MOUNTAIN VIEW MEADOWS

Preliminary Engineering Report

for

Craftsman Village of the Crossroads at Mountain View Meadows

August 2022

Prepared for:
Mountain View Meadows
431 South Alice Street
Helena, MT 59601

Prepared by:

Engineers and Land Surveyors
3530 Centennial Drive, Helena, MT 59601 | phone: 406-442-8594
851 Bridger Drive, Suite 1, Bozeman, MT 59715 | phone: 406-522-8594
2223 Montana Avenue, Suite 201, Billings, MT 59101 | phone: 406- 601-4055
www.seaeng.com

TABLE OF CONTENTS

1.0 INTRODUCTION

The proposed Craftsman Village Subdivision will create approximately 200 new lots for single family residential development consistent with the active, existing development at the site. The proposed project is generally located east of Alice Steet, north of Runkle Parkway, west of Highway 282 and the corporate limits of the City of East Helena. The parent tract of the lands being proposed for development is the remainder tract of the Craftsman Village Phase 7 of the Crossroads at Mountain View Meadows, which is in active platting.

The existing site is vacant and is currently utilized for aggregate crushing and processing. The lands are proposed to be annexed into the City of Helena and zoned R-U, being residential urban zoning. Lot sizes will range from approximately 3,300-6,600 square feet.

Water and sanitary sewer service will be provided by new connections to existing City of Helena infrastructure. Storm water generated by the site improvements will be collected and conveyed utilizing new systems and retained onsite via an existing storm water pond. Access to the new lots will be provided by the extension of existing streets and the addition of one new street.

Any new infrastructure required for the development will be reviewed by the City of Helena in compliance with City Code, the Engineering Standards, applicable Master Plans, DEQ Circulars and the Montana Public Works Standard Specifications.

2.0 SANITARY SEWER SYSTEM

2.1 WASTEWATER FLOWS

According to the City of Helena Engineering and Design Standards, the design wastewater flow is 112 gallons per day per capita with an average of 2.39 people per residence yielding approximately 270 gallons per day per single family residence living unit. For preliminary engineering reporting purposes, the sanitary sewer main extension may directly serve an ultimate condition of two hundred 30 (230) single family residences; thus the average daily wastewater flow is calculated as follows.

Average Daily Wastewater Flow

$$\frac{270\ gallons}{residence * day} * 230\ residences\ = \frac{62{,}100\ gallons}{day}$$

Infiltration according to the City of Helena Engineering Standards is 150 gallons per acre per day, conservatively using the total subdivision development size of approximately thirty-seven (37) acres, the infiltration is calculated as follows.

Daily Infiltration Flow

$$\frac{150\ gallons}{acre * day} * 37\ acres\ = \frac{5{,}550\ gallons}{day}$$

Using both the site generated wastewater flow and infiltration, the total daily wastewater flow is calculated as follows.

Total Daily Wastewater Flow

$$\frac{62{,}100\ gallons}{day} + \frac{5{,}550\ gallons}{day} = \frac{67{,}650\ gallons}{day}$$

Conservatively using a peak hour factor of 4, according to DEQ Circular 2, and using both the site wastewater generation and infiltration, the peak hour wastewater flow is calculated as follows.

Peak Hour Wastewater Flow

$$4 * \frac{67{,}650\ gallons}{day} = \frac{270{,}600\ gallons}{day} = \frac{190\ gallons}{minute}$$

2.3 WASTEWATER COLLECTION

Wastewater from each lot will be collected by new service connections to a network extension of 8” diameter gravity collection mains throughout the proposed development which connect to existing 24” and 30” diameter sections of sanitary sewer main located in Alpine View Drive. The existing sanitary sewer collection system in the immediate vicinity to the subject project is modern corresponding to recent development and is in very good condition, thus no problems are expected.

Existing down gradient mains are analyzed to use not more than 75% capacity while onsite mains are analyzed to not use more than 50% capacity when no additional connections are possible and no more than 25% capacity when future development is anticipated.

