wet): | **1.90** g/cm^3 | | **118.3** pcf | Water Wt.: | 17.02 | Water Wt.: | 99.91 |
| Unit Wt.(dry): | **1.64** g/cm^3 | | **102.3** pcf | % moist.: | **15.6** | % moist.: | **22.7** |

Specific Gravity : **2.70** ( estimated: X actual: __ )
Max Dry Density =
OMC % =
% of max =
% +/- OMC =
Calculated % saturation: 94.9
Void ratio (e) = **0.647**
Porosity (n)= **0.393**

Pressure Differential (psi) = 2.0
Pressure Head (cm) = **140.82**

| Hydraulic Gradient: | Maximum* | Minimum* | Average* |
|---|---|---|---|
| | **20.0** | **16.0** | **20.1** |

## TEST READINGS

| Date/time (i) m/d hr:min | Date/time (f) m/d/hr:min | elapsed t (day) | elapsed t (sec) | H initial Hi (cm) | H final Hf (cm) | Flow in qi (cc) | Flow out qo (cc) | temp (deg C) | $\alpha$ (temp corr) | k (cm/sec) | k (ft./day) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/27 10:00 | 4/27 10:00 | 0.0001 | 5 | 6.7 | 5.7 | 1.0 | 1.0 | 23.2 | 0.927 | 2.22E-04 | 6.28E-01 |
| 4/27 10:00 | 4/27 10:00 | 0.0001 | 5 | 5.7 | 4.9 | 0.8 | 0.8 | 23.2 | 0.927 | 1.84E-04 | 5.22E-01 |
| 4/27 10:00 | 4/27 10:00 | 0.0001 | 5 | 4.9 | 4.1 | 0.8 | 0.8 | 23.2 | 0.927 | 1.73E-04 | 4.90E-01 |
| 4/27 10:00 | 4/27 10:00 | 0.0001 | 5 | 4.1 | 3.4 | 0.7 | 0.7 | 23.2 | 0.927 | 1.62E-04 | 4.58E-01 |

## SUMMARY

ka = 1.85E-04 cm/sec ( k Acceptance criteria: Vm< = 50 %)

| Reading | qo/qi | acceptance | ki | | Vm | |
|---|---|---|---|---|---|---|
| 1 | 0.97 | ok | k1 = | 2.22E-04 cm/sec | 19.7 | % |
| 2 | 0.95 | ok | k2 = | 1.84E-04 cm/sec | 0.5 | % |
| 3 | 0.97 | ok | k3 = | 1.73E-04 cm/sec | 6.6 | % |
| 4 | 1.00 | ok | k4 = | 1.62E-04 cm/sec | 12.7 | % |

$\boxed{k = 1.85E-04 \text{ cm/sec}}$ (hydraulic conductivity)

**Acceptance criteria as Vm**:
(Variation from ASTM D 5084)
50 % for ka >= 1.00E-08
95% for ka < 1.00E-08
**Acceptance criteria for qo/qi ratio**:
0.75 <= qo/qi <= 1.25
(All acceptance criteria for 4 consecutive readings)

$$Vm = \frac{|ka-ki|}{ka} \times 100$$

*__Hydraulic Gradient Notes__:
**Maximum** and **Minimum** refer to the range possible during the test. The maximum and/or mimimum limits may not be reached. **Average** is the average of **actual** hydraulic gradients achieved during the test.

# ANALYTICAL SUMMARY REPORT

May 06, 2021

Terracon Consultants
2110 Overland Ave Ste 124
Billings , MT 59102-6440

Work Order: B21041350 Quote ID: B5647

Project Name: 26215031

Energy Laboratories Inc Billings MT received the following 2 samples for Terracon Consultants on 4/19/2021 for analysis.

| Lab ID | Client Sample ID | Collect Date | Receive Date | Matrix | Test |
|---|---|---|---|---|---|
| B21041350-001 | B-2 [2.5-4]feet | 04/13/21 10:00 | 04/19/21 | Soil | pH, Saturated Paste<br>Saturated Paste Extraction ASA<br>Resistivity, Sat Paste<br>Sulfate-Geochemical |
| B21041350-002 | B-4 [2.5-4]feet | 04/12/21 12:00 | 04/19/21 | Soil | Same As Above |

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

# LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

**Client:** Terracon Consultants
**Project:** 26215031
**Report Date:** 05/06/21

**Lab ID:** B21041350-001
**Client Sample ID:** B-2 [2.5-4]
**Collection Date:** 04/13/21 10:00
**DateReceived:** 04/19/21
**Matrix:** Soil

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **SATURATED PASTE EXTRACT** | | | | | | | |
| Resistivity, Sat. Paste | 1620 | ohm-cm | | 1 | | Calculation | 04/29/21 09:22 / srm |
| pH, sat. paste | 8.1 | s.u. | | 0.1 | | ASA10-3 | 04/29/21 09:22 / srm |
| **CHEMICAL CHARACTERISTICS** | | | | | | | |
| Sulfate, HCL Extractable | 0.03 | wt% | | 0.01 | | MTDOT | 05/05/21 09:21 / srm |

**Lab ID:** B21041350-002
**Client Sample ID:** B-4 [2.5-4]
**Collection Date:** 04/12/21 12:00
**DateReceived:** 04/19/21
**Matrix:** Soil

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **SATURATED PASTE EXTRACT** | | | | | | | |
| Resistivity, Sat. Paste | 328 | ohm-cm | | 1 | | Calculation | 04/29/21 09:22 / srm |
| pH, sat. paste | 7.5 | s.u. | | 0.1 | | ASA10-3 | 04/29/21 09:22 / srm |
| **CHEMICAL CHARACTERISTICS** | | | | | | | |
| Sulfate, HCL Extractable | 2.00 | wt% | | 0.01 | | MTDOT | 05/05/21 09:21 / srm |

**Report Definitions:**
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

# QA/QC Summary Report

Prepared by Billings, MT Branch

**Client:** Terracon Consultants **Work Order:** B21041350 **Report Date:** 05/06/21

| Analyte | Count | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|
| **Method: ASA10-3** | | | | | | | | | | Batch: 154910 |
| **Lab ID: B21041133-001A DUP** | | Sample Duplicate | | | | Run: MISC-SOIL_210429A | | | | 04/29/21 09:22 |
| pH, sat. paste | | 7.70 | s.u. | 0.10 | | | | 0.0 | 10 | |
| **Lab ID: LCS-2104290922** | | Laboratory Control Sample | | | | Run: MISC-SOIL_210429A | | | | 04/29/21 09:22 |
| pH, sat. paste | | 7.10 | s.u. | 0.10 | 95 | 90 | 110 | | | |

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

# QA/QC Summary Report

Prepared by Billings, MT Branch

**Client:** Terracon Consultants **Work Order:** B21041350 **Report Date:** 05/06/21

| Analyte | Count | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|
| **Method: Calculation** | | | | | | | | | | Batch: 154910 |
| **Lab ID: B21041133-001A DUP** | | Sample Duplicate | | | | Run: MISC-SOIL_210429A | | | 04/29/21 09:22 | |
| Resistivity, Sat. Paste | | 1150 | ohm-cm | 1.0 | | 70 | 130 | 3.4 | 30 | |
| **Lab ID: LCS-2104290922** | | Laboratory Control Sample | | | | Run: MISC-SOIL_210429A | | | 04/29/21 09:22 | |
| Resistivity, Sat. Paste | | 249 | ohm-cm | 1.0 | 102 | 70 | 130 | | | |

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

# QA/QC Summary Report

Prepared by Billings, MT Branch

**Client:** Terracon Consultants **Work Order:** B21041350 **Report Date:** 05/06/21

| Analyte | Count | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|
| **Method: MTDOT** | | | | | | | | | Batch: R360273 | |
| **Lab ID: B21041350-001A DUP** | | Sample Duplicate | | | | Run: MISC-SOIL_210506A | | | 05/05/21 09:21 | |
| Sulfate, HCL Extractable | | 0.03 | wt% | 0.01 | | | | 13 | 30 | |
| **Lab ID: LCS** | | Laboratory Control Sample | | | | Run: MISC-SOIL_210506A | | | 05/05/21 09:21 | |
| Sulfate, HCL Extractable | | 0.08 | wt% | 0.01 | 109 | 70 | 130 | | | |
| **Lab ID: MBLK1** | | Method Blank | | | | Run: MISC-SOIL_210506A | | | 05/05/21 09:21 | |
| Sulfate, HCL Extractable | | 0.009 | wt% | | | | | | | |

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

# Work Order Receipt Checklist

## Terracon Consultants B21041350

| | | | |
|---|---|---|---|
| Login completed by: | Leslie S. Cadreau | Date Received: | 4/19/2021 |
| Reviewed by: | BL2000\darcy | Received by: | dac |
| Reviewed Date: | 4/20/2021 | Carrier name: | Hand Del |

| | | | |
|---|---|---|---|
| Shipping container/cooler in good condition? | Yes ☐ | No ☐ | Not Present ☑ |
| Custody seals intact on all shipping container(s)/cooler(s)? | Yes ☐ | No ☐ | Not Present ☑ |
| Custody seals intact on all sample bottles? | Yes ☐ | No ☐ | Not Present ☑ |
| Chain of custody present? | Yes ☑ | No ☐ | |
| Chain of custody signed when relinquished and received? | Yes ☑ | No ☐ | |
| Chain of custody agrees with sample labels? | Yes ☑ | No ☐ | |
| Samples in proper container/bottle? | Yes ☑ | No ☐ | |
| Sample containers intact? | Yes ☑ | No ☐ | |
| Sufficient sample volume for indicated test? | Yes ☑ | No ☐ | |
| All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.) | Yes ☑ | No ☐ | |
| Temp Blank received in all shipping container(s)/cooler(s)? | Yes ☐ | No ☑ | Not Applicable ☐ |
| Container/Temp Blank temperature: | 19.4°C No Ice | | |
| Water - VOA vials have zero headspace? | Yes ☐ | No ☐ | No VOA vials submitted ☑ |
| Water - pH acceptable upon receipt? | Yes ☐ | No ☐ | Not Applicable ☑ |

### Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

### Contact and Corrective Action Comments:

None

ENERGY LABORATORIES
Trust our People. Trust our Data.

# Chain of Custody & Analytical Request Record

www.energylab.com

Page _____ of _____

## Account Information (Billing information)

| | |
|---|---|
| Company/Name | Terracon |
| Contact | Chris LaRance |
| Phone | 406-656-3072 |
| Mailing Address | 2110 Overland Avenue, Suite 124 |
| City, State, Zip | Billings, MT 59102 |
| Email | Chris.LaRance@terracon.com |
| Receive Invoice | ☐Hard Copy ☒Email |
| Receive Report | ☑Hard Copy ☐Email |
| Purchase Order | |
| Quote | |
| Bottle Order | |

## Report Information (if different than Account Information)

| | |
|---|---|
| Company/Name | |
| Contact | Travis Goracke |
| Phone | |
| Mailing Address | |
| City, State, Zip | |
| Email | Travis.Goracke@terracon.com |
| Receive Report | ☐Hard Copy ☒Email |
| Special Report/Formats: | ☐ LEVEL IV ☐ NELAC ☐ EDD/EDT (contact laboratory) ☐ Other_______ |

## Comments

## Project Information

| | |
|---|---|
| Project Name, PWSID, Permit, etc. | 26215031 |
| Sampler Name | J. Schaefbauer |
| Sampler Phone | 701-429-3294 |
| Sample Origin State | MT |
| EPA/State Compliance | ☐ Yes ☒ No |
| Lab provided preservatives were used | ☐ Yes ☒ No |

MINING CLIENTS, please indicate sample type.
*If ore has been processed or refined, call before sending.
☐ Byproduct 11 (e)2 material ☐ Unprocessed ore (NOT ground or refined)*

**Matrix Codes**
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

**Analysis Requested**

All turnaround times are standard unless marked as RUSH

Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

| | Sample Identification (Name, Location, Interval, etc.) | Collection Date | Collection Time | Number of Containers | Matrix (See Codes Above) | pH, sulphates, resistivity | | | | | | | | | See Attached | RUSH TAT | ELI LAB ID Laboratory Use Only |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B-2, 2.5-4' | 4/13/21 | 1000 | | S | | | | | | | | | | | | B21041350 |
| 2 | B-4, 2.5-4' | 4/12/21 | 1200 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |

| Custody Record MUST be signed | Relinquished by (print) | Date/Time | Signature | Received by (print) | Date/Time | Signature |
|---|---|---|---|---|---|---|
| | Jordan Schaefbauer | 4/19/21 1302 | [signature] | | | |
| | Relinquished by (print) | Date/Time | Signature | Received by Laboratory (print) Dylan Chirwa | 4/19/21 1302 | [signature] |

**LABORATORY USE ONLY**

| Shipped By | Cooler ID(s) | Custody Seals Y N C B | Intact Y N | Receipt Temp °C | Temp Blank Y N | On Ice Y N | Payment Type CC Cash Check_______ | Amount $ | Receipt Number (cash/check only) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-06/08 v.2

# SUPPORTING INFORMATION

**Contents:**



Note: All attachments are one page unless noted above.

# GENERAL NOTES

**DESCRIPTION OF SYMBOLS AND ABBREVIATIONS**

**4.55 Acre Site ■ Livingston, MT**

**Terracon Project No. 26215031**

Terracon GeoReport

| SAMPLING | WATER LEVEL | FIELD TESTS |
| --- | --- | --- |
| Grab Sample; Shelby Tube; Split Spoon | Water Initially Encountered; Water Level After a Specified Period of Time; Water Level After a Specified Period of Time; Cave In Encountered | N — Standard Penetration Test Resistance (Blows/Ft.); (HP) — Hand Penetrometer; (T) — Torvane; (DCP) — Dynamic Cone Penetrometer; UC — Unconfined Compressive Strength; (PID) — Photo-Ionization Detector; (OVA) — Organic Vapor Analyzer |

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

## LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

## STRENGTH TERMS

| RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance | | CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance | | |
| --- | --- | --- | --- | --- |
| **Descriptive Term (Density)** | **Standard Penetration or N-Value Blows/Ft.** | **Descriptive Term (Consistency)** | **Unconfined Compressive Strength Qu, (tsf)** | **Standard Penetration or N-Value Blows/Ft.** |
| Very Loose | 0 - 3 | Very Soft | less than 0.25 | 0 - 1 |
| Loose | 4 - 9 | Soft | 0.25 to 0.50 | 2 - 4 |
| Medium Dense | 10 - 29 | Medium Stiff | 0.50 to 1.00 | 4 - 8 |
| Dense | 30 - 50 | Stiff | 1.00 to 2.00 | 8 - 15 |
| Very Dense | > 50 | Very Stiff | 2.00 to 4.00 | 15 - 30 |
| | | Hard | > 4.00 | > 30 |

## RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

# UNIFIED SOIL CLASSIFICATION SYSTEM

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A] | | | | Soil Classification | |
|---|---|---|---|---|---|
| | | | | Group Symbol | Group Name [B] |
| **Coarse-Grained Soils:** More than 50% retained on No. 200 sieve | **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve | **Clean Gravels:** Less than 5% fines [C] | $Cu \geq 4$ and $1 \leq Cc \leq 3$ [E] | GW | Well-graded gravel [F] |
| | | | $Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E] | GP | Poorly graded gravel [F] |
| | | **Gravels with Fines:** More than 12% fines [C] | Fines classify as ML or MH | GM | Silty gravel [F, G, H] |
| | | | Fines classify as CL or CH | GC | Clayey gravel [F, G, H] |
| | **Sands:** 50% or more of coarse fraction passes No. 4 sieve | **Clean Sands:** Less than 5% fines [D] | $Cu \geq 6$ and $1 \leq Cc \leq 3$ [E] | SW | Well-graded sand [I] |
| | | | $Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E] | SP | Poorly graded sand [I] |
| | | **Sands with Fines:** More than 12% fines [D] | Fines classify as ML or MH | SM | Silty sand [G, H, I] |
| | | | Fines classify as CL or CH | SC | Clayey sand [G, H, I] |
| **Fine-Grained Soils:** 50% or more passes the No. 200 sieve | **Silts and Clays:** Liquid limit less than 50 | **Inorganic:** | $PI > 7$ and plots on or above "A" line | CL | Lean clay [K, L, M] |
| | | | $PI < 4$ or plots below "A" line [J] | ML | Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried / Liquid limit - not dried $< 0.75$ | OL | Organic clay [K, L, M, N] |
| | | | | | Organic silt [K, L, M, O] |
| | **Silts and Clays:** Liquid limit 50 or more | **Inorganic:** | PI plots on or above "A" line | CH | Fat clay [K, L, M] |
| | | | PI plots below "A" line | MH | Elastic Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried / Liquid limit - not dried $< 0.75$ | OH | Organic clay [K, L, M, P] |
| | | | | | Organic silt [K, L, M, Q] |
| **Highly organic soils:** | Primarily organic matter, dark in color, and organic odor | | | PT | Peat |

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

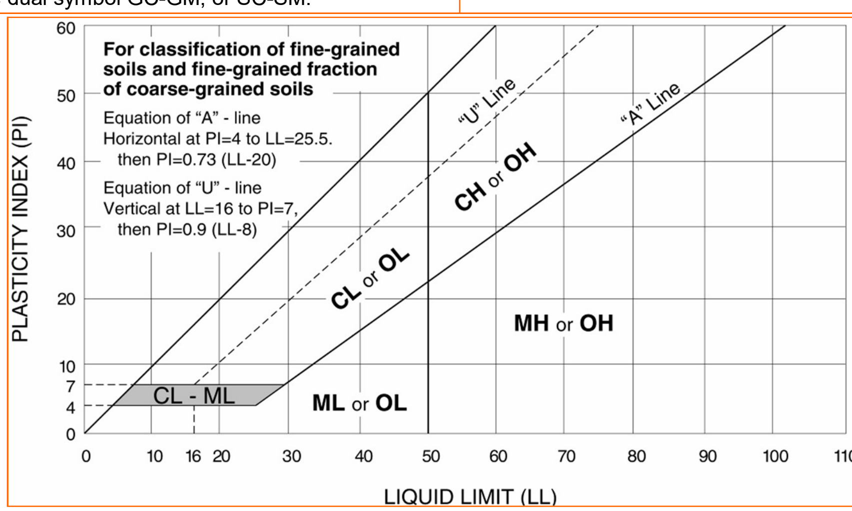
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



| WEATHERING | |
|---|---|
| Fresh | Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline. |
| Very slight | Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline. |
| Slight | Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer. |
| Moderate | Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock. |
| Moderately severe | All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. |
| Severe | All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left. |
| Very severe | All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining. |
| Complete | Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers. |

| HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals) | |
|---|---|
| Very hard | Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick. |
| Hard | Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen. |
| Moderately hard | Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow. |
| Medium | Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick. |
| Soft | Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure. |
| Very soft | Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail. |

**Joint, Bedding, and Foliation Spacing in Rock [1]**

| Spacing | Joints | Bedding/Foliation |
|---|---|---|
| Less than 2 in. | Very close | Very thin |
| 2 in. – 1 ft. | Close | Thin |
| 1 ft. – 3 ft. | Moderately close | Medium |
| 3 ft. – 10 ft. | Wide | Thick |
| More than 10 ft. | Very wide | Very thick |

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

**Rock Quality Designator (RQD) [1]**

| RQD, as a percentage | Diagnostic description |
|---|---|
| Exceeding 90 | Excellent |
| 90 – 75 | Good |
| 75 – 50 | Fair |
| 50 – 25 | Poor |
| Less than 25 | Very poor |

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

**Joint Openness Descriptors**

| Openness | Descriptor |
|---|---|
| No Visible Separation | Tight |
| Less than 1/32 in. | Slightly Open |
| 1/32 to 1/8 in. | Moderately Open |
| 1/8 to 3/8 in. | Open |
| 3/8 in. to 0.1 ft. | Moderately Wide |
| Greater than 0.1 ft. | Wide |

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX B

Preliminary Sewer & Water Design Report

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

June 2023
Project No. 18005.05

# PRELIMINARY SEWER AND WATER DESIGN REPORT FOR MOUNTAIN VIEW SUBDIVISION LIVINGSTON, MONTANA

## SITE NARRATIVE

The purpose of this preliminary report is to summarize the design of the completed sanitary sewer and water main installation associated with the Mountain View Major Subdivision in Livingston, Montana. The project will provide water service stubs and sanitary stubs to serve future lots within the subdivision. The following report will summarize the water and sewer main design and capacity calculations for the water and sewer services to the Mountain View Major Subdivision and the existing facilities currently contributing to the infrastructure. The "Sewer and Water Design Report Ruedebusch Infrastructure Improvements" document dated April 18, 2022, is referenced in this report, which the City of Livingston has approved.

## SITE DEVELOPMENT PLAN

The assumed development plan proposes three general development areas to include highway commercial, light industrial/commercial at 60% lot coverage, and multi-family residential. The highway commercial lots are proposed to include a 50-room hotel, two gas stations with 20 total fueling positions, one 2,000 square-foot coffee shop, and one 5,000 square-foot fast-food restaurant. Approximately 165,101 square feet are proposed for industrial uses, as well as 12 apartments on the residential lots.

## SEWER

The existing 10-inch sanitary sewer system has capacity to handle the proposed build out of Mountain View Major Subdivision. Refer to the "Sewer and Water Design Report Ruedebusch Infrastructure Improvements" document dated April 18, 2022.

Capacity calculations were conducted per the City of Livingston Design Standards Revised August 2022. The 10-inch sewer main capacity at 75 percent full is 391-gal/min using the minimum pipe slope of 0.0028 ft/ft.

Using a zoned Highway Commercial designation peak flow calculations for the existing and sewer pipes were completed to find the overall peak flow in the 10-inch sewer main exiting the subdivision to the southeast. Highway Commercial zoning requires “Maximum Property Use Estimates” (MPUE) based on DEQ Circular 4 to determine typical wastewater flow estimates.

Highway Commercial designations were broken into lots, area, and people. The designation of lots assumed a 4-plex on each lot with 2.5 people per living unit, and 100-gallons per capita per day. Area assumed 1,000 gallons per acre per day. The designation of people had a different assumption based on if the lot was designated to a small hotel, coffee shop, automobile service station, or restaurant. Refer to *DEQ Circular 4* to reference flow assumptions. Using the above assumptions, the average daily flow exiting the subdivision was estimated at 13.67 gal/min. A peaking factor of 4.24 was then applied for a peak hourly flow rate of 57.99 gal/min. An infiltration flowrate of 150 gal/acre/day was then used to calculate a total peak hourly flow rate with infiltration at 59.80 gal/min, which is significantly less than the 10-inch capacity of 391 gal/min stated above.

## WATER

The existing 12-inch water system has the capacity to handle the build out of Mountain View Major Subdivision. Refer to the Sewer and Water Design Report Ruedebusch Infrastructure Improvements” documents dated April 18, 2022.

Given the Highway Commercial zoning (non-residential lots), the proposed 12.35 acres serving the proposed area would serve around 97 persons based on wastewater usage of 127.5 gal/day/person (1,000 gal/day/acre x 12.35 acres)/127.5 gal per day per person = 97 persons). The 3 lots with assumed 4-plex development with 2.5 people per living unit add an additional 30 persons. The small hotel, coffee shop, two automobile service stations, and restaurant add an additional 452 persons. The proposed area would serve around 579 persons. Using a more conservative value of 600 people, the average daily domestic flow using 127.5 gpd/person per Livingston Design Standards is as follows:

Average Daily Flow = 600 people x 127.5 gal/day/person = 76,500 gal/day = 53.13 gpm

Using a peaking factor of 2.36 per the City of Livingston Design Standards, the Maximum Day Demand is as follows:

Maximum Day Demand = 2.36 x 53.13 = 125.38 gpm (round to 126 gpm)

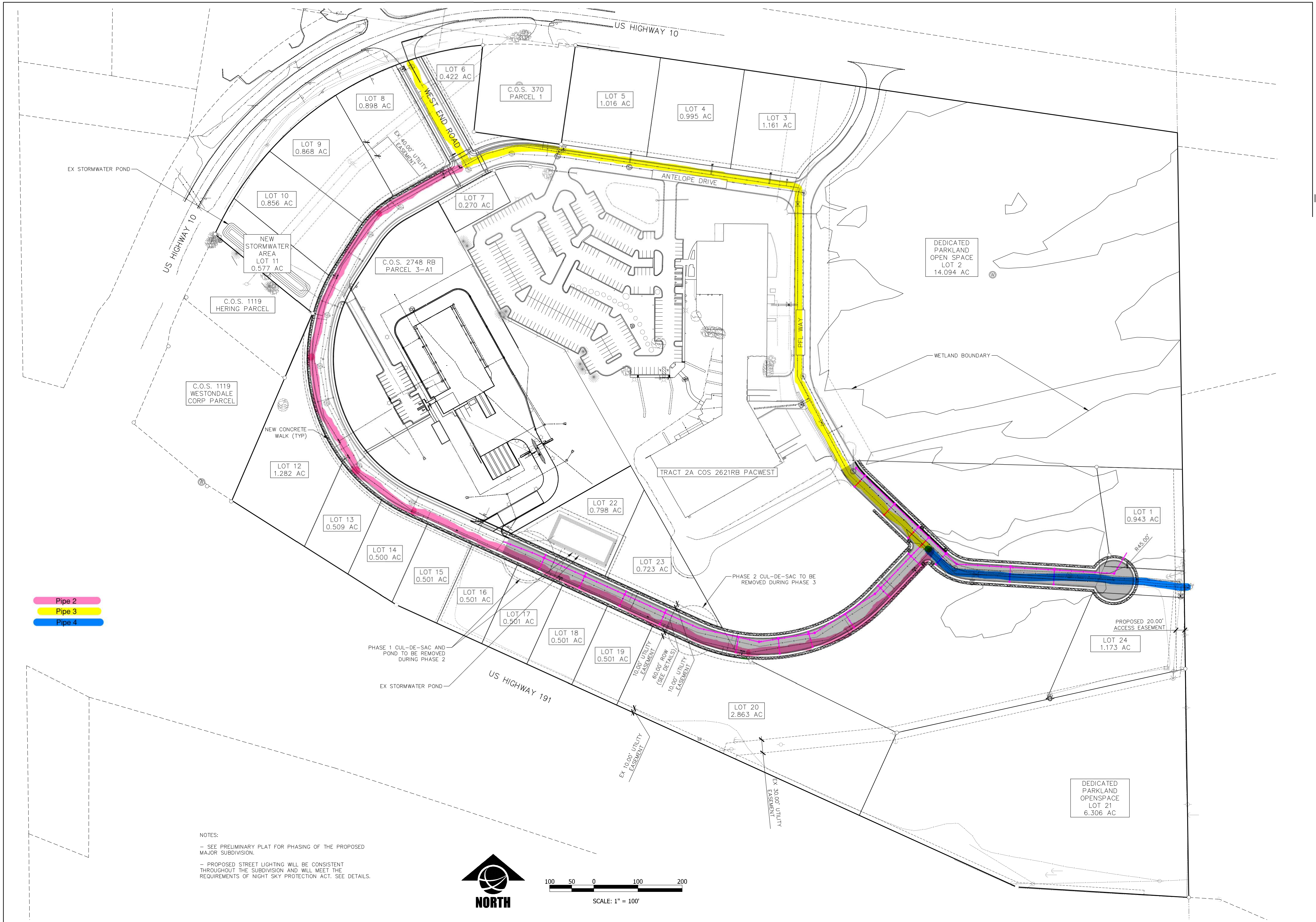
The water main will be designed using a fire flow of 1,500 gpm plus the 126 gpm domestic flow for a total of 1,626 gpm.

## CONCLUSION

Based on the assumptions provided above and the Sewer and Water Design Report for the Ruedebusch Infrastructure Improvements, the existing 10-inch sanitary sewer and 12-inch water main installation will provide the required capacity for the build out of the planned developments in the project area. Please contact Sumner Anacker, PE for any questions pertaining to this preliminary report by email, sanacker@sandersonstewart.com or by phone 406-922-4308.

Attached:

- Pipe Designation Map
- Pipe 2 Spreadsheet
- Pipe 3 Spreadsheet
- Pipe 4 Spreadsheet




SANDERSON STEWART
Enduring Community D

PIPE DESIGNATION EXHIBIT

Pipe 2
Project: 18005.05 Mountain View Subdivision
Date: 06/20/2023

SANDERSON STEWART

## Capacity Calclulations

| | | |
|---|---|---|
| 10" Pipe Flowing Full Capacity | 1.16 | cfs |
| 10" Pipe Flowing Full Capacity | 522 | gal/min |
| Q/Qfill @ 75% full, | 0.75 | per nomograph |
| Capacity @ 75% full | 391 | gal/min |

## System Demand

**Service Lots**

| DESIGNATION | Lots (#) | | | Area (AC) |
|---|---|---|---|---|
| HC (MPUE - Assumed 4-plex on each lot, 2.5 people per living unit, 100-gallons per capita per day) | 1.00 | 1000.00 | gal/day | 2.863 |

**Service Area**

| Designation | Area (AC) | | |
|---|---|---|---|
| HC (MPUE - Assumed 1,000 gallons/acre/day) | 5.8645 | 5864.5 | gal/day |

| Designation | People (#) | | | Area (AC) |
|---|---|---|---|---|
| HC (Small Hotel - Assumed 48 gallons/guest/day) | 150 | 7200 | gal/day | 0.856 |
| HC (Small Hotel - Assumed 10 gallons/employee/day) | 5 | 50 | gal/day | |
| HC (Coffee Shop - Assumed 6 gallons/customer/day) | 100 | 600 | gal/day | 0.868 |
| HC (Coffee Shop - Assumed 10 gallons/employee/day) | 3 | 30 | gal/day | |
| HC (Automobile Service Station - Assumed 10 gallons/vehicle served/day) | 45 | 450 | gal/day | 0.898 |
| HC (Automobile Service Station - Assumed 12 gallons/employee/day) | 2 | 24 | gal/day | |

**Total Service (Pipe 2)**

| | | |
|---|---|---|
| 15218.50 | gal/day | 11.3495 |
| 10.57 | gal/min | |

| | | |
|---|---|---|
| Peaking Factor (per DEQ circular 2 formula) | 4.24 | |
| Peak Hourly Flow | 44.85 | gal/min |
| Infiltration at 150 gal/acre/day (per City of Livingston) | 1702.43 | gal/day |
| Infiltration gal/min | 1.18 | gal/min |
| Total Peak Hourly Flow plus Infiltration | **46.03** | **gal/min** |

**Result**

| | |
|---|---|
| Q/Qfull based on peak hour | 0.09 |
| Percent Full for 8" From Nomograph at peak hour | 25% |

Pipe 3
Project: 18005.05 Mountain View Subdivision
Date: 09/15/2022

## Capacity Calclulations

| | | |
|---|---|---|
| 8" Pipe Flowing Full Capacity | 0.77 | cfs |
| 8" Pipe Flowing Full Capacity | 344 | gal/min |
| (8") Q/Qfill @ 75% full, | 0.75 | per nomograph |
| (8") Capacity @ 75% full | 258 | gal/min |
| 10" Pipe Flowing Full Capacity | 1.16 | cfs |
| 10" Pipe Flowing Full Capacity | 522 | gal/min |
| (10") Q/Qfill @ 75% full, | 0.75 | per nomograph |
| (10") Capacity @ 75% full | 391 | gal/min |

## System Demand

**Service Lots**

| DESIGNATION | People (#) | | | Area (AC) |
|---|---|---|---|---|
| HC (Automobile Service Station - Assumed 10 gallons/vehicle served/day) | 45 | 450 | gal/day | 1.016 |
| HC (Automobile Service Station - Assumed 12 gallons/employee/day) | 2 | 24 | gal/day | 1.016 |
| HC (Restaurant - Assumed 3 gallons/customer/day) | 100 | 300 | gal/day | 1.161 |

**Service Area**

| DESIGNATION | Area (AC) | | |
|---|---|---|---|
| HC (MPUE - Assumed 1,000 gallons/acre/day) | 1.687 | 1687 | gal/day |
| | | 1.71 | gal/min |

| | | |
|---|---|---|
| Peaking Factor (per DEQ circular 2 formula) | 4.24 | |
| Peak Hourly Flow | 7.25 | gal/min |
| Infiltration at 150 gal/acre/day (per City of Livingston) | 579.60 | gal/day |
| Infiltration gal/min | 0.40 | gal/min |
| Total Peak Hourly Flow plus Infiltration | **7.65** | **gal/min** |

**Result**

| | |
|---|---|
| Q/Qfull based on peak hour | 0.01 |
| Percent Full for 8" From Nomograph at peak hour | 10% |

Pipe 4
Project: 18005.05 Mountain View Subdivision
Date: 09/28/2022

SANDERSON STEWART

**Capacity Calclulations**

| | | |
|---|---|---|
| 10" Pipe Flowing Full Capacity | 1.16 | cfs |
| 10" Pipe Flowing Full Capacity | 522 | gal/min |
| Q/Qfill @ 75% full, | 0.75 | per nomograph |
| Capacity @ 75% full | 391 | gal/min |

**System Demand**

**Service Lots**

| DESIGNATION | Lots (#) | | | Area (AC) |
|---|---|---|---|---|
| HC (MPUE - Assumed 4-plex on each lot, 2.5 people per living unit, 100-gallons per capita per day) | 2.00 | 2000.00 | gal/day | 2.116 |
| **Pipe 4** | **1.39** | **gal/min** | | |
| **Previous Service (Pipe 2 and 3)** | | | | |
| Pipe 2 | 10.57 | gal/min | | |
| Pipe 3 | 1.71 | gal/min | | |
| **All Pipes** | **13.67** | **gal/min** | | |
| Peaking Factor (per DEQ Circular 2 Formula) | 4.24 | | | |
| Peak Hourly Flow | 57.99 | gal/min | | |
| Infiltration at 150 gal/acre/day (per City of Livingston) | 2599.43 | gal/day | | |
| Infiltration gal/min | 1.81 | gal/min | | |
| **Total Peak Hourly Flow plus Infiltration** | **59.80** | **gal/min** | | |

**Result**

| | |
|---|---|
| Q/Qfull based on peak hour | 0.11 |
| Percent Full for 10" From Nomograph at peak hour | 28% |

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX C
Subdivision Improvements

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 21, 2023
Project No. 18005.05

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION SUBDIVISION IMPROVEMENTS

The proposed general improvements of the Mountain View Subdivision include streets, street signage, boulevards, sidewalks, and street lighting. All these improvements will be designed to meet the requirements established in the City of Livingston Public Works Design Standards and Specifications Policy including the corresponding Modifications to Montana Public Works Standards. As such all sidewalks will be ADA compliant and all street lighting will meet the requirements of the Night Sky Protection Act.

## STREETS & ALLEYS

All the proposed streets and any future alleys will be designed and constructed in accordance with the City of Livingston Public Works Standards and Subdivision Regulations. The proposed new streets are designed to the "local" street classification standards approved by the City of Livingston for the recently completed Ruedebusch FedEx project. For more details see the Civil Engineering Plans.

## DRAINAGE STRUCTURES

All proposed stormwater drainage structures will be designed and constructed in accordance with the City of Livingston Public Works Standards and applicable DEQ Circulars. For more information and details see Appendix A: Preliminary Stormwater Report and Civil Engineering Plans.

## SIGNS

The proposed Mountain View Subdivision will meet the standards established by the City of Livingston Public Works Standards and Manual on Uniform Control Devices.

## SIDEWALKS

All the proposed sidewalks will be designed and constructed in accordance with the City of Livingston Public Works Standards and Subdivision Regulations. The proposed new sidewalks will be designed and constructed to match the specifications and standards approved by the City of Livingston for the recently completed Ruedebusch FedEx project. For more information see the Civil Engineering Plans.

## STREETLIGHTS

All the proposed street lighting will be designed and installed in accordance with the City of Livingston Public Works Standards, Subdivision Regulations, and the Night Sky Protection Act. The proposed new streetlights will be installed to match the specifications and standards approved by the City of Livingston for the recently completed Ruedebusch FedEx project. For more information see the Civil Engineering Plans.

## SOLID WASTE FACILITIES

Per the Administrative Rules of Montana17.36.309, the Mountain View Subdivision tenants will store solid waste in adequate containers and will contract with the City of Livingston Solid Waste Department to be removed frequently to prevent a nuisance.

## FIRE HYDRANTS

All the required fire hydrants will be designed and installed in accordance with the City of Livingston Public Works Standards and Subdivision Regulations. For more details see the Civil Engineering Plans.

## SEWER, WATER & STORM FACILITIES

All the proposed sewer, water, and stormwater facilities will be designed and constructed in accordance with the City of Livingston Public Works Standards, Subdivision Regulations, and applicable DEQ Circulars. The new subdivision wet utilities will be designed and installed to integrate with the existing City services including those recently constructed for the Ruedebusch FedEx project. For more information and details see Appendix A: Preliminary Stormwater Report, Appendix B: Preliminary Sewer & Water Report, and the Civil Engineering Plans.

## MAIL DELIVERY

Mail deliver services will be provided for the proposed Mountain View Subdivision on a contract basis from the United States Postal Service. It is anticipated the USPS will require that the subdivision would need to provide a central mailbox bank. For more details see Appendix H: Private Service Providers Review.

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX D

Mountain View Subdivision Traffic Impact Study

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

# MOUNTAIN VIEW SUBDIVISION

# TRAFFIC IMPACT STUDY

18005.05

Mr. Andrew Field
Livingston West, LLC
100 PFL Way
Livingston, MT 59047

Placemaking

Infrastructure Engineering

Surveying + Mapping

Community Planning

Landscape Architecture

Branding + Visualization

MONTANA
JOSEPH M. STASZCUK
28335PE
LICENSED PROFESSIONAL ENGINEER

**May 2023**

SANDERSON STEWART
ENDURING COMMUNITY DESIGN

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# INTRODUCTION

This traffic impact study (TIS) assesses the traffic-related impacts associated with the proposed Mountain View Subdivision in Livingston, Montana on the surrounding transportation system. This report also provides recommendations to mitigate any such impacts. The methodology and analysis procedures used in this study employ the latest technology and nationally accepted standards in the areas of site development and transportation impact assessment. Recommendations made in this report are based on professional judgment and these principles.

# SITE LOCATION AND DESCRIPTION

Mountain View Subdivision is located southeast of US Highway 10 north of the Interstate 90 interchange west of Livingston, Montana. The site is bordered by Interstate 90 to the south, US Highway 10 to the west and north, and undeveloped land to the east. An existing Printing for Less (PFL) facility is contained within the proposed subdivision. Figure 1 on the following page depicts the study area.

# SITE DEVELOPMENT PLAN

The site development plan proposes three general development areas to include highway commercial, light industrial/ commercial at 60% lot coverage, and multi-family residential. The highway commercial lots are proposed to include a 50-room hotel, two gas stations with 20 total fueling positions, a 2,000 square-foot coffee shop, and a 5,000 square-foot fast-food restaurant. Approximately 165,101 square feet are proposed for industrial uses, as well as 12 apartments on the residential lots.

Access to the site is proposed via a new full-movement road connection to US 10 across from West End Road and new internal connections to PFL Way, which also accesses US 10. Figure 2 (page 3) shows the current proposed site plan for Mountain View Subdivision.

# EXISTING CONDITIONS

## Streets

Figure 3 on page 4 shows the MDT street classifications and speed limits on study area streets. Additional conditions of study area streets most likely to be affected by the development are described below.

All study area streets are paved. The EB and WB I-90 ramps all have single lane approaches and US 10, West End Road, and PFL Way all have two-lane sections. West Park Street has one thru lane in each direction in the study area with multiple turn lanes at the US 10 intersection. US 10 and the ramps all have paved shoulders, while there is curb and gutter on West Park Street and on PFL Way beginning approximately 150 feet south of US 10. There is a minimally used at-grade railroad crossing on US 10 approximately 70 feet west of West Park Street and another crossing approximately another 0.2-miles to the west.


*Figure 1. Study Area*
*Mountain View Subdivision TIS*


*Figure 2. Site Layout*

*Mountain View Subdivision TIS*


*Figure 3. Street and Intersection Characteristics*

## Intersections

Figure 3 also shows the traffic control utilized at each study area intersection. The West Park Street/US 10 intersection has separate southbound left-turn, thru, and right-turn lanes, and a dedicated northbound left-turn lane. Although there are no marked eastbound turn lanes, the approach provides adequate width that right-turning vehicles often form a separate lane. The signal at this intersection operates with protected/permissive phasing for northbound left turns and permissive phasing for all other movements. The remaining intersections in the study area have no auxiliary turn lanes and are all stop-controlled.

## Bicycle/Pedestrian Facilities

There is a paved path along the north side of US 10 beginning at the westernmost railroad crossing and continuing east and then north along the west side of West Park Street. A sidewalk is provided along the eastern side of West Park Street. There are also sidewalks and multi-use paths within the Printing for Less development area. There are no other bicycle or pedestrian facilities in the study area.

## Traffic Volumes

Weekday AM and PM peak hour turning movement counts were collected for study area intersections on Tuesday, August 30, 2022. The traffic data was collected using Miovision Scout video-based systems. In general, the weekday AM and PM peak hour periods were found to occur from 7:30 to 8:30 AM and 4:30 to 5:30 PM. Raw count data was adjusted for seasonal variation using MDT seasonal adjustment factors. Figure 4 on page 6 summarizes the calculated Existing Conditions (2022) peak hour turning movement volumes for the AM and PM peak hours. Detailed traffic count data worksheets are included in Appendix A.

## Intersection Capacity

Intersection capacity calculations for Existing Conditions (2022) were performed for the study area intersections using Synchro, Version 11, which is based on the Highway Capacity Manual, 6th Edition (Transportation Research Board, 2016) methodologies. Level of service (LOS) is defined as a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. LOS is a qualitative measure of the performance of an intersection with values ranging from LOS A, indicating good operation and low vehicle delays, to LOS F, which indicates congestion and longer vehicle delays. LOS C is typically considered a minimum acceptable threshold for operations in Montana-based communities, though exceptions are made in certain cases.

The results of the Existing Conditions (2022) intersection capacity calculations showed that all intersections and approaches operate at LOS C or better except for the eastbound approach at the West Park Street/US 10 intersection, which operates at LOS D during the AM peak hour, although just under a second over the LOS C cutoff threshold. Figure 4 also shows the Existing Conditions (2022) LOS results at each intersection. Projected 95th percentile queuing is moderate at the West Park Street/US 10 intersection, with queues of up to 13 vehicles on West Park Street and up to 11 vehicles on US 10 to the west, which extends across the at-grade rail crossing. US 10 provides a stop bar in advance of the crossing for eastbound vehicles to queue and prevent them from stopping across the railroad tracks. A detailed capacity summary table and capacity calculation worksheets for the study area intersections can be found in Appendix B.