Using an industry standard Manning’s equation with an “n” value (coefficient of roughness) of 0.013 for a PVC pipe at a design minimum grade of 0.5%, the flowrate capacities in gallons per minute (gpm) are as follows;

Main Size	25% Capacity	50% Capacity	75% Capacity
8”	55 gpm	195 gpm	350 gpm
24”	1,080 gpm	3,940 gpm	7,135 gpm
30”	1,960 gpm	7,140 gpm	12,935 gpm

The wastewater flow produced by the proposed project will be accommodated by the new 8” on-site gravity mains, designed in excess of minimum grades, and easily accommodated by the existing 24” and 30” sections of main with minimal impact on existing downgradient mains within the Mountain View Meadows subdivision project.

2.4 WASTEWATER CONVEYANCE

Wastewater is conveyed from Mountain View Meadows through existing 30” and 24” diameter gravity sanitary sewer mains to the Airport Lift Station.

The existing downgradient, gravity sanitary sewer mains serving Mountain View Meadows were recently upgraded with projects under Montana Department of Environmental Quality Projects EQ#13-1102 and EQ#18-2015. These projects upsized the downgradient sewer main to a 24” diameter in accordance with the 2008 City of Helena Wastewater Collection Master Plan and found the main to be at approximately 68% capacity with the full build-out of the upgradient areas including Mountain View Meadows.

Downgradient, gravity sanitary sewer main capacities in the project vicinity were observed and found the peak depth of flow in the existing 30” diameter main to be approximately 2” in depth and the peak flow in the existing 24” diameter main to be approximately 3” in depth. Field observations yield remaining capacity within the existing downgradient sanitary sewer mains.

Additionally, the airport lift station was upgraded by Mountain View Meadows with a project under EQ#10-2008 and recent observation and analysis as requested by the City of Helena for recent projects at Mountain View Meadows, identified ample capacity in the lift station and force main.

The existing airport lift station is configured with standard duplex pumps with the design pumping rates of 1,000 gpm each and were observed to be operating at 360 gpm and 450 gpm. The 8” diameter force main maximum flowrate is approximately 1,000 gpm, based on a maximum velocity, according to DEQ of 8 feet per second. The maximum inflow rate into the 10 foot diameter wet well based on the shortest pump cycle time was approximately 100 gpm.

2.3 WASTEWATER TREATMENT

The City of Helena wastewater treatment plant is currently operating at about half capacity and can easily handle the increased flows from this proposed project.

3.0 WATER SYSTEM

3.1 WATER DEMAND

Domestic water usage is based on 1.6 times the wastewater flow according to the City of Helena Water Facilities Plan. According to the City of Helena Engineering and Design Standards, the design wastewater flow is 112 gallons per day per capita with an average of 2.39 people per residence yielding approximately 270 gallons per day per single family residence living unit. For preliminary engineering reporting purposes, this water main extension is to directly serve approximately two hundred thirty (230) single family residences, thus the average daily domestic water use is calculated as follows.

Average Daily Domestic Water Use

$$1.6 * \frac{270\ gallons}{day * residence} * 230\ redisences\ = \frac{99{,}360\ gallons}{day} = \frac{69\ gallons}{minute}$$

Irrigation water usage is based on 1" of irrigation per week which equates to 0.01 feet per day. Based on an average lot size of 5,100 square feet, the proposed City zoning of R-U, which allows for a maximum lot coverage of 60%, and service to 230 lots, a resulting estimation is as follows.

Average Daily Irrigation Water Use

$$\frac{0.01\ ft}{day} * \frac{5{,}100\ ft^2}{lot} * (1 - 0.6) * \frac{7.48\ gallons}{ft^3} * 230\ lots$$

$$= \frac{35{,}100\ gallons}{day} = \frac{25\ gallons}{minute}$$

Using both the domestic and irrigation water usage, the total daily water usage is calculated as follows.

Total Average Daily Water Use

$$\frac{69\ gallons}{minute} + \frac{25\ gallons}{minute} = \frac{94 gallons}{minute}$$

According to the City of Helena Water Facilities Plan the Maximum Day Factor is 2.4 and the Peak Hour Factor is 3.5 and are calculated as follows;

Maximum Day Demand

$$2.4 * \frac{94\ gallons}{minute} = \frac{226\ gallons}{minute}$$

Peak Hour Demand

$$3.5 * \frac{94\ gallons}{minute} = \frac{329\ gallons}{minute}$$

3.2 WATER SUPPLY

The proposed project will be served by the City of Helena Municipal Public Water System. The City of Helena water system is primarily supplied by the Ten Mile Creek water source and supplemented as needed by the Missouri River water source. Reviewing water use data on the City of Helena website, these two sources currently provide 11.9 MGD as of June 2022. The peak day demand in June 2021 was 16.6 MGD and in June 2022 was 11.9 MGD. The current average demand is approximately 6 MGD over the entire year, with an increased average demand of 12 MGD during summer days.

3.3 WATER STORAGE

The proposed Craftsman Village Phase Subdivision is located within the Malben High pressure zone. According to a Water Storage Analysis Technical Memorandum #5, prepared by AE2S, dated December 2020, the Malben High and Low pressure zones are served by the Nob Hill, Malben and Woolston No. 2 Tanks, which have a combined storage capacity of 11 MG. Utilizing a maximum day demand plus commercial fire flow, the required storage for the Malben High and Low pressure zones was determined to be 9 MG. Utilizing the average day demand and commercial fire flow demand, the required storage was determined to be 5.4 MG.

3.4 WATER DISTRIBUTION

Water service will be provided by extending the existing 8” diameter water mains constructed in previous phases at Mountain View Meadows. The water mains will be extended in a typical grid pattern conforming to the streets and provided looped connections

3.5 FIRE FLOW REQUIREMENTS

The following fire hydrant flow test results were provided by the City of Helena for the nearest existing fire hydrants. For reference, the City of Helena Fire Flow Information Request and Results included in the Appendix.

Hydrant #1774
Static Pressure = 120 psi
Residual Pressure = 115 psi
Residual Flow = 1,500 gpm
Fire Flow = 7,566 gpm
Test Date = June 14, 2022
Location: Alexis Avenue & Swift Current Street

Hydrant #1920
Static Pressure = 120 psi
Residual Pressure = 110 psi
Residual Flow = 1,500 gpm
Fire Flow = 5,204 gpm
Test Date = June 14, 2022
Location: 2896 Stacia Avenue

Hydrant #1929
Static Pressure = 120 psi
Residual Pressure = 115 psi
Residual Flow = 1,500 gpm
Fire Flow = 7,566 gpm
Test Date = June 14, 2022
Location: Jeannette Rankin Drive

Hydrant #1930
Static Pressure = 120 psi
Residual Pressure = 115 psi
Residual Flow = 1,500 gpm
Fire Flow = 7,566 gpm
Test Date = June 14, 2022
Location: Alexis Avenue & Swift Current Street

Hydrant #2074
Static Pressure = 125 psi
Residual Pressure = 118 psi
Residual Flow = 1,529 gpm
Fire Flow = 6,598 gpm
Test Date = June 14, 2022
Location: Alpine View Drive

Hydrant #2079
Static Pressure = 125 psi
Residual Pressure = 118 psi
Residual Flow = 1,678 gpm
Fire Flow = 7,242 gpm
Test Date = June 14, 2022
Location: Adam Run Avenue & Teagan Street

Hydrant #2083
Static Pressure = 123 psi
Residual Pressure = 118 psi
Residual Flow = 1,482 gpm
Fire Flow = 7,591 gpm
Test Date = June 14, 2022
Location: Teagan Street & Travis Avenue

Hydrant #2075
Static Pressure = 125 psi
Residual Pressure = 115 psi
Residual Flow = 1,635 gpm
Fire Flow = 5,822 gpm
Test Date = June 14, 2022
Location: Alpine View Drive & Jean Baucus Street

Hydrant #2076
Static Pressure = 125 psi
Residual Pressure = 120 psi
Residual Flow = 1,547 gpm
Fire Flow = 8,007 gpm
Test Date = June 14, 2022
Location: Jean Baucus Street & Jeannette Rankin Drive

Hydrant #2077
Static Pressure = 125 psi
Residual Pressure = 120 psi
Residual Flow = 1,592 gpm
Fire Flow = 8,239 gpm
Test Date = June 14, 2022
Location: Jean Baucus Street & Travis Avenue

Hydrant #2078
Static Pressure = 125 psi
Residual Pressure = 115 psi
Residual Flow = 1,592 gpm
Fire Flow = 5,667 gpm
Test Date = June 14, 2022
Location: Adam Run Avenue