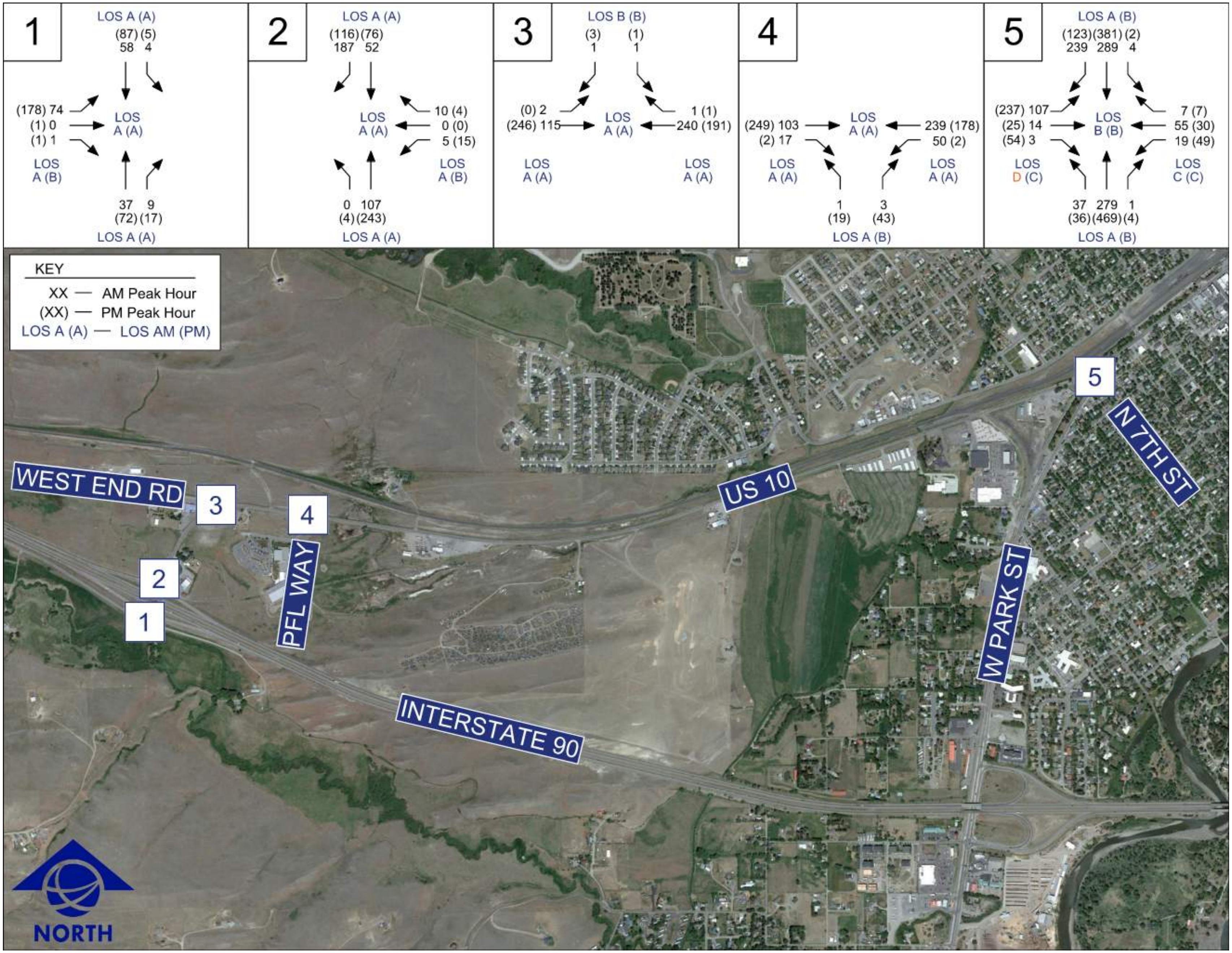



*Figure 4. Existing Conditions (2022) Peak Hour Traffic Volumes*

## Crash Analysis

Historical crash data was requested from MDT and Montana Highway Patrol (MHP) for the 5-year period from January 1, 2015 through December 31, 2019 for all study area intersections. No MDT information could be provided for the West Park Street/US 10 or US 10/West End Road intersections and MHP has no record of crashes at these two intersections. The crash data was analyzed for the purpose of calculating intersection crash/severity rates and evaluating collision type trends. Tables 1 and 2 below and on page 8, respectively, illustrate the results of that analysis.

***Table 1. Crash History – Frequency and Severity Statistics***

| Intersection | 2015-2019 DEV[1] | Reported Crashes[2] | Crash Type | | | Crash Data[3] | | | HSM Predictions[4] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PDO | Injury | Fatality | Average Crash Frequency (Crash/Yr) | Crash Rate (Crash/ MVE) | Severity Index | Predicted Average Crash Frequency (Crash/Yr) | Predicted Crash Rate (Crash/ MVE) |
| US Hwy 10/I-90 EB Ramps | 1774 | 4 | 4 | 0 | 0 | 0.8 | 1.24 | 1.00 | 0.23 | 0.36 |
| US Hwy 10/I-90 WB Ramps | 3579 | 1 | 1 | 0 | 0 | 0.2 | 0.15 | 1.00 | 0.19 | 0.15 |
| US Hwy 10/West Park Street | 15815 | 1 | 1 | 0 | 0 | 0.2 | 0.03 | 1.00 | 2.50 | 0.43 |
| US Hwy 10/West End Road | 5069 | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0.00 | 0.16 | 0.09 |
| US Hwy 10/PFL Way | 4962 | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0.00 | 0.42 | 0.23 |

[1] Daily Entering Volume (DEV) estimated from 2022 peak hour counts and 2015 through 2019 MDT published ADTs
[2] Crashes reported from January 1, 2015 to December 31, 2019
[3] Crash rates expressed as crashes per million vehicles entering (MVE)
[4] Rates calculated using SPICE tool using Highway Safety Manual (HSM) 1st Edition predictive methodology

Intersection crash frequency rates were calculated on the basis of crashes per million vehicles entering (MVE). The MVE metric was estimated based on published historical ADT volumes from the MDT website and 2022 peak hour counts. The highest crash rate was observed to be 1.24 crashes/MVE at the intersection of US 10/I-90 EB Ramps, but the high crash rate is most likely due to the very low traffic volumes since only four crashes occurred during the five years at the intersection. Crash rates for the other study area intersections were 0.00 and 0.15 crashes/MVE. These rates are shown in Table 1.

To evaluate the relative significance of the calculated historical crash rates, an expected rate was calculated using the predictive crash rate formulas in the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM). The process involves calculating the number of crashes predicted at a given intersection in a year based on traffic demand (AADTs) and various physical and traffic environment-based conditions, such as lane configurations and traffic signal phasing. The calculation results in a crashes-per-year prediction. An equivalent MVE frequency rate was then back calculated to compare the predicted crash rate with the actual historical crash rate at the intersection. The results of the calculations showed that the historical crash rate is 3 times higher than the predicted crash rate at the intersection of US 10/I-90 EB Ramps. This is most likely due to four crashes occurring with low volumes at the intersection. The predicted crash rate is equal to the historical crash rate at the intersection of US 10/I-90 WB Ramps. There were no recorded crashes that occurred at the remaining study area intersections during the 5-year period.

In general, the crash rates are generally low relative to intersections with similar attributes that Sanderson Stewart has analyzed around the state over the years. The HSM rate predictions and 5-year crash totals for each intersection are summarized in Table 1.

Severity indexes were also calculated for all study area intersections based on standard MDT protocols. A severity index gives an indication of relative crash severity for a location based on the number of fatal, injury, and property damage only (PDO) crashes. The severity indexes were found to be relatively low (0.00 or 1.00) due to all recorded crashes being PDO. The severity rates are also shown in Table 1.

Collision types were also quantified to identify any significant trends in the crash data. Table 2 below presents the results of that analysis. Fixed object crashes were the most commonly reported collision type (2 of 4, 50%) at the intersection of US 10/I-90 EB Ramps. Three (3) of the 5 total study area intersection crashes were single vehicles crashes (run-off-road or fixed object). All fixed object crashes occurred during daylight with dry roadway conditions. It is possible that high speeds on US Highway 10 are contributing to the single vehicle crashes and inability of drivers to have time to react when leaving a lane before a collision occurs.

*Table 2. Crash History – Collision Type*

| | Collision Type | | | | |
|---|---|---|---|---|---|
| | Right Angle | Rear End | Fixed Object | Run Off Road | Total |
| US Hwy 10/I-90 EB Ramps | 1 | 1 | 2 | | 4 |
| US Hwy 10/I-90 WB Ramps | | | | 1 | 1 |
| US Hwy 10/West Park Street | 1 | | | | 1 |
| US Hwy 10/West End Road | | | | | 0 |
| US Hwy 10/PFL Way | | | | | 0 |

A speed study is recommended to be completed on US 10 upon development of Mountain View Subdivision. It is likely that operations on the highway will become more urban in nature with the addition of the subdivision trips and speed limit changes may be necessary.

It is important to note that more detailed information about individual crashes would be needed to determine exact causes for each collision and identify any additional trends.

# TRIP GENERATION

This study utilized *Trip Generation Manual*, 11th Edition, published by the Institute of Transportation Engineers (ITE), which is the most widely accepted source in the United States for determining trip generation projections. These projections are used to analyze the impacts of a new development on the surrounding area. For the purposes of this study, Land Use Code 110 – General Light Industrial, Land Use Code 220 – Multifamily Housing (Low-Rise), Land Use Code 310 – Hotel, Land Use Code 934 – Fast-Food Restaurant with Drive-Thru Window, Land Use Code 937 – Coffee/Donut Shop with Drive-Thru Window, and Land Use Code 945 – Convenience Store/Gas Station were utilized to estimate trip generation for Mountain View Subdivision. Table 3 on the following page illustrates the results of the trip generation calculations for the site.

At full buildout, Mountain View Subdivision is projected to generate a total of 9,991 gross average weekday trips with 866 trips (484 entering/382 exiting) generated during the AM peak hour and 754 trips (343 entering/411 exiting) generated during the PM peak hour.

Trip generation projections provide an estimate of the total number of trips that would be generated by a proposed development. However, to estimate the net number of new trips made by personal vehicles external to the site, adjustments must often be made to account for internal capture trips, pass-by trips, and trips made by alternate modes.

***Table 3. Trip Generation Summary***

| Land Use | Independent Variable | | Average Weekday | | | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Intensity | Units | total | enter | exit | total | enter | exit | total | enter | exit |
| *Highway Commercial* | | | | | | | | | | | |
| Hotel[1] | 50 | Rooms | 400 | 200 | 200 | 23 | 13 | 10 | 30 | 15 | 15 |
| Internal Capture Trips** | | | 200 | 93 | 107 | 3 | 1 | 2 | 19 | 11 | 8 |
| Convenience Store/Gas Station[2] | 20 | Veh Fueling Positions | 5302 | 2651 | 2651 | 321 | 161 | 160 | 368 | 184 | 184 |
| Internal Capture Trips** | | | 1091 | 507 | 584 | 35 | 14 | 21 | 92 | 51 | 41 |
| Pass-By Trips (Avg. Rate = 56%)** | | | 2359 | 1201 | 1158 | 160 | 82 | 78 | 154 | 74 | 80 |
| Coffee/Donut Shop w/ Drive-Thru Window[3] | 2 | 1000 SF GFA | 1067 | 534 | 533 | 172 | 88 | 84 | 78 | 39 | 39 |
| Internal Capture Trips** | | | 372 | 201 | 171 | 16 | 10 | 6 | 31 | 13 | 18 |
| Pass-By Trips (Avg. Rate = 49%)**† | | | 340 | 163 | 177 | 76 | 38 | 38 | 23 | 13 | 10 |
| Fast-Food Restaurant w/ Drive-Thru Window[4] | 5 | 1000 SF GFA | 2337 | 1169 | 1168 | 223 | 114 | 109 | 165 | 86 | 79 |
| Internal Capture Trips** | | | 817 | 441 | 376 | 21 | 13 | 8 | 68 | 29 | 39 |
| Pass-By Trips (Avg. Rate = 49%)** | | | 745 | 357 | 388 | 98 | 49 | 49 | 48 | 28 | 20 |
| *Light Industrial/Commercial* | | | | | | | | | | | |
| General Light Industrial[5] | 165.101 | 1000 SF GFA | 804 | 402 | 402 | 122 | 107 | 15 | 107 | 15 | 92 |
| *Residential* | | | | | | | | | | | |
| Multifamily Housing (Low-Rise)[6] | 12 | Dwelling Units | 81 | 41 | 40 | 5 | 1 | 4 | 6 | 4 | 2 |
| Internal Capture Trips** | | | 32 | 14 | 18 | 1 | 0 | 1 | 4 | 3 | 1 |
| **Total Gross Trips** | | | **9991** | **4997** | **4994** | **866** | **484** | **382** | **754** | **343** | **411** |
| **Total Internal Capture Trips** | | | **2512** | **1256** | **1256** | **76** | **38** | **38** | **214** | **107** | **107** |
| **Total Pass-By Trips** | | | **3444** | **1721** | **1723** | **334** | **169** | **165** | **225** | **115** | **110** |
| **Total New External Trips** | | | **4035** | **2020** | **2015** | **456** | **277** | **179** | **315** | **121** | **194** |

| | | | |
|---|---|---|---|
| (1) | Hotel - Land Use 310* | Units = Rooms | |
| | Average Weekday: | Average Rate = 7.99 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: | Average Rate = 0.46 | (56% entering/44% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: | Average Rate = 0.59 | (51% entering/49% exiting) |
| (2) | Convenience Store/Gas Station - Land Use 945* | Units = Vehicle Fueling Positions | |
| | Average Weekday: | Average Rate = 265.12 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: | Average Rate = 16.06 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: | Average Rate = 18.42 | (50% entering/50% exiting) |
| (3) | Coffee/Donut Shop with Drive-Thru Window - Land Use Code 937* | Units = 1000 SF GFA | |
| | Average Weekday: | Average Rate = 533.57 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: | Average Rate = 85.88 | (51% entering/49% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: | Average Rate = 38.99 | (50% entering/50% exiting) |
| (4) | Fast-Food Restaurant with Drive-Thru Window - Land Use 934* | Units = 1000 SF GFA | |
| | Average Weekday: | Average Rate = 467.48 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: | Average Rate = 44.61 | (51% entering/49% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: | Average Rate = 33.03 | (52% entering/48% exiting) |
| (5) | General Light Industrial - Land Use 110* | Units = 1000 SF GFA | |
| | Average Weekday: | Average Rate = 4.87 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: | Average Rate = 0.74 | (88% entering/12% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: | Average Rate = 0.65 | (14% entering/86% exiting) |
| (6) | Multifamily Housing (Low-Rise) - Land Use 220* | Units = Dwelling Units | |
| | Average Weekday: | Average Rate = 6.74 | (50% entering/50% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 7 and 9 AM: | Average Rate = 0.40 | (24% entering/76% exiting) |
| | Peak Hour of the Adjacent Street, One Hour between 4 and 6 PM: | Average Rate = 0.51 | (63% entering/37% exiting) |

**Trip Generation, 11th Edition*, Institute of Transportation Engineers, 2021

***Trip Generation Handbook, 3rd Edition*, Institute of Transportation Engineers, 2017

†Pass-By Trips Average Rate for Coffee/Donut Shop w/ Drive-Through Window is not included in ITE Pass-By data, therefore 49% Pass-By Average Rate for Fast Food Restaurant w/ Drive-Through was selected

Internal capture (IC) trips are trips that do not have origins or destinations external to a project site and therefore do not have an impact on external traffic operations. IC trips most often occur in mixed-use developments where residential, commercial, and office-related land uses exhibit a high rate of internal trip exchange. IC trips were therefore calculated between the commercial, and residential uses in the subdivision.

Pass-by trips are trips that are made as intermediate stops on the way from a point of origin to a primary trip destination. Pass-by trips are attracted from traffic "passing by" on an adjacent street that offers direct access to that site. Pass-by trips are primarily attracted by commercial type land uses such as restaurants, convenience markets, and gas stations and were therefore also calculated for this study.

Trips made by alternate modes (walking, biking, transit) were considered as negligible for this site due to its location and the lack of multi-modal accessibility on US 10.

With reductions made for internal capture and pass-by trips, the Mountain View Subdivision is projected to generate 4,305 net new external vehicular trips on a typical weekday with 456 trips (277 entering/179 exiting) during the AM peak hour and 315 trips (121 entering/194 exiting) during the PM peak hour.

# TRIP DISTRIBUTION

Trip distribution is an estimate of site-generated trip routing, which can be determined by several methods such as computerized travel demand models, calculation of travel time for various available routes, and/or simple inspection of existing traffic patterns within the project area. For this study, distribution percentages were calculated based on existing traffic volumes and other nearby studies. Figure 5 on page 11 presents the trip distribution scheme.

# TRAFFIC ASSIGNMENT

Traffic assignment is the procedure whereby site-generated vehicle trips are assigned to study area streets, intersections, and site access driveways based on the calculated trip distribution and the physical attributes of the development site. Using this approach, site-generated trips for Mountain View Subdivision were assigned to the study area intersections for the purposes of projecting future traffic volumes for analysis. The results of this exercise are also illustrated in Figure 5 on page 11.

# TRAFFIC IMPACTS

## Traffic Volumes

Based on information from the client, a buildout year of 2027 was utilized for the purposes of calculating future traffic projections. In addition to site-generated trips, background traffic volumes will also likely increase for study area streets and intersections due to general growth. To account for that growth, historical MDT traffic data on US 10 and I-90 was reviewed, and it was determined that an annual background growth rate (AGR) of 2% would be conservatively appropriate for modeling ambient growth on US 10 and West Park Street, and 4% AGR would be appropriate on the I-90 ramps. Future (2027) traffic projections for the facility were then calculated by combining existing traffic volumes with anticipated background growth, site-generated traffic assignments, and projected trips for the FedEx facility currently under construction within the Mountain View Subdivision area. Figure 6 on page 12 illustrates the resulting AM and PM peak hour traffic volume projections.

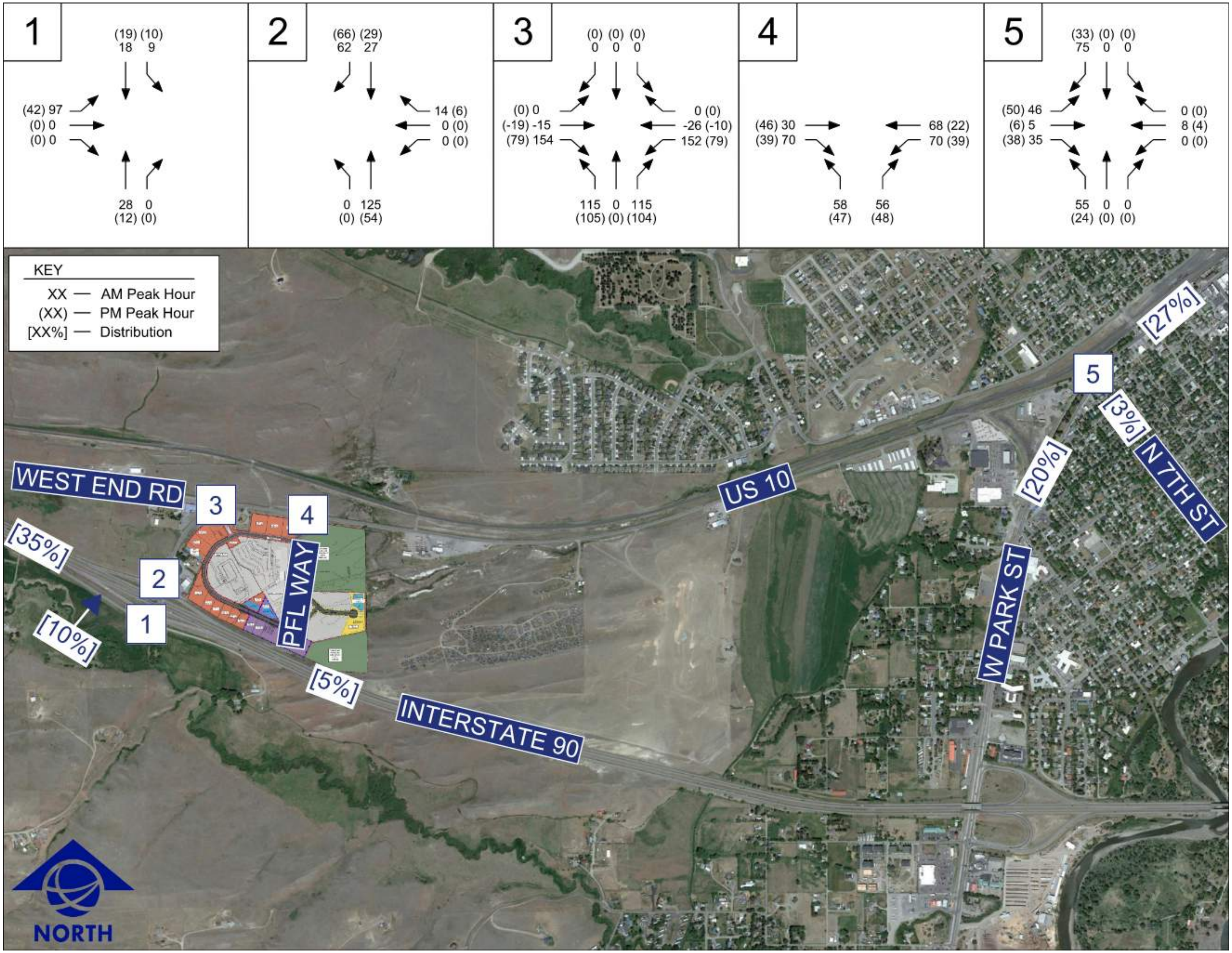



*Figure 5. Trip Distribution & Traffic Assignment Summary*

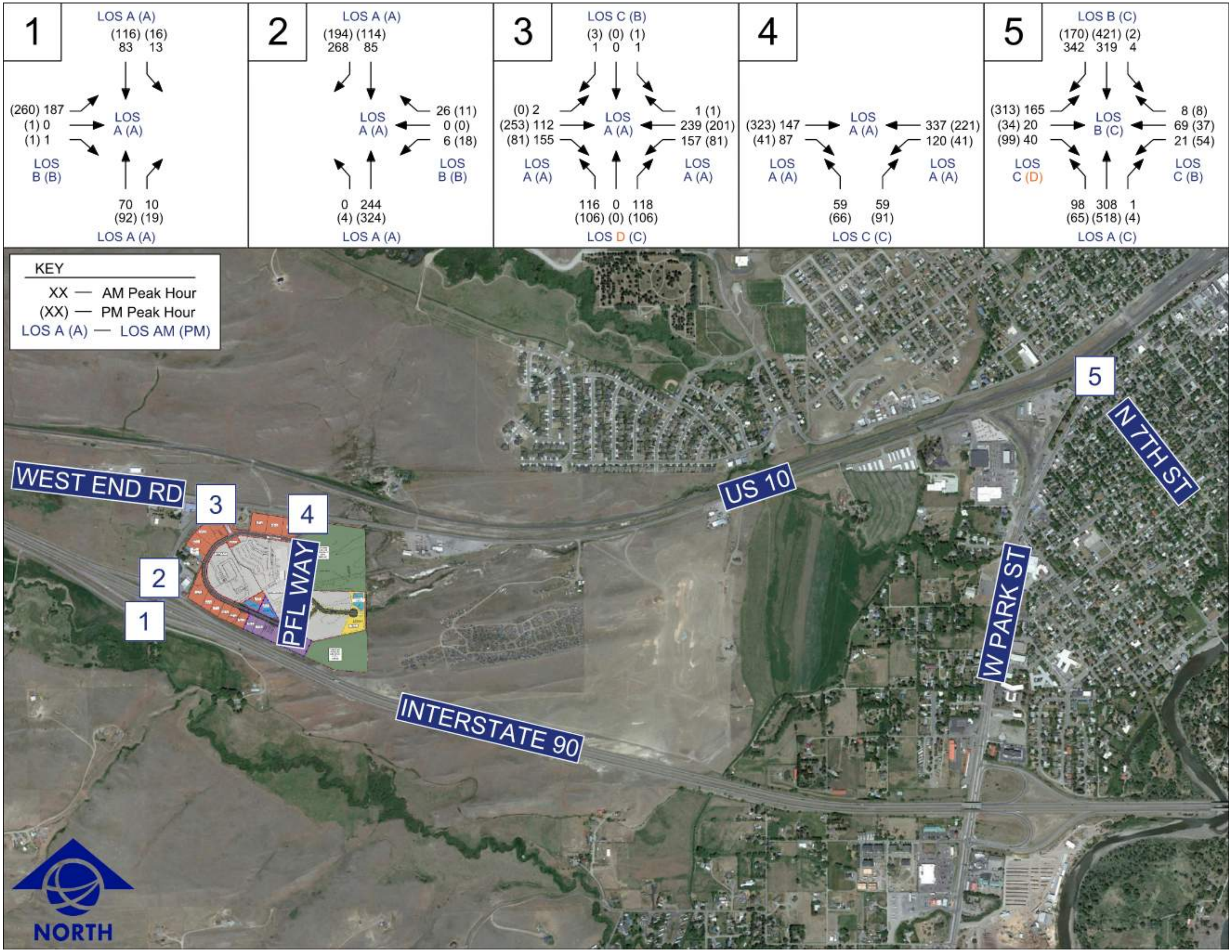



*Figure 6. Future (2027) Traffic Projections*

## Intersection Capacity

Intersection capacity calculations were performed for the Future (2027) scenario based on the AM and PM peak hour traffic volume projections presented in Figure 6. Peak hour factors (PHFs) for the design year were conservatively assumed to be 0.92 for all intersections, per HCM guidelines and common industry practice for future scenarios. The assumed values were utilized to not overestimate future congestion in the study area. Figure 6 also shows the Future (2027) LOS results at each intersection.

Future (2027) scenario capacity results are projected to be similar to Existing Conditions (2022) results. The northbound approach at the US 10/West End Road intersection is projected to operate at LOS D during the AM peak hour with the addition of subdivision trips. The West Park Street/US 10 intersection is projected to operate at LOS D on the eastbound approach during the PM peak hour. During the AM peak hour, that approach is projected to improve from LOS D to C because the average delay value decreases due to the addition of eastbound right-turning trips from Mountain View Subdivision which have low delay values. All other intersections and approaches are projected to continue to operate at or above LOS C. Projected 95th percentile queuing is projected to worsen at the West Park Street/US 10 intersection, with a queue of 19 vehicles projected eastbound on US 10. A detailed intersection capacity summary table and capacity calculation worksheets for the Future (2027) traffic projection scenario can be found in Appendix C.

## Bicycle and Pedestrian Facilities

It is recommended that the road ditches on the south side of US 10 be regraded in order to build a multi-use path along the entirety of US 10, as requested by the City of Livingston. It is assumed the full path typical section will fit within the existing MDT Highway 10 right-of-way, but ultimate location will be determined through final design. Designing the path to an elevation close to the roadway elevation will require the roadside berms to be regraded which subsequently will optimize sight distance.

## Mitigation Alternatives

A variety of potential mitigation improvement options were evaluated to address existing concerns and/or projected impacts for the study area streets and intersections. The following paragraphs provide details on that analysis.

### *Auxiliary Turn Lanes*

Auxiliary right- and left-turn lane warrants were evaluated based on the methodology outlined in the MDT Traffic Engineering Manual (November 2007) for the Existing Conditions (2022) and Future (2027) analysis scenarios:

- **US 10/PFL Way intersection:** A westbound left-turn lane is warranted based on the Existing Conditions (2022) scenario. An eastbound right-turn lane is not projected to be warranted in the Future (2027) scenario, but the turning volume is only two vehicles below the required threshold for considering a turn lane.
- **US 10/West End Road intersection:** An eastbound right-turn lane and a westbound left-turn lane are both projected to be warranted based on the Future (2027) scenario.
- **I-90 WB Ramps/US 10 intersection:** A southbound right-turn is warranted based on the Existing Conditions (2022) scenario.

- **I-90 EB Ramps/US 10 intersection:** No turn lanes are warranted based on the Existing Conditions (2022) or Future (2027) scenarios.

The high volume of trips added to the network by the Mountain View Subdivision are projected to trigger the warrants for turn lanes into the site access intersections. The final decision to install any turn lanes shall be made by MDT after evaluation of what impacts they may have to other aspects of the intersections or adjacent intersections. Auxiliary turn lane warrant worksheets for Existing Conditions (2022) and Future (2027) scenarios can be found in Appendix D.

### *Improved Intersection Capacity*

The warranted eastbound right-turn and westbound left-turn lanes at the US 10/West End Road intersection are projected to reduce northbound delay during the AM peak hour by over 6 seconds/vehicle, resulting in an improved capacity of LOS C on that approach in the Future (2027) scenario. These lanes should be considered for installation due to the projected capacity improvements, as well as the safety benefits provided by separating thru and turning movements on a higher speed facility.

The warranted turn lanes at the US 10/PFL Way and I-90 WB Ramps/US 10 intersections are projected to have a minimal impact on capacity, and both intersections are projected to operate at LOS C or better with existing lane configurations. Although these turn lanes do not provide capacity benefits, they should be considered by MDT due to their potential to improve safety at the intersections by separating thru and turning movements, particularly at the PFL Way intersection where the speed limit is 60 mph.

Minor changes to the signal timing plan at the West Park Street/US 10 intersection are projected to improve capacity from LOS D to LOS C during the PM peak hour in the Future (2027) scenario.

### *Other Area Developments*

Although a development application was previously submitted for land on the northwest side of US 10, that application was denied, and no further plans have been made public for potential development at that location or other sites adjacent to the Mountain View Subdivision area. Therefore, no additional trips were added to the Future (2027) scenario to account for potential area development in addition to the ambient background growth.

# CONCLUSIONS AND RECOMMENDATIONS

## Conclusions

The preceding analysis has shown that construction of the facility will generate a substantial volume of new traffic demand for area streets and intersections. Through the planned development, it is estimated that approximately 4,035 new external vehicle trips could be generated daily upon full buildout of the subdivision. This would result in approximately 2,000 new vehicle trips per day on US 10 just west of the West Park Street intersection.

An evaluation of Existing Conditions (2022) intersection capacity showed that all intersections and approaches currently operate at LOS C or better except for the eastbound approach at the West Park Street/US 10 intersection, which operates at LOS D during the AM peak hour. A crash history analysis showed that crash and severity rates are generally low for all study area intersections. Fixed object/run off road collisions were found to be the most common amongst historical crashes overall, with speed possibly being a contributing factor.

Initial intersection capacity analysis results for the Future (2027) scenario projected that the new northbound approach at the US 10/West End Road intersection would operate at LOS D during the AM peak hour. The eastbound approach at the West Park Street/US 10 intersection is also projected to worsen to LOS D during the PM peak hour.

Auxiliary turn lane warrants were evaluated at all study area intersections. Based on the application of MDT Traffic Engineering Manual criteria, turn lanes were found to be warranted at the US 10/PFL Way, US 10/West End Road, and I-90 WB Ramps/US 10 intersections. The warranted lanes should be considered for installation based on projected capacity improvements at the US 10/West End Road intersection and potential safety benefits at all three intersections provided by separating thru and turning movements. The final decision to install any turn lanes will be made by MDT.

## Recommendations

The following list of recommendations is based on the analysis results from this study and professional judgment:

- An R1-1 (stop) sign shall be installed on the southern leg of the new site access intersection with US 10 at West End Road.
- A speed study should be conducted for US 10 upon full buildout of Mountain View Subdivision to evaluate whether the resulting traffic increase and safety concerns may warrant reduced speed limits.
- Installation of the following turn lanes should be considered, although MDT may decide the intersection characteristics and safety considerations would not benefit from the warranted lanes.
    - A westbound left-turn lane should be considered at the US 10/PFL Way intersection based on Existing Conditions (2022) and Future (2027) scenario turn lane warrant results. An eastbound right-turn lane should also be considered at the intersection, as Future (2027) projected volumes are extremely close to meeting the warrant. These lanes may provide safety benefits at the intersection.
    - A westbound left-turn lane and eastbound right-turn lane should be considered at the US 10/West End Road intersection based on Future (2027) scenario turn lane warrant results. These lanes are projected to provide capacity benefits and may provide safety benefits at the intersection.
    - A southbound right-turn lane should be considered at the I-90 WB Ramps/US 10 intersection based on Existing Conditions (2022) turn lane warrant results. This turn lane may provide safety benefits at the intersection.
- Safety and operations should be monitored at the West Park Street/US 10 intersection as area volumes increase, particularly on the west leg. Steps should be taken to prevent vehicles from stopping across the railroad tracks if necessary, and the signal timing plan should be reevaluated as capacity deteriorates. If deemed necessary by an engineering study, a pre-signal on US 10 may be considered as outlined in Chapter 8C.09.16 of the MUTCD. Any modifications to the at-grade railroad crossing shall be evaluated by and coordinated with MRL and BNSF.
- Any proposed improvements should be coordinated with MDT area projects and all transportation-related improvements shall be designed in accordance with MDT standards (where applicable), the City of Livingston, and the Manual on Uniform Traffic Control Devices (MUTCD).

# TRAFFIC VOLUME DATA

APPENDIX A

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

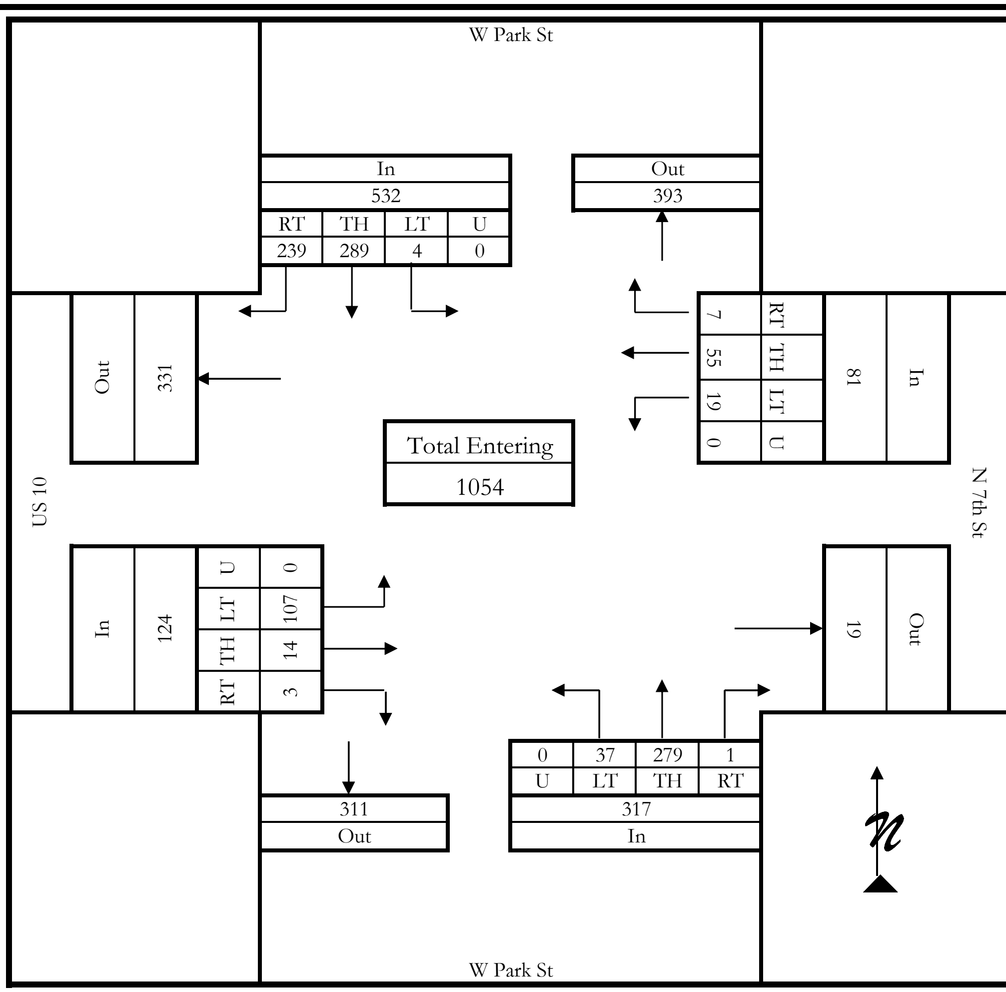
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & W Park St |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | AM Peak Hour (7:30 - 8:30 AM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | W Park St | East/West Street: | US 10 |

## Vehicle Volumes and Adjustments

| | W Park St Southbound | | | | | W Park St Northbound | | | | | US 10 Eastbound | | | | | N 7th St Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | 1.00 | 1.00 | 1.00 | 1.00 | | |
| 7:30 AM | 59 | 60 | 0 | 0 | 119 | 0 | 49 | 6 | 0 | 55 | 2 | 3 | 32 | 0 | 37 | 0 | 12 | 3 | 0 | 15 | 226 |
| 7:45 AM | 59 | 79 | 0 | 0 | 138 | 0 | 82 | 12 | 0 | 94 | 0 | 4 | 32 | 0 | 36 | 2 | 19 | 6 | 0 | 27 | 295 |
| 8:00 AM | 65 | 89 | 4 | 0 | 158 | 1 | 82 | 11 | 0 | 94 | 1 | 4 | 22 | 0 | 27 | 2 | 13 | 4 | 0 | 19 | 298 |
| 8:15 AM | 56 | 61 | 0 | 0 | 117 | 0 | 66 | 8 | 0 | 74 | 0 | 3 | 21 | 0 | 24 | 3 | 11 | 6 | 0 | 20 | 235 |
| Grand Total | 239 | 289 | 4 | 0 | 532 | 1 | 279 | 37 | 0 | 317 | 3 | 14 | 107 | 0 | 124 | 7 | 55 | 19 | 0 | 81 | 1054 |
| Medium Truck % | 2.9 | 3.5 | 0.0 | 0.0 | 3.2 | 0.0 | 1.8 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 2.8 | 0.0 | 2.4 | 0.0 | 0.0 | 10.5 | 0.0 | 2.5 | |
| Heavy Truck % | 0.8 | 1.4 | 0.0 | 0.0 | 1.1 | 0.0 | 1.1 | 2.7 | 0.0 | 1.3 | 0.0 | 0.0 | 1.9 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Truck % | 3.8 | 4.8 | 0.0 | 0.0 | 4.3 | 0.0 | 2.9 | 2.7 | 0.0 | 2.8 | 0.0 | 0.0 | 4.7 | 0.0 | 4.0 | 0.0 | 0.0 | 10.5 | 0.0 | 2.5 | |
| Total % | 22.7 | 27.4 | 0.4 | 0.0 | 50.5 | 0.1 | 26.5 | 3.5 | 0.0 | 30.1 | 0.3 | 1.3 | 10.2 | 0.0 | 11.8 | 0.7 | 5.2 | 1.8 | 0.0 | 7.7 | 100.0 |
| PHF | 0.84 | 0.84 | 0.84 | | | 0.85 | 0.85 | 0.85 | | | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | | | 0.88 |



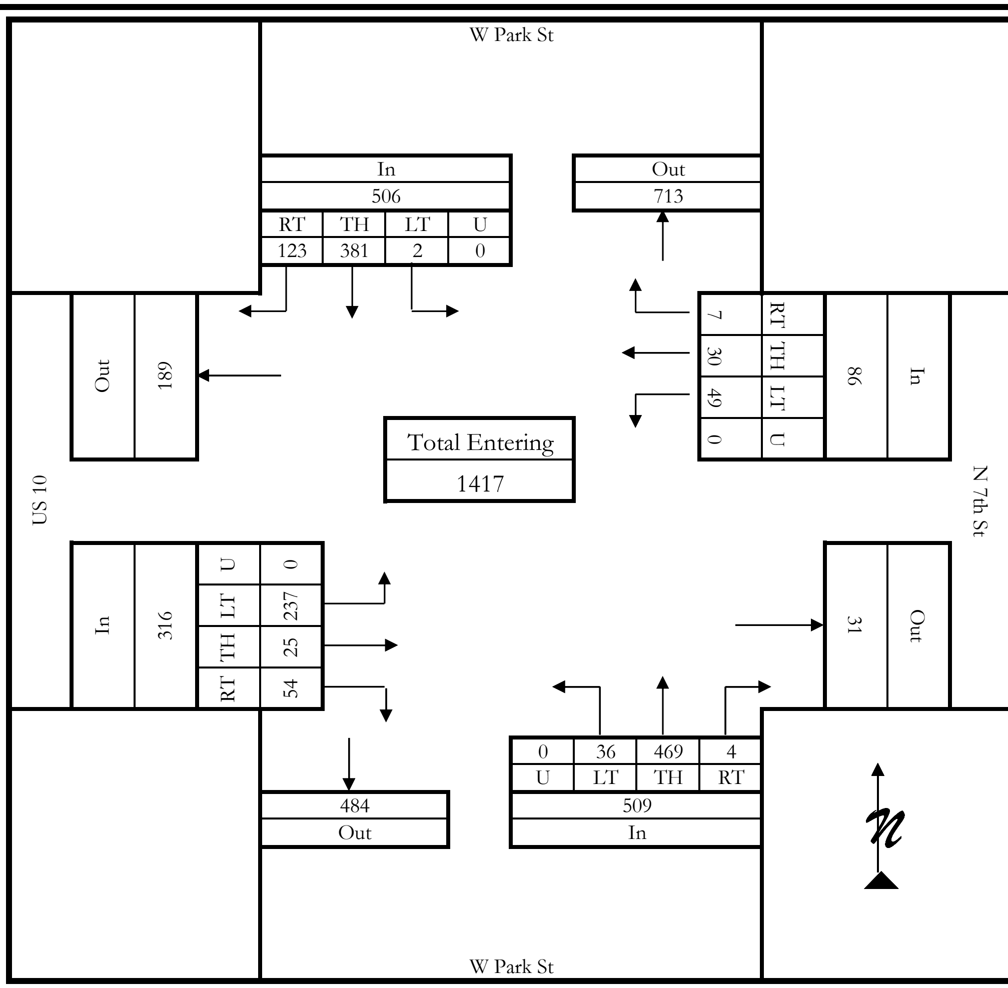
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & W Park St |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | PM Peak Hour (4:30 - 5:30 PM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | W Park St | East/West Street: | US 10 |