Hydrant #2082
Static Pressure = 125 psi
Residual Pressure = 115 psi
Residual Flow = 1,500 gpm
Fire Flow = 5,342 gpm
Test Date = June 14, 2022
Location: Travis Avenue

Hydrant #2084
Static Pressure = 125 psi
Residual Pressure = 115 psi
Residual Flow = 1,635 gpm
Fire Flow = 5,822 gpm
Test Date = June 14, 2022
Location: Alpine View Drive

Review of the City of Helena provided fire flow information indicates ample static operating pressures and available fire flows Fire flows shown are more than 5,000 gpm which greatly exceeds the minimum required flow of 1,750 gpm, at a minimum residual pressure of 20 psi, for residential development.

Additionally, a hydraulic analysis is included in the Appendix, showing ample fire flows will be provided with the water main extension.

Upon completion of the new mains, the new fire hydrants will be flow tested by the City of Helena to determine the actual fire flow capacity. Full compliance with the applicable Fire Code will be conducted by the City of Helena Fire Marshall during the building permit process based on the building size, type and fire protection provisions, and resources available to the City of Helena Fire Department.

4.0 STORM DRAINAGE

4.1 SITE INFORMATION

The project site is vacant with native grass cover and is currently utilized for aggregate crushing and processing; it generally slopes to the northeast at approximately 3%. Past geotechnical soil sampling and analysis has described the soils as clayey sand, the static water level is well below the ground surface. According to the FEMA Flood Insurance Rate Map No. 30049C2350E, with an effective date of September 19, 2012, the site is located in Zone D, which are areas in which flood hazards are undetermined but possible. It is surrounded by other developed property to the south and west and undeveloped native grassland to the east and north.

4.2 PROJECT SUMMARY

Storm drainage for the proposed project has been analyzed in accordance with the City of Helena requirements. Storm runoff from developed areas is collected in curb and gutters and directed to a combination of curb inlets and storm sewers. These conveyance structures transport storm runoff to an existing runoff control basin, Detention Pond 2-2, located at the down gradient, northern edge of the subdivision. The basin will settle, store, and attenuate the release of storm water to existing drainage ways leaving the site. In accordance with City Standards, the entire runoff volume from the water quality event will be retained on-site for infiltration or evapotranspiration. No other specific water quality treatment measures are proposed since the runoff from this residential subdivision is not anticipated to contain any containments or harmful substances.

4.3 RUNOFF CALCULATIONS

4.3.1 Design Storms

Storm runoff was determined using the SCS Curve Number Method and calculations were performed with the Hydraflow Hydrographs software. The design storms are a 24 hour duration following the standard SCS Type II rainfall distribution. The design storm precipitation values from the City of Helena Engineering Standards is shown below in **Table 1**:

Table 1: Design Storm Precipitation

Design Storm	Precipitation (inches)
Water Quality	0.5
2-year, 24-hour	1.3
5-year, 24-hour	1.7
10-year, 24-hour	1.9
25-year, 24-hour	2.4
50-year, 24-hour	2.7
100-year, 24-hour	2.9

Storm runoff was resolved to 6-minute intervals. The intervals meet the constraint of time interval < 0.5-unit hydrograph time of peak.

4.3.2 Drainage Basin

The project site is vacant with native grass cover and is currently utilized for aggregate crushing and processing; it generally slopes to the northeast at approximately 3%. Proposed streets and driveways will be sloped accordingly, and the final drainage patterns mimic existing drainage patterns. Surface run-on from upgradient sources is considered minimal due to topography and existing storm drainage infrastructure.

The 37-acre property has been delineated into five (5) sub-basin areas for runoff analysis purposes and can be viewed in the attached drainage figure. Area, flow length, and average slope were computed for the basin. Time of concentration (T_c) was determined by the Lag Method (TR-20 default) where T_c increases with flow length and decreases with increasing curve number (CN) and basin slope.

Curve numbers were selected for pre-development and post-development conditions. The NRCS soil type is Musselshell-Crago complex and Crago-Musselshell gravelly loams and has the characteristics of Hydrologic Soil Group B which are soils having moderate infiltration rates when thoroughly wet. A pre-development curve number of 58 was utilized for a meadow with continuous grass, generally mowed for hay. A post-development curve number of 85 was utilized for Residential districts by average,1/8 acre lot size. Drainage basin data is summarized in the following **Table 2.**

Table 2: Drainage Basin Data

Basin ID	Drainage Basin Area	Basin High Point Elev.	Basin Low Point Elev.	Basin Flow Length	Average Basin Slope	Pre-Development CN	Post Development CN
	(acre)	(feet)	(feet)	(feet)	(%)		
SB-1	12.12	4022	3996	765	3.4	58	85
SB-2	11.98	4036	3995	1610	2.52	58	85
SB-3	7.49	4006	3993	615	2.1	58	85
SB-4	3.61	4001	3992	1524	0.6	58	85
SB-5	2.01	4007	3992	1275	1.2	58	85

4.3.3 Design Storm Runoff

Runoff hydrographs were generated for the design storms and are provided with this report. The pre-development and post development peak runoff rates and volumes for the 25 year and 100 year events are summarized as follows in **Tables 3 and 4**.

Table 3: Pre-Development Runoff

	2-Year Event		10-Year Event		25-Year Event		100-Year Event	
Basin ID	Peak Flow	Volume	Peak Flow	Volume	Peak Flow	Volume	Peak Flow	Volume
	(cfs)	(ft^3)	(cfs)	(ft^3)	(cfs)	(ft^3)	(cfs)	(ft^3)
SB-1	0	0	0.033	1,167	0.25	4,819	0.992	10,433
SB-2	0	0	0.033	1,153	0.21	4,763	0.694	10,313
SB-3	0	0	0.02	721	0.155	2,978	0.613	6,448
SB-4	0	0	0.01	344	0.054	1,419	0.154	3,072
SB-5	0	0	0.006	197	0.034	813	0.109	1,761

Table 4: Post Development Runoff

	2-Year Event		10-Year Event		25-Year Event		100-Year Event	
Basin ID	Peak Flow	Volume	Peak Flow	Volume	Peak Flow	Volume	Peak Flow	Volume
	(cfs)	(ft^3)	(cfs)	(ft^3)	(cfs)	(ft^3)	(cfs)	(ft^3)
SB-1	3.967	13,642	9.256	29,808	14.5	45,344	20.09	62,059
SB-2	3.138	14,384	7.463	31,428	11.55	47,808	15.97	65,431
SB-3	2.451	8,431	2.72	18,421	8.964	28,022	12.42	38,351
SB-4	0.653	4,226	1.584	9,234	2.467	14,046	3.407	19,224
SB-5	0.433	2,489	1.047	5,438	1.629	8,272	2.247	11,321

4.4 STORM WATER COLLECTION AND CONVEYANCE

Street curb and gutters will be designed to intercept stormwater runoff from the development, which primarily consists of streets, lawns and homes. The curb and gutters will be designed to convey the runoff to curb inlets and storm drains to an existing detention pond. Considerations to curb inlets placement include contributing drainage area, topography, hydraulic analysis of curb capacity, street spread width and to minimize impacts from nuisance water. Typical storm drainage structures have been designed to convey the stormwater generated by the 25-year design storm event.

4.5 RUNOFF CONTROL

Runoff control will be provided by a previously designed and constructed detention pond at Mountain View Meadows, Detention Pond 2-2 (along the northern edge of subdivision). The pond was designed and constructed for future development conditions (complete build-out), as part of the overall storm water management for the Crossroads at Mountain View Meadows project. The approved storm water engineering design report for Crossroads (2006) is on file with the City of Helena.

All of storm water from the Craftsman Village will be routed into existing Detention Pond 2-2. This subdivision will contribute a total of 164,359 ft3 (3.77 acre-ft) to Detention Pond 2-2 in addition to the 70,728 ft3 (1.64 acre-ft) contributed by previous Craftsman Village Phases. Detention Pond 2-2 has a total volume of 529,668 ft3 (12.16 acre-ft), providing a substantial amount of additional capacity to contain runoff from this phase and future phases.

Since runoff control facilities exist for this development, no further analysis has been conducted. The existing Detention Pond 2-2 is designed to settle, store and attenuate the release of storm water to the existing drainage ways leaving the site.