## Vehicle Volumes and Adjustments

| | W Park St Southbound | | | | | W Park St Northbound | | | | | US 10 Eastbound | | | | | N 7th St Westbound | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | |
| Factor | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | 1.00 | 1.00 | 1.00 | 1.00 | | |
| 4:30 PM | 31 | 77 | 0 | 0 | 108 | 4 | 123 | 11 | 0 | 138 | 6 | 4 | 53 | 0 | 63 | 2 | 6 | 9 | 0 | 17 | 326 |
| 4:45 PM | 29 | 101 | 0 | 0 | 130 | 0 | 102 | 5 | 0 | 107 | 17 | 6 | 61 | 0 | 84 | 3 | 6 | 14 | 0 | 23 | 344 |
| 5:00 PM | 42 | 97 | 1 | 0 | 140 | 0 | 145 | 11 | 0 | 156 | 17 | 9 | 58 | 0 | 84 | 0 | 8 | 17 | 0 | 25 | 405 |
| 5:15 PM | 21 | 106 | 1 | 0 | 128 | 0 | 99 | 9 | 0 | 108 | 14 | 6 | 65 | 0 | 85 | 2 | 10 | 9 | 0 | 21 | 342 |
| Grand Total | 123 | 381 | 2 | 0 | 506 | 4 | 469 | 36 | 0 | 509 | 54 | 25 | 237 | 0 | 316 | 7 | 30 | 49 | 0 | 86 | 1417 |
| Medium Truck % | 0.8 | 0.3 | 0.0 | 0.0 | 0.4 | 0.0 | 1.1 | 2.8 | 0.0 | 1.2 | 0.0 | 4.0 | 0.8 | 0.0 | 0.9 | 0.0 | 0.0 | 2.0 | 0.0 | 1.2 | |
| Heavy Truck % | 0.8 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.4 | 2.8 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Truck % | 1.6 | 1.3 | 0.0 | 0.0 | 1.4 | 0.0 | 1.5 | 5.6 | 0.0 | 1.8 | 0.0 | 4.0 | 0.8 | 0.0 | 0.9 | 0.0 | 0.0 | 2.0 | 0.0 | 1.2 | |
| Total % | 8.7 | 26.9 | 0.1 | 0.0 | 35.7 | 0.3 | 33.1 | 2.5 | 0.0 | 35.9 | 3.8 | 1.8 | 16.7 | 0.0 | 22.3 | 0.5 | 2.1 | 3.5 | 0.0 | 6.1 | 100.0 |
| PHF | 0.90 | 0.90 | 0.90 | | | 0.81 | 0.81 | 0.81 | | | 0.95 | 0.95 | 0.95 | | | 0.86 | 0.86 | 0.86 | | | 0.88 |



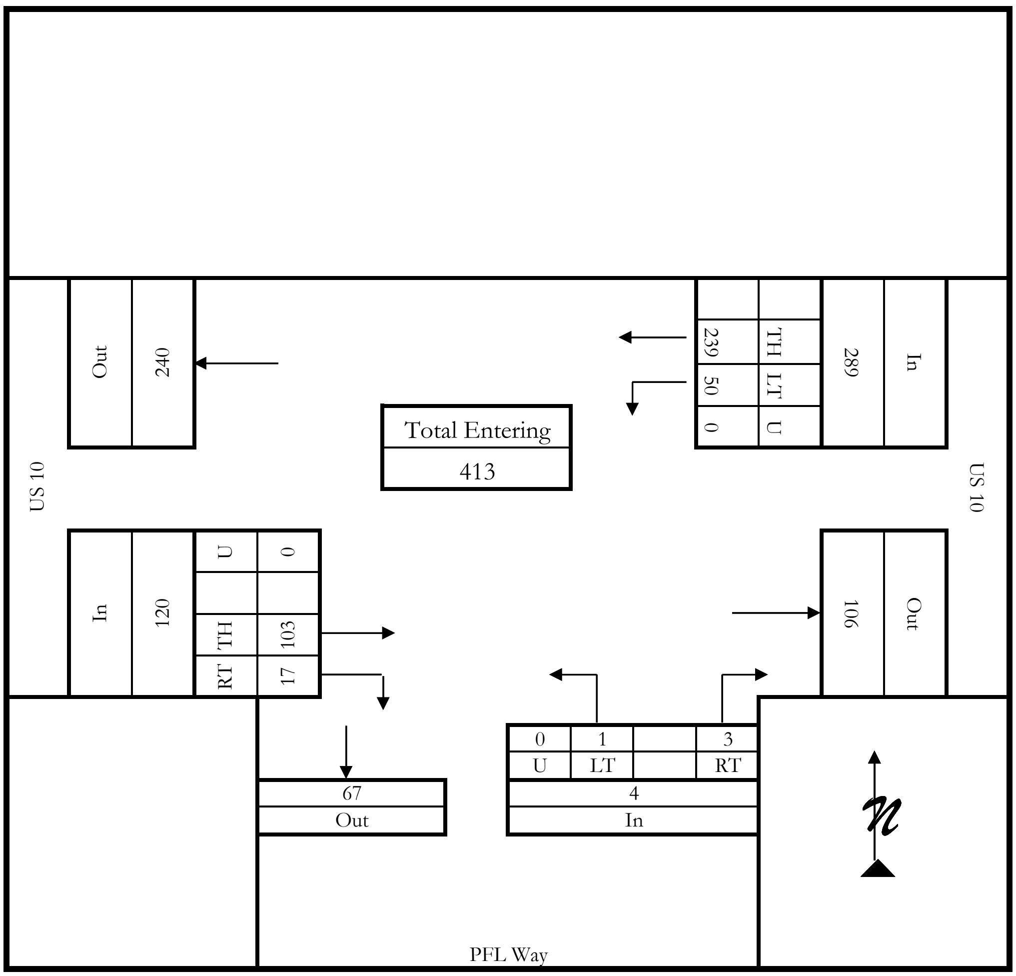
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & PFL Way |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | AM Peak Hour (7:30 - 8:30 AM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | PFL Way | East/West Street: | US 10 |

## Vehicle Volumes and Adjustments

| | PFL Way Southbound | | | | | PFL Way Northbound | | | | | US 10 Eastbound | | | | | US 10 Westbound | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | |
| Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | |
| 7:30 AM | | | | | | 0 | 0 | 1 | 0 | 1 | 4 | 35 | 0 | 0 | 39 | 0 | 60 | 5 | 0 | 65 | 105 |
| 7:45 AM | | | | | | 0 | 0 | 0 | 0 | 0 | 7 | 35 | 0 | 0 | 42 | 0 | 47 | 23 | 0 | 70 | 112 |
| 8:00 AM | | | | | | 0 | 0 | 0 | 0 | 0 | 4 | 16 | 0 | 0 | 20 | 0 | 74 | 16 | 0 | 90 | 110 |
| 8:15 AM | | | | | | 3 | 0 | 0 | 0 | 3 | 2 | 17 | 0 | 0 | 19 | 0 | 58 | 6 | 0 | 64 | 86 |
| Grand Total | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 4 | 17 | 103 | 0 | 0 | 120 | 0 | 239 | 50 | 0 | 289 | 413 |
| Medium Truck % | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | 1.7 | 0.0 | 2.9 | 0.0 | 0.0 | 2.4 | |
| Heavy Truck % | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.8 | 0.0 | 3.8 | 0.0 | 0.0 | 3.1 | |
| Total Truck % | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 2.5 | 0.0 | 6.7 | 0.0 | 0.0 | 5.5 | |
| Total % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.2 | 0.0 | 1.0 | 4.1 | 24.9 | 0.0 | 0.0 | 29.1 | 0.0 | 57.9 | 12.1 | 0.0 | 70.0 | 100.0 |
| PHF | | | | | | 1.00 | 1.00 | 1.00 | | | 0.71 | 0.71 | 0.71 | | | 1.00 | 1.00 | 1.00 | | | 0.92 |



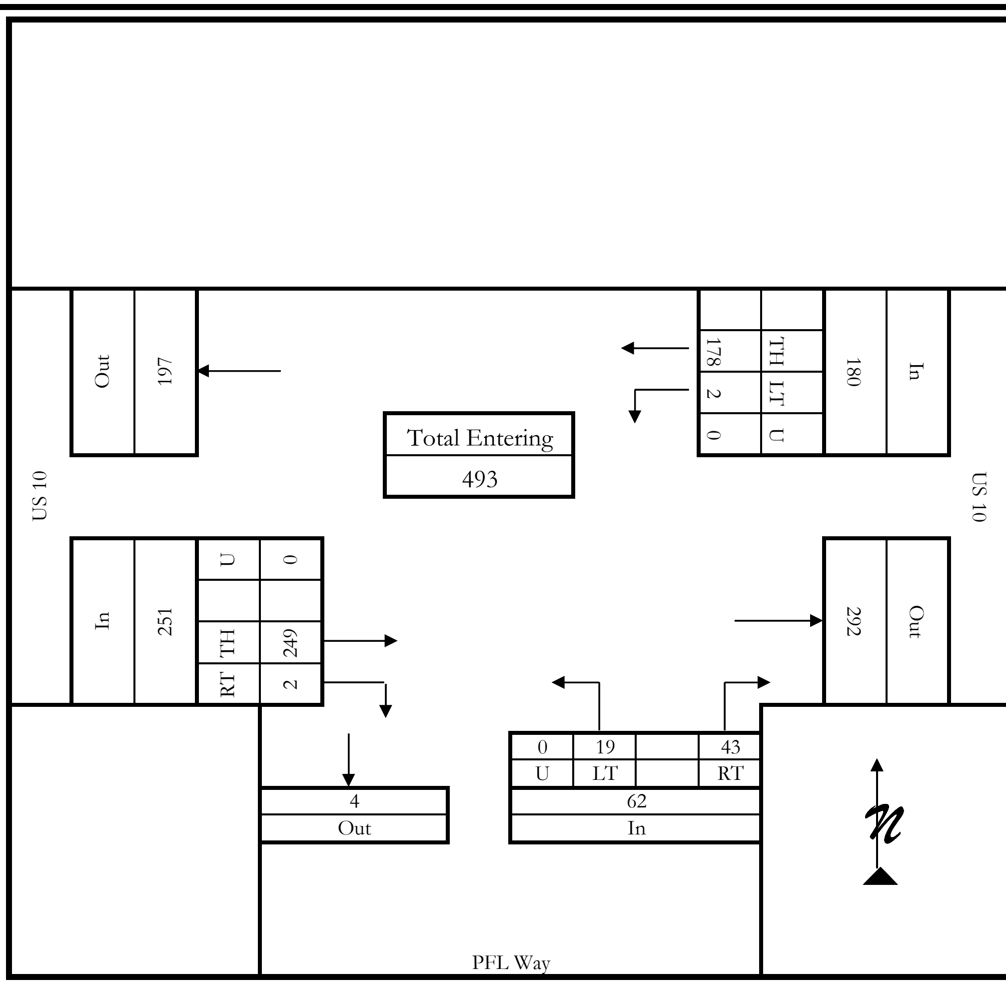
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & PFL Way |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | PM Peak Hour (4:30 - 5:30 PM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | PFL Way | East/West Street: | US 10 |

## Vehicle Volumes and Adjustments

| | PFL Way Southbound | | | | | PFL Way Northbound | | | | | US 10 Eastbound | | | | | US 10 Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | |
| 4:30 PM | | | | | 0 | 5 | 0 | 3 | 0 | 8 | 1 | 66 | 0 | 0 | 67 | 0 | 44 | 1 | 0 | 45 | 120 |
| 4:45 PM | | | | | 0 | 8 | 0 | 4 | 0 | 12 | 0 | 60 | 0 | 0 | 60 | 0 | 33 | 1 | 0 | 34 | 106 |
| 5:00 PM | | | | | 0 | 21 | 0 | 10 | 0 | 31 | 0 | 52 | 0 | 0 | 52 | 0 | 50 | 0 | 0 | 50 | 133 |
| 5:15 PM | | | | | 0 | 9 | 0 | 2 | 0 | 11 | 1 | 71 | 0 | 0 | 72 | 0 | 51 | 0 | 0 | 51 | 134 |
| Grand Total | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 19 | 0 | 62 | 2 | 249 | 0 | 0 | 251 | 0 | 178 | 2 | 0 | 180 | 493 |
| Medium Truck % | | | | | 0.0 | 0.0 | 0.0 | 5.3 | 0.0 | 1.6 | 0.0 | 1.2 | 0.0 | 0.0 | 1.2 | 0.0 | 2.8 | 0.0 | 0.0 | 2.8 | |
| Heavy Truck % | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 1.6 | 0.0 | 3.4 | 0.0 | 0.0 | 3.3 | |
| Total Truck % | | | | | 0.0 | 0.0 | 0.0 | 5.3 | 0.0 | 1.6 | 0.0 | 2.8 | 0.0 | 0.0 | 2.8 | 0.0 | 6.2 | 0.0 | 0.0 | 6.1 | |
| Total % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.7 | 0.0 | 3.9 | 0.0 | 12.6 | 0.4 | 50.5 | 0.0 | 0.0 | 50.9 | 0.0 | 36.1 | 0.4 | 0.0 | 36.5 | 100.0 |
| PHF | | | | | | 1.00 | 1.00 | 1.00 | | | 0.88 | 0.88 | 0.88 | | | 0.88 | 0.88 | 0.88 | | | 0.92 |



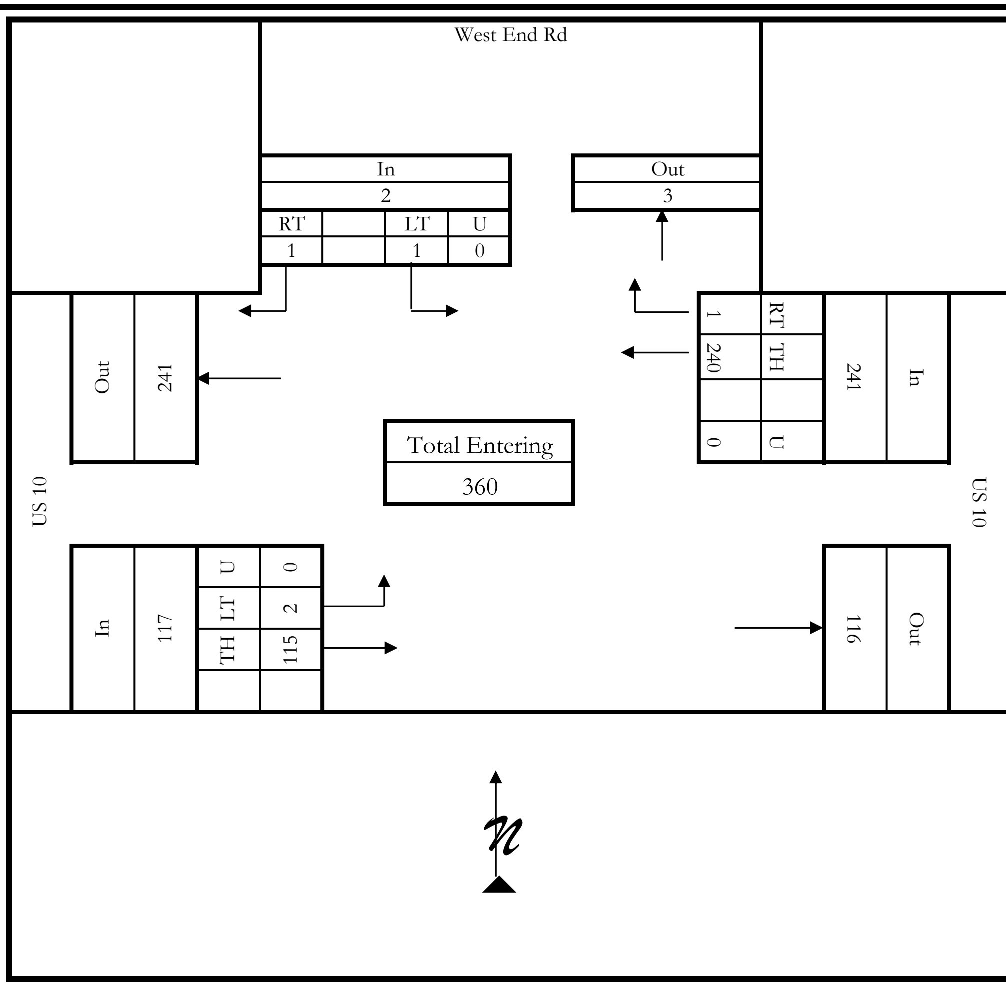
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & West End Rd |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | AM Peak Hour (7:30 - 8:30 AM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | West End Rd | East/West Street: | US 10 |

## Vehicle Volumes and Adjustments

| | West End Rd Southbound | | | | | West End Rd Northbound | | | | | US 10 Eastbound | | | | | US 10 Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | |
| 7:30 AM | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 1 | 0 | 39 | 1 | 60 | 0 | 0 | 61 | 101 |
| 7:45 AM | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 1 | 0 | 41 | 0 | 45 | 0 | 0 | 45 | 87 |
| 8:00 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 19 | 0 | 77 | 0 | 0 | 77 | 96 |
| 8:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 18 | 0 | 58 | 0 | 0 | 58 | 76 |
| Grand Total | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 115 | 2 | 0 | 117 | 1 | 240 | 0 | 0 | 241 | 360 |
| Medium Truck % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 1.7 | 0.0 | 2.9 | 0.0 | 0.0 | 2.9 | |
| Heavy Truck % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 1.7 | 0.0 | 3.8 | 0.0 | 0.0 | 3.7 | |
| Total Truck % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.5 | 0.0 | 0.0 | 3.4 | 0.0 | 6.7 | 0.0 | 0.0 | 6.6 | |
| Total % | 0.3 | 0.0 | 0.3 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31.9 | 0.6 | 0.0 | 32.5 | 0.3 | 66.7 | 0.0 | 0.0 | 66.9 | 100.0 |
| PHF | 0.50 | 0.50 | 0.50 | | | 1.00 | 1.00 | 1.00 | | | 0.75 | 0.75 | 0.75 | | | 0.99 | 0.99 | 0.99 | | | 0.89 |



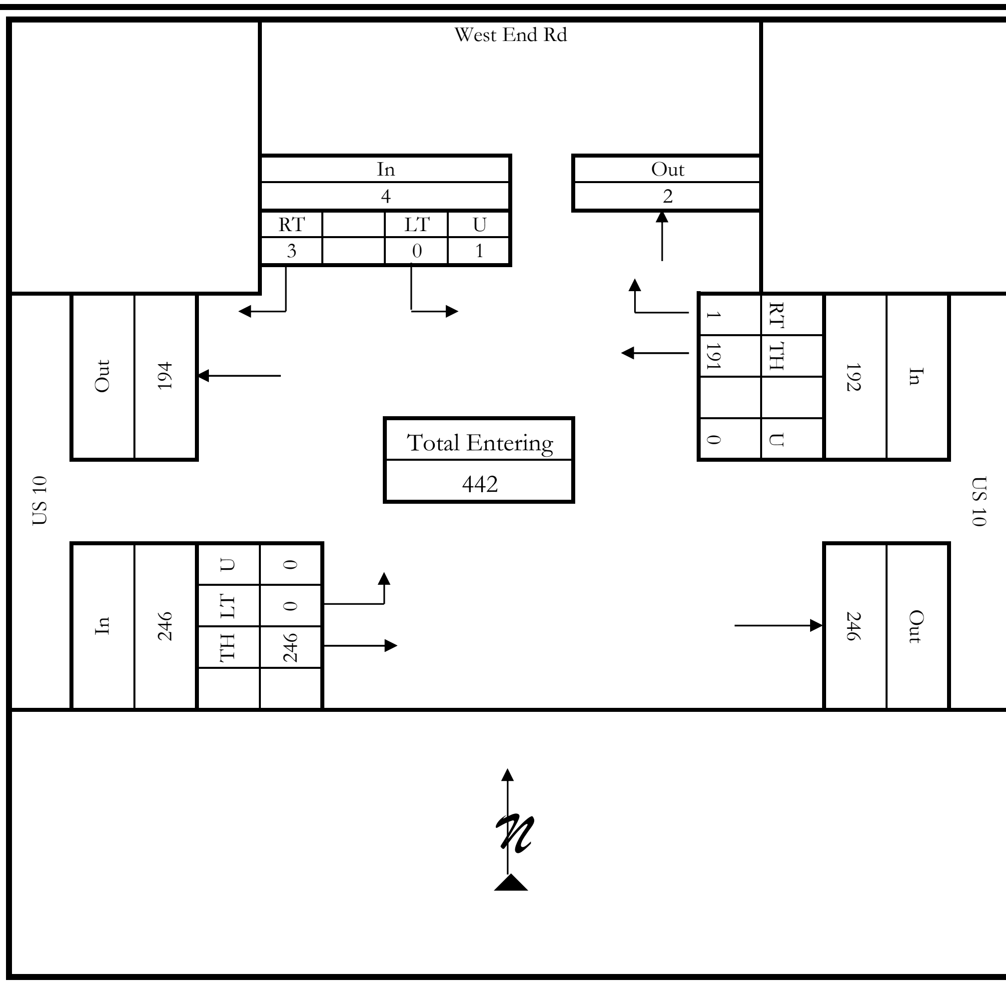
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & West End Rd |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | PM Peak Hour (4:30 - 5:30 PM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | West End Rd | East/West Street: | US 10 |

## Vehicle Volumes and Adjustments

| | West End Rd Southbound | | | | | West End Rd Northbound | | | | | US 10 Eastbound | | | | | US 10 Westbound | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | |
| Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | |
| 4:30 PM | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 66 | 0 | 0 | 66 | 1 | 45 | 0 | 0 | 46 | 113 |
| 4:45 PM | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 59 | 0 | 36 | 0 | 0 | 36 | 97 |
| 5:00 PM | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 0 | 0 | 51 | 0 | 58 | 0 | 0 | 58 | 110 |
| 5:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 70 | 0 | 52 | 0 | 0 | 52 | 122 |
| Grand Total | 3 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 246 | 0 | 0 | 246 | 1 | 191 | 0 | 0 | 192 | 442 |
| Medium Truck % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.8 | 0.0 | 3.7 | 0.0 | 0.0 | 3.6 | |
| Heavy Truck % | 33.3 | 0.0 | 0.0 | 100.0 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 2.0 | 0.0 | 3.1 | 0.0 | 0.0 | 3.1 | |
| Total Truck % | 33.3 | 0.0 | 0.0 | 100.0 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 0.0 | 0.0 | 2.8 | 0.0 | 6.8 | 0.0 | 0.0 | 6.8 | |
| Total % | 0.7 | 0.0 | 0.0 | 0.2 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 55.7 | 0.0 | 0.0 | 55.7 | 0.2 | 43.2 | 0.0 | 0.0 | 43.4 | 100.0 |
| PHF | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | | | 0.88 | 0.88 | 0.88 | | | 0.92 | 0.92 | 0.92 | | | 0.90 |



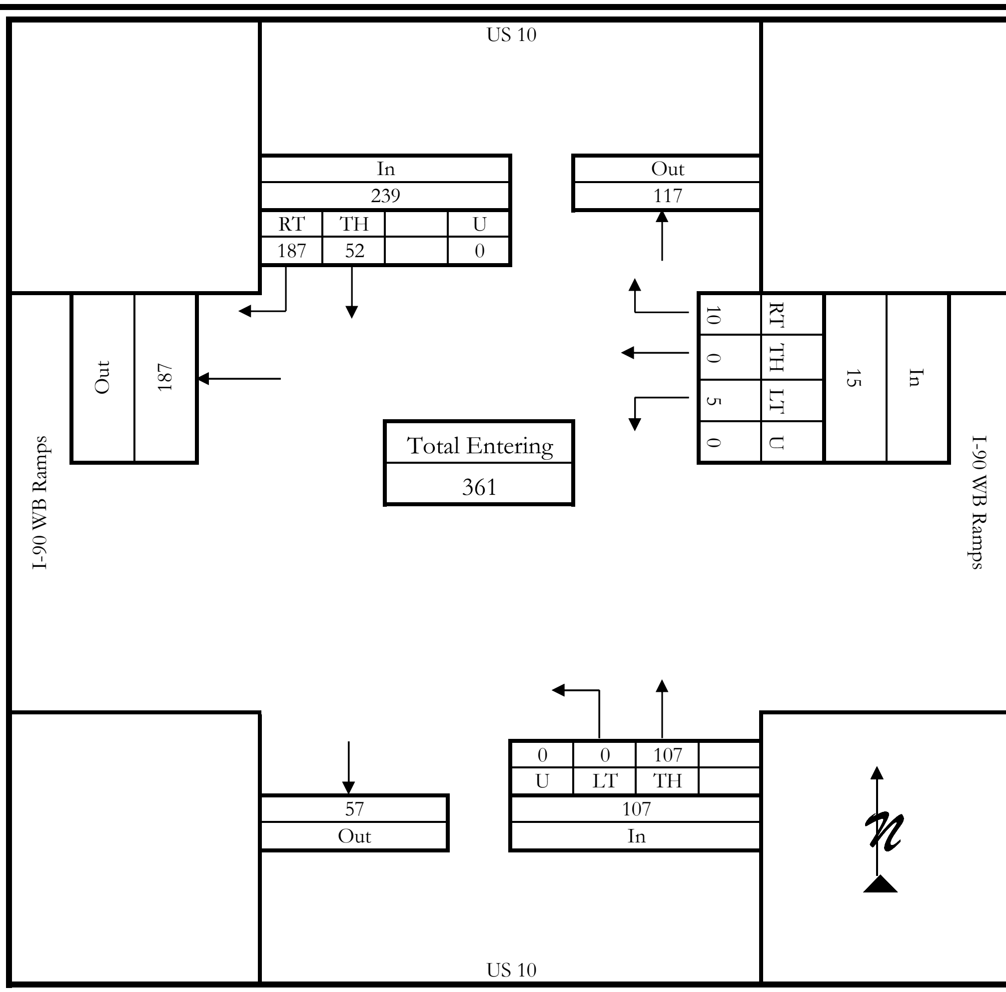
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & I-90 WB Ramps |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | AM Peak Hour (7:30 - 8:30 AM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | US 10 | East/West Street: | I-90 WB Ramps |

## Vehicle Volumes and Adjustments

| | US 10 Southbound | | | | | US 10 Northbound | | | | | I-90 WB Ramps Eastbound | | | | | I-90 WB Ramps Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.87 | 0.87 | 0.87 | 0.87 | | 0.87 | 0.87 | 0.87 | 0.87 | | |
| 7:30 AM | 49 | 12 | 0 | 0 | 61 | 0 | 35 | 0 | 0 | 35 | | | | | 0 | 3 | 0 | 0 | 0 | 3 | 99 |
| 7:45 AM | 35 | 12 | 0 | 0 | 47 | 0 | 37 | 0 | 0 | 37 | | | | | 0 | 4 | 0 | 3 | 0 | 7 | 91 |
| 8:00 AM | 58 | 16 | 0 | 0 | 74 | 0 | 18 | 0 | 0 | 18 | | | | | 0 | 3 | 0 | 1 | 0 | 4 | 96 |
| 8:15 AM | 45 | 12 | 0 | 0 | 57 | 0 | 17 | 0 | 0 | 17 | | | | | 0 | 0 | 0 | 1 | 0 | 1 | 75 |
| Grand Total | 187 | 52 | 0 | 0 | 239 | 0 | 107 | 0 | 0 | 107 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 5 | 0 | 15 | 361 |
| Medium Truck % | 2.1 | 3.8 | 0.0 | 0.0 | 2.5 | 0.0 | 0.9 | 0.0 | 0.0 | 0.9 | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Heavy Truck % | 3.7 | 3.8 | 0.0 | 0.0 | 3.8 | 0.0 | 0.9 | 0.0 | 0.0 | 0.9 | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Truck % | 5.9 | 7.7 | 0.0 | 0.0 | 6.3 | 0.0 | 1.9 | 0.0 | 0.0 | 1.9 | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total % | 51.8 | 14.4 | 0.0 | 0.0 | 66.2 | 0.0 | 29.6 | 0.0 | 0.0 | 29.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 0.0 | 1.4 | 0.0 | 4.2 | 100.0 |
| PHF | 0.99 | 0.99 | 0.99 | | | 0.76 | 0.76 | 0.76 | | | | | | | | 1.00 | 1.00 | 1.00 | | | 0.92 |



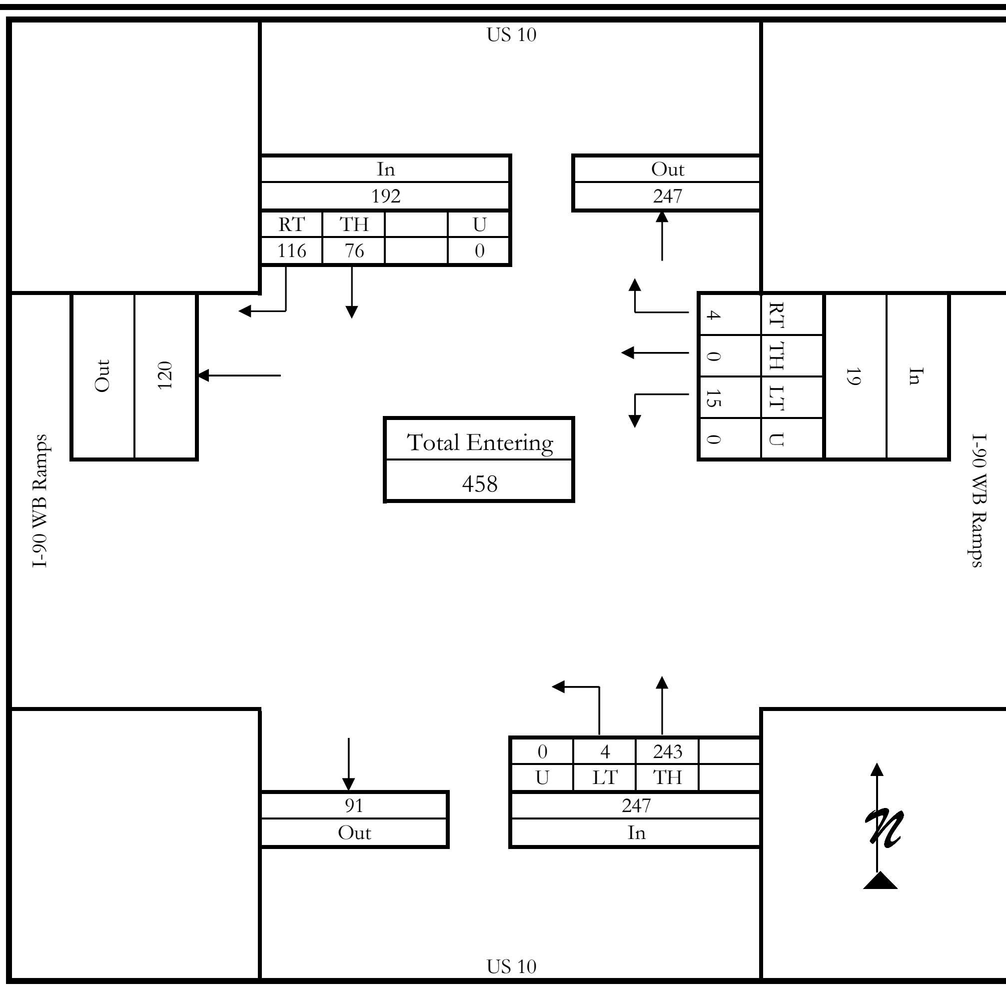
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & I-90 WB Ramps |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | PM Peak Hour (4:30 - 5:30 PM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | US 10 | East/West Street: | I-90 WB Ramps |

## Vehicle Volumes and Adjustments

| | US 10 Southbound | | | | | US 10 Northbound | | | | | I-90 WB Ramps Eastbound | | | | | I-90 WB Ramps Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 0.89 | 0.89 | 0.89 | 0.89 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.87 | 0.87 | 0.87 | 0.87 | | 0.87 | 0.87 | 0.87 | 0.87 | | |
| 4:30 PM | 27 | 15 | 0 | 0 | 42 | 0 | 65 | 1 | 0 | 66 | | | | | 0 | 0 | 0 | 4 | 0 | 4 | 112 |
| 4:45 PM | 23 | 19 | 0 | 0 | 42 | 0 | 58 | 3 | 0 | 61 | | | | | 0 | 2 | 0 | 3 | 0 | 5 | 108 |
| 5:00 PM | 37 | 19 | 0 | 0 | 56 | 0 | 49 | 0 | 0 | 49 | | | | | 0 | 0 | 0 | 4 | 0 | 4 | 109 |
| 5:15 PM | 29 | 23 | 0 | 0 | 52 | 0 | 71 | 0 | 0 | 71 | | | | | 0 | 2 | 0 | 4 | 0 | 6 | 129 |
| Grand Total | 116 | 76 | 0 | 0 | 192 | 0 | 243 | 4 | 0 | 247 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 15 | 0 | 19 | 458 |
| Medium Truck % | 5.2 | 3.9 | 0.0 | 0.0 | 4.7 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | | | | | 0.0 | 25.0 | 0.0 | 6.7 | 0.0 | 10.5 | |
| Heavy Truck % | 2.6 | 3.9 | 0.0 | 0.0 | 3.1 | 0.0 | 1.2 | 0.0 | 0.0 | 1.2 | | | | | 0.0 | 25.0 | 0.0 | 0.0 | 0.0 | 5.3 | |
| Total Truck % | 7.8 | 7.9 | 0.0 | 0.0 | 7.8 | 0.0 | 1.6 | 0.0 | 0.0 | 1.6 | | | | | 0.0 | 50.0 | 0.0 | 6.7 | 0.0 | 15.8 | |
| Total % | 25.3 | 16.6 | 0.0 | 0.0 | 41.9 | 0.0 | 53.1 | 0.9 | 0.0 | 53.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 0.0 | 3.3 | 0.0 | 4.1 | 100.0 |
| PHF | 0.92 | 0.92 | 0.92 | | | 0.87 | 0.87 | 0.87 | | | | | | | | 0.82 | 0.82 | 0.82 | | | 0.89 |



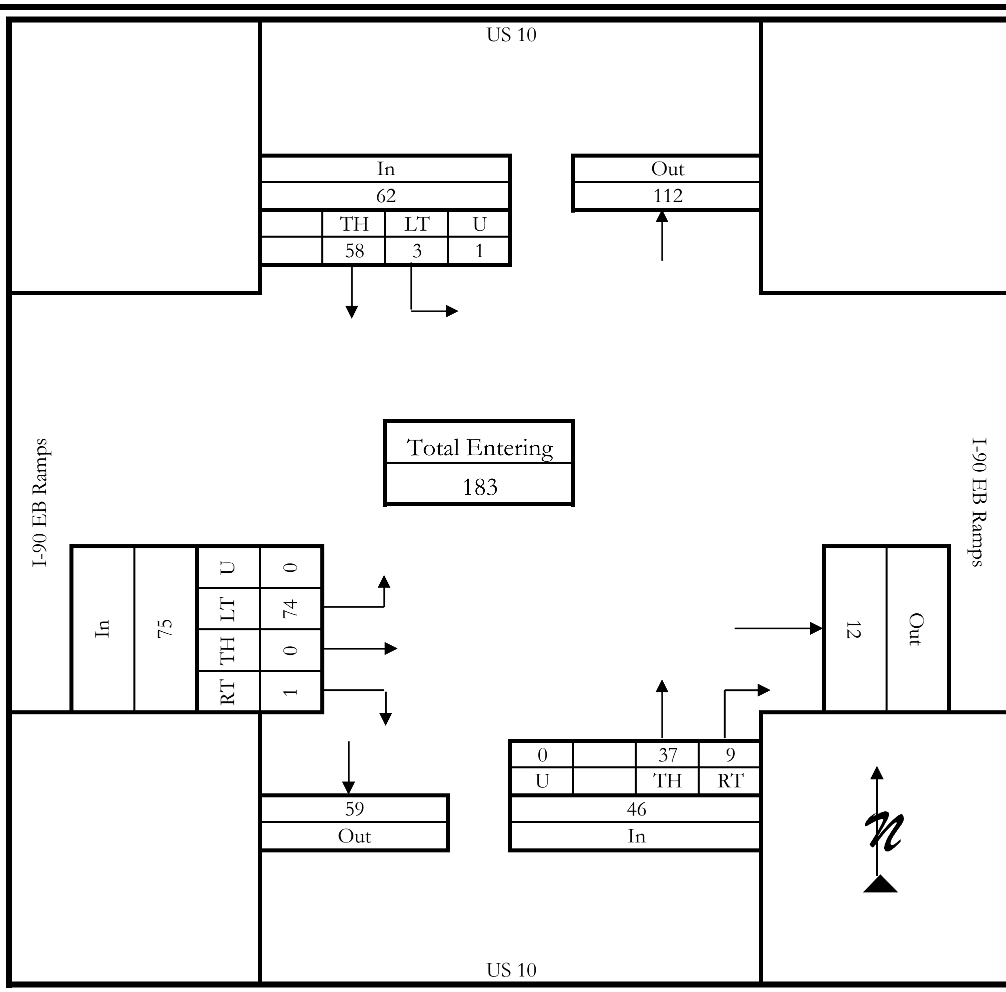
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & I-90 EB Ramps |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | AM Peak Hour (7:30 - 8:30 AM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | US 10 | East/West Street: | I-90 EB Ramps |

## Vehicle Volumes and Adjustments

| | US 10 Southbound | | | | | US 10 Northbound | | | | | I-90 EB Ramps Eastbound | | | | | I-90 EB Ramps Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.87 | 0.87 | 0.87 | 0.87 | | 0.87 | 0.87 | 0.87 | 0.87 | | |
| 7:30 AM | 0 | 12 | 2 | 0 | 14 | 5 | 15 | 0 | 0 | 20 | 0 | 0 | 23 | 0 | 23 | | | | | 0 | 57 |
| 7:45 AM | 0 | 15 | 0 | 1 | 16 | 2 | 11 | 0 | 0 | 13 | 0 | 0 | 27 | 0 | 27 | | | | | 0 | 56 |
| 8:00 AM | 0 | 18 | 1 | 0 | 19 | 1 | 7 | 0 | 0 | 8 | 1 | 0 | 11 | 0 | 12 | | | | | 0 | 39 |
| 8:15 AM | 0 | 13 | 0 | 0 | 13 | 1 | 4 | 0 | 0 | 5 | 0 | 0 | 13 | 0 | 13 | | | | | 0 | 31 |
| Grand Total | 0 | 58 | 3 | 1 | 62 | 9 | 37 | 0 | 0 | 46 | 1 | 0 | 74 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 183 |
| Medium Truck % | 0.0 | 5.2 | 0.0 | 0.0 | 4.8 | 0.0 | 2.7 | 0.0 | 0.0 | 2.2 | 0.0 | 0.0 | 2.7 | 0.0 | 2.7 | | | | | 0.0 | |
| Heavy Truck % | 0.0 | 0.0 | 33.3 | 100.0 | 3.2 | 11.1 | 0.0 | 0.0 | 0.0 | 2.2 | 0.0 | 0.0 | 1.4 | 0.0 | 1.3 | | | | | 0.0 | |
| Total Truck % | 0.0 | 5.2 | 33.3 | 100.0 | 8.1 | 11.1 | 2.7 | 0.0 | 0.0 | 4.3 | 0.0 | 0.0 | 4.1 | 0.0 | 4.0 | | | | | 0.0 | |
| Total % | 0.0 | 31.7 | 1.6 | 0.5 | 33.9 | 4.9 | 20.2 | 0.0 | 0.0 | 25.1 | 0.5 | 0.0 | 40.4 | 0.0 | 41.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| PHF | 0.97 | 0.97 | 0.97 | | | 0.88 | 0.88 | 0.88 | | | 0.69 | 0.69 | 0.69 | | | | | | | | 0.81 |



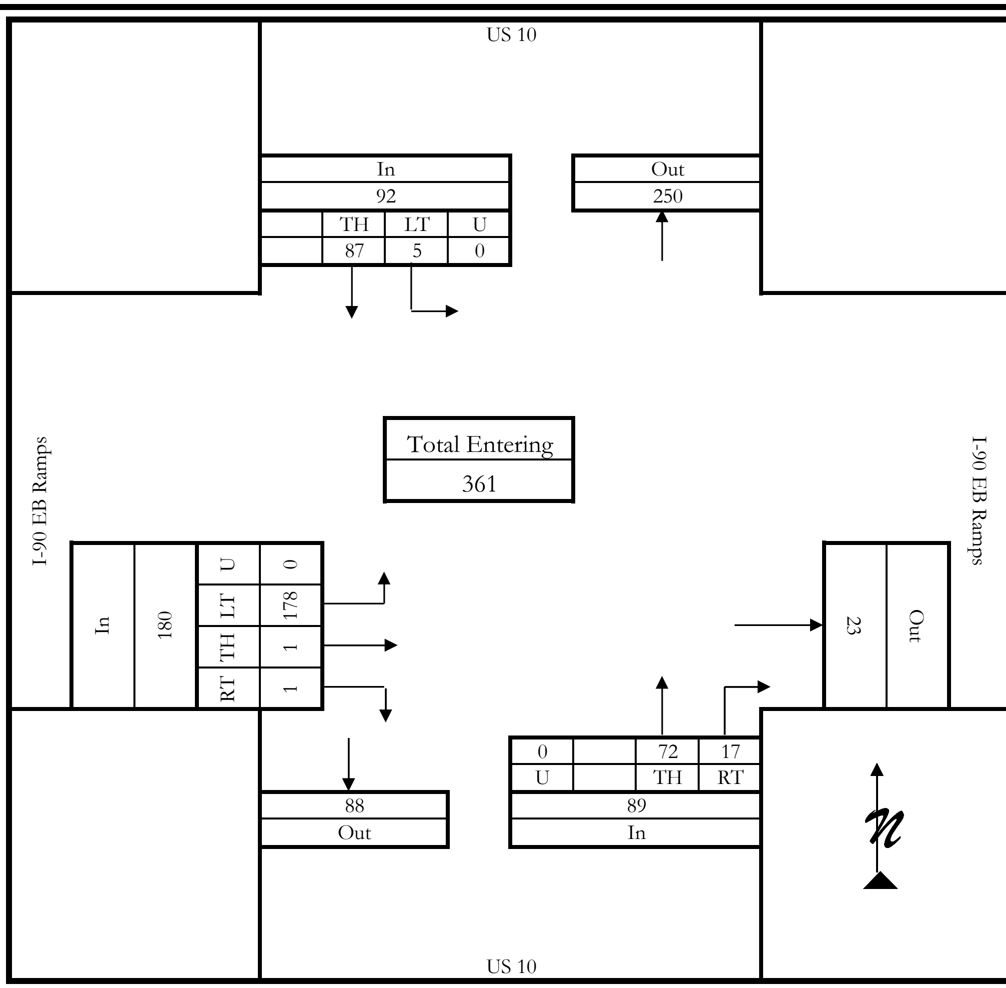
# INTERSECTION TURNING MOVEMENT COUNT SUMMARY