5.0 TRANSPORTATION

5.1 EXISTING AND PROPOSED STREETS

Access to the proposed project will be provided by extending and connecting the northern and southern ends of Alpine View Drive (collector) through the proposed project. Further access to the project will also be provided by the extension of Jeannette Rankin Drive (collector) and local level streets: Adam Run Avenue, Travis Avenue, Alexis Avenue, and Stacia Avenue. Internally, one new street, Berwin Street, will be constructed running north-south through the proposed project and connect Jeannette Rankin Drive and Alpine View Avenue.

Extension of Alpine View Drive offers direct connection to Alice Street and Runkle Parkway. Alice Street provides further connection to Crossroads Parkway and U.S. Highway 12. Runkle Parkway offers direct access to Highway 282.

Non-motorized transportation will be provided with boulevard sidewalks on both sides of all streets. Alpine View Drive is proposed to include a bike/pedestrian path on one side, consistent with the existing development and City development standards.

The existing transportation network in the immediate vicinity to the subject project is modern, corresponding to recent residential development and is in very good condition, thus no problems are expected, and no needed remediation or corrections are proposed.

According to the Greater Helena Area Long Range Transportation Plan 2014 Update, Adams Run Avenue and Travis Avenue are classified as local streets. Jeanette Rankin and Alpine View are constructed as a collectors, however, due to lack of existing development and connectivity, traffic volumes are very low and both streets will be functioning below collector status. All other streets, within the Craftsman Village Phases will be designed to a local street level classification.

U.S. Highway 12, north of Mountain View Meadows and in the immediate area of this proposed project is classified as a Principal Arterial. Highway 282, east of Mountain View Meadows and in the immediate area of this proposed project is classified as a Minor Collector.

5.2 TRAFFIC IMPACT

According to the Traffic Impact Study (TIS) conducted by Abelin Traffic Services for the project, anticipated future traffic volumes from the proposed were analyzed using the trip generation rates as established by the Institute of Transportation Engineers (ITE). A vehicle “trip” is defined as any trip that either begins or ends at the proposed development site. According to the trip generation rates, upon final completion, the project would produce the additional trips as tabulated below.

Trip Generation

Land Use	Total AM Peak Hour Trip Ends	Total PM Peak Hour Trip Ends	Total Weekday Trip Ends
Single-Family Residential ITE #210	161	216	2,169

The TIS applies the generated traffic from the proposed project to the existing street network with a trip assignment and determines the efficiency of major intersections, known as Level of Service (LOS). For this analysis, the LOS calculations also considered the trip generations from the nearby condominium development currently under construction. The projected level of service summary is summarized below.

Projected Level of Service Summary

	AM Peak Hour		PM Peak Hour	
Intersection	Existing LOS	Proposed LOS	Existing LOS	Proposed LOS
Highway 282 & Runkle Parkway*	B	B	A	A
Runkle Parkway & Alpine View*	A	A	A	A
Alice Street & Jeannette Rankin*	A	A	A	A

*Northbound/Southbound LOS and Delay or
Eastbound/Westbound Side Street LOS and Delay.

Based on the projected level of service, the proposed project will not affect the roadway operations in the area. All nearby intersections will continue to function at acceptable levels of service and no mitigation measures are needed.

6.0 PHASING

6.1 PROPOSED PHASING

The proposed project is planned for three (3) development phases. The anticipated subdivision development schedule of implementation will be one phase per year, with potentially combining phases depending on market demand for lot sales and avoidance of excess inventory. Subdivision development construction phasing will be sequenced based on infrastructure needs and cost efficiencies.

The City of Helena will be notified upon the commencement of each or any subdivision development phase. Provisions will be implemented for each phase in accordance with City of Helena development requirements such as secondary or emergency access and infrastructure requirements. Each phase will include provisions to operate solely and not be dependent on a future phase. Additionally, each phase will include the required water, wastewater, storm water and transportation infrastructure, that can function independently for each phase and will provide for future connectivity.

The required parkland dedication is proposed to be dedicated for the entire subdivision with the initial phase. The proposed park land to be dedicated in the first phase include Lot 1 in Block 9 of the Aspen Park Subdivision. Access to Lot 1 in Block 9 of the Aspen Park Subdivision is provided by the recently constructed southern portion of Alpine View Drive and is near the Craftsman Village.

The proposed Phasing Plan reflects infrastructure proposed for each phase and is included in this application.