## General Information

| | | | |
|---|---|---|---|
| Counted By: | Wyatt Brown | Intersection: | US 10 & I-90 EB Ramps |
| Agency/Company: | Sanderson Stewart | | |
| Date Performed: | Tuesday, August 30, 2022 | Jurisdiction: | Livingston, MT /MDT |
| Count Time Period: | PM Peak Hour (4:30 - 5:30 PM) | | |
| Project Number: | 18005.05 | Project Description: | Mountain View Subdivision |
| North/South Street: | US 10 | East/West Street: | I-90 EB Ramps |

## Vehicle Volumes and Adjustments

| | US 10 Southbound | | | | | US 10 Northbound | | | | | I-90 EB Ramps Eastbound | | | | | I-90 EB Ramps Westbound | | | | | Int. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Right | Thru | Left | U-turn | Total | Total |
| Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | | 0.87 | 0.87 | 0.87 | 0.87 | | 0.87 | 0.87 | 0.87 | 0.87 | | |
| 4:30 PM | 0 | 18 | 2 | 0 | 20 | 8 | 21 | 0 | 0 | 29 | 1 | 0 | 44 | 0 | 45 | | | | | 0 | 94 |
| 4:45 PM | 0 | 21 | 1 | 0 | 22 | 3 | 28 | 0 | 0 | 31 | 0 | 0 | 35 | 0 | 35 | | | | | 0 | 88 |
| 5:00 PM | 0 | 21 | 1 | 0 | 22 | 2 | 10 | 0 | 0 | 12 | 0 | 1 | 39 | 0 | 40 | | | | | 0 | 74 |
| 5:15 PM | 0 | 27 | 1 | 0 | 28 | 4 | 13 | 0 | 0 | 17 | 0 | 0 | 60 | 0 | 60 | | | | | 0 | 105 |
| Grand Total | 0 | 87 | 5 | 0 | 92 | 17 | 72 | 0 | 0 | 89 | 1 | 1 | 178 | 0 | 180 | 0 | 0 | 0 | 0 | 0 | 361 |
| Medium Truck % | 0.0 | 2.3 | 40.0 | 0.0 | 4.3 | 11.8 | 1.4 | 0.0 | 0.0 | 3.4 | 0.0 | 0.0 | 0.6 | 0.0 | 0.6 | | | | | 0.0 | |
| Heavy Truck % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.9 | 1.4 | 0.0 | 0.0 | 2.2 | 0.0 | 0.0 | 1.7 | 0.0 | 1.7 | | | | | 0.0 | |
| Total Truck % | 0.0 | 2.3 | 40.0 | 0.0 | 4.3 | 17.6 | 2.8 | 0.0 | 0.0 | 5.6 | 0.0 | 0.0 | 2.2 | 0.0 | 2.2 | | | | | 0.0 | |
| Total % | 0.0 | 24.1 | 1.4 | 0.0 | 25.5 | 4.7 | 19.9 | 0.0 | 0.0 | 24.7 | 0.3 | 0.3 | 49.3 | 0.0 | 49.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| PHF | 0.82 | 0.82 | 0.82 | | | 1.00 | 1.00 | 1.00 | | | 0.75 | 0.75 | 0.75 | | | | | | | | 0.85 |



# CAPACITY CALCULATIONS – EXISTING CONDITIONS (2022)

APPENDIX B

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

| Intersection | Approach | Existing (2022) | | | | | |
|---|---|---|---|---|---|---|---|
| | | AM Peak | | | PM Peak | | |
| | | Avg Delay (s/veh) | LOS | 95th % Queue (veh) | Avg Delay (s/veh) | LOS | 95th % Queue (veh) |
| *Intersection Control* | | *Signalized* | | | | | |
| West Park Street & US 10 | EB | 35.6 | D | 5 | 34.8 | C | 11 |
| | WB | 33.4 | C | 3 | 24.8 | C | 3 |
| | NB | 4.1 | A | 5 | 13.2 | B | 13 |
| | SB | 6.7 | A | 7 | 15.1 | B | 13 |
| | Intersection | 11.4 | B | -- | 19.4 | B | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (NB)* | | | | | |
| US 10 & PFL Way | EB | 0.0 | A | 0 | 0.0 | A | 0 |
| | WB | 1.3 | A | 1 | 0.1 | A | 0 |
| | NB | 9.6 | A | 0 | 10.8 | B | 1 |
| | Intersection | 1.0 | A | -- | 1.4 | A | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (SB)* | | | | | |
| US 10 & West End Road | EB | 0.1 | A | 0 | 0.0 | A | 0 |
| | WB | 0.0 | A | 0 | 0.0 | A | 0 |
| | SB | 10.3 | B | 0 | 10.9 | B | 0 |
| | Intersection | 0.1 | A | -- | 0.1 | A | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (WB)* | | | | | |
| US 10 & I-90 WB Ramps | WB | 9.3 | A | 1 | 11.4 | B | 1 |
| | NB | 0.0 | A | 0 | 0.1 | A | 0 |
| | SB | 0.0 | A | 0 | 0.0 | A | 0 |
| | Intersection | 0.4 | A | -- | 0.5 | A | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (EB)* | | | | | |
| US 10 & I-90 EB Ramps | EB | 9.7 | A | 1 | 11.4 | B | 2 |
| | NB | 0.0 | A | 0 | 0.0 | A | 0 |
| | SB | 0.5 | A | 0 | 0.4 | A | 0 |
| | Intersection | 4.1 | A | -- | 5.8 | A | -- |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 5 | 0 | 10 | 0 | 107 | 0 | 0 | 52 | 187 |
| Future Vol, veh/h | 0 | 0 | 0 | 5 | 0 | 10 | 0 | 107 | 0 | 0 | 52 | 187 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 1 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 8 | 6 |
| Mvmt Flow | 0 | 0 | 0 | 5 | 0 | 11 | 0 | 116 | 0 | 0 | 57 | 203 |

| Major/Minor | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 275 | 376 | 116 | 260 | 0 | - | - | - | 0 |
| Stage 1 | 116 | 116 | - | - | - | - | - | - | - |
| Stage 2 | 159 | 260 | - | - | - | - | - | - | - |
| Critical Hdwy | 6.4 | 6.5 | 6.2 | 4.1 | - | - | - | - | - |
| Critical Hdwy Stg 1 | 5.4 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.4 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.5 | 4 | 3.3 | 2.2 | - | - | - | - | - |
| Pot Cap-1 Maneuver | 719 | 558 | 942 | 1316 | - | 0 | 0 | - | - |
| Stage 1 | 914 | 803 | - | - | - | 0 | 0 | - | - |
| Stage 2 | 875 | 697 | - | - | - | 0 | 0 | - | - |
| Platoon blocked, % | | | | | - | | | - | - |
| Mov Cap-1 Maneuver | 719 | 0 | 942 | 1316 | - | - | - | - | - |
| Mov Cap-2 Maneuver | 719 | 0 | - | - | - | - | - | - | - |
| Stage 1 | 914 | 0 | - | - | - | - | - | - | - |
| Stage 2 | 875 | 0 | - | - | - | - | - | - | - |

| Approach | WB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 9.3 | 0 | 0 |
| HCM LOS | A | | |

| Minor Lane/Major Mvmt | NBL | NBT | WBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1316 | - | 854 | - | - |
| HCM Lane V/C Ratio | - | - | 0.019 | - | - |
| HCM Control Delay (s) | 0 | - | 9.3 | - | - |
| HCM Lane LOS | A | - | A | - | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.1 | - | - |

| Intersection | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Int Delay, s/veh | 4.1 | | | | | | | | | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 74 | 0 | 1 | 0 | 0 | 0 | 0 | 37 | 9 | 4 | 58 | 0 |
| Future Vol, veh/h | 74 | 0 | 1 | 0 | 0 | 0 | 0 | 37 | 9 | 4 | 58 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 |
| Heavy Vehicles, % | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 33 | 5 | 0 |
| Mvmt Flow | 91 | 0 | 1 | 0 | 0 | 0 | 0 | 46 | 11 | 5 | 72 | 0 |

| Major/Minor | Minor2 | | | | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 134 | 139 | 72 | | | | - | 0 | 0 | 57 | 0 | 0 |
| Stage 1 | 82 | 82 | - | | | | - | - | - | - | - | - |
| Stage 2 | 52 | 57 | - | | | | - | - | - | - | - | - |
| Critical Hdwy | 6.44 | 6.5 | 6.2 | | | | - | - | - | 4.43 | - | - |
| Critical Hdwy Stg 1 | 5.44 | 5.5 | - | | | | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.44 | 5.5 | - | | | | - | - | - | - | - | - |
| Follow-up Hdwy | 3.536 | 4 | 3.3 | | | | - | - | - | 2.497 | - | - |
| Pot Cap-1 Maneuver | 855 | 756 | 996 | | | | 0 | - | - | 1371 | - | 0 |
| Stage 1 | 936 | 831 | - | | | | 0 | - | - | - | - | 0 |
| Stage 2 | 965 | 851 | - | | | | 0 | - | - | - | - | 0 |
| Platoon blocked, % | | | | | | | | - | - | | - | |
| Mov Cap-1 Maneuver | 852 | 0 | 996 | | | | - | - | - | 1371 | - | - |
| Mov Cap-2 Maneuver | 852 | 0 | - | | | | - | - | - | - | - | - |
| Stage 1 | 936 | 0 | - | | | | - | - | - | - | - | - |
| Stage 2 | 961 | 0 | - | | | | - | - | - | - | - | - |

| Approach | EB | | | | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCM Control Delay, s | 9.7 | | | | | | 0 | | | 0.5 | | |
| HCM LOS | A | | | | | | | | | | | |

| Minor Lane/Major Mvmt | NBT | NBR | EBLn1 | SBL | SBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 854 | 1371 | - |
| HCM Lane V/C Ratio | - | - | 0.108 | 0.004 | - |
| HCM Control Delay (s) | - | - | 9.7 | 7.6 | 0 |
| HCM Lane LOS | - | - | A | A | A |
| HCM 95th %tile Q(veh) | - | - | 0.4 | 0 | - |

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 0.1 | | | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 2 | 115 | 240 | 1 | 1 | 1 |
| Future Vol, veh/h | 2 | 115 | 240 | 1 | 1 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 89 | 89 | 89 | 89 | 89 | 89 |
| Heavy Vehicles, % | 0 | 4 | 7 | 0 | 0 | 0 |
| Mvmt Flow | 2 | 129 | 270 | 1 | 1 | 1 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 271 | 0 | - | 0 | 404 | 271 |
| Stage 1 | - | - | - | - | 271 | - |
| Stage 2 | - | - | - | - | 133 | - |
| Critical Hdwy | 4.1 | - | - | - | 6.4 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.4 | - |
| Follow-up Hdwy | 2.2 | - | - | - | 3.5 | 3.3 |
| Pot Cap-1 Maneuver | 1304 | - | - | - | 606 | 773 |
| Stage 1 | - | - | - | - | 779 | - |
| Stage 2 | - | - | - | - | 898 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1304 | - | - | - | 605 | 773 |
| Mov Cap-2 Maneuver | - | - | - | - | 605 | - |
| Stage 1 | - | - | - | - | 777 | - |
| Stage 2 | - | - | - | - | 898 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.1 | 0 | 10.3 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1304 | - | - | - | 679 |
| HCM Lane V/C Ratio | 0.002 | - | - | - | 0.003 |
| HCM Control Delay (s) | 7.8 | 0 | - | - | 10.3 |
| HCM Lane LOS | A | A | - | - | B |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0 |

# Queues
## 15: W Park St & Hwy 10/7th St



| Lane Group | EBT | WBT | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 141 | 93 | 42 | 318 | 5 | 328 | 272 |
| v/c Ratio | 0.59 | 0.32 | 0.06 | 0.28 | 0.01 | 0.33 | 0.28 |
| Control Delay | 38.9 | 27.3 | 5.2 | 7.3 | 11.2 | 12.0 | 2.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 38.9 | 27.3 | 5.2 | 7.3 | 11.2 | 12.0 | 2.6 |
| Queue Length 50th (ft) | 65 | 38 | 5 | 57 | 1 | 86 | 0 |
| Queue Length 95th (ft) | 106 | 69 | 18 | 119 | 7 | 171 | 37 |
| Internal Link Dist (ft) | 582 | 178 | | 347 | | 219 | |
| Turn Bay Length (ft) | | | 100 | | 100 | | 100 |
| Base Capacity (vph) | 365 | 446 | 710 | 1127 | 587 | 984 | 956 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.39 | 0.21 | 0.06 | 0.28 | 0.01 | 0.33 | 0.28 |

Intersection Summary

# HCM 6th Signalized Intersection Summary
## 15: W Park St & Hwy 10/7th St

09/09/2022

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 107 | 14 | 3 | 19 | 55 | 7 | 37 | 279 | 1 | 4 | 289 | 239 |
| Future Volume (veh/h) | 107 | 14 | 3 | 19 | 55 | 7 | 37 | 279 | 1 | 4 | 289 | 239 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1682 | 1750 | 1750 | 1614 | 1750 | 1750 | 1709 | 1709 | 1750 | 1750 | 1682 | 1695 |
| Adj Flow Rate, veh/h | 122 | 16 | 3 | 22 | 62 | 8 | 42 | 317 | 1 | 5 | 328 | 272 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Percent Heavy Veh, % | 5 | 0 | 0 | 10 | 0 | 0 | 3 | 3 | 0 | 0 | 5 | 4 |
| Cap, veh/h | 240 | 20 | 4 | 87 | 158 | 18 | 614 | 1241 | 4 | 795 | 1099 | 939 |
| Arrive On Green | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.04 | 0.73 | 0.73 | 0.65 | 0.65 | 0.65 |
| Sat Flow, veh/h | 1287 | 169 | 32 | 254 | 1300 | 148 | 1628 | 1703 | 5 | 1078 | 1682 | 1437 |
| Grp Volume(v), veh/h | 141 | 0 | 0 | 92 | 0 | 0 | 42 | 0 | 318 | 5 | 328 | 272 |
| Grp Sat Flow(s),veh/h/ln | 1487 | 0 | 0 | 1702 | 0 | 0 | 1628 | 0 | 1708 | 1078 | 1682 | 1437 |
| Q Serve(g_s), s | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 5.0 | 0.1 | 6.7 | 6.5 |
| Cycle Q Clear(g_c), s | 7.2 | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | 0.6 | 0.0 | 5.0 | 0.1 | 6.7 | 6.5 |
| Prop In Lane | 0.87 | | 0.02 | 0.24 | | 0.09 | 1.00 | | 0.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 264 | 0 | 0 | 262 | 0 | 0 | 614 | 0 | 1245 | 795 | 1099 | 939 |
| V/C Ratio(X) | 0.53 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.07 | 0.00 | 0.26 | 0.01 | 0.30 | 0.29 |
| Avail Cap(c_a), veh/h | 495 | 0 | 0 | 533 | 0 | 0 | 776 | 0 | 1245 | 795 | 1099 | 939 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 33.9 | 0.0 | 0.0 | 32.6 | 0.0 | 0.0 | 3.8 | 0.0 | 3.6 | 4.8 | 6.0 | 5.9 |
| Incr Delay (d2), s/veh | 1.7 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.7 | 0.8 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.7 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 0.2 | 0.0 | 1.5 | 0.0 | 2.3 | 1.9 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 35.6 | 0.0 | 0.0 | 33.4 | 0.0 | 0.0 | 3.9 | 0.0 | 4.1 | 4.8 | 6.7 | 6.7 |
| LnGrp LOS | D | A | A | C | A | A | A | A | A | A | A | A |
| Approach Vol, veh/h | | 141 | | | 92 | | | 360 | | | 605 | |
| Approach Delay, s/veh | | 35.6 | | | 33.4 | | | 4.1 | | | 6.7 | |
| Approach LOS | | D | | | C | | | A | | | A | |
| Timer - Assigned Phs | | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 64.3 | | 15.7 | 6.0 | 58.3 | | 15.7 | | | | |
| Change Period (Y+Rc), s | | 6.0 | | 6.0 | 3.0 | 6.0 | | 6.0 | | | | |
| Max Green Setting (Gmax), s | | 45.0 | | 23.0 | 11.0 | 31.0 | | 23.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 7.0 | | 9.2 | 2.6 | 8.7 | | 6.0 | | | | |
| Green Ext Time (p_c), s | | 2.2 | | 0.6 | 0.0 | 3.1 | | 0.4 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 11.4 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 1 | | | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 103 | 17 | 50 | 239 | 1 | 3 |
| Future Vol, veh/h | 103 | 17 | 50 | 239 | 1 | 3 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 3 | 0 | 0 | 7 | 0 | 0 |
| Mvmt Flow | 112 | 18 | 54 | 260 | 1 | 3 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 130 | 0 | 489 | 121 |
| Stage 1 | - | - | - | - | 121 | - |
| Stage 2 | - | - | - | - | 368 | - |
| Critical Hdwy | - | - | 4.1 | - | 6.4 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.4 | - |
| Follow-up Hdwy | - | - | 2.2 | - | 3.5 | 3.3 |
| Pot Cap-1 Maneuver | - | - | 1468 | - | 542 | 936 |
| Stage 1 | - | - | - | - | 909 | - |
| Stage 2 | - | - | - | - | 704 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1468 | - | 519 | 936 |
| Mov Cap-2 Maneuver | - | - | - | - | 519 | - |
| Stage 1 | - | - | - | - | 909 | - |
| Stage 2 | - | - | - | - | 674 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 1.3 | 9.6 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 779 | - | - | 1468 | - |
| HCM Lane V/C Ratio | 0.006 | - | - | 0.037 | - |
| HCM Control Delay (s) | 9.6 | - | - | 7.5 | 0 |
| HCM Lane LOS | A | - | - | A | A |
| HCM 95th %tile Q(veh) | 0 | - | - | 0.1 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 15 | 0 | 4 | 4 | 243 | 0 | 0 | 76 | 116 |
| Future Vol, veh/h | 0 | 0 | 0 | 15 | 0 | 4 | 4 | 243 | 0 | 0 | 76 | 116 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 1 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 |
| Heavy Vehicles, % | 0 | 0 | 0 | 7 | 0 | 50 | 0 | 2 | 0 | 0 | 8 | 8 |
| Mvmt Flow | 0 | 0 | 0 | 17 | 0 | 4 | 4 | 273 | 0 | 0 | 85 | 130 |

| Major/Minor | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 431 | 496 | 273 | 215 | 0 | - | - | - | 0 |
| Stage 1 | 281 | 281 | - | - | - | - | - | - | - |
| Stage 2 | 150 | 215 | - | - | - | - | - | - | - |
| Critical Hdwy | 6.47 | 6.5 | 6.7 | 4.1 | - | - | - | - | - |
| Critical Hdwy Stg 1 | 5.47 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.47 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.563 | 4 | 3.75 | 2.2 | - | - | - | - | - |
| Pot Cap-1 Maneuver | 572 | 478 | 664 | 1367 | - | 0 | 0 | - | - |
| Stage 1 | 755 | 682 | - | - | - | 0 | 0 | - | - |
| Stage 2 | 866 | 729 | - | - | - | 0 | 0 | - | - |
| Platoon blocked, % | | | | | - | | | - | - |
| Mov Cap-1 Maneuver | 570 | 0 | 664 | 1367 | - | - | - | - | - |
| Mov Cap-2 Maneuver | 570 | 0 | - | - | - | - | - | - | - |
| Stage 1 | 753 | 0 | - | - | - | - | - | - | - |
| Stage 2 | 866 | 0 | - | - | - | - | - | - | - |

| Approach | WB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 11.4 | 0.1 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | WBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1367 | - | 588 | - | - |
| HCM Lane V/C Ratio | 0.003 | - | 0.036 | - | - |
| HCM Control Delay (s) | 7.6 | 0 | 11.4 | - | - |
| HCM Lane LOS | A | A | B | - | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.1 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 178 | 1 | 1 | 0 | 0 | 0 | 0 | 72 | 17 | 5 | 87 | 0 |
| Future Vol, veh/h | 178 | 1 | 1 | 0 | 0 | 0 | 0 | 72 | 17 | 5 | 87 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Heavy Vehicles, % | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 18 | 40 | 2 | 0 |
| Mvmt Flow | 209 | 1 | 1 | 0 | 0 | 0 | 0 | 85 | 20 | 6 | 102 | 0 |

| Major/Minor | Minor2 | | | | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 209 | 219 | 102 | | | | - | 0 | 0 | 105 | 0 | 0 |
| Stage 1 | 114 | 114 | - | | | | - | - | - | - | - | - |
| Stage 2 | 95 | 105 | - | | | | - | - | - | - | - | - |
| Critical Hdwy | 6.42 | 6.5 | 6.2 | | | | - | - | - | 4.5 | - | - |
| Critical Hdwy Stg 1 | 5.42 | 5.5 | - | | | | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | 5.5 | - | | | | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4 | 3.3 | | | | - | - | - | 2.56 | - | - |
| Pot Cap-1 Maneuver | 779 | 683 | 959 | | | | 0 | - | - | 1280 | - | 0 |
| Stage 1 | 911 | 805 | - | | | | 0 | - | - | - | - | 0 |
| Stage 2 | 929 | 812 | - | | | | 0 | - | - | - | - | 0 |
| Platoon blocked, % | | | | | | | | - | - | | - | |
| Mov Cap-1 Maneuver | 775 | 0 | 959 | | | | - | - | - | 1280 | - | - |
| Mov Cap-2 Maneuver | 775 | 0 | - | | | | - | - | - | - | - | - |
| Stage 1 | 911 | 0 | - | | | | - | - | - | - | - | - |
| Stage 2 | 924 | 0 | - | | | | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 11.4 | 0 | 0.4 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBR | EBLn1 | SBL | SBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 776 | 1280 | - |
| HCM Lane V/C Ratio | - | - | 0.273 | 0.005 | - |
| HCM Control Delay (s) | - | - | 11.4 | 7.8 | 0 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 1.1 | 0 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.1 |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 246 | 191 | 1 | 1 | 3 |
| Future Vol, veh/h | 0 | 246 | 191 | 1 | 1 | 3 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 90 | 90 | 90 | 90 | 90 | 90 |
| Heavy Vehicles, % | 0 | 3 | 7 | 0 | 100 | 33 |
| Mvmt Flow | 0 | 273 | 212 | 1 | 1 | 3 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 213 | 0 | - | 0 | 486 | 213 |
| Stage 1 | - | - | - | - | 213 | - |
| Stage 2 | - | - | - | - | 273 | - |
| Critical Hdwy | 4.1 | - | - | - | 7.4 | 6.53 |
| Critical Hdwy Stg 1 | - | - | - | - | 6.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 6.4 | - |
| Follow-up Hdwy | 2.2 | - | - | - | 4.4 | 3.597 |
| Pot Cap-1 Maneuver | 1369 | - | - | - | 400 | 755 |
| Stage 1 | - | - | - | - | 636 | - |
| Stage 2 | - | - | - | - | 592 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1369 | - | - | - | 400 | 755 |
| Mov Cap-2 Maneuver | - | - | - | - | 400 | - |
| Stage 1 | - | - | - | - | 636 | - |
| Stage 2 | - | - | - | - | 592 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | 10.9 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1369 | - | - | - | 618 |
| HCM Lane V/C Ratio | - | - | - | - | 0.007 |
| HCM Control Delay (s) | 0 | - | - | - | 10.9 |
| HCM Lane LOS | A | - | - | - | B |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0 |

# Queues
## 15: W Park St & Hwy 10/7th St



| | → | ← | ↖ | ↑ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|
| Lane Group | EBT | WBT | NBL | NBT | SBL | SBT | SBR |
| Lane Group Flow (vph) | 358 | 98 | 41 | 538 | 2 | 433 | 140 |
| v/c Ratio | 0.84 | 0.23 | 0.10 | 0.59 | 0.01 | 0.54 | 0.19 |
| Control Delay | 44.9 | 20.0 | 11.2 | 19.0 | 18.5 | 23.2 | 7.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 44.9 | 20.0 | 11.2 | 19.0 | 18.5 | 23.2 | 7.4 |
| Queue Length 50th (ft) | 175 | 36 | 10 | 206 | 1 | 190 | 13 |
| Queue Length 95th (ft) | 265 | 67 | 27 | 325 | 5 | 302 | 50 |
| Internal Link Dist (ft) | 582 | 178 | | 347 | | 219 | |
| Turn Bay Length (ft) | | | 100 | | 100 | | 100 |
| Base Capacity (vph) | 493 | 495 | 416 | 915 | 336 | 811 | 737 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.73 | 0.20 | 0.10 | 0.59 | 0.01 | 0.53 | 0.19 |

Intersection Summary

# HCM 6th Signalized Intersection Summary
## 15: W Park St & Hwy 10/7th St



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 237 | 25 | 54 | 49 | 30 | 7 | 36 | 469 | 4 | 2 | 381 | 123 |
| Future Volume (veh/h) | 237 | 25 | 54 | 49 | 30 | 7 | 36 | 469 | 4 | 2 | 381 | 123 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1695 | 1750 | 1723 | 1750 | 1750 | 1668 | 1723 | 1750 | 1750 | 1736 | 1723 |
| Adj Flow Rate, veh/h | 269 | 28 | 61 | 56 | 34 | 8 | 41 | 533 | 5 | 2 | 433 | 140 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Percent Heavy Veh, % | 1 | 4 | 0 | 2 | 0 | 0 | 6 | 2 | 0 | 0 | 1 | 2 |
| Cap, veh/h | 370 | 31 | 68 | 287 | 162 | 34 | 424 | 994 | 9 | 427 | 893 | 751 |
| Arrive On Green | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.04 | 0.58 | 0.58 | 0.51 | 0.51 | 0.51 |
| Sat Flow, veh/h | 1060 | 110 | 240 | 791 | 573 | 121 | 1589 | 1704 | 16 | 881 | 1736 | 1460 |
| Grp Volume(v), veh/h | 358 | 0 | 0 | 98 | 0 | 0 | 41 | 0 | 538 | 2 | 433 | 140 |
| Grp Sat Flow(s),veh/h/ln | 1411 | 0 | 0 | 1486 | 0 | 0 | 1589 | 0 | 1720 | 881 | 1736 | 1460 |
| Q Serve(g_s), s | 17.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 17.1 | 0.1 | 14.5 | 4.6 |
| Cycle Q Clear(g_c), s | 21.8 | 0.0 | 0.0 | 4.3 | 0.0 | 0.0 | 1.0 | 0.0 | 17.1 | 11.0 | 14.5 | 4.6 |
| Prop In Lane | 0.75 | | 0.17 | 0.57 | | 0.08 | 1.00 | | 0.01 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 470 | 0 | 0 | 484 | 0 | 0 | 424 | 0 | 1003 | 427 | 893 | 751 |
| V/C Ratio(X) | 0.76 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.10 | 0.00 | 0.54 | 0.00 | 0.48 | 0.19 |
| Avail Cap(c_a), veh/h | 616 | 0 | 0 | 638 | 0 | 0 | 490 | 0 | 1003 | 427 | 893 | 751 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 30.7 | 0.0 | 0.0 | 24.6 | 0.0 | 0.0 | 10.1 | 0.0 | 11.4 | 16.6 | 14.1 | 11.7 |
| Incr Delay (d2), s/veh | 4.1 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 2.1 | 0.0 | 1.9 | 0.5 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 7.7 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.3 | 0.0 | 6.7 | 0.0 | 5.9 | 1.6 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 34.8 | 0.0 | 0.0 | 24.8 | 0.0 | 0.0 | 10.2 | 0.0 | 13.4 | 16.6 | 16.0 | 12.3 |
| LnGrp LOS | C | A | A | C | A | A | B | A | B | B | B | B |
| Approach Vol, veh/h | | 358 | | | 98 | | | 579 | | | 575 | |
| Approach Delay, s/veh | | 34.8 | | | 24.8 | | | 13.2 | | | 15.1 | |
| Approach LOS | | C | | | C | | | B | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 58.5 | | 31.5 | 6.2 | 52.3 | | 31.5 | | | | |
| Change Period (Y+Rc), s | | 6.0 | | 6.0 | 3.0 | 6.0 | | 6.0 | | | | |
| Max Green Setting (Gmax), s | | 43.0 | | 35.0 | 7.0 | 33.0 | | 35.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 19.1 | | 23.8 | 3.0 | 16.5 | | 6.3 | | | | |
| Green Ext Time (p_c), s | | 3.9 | | 1.7 | 0.0 | 3.1 | | 0.5 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 19.4 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.4 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 249 | 2 | 2 | 178 | 19 | 43 |
| Future Vol, veh/h | 249 | 2 | 2 | 178 | 19 | 43 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 3 | 0 | 0 | 6 | 5 | 0 |
| Mvmt Flow | 271 | 2 | 2 | 193 | 21 | 47 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 273 | 0 | 469 | 272 |
| Stage 1 | - | - | - | - | 272 | - |
| Stage 2 | - | - | - | - | 197 | - |
| Critical Hdwy | - | - | 4.1 | - | 6.45 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.45 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.45 | - |
| Follow-up Hdwy | - | - | 2.2 | - | 3.545 | 3.3 |
| Pot Cap-1 Maneuver | - | - | 1302 | - | 547 | 772 |
| Stage 1 | - | - | - | - | 767 | - |
| Stage 2 | - | - | - | - | 829 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1302 | - | 546 | 772 |
| Mov Cap-2 Maneuver | - | - | - | - | 546 | - |
| Stage 1 | - | - | - | - | 767 | - |
| Stage 2 | - | - | - | - | 827 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.1 | 10.8 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 685 | - | - | 1302 | - |
| HCM Lane V/C Ratio | 0.098 | - | - | 0.002 | - |
| HCM Control Delay (s) | 10.8 | - | - | 7.8 | 0 |
| HCM Lane LOS | B | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.3 | - | - | 0 | - |

# CAPACITY CALCULATIONS – FUTURE (2027)

APPENDIX C

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

| Intersection | Approach | Future (2027) | | | | | |
|---|---|---|---|---|---|---|---|
| | | AM Peak | | | PM Peak | | |
| | | Avg Delay (s/veh) | LOS | 95th % Queue (veh) | Avg Delay (s/veh) | LOS | 95th % Queue (veh) |
| *Intersection Control* | | *Signalized* | | | | | |
| West Park Street & US 10 | EB | 32.9 | C | 8 | 36.6 | D | 19 |
| | WB | 27.8 | C | 4 | 19.5 | B | 4 |
| | NB | 6.7 | A | 6 | 20.1 | C | 15 |
| | SB | 11.7 | B | 9 | 22.8 | C | 14 |
| | Intersection | 14.8 | B | -- | 25.3 | C | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (NB)* | | | | | |
| US 10 & PFL Way | EB | 0.0 | A | 0 | 0.0 | A | 0 |
| | WB | 2.1 | A | 1 | 1.3 | A | 1 |
| | NB | 16.5 | C | 2 | 15.5 | C | 2 |
| | Intersection | 3.6 | A | -- | 3.5 | A | -- |
| *Intersection Control* | | *Two-Way Stop-Controlled (NB/SB)* | | | | | |
| US 10 & West End Road | EB | 0.1 | A | 0 | 0.0 | A | 0 |
| | WB | 3.3 | A | 1 | 2.4 | A | 1 |
| | NB | 28.2 | D | 5 | 21.2 | C | 3 |
| | SB | 16.3 | C | 0 | 13.8 | B | 0 |
| | Intersection | 8.8 | A | -- | 6.3 | A | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (WB)* | | | | | |
| US 10 & I-90 WB Ramps | WB | 10.3 | B | 1 | 12.3 | B | 1 |
| | NB | 0.0 | A | 0 | 0.1 | A | 0 |
| | SB | 0.0 | A | 0 | 0.0 | A | 0 |
| | Intersection | 0.5 | A | -- | 0.6 | A | -- |
| *Intersection Control* | | *One-Way Stop-Controlled (EB)* | | | | | |
| US 10 & I-90 EB Ramps | EB | 11.2 | B | 1 | 13.4 | B | 2 |
| | NB | 0.0 | A | 0 | 0.0 | A | 0 |
| | SB | 1.0 | A | 0 | 0.9 | A | 0 |
| | Intersection | 6.0 | A | -- | 7.2 | A | -- |

HCM 6th TWSC
7: Hwy 10 & I-90 WB Ramps

05/11/2023

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 6 | 0 | 26 | 0 | 244 | 0 | 0 | 85 | 268 |
| Future Vol, veh/h | 0 | 0 | 0 | 6 | 0 | 26 | 0 | 244 | 0 | 0 | 85 | 268 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 1 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 4 |
| Mvmt Flow | 0 | 0 | 0 | 7 | 0 | 28 | 0 | 265 | 0 | 0 | 92 | 291 |

| Major/Minor | | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | | | | 503 | 648 | 265 | 383 | 0 | - | - | - | 0 |
| Stage 1 | | | | 265 | 265 | - | - | - | - | - | - | - |
| Stage 2 | | | | 238 | 383 | - | - | - | - | - | - | - |
| Critical Hdwy | | | | 6.4 | 6.5 | 6.2 | 4.1 | - | - | - | - | - |
| Critical Hdwy Stg 1 | | | | 5.4 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | | | | 5.4 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | | | | 3.5 | 4 | 3.3 | 2.2 | - | - | - | - | - |
| Pot Cap-1 Maneuver | | | | 532 | 392 | 779 | 1187 | - | 0 | 0 | - | - |
| Stage 1 | | | | 784 | 693 | - | - | - | 0 | 0 | - | - |
| Stage 2 | | | | 806 | 616 | - | - | - | 0 | 0 | - | - |
| Platoon blocked, % | | | | | | | | - | | | - | - |
| Mov Cap-1 Maneuver | | | | 532 | 0 | 779 | 1187 | - | - | - | - | - |
| Mov Cap-2 Maneuver | | | | 532 | 0 | - | - | - | - | - | - | - |
| Stage 1 | | | | 784 | 0 | - | - | - | - | - | - | - |
| Stage 2 | | | | 806 | 0 | - | - | - | - | - | - | - |

| Approach | WB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 10.3 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | WBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1187 | - | 717 | - | - |
| HCM Lane V/C Ratio | - | - | 0.049 | - | - |
| HCM Control Delay (s) | 0 | - | 10.3 | - | - |
| HCM Lane LOS | A | - | B | - | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.2 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 6 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 187 | 0 | 1 | 0 | 0 | 0 | 0 | 70 | 10 | 13 | 83 | 0 |
| Future Vol, veh/h | 187 | 0 | 1 | 0 | 0 | 0 | 0 | 70 | 10 | 13 | 83 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 15 | 3 | 0 |
| Mvmt Flow | 203 | 0 | 1 | 0 | 0 | 0 | 0 | 76 | 11 | 14 | 90 | 0 |

| Major/Minor | Minor2 | | | | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 200 | 205 | 90 | | | | - | 0 | 0 | 87 | 0 | 0 |
| Stage 1 | 118 | 118 | - | | | | - | - | - | - | - | - |
| Stage 2 | 82 | 87 | - | | | | - | - | - | - | - | - |
| Critical Hdwy | 6.42 | 6.5 | 6.2 | | | | - | - | - | 4.25 | - | - |
| Critical Hdwy Stg 1 | 5.42 | 5.5 | - | | | | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | 5.5 | - | | | | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4 | 3.3 | | | | - | - | - | 2.335 | - | - |
| Pot Cap-1 Maneuver | 789 | 695 | 973 | | | | 0 | - | - | 1431 | - | 0 |
| Stage 1 | 907 | 802 | - | | | | 0 | - | - | - | - | 0 |
| Stage 2 | 941 | 827 | - | | | | 0 | - | - | - | - | 0 |
| Platoon blocked, % | | | | | | | | - | - | | - | |
| Mov Cap-1 Maneuver | 781 | 0 | 973 | | | | - | - | - | 1431 | - | - |
| Mov Cap-2 Maneuver | 781 | 0 | - | | | | - | - | - | - | - | - |
| Stage 1 | 907 | 0 | - | | | | - | - | - | - | - | - |
| Stage 2 | 932 | 0 | - | | | | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 11.2 | 0 | 1 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBR | EBLn1 | SBL | SBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 782 | 1431 | - |
| HCM Lane V/C Ratio | - | - | 0.261 | 0.01 | - |
| HCM Control Delay (s) | - | - | 11.2 | 7.5 | 0 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 1 | 0 | - |

# HCM 6th TWSC
## 14: Site Access/West End Rd & Hwy 10



| Intersection | |
|---|---|
| Int Delay, s/veh | 8.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 2 | 112 | 155 | 157 | 239 | 1 | 116 | 0 | 118 | 1 | 0 | 1 |
| Future Vol, veh/h | 2 | 112 | 155 | 157 | 239 | 1 | 116 | 0 | 118 | 1 | 0 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 4 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mvmt Flow | 2 | 122 | 168 | 171 | 260 | 1 | 126 | 0 | 128 | 1 | 0 | 1 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 261 | 0 | 0 | 290 | 0 | 0 | 813 | 813 | 206 | 877 | 897 | 261 |
| Stage 1 | - | - | - | - | - | - | 210 | 210 | - | 603 | 603 | - |
| Stage 2 | - | - | - | - | - | - | 603 | 603 | - | 274 | 294 | - |
| Critical Hdwy | 4.1 | - | - | 4.1 | - | - | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.1 | 5.5 | - | 6.1 | 5.5 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.1 | 5.5 | - | 6.1 | 5.5 | - |
| Follow-up Hdwy | 2.2 | - | - | 2.2 | - | - | 3.5 | 4 | 3.3 | 3.5 | 4 | 3.3 |
| Pot Cap-1 Maneuver | 1315 | - | - | 1283 | - | - | 299 | 315 | 840 | 271 | 281 | 783 |
| Stage 1 | - | - | - | - | - | - | 797 | 732 | - | 489 | 492 | - |
| Stage 2 | - | - | - | - | - | - | 489 | 492 | - | 736 | 673 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1315 | - | - | 1283 | - | - | 263 | 265 | 840 | 202 | 237 | 783 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 263 | 265 | - | 202 | 237 | - |
| Stage 1 | - | - | - | - | - | - | 795 | 731 | - | 488 | 415 | - |
| Stage 2 | - | - | - | - | - | - | 412 | 415 | - | 622 | 672 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.1 | 3.3 | 28.2 | 16.3 |
| HCM LOS | | | D | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 402 | 1315 | - | - | 1283 | - | - | 321 |
| HCM Lane V/C Ratio | 0.633 | 0.002 | - | - | 0.133 | - | - | 0.007 |
| HCM Control Delay (s) | 28.2 | 7.7 | 0 | - | 8.2 | 0 | - | 16.3 |
| HCM Lane LOS | D | A | A | - | A | A | - | C |
| HCM 95th %tile Q(veh) | 4.2 | 0 | - | - | 0.5 | - | - | 0 |

# Queues
## 15: W Park St & Hwy 10/7th St



| Lane Group | EBT | WBT | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 244 | 107 | 107 | 336 | 4 | 347 | 372 |
| v/c Ratio | 0.79 | 0.29 | 0.18 | 0.32 | 0.01 | 0.42 | 0.41 |
| Control Delay | 45.2 | 24.1 | 7.1 | 9.5 | 14.2 | 17.1 | 3.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 45.2 | 24.1 | 7.1 | 9.5 | 14.2 | 17.1 | 3.4 |
| Queue Length 50th (ft) | 106 | 40 | 19 | 76 | 1 | 112 | 0 |
| Queue Length 95th (ft) | #186 | 78 | 41 | 137 | 7 | 207 | 51 |
| Internal Link Dist (ft) | 582 | 178 | | 347 | | 219 | |
| Turn Bay Length (ft) | | | 100 | | 100 | | 100 |
| Base Capacity (vph) | 370 | 449 | 625 | 1040 | 487 | 832 | 907 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.66 | 0.24 | 0.17 | 0.32 | 0.01 | 0.42 | 0.41 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

# HCM 6th Signalized Intersection Summary
## 15: W Park St & Hwy 10/7th St

05/11/2023

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 165 | 20 | 40 | 21 | 69 | 8 | 98 | 308 | 1 | 4 | 319 | 342 |
| Future Volume (veh/h) | 165 | 20 | 40 | 21 | 69 | 8 | 98 | 308 | 1 | 4 | 319 | 342 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1682 | 1750 | 1750 | 1614 | 1750 | 1750 | 1709 | 1709 | 1750 | 1750 | 1682 | 1709 |
| Adj Flow Rate, veh/h | 179 | 22 | 43 | 23 | 75 | 9 | 107 | 335 | 1 | 4 | 347 | 372 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 5 | 0 | 0 | 10 | 0 | 0 | 3 | 3 | 0 | 0 | 5 | 3 |
| Cap, veh/h | 287 | 26 | 50 | 97 | 262 | 28 | 504 | 1110 | 3 | 682 | 938 | 808 |
| Arrive On Green | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.06 | 0.65 | 0.65 | 0.56 | 0.56 | 0.56 |
| Sat Flow, veh/h | 1054 | 133 | 254 | 215 | 1323 | 141 | 1628 | 1703 | 5 | 1061 | 1682 | 1448 |
| Grp Volume(v), veh/h | 244 | 0 | 0 | 107 | 0 | 0 | 107 | 0 | 336 | 4 | 347 | 372 |
| Grp Sat Flow(s),veh/h/ln | 1441 | 0 | 0 | 1679 | 0 | 0 | 1628 | 0 | 1708 | 1061 | 1682 | 1448 |
| Q Serve(g_s), s | 8.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 6.8 | 0.1 | 9.2 | 12.2 |
| Cycle Q Clear(g_c), s | 13.0 | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 2.0 | 0.0 | 6.8 | 0.1 | 9.2 | 12.2 |
| Prop In Lane | 0.73 | | 0.18 | 0.21 | | 0.08 | 1.00 | | 0.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 363 | 0 | 0 | 387 | 0 | 0 | 504 | 0 | 1114 | 682 | 938 | 808 |
| V/C Ratio(X) | 0.67 | 0.00 | 0.00 | 0.28 | 0.00 | 0.00 | 0.21 | 0.00 | 0.30 | 0.01 | 0.37 | 0.46 |
| Avail Cap(c_a), veh/h | 488 | 0 | 0 | 533 | 0 | 0 | 636 | 0 | 1114 | 682 | 938 | 808 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 30.7 | 0.0 | 0.0 | 27.4 | 0.0 | 0.0 | 6.5 | 0.0 | 6.0 | 7.9 | 9.9 | 10.5 |
| Incr Delay (d2), s/veh | 2.2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.2 | 0.0 | 0.7 | 0.0 | 1.1 | 1.9 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 4.7 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | 0.6 | 0.0 | 2.3 | 0.0 | 3.4 | 4.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 32.9 | 0.0 | 0.0 | 27.8 | 0.0 | 0.0 | 6.7 | 0.0 | 6.7 | 7.9 | 11.0 | 12.4 |
| LnGrp LOS | C | A | A | C | A | A | A | A | A | A | B | B |
| Approach Vol, veh/h | | 244 | | | 107 | | | 443 | | | 723 | |
| Approach Delay, s/veh | | 32.9 | | | 27.8 | | | 6.7 | | | 11.7 | |
| Approach LOS | | C | | | C | | | A | | | B | |
| Timer - Assigned Phs | | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 58.2 | | 21.8 | 7.5 | 50.6 | | 21.8 | | | | |
| Change Period (Y+Rc), s | | 6.0 | | 6.0 | 3.0 | 6.0 | | 6.0 | | | | |
| Max Green Setting (Gmax), s | | 45.0 | | 23.0 | 11.0 | 31.0 | | 23.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 8.8 | | 15.0 | 4.0 | 14.2 | | 6.2 | | | | |
| Green Ext Time (p_c), s | | 2.3 | | 0.9 | 0.1 | 3.4 | | 0.5 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 14.8 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

| Intersection | |
|---|---|
| Int Delay, s/veh | 3.6 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 147 | 87 | 120 | 337 | 59 | 59 |
| Future Vol, veh/h | 147 | 87 | 120 | 337 | 59 | 59 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 3 | 0 | 0 | 4 | 0 | 0 |
| Mvmt Flow | 160 | 95 | 130 | 366 | 64 | 64 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 255 | 0 | 834 | 208 |
| Stage 1 | - | - | - | - | 208 | - |
| Stage 2 | - | - | - | - | 626 | - |
| Critical Hdwy | - | - | 4.1 | - | 6.4 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.4 | - |
| Follow-up Hdwy | - | - | 2.2 | - | 3.5 | 3.3 |
| Pot Cap-1 Maneuver | - | - | 1322 | - | 341 | 837 |
| Stage 1 | - | - | - | - | 832 | - |
| Stage 2 | - | - | - | - | 537 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1322 | - | 299 | 837 |
| Mov Cap-2 Maneuver | - | - | - | - | 299 | - |
| Stage 1 | - | - | - | - | 832 | - |
| Stage 2 | - | - | - | - | 471 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 2.1 | 16.5 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 441 | - | - | 1322 | - |
| HCM Lane V/C Ratio | 0.291 | - | - | 0.099 | - |
| HCM Control Delay (s) | 16.5 | - | - | 8 | 0 |
| HCM Lane LOS | C | - | - | A | A |
| HCM 95th %tile Q(veh) | 1.2 | - | - | 0.3 | - |

# HCM 6th TWSC
## 7: Hwy 10 & I-90 WB Ramps

05/11/2023

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.6 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 18 | 0 | 11 | 4 | 324 | 0 | 0 | 114 | 194 |
| Future Vol, veh/h | 0 | 0 | 0 | 18 | 0 | 11 | 4 | 324 | 0 | 0 | 114 | 194 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 1 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 0 | 5 | 0 | 10 | 0 | 2 | 0 | 0 | 4 | 4 |
| Mvmt Flow | 0 | 0 | 0 | 20 | 0 | 12 | 4 | 352 | 0 | 0 | 124 | 211 |

| Major/Minor | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 590 | 695 | 352 | 335 | 0 | - | - | - | 0 |
| Stage 1 | 360 | 360 | - | - | - | - | - | - | - |
| Stage 2 | 230 | 335 | - | - | - | - | - | - | - |
| Critical Hdwy | 6.45 | 6.5 | 6.3 | 4.1 | - | - | - | - | - |
| Critical Hdwy Stg 1 | 5.45 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.45 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.545 | 4 | 3.39 | 2.2 | - | - | - | - | - |
| Pot Cap-1 Maneuver | 465 | 368 | 674 | 1236 | - | 0 | 0 | - | - |
| Stage 1 | 699 | 630 | - | - | - | 0 | 0 | - | - |
| Stage 2 | 801 | 646 | - | - | - | 0 | 0 | - | - |
| Platoon blocked, % | | | | | - | | | - | - |
| Mov Cap-1 Maneuver | 463 | 0 | 674 | 1236 | - | - | - | - | - |
| Mov Cap-2 Maneuver | 463 | 0 | - | - | - | - | - | - | - |
| Stage 1 | 696 | 0 | - | - | - | - | - | - | - |
| Stage 2 | 801 | 0 | - | - | - | - | - | - | - |

| Approach | WB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 12.3 | 0.1 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | WBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1236 | - | 525 | - | - |
| HCM Lane V/C Ratio | 0.004 | - | 0.06 | - | - |
| HCM Control Delay (s) | 7.9 | 0 | 12.3 | - | - |
| HCM Lane LOS | A | A | B | - | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.2 | - | - |

| Intersection | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Int Delay, s/veh | 7.2 | | | | | | | | | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 260 | 1 | 1 | 0 | 0 | 0 | 0 | 92 | 19 | 16 | 116 | 0 |
| Future Vol, veh/h | 260 | 1 | 1 | 0 | 0 | 0 | 0 | 92 | 19 | 16 | 116 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 10 | 2 | 0 |
| Mvmt Flow | 283 | 1 | 1 | 0 | 0 | 0 | 0 | 100 | 21 | 17 | 126 | 0 |

| Major/Minor | Minor2 | | | | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 271 | 281 | 126 | | | | - | 0 | 0 | 121 | 0 | 0 |
| Stage 1 | 160 | 160 | - | | | | - | - | - | - | - | - |
| Stage 2 | 111 | 121 | - | | | | - | - | - | - | - | - |
| Critical Hdwy | 6.42 | 6.5 | 6.2 | | | | - | - | - | 4.2 | - | - |
| Critical Hdwy Stg 1 | 5.42 | 5.5 | - | | | | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.42 | 5.5 | - | | | | - | - | - | - | - | - |
| Follow-up Hdwy | 3.518 | 4 | 3.3 | | | | - | - | - | 2.29 | - | - |
| Pot Cap-1 Maneuver | 718 | 631 | 930 | | | | 0 | - | - | 1418 | - | 0 |
| Stage 1 | 869 | 769 | - | | | | 0 | - | - | - | - | 0 |
| Stage 2 | 914 | 800 | - | | | | 0 | - | - | - | - | 0 |
| Platoon blocked, % | | | | | | | | - | - | | - | |
| Mov Cap-1 Maneuver | 709 | 0 | 930 | | | | - | - | - | 1418 | - | - |
| Mov Cap-2 Maneuver | 709 | 0 | - | | | | - | - | - | - | - | - |
| Stage 1 | 869 | 0 | - | | | | - | - | - | - | - | - |
| Stage 2 | 902 | 0 | - | | | | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 13.4 | 0 | 0.9 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBR | EBLn1 | SBL | SBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 710 | 1418 | - |
| HCM Lane V/C Ratio | - | - | 0.401 | 0.012 | - |
| HCM Control Delay (s) | - | - | 13.4 | 7.6 | 0 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 1.9 | 0 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 6.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 253 | 81 | 81 | 201 | 1 | 106 | 0 | 106 | 1 | 0 | 3 |
| Future Vol, veh/h | 0 | 253 | 81 | 81 | 201 | 1 | 106 | 0 | 106 | 1 | 0 | 3 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 3 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 100 | 0 | 33 |
| Mvmt Flow | 0 | 275 | 88 | 88 | 218 | 1 | 115 | 0 | 115 | 1 | 0 | 3 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 219 | 0 | 0 | 363 | 0 | 0 | 715 | 714 | 319 | 772 | 758 | 219 |
| Stage 1 | - | - | - | - | - | - | 319 | 319 | - | 395 | 395 | - |
| Stage 2 | - | - | - | - | - | - | 396 | 395 | - | 377 | 363 | - |
| Critical Hdwy | 4.1 | - | - | 4.11 | - | - | 7.1 | 6.5 | 6.2 | 8.1 | 6.5 | 6.53 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.1 | 5.5 | - | 7.1 | 5.5 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.1 | 5.5 | - | 7.1 | 5.5 | - |
| Follow-up Hdwy | 2.2 | - | - | 2.209 | - | - | 3.5 | 4 | 3.3 | 4.4 | 4 | 3.597 |
| Pot Cap-1 Maneuver | 1362 | - | - | 1201 | - | - | 348 | 359 | 726 | 223 | 339 | 749 |
| Stage 1 | - | - | - | - | - | - | 697 | 657 | - | 473 | 608 | - |
| Stage 2 | - | - | - | - | - | - | 633 | 608 | - | 485 | 628 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1362 | - | - | 1201 | - | - | 324 | 329 | 726 | 176 | 311 | 749 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 324 | 329 | - | 176 | 311 | - |
| Stage 1 | - | - | - | - | - | - | 697 | 657 | - | 473 | 558 | - |
| Stage 2 | - | - | - | - | - | - | 578 | 558 | - | 408 | 628 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 2.4 | 21.2 | 13.8 |
| HCM LOS | | | C | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 448 | 1362 | - | - | 1201 | - | - | 413 |
| HCM Lane V/C Ratio | 0.514 | - | - | - | 0.073 | - | - | 0.011 |
| HCM Control Delay (s) | 21.2 | 0 | - | - | 8.2 | 0 | - | 13.8 |
| HCM Lane LOS | C | A | - | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 2.9 | 0 | - | - | 0.2 | - | - | 0 |

| Lane Group | EBT | WBT | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 485 | 108 | 71 | 567 | 2 | 458 | 185 |
| v/c Ratio | 0.95 | 0.22 | 0.23 | 0.72 | 0.01 | 0.71 | 0.30 |
| Control Delay | 57.6 | 18.3 | 13.7 | 25.6 | 18.5 | 32.1 | 8.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 57.6 | 18.3 | 13.7 | 25.6 | 18.5 | 32.1 | 8.6 |
| Queue Length 50th (ft) | 246 | 36 | 21 | 259 | 1 | 234 | 22 |
| Queue Length 95th (ft) | #474 | 76 | 42 | 365 | 5 | 336 | 67 |
| Internal Link Dist (ft) | 582 | 178 |  | 347 |  | 219 |  |
| Turn Bay Length (ft) |  |  | 100 |  | 100 |  | 100 |
| Base Capacity (vph) | 508 | 492 | 313 | 819 | 231 | 666 | 639 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.95 | 0.22 | 0.23 | 0.69 | 0.01 | 0.69 | 0.29 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 313 | 34 | 99 | 54 | 37 | 8 | 65 | 518 | 4 | 2 | 421 | 170 |
| Future Volume (veh/h) | 313 | 34 | 99 | 54 | 37 | 8 | 65 | 518 | 4 | 2 | 421 | 170 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1736 | 1695 | 1750 | 1723 | 1750 | 1750 | 1695 | 1723 | 1750 | 1750 | 1736 | 1723 |
| Adj Flow Rate, veh/h | 340 | 37 | 108 | 59 | 40 | 9 | 71 | 563 | 4 | 2 | 458 | 185 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 1 | 4 | 0 | 2 | 0 | 0 | 4 | 2 | 0 | 0 | 1 | 2 |
| Cap, veh/h | 429 | 39 | 115 | 332 | 212 | 44 | 319 | 854 | 6 | 298 | 730 | 614 |
| Arrive On Green | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.05 | 0.50 | 0.50 | 0.42 | 0.42 | 0.42 |
| Sat Flow, veh/h | 984 | 107 | 312 | 737 | 579 | 120 | 1615 | 1708 | 12 | 858 | 1736 | 1460 |
| Grp Volume(v), veh/h | 485 | 0 | 0 | 108 | 0 | 0 | 71 | 0 | 567 | 2 | 458 | 185 |
| Grp Sat Flow(s),veh/h/ln | 1403 | 0 | 0 | 1435 | 0 | 0 | 1615 | 0 | 1721 | 858 | 1736 | 1460 |
| Q Serve(g_s), s | 25.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 0.0 | 22.1 | 0.2 | 18.7 | 7.6 |
| Cycle Q Clear(g_c), s | 30.0 | 0.0 | 0.0 | 4.3 | 0.0 | 0.0 | 2.1 | 0.0 | 22.1 | 15.1 | 18.7 | 7.6 |
| Prop In Lane | 0.70 | | 0.22 | 0.55 | | 0.08 | 1.00 | | 0.01 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 582 | 0 | 0 | 588 | 0 | 0 | 319 | 0 | 860 | 298 | 730 | 614 |
| V/C Ratio(X) | 0.83 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.22 | 0.00 | 0.66 | 0.01 | 0.63 | 0.30 |
| Avail Cap(c_a), veh/h | 613 | 0 | 0 | 620 | 0 | 0 | 371 | 0 | 860 | 298 | 730 | 614 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 27.3 | 0.0 | 0.0 | 19.4 | 0.0 | 0.0 | 14.9 | 0.0 | 16.8 | 25.1 | 20.5 | 17.3 |
| Incr Delay (d2), s/veh | 9.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.3 | 0.0 | 3.9 | 0.0 | 4.0 | 1.3 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 11.2 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.8 | 0.0 | 9.3 | 0.0 | 8.2 | 2.7 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 36.6 | 0.0 | 0.0 | 19.5 | 0.0 | 0.0 | 15.3 | 0.0 | 20.7 | 25.1 | 24.6 | 18.6 |
| LnGrp LOS | D | A | A | B | A | A | B | A | C | C | C | B |
| Approach Vol, veh/h | | 485 | | | 108 | | | 638 | | | 645 | |
| Approach Delay, s/veh | | 36.6 | | | 19.5 | | | 20.1 | | | 22.8 | |
| Approach LOS | | D | | | B | | | C | | | C | |
| Timer - Assigned Phs | | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 51.0 | | 39.0 | 7.2 | 43.9 | | 39.0 | | | | |
| Change Period (Y+Rc), s | | 6.0 | | 6.0 | 3.0 | 6.0 | | 6.0 | | | | |
| Max Green Setting (Gmax), s | | 43.0 | | 35.0 | 7.0 | 33.0 | | 35.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 24.1 | | 32.0 | 4.1 | 20.7 | | 6.3 | | | | |
| Green Ext Time (p_c), s | | 3.8 | | 0.9 | 0.0 | 3.0 | | 0.6 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 25.3 | | | | | | | | | |
| HCM 6th LOS | | | C | | | | | | | | | |

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 3.5 | | | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 323 | 41 | 41 | 221 | 66 | 91 |
| Future Vol, veh/h | 323 | 41 | 41 | 221 | 66 | 91 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 0 | 0 | 3 | 2 | 0 |
| Mvmt Flow | 351 | 45 | 45 | 240 | 72 | 99 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 396 | 0 | 704 | 374 |
| Stage 1 | - | - | - | - | 374 | - |
| Stage 2 | - | - | - | - | 330 | - |
| Critical Hdwy | - | - | 4.1 | - | 6.42 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.2 | - | 3.518 | 3.3 |
| Pot Cap-1 Maneuver | - | - | 1174 | - | 403 | 677 |
| Stage 1 | - | - | - | - | 696 | - |
| Stage 2 | - | - | - | - | 728 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1174 | - | 385 | 677 |
| Mov Cap-2 Maneuver | - | - | - | - | 385 | - |
| Stage 1 | - | - | - | - | 696 | - |
| Stage 2 | - | - | - | - | 696 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 1.3 | 15.5 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 513 | - | - | 1174 | - |
| HCM Lane V/C Ratio | 0.333 | - | - | 0.038 | - |
| HCM Control Delay (s) | 15.5 | - | - | 8.2 | 0 |
| HCM Lane LOS | C | - | - | A | A |
| HCM 95th %tile Q(veh) | 1.4 | - | - | 0.1 | - |

# AUXILIARY TURN LANE WARRANT WORKSHEETS

APPENDIX D

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

| TURN LANE WARRANTS | | US 10 & PFL Way | | US 10 & West End Road | | I-90 WB Ramps & US 10 | | I-90 EB Ramps & US 10 | |
|---|---|---|---|---|---|---|---|---|---|
| | | AM | PM | AM | PM | AM | PM | AM | PM |
| 2022 | NB Right-Turn Lane | | | | | | | NO | NO |
| | NB Left-Turn Lane | | | | | NO | NO | | |
| | SB Right-Turn Lane | | | | | YES | YES | | |
| | SB Left-Turn Lane | | | | | | | NO | NO |
| | EB Right-Turn Lane | NO | NO | | | | | | |
| | EB Left-Turn Lane | | | NO | NO | | | | |
| | WB Right-Turn Lane | | | NO | NO | | | | |
| | WB Left-Turn Lane | YES | NO | | | | | | |
| 2027 | NB Right-Turn Lane | | | | | | | NO | NO |
| | NB Left-Turn Lane | | | | | NO | NO | | |
| | SB Right-Turn Lane | | | | | YES | YES | | |
| | SB Left-Turn Lane | | | | | | | NO | NO |
| | EB Right-Turn Lane | NO | NO | YES | YES | | | | |
| | EB Left-Turn Lane | | | NO | NO | | | | |
| | WB Right-Turn Lane | | | NO | NO | | | | |
| | WB Left-Turn Lane | YES | YES | YES | YES | | | | |

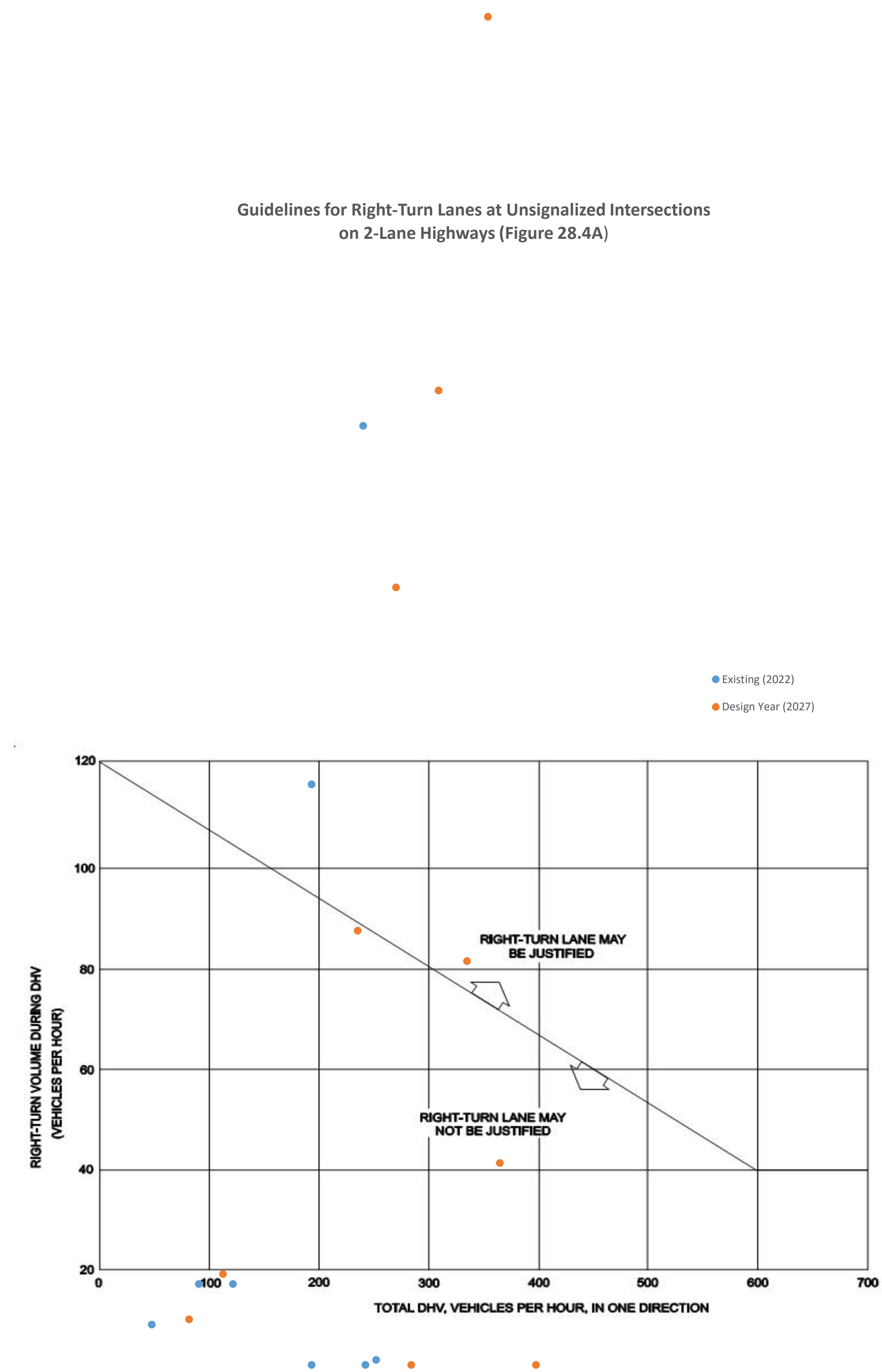
**Existing Traffic Volumes (2022) - Right-Turn Lanes at Unsignalized Intersections on 2-Lane Highways**

| Approach | Time | Total DHV (veh/hr) | Right-Turn Volume During DHV (veh/hr, one direction) | Required Right-Turn Volume for Warranted Lane | Warranted Right-Turn Lane? (Y/N) | Speed Limit at Approach | Adjustment |
|---|---|---|---|---|---|---|---|
| Hwy 10 & PFL EB | AM weekday | 120 | 17 | 104 | N | 60 | 0 |
| | PM weekday | 251 | 2 | 87 | N | 60 | 0 |
| US 10 & West End WB | AM weekday | 241 | 1 | 88 | N | 45 | 0 |
| | PM weekday | 192 | 1 | 94 | N | 45 | 0 |
| I-90 WB & US 10 SB | AM weekday | 239 | 187 | 108 | Y | 45 | 20 |
| | PM weekday | 192 | 116 | 114 | Y | 45 | 20 |
| I-90 EB & US 10 NB | AM weekday | 46 | 9 | 114 | N | 45 | 0 |
| | PM weekday | 89 | 17 | 108 | N | 45 | 0 |

**Future Traffic Volumes (2027) - Right-Turn Lanes at Unsignalized Intersections on 2-Lane Highways**

| Approach | Time | Total DHV (veh/hr) | Right-Turn Volume During DHV (veh/hr, one direction) | Required Right-Turn Volume for Warranted Lane | Warranted Right-Turn Lane? (Y/N) | Speed Limit at Approach | Adjustment |
|---|---|---|---|---|---|---|---|
| Hwy 10 & PFL EB | AM weekday | 234 | 87 | 89 | N | 60 | 0 |
| | PM weekday | 364 | 41 | 71 | N | 60 | 0 |
| US 10 & West End EB | AM weekday | 269 | 155 | 104 | Y | 45 | 20 |
| | PM weekday | 334 | 81 | 75 | Y | 45 | 0 |
| US 10 & West End WB | AM weekday | 397 | 1 | 67 | N | 45 | 0 |
| | PM weekday | 283 | 1 | 82 | N | 45 | 0 |
| I-90 WB & US 10 SB | AM weekday | 353 | 268 | 73 | Y | 45 | 0 |
| | PM weekday | 308 | 194 | 79 | Y | 45 | 0 |
| I-90 EB & US 10 NB | AM weekday | 80 | 10 | 109 | N | 45 | 0 |
| | PM weekday | 111 | 19 | 105 | N | 45 | 0 |

Guidelines for Right-Turn Lanes at Unsignalized Intersections
on 2-Lane Highways (Figure 28.4A)

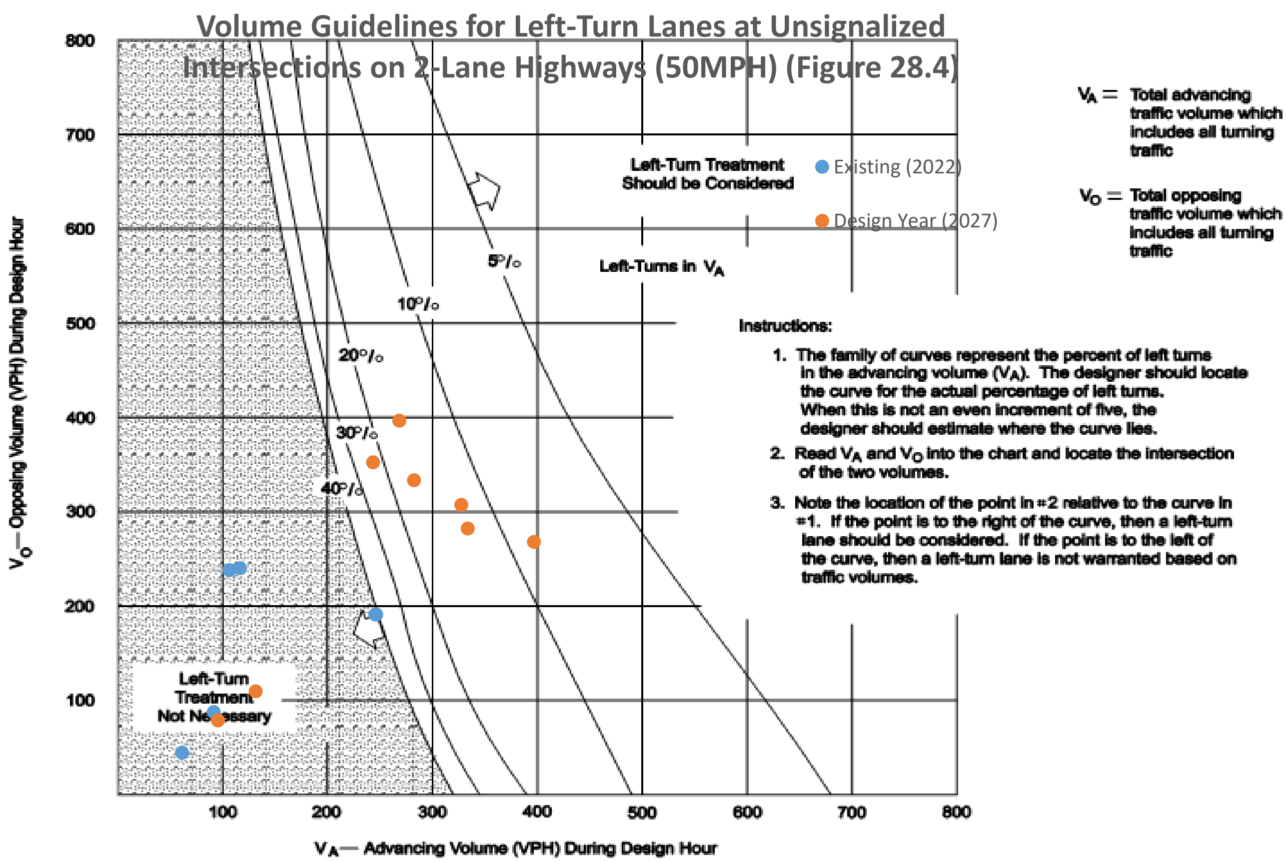


**Existing Traffic Volumes (2022) - Left-Turn Lanes at Unsignalized Intersections on 2-Lane Highways**

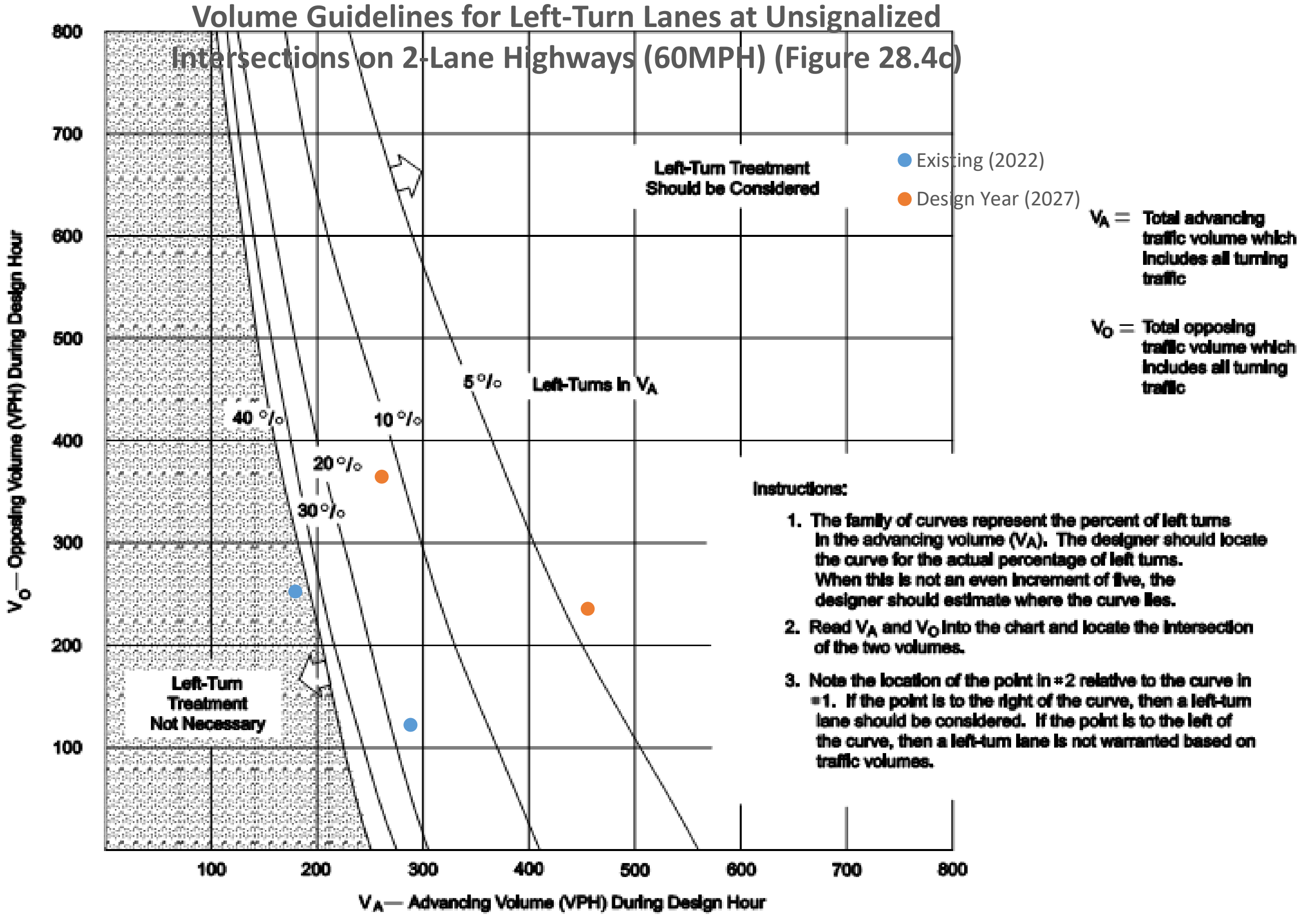
| Approach | Time | Va = Total advancing traffic volume | Val = Total left-turn volume in advancing traffic | Percent left-turns in Va | Vo = Total opposing traffic volume | Warranted Left-Turn Lane? (Y/N) | Speed Limit at Approach |
|---|---|---|---|---|---|---|---|
| Hwy 10 & PFL WB | AM weekday | 289 | 50 | 17.3% | 120 | Y | 60 |
| | PM weekday | 180 | 2 | 1.1% | 251 | N | 60 |
| US 10 & West End EB | AM weekday | 117 | 2 | 1.7% | 241 | N | 45 |
| | PM weekday | 246 | 0 | 0.0% | 192 | N | 45 |
| I-90 WB & US 10 NB | AM weekday | 107 | 0 | 0.0% | 239 | N | 45 |
| | PM weekday | 247 | 4 | 1.6% | 192 | N | 45 |
| I-90 EB & US 10 SB | AM weekday | 62 | 4 | 6.5% | 46 | N | 45 |
| | PM weekday | 92 | 5 | 5.4% | 89 | N | 45 |

**Future Traffic Volumes (2027) - Left-Turn Lanes at Unsignalized Intersections on 2-Lane Highways**

| Approach | Time | Va = Total advancing traffic volume | Val = Total left-turn volume in advancing traffic | Percent left-turns in Va | Vo = Total opposing traffic volume | Warranted Left-Turn Lane? (Y/N) | Speed Limit at Approach |
|---|---|---|---|---|---|---|---|
| Hwy 10 & PFL WB | AM weekday | 457 | 120 | 26.3% | 234 | Y | 60 |
| | PM weekday | 262 | 41 | 15.6% | 364 | Y | 60 |
| US 10 & West End EB | AM weekday | 269 | 2 | 0.7% | 397 | N | 45 |
| | PM weekday | 334 | 0 | 0.0% | 283 | N | 45 |
| US 10 & West End WB | AM weekday | 397 | 157 | 39.5% | 269 | Y | 45 |
| | PM weekday | 283 | 81 | 28.6% | 334 | Y | 45 |
| I-90 WB & US 10 NB | AM weekday | 244 | 0 | 0.0% | 353 | N | 45 |
| | PM weekday | 328 | 4 | 1.2% | 308 | N | 45 |
| I-90 EB & US 10 SB | AM weekday | 96 | 13 | 13.5% | 80 | N | 45 |
| | PM weekday | 132 | 16 | 12.1% | 111 | N | 45 |


Volume Guidelines for Left-Turn Lanes at Unsignalized Intersections on 2-Lane Highways (50MPH) (Figure 28.4)
Existing (2022)
Design Year (2027)
Left-Turn Treatment Should be Considered
Left-Turns in $V_A$
5%
10%
20%
30%
40%
Left-Turn Treatment Not Necessary
$V_O$— Opposing Volume (VPH) During Design Hour
$V_A$— Advancing Volume (VPH) During Design Hour
$V_A$ = Total advancing traffic volume which includes all turning traffic
$V_O$ = Total opposing traffic volume which includes all turning traffic
Instructions:
1. The family of curves represent the percent of left turns in the advancing volume ($V_A$). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of five, the designer should estimate where the curve lies.
2. Read $V_A$ and $V_O$ into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the curve in #1. If the point is to the right of the curve, then a left-turn lane should be considered. If the point is to the left of the curve, then a left-turn lane is not warranted based on traffic volumes.

## Volume Guidelines for Left-Turn Lanes at Unsignalized Intersections on 2-Lane Highways (60MPH) (Figure 28.4c)



# ENDURING COMMUNITY DESIGN

SANDERSONSTEWART.COM

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX E

Wetland Delineation Report

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

# Printing for Less

# Wetland Delineation Report

Prepared By:

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09/13/2019

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# List of Figures and Tables

# Appendices

Appendix A – Project Area Maps

Appendix B – Mapped Wetland Boundary

Appendix C – Wetland Determination Data Forms

Appendix D – Site Photographs

## Introduction

A routine wetland delineation was conducted by Sundog Ecological Inc., on June 19th and 26th, 2019 on behalf of property owner, Printing for Less (PFL), to verify wetland boundaries east of PFL Way. The purpose of this wetland delineation was to investigate the project area, identify areas meeting technical guidelines for wetlands, delineate the extent of wetlands within the project area and to classify these wetland habitats. This report describes methodologies used, summarizes results of wetland investigations, and provides technical documentation for all delineated wetlands within the project area. Figures referred to in text are included in Appendices at the end of the report.

## Site Description

The PFLWetland Delineation site is located in the northwest quarter of Section 22, Township 2 South, Range 9 East, approximately 2.15 miles west of Livingston, Montana. The property is located immediately east of the Printing for Less headquarters on PFL Way. Upland communities are comprised of pasture grasses, Montana State Listed noxious weeds, small shrubs and other weedy species. Wetlands communities are dominated by mixed grasses, rushes, sedges and cattails. Four wetland types and one upland type were identified within project boundaries.


**Figure 1: Location of the Printing for Less Wetland Delineation Site relative to US Interstate 90 and MT Highway 10.**

<u>Directions to site from Bozeman</u>: From North 7th Avenue take Interstate 90 east for 22.7 miles, exiting at Livingston Exit 330. Turn left onto 1-90 Business Loop/MT Highway 10 for 0.5 miles. Turn right onto PFL Way, the project area is on the left.

## Waterbodies and Waterways

While there are no direct waterbodies or streams on the PFL wetland site, there is a stream that flows west from the north side of the Interstate 90 business loop to the south side and eventually discharges into the wetland in the northeast corner of the site. A review of aerial photos shows that this water appears to be diverted from Fleshman Creek (north of the site). Other waterways in the area include Billman Creek (south of the site) and the Yellowstone River (east of the site).

## Methods

This wetland delineation was conducted using the routine on-site-approach in accordance with standard practices outlined in the 1987 Army Corps of Engineers (ACOE) Wetland Delineation Manual (Environmental Laboratory 1987) and by Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast - Version 2.0 (ACOE 2010). The study evaluated the presence or absence of indicators of three wetlands parameters described in the ACOE Wetland Delineation Manual. Under the delineation procedures outlined in this manual, an area must exhibit characteristic wetland hydrology, hydric soils, and hydrophytic vegetation to be considered a wetland. If field investigation determines that any of the three parameters are not satisfied, the area does not usually qualify as a wetland. Wetlands were classified according to the Cowardin classification system (Cowardin *et al*., 1979). Non-wetland water bodies such as streams were classified according to flow regime (perennial, seasonal, etc.) and substrate (rock bottom, unconsolidated bottom, etc.) according to the Cowardin system (Cowardin *et al*., 1979).

Prior to conducting field studies, available background and supplementary reference materials were reviewed, including aerial photographs and maps from: Google Earth Pro, National Wetlands Inventory, Montana Natural Heritage Program, the Park County Soil Survey, Web Soil Survey, the National Wetlands Plant List, plat and topographic maps. Site maps used for assessment of the Printing for Less wetland delineation site are included in Appendix A.

As part of a delineation report, data forms and technical information are required by the ACOE to document the three parameters for any area determined to be wetland. A total of seventeen (17) data points were observed. Wetland boundaries were drawn utilizing field data, aerial photographs and topographic boundaries. Wetland boundaries were surveyed using survey grade GPS equipment and data point locations were collected using a resource grade handheld GPS unit. Exact accuracy of maps and locations of boundaries and data points is limited by the accuracy of data collection devices (less than 30 cm for survey grade and 0.5 to 2 meters for handheld). Data forms for sample locations are provided in Appendix B. Representative photographs of sample locations and delineated wetlands are provided in Appendix D.

## Results

The following discussion provides an overview of each of the four wetland components inventoried at the PFL wetland delineation site. In June 2019, four wetland types were identified and delineated within the 25-acre project boundary. All potential areas of impact were assessed for dominant hydrophytic vegetation, hydric soils, and evidence of wetland hydrology. Wetland areas outside of the project limits were not assessed. Overall, 17 (seven matched sets) data points were investigated to determine the wetland/upland boundary within the project area. Data points were placed along the wetland/upland boundary and in areas where vegetation and topographic changes appeared across the landscape.

The location of identified wetlands, upland sample points and wetland sample points are shown on Figure 1 (Appendix B). Data forms for sample locations can be found in Appendix C. Photographs of sample locations are located in Appendix D.

## Vegetation

Approximately 34 plant species were identified within the proposed project site (Table 1). Plants observed at sample locations are listed on their respective data forms. Of the plant species observed, four are listed as Montana State noxious weeds. Three priority 2B species observed are: whitetop (*Cardaria draba*), Canada thistle (*Cirsium arvense*) and gypsyflower (*Cynoglossum officinale*); which are widespread on the property. One priority 3 species, Russian olive (*Elaeagnus angustifolia)*, was observed in a few isolated locations. A weed management plan should be developed and implemented for this site.

## Uplands

A total of 7 upland sample points (paired with 9 wetland sample points) were documented within the project area and are shown on Figure 1, Appendix B. These sample points were used to assist in establishing wetland boundaries and to determine/verify upland areas. Taken throughout the project limits, sample points varied throughout upland areas. Uplands generally occur in areas of slightly higher topography and in some cases, convex surfaces. Vegetation within the uplands included a mix of hydrophytic and upland species but facultative upland (FACU) generally dominated the overall cover. Common species noted in the uplands included: smooth brome, redtop and Kentucky bluegrass. Soils ranged from a grey, very dark greyish brown to dark brown and typically lacked redox concentrations. Soil textures varied, but generally ranged from a silty clay loam to silty loam.

## Delineated Wetlands

Four wetland types, covering 13-acres were delineated within the PFL wetland delineation site boundaries.

***Wetland Type 1*** is dominated by cattails (*Typha latifolia)* and occupies 1.75 acres of wetlands. Wetland Type 1 areas are generally located along the east property boundary, extending west of the property. Cattails were observed in both the north and central wetland cells (1.43 and 0.32 acres, respectfully).

***Wetland Type 2*** is a willow dominated scrub-shrub community with a *Salix exigua* (narrowleaf willow ) overstory and a mixed *Juncus/Agrostis (J. balticus, A. alba*) understory. Wetland Type 2 accounts for 0.35 wetland acres located along north (0.21 acres) and south sides (0.14 acres) of the abandoned railroad grade.

***Wetland Type 3*** is dominated by a mixed *Juncus* community (*J. balticus, J. effusus)* with lesser amounts of reed canary grass (*Phalaris arundinacea*), redtop (*A. alba) and* Rocky Mountain iris (*Iris missouriensis*). Wetland Type 3 occupies 4.02 acres.

***Wetland Type 4*** is the largest wetland community, covering 6.68 acres (5.11, 1.07 and 0.5 acres in the north, central and south complexes, respectively). This community is comprised of redtop, Rocky Mountain iris, common rush, reed canary grass and Baltic rush.

**Table 1: Plant species observed at the Printing for Less Wetland Delineation Site.**

| Scientific Name | Common Name | Indicator Status |
|---|---|---|
| *Achillea millefolium* | common yarrow | FACU |
| *Agrostis alba* | redtop | FAC |
| *Agroypron intermedium* | intermediate wheatgrass | UPL |
| *Alopecurus arundinaceus* | Garrison creeping foxtail | FAC |
| *Bromus inermis* | smooth brome | UPL |
| *Cardaria draba* | whitetop | UPL |
| *Carex nebrascensis* | Nebraska sedge | OBL |
| *Carex stipata* | awlfruit sedge | OBL |
| *Cirsium arvense* | Canada thistle | FACU |
| *Cynoglossum officinale* | gypsyflower | FACU |
| *Dactylis glomerata* | orchard grass | FACU |
| *Elaeagnus angustifolia* | Russian olive | FAC |
| *Eleocharis palustris* | common spikerush | OBL |
| *Elymus lanceolatus* | streambank wheatgrass | FACU |
| *Equisetum hyemale* | rough horsetail | FACW |
| *Helianthus annus* | common sunflower | FACU |
| *Hordeum jubatum* | foxtail barley | FAC |
| *Iris missourienssis* | Rocky Mountain iris | FACW |
| *Juncus balticus* | Baltic rush | FACW |
| *Juncus effusus* | common rush | FACW |
| *Mentha arvesis* | field mint | FACW |
| *Pascopyrum smithii* | western wheatgrass | FACU |
| *Poa pratensis* | Kentucky bluegrass | FAC |
| *Rosa woodsii* | Wood's rose | FACU |
| *Salix exigua* | narrowleaf willow | FACW |
| *Schoenoplectus pungens* | common threesqure | OBL |
| *Solidago canadensis* | Canada goldenrod | FACU |
| *Sonchus arvensis* | field sowthistle | FACU |
| *Sporobolus airoides* | alkali sacaton | FAC |
| *Stipa viradula* | green needlegrass | UPL |
| *Symphoricarpos albus* | common snowberry | FACU |
| *Taraxacum officinale* | common dandelion | FACU |
| *Triglochin maritima* | seaside arrowgrass | OBL |
| *Typha latifolia* | broadleaf cattail | OBL |

**Table 2: Wetland characteristics identified at the Printing for Less Wetland Delineation Site.**

| Site | General Location | Size (Acres) | Cowardin Class | Primary Hydrology | Dominant Vegetation |
|---|---|---|---|---|---|
| Upland | Throughout project area | 12.00 | none | none | smooth brome, Kentucky bluegrass, common snowberry |
| Wetland Type 1 | Throughout project area | 1.75 | PEMA | ground and surface water | cattails, common rush |
| Wetland Type 2 | Throughout project area | 0.35 | PSS | ground and surface water | narrowleaf willow, redtop, Baltic rush |
| Wetland Type 3 | Throughout project area | 4.22 | PEMA | ground and surface water | common rush, Baltic rush, Rocky Mountain iris, redtop |
| Wetland Type 4 | Throughout project area | 6.68 | PEMA | ground and surface water | redtop, Rocky Mountain iris, reed canary grass, common rush, Baltic rush |

## Soils

One soil unit was observed within the project limits of the PFL wetland delineation site, the Reedpoint-Tanna-Ethridge complex. This soil complex is variable with loamy, sandy clay loam and silty clay loam soils. Soil matrix observations for hues were 7.5 YR and 10YR, matrix values ranged from 2 to 5 and chromas were 2 or less. Redox concentrations were generally common throughout most observed wetland soils within the project area. Redox values ranged from 4 to 6 and chromas were 3 or less. Hydric soil indicators were generally Hydrogen Sulfide odor (A4), depleted matrix (F3) or redox dark surface (F6). Detailed soil descriptions for each wetland and upland sample point are provided on the wetland delineation data forms, in Appendix C.

## Hydrology

Typical conditions for the region were observed during field sampling. Primary indictors of wetland hydrology were surface water present (A1), saturation (A3) or Hydrogen Sulfide odor (C1). Most wetlands sites also met wetland hydrology indicators based on secondary indicators of geomorphic position (D2) and positive FAC-Neutral test (D5). Depressional wetlands and swales are supported by high groundwater or seasonal groundwater expressed at or near ground surface. Hydrologic indicators at sample locations are documented on their respective data forms located in Appendix C.

## Wetland Boundaries

Wetland boundaries were generally readily identifiable due to changes in topography, shifts in vegetation structure or changes in vegetation dominance from FAC to wetter (FACW, OBL) or drier (FACU, UPL) species, changes in hydrology and/or changes in soil types. Topographic breaks were frequently used to help identify wetland boundaries in depressions and swales. In some areas, shifts in plant species composition toward drier species such as smooth brome (*Bromus inermis*) and common snowberry (*Symphoricarpos albus)* also assisted with boundary determinations. When Kentucky bluegrass, redtop or Baltic rush were common in both wetland and upland sample plots, subsurface explorations to assess soil and hydrology assisted in identifying boundaries.

## Wetland Impacts

This wetland delineation report for PFL provides baseline information that will assist in developing practices to minimize wetland impacts during development.

## Threatened and Endangered Species

A review of USFWS Information, Planning and Conservation System database for the site listed the Canada Lynx as threatened and the North American Wolverine as proposed threatened. Development within the PFL site is not expected to impact any of these species as there are no critical habitats for these species within the project area.

## Cultural Resources and Historic Structures

There are no cultural resources, historic or other structures that would be impacted by development activities at the PFL wetland delineation site.

## Summary

Four wetland types and one upland type were identified within the PFL wetland delineation site project boundaries totaling 13 and 12 acres, respectively. The largest wetland area accounts for 6.68-acres of mixed *Agrostis* community that is abundant throughout the site. Three wetlands were classified as palustrine emergent wetlands (9.65 acres) and one wetland was classified as shrub-scrub (0.35 acres).

# References

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. U.S.D.I Fish and Wildlife Service. Washington D.C.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. U.S. Army Corps of Engineers. Washington, DC.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. The National Wetland Plant List. 2014 Update of Wetland Ratings. Phytoneuron 2014-41:1-42.

Reed, P.B. 1988. National list of plant species that occur in wetlands: North West (Region 9). Biological Report 88(26.9), May 1988. U.S. Fish and Wildlife Service, Washington, DC.

U.S. Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-3. Vicksburg, MS: U.S. Army Engineer Research and Development Center

## Websites

Montana Department of Agriculture website. Accessed July 2019 at https://agr.mt.gov/Weeds

Montana Natural Heritage Program website. Accessed in July 2019 at http://mtnhp.org/mapviewer

USDA, Natural Resources Conservation Service Web Soil Survey. Park County, Montana. Accessed July 2019 at: http://websoilsurvey.nrcs.usda.gov/app/

U.S. Fish and Wildlife Service National Wetlands Inventory website. Accessed in July 2019 at: https://www.fws.gov/wetlands/data/mapper.html.

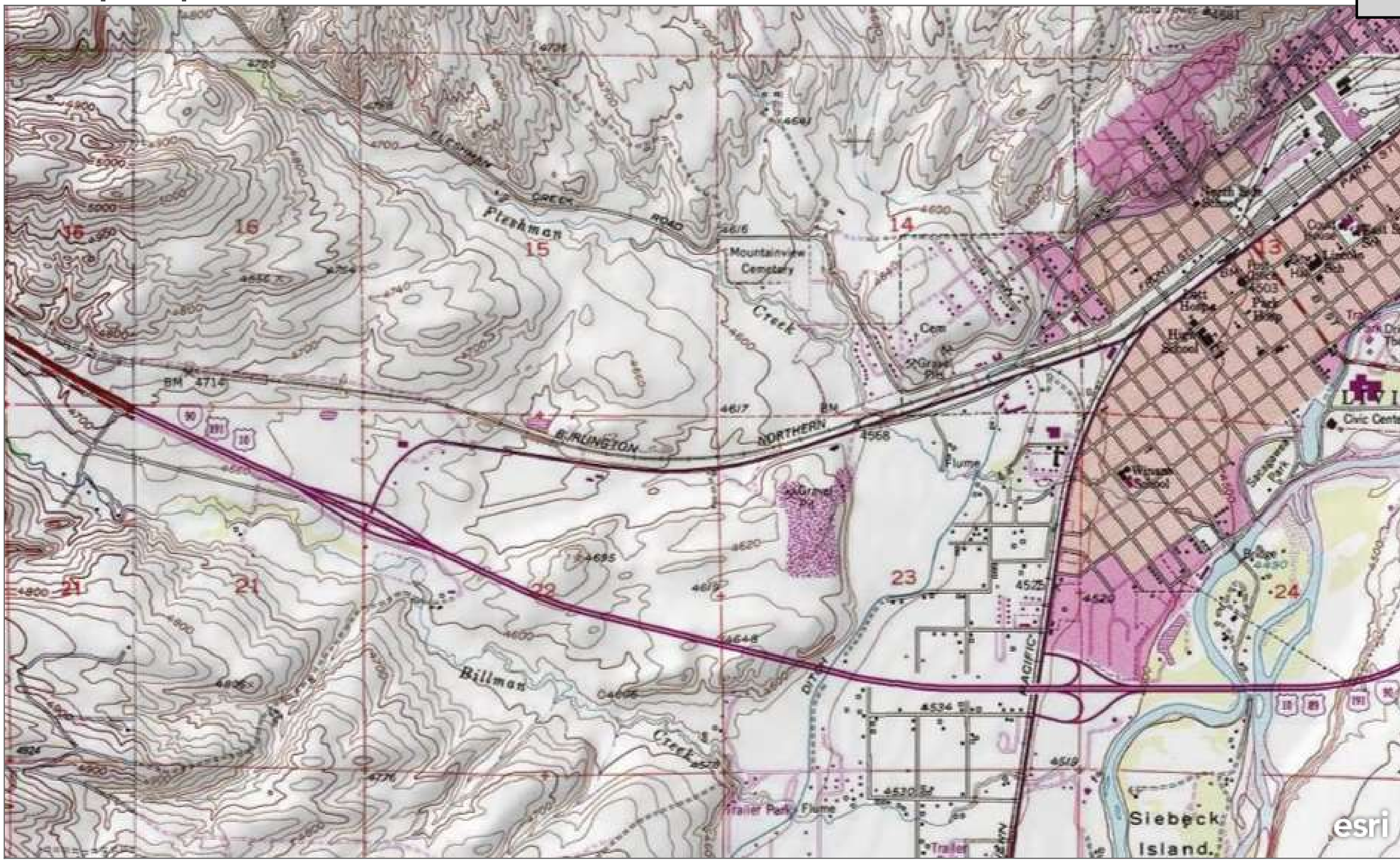
US Fish & Wildlife Service. Information for Planning and Conservation. Accessed in July 2019 at: https://ecos.fws.gov/ipac/

## Appendix A

Aerial Overview of the Printing for Less Wetland Delineation Site
Topographic Overview of the Printing for Less Wetland Delineation Site
National Wetland Inventory – Mapped Wetlands of the Printing for Less Wetland Delineation Site
Montana Natural Heritage Program - Mapped Wetlands of the Printing for Less Wetland Delineation Site
Soils of the Printing for Less Wetland Delineation Site in Park County, MT


PFL Way
90
Prairie Dog Rd
N
1000 ft
Google Earth
© 2018 Google

## USA Topo Maps




This map features detailed USGS topographic maps for the United States at multiple scales.

0.4mi

U.S. Fish and Wildlife Service

# National Wetlands Inventory

## Printing for Less


July 23, 2019

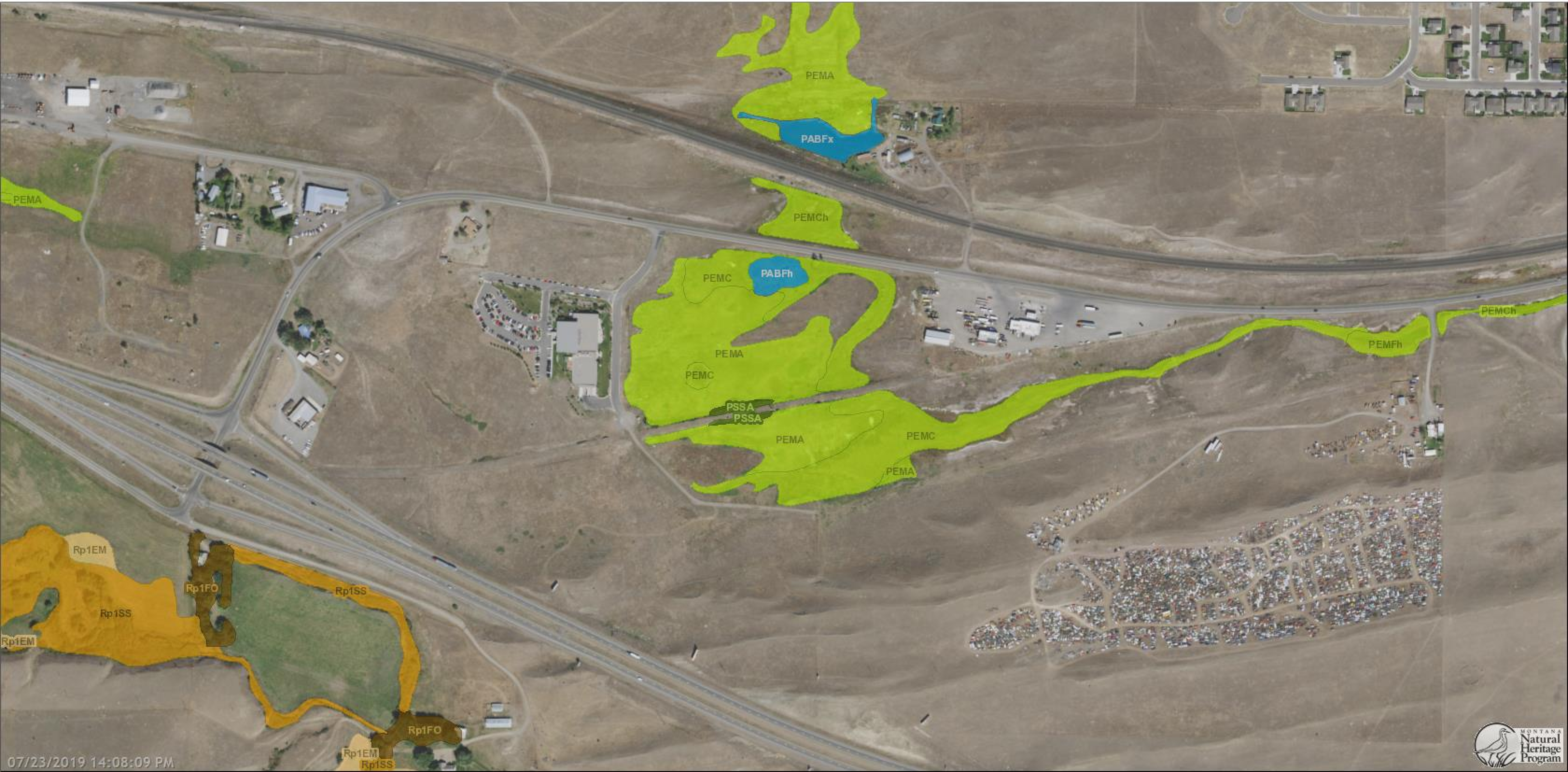
**Wetlands**

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

# NHP Map Viewer

| Latitude | Longitude |
|---|---|
| 45.64766 | -110.58997 |
| 45.65676 | 551 |





United States Department of Agriculture

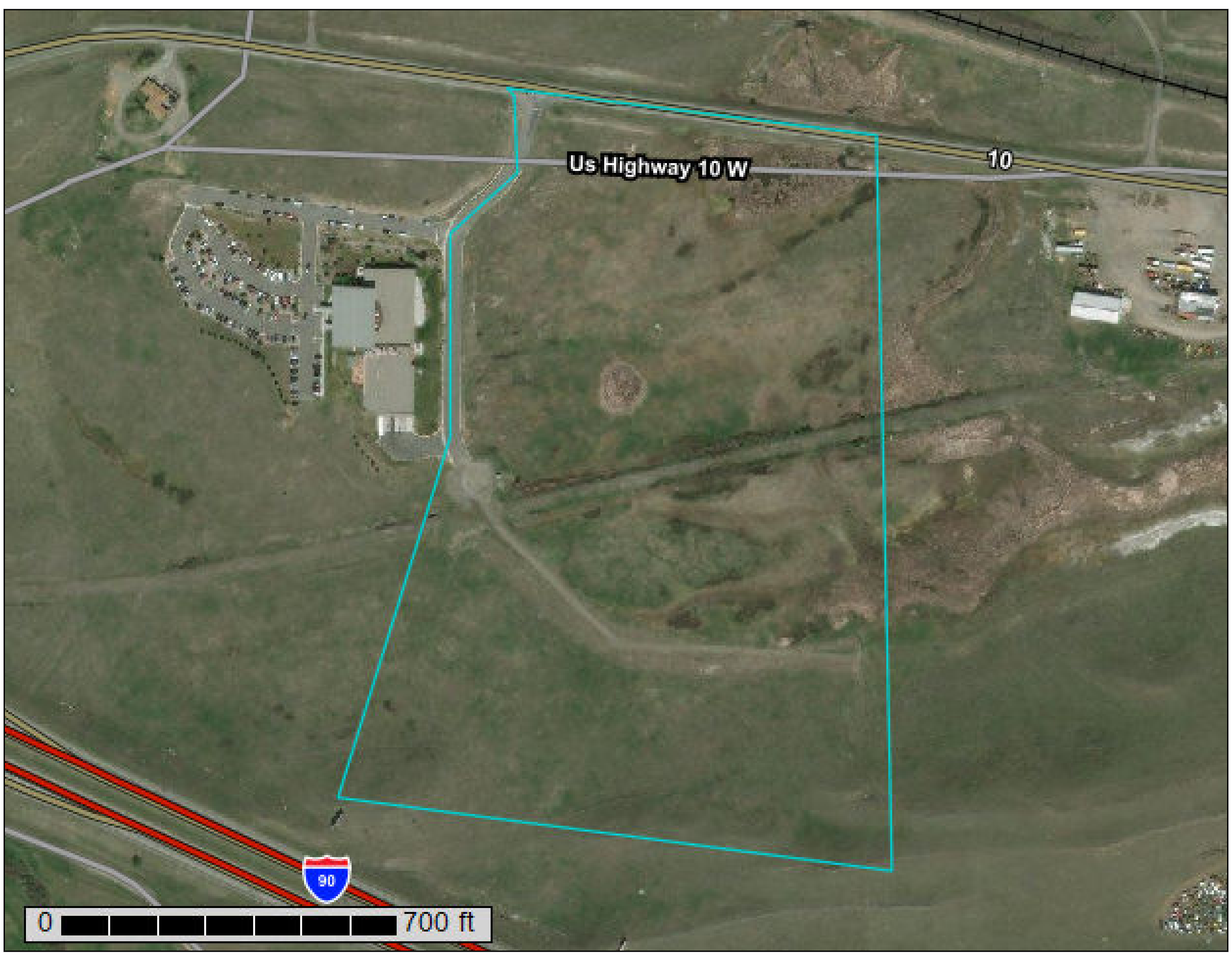
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for

# Park County Area, Montana

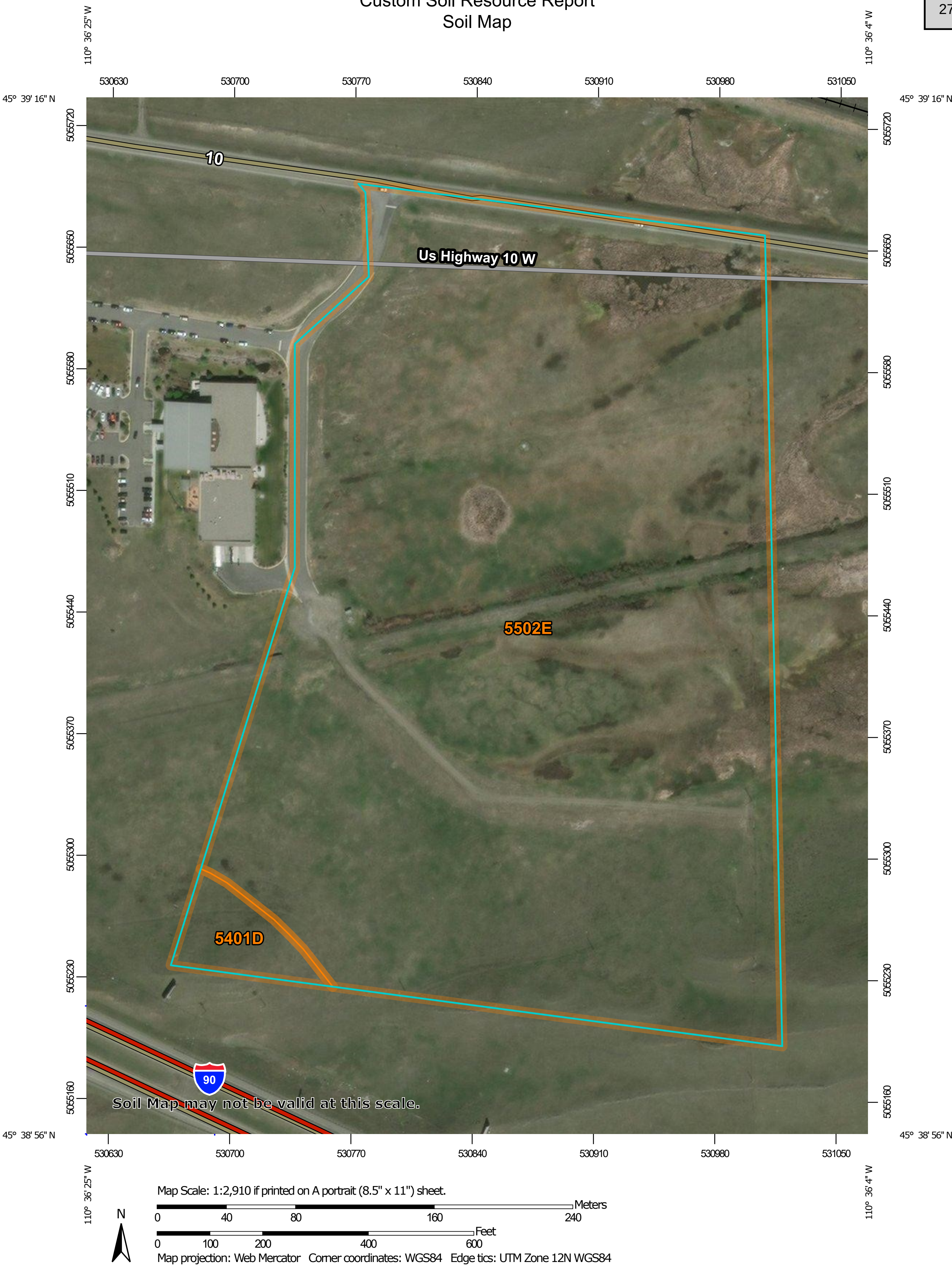



July 23, 2019

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Park County Area, Montana
Survey Area Data: Version 10, Sep 11, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 3, 2009—Sep 1, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 5401D | Ethridge-Tanna-Reedpoint complex, 2 to 15 percent slopes | 0.8 | 2.3% |
| 5502E | Reedpoint-Tanna-Ethridge complex, 4 to 35 percent slopes | 32.4 | 97.7% |
| **Totals for Area of Interest** | | **33.2** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Park County Area, Montana

## 5401D—Ethridge-Tanna-Reedpoint complex, 2 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 582g
*Elevation:* 4,300 to 5,100 feet
*Mean annual precipitation:* 12 to 14 inches
*Mean annual air temperature:* 43 to 45 degrees F
*Frost-free period:* 90 to 120 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Ethridge and similar soils:* 35 percent
*Tanna and similar soils:* 25 percent
*Reedpoint and similar soils:* 15 percent
*Minor components:* 25 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Ethridge

#### Setting

*Landform:* Swales on hills
*Landform position (two-dimensional):* Footslope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Clayey alluvium derived from sedimentary rock

#### Typical profile

*A - 0 to 4 inches:* clay loam
*Bt - 4 to 17 inches:* clay loam
*Bk1 - 17 to 53 inches:* clay loam
*2Bk2 - 53 to 60 inches:* gravelly loam

#### Properties and qualities

*Slope:* 2 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Sodium adsorption ratio, maximum in profile:* 5.0
*Available water storage in profile:* High (about 10.4 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 3e
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* C
*Ecological site:* Clayey (Cy) 9-14" p.z. (R044XS330MT)
*Hydric soil rating:* No

**Description of Tanna**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy alluvium derived from igneous, metamorphic and sedimentary rock

**Typical profile**

*A - 0 to 8 inches:* clay loam
*Bt - 8 to 16 inches:* clay loam
*Bk - 16 to 23 inches:* loam
*Cr - 23 to 60 inches:* weathered bedrock, bedrock
*Cr - 23 to 60 inches:*

**Properties and qualities**

*Slope:* 4 to 15 percent
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Available water storage in profile:* Low (about 3.9 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* C
*Ecological site:* Silty (Si) 9-14" p.z. (R044XS339MT)
*Hydric soil rating:* No

**Description of Reedpoint**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Summit
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy residuum weathered from sandstone

**Typical profile**

*A1 - 0 to 2 inches:* very channery loam
*A2 - 2 to 8 inches:* extremely channery loam
*R - 8 to 18 inches:* bedrock

**Properties and qualities**

*Slope:* 4 to 15 percent
*Depth to restrictive feature:* 4 to 10 inches to lithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Very low (about 0.8 inches)

**Interpretive groups**
*Land capability classification (irrigated):* 7s
*Land capability classification (nonirrigated):* 7s
*Hydrologic Soil Group:* D
*Ecological site:* Very Shallow (VSw) 9-14" p.z. (R044XS348MT)
*Hydric soil rating:* No

**Minor Components**

**Yamacall**
*Percent of map unit:* 10 percent
*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Ecological site:* Silty (Si) 9-14" p.z. (R044XS339MT)
*Hydric soil rating:* No

**Cabbart**
*Percent of map unit:* 10 percent
*Landform:* Scarp slopes
*Landform position (two-dimensional):* Backslope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Ecological site:* Shallow Limy (SwLy) 9-14" p.z. (R044XS612MT)
*Hydric soil rating:* No

**Rock outcrop**
*Percent of map unit:* 5 percent

## 5502E—Reedpoint-Tanna-Ethridge complex, 4 to 35 percent slopes

**Map Unit Setting**
*National map unit symbol:* 580l
*Elevation:* 4,300 to 5,200 feet
*Mean annual precipitation:* 12 to 14 inches
*Mean annual air temperature:* 43 to 45 degrees F
*Frost-free period:* 90 to 120 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Reedpoint and similar soils:* 35 percent
*Tanna and similar soils:* 25 percent
*Ethridge and similar soils:* 20 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Reedpoint**

**Setting**

*Landform:* Dip slopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Loamy residuum weathered from sandstone

**Typical profile**

*A1 - 0 to 2 inches:* very channery loam
*A2 - 2 to 8 inches:* extremely channery loam
*R - 8 to 18 inches:* bedrock

**Properties and qualities**

*Slope:* 4 to 35 percent
*Depth to restrictive feature:* 4 to 10 inches to lithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Very low (about 0.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7s
*Hydrologic Soil Group:* D
*Ecological site:* Very Shallow (VSw) 9-14" p.z. (R044XS348MT)
*Hydric soil rating:* No

**Description of Tanna**

**Setting**

*Landform:* Swales on dip slopes
*Landform position (two-dimensional):* Backslope
*Down-slope shape:* Concave
*Across-slope shape:* Convex
*Parent material:* Loamy alluvium derived from sandstone and shale

**Typical profile**

*A - 0 to 2 inches:* sandy clay loam
*Bt - 2 to 8 inches:* clay loam
*Bk - 8 to 26 inches:* loam
*Cr - 26 to 30 inches:* weathered bedrock
*R - 30 to 40 inches:* bedrock

**Properties and qualities**

*Slope:* 4 to 25 percent
*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock; 20 to 40 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Available water storage in profile:* Low (about 3.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* C
*Ecological site:* Silty (Si) 9-14" p.z. (R044XS339MT)
*Hydric soil rating:* No

### Description of Ethridge

**Setting**

*Landform:* Swales on dip slopes
*Landform position (two-dimensional):* Toeslope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Clayey alluvium derived from sandstone and shale

**Typical profile**

*A - 0 to 5 inches:* clay loam
*Bt - 5 to 21 inches:* clay loam
*Bk1 - 21 to 30 inches:* clay loam
*2Bk2 - 30 to 60 inches:* gravelly loam

**Properties and qualities**

*Slope:* 4 to 15 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Sodium adsorption ratio, maximum in profile:* 5.0
*Available water storage in profile:* High (about 9.4 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* C
*Ecological site:* Clayey (Cy) 9-14" p.z. (R044XS330MT)
*Hydric soil rating:* No

**Minor Components**

**Cabbart**

*Percent of map unit:* 12 percent
*Landform:* Scarp slopes
*Landform position (two-dimensional):* Backslope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Ecological site:* Shallow Limy (SwLy) 9-14" p.z. (R044XS612MT)
*Hydric soil rating:* No

**Rock outcrop**

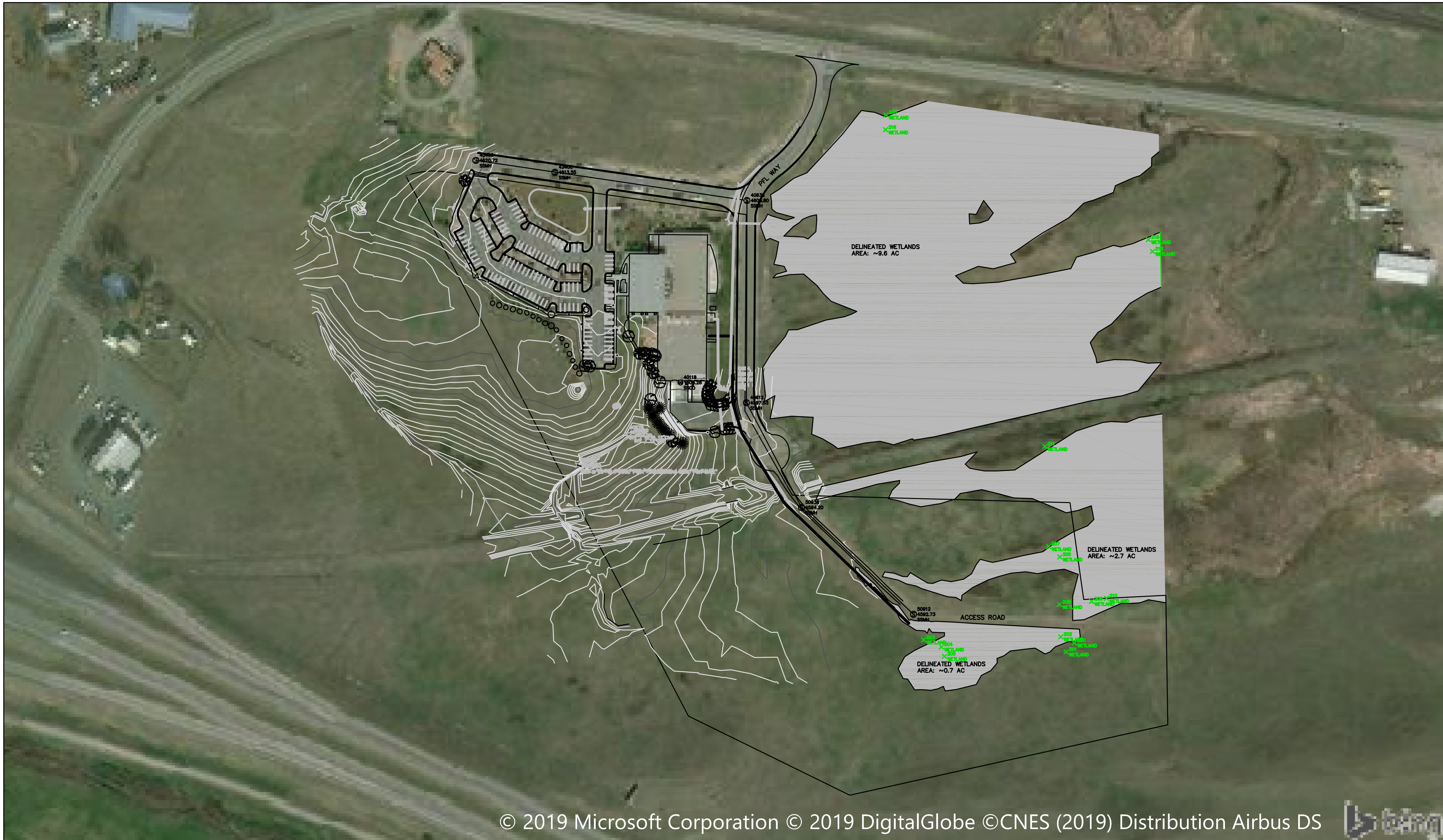
*Percent of map unit:* 5 percent

**Bigsandy**

*Percent of map unit:* 3 percent
*Landform:* Drainageways
*Landform position (two-dimensional):* Footslope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Ecological site:* Saline Subirrigated (SSb) 9-14" p.z. (R044XS333MT)
*Hydric soil rating:* Yes

# Appendix B

Figure 1 – Mapped Wetland Boundary at the Printing for Less Wetland Delineation Site




\\10.10.10.8\aesi\Projects\2018\18-018 Printing For Less Addition Geotech\97-Received-Sent\2019_08_29 SS ACAD\18-018 Wetlands_AES.dwg Sep 11, 2019 - 10:19am

| NO. | REVISIONS | DRAWN BY | DATE |
|---|---|---|---|
| | | | |

SCALE (FEET): 0 100 200 300

PROJECT ENGINEER: RO
DRAWN BY: Sanderson Stewart
DESIGNED BY:
REVIEWED BY:

# PRINTING FOR LESS
# WETLAND DELINEATION
LIVINGSTON, MT

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

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ALLIED ENGINEERING SERVICES, INC. Diverse Projects

PROJECT #: 18-018
DATE: 09/05/2019

FIGURE
W-1

# Appendix C

Printing for Less Wetland Determination Data Forms

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 1

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'2.53"N **Long.:** 110°36'10.41"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (●) No ( ) (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ( ) No (●) | Is the Sampled Area within a Wetland? Yes ( ) No (●) |
| Hydric Soil Present? | Yes (●) No ( ) | |
| Wetland Hydrology Present? | Yes ( ) No (●) | |

**Remarks:**
Sample located south of gravel access drive.

## VEGETATION - Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft.) | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Bromus inermis | 75 | ☑ | 78.9% | UPL |
| 2. Litter | 15 | ☐ | 15.8% | |
| 3. Poa pratensis | 5 | ☐ | 5.3% | FAC |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| 6. | 0 | ☐ | 0.0% | |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 95 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 0 | (A) |
| Total Number of Dominant Species Across All Strata: | 1 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 0.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 0 | x 2 = | 0 |
| FAC species | 5 | x 3 = | 15 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 75 | x 5 = | 375 |
| Column Totals: | 80 | (A) | 390 (B) |

Prevalence Index = B/A = 4.875

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ( ) No (●)

**Remarks:**
Community dominated by pasture grasses.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 7.5YR | 3/2 | 93 | 7.5YR | 5/1 | 7 | C | M | Silty Clay Loam | wet, not saturated |
| 6-13 | 7.5YR | 3/2 | 95 | 7.5YR | 5/3 | 3 | C | M | Silty Clay | very clayey |
| | | | | 7.5YR | 4/4 | 2 | C | M | | |
| 13-22 | 7.5YR | 4/2 | 80 | 7.5YR | 5/3 | 20 | C | M | Silty Clay Loam | reddish profile, wet, not saturated |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [x] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** **Yes** (●) **No** ( )

Remarks:

Mottles at 3 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | **Yes** ( ) | **No** (●) | Depth (inches): |
| Water Table Present? | **Yes** ( ) | **No** (●) | Depth (inches): |
| Saturation Present? (includes capillary fringe) | **Yes** ( ) | **No** (●) | Depth (inches): |

**Wetland Hydrology Present?** **Yes** ( ) **No** (●)

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No wetland hydrology indicators were observed at this sample location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 2

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'2.65"N **Long.:** 110°36'10.65"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (●) No ( ) (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (●) No ( ) | **Is the Sampled Area within a Wetland?** Yes (●) No ( ) |
| **Hydric Soil Present?** | Yes (●) No ( ) | |
| **Wetland Hydrology Present?** | Yes (●) No ( ) | |

**Remarks:**
Sample located eight feet from sample point 1.

## VEGETATION - Use scientific names of plants.

| Stratum / Species | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. Elaeagnus angustifolia | 5 | ☑ | 100.0% | FAC |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 5 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Poa pratensis | 35 | ☑ | 36.8% | FAC |
| 2. Sporobolus airoides | 30 | ☑ | 31.6% | FAC |
| 3. Litter | 15 | ☐ | 15.8% | |
| 4. Hordeum jubatum | 10 | ☐ | 10.5% | FAC |
| 5. Sonchus arvensis | 5 | ☐ | 5.3% | FACU |
| 6. | 0 | ☐ | 0.0% | |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 95 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 5

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 3 | (A) |
| Total Number of Dominant Species Across All Strata: | 3 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 0 | x 2 = | 0 |
| FAC species | 80 | x 3 = | 240 |
| FACU species | 5 | x 4 = | 20 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 85 (A) | | 260 (B) |

Prevalence Index = B/A = 3.059

**Hydrophytic Vegetation Indicators:**

- ☐ 1 - Rapid Test for Hydrologic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤3.0 [1]
- ☐ 4 - Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - Wetland Non-Vascular Plants [1]
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes (●) No ( )

**Remarks:**
Sample dominated by Kentucky bluegrass and alkai sacaton.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 7.5YR | 4/1 | 100 | | | | | | Silty Clay Loam | saturated to soil surface |
| 4-12 | 7.5YR | 3/1 | 94 | 7.5YR | 6/1 | 3 | C | M | Silty Clay Loam | |
| | | | | 7.5YR | 5/2 | 3 | C | M | | |
| 12-18+ | 7.5YR | 3/2 | 50 | 7.5YR | 4/2 | 50 | | | Silty Clay Loam | soil almost appears mixed |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** **Yes** ◉ **No** ○

Remarks:

Mottles at 4 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | **Yes** ○ | **No** ◉ | Depth (inches): |
| Water Table Present? | **Yes** ○ | **No** ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | **Yes** ◉ | **No** ○ | Depth (inches): 0 |

**Wetland Hydrology Present?** **Yes** ◉ **No** ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Soil saturated to surface.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 3

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'2.66"N **Long.:** 110°36'10.80"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-TannaEthridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (•) No ( ) **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (•) No ( ) | **Is the Sampled Area within a Wetland?** Yes (•) No ( ) |
| **Hydric Soil Present?** | Yes (•) No ( ) | |
| **Wetland Hydrology Present?** | Yes (•) No ( ) | |

**Remarks:**
Sample located in small depression.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? Rel.Strat. Cover | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | |
| 1. Elaeagnus angustifolia | 3 | ☐ 100.0% | FAC |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| 5. | 0 | ☐ 0.0% | |
| | 3 | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft.) | | | |
| 1. Schoenoplectus pungens | 65 | ☑ 81.3% | OBL |
| 2. Sporobolus airoides | 5 | ☐ 6.3% | FAC |
| 3. Juncus effusus | 5 | ☐ 6.3% | FACW |
| 4. Juncus balticus | 5 | ☐ 6.3% | FACW |
| 5. | 0 | ☐ 0.0% | |
| 6. | 0 | ☐ 0.0% | |
| 7. | 0 | ☐ 0.0% | |
| 8. | 0 | ☐ 0.0% | |
| 9. | 0 | ☐ 0.0% | |
| 10. | 0 | ☐ 0.0% | |
| 11. | 0 | ☐ 0.0% | |
| | 80 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |

**% Bare Ground in Herb Stratum:** 5

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 1 | (A) |
| Total Number of Dominant Species Across All Strata: | 1 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 65 | x 1 = | 65 |
| FACW species | 10 | x 2 = | 20 |
| FAC species | 8 | x 3 = | 24 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 83 (A) | | 109 (B) |

Prevalence Index = B/A = 1.313

**Hydrophytic Vegetation Indicators:**

- ☑ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes (•) No ( )

**Remarks:**
Mixed wetland species were observed at this sample location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 3

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 3/1 | 90 | 10YR | 5/2 | 10 | C | M | Silty Clay Loam | aturated to soil surface, mottles at 4 inches |
| 6-14+ | 10YR | 2/1 | 100 | | | | | | Silty Clay Loam | dark, saturated, stinky |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [x] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes (●) No ( )

Remarks:

Strong mottles at 4 inches with hydrogen sulfide odor.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [x] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [x] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ( ) | No (●) | Depth (inches): |
| Water Table Present? | Yes ( ) | No (●) | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes (●) | No ( ) | Depth (inches): 0 |

**Wetland Hydrology Present?** Yes (●) No ( )

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Sample was saturated to surface with hydrogen sulfide odor. Two seconday indicators were also observed.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 4

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** convex **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'2.62"N **Long.:** 110°36'14.77"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ● No ○ (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ● No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ○ No ● | **Is the Sampled Area within a Wetland?** Yes ○ No ● |
| **Hydric Soil Present?** | Yes ○ No ● | |
| **Wetland Hydrology Present?** | Yes ○ No ● | |

**Remarks:**
Upland site, southwest of PFL Way.

## VEGETATION - Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft.) | Absolute % Cover | Dominant Species? Rel.Strat. Cover | Indicator Status |
|---|---|---|---|
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| 5. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft.) | | | |
| 1. Bromus inermis | 60 | ☑ 66.7% | UPL |
| 2. Litter | 10 | ☐ 11.1% | |
| 3. Cardaria draba | 10 | ☐ 11.1% | UPL |
| 4. Poa pratensis | 5 | ☐ 5.6% | FAC |
| 5. Sporobolus airoides | 5 | ☐ 5.6% | FAC |
| 6. | 0 | ☐ 0.0% | |
| 7. | 0 | ☐ 0.0% | |
| 8. | 0 | ☐ 0.0% | |
| 9. | 0 | ☐ 0.0% | |
| 10. | 0 | ☐ 0.0% | |
| 11. | 0 | ☐ 0.0% | |
| | 90 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 0 | x 2 = | 0 |
| FAC species | 10 | x 3 = | 30 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 70 | x 5 = | 350 |
| Column Totals: | 80 (A) | | 380 (B) |

Prevalence Index = B/A = 4.750

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ○ No ●

**Remarks:**
Smooth brome and weeds dominated this location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 4

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 3/2 | 100 | | | | | | Silty Clay Loam | friable |
| 6-12 | 10YR | 3/3 | 100 | | | | | | Silty Clay Loam | Damp |
| 12-22+ | 10YR | 3/3 | 98 | 10YR | 5/2 | 20 | C | M | Silty Clay Loam | small mottles at 16 inches |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ○ No ●

Remarks:

Small mottles at 16 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | |
|---|---|---|
| Surface Water Present? | Yes ○ No ● | Depth (inches): |
| Water Table Present? | Yes ○ No ● | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ○ No ● | Depth (inches): |

**Wetland Hydrology Present?** Yes ○ No ●

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology was observed at this sample location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 5

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'2.47"N **Long.:** 110°36'14.28"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (●) No ( ) (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (●) No ( ) | **Is the Sampled Area within a Wetland?** Yes (●) No ( ) |
| **Hydric Soil Present?** | Yes (●) No ( ) | |
| **Wetland Hydrology Present?** | Yes (●) No ( ) | |

**Remarks:**
Sample located in slight depression.

## VEGETATION - Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft.) | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum (Plot size: 15 ft.)** | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum (Plot size: 5 ft.)** | | | | |
| 1. Poa pratensis | 50 | ☑ | 47.6% | FAC |
| 2. Juncus effusus | 25 | ☑ | 23.8% | FACW |
| 3. Litter | 15 | ☐ | 14.3% | |
| 4. Cirsium arvense | 5 | ☐ | 4.8% | FAC |
| 5. Cardaria draba | 5 | ☐ | 4.8% | UPL |
| 6. Carex microptera | 5 | ☐ | 4.8% | FACU |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 105 | = Total Cover | | |
| **Woody Vine Stratum (Plot size: )** | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 25 | x 2 = | 50 |
| FAC species | 55 | x 3 = | 165 |
| FACU species | 5 | x 4 = | 20 |
| UPL species | 5 | x 5 = | 25 |
| Column Totals: | 90 (A) | | 260 (B) |

Prevalence Index = B/A = 2.889

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes (●) No ( )

**Remarks:**
Kentucky bluegrass and Baltic rush were most dominant at this location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 5

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 3/1 | 100 | | | | | | Silty Clay Loam | saturated to soil surface |
| 6-18+ | 10YR | 3/2 | 92 | 10YR | 5/1 | 5 | C | M | Silty Clay Loam | increased saturation |
| | | | | 10YR | 4/2 | 3 | C | M | | |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ◉ No ○

Remarks:

Mottles at 6 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ○ | No ◉ | Depth (inches): |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ◉ | No ○ | Depth (inches): 0 |

**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Soil saturated to surface.  Two secodnary indicators of wetland hydrology were also observed.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 6

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'2.28"N **Long.:** 110°36'14.17"W **Datum:** WGS 84

**Soil Map Unit Name:** reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (•) No ( ) **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (•) No ( ) | **Is the Sampled Area within a Wetland?** Yes (•) No ( ) |
| **Hydric Soil Present?** | Yes (•) No ( ) | |
| **Wetland Hydrology Present?** | Yes (•) No ( ) | |

**Remarks:**

Sample located in slight depression south of access road.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? Rel.Strat. Cover | | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Juncus effusus | 20 | ☑ | 26.7% | FACW |
| 2. Carex microptera | 20 | ☑ | 26.7% | FACU |
| 3. Sporobolus airoides | 15 | ☑ | 20.0% | FAC |
| 4. Alopecurus arundinaceus | 10 | ☐ | 13.3% | FAC |
| 5. Cirsium arvense | 5 | ☐ | 6.7% | FAC |
| 6. Litter | 5 | ☐ | 6.7% | |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 75 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 20 | x 2 = | 40 |
| FAC species | 30 | x 3 = | 90 |
| FACU species | 20 | x 4 = | 80 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 70 (A) | | 210 (B) |

Prevalence Index = B/A = 3.000

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes (•) No ( )

**Remarks:**

Sample loction contained approximately 25% water.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 6

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 4/1 | 100 | | | | | | Silt Loam | saturated to surface |
| 6-12 | 10YR | 4/1 | 95 | 10YR | 4/6 | 5 | C | M | Silt Loam | mottles at 6 inches |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes (●) No ( )

Remarks:

Good mottles at 6 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes (●) | No ( ) | Depth (inches): 1 |
| Water Table Present? | Yes ( ) | No (●) | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes (●) | No ( ) | Depth (inches): 0 |

**Wetland Hydrology Present?** Yes (●) No ( )

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

One inch of surface water was observed.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 7

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'4.28"N **Long.:** 110°36'10.81"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** PEM1C

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ◉ No ○ **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ◉ No ○ | **Is the Sampled Area within a Wetland?** Yes ◉ No ○ |
| **Hydric Soil Present?** | Yes ◉ No ○ | |
| **Wetland Hydrology Present?** | Yes ◉ No ○ | |

**Remarks:**
Sample located in wetland swale.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Juncus effusus | 50 | ☑ | 52.1% | FACW |
| 2. Litter | 10 | ☐ | 10.4% | |
| 3. Solidago canadensis | 10 | ☐ | 10.4% | FACU |
| 4. Rosa woodsii | 5 | ☐ | 5.2% | FACU |
| 5. Symphoricarpos albus | 5 | ☐ | 5.2% | FACU |
| 6. Helianthus annuus | 5 | ☐ | 5.2% | FACU |
| 7. Taraxacum officinale | 5 | ☐ | 5.2% | FACU |
| 8. Eleocharis palustris | 3 | ☐ | 3.1% | OBL |
| 9. Triglochin maritima | 3 | ☐ | 3.1% | OBL |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 96 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 1 | (A) |
| Total Number of Dominant Species Across All Strata: | 1 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 6 | x 1 = | 6 |
| FACW species | 50 | x 2 = | 100 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 30 | x 4 = | 120 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 86 (A) | | 226 (B) |

Prevalence Index = B/A = 2.628

**Hydrophytic Vegetation Indicators:**

- ☑ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ◉ No ○

**Remarks:**
Baltic rush dominated this sample location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 7

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 4/1 | 100 | | | | | | Silt Loam | saturated to soil surface |
| 6-14 | 10YR | 4/1 | 93 | 10YR | 4/6 | 7 | C | M | Silt Loam | mottles at 6 inches |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ◉ No ○

Remarks:

Mottles at 6 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ○ | No ◉ | Depth (inches): |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ◉ | No ○ | Depth (inches): 0 |

**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Soil saturated to surface. Two secondary indicators of wetland hydrology were also observed.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 19-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 8

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'4.49"N **Long.:** 110°36'11.13"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** PEM1C

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ● No ○ (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ● No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ○ No ● | **Is the Sampled Area within a Wetland?** Yes ○ No ● |
| **Hydric Soil Present?** | Yes ○ No ● | |
| **Wetland Hydrology Present?** | Yes ○ No ● | |

**Remarks:**
Located approximately three feet above sample seven.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? Rel.Strat. Cover | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| 5. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft.) | | | |
| 1. Bromus inermis | 50 | ☑ 51.0% | UPL |
| 2. Symphoricarpos albus | 20 | ☑ 20.4% | FACU |
| 3. Poa pratensis | 10 | ☐ 10.2% | FAC |
| 4. Litter | 5 | ☐ 5.1% | |
| 5. Rosa woodsii | 5 | ☐ 5.1% | FACU |
| 6. Juncus balticus | 5 | ☐ 5.1% | FACW |
| 7. Iris missouriensis | 3 | ☐ 3.1% | FACW |
| 8. | 0 | ☐ 0.0% | |
| 9. | 0 | ☐ 0.0% | |
| 10. | 0 | ☐ 0.0% | |
| 11. | 0 | ☐ 0.0% | |
| | 98 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 0 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 0.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 8 | x 2 = | 16 |
| FAC species | 10 | x 3 = | 30 |
| FACU species | 25 | x 4 = | 100 |
| UPL species | 50 | x 5 = | 250 |
| Column Totals: | 93 (A) | | 396 (B) |

Prevalence Index = B/A = 4.258

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ○ No ●

**Remarks:**
Smooth brome and snowberry dominated this sample location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 8

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR | 3/2 | 100 | | | | | Silty Clay Loam | damp |
| 4-22+ | 10YR | 3/3 | 100 | | | | | Silty Clay Loam | damp |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ○ No ◉

Remarks:

No hydric soil indicators were observed at this sample location.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ○ | No ◉ | Depth (inches): |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ○ | No ◉ | Depth (inches): |

**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No wetland hydrology indicators were observed at this sample location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 9

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'3.32"N **Long.:** 110°36'10.83"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** PEM1C

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (●) No ( ) **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (●) No ( ) | **Is the Sampled Area within a Wetland?** | Yes ( ) No (●) |
| **Hydric Soil Present?** | Yes (●) No ( ) | | |
| **Wetland Hydrology Present?** | Yes ( ) No (●) | | |

**Remarks:**
Two of three wetland indicators were observed at this sample location.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? Rel.Strat. Cover | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| 5. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft.) | | | |
| 1. Agrostis gigantea | 50 | ☑ 52.6% | FAC |
| 2. Cirsium arvense | 10 | ☐ 10.5% | FAC |
| 3. Poa pratensis | 10 | ☐ 10.5% | FAC |
| 4. Juncus balticus | 10 | ☐ 10.5% | FACW |
| 5. Litter | 10 | ☐ 10.5% | |
| 6. Cardaria draba | 5 | ☐ 5.3% | UPL |
| 7. | 0 | ☐ 0.0% | |
| 8. | 0 | ☐ 0.0% | |
| 9. | 0 | ☐ 0.0% | |
| 10. | 0 | ☐ 0.0% | |
| 11. | 0 | ☐ 0.0% | |
| | 95 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 1 | (A) |
| Total Number of Dominant Species Across All Strata: | 1 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 10 | x 2 = | 20 |
| FAC species | 70 | x 3 = | 210 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 5 | x 5 = | 25 |
| Column Totals: | 85 (A) | | 255 (B) |

Prevalence Index = B/A = 3.000

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes (●) No ( )

**Remarks:**
Redtop dominated the sample location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 9

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-2 | 10YR | 3/2 | 100 | | | | | | silty clay loam | rooty, organic |
| 2-8 | 10YR | 4/1 | 97 | 10YR | 5/1 | 3 | C | M | Silty Clay Loam | increase clay as increase depth, 3% mottles at 6 |
| 8-22 | 10YR | 4/1 | 92 | 10YR | 5/1 | 5 | C | M | Silty Clay Loam | very clayey, very wet soil |
| | | | | 10YR | 5/3 | 3 | C | M | | |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes (●) No ( )

Remarks:

Mottles at 6 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ( ) | No (●) | Depth (inches): |
| Water Table Present? | Yes ( ) | No (●) | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ( ) | No (●) | Depth (inches): |

**Wetland Hydrology Present?** Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No hydric soil indicators were observed at this locaiton.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 10

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'3.37"N **Long.:** 110°36'9.90"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** PEM1C

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ● No ○ (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ● No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ● No ○ | Is the Sampled Area within a Wetland? Yes ● No ○ |
| Hydric Soil Present? | Yes ● No ○ | |
| Wetland Hydrology Present? | Yes ● No ○ | |

**Remarks:**
Sample located three feet below sample nine.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Juncus effusus | 65 | ☑ | 68.4% | FACW |
| 2. Alopecurus arundinaceus | 25 | ☑ | 26.3% | FAC |
| 3. Mentha arvensis | 5 | ☐ | 5.3% | FACW |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| 6. | 0 | ☐ | 0.0% | |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 95 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 70 | x 2 = | 140 |
| FAC species | 25 | x 3 = | 75 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 95 (A) | | 215 (B) |

Prevalence Index = B/A = 2.263

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ● No ○

**Remarks:**
Sample location dominated by Baltic rush.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 10

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-14 | 10YR | 4/1 | 90 | 10YR | 4/4 | 5 | C | M | Silty Clay Loam | saturated to soil surface |
| | | | | 10YR | 4/6 | 5 | C | M | | increase clay as increae depth |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☑ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☑ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ◉ No ○

Remarks:

Black (10YR 2/1) spots throughout profile from 2 to 4 inches. Hydrogen sulfide odor was observed.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | | |
|---|---|---|---|---|
| Surface Water Present? | Yes ○ | No ◉ | Depth (inches): | |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): | |
| Saturation Present? (includes capillary fringe) | Yes ◉ | No ○ | Depth (inches): | 0 |

**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Soil saturated to surface. Soil had a hydrogen sulfide odor. Two secondary indicators of wetland hydrology were observed at this sample location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 11

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'3.43"N **Long.:** 110°36'9.48"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** PEM1C

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ◉ No ○ **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ◉ No ○ | **Is the Sampled Area within a Wetland?** | Yes ◉ No ○ |
| **Hydric Soil Present?** | Yes ◉ No ○ | | |
| **Wetland Hydrology Present?** | Yes ◉ No ○ | | |

**Remarks:**
Cattail marsh.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? Rel.Strat. Cover | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| 3. | 0 | ☐ 0.0% | |
| 4. | 0 | ☐ 0.0% | |
| 5. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft.) | | | |
| 1. Typha latifolia | 40 | ☑ 42.1% | OBL |
| 2. Juncus effusus | 35 | ☑ 36.8% | FACW |
| 3. Carex nebrascensis | 10 | ☐ 10.5% | OBL |
| 4. Mentha arvensis | 5 | ☐ 5.3% | FACW |
| 5. Litter | 5 | ☐ 5.3% | |
| 6. | 0 | ☐ 0.0% | |
| 7. | 0 | ☐ 0.0% | |
| 8. | 0 | ☐ 0.0% | |
| 9. | 0 | ☐ 0.0% | |
| 10. | 0 | ☐ 0.0% | |
| 11. | 0 | ☐ 0.0% | |
| | 95 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | 0 | ☐ 0.0% | |
| 2. | 0 | ☐ 0.0% | |
| | 0 | = Total Cover | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 50 | x 1 = | 50 |
| FACW species | 40 | x 2 = | 80 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 90 (A) | | 130 (B) |

Prevalence Index = B/A = 1.444

**Hydrophytic Vegetation Indicators:**

- ☑ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ◉ No ○

**Remarks:**
Site dominated by cattails and Baltic rush.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 11

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 4/1 | 100 | | | | | | Silty Clay Loam | saturated, stinky soil |
| 6-14+ | 10YR | 4/1 | 95 | 10YR | 4/6 | 5 | C | M | Silty Clay Loam | stinky, silky soil |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☑ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ◉ No ○

Remarks:

Hydrogen sulfide odor was observed.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ◉ | No ○ | Depth (inches): 1 |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ◉ | No ○ | Depth (inches): 0 |

**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Approximately one inch of surface water.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 12

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'6.36"N **Long.:** 110°36'11.12"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** FSW

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (●) No ( ) (If no, explain in Remarks.)

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (●) No ( ) | **Is the Sampled Area within a Wetland?** Yes (●) No ( ) |
| **Hydric Soil Present?** | Yes (●) No ( ) | |
| **Wetland Hydrology Present?** | Yes (●) No ( ) | |

**Remarks:**
Shrub/scrub sample location along railroad grade.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. Salix exigua | 40 | ☑ | 100.0% | FACW |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 40 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Juncus effusus | 20 | ☑ | 37.7% | FACW |
| 2. Agrostis gigantea | 15 | ☑ | 28.3% | FAC |
| 3. Triglochin maritima | 5 | ☐ | 9.4% | OBL |
| 4. Eleocharis palustris | 5 | ☐ | 9.4% | OBL |
| 5. Litter | 3 | ☐ | 5.7% | |
| 6. Symphoricarpos albus | 5 | ☐ | 9.4% | FACU |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 53 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 3 | (A) |
| Total Number of Dominant Species Across All Strata: | 3 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 10 | x 1 = | 10 |
| FACW species | 60 | x 2 = | 120 |
| FAC species | 15 | x 3 = | 45 |
| FACU species | 5 | x 4 = | 20 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 90 (A) | | 195 (B) |

Prevalence Index = B/A = 2.167

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes (●) No ( )

**Remarks:**
Salix overstory with mixed understory.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 12

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR | 4/1 | 100 | | | | | | Silty Clay Loam | saturated, surface water |
| 6-15 | 10YR | 4/1 | 94 | 10YR | 4/6 | 6 | C | M | Silty Clay Loam | mottles at 6 inches |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes (●) No ( )

Remarks:

Mottles at 6 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [x] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes (●) | No ( ) | Depth (inches): 1 |
| Water Table Present? | Yes ( ) | No (●) | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes (●) | No ( ) | Depth (inches): |

**Wetland Hydrology Present?** Yes (●) No ( )

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

One inch of surface water was observed. Two secondary indicators of wetland hydrology were observed at this location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 13

**Investigator(s):** B Schultz **Section, Township, Range: S** 22 **T** 2 S **R** 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

**Subregion (LRR):** LRR E **Lat.:** 45°39'6.52"N **Long.:** 110°36'11.22"W **Datum:** WGS 84

**Soil Map Unit Name:** reedpoint-Tanna-Ethridge complex **NWI classification:** FSW

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (x) No ( ) **(If no, explain in Remarks.)**

**Are Vegetation** [ ] **, Soil** [ ] **, or Hydrology** [ ] **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (x) No ( )

**Are Vegetation** [ ] **, Soil** [ ] **, or Hydrology** [ ] **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ( ) No (x) | **Is the Sampled Area within a Wetland?** | Yes ( ) No (x) |
| **Hydric Soil Present?** | Yes ( ) No (x) | | |
| **Wetland Hydrology Present?** | Yes ( ) No (x) | | |

**Remarks:**
No wetland indicators were observed at this sample location.

## VEGETATION - Use scientific names of plants.

| **Tree Stratum** (Plot size: 30 ft.) | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| 1. | 0 | [ ] | 0.0% | |
| 2. | 0 | [ ] | 0.0% | |
| 3. | 0 | [ ] | 0.0% | |
| 4. | 0 | [ ] | 0.0% | |
| | 0 | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. Salix exigua | 5 | [x] | 100.0% | FACW |
| 2. | 0 | [ ] | 0.0% | |
| 3. | 0 | [ ] | 0.0% | |
| 4. | 0 | [ ] | 0.0% | |
| 5. | 0 | [ ] | 0.0% | |
| | 5 | | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Symphoricarpos albus | 50 | [x] | 53.8% | FACU |
| 2. Rosa woodsii | 15 | [ ] | 16.1% | FACU |
| 3. Dactylis glomerata | 10 | [ ] | 10.8% | FACU |
| 4. Achillea millefolium | 10 | [ ] | 10.8% | FACU |
| 5. Equisetum hyemale | 5 | [ ] | 5.4% | FACW |
| 6. Helianthus annuus | 3 | [ ] | 3.2% | FACU |
| 7. | 0 | [ ] | 0.0% | |
| 8. | 0 | [ ] | 0.0% | |
| 9. | 0 | [ ] | 0.0% | |
| 10. | 0 | [ ] | 0.0% | |
| 11. | 0 | [ ] | 0.0% | |
| | 93 | | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | [ ] | 0.0% | |
| 2. | 0 | [ ] | 0.0% | |
| | 0 | | = Total Cover | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 1 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 50.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 10 | x 2 = | 20 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 88 | x 4 = | 352 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 98 (A) | | 372 (B) |

Prevalence Index = B/A = 3.796

**Hydrophytic Vegetation Indicators:**

- [ ] **1 - Rapid Test for Hydrologic Vegetation**
- [ ] **2 - Dominance Test is > 50%**
- [ ] **3 - Prevalence Index is ≤3.0** [1]
- [ ] **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- [ ] **5 - Wetland Non-Vascular Plants** [1]
- [ ] **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ( ) No (x)

**Remarks:**
Snowberry domianted this site.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 13

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix | | | Redox Features | | | | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | Color (moist) | | % | Color (moist) | % | Type[1] | Loc² | | |
| 0-4 | 10YR | 3/2 | 100 | | | | | silty lay loam | organic, rooty |
| 4-20 | 10YR | 4/1 | 100 | | | | | Silty Clay Loam | increase clay as deeper in profile |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils [3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ○ No ●

Remarks:

No hydric soil indicators were observed at this sample location.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ○ | No ● | Depth (inches): |
| Water Table Present? | Yes ○ | No ● | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ○ | No ● | Depth (inches): |

**Wetland Hydrology Present?** Yes ○ No ●

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology was observed at this sample location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** **PFL 14**

**Investigator(s):** B Schultz **Section, Township, Range: S** 22 **T** 2 S **R** 9 E

**Landform (hillslope, terrace, etc.):** **Local relief (concave, convex, none):** **Slope:** 0.0 **% /** 0.0 **°**

**Subregion (LRR):** LRR E **Lat.:** 45°39'10.46"N **Long.:** 110°36'8.06"W **Datum:** WGS 84

**Soil Map Unit Name:** **NWI classification:**

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ◉ No ○ **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ◉ No ○ | **Is the Sampled Area within a Wetland?** Yes ○ No ◉ |
| **Hydric Soil Present?** | Yes ○ No ◉ | |
| **Wetland Hydrology Present?** | Yes ◉ No ○ | |

**Remarks:**
Sample located along eastern boundary.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Agrostis gigantea | 30 | ☑ | 32.3% | FAC |
| 2. Juncus effusus | 30 | ☑ | 32.3% | FACW |
| 3. Litter | 15 | ☐ | 16.1% | |
| 4. Solidago canadensis | 10 | ☐ | 10.8% | FACU |
| 5. Poa pratensis | 5 | ☐ | 5.4% | FAC |
| 6. Cirsium arvense | 3 | ☐ | 3.2% | FAC |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 93 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 30 | x 2 = | 60 |
| FAC species | 38 | x 3 = | 114 |
| FACU species | 10 | x 4 = | 40 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 78 (A) | | 214 (B) |

Prevalence Index = B/A = 2.744

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ◉ No ○

**Remarks:**
Redtop and Baltic rush dominated this location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 14

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-3 | 10YR | 3/1 | 100 | | | | | | silty clay loam | organic, rooty |
| 3-12 | 10YR | 4/2 | 94 | 10YR | 4/6 | 3 | C | M | Silty Clay Loam | mottles start at 3 inches |
| | | | | 10YR | 5/2 | 3 | C | M | | |
| 12-18+ | 10YR | 4/2 | 87 | 10YR | 4/6 | 8 | C | M | Silty Clay Loam | increase mottles |
| | | | | 10YR | 5/2 | 5 | C | M | | |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1) (except in MLRA 1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- [ ] 2 cm Muck (A10)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ○ No ◉

Remarks:

Mottles at 3 inches.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Stunted or Stressed Plants (D1) (LRR A)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- [ ] Drainage Patterns (B10)
- [ ] Dry Season Water Table (C2)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [x] FAC-neutral Test (D5)
- [ ] Raised Ant Mounds (D6) (LRR A)
- [ ] Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ○ | No ◉ | Depth (inches): |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ○ | No ◉ | Depth (inches): |

**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Two secondary indicators of wetland hydrology were observed at this sample location

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 15

**Investigator(s):** B Schultz **Section, Township, Range:** S 22 T 2 S R 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E **Lat.:** 45°39'10.70"N **Long.:** 110°36'8.20"W **Datum:** WGS 84

**Soil Map Unit Name:** Reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ◉ No ○ **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ○ No ◉ | **Is the Sampled Area within a Wetland?** Yes ○ No ◉ |
| **Hydric Soil Present?** | Yes ○ No ◉ | |
| **Wetland Hydrology Present?** | Yes ○ No ◉ | |

**Remarks:**
Sample located along eastern boundary.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Symphoricarpos albus | 40 | ☑ | 42.1% | FACU |
| 2. Pascopyrum smithii | 25 | ☑ | 26.3% | FACU |
| 3. Juncus balticus | 10 | ☐ | 10.5% | FACW |
| 4. Solidago canadensis | 10 | ☐ | 10.5% | FACU |
| 5. Cirsium arvense | 5 | ☐ | 5.3% | FAC |
| 6. Stipa viridula | 5 | ☐ | 5.3% | UPL |
| 7. | 0 | ☐ | 0.0% | |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 95 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 0 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 0.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 10 | x 2 = | 20 |
| FAC species | 5 | x 3 = | 15 |
| FACU species | 75 | x 4 = | 300 |
| UPL species | 5 | x 5 = | 25 |
| Column Totals: | 95 (A) | | 360 (B) |

Prevalence Index = B/A = 3.789

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ○ No ◉

**Remarks:**
Dominated by snowberry and Baltic rush.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 15

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc² | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 0-3 | 10YR | 4/1 | 100 | | | | | Silty Clay Loam | powdery, friable |
| 3-6 | 10YR | 4/2 | 100 | | | | | Silty Clay Loam | dry |
| 6-18+ | 10YR | 5/2 | 100 | | | | | Silty Clay Loam | friable |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils [3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** **Yes** ○ **No** ◉

Remarks:

No hydric soil indicators were observed at this sample location.

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

Surface Water Present? **Yes** ○ **No** ◉ Depth (inches):

Water Table Present? **Yes** ○ **No** ◉ Depth (inches):

Saturation Present? (includes capillary fringe) **Yes** ○ **No** ◉ Depth (inches):

**Wetland Hydrology Present?** **Yes** ○ **No** ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology was observed at this sample location.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less **City/County:** Livingston/Park **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less **State:** MT **Sampling Point:** PFL 16

**Investigator(s):** B Schultz **Section, Township, Range: S** 22 **T** 2 S **R** 9 E

**Landform (hillslope, terrace, etc.):** Undulating **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

**Subregion (LRR):** LRR E **Lat.:** 45°39'13.27"N **Long.:** 110°36'15.76"W **Datum:** WGS 84

**Soil Map Unit Name:** reedpoint-Tanna-Ethridge complex **NWI classification:** none

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes (•) No ( ) **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes (•) No ( ) | **Is the Sampled Area within a Wetland?** Yes ( ) No (•) |
| **Hydric Soil Present?** | Yes (•) No ( ) | |
| **Wetland Hydrology Present?** | Yes ( ) No (•) | |

**Remarks:**
Sample located at toe slope along Business 90.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Rel.Strat. Cover | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Poa pratensis | 20 | ☑ | 23.5% | FAC |
| 2. Pascopyrum smithii | 20 | ☑ | 23.5% | FACU |
| 3. Hordeum jubatum | 15 | ☑ | 17.6% | FAC |
| 4. Agropyron intermedium | 10 | ☐ | 11.8% | UPL |
| 5. Sonchus arvensis | 10 | ☐ | 11.8% | FACU |
| 6. Solidago canadensis | 5 | ☐ | 5.9% | FACU |
| 7. Iris missouriensis | 5 | ☐ | 5.9% | FACW |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 85 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 3 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 66.7% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 5 | x 2 = | 10 |
| FAC species | 35 | x 3 = | 105 |
| FACU species | 35 | x 4 = | 140 |
| UPL species | 10 | x 5 = | 50 |
| Column Totals: | 85 (A) | | 305 (B) |

Prevalence Index = B/A = 3.588

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes (•) No ( )

**Remarks:**
MIxed grasses were observed.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 16

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR | 4/1 | 100 | | | | | | Silty Clay Loam | dry |
| 4-16 | 10YR | 4/2 | 95 | 10YR | 5/4 | 5 | C | M | Silty Clay Loam | yellowish mottles |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** **Yes** ◉ **No** ○

Remarks:

possible mixed profile close to the road?

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | **Yes** ○ | **No** ◉ | Depth (inches): |
| Water Table Present? | **Yes** ○ | **No** ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | **Yes** ○ | **No** ◉ | Depth (inches): |

**Wetland Hydrology Present?** **Yes** ○ **No** ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No hydric soil indicators were observed at this locaiton.

# WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

**Project/Site:** Printing for Less  **City/County:** Livingston/Park  **Sampling Date:** 26-Jun-19

**Applicant/Owner:** Printing for Less  **State:** MT  **Sampling Point:** PFL 17

**Investigator(s):** B Schultz  **Section, Township, Range:** S 22  T 2 S  R 9 E

**Landform (hillslope, terrace, etc.):** Undulating  **Local relief (concave, convex, none):** none  **Slope:** 0.0 % / 0.0 °

**Subregion (LRR):** LRR E  **Lat.:** 45°39'12.97"N  **Long.:** 110°36'15.75"W  **Datum:** WGS 84

**Soil Map Unit Name:** reedpoint-Tanna-Ethridge complex  **NWI classification:** PEMA

**Are climatic/hydrologic conditions on the site typical for this time of year?** Yes ◉ No ○ **(If no, explain in Remarks.)**

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

**Are Vegetation** ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

## Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| **Hydrophytic Vegetation Present?** | Yes ◉ No ○ | **Is the Sampled Area within a Wetland?** Yes ◉ No ○ |
| **Hydric Soil Present?** | Yes ◉ No ○ | |
| **Wetland Hydrology Present?** | Yes ◉ No ○ | |

**Remarks:**
Sample located at toe slope along Business 90.

## VEGETATION - Use scientific names of plants.

| | Absolute % Cover | Dominant Species? Rel.Strat. Cover | | Indicator Status |
|---|---|---|---|---|
| **Tree Stratum** (Plot size: 30 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft.) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| 3. | 0 | ☐ | 0.0% | |
| 4. | 0 | ☐ | 0.0% | |
| 5. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft.) | | | | |
| 1. Agrostis gigantea | 50 | ☑ | 53.8% | FAC |
| 2. Iris missouriensis | 15 | ☐ | 16.1% | FACW |
| 3. Litter | 10 | ☐ | 10.8% | |
| 4. Alopecurus arundinaceus | 5 | ☐ | 5.4% | FAC |
| 5. Rosa woodsii | 5 | ☐ | 5.4% | FACU |
| 6. Cynoglossum officinale | 3 | ☐ | 3.2% | FACU |
| 7. Elymus lanceolatus | 5 | ☐ | 5.4% | FACU |
| 8. | 0 | ☐ | 0.0% | |
| 9. | 0 | ☐ | 0.0% | |
| 10. | 0 | ☐ | 0.0% | |
| 11. | 0 | ☐ | 0.0% | |
| | 93 | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | | |
| 1. | 0 | ☐ | 0.0% | |
| 2. | 0 | ☐ | 0.0% | |
| | 0 | = Total Cover | | |

**% Bare Ground in Herb Stratum:** 0

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That are OBL, FACW, or FAC: | 1 | (A) |
| Total Number of Dominant Species Across All Strata: | 1 | (B) |
| Percent of dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 15 | x 2 = | 30 |
| FAC species | 55 | x 3 = | 165 |
| FACU species | 13 | x 4 = | 52 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 83 (A) | | 247 (B) |

Prevalence Index = B/A = 2.976

**Hydrophytic Vegetation Indicators:**

- ☐ **1 - Rapid Test for Hydrologic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

**Hydrophytic Vegetation Present?** Yes ◉ No ○

**Remarks:**
Primarily redtop was observed at this sample location.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

## Soil

**Sampling Point:** PFL 17

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | | Matrix % | Redox Features Color (moist) | | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR | 4/1 | 100 | | | | | | Silty Clay Loam | dry, rooty |
| 4-8 | 10YR | 4/1 | 94 | 10YR | 5/1 | 3 | C | M | Silty Clay Loam | saturated |
| , saturate | | | | 10YR | 4/6 | 3 | C | M | | |
| 8-16 | 10YR | 4/2 | 85 | 10YR | 4/6 | 10 | C | M | Silty Clay Loam | oxidized root zones? Calcium? Salts? |
| | | | | 10YR | 6/1 | 5 | C | M | | |

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type:

Depth (inches):

**Hydric Soil Present?** Yes ◉ No ○

Remarks:

Salt concentrations on surface

## Hydrology

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ○ | No ◉ | Depth (inches): |
| Water Table Present? | Yes ○ | No ◉ | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes ◉ | No ○ | Depth (inches): 4 |

**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Saturated at 4 inches below ground surface

# Appendix D

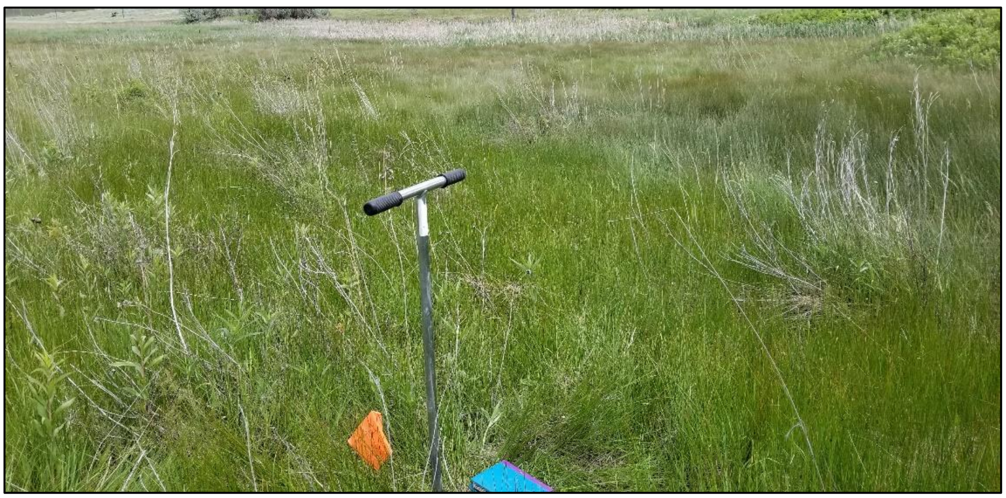
Printing for Less Wetland Delineation Site Photographs


(Data Points 1-3)


(Data Point 4)


(Data Point 5)


(Data Point 6)


(Data Point 7)


(Data Point 8)


(Data Point 9)


(Data Points 10-11)


(Data Point 12)


(Data Point 13)


(Data Point 14)


(Data Point 15)


(Data Point 16)


(Data Point 17)

)

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX F

Public Agency Review

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Jen Smithham
Helena Area Resource Office
Montana Fish, Wildlife, and Parks
PO Box 200701
Helena, MT 59620-0701
fwpcomments@mt.gov

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Ms. Smithham:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

The project is located within the Livingston city limits and will be accessed via Highway 10 via PFL Way and Antelope Drive. The project site is legally described as Tract 1-A of COS 2748RB and is located within Section 22 of Township 2 South, Range 9 East, Principal Meridian Montana, City of Livingston, Park County, Montana. Attached is the proposed subdivision vicinity map.

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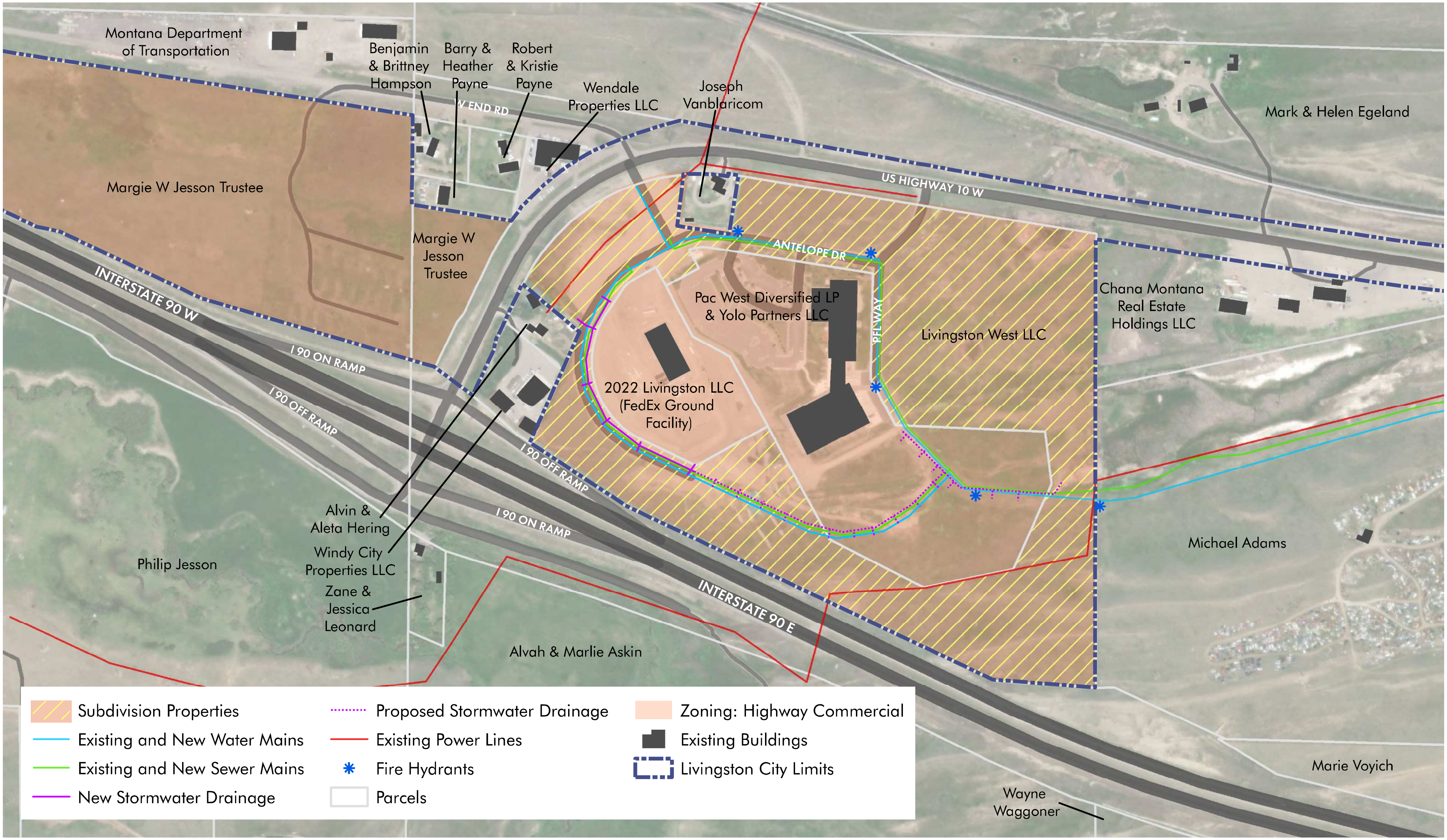
If you have any further questions or comments, please do not hesitate to call me at (406) 922-4314 or email me at sanacker@sandersonstewart.com.

Sincerely,

Sumner Anacker

Sumner Anacker, PE
Project Engineer
Sanderson Stewart
106 East Babcock Street, Suite L1
Bozeman, MT 59715
sanacker@sandersonstewart.com
ph: 406-922-4314




June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Lonnie Von Oesen, SIAP Planner
Rail, Transit, & Planning Division
Montana Department of Transportation
PO Box 201001
Helena, MT 59601-2001
lvonoesen@mt.gov

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Mr. Von Oesen:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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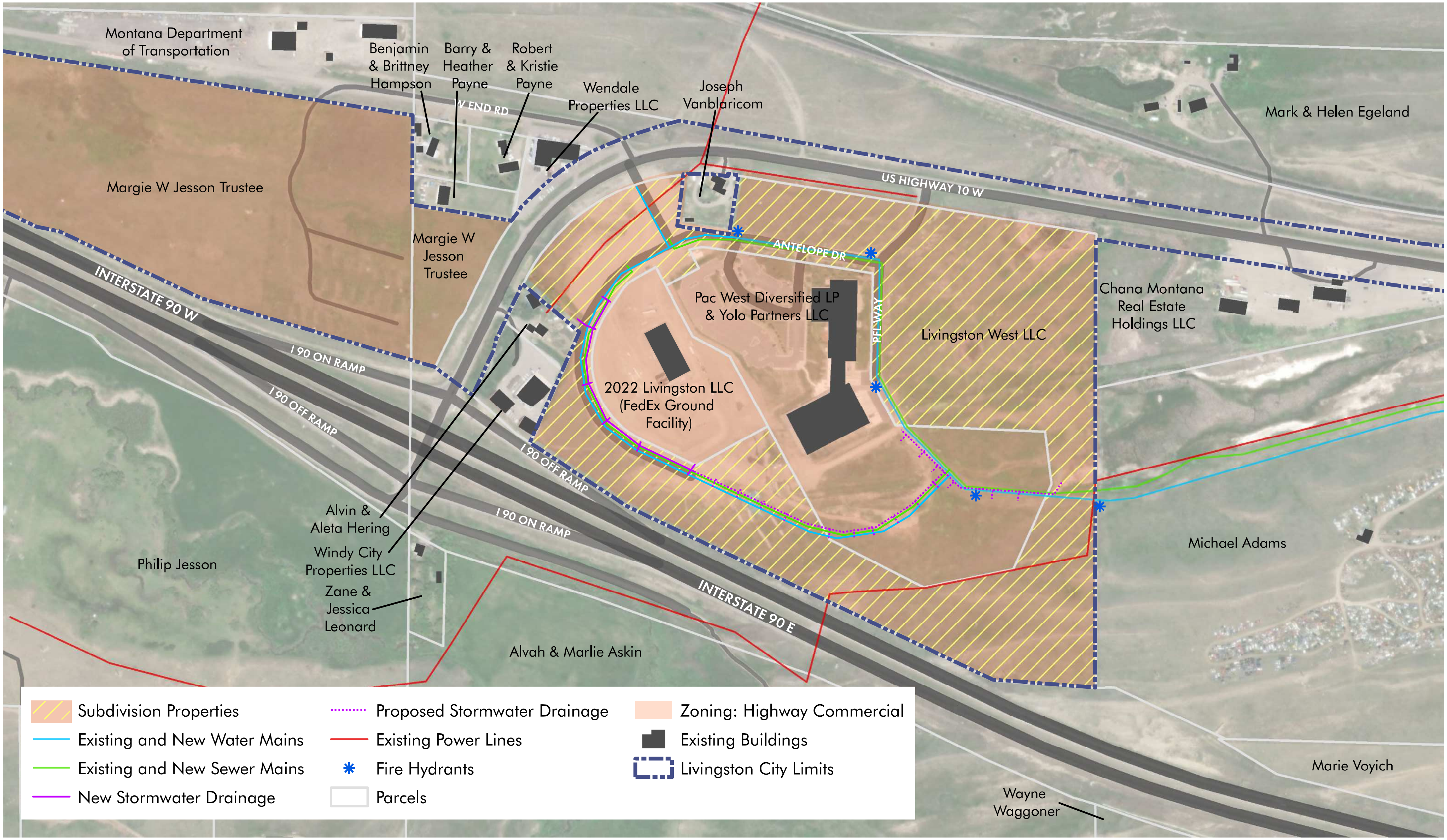


June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Pete Brown
State Historic Preservation Officer
Montana Historical Society
PO Box 201201
Helena, MT 59620-1201
pebrown@mt.gov

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Mr. Brown:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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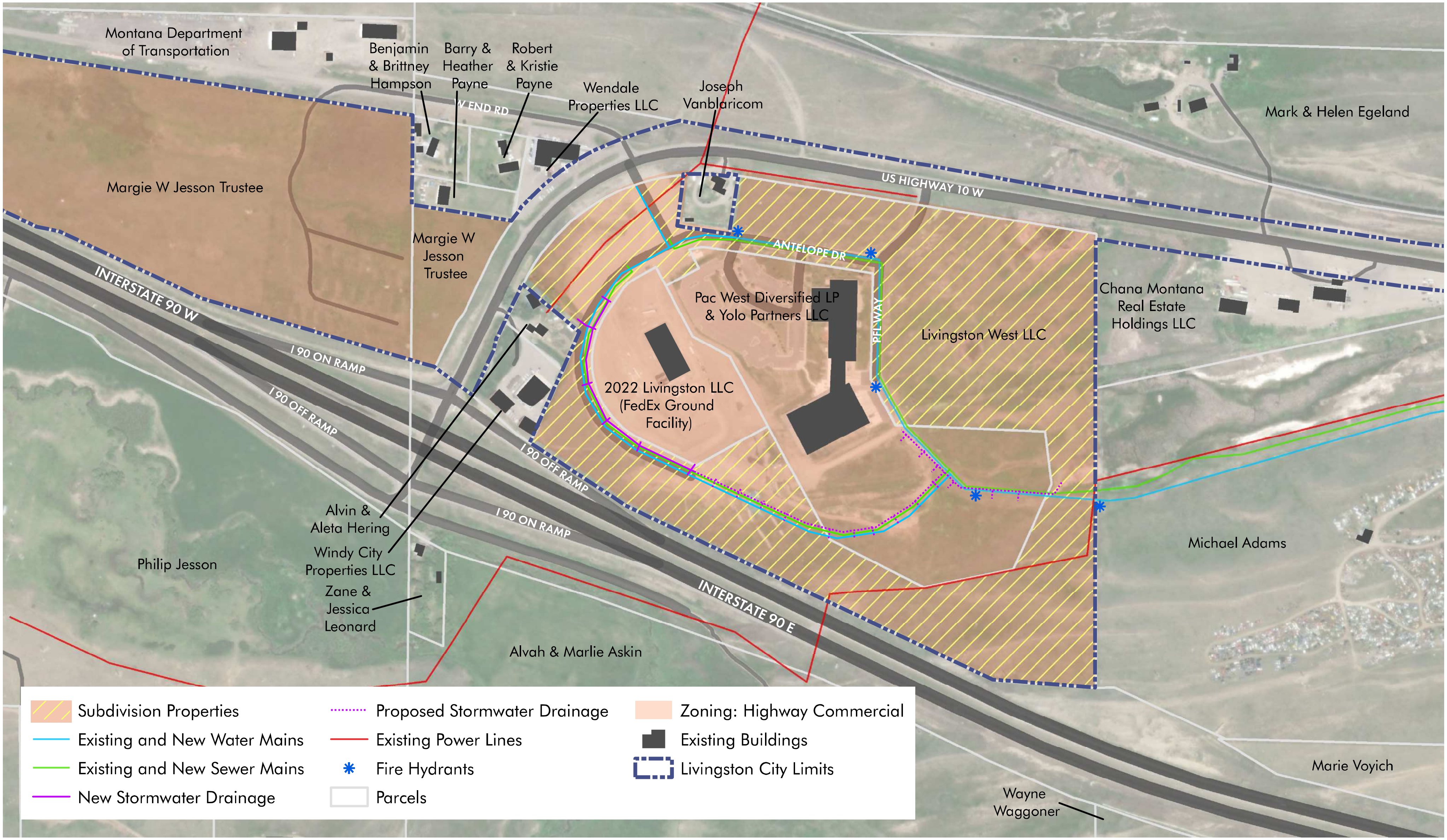
Sincerely,

Sumner Anacker

Sumner Anacker, PE
Project Engineer
Sanderson Stewart
106 East Babcock Street, Suite L1
Bozeman, MT 59715
sanacker@sandersonstewart.com
ph: 406-922-4314




June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

NORTH

0 250 500 1,000 Feet

## Sumner Anacker

**From:** Murdo, Damon <dmurdo@mt.gov>
**Sent:** Thursday, June 8, 2023 2:59 PM
**To:** Sumner Anacker
**Subject:** RE: Mountain View Subdivision Preliminary Plat - Request for Comment (SHPO)
**Attachments:** Reports.pdf; 2023060806.pdf

June 8, 2023

MONTANA HISTORICAL SOCIETY
State Historic Preservation Office

Sumner Anacker
Sanderson Stewart
106 East Babcock St, Suite L
Bozeman MT 59715

RE: MOUNTAIN VIEW SUBDIVISION, LIVINGSTON. SHPO Project #: 2023060806

Dear Sumner:

I have conducted a cultural resource file search for the above-cited project located in Section 22, T2S R9E. According to our records there have been no previously recorded sites within the designated search locale. However, there have been a few previously conducted cultural resource inventories done in the area. I've attached a list of these reports. If you would like any further information regarding these reports, you may contact me at the number listed below.

It is SHPO's position that any structure over fifty years of age is considered historic and is potentially eligible for listing on the National Register of Historic Places. If any structures are within the Area of Potential Effect, and are over fifty years old, we would recommend that they be recorded, and a determination of their eligibility be made prior to any disturbance taking place.

As long as there will be no disturbance or alteration to structures over fifty years of age, we feel that there is a low likelihood cultural properties will be impacted. We, therefore, feel that a recommendation for a cultural resource inventory is unwarranted at this time. However, should structures need to be altered or if cultural materials are inadvertently discovered during this project, we would ask that our office be contacted, and the site investigated.

If you have any further questions or comments, you may contact me at (406) 444-7767 or by e-mail at dmurdo@mt.gov. I have attached an invoice for the file search. Thank you for consulting with us.

Sincerely,

Damon Murdo
Cultural Records Manager
State Historic Preservation Office

File: LOCAL/SUBDIVISIONS/2023

Township:2 S Range:9 E Section: 22

**GREISER T. WEBER, ET AL.**

11/1/2000 RESULTS OF A CULTURAL RESOURCES INVENTORY FOR THE TOUCH AMERICA/AT & T FIBER OPTIC CABLE ROUTE BETWEEN BILLINGS AND LOOKOUT PASS IN MONTANA

CRABS Document Number: ZZ 6 23275 Agency Document Number:

Township:2 S Range:9 E Section: 22

**LAHREN LARRY A.**

1/16/2004 CULTURAL RESOURCE EVALUATIONS OF THE PROPOSED PRINTING FOR LESS FACILITY IN PARK COUNTY MONTANA

CRABS Document Number: PA 6 27162 Agency Document Number:

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX G

Private Service Providers Review

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Julie Sterr
Lumen
Julie.Sterr1@lumen.com

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Ms. Sterr:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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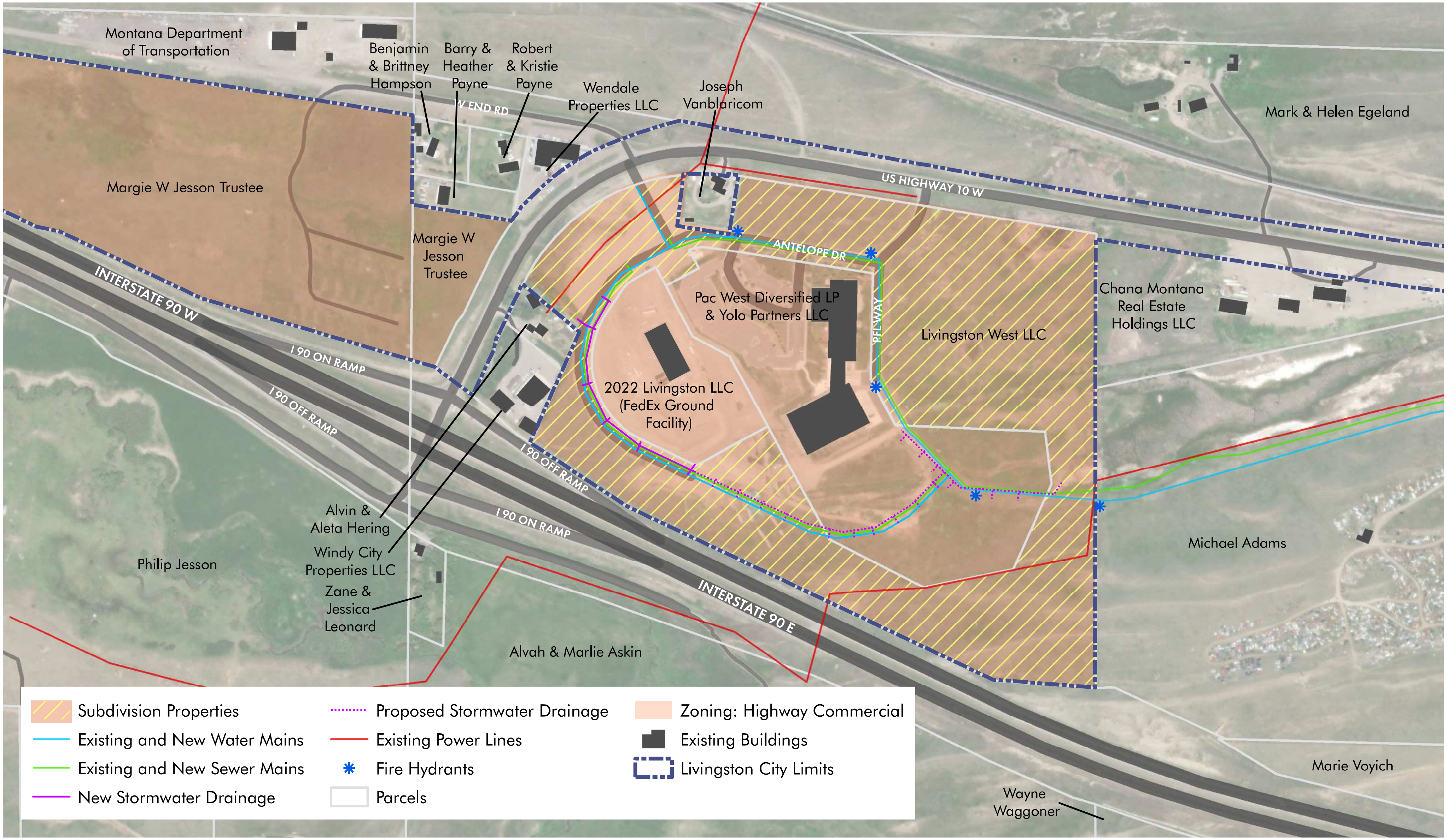
Sincerely,

Sumner Anacker

Sumner Anacker, PE
Project Engineer
Sanderson Stewart
106 East Babcock Street, Suite L1
Bozeman, MT 59715
sanacker@sandersonstewart.com
ph: 406-922-4314




June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Sheryl Raddas
Windrider
414 E Callender Street
Livingston, MT 59047
sraddas@parkcounty.org

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Ms. Raddas:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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Sincerely,

Sumner Anacker

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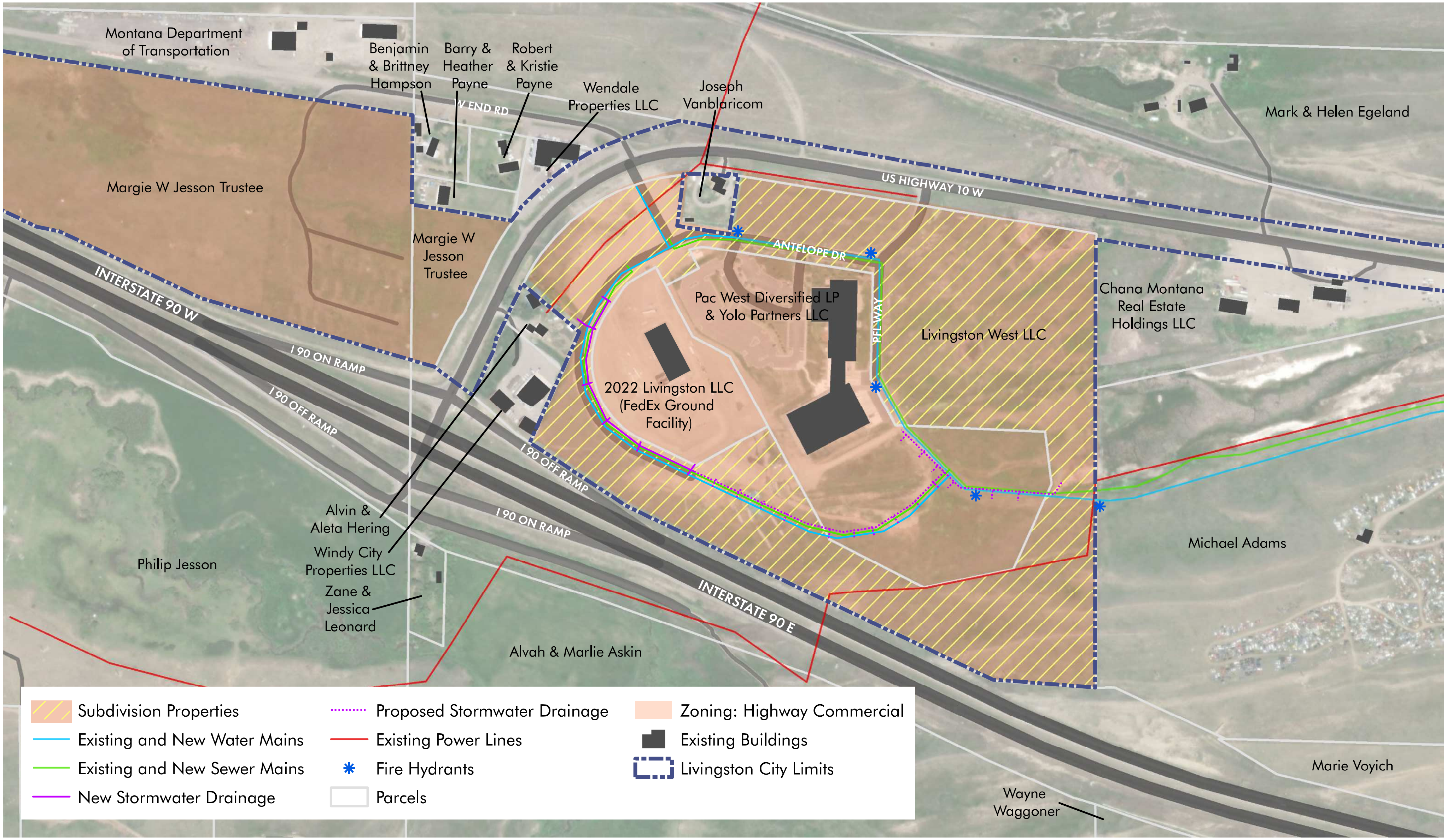
Project Engineer
Sanderson Stewart
106 East Babcock Street, Suite L1
Bozeman, MT 59715
sanacker@sandersonstewart.com
ph: 406-922-4314




June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Matt Fettig
Manager of District Operations – Livingston
Northwestern Energy
224 S B Street
Livingston, MT
matthew.fettig@northwestern.com

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Mr. Fettig:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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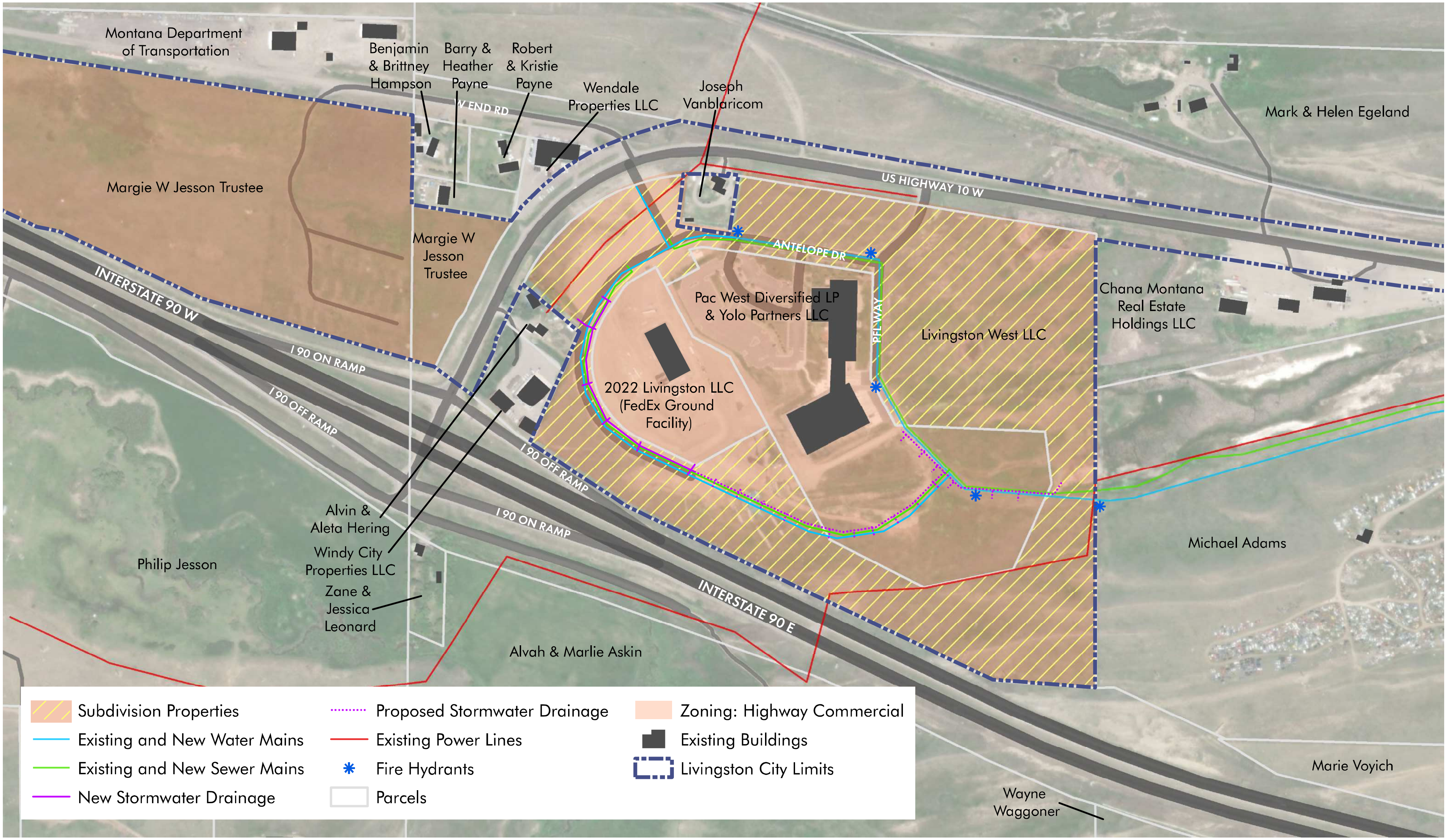


June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

NORTH

0 250 500 1,000 Feet

NorthWestern Energy
Delivering a Bright Future

sent via email June 7, 2023

*Chris Naumann*
*Sanderson Stewart – Senior Planner*
*106 E Babcock St. – Suite L1*
*Bozeman, MT 59718*

*Dear Chris,*

*Northwestern Energy is willing and able to provide electric and natural gas services to the proposed Mountain View Subdivision in Livingston, MT near the West Interchange and 100 PFL Way. The area in question consists of portions of T2S, R9E, S22.*

*These services will be provided in accordance with applicable Montana Public Services rules and regulations and the current Northwestern Energy tariff schedule. NWE has both underground and overhead electric, as well as gas distribution in and around the project area.*

*Northwestern Energy shall determine the locations of all transformers, underground lines and equipment for proper installation and maintenance. These facilities shall be located on front lot lines in the utility easement right-of-way unless otherwise approved by both parties.*

*As the project gets closer to approved plat and a finalized development plan, please reach out to NWE directly in order to start the utility planning, design and sizing process for your development. Please feel free to contact me if you have any questions or require any additional information.*

*Sincerely,*

*Matt Fettig*

*Matt Fettig*
*Livingston District Manager*
matthew.fettig@northwestern.com
224 S. B St.
Livingston, MT 59047
406-582-4606

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Matt Grose
Park Electric Cooperative
PO Box 1119
Livingston, MT 59047-1119
mgrose@parkelectric.coop

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Mr. Grose:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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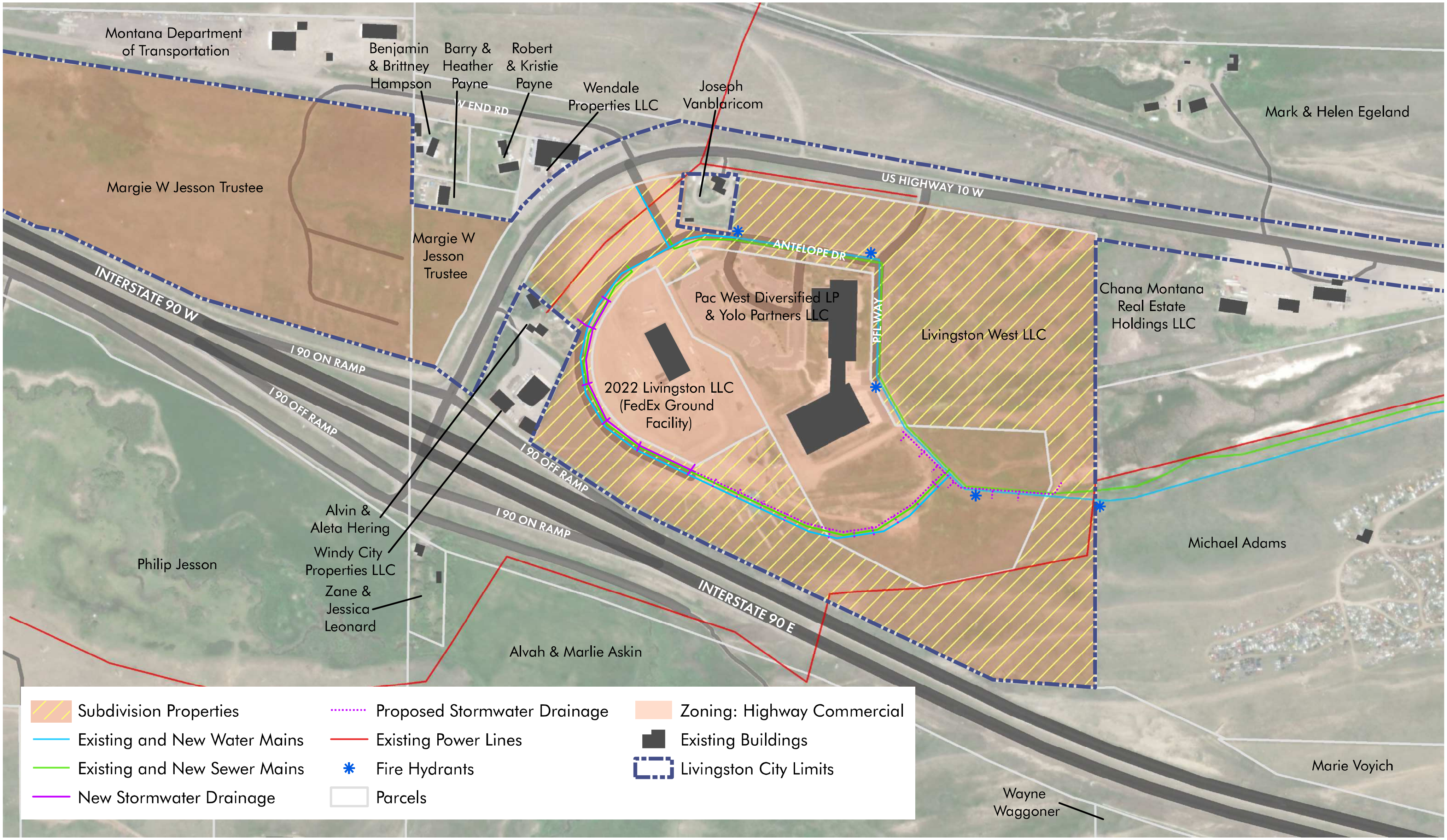
Sincerely,

Sumner Anacker

Sumner Anacker, PE
Project Engineer
Sanderson Stewart
106 East Babcock Street, Suite L1
Bozeman, MT 59715
sanacker@sandersonstewart.com
ph: 406-922-4314




June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

SANDERSON STEWART

Billings
Bozeman
Fort Collins

June 7, 2023

Daniel Payne
United States Postal Service
105 N 2nd Floor
Livingston, MT 59047-9998
daniel.f.payne@usps.gov

Delivered via Email

**Reference: Mountain View Subdivision, Livingston, Montana**

Dear Mr. Payne:

We are soliciting your comments regarding a proposed highway commercial subdivision with the City of Livingston. The project would create 22 highway commercial lots, two (2) dedicated parkland open space lots, and public right-of-way totaling 44.149 acres. These new lots would be served by the City of Livingston water and sanitary sewer systems.

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Project Engineer
Sanderson Stewart
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Bozeman, MT 59715
sanacker@sandersonstewart.com
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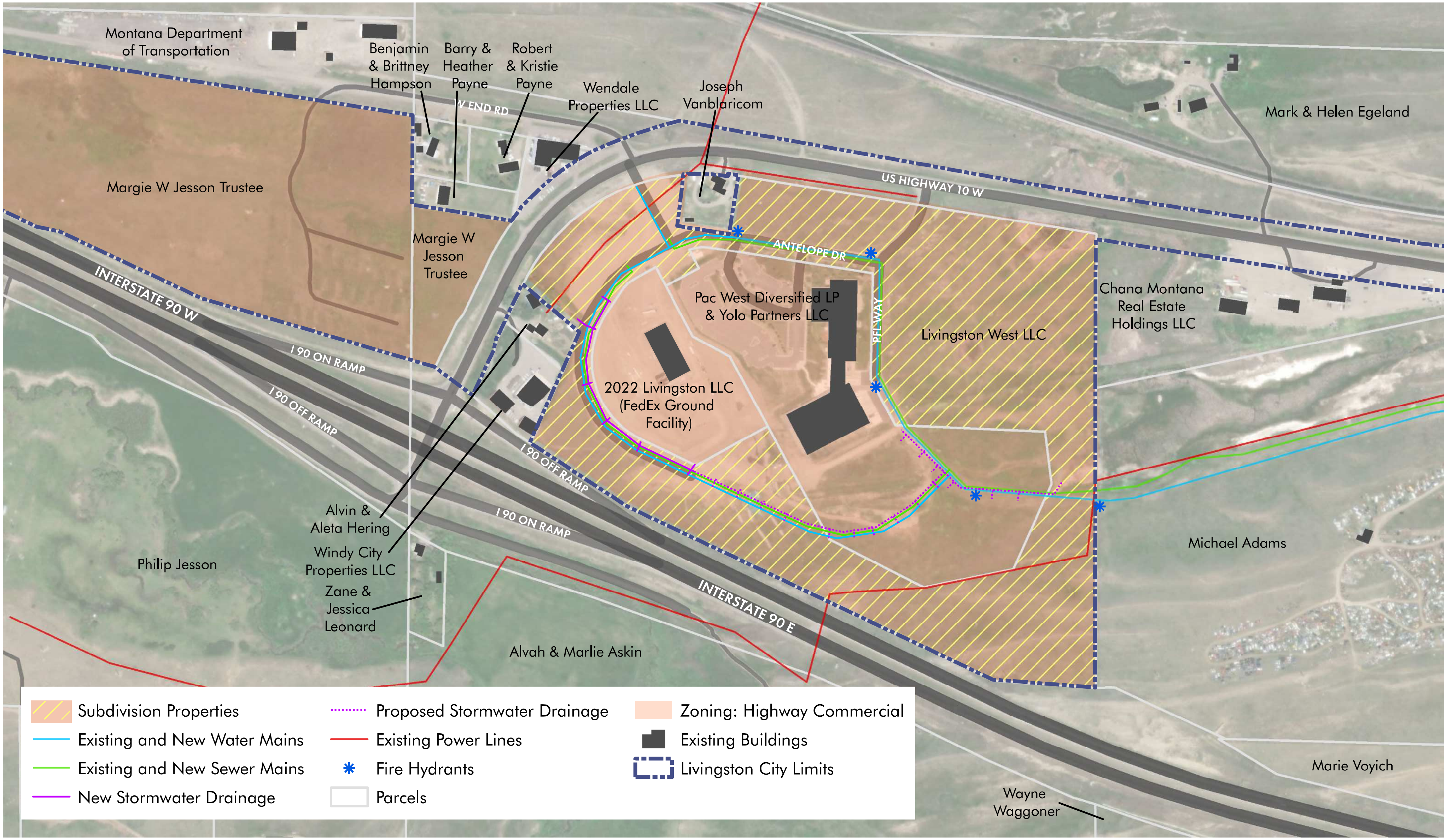


June 5, 2023

SANDERSONSTEWART

# Mountain View Subdivision: Vicinity Map

# MOUNTAIN VIEW MAJOR SUBDIVISION PRELIMINARY PLAT APPLICATION

Project No. 18005.05

## APPENDIX H
## Covenants, Conditions, and Restrictions Summary

ENDURING COMMUNITY DESIGN

SANDERSON STEWART

# Mountain View Subdivision

## SUMMARY OF COVENANTS

The purpose of these covenants is to facilitate the Mountain View Subdivision becoming an appealing entrance to the City, preserve and protect the interests and investment of the individual owners, and provide for an attractive appearance for buildings across the development without creating a "cookie-cutter" approach to design. The following is a summary list of the protective covenants for Mountain View Subdivision. This list is not intended to be all-inclusive or a replacement of the actual covenants.

## GENERAL

- The purpose of these covenants is to provide for individual and community decision making.
- Property Owners' Association (hereafter "The Association") Design Review Committee shall implement and enforce covenants and guidelines. The Developer shall be the Chair of the Design Review Committee until the majority of the lots are sold.
- 4-sided 3-dimensional architectural designs are required for review by the Design Review submittal.
- The Association will be responsible for maintenance of streets and common areas.
- Individual parcel owners may not build fences or structures on common easements.
- Individual property owners are responsible for the control of noxious weeds. The Association will be responsible for common areas.
- Approved landscaping installation required within one year of construction completion.
- Where there is a common border between a commercial use and a residential use, a landscape feature (such as a row of trees or landscaped berm) must be installed to provide a graceful transition between use types.
- Construction, improvements, landscaping, or alteration to exterior of any building or addition of any structure to a lot requires an Association Design Review Committee approval.
- No RV, boat, trailer, junk, or inoperable vehicle storage allowed on site unless stored inside a garage.
- No open burning allowed.
- All garbage shall be stored in animal-proof containers or be made unavailable to animals.
- Shielded downlight exterior lighting only in conformance with the City of Livingston's Night Sky Protection Act
- Property is located within view of agricultural activities, which may cause noise, dust, odors, etc.

## RESIDENTIAL

- Traditional stick-built homes shall be built to current IRC standards.
- No mobile, modular, or re-located homes allowed but ADU units can be considered in a back yard on a case-by-case basis.
- Onsite parking must be addressed in design review submittals.

- A maximum of two (2) dogs or two (2) cats may be kept on any lot. Commercial breeding, care or keeping of animals is not allowed.
- Fencing should be wildlife friendly.
- All garbage shall be stored in animal-proof containers or be made unavailable to animals.
- Architectural design must include multiple roof elements ideally incorporating both varying heights and intersecting ridgelines.
- A tri-color paint scheme of natural colors is encouraged.

## COMMERCIAL / OFFICE / INDUSTRIAL

- All buildings shall be built to current UBC standards.
- Onsite parking must be addressed in design review submittals. Spaces shall be paved and provide adequate driveway and space for movement of vehicles.
- The office portion of the building can be three stories, while the maximum height of any office/warehouse is 42'.
- Signage must be professionally done and approved by the City of Livingston.
- Ground lines, wires, antennas, or satellite dishes shall be placed out of sight as much as possible.

**Jennifer Severson**

**Subject:** FW: Mountain View Subdivision Resubmittal Comments

---

**From:** Shannon Holmes <sholmes@livingstonmontana.org>
**Sent:** Wednesday, July 19, 2023 12:08 PM
**To:** Jennifer Severson <jseverson@livingstonmontana.org>; Martha ORourke <morourke@livingstonmontana.org>
**Subject:** RE: Mountain View Subdivision Resubmittal Comments

Jennifer,
Here are my comments.

Please let me know if you have any questions.

1. Starlo Booster Station does have additional costs for pumping water and providing fire flows to this development.
2. The sewer main near Kenyon Noble is a high risk area with clay tile and capacity issues for future flows. A 15-inch main replacement is recommended in the Wastewater Collection PER.
3. All weather access road in Antelope Drive to PFL Way needs to be constructed in Phase 1.
4. Please provide dead end barricades at cul de sacs for each phase.
5. Erosion Control needs to be placed per the SWPPP
6. Improve PFL Way from end of pavement Fire hydrant past Antelope Drive.
7. No return letters from FWP, MDT, Windrider and Park electric and USPS
8. Covenants- City takes care of Streets. POA takes care of dedicated open space, retention ponds
9. Covenants should address sidewalk construction.

Thanks!

Shannon Holmes
Public Works Director
(406) 222--5667

**From:** Shannon Holmes <sholmes@livingstonmontana.org>
**Sent:** Wednesday, July 19, 2023 8:06:58 AM
**To:** Jennifer Severson <jseverson@livingstonmontana.org>; Martha ORourke <morourke@livingstonmontana.org>
**Subject:** RE: Mountain View Subdivision Resubmittal Comments

Good morning,

Yes, each lot needs water and sewer service stubs now as part of the subdivision.  I will provide any comments that I have later this morning.

Thanks!

Shannon Holmes
Public Works Director
(406) 222--5667

---

**From:** Jennifer Severson <jseverson@livingstonmontana.org>
**Sent:** Tuesday, July 18, 2023 3:39 PM
**To:** Martha ORourke <morourke@livingstonmontana.org>
**Cc:** Shannon Holmes <sholmes@livingstonmontana.org>
**Subject:** RE: Mountain View Subdivision Resubmittal Comments

Thanks Martha- re: #3 below- Can you make the decision now whether or not you would allow each developer to do their own water/ sewer services? It just sounds a bit ambiguous as it is…unless this is a standard Public Works comment/ condition language for subs?

Also, is the below all comments from public works on the subdivision? I.E. Shannon, are you planning to also submit comments or does Martha's response cover it?

Thank you!

**Jennifer Severson – Planning Director**
City of Livingston
(406) 222-4903

---

**From:** Martha ORourke <morourke@livingstonmontana.org>
**Sent:** Tuesday, July 18, 2023 3:31 PM
**To:** Jennifer Severson <jseverson@livingstonmontana.org>
**Cc:** Shannon Holmes <sholmes@livingstonmontana.org>
**Subject:** Mountain View Subdivision Resubmittal Comments

Good afternoon Jennifer,

This application looks good. I don't have too many comments except:

- We should consider asking for an easement to be shown across lot 12 for future water and sewer service connection to the Westondale Corp parcel;
- Public Works will need to review stormwater and street plan and profiles for phases 2 and 3 of this subdivision;
- All new lots will need water and sewer services, unless we will allow each lot developer to do their own due to unknown proposed future development and unknown water and sewer service size needs.

Thank you,

**Jennifer Severson**

**Subject:** FW: Mountain View Subdivision (June 2023 Application)

**From:** Josh Chabalowski <firechief@livingstonmontana.org>
**Sent:** Tuesday, July 18, 2023 3:56 PM
**To:** Jennifer Severson <jseverson@livingstonmontana.org>
**Subject:** RE: Mountain View Subdivision (June 2023 Application)

No comments at this time. Looks good to me since they have the new line extensions in place with lots of hydrants. Makes me happy.

Josh

**From:** Jennifer Severson
**Sent:** Wednesday, June 28, 2023 2:50 PM
**To:** Shannon Holmes <sholmes@livingstonmontana.org>; Jim Woodhull <jwoodhull@livingstonmontana.org>; 'firechief@livingstonmontana.org' <firechief@livingstonmontana.org>; Dale Johnson <djohnson@livingstonmontana.org>; Martha ORourke <morourke@livingstonmontana.org>
**Subject:** Mountain View Subdivision (June 2023 Application)

Hi folks,

I just shared a dropbox link with you that includes the latest Mountain View Subdivision application- file is too large to email. For easy reference, I'll also share the link here: https://www.dropbox.com/s/yc7ex33f0d0fql1/Mountain%20View%20Subdivision%20-%20Preliminary%20Plat%20Submittal%20-%20June%2021%202023.pdf?dl=0

The City has 15 working days to review the application materials for sufficiency- i.e. have they provided all the information you need to fully evaluate the proposed subdivision? I'll be responsible for notifying the applicant if we need additional information so that I can track all information submitted by the application for the planning review of the subdivision. If you need additional information from the applicant, please let me know **NO LATER THAN 2 pm on Wed. July 19** so I'll have time to compile requests for additional info and forward all requests for info to the applicant? I'm including a follow up notification in this email for July 18 at noon as a reminder.

Let me know if anyone has questions. This submittal is pretty close to what they submitted last time so I doubt the application will be missing much (if anything).

Thx,
Jen

**Jennifer Severson, AICP – Planning Director**
City of Livingston
220 E. Park St.
Livingston, MT 59047
(406) 222-4903
*jseverson@livingstonmontana.org*

**From:** Dale Johnson
**To:** Jennifer Severson
**Subject:** RE: Mountain View Subdivision (June 2023 Application)
**Date:** Wednesday, July 5, 2023 1:09:32 PM
**Attachments:** image002.png

From everything I looked at, I didn't see any issues from my department.

*Dale*

**From:** Jennifer Severson <jseverson@livingstonmontana.org>
**Sent:** Wednesday, June 28, 2023 2:50 PM
**To:** Shannon Holmes <sholmes@livingstonmontana.org>; Jim Woodhull <jwoodhull@livingstonmontana.org>; Josh Chabalowski <firechief@livingstonmontana.org>; Dale Johnson <djohnson@livingstonmontana.org>; Martha ORourke <morourke@livingstonmontana.org>
**Subject:** Mountain View Subdivision (June 2023 Application)

Hi folks,

I just shared a dropbox link with you that includes the latest Mountain View Subdivision application- file is too large to email. For easy reference, I'll also share the link here: https://www.dropbox.com/s/yc7ex33f0d0fql1/Mountain%20View%20Subdivision%20-%20Preliminary%20Plat%20Submittal%20-%20June%2021%202023.pdf?dl=0

The City has 15 working days to review the application materials for sufficiency- i.e. have they provided all the information you need to fully evaluate the proposed subdivision? I'll be responsible for notifying the applicant if we need additional information so that I can track all information submitted by the application for the planning review of the subdivision. If you need additional information from the applicant, please let me know **NO LATER THAN 2 pm on Wed. July 19** so I'll have time to compile requests for additional info and forward all requests for info to the applicant? I'm including a follow up notification in this email for July 18 at noon as a reminder.

Let me know if anyone has questions. This submittal is pretty close to what they submitted last time so I doubt the application will be missing much (if anything).

Thx,
Jen

**Jennifer Severson, AICP – Planning Director**
City of Livingston
220 E. Park St.
Livingston, MT 59047
(406) 222-4903

**From:** Jim Woodhull
**To:** Jennifer Severson
**Subject:** Mountain View Subdivision
**Date:** Tuesday, July 18, 2023 1:11:35 PM

The Building Department has not concerns or conditions to recommend.

sent via email June 7, 2023

*Chris Naumann*
*Sanderson Stewart – Senior Planner*
*106 E Babcock St. – Suite L1*
*Bozeman, MT 59718*

*Dear Chris,*

*Northwestern Energy is willing and able to provide electric and natural gas services to the proposed Mountain View Subdivision in Livingston, MT near the West Interchange and 100 PFL Way. The area in question consists of portions of T2S, R9E, S22.*

*These services will be provided in accordance with applicable Montana Public Services rules and regulations and the current Northwestern Energy tariff schedule. NWE has both underground and overhead electric, as well as gas distribution in and around the project area.*

*Northwestern Energy shall determine the locations of all transformers, underground lines and equipment for proper installation and maintenance. These facilities shall be located on front lot lines in the utility easement right-of-way unless otherwise approved by both parties.*

*As the project gets closer to approved plat and a finalized development plan, please reach out to NWE directly in order to start the utility planning, design and sizing process for your development. Please feel free to contact me if you have any questions or require any additional information.*

*Sincerely,*

*Matt Fettig*

*Matt Fettig*
*Livingston District Manager*
matthew.fettig@northwestern.com
224 S. B St.
Livingston, MT 59047
406-582-4606

**Sumner Anacker**

**From:** Murdo, Damon <dmurdo@mt.gov>
**Sent:** Thursday, June 8, 2023 2:59 PM
**To:** Sumner Anacker
**Subject:** RE: Mountain View Subdivision Preliminary Plat - Request for Comment (SHPO)
**Attachments:** Reports.pdf; 2023060806.pdf

June 8, 2023

MONTANA HISTORICAL SOCIETY
State Historic Preservation Office

Sumner Anacker
Sanderson Stewart
106 East Babcock St, Suite L
Bozeman MT 59715

RE: MOUNTAIN VIEW SUBDIVISION, LIVINGSTON. SHPO Project #: 2023060806

Dear Sumner:

I have conducted a cultural resource file search for the above-cited project located in Section 22, T2S R9E. According to our records there have been no previously recorded sites within the designated search locale. However, there have been a few previously conducted cultural resource inventories done in the area. I've attached a list of these reports. If you would like any further information regarding these reports, you may contact me at the number listed below.

It is SHPO's position that any structure over fifty years of age is considered historic and is potentially eligible for listing on the National Register of Historic Places. If any structures are within the Area of Potential Effect, and are over fifty years old, we would recommend that they be recorded, and a determination of their eligibility be made prior to any disturbance taking place.

As long as there will be no disturbance or alteration to structures over fifty years of age, we feel that there is a low likelihood cultural properties will be impacted. We, therefore, feel that a recommendation for a cultural resource inventory is unwarranted at this time. However, should structures need to be altered or if cultural materials are inadvertently discovered during this project, we would ask that our office be contacted, and the site investigated.

If you have any further questions or comments, you may contact me at (406) 444-7767 or by e-mail at dmurdo@mt.gov. I have attached an invoice for the file search. Thank you for consulting with us.

Sincerely,

Damon Murdo
Cultural Records Manager
State Historic Preservation Office

File: LOCAL/SUBDIVISIONS/2023

Township:2 S Range:9 E Section: 22

**GREISER T. WEBER, ET AL.**

11/1/2000 RESULTS OF A CULTURAL RESOURCES INVENTORY FOR THE TOUCH AMERICA/AT & T FIBER OPTIC CABLE ROUTE BETWEEN BILLINGS AND LOOKOUT PASS IN MONTANA

CRABS Document Number: ZZ 6 23275 Agency Document Number:

Township:2 S Range:9 E Section: 22

**LAHREN LARRY A.**

1/16/2004 CULTURAL RESOURCE EVALUATIONS OF THE PROPOSED PRINTING FOR LESS FACILITY IN PARK COUNTY MONTANA

CRABS Document Number: PA 6 27162 Agency Document Number: