RIVERFRONT TRAILS

For Review
07/27/2022 4:32:46 PM

A new major subdivision in Missoula, Montana

Water Supply Design Report

Revision	*Date*
Fourth Element Review	March 1, 2022
Second Sufficiency Review	July 21, 2022

Prepared for:

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1.1.1. GENERAL INFORMATION

This design report provides the criteria used as a basis of design for the water main extension intended to serve the proposed Riverfront Trails subdivision in Missoula, Montana. This report is submitted in conjunction with the Montana Department of Environmental Quality (MDEQ) certified checklist, water main specifications, and construction plans. This report is organized following the outline recommended in MDEQ-1, Chapter 1, Section 1.1.

A. EXISTING FACILITIES

The proposed subdivision is to consist of 174 lots containing residential homes, townhomes, and courtyard townhomes, a 5.47-acre lot intended for a religious assembly development, and a 5.13-acre lot intended for a senior living facility. The 92.73-acre parcel to be subdivided can be more particularly described as Portion A and Tract 1 of Certificate of Survey 6449 located in Section 2, Township 12 North, Range 20 West, P.M.M., Missoula County, Montana. The subject parcel is divided by Old Bitterroot Road, an existing dirt roadway, and lies adjacent to the Bitterroot River and Lower Miller Creek Road in Missoula. Adjacent Developments include the Jeanette Rankin Elementary School owned by Missoula County Public Schools, the Linda Vista Subdivision, and Blue Vista Acreage Tracts. This report is organized following the outline recommended in DEQ-1, Chapter 1, Section 1.1.

Existing sanitary sewer infrastructure in the vicinity includes a 15” main that runs along the western margin of the property, south of the Bitterroot Road right-of-way, and subsequently within the right-of-way itself eastward to the intersection of Lower Miller Creek Road. Please refer to the attached as built drawings for more detailed information pertaining to this existing main in the project area (Record Drawing LMC Sewer Main Extension P-08-028). The existing system is owned and operated by the City of Missoula and was constructed in 2010.

Existing water distribution infrastructure is also adjacent to the subject parcel to the south in the City of Missoula service area. Water distribution mains serving the proposed development shall connect to both an existing 12” main, located in the Gustuson Road right-of-way approximately 260 feet from the proposed subdivision boundary, and an 8” main in the Bigfork Road right-of-way approximately 200 feet from the proposed subdivision boundary. The existing system is owned and operated by the City of Missoula. Please refer to the attached as built drawings for more detailed information pertaining to the existing mains in the project area (Record Drawing 302-C Maloney Ranch Water Main & Bigfork Water Main Extension Cold Springs Elementary Drawings).

The proposed water supply and distribution infrastructure includes the permitting, drilling, and construction of a new public water supply well and pump station, a main extension to connect the new well to the City's existing distribution system, and main extensions to provide finished water to Lots within the Riverfront Trails subdivision. The provisions for the new public water supply well are detailed in Section 1.1.7 of this report.

B. AREA SERVED

The proposed public water supply well and water main extensions will serve the City of Missoula, as an extension of the City's existing water distribution system. More particularly, the proposed extensions will serve the Riverfront Trails subdivision proposed in the City of Missoula.

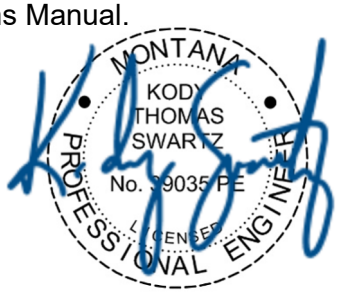
C. CONTACT INFORMATION

Owner Contact Information: **City of Missoula**
435 Ryman Street
Missoula, MT 59802

Developer Contact Information: **Tollefson Properties, LLC.**
15311 Tyson Way
Frenchtown, MT 59834

D. SEAL AND SIGNATURE

I hereby state that this Water Distribution Design 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 within the standard accepted practices, and in accordance with the Missoula City Public Works Standards and Specifications Manual.



Approved By *Date*

1.1.2. EXTENT OF THE WATER WORKS SYSTEM

A. NATURE AND EXTENT OF AREA SERVED

The proposed subdivision development will include a mixture of uses including residential, religious assembly, and commercial. Development will occur on 176 separate lots including one 5.47-acre lot intended for a religious assembly development and one 5.13-acre lot proposed for a senior living facility.

The proposed development will include the improvement of the 80’ Old Bitterroot Road right-of-way, classified as an Urban Collector, with parking lanes, bike lanes, and sidewalks. A 90-foot right-of-way will be provided for Lower Miller Creek Road along the eastern boundary of the property. For the portion of Lower Miller Creek Road that splits the subject property, an 80-foot right-of-way will be provided. The City of Missoula is responsible for the design of upgrades to Lower Miller Creek Road in the project vicinity, including mill and overlay, 10’ wide travel lanes, parking lanes where applicable, a concrete sidewalk along the properties fronting the roadway to the east, and a roundabout at the intersection of Lower Miller Creek Road and Old Bitterroot Road. A provision has been made for the southern internal local street to be extended into the parcel to the west, should that parcel ever be developed. Additionally, a street connection to Jeannette Rankin elementary has been provided, in coordination with the school district and the City of Missoula. All roadways within the proposed subdivision will be located within dedicated public rights-of-way. Several utility easements will be provided and maintained including the 20’ sanitary sewer easement per book 810 micro, pages 1255, 1272-1273 and book 857 micro, page 1224. A 40'-wide public access and utility easement will be provided along the boundary of Lot 1 and the school parcel for construction and maintenance of a water transmission main to serve the proposed subdivision per certificate of survey 6568. The development will include four 20’ wide alleys, two 54’ wide rights-of-way classified as neighborhood streets (Meyers Way and Anders Way), four 64’ wide rights-of-way classified as urban local streets (Riverfront Place, Naomi Lane, Tolley Lane, and Drago Lane), and one 56’ wide right of way classified as a neighborhood yield street (Cassidy Court). All proposed water main extensions will be located within the proposed rights-of-way or dedicated 20’ wide public utility easements. Please refer to the Preliminary Plat and included drawings for more detailed information regarding the proposed road layout and utility configuration for the proposed development.

At full build-out, the development could be expected to serve a total of 1,237 daily users, assuming 174 single-family lots with 3 residents per lot, a 110-unit assisted living facility with 1.25 residents per unit and 30 employees, and a religious assembly building with 172 average daily users. The

proposed complete water main extensions will include approximately 1,990 lineal feet of 12" ductile iron pipe, 10,385 lineal feet of 8" ductile iron pipe and 10 fire hydrant assemblies. The 12" main shall tie into the existing 12" main located in Gustuson Road approximately 260 feet south of the subdivision boundary and continue north through the Lower Miller Creek Road and enter the property through the Drago Lane right-of-way. From there it will travel north to the intersection of Old Bitterroot Road. This is to ensure that the proposed commercial water and fire services tie into a 12" main as required by the City of Missoula. The remaining water main extensions will be 8" mains and tie into the existing 8" main located in the Bigfork Road right-of-way located approximately 200' south of the proposed subdivision boundary.

B. PROVISIONS FOR FUTURE EXTENSIONS

The proposed water main extensions shall be fitted with a blow-off valve on the west side of the proposed 8" cross located at the western terminus of Old Bitterroot Road to facilitate future extension to the west. Another blow-off valve will be located on the east side of the proposed 8" cross located on the looped main in Old Bitterroot Road to facilitate future extension to the east and to Lower Miller Creek Road. A blow-off valve will be located on the west side of the proposed 8" tee near the intersection of the school access drive and Drago Lane to allow additional future extension to the west. Finally, a blow-off valve will be located on the 12" main extension at the intersection of Lower Miller Creek Road and Drago Lane where the 12" main turns west onto the subdivision property on the north side of the 12" tee to provide ability for future main extensions to the north through Lower Miller Creek Road.

C. APPRAISAL OF FUTURE SERVICE REQUIREMENTS

The future service requirements for the proposed water main extension will be limited to the total proposed number of living units and daily users on the subdivision property; a total of approximately 284 living units and 172 average daily users of the religious assembly development. Further assessment of the future requirements for service of the main extensions upon completion will be needed in order to analyze the additional allowable living units and capacities that can be served by future water main extensions to the east and west of the development based on the growth policy and densities permitted by zoning on adjacent future developments.

The City of Missoula has identified mitigation required to allow capacity to serve the proposed subdivision. This mitigation is discussed in detail in Section 1.1.7 of this report.

1.1.3. ALTERNATE PLANS

The proposed water main extensions connect to existing City of Missoula transmission mains directly adjacent to the proposed development. No other alternate plans were considered due to the proximity of the available City of Missoula water transmission system.

1.1.4. SITE CONDITIONS

A. SOIL CHARACTER

The project site is currently undeveloped vacant land that has been historically used primarily for agricultural grazing and haying purposes. The proposed subdivision would directly impact approximately 40 acres of land historically used for the production of grass hay and alfalfa, removing this land from production. There is no land currently or historically used for timber production on the subject parcel. According to the NRCS Soils Survey Report, approximately 47.7 acres of the parcel is classified as Farmland of Local Importance (Grassvalley silty clay loam). The remainder of the parcel is not prime farmland, and not identified as having significant importance to agriculture. A drainage ditch travels along the southern portion of the property's western boundary, passes beneath Old Bitterroot Road, and angles to the northwest toward the Bitterroot River away from the northern portion of the property's western boundary.

Geologically, this area is mapped on the MBMG Open File Report 373 - Missoula West 30' x 60' Quadrangle Geologic Map as Quaternary period Alluvium of Modern Channels and Flood Plains (Qal). These deposits are characterized as well-rounded gravel and sand with lesser amounts of clay. Lithologies from two nearby water wells associated with the recently constructed Jeanette Rankine Elementary School and dated based at the Montana Bureau of Mines and Geology were somewhat varied. The two wells were drilled to depths of 120 and 178 feet, respectively. The shallower well was logged as 15 feet of silty sand and gravel overlying an 8-foot-thick moist clay layer, then moving into saturated sand with clay seams. Bedrock was encountered in the shallower well at a depth of 114 feet. The deeper of the two wells was logged as 35 feet of sand and gravel overlying saturated sand with clay seams. Bedrock was logged in the deeper well at a depth of 105 feet.

According to the project Geotechnical Report provided by Lorenzen Soil Mechanics, a subsurface investigation was conducted on September 9th and 10th, 2020. Boland Drilling of Great Falls drilled a total of ten boreholes with their truck mounted Mobile B59 drill rig. In general, silty sands and sandy silts were found to lie above high-quality sand and gravel aggregates.

B. FOUNDATION CONDITIONS

Foundation conditions at building sites will be suitable for construction in accordance with recommendations outlined in the geotechnical report.

C. GROUNDWATER

The two above-mentioned water wells indicated groundwater table depths of 19 and 35 feet, respectively. The groundwater table was also encountered in each of the subsurface investigation boreholes performed by Lorenzen Soil Mechanics that were drilled to 15 feet and deeper. The water table was found approximately twelve to fifteen feet beneath the project site. Please refer to the project geotechnical report for further information.

1.1.5. WATER USE DATA

A. POPULATION TRENDS

The estimated maximum population which will be served by the proposed water main extension for the proposed subdivision is 690 residents, assuming 174 single-family lots with 3 residents per lot and a 110-unit assisted living facility with 1.25 residents per unit and 30 employees. The proposed religious assembly is estimated to have 172 average daily users. The population is not expected to change within 20 years or over the useful life of the distribution infrastructure.

B. PRESENT WATER CONSUMPTION

Water usage for the proposed development includes domestic water demands and irrigation demands. The average daily demand during the summer months, when landscaping requires irrigation, is calculated in this section.

Single-Family Lots

The estimated maximum population living in the single-family and townhouse lots within the subdivision which will be served by the proposed water main extension will be 522 people (174 single family residences * 3 people per home). Water usage for the new buildings consists of domestic and irrigation demands.

Average Daily Demand

The average daily demand for the single-family residential portion of the project was based on the following assumptions:

- Under fully developed conditions there will be 174 single-family and townhouse lots.
- The City of Missoula Water Facilities Master Plan was used for flow estimates;
  Average daily demands are as follows: 3-bedroom unit = 322 gpd
- Irrigation flows are included in the City's provided average daily demands for single-family development.

Based on the above assumptions, the average daily domestic demand is calculated as follows:

Average Daily Domestic Demand (ADD) = (174) (322 gpd) = **56,028 gpd.**

The Goodman Group Assisted Living Facility

Average Daily Demand

The average daily demand was based on the following assumptions:

- Under fully-developed conditions, there will be 1.25 residents per unit in the 110-unit assisted living facility, and 30 employees.
- Circular DEQ-4 was used for flow estimates (3.1-1 pg 27)
  Average daily demands are as follows: 85 gpd per resident.
  Irrigation flows: two inches per week during the summer months (May-September). Assuming 50% of lot area is irrigated.

Based on the above assumptions, the maximum daily domestic demand is calculated as follows:

Average Daily Domestic Demand = (1.25) (110) (85 gpd) = **11,688 gpd.**

The average daily irrigation demand during the summer months is calculated as follows:

$$D_{IRR} = \left(\frac{2"}{\text{week}}\right)\left(\frac{1'}{12"}\right)\left(\frac{7.48\ \text{gal}}{\text{ft}^3}\right)\left(\frac{\text{week}}{7\ \text{days}}\right)(77{,}062\ \text{ft}^2\ \text{landscaping}) = \mathbf{13{,}724\ gpd}$$

The average daily demand (ADD), including both domestic and irrigation use, is calculated as follows:

Total ADD = 11,688 gpd + 13,724 gpd **= 25,412 gpd**

Religious Assembly Lot

Average Daily Demand

The average daily demand was based on the following assumptions:

- Under fully developed conditions there will be 172 average daily users, assuming 172 users five days per week, with a peak of 349 users for one day, and no usage on the final day.
- Assume 5 gallons per day per user for a religious assembly with a kitchen (MDEQ Circular 4, Table 3.1-1)
- Irrigation flows: two inches per week during the summer months (May-September). Assuming 15% of lot area is irrigated in accordance with Title 20 landscaping standards.

Based on the above assumptions, the average daily domestic demand is calculated as follows:

Average Daily Domestic Demand = (172) (5 gpd) = **860 gpd.**

The average daily irrigation demand during the summer months is calculated as follows:

$$D_{IRR} = \left(\frac{2"}{\text{week}}\right)\left(\frac{1'}{12"}\right)\left(\frac{7.48\ \text{gal}}{\text{ft}^3}\right)\left(\frac{\text{week}}{7\ \text{days}}\right)(49{,}549\ \text{ft}^2\ \text{landscaping}) = \mathbf{8{,}824\ gpd}$$

The total average daily demand, including both domestic and irrigation use is calculated as follows:

Total ADD = 860 gpd + 8,824 gpd **= 9,684 gpd**

Total Daily Demands

The total average daily demand, including domestic and irrigation flows, is calculated as follows:

25,412 gpd + 56,028 gpd + 9,684 gpd **= 91,124 gpd**

Using the average daily demand, the average yearly volume, maximum daily demand (MDD), and peak instantaneous demand can be calculated as shown in Table 1-1. The maximum daily demand and peak instantaneous demand peaking factors for single-family customers were developed based on the actual maximum day demands and peak hour demands recorded for the "Twite 85K Res" pressure zone provided by the City. The MDD and PID observed per customer in this zone were 1.07 gallons per minute and 2.01 gallons per minute, respectively. The peaking

factors for the religious assembly facility and assisted living facility are based on those provided in Section 6.6.3 of the Missoula Water Facilities Master Plan.

Table 1-5-1. Summary of average daily demand (ADD), maximum daily demand (MDD), and peak instantaneous demand (PID).

Description	Units	Average Day (ADD)		Yearly Vol.	Max. Day Factor	Max. Day (MDD)	Peak Hour Factor	Peak (PID)
		gpd	gpm	(ac-ft)		gpm		gpm
Assisted Living	110	25412	18	28.46	2.03	36.54	3.14	56.52
Religious	172	9684	7	10.85	2.03	14.21	3.14	21.98
Residential	174	56028	39	62.76	1.07 gpm/unit	186.18	2.01 gpm/unit	349.74
Total:		91,124	64	102		236.93		428.24

C. YIELD OF SOURCES OF SUPPLY

Please reference the City of Missoula's PWS (PWSID: MT0000294) on file for detailed information. Further information is also provided in Section 1.1.7. of this report.

D. UNUSUAL OCCURRENCES

Please reference the City of Missoula's PWS (PWSID: MT0000294) on file for detailed information.

E. WATER LOSSES

Please reference the City of Missoula's PWS (PWSID: MT0000294) on file for detailed information.

1.1.6. FLOW REQUIREMENTS

A. HYDRAULIC ANALYSES

The peak instantaneous demand is estimated using the City's peaking factors in the previous section.

B. FIRE FLOWS

Missoula Fire Marshal Dax Fraser verified and approved of the fire protection infrastructure placement for the proposed subdivision and specified that fire hydrants would need to achieve

1,500 gpm in this development. Hydraulic modeling performed by the City of Missoula verified that the proposed extensions have capacity to meet the development's potential demands, assuming completion of the source development and main extension detailed in the following section. Confirmation of the fire hydrant locations is included as an attachment to this report.

1.1.7. SOURCES OF WATER SUPPLY

To secure adequate water supply, the developer, on behalf of the City of Missoula, will prepare a new DNRC permit to add a new water supply well located at the existing Haugan Lane well field. The new Well will be operated for seasonal use within City of Missoula municipal service areas, including Riverfront Trails. The flow rate and volume of the new Well will be mitigated by changing existing Riverfront Trails irrigation claim 76H-105168-00 from irrigation to mitigation. Prior to the City of Missoula taking ownership, Mountain Water Company placed a moratorium on new connections in the vicinity of the proposed subdivision due to insufficient water supply. Subsequently, the Twite family built the Miller Creek Water System to serve the Linda Vista and Teton Developments. Portions of these facilities were oversized to accommodate surrounding properties, including the proposed subdivision, with provisions made for this fourth well in the Haugan Well Field. The water distribution system has capacity to serve Riverfront Trails, but the existing wells' water rights do not extend supply to the Riverfront Trails place of use. To mitigate this and allow the development to connect to the Miller Creek Water System, the following process is proposed:

First, the developer is required to transfer the existing irrigation water right, 76H-105168-00, to the City of Missoula and prepare a change application to change the water right to a mitigation purpose of use. This mitigation will offset the annual volume and the irrigation season flows of the proposed development. The transfer will include a change application, the process of which is described below. The City will file a new permit application with the Montana Department of Natural Resources and Conservation (DNRC) to add the fourth well to the Haugan site. The proposed well will add additional water to the existing Sophie Reservoir pressure zone, upstream from Riverfront Trails.

Water right claim 76H-105168-00, with a priority date of June 1, 1958, is currently used on Riverfront Trails property. This is a claim for 2.5 CFS for irrigation of 92 acres from April 1 to October 31. To ensure the historic flow rate is not exceeded, the 2.5 CFS total diverted flow rate is technically shared with Peak Health Management for irrigation of 8.0 acres on the west side of the Bitterroot River under their claim, 76H-301226-09. All 92 acres claimed under 76H 105168-00 have historically been used to irrigate Riverfront Trails property. Peak Health Management

and Riverfront Trails each receive a pro-rata share of the original flow rate based on the number of acres irrigated. Peak Health Management can divert 8% of the flow rate, or 0.2 CFS, and Riverfront Trails can divert 92% of the flow rate, or 2.3 CFS (1,032 gallons per minutes). Water was historically diverted from the Bitterroot River using a pump, and a pipeline was used for conveyance to the place of use. Based on current DNRC standards, 110.11 acre-feet of volume is the total historic consumptive use of water available to change to another purpose, for use during the April 1 to October 31 period of use.

The steps for completing a permit and mitigation change application include the following:

1. Prepare DNRC application 600 GW: Groundwater Application for Beneficial Water Use Permit (Revised 07-2020) with a volume and flow rate matching the approved mitigation rights (see #2 below).

2. Prepare DNRC application 606 NIR (R 07-2020), including:
   a. Application details describing elements to change (point of diversion, place of use and purpose of use), water right being changed (76H-105168-00). The location of the new point of diversion will match the POD of the existing Haugan wells. The location of the new place of use is the City of Missoula's water service area. The purpose will change from irrigation to mitigation.
   b. Description of historic use of the water right being changed (prior to July 1, 1973). Provide water use records as far back as available. Affidavits can also be considered.
   c. Description of how the change will not adversely affect other water rights (flow rate and volume will not increase) including how operation will not exceed the permitted flow rate and volume (metered well diversions).
   d. Preparation of maps showing the existing and proposed points of diversion and places of use, and the new conveyance pipelines.

The new permit and change application are required for the City's water distribution system to have adequate capacity to serve the demands of the development and will be used to add seasonal capacity to the City system. The new permitted water right and mitigation right shall, at a minimum, fully meet the anticipated water supply demands of the proposed development from April 1 to October 31 (the historic period of diversion). If the new permit or change application is denied, the City of Missoula cannot provide municipal water to the development without an additional source of water to the system.

This project will be led by the developer, but the City and its water rights consultants shall review and approve of the applications and be consulted prior to major decisions being made in the application process.

Provisions for Phase 1A

To account for the uncertainty in the change application process outlined above, the phasing plan for the proposed subdivision includes an initial phase that can be supplied domestic water through a pair of exempt public water supply wells, with a potential layout shown on Exhibit EX-16. Lot 1, containing the assisted living facility, and Lot 2, containing the religious assembly facility, are included in this Phase 1A.

Exempt public water supply wells are limited volumetrically to ten acre-feet of production per year and limited in flow rate to 35 gallons per minute. The two proposed exempt wells must be located at least one-quarter mile apart, as wells within this distance are considered a combined appropriation. Under these limitations, the assisted living facility would be limited to 105 residents. The annual volumes consumed for domestic usage on Lot 1 and Lot 2 are shown in Table 7-1.

Table 7-1. Annual domestic usage for Lot 1 and Lot 2 under exempt well conditions.

Description	Residents or Users	Average Day (ADD) (Domestic Only)		Yearly Vol.
		gpd	gpm	(ac-ft)
Assisted Living	105	8925.00	6.20	10.00
Religious	172	860.00	0.60	0.96
Total:		9785	6.80	10.96

In this scenario, irrigation water will be supplied to Lot 1 and Lot 2 through the existing surface water irrigation right and the existing buried irrigation main pipe across the property. Additionally, water mains would need to be extended from the City's system to serve Lot 1 and Lot 2 with water authorized only for fire protection purposes. In this interim scenario, the City would not be responsible in any way for operation or maintenance of the exempt water supply wells, or their distribution systems. Responsibility for operation and maintenance would fall entirely on the Lot owners or developer. After the permit and change applications are completed, and fully meet, or exceed, the anticipated water supply demands, and public water supply becomes available through the extension of the City's municipal system, Phase 1A will be able to be served with domestic, irrigation, and fire protection water through the municipal system.

1.1.8. PROPOSED TREATMENT PROCESSES

There are no proposed treatment processes for this project. The proposed water main will connect to the City of Missoula's existing public water system.

1.1.9. SEWAGE SYSTEM AVAILABLE

The existing sewage collection system adjacent to the development are owned and operated by the City of Missoula. The proposed sewer mains to be installed as part of the development will maintain a minimum 10-foot horizontal and 18-inch vertical edge-to-edge separation from all existing and proposed water transmission mains.

1.1.10. WASTE DISPOSAL

Please reference the City of Missoula's PWS (PWSID: MT0000294) on file for detailed information.

1.1.11. AUTOMATION

Automated controls will be required for the new public water supply well and pump station. The specific details of the automated controls will be coordinated with the City of Missoula, and added to this section, at a later date.

1.1.12. PROJECT SITES

A. SITES CONSIDERED

Not applicable – alternate sites were not considered for this project.

B. PROXIMITY OF RESIDENCES AND INDUSTRIES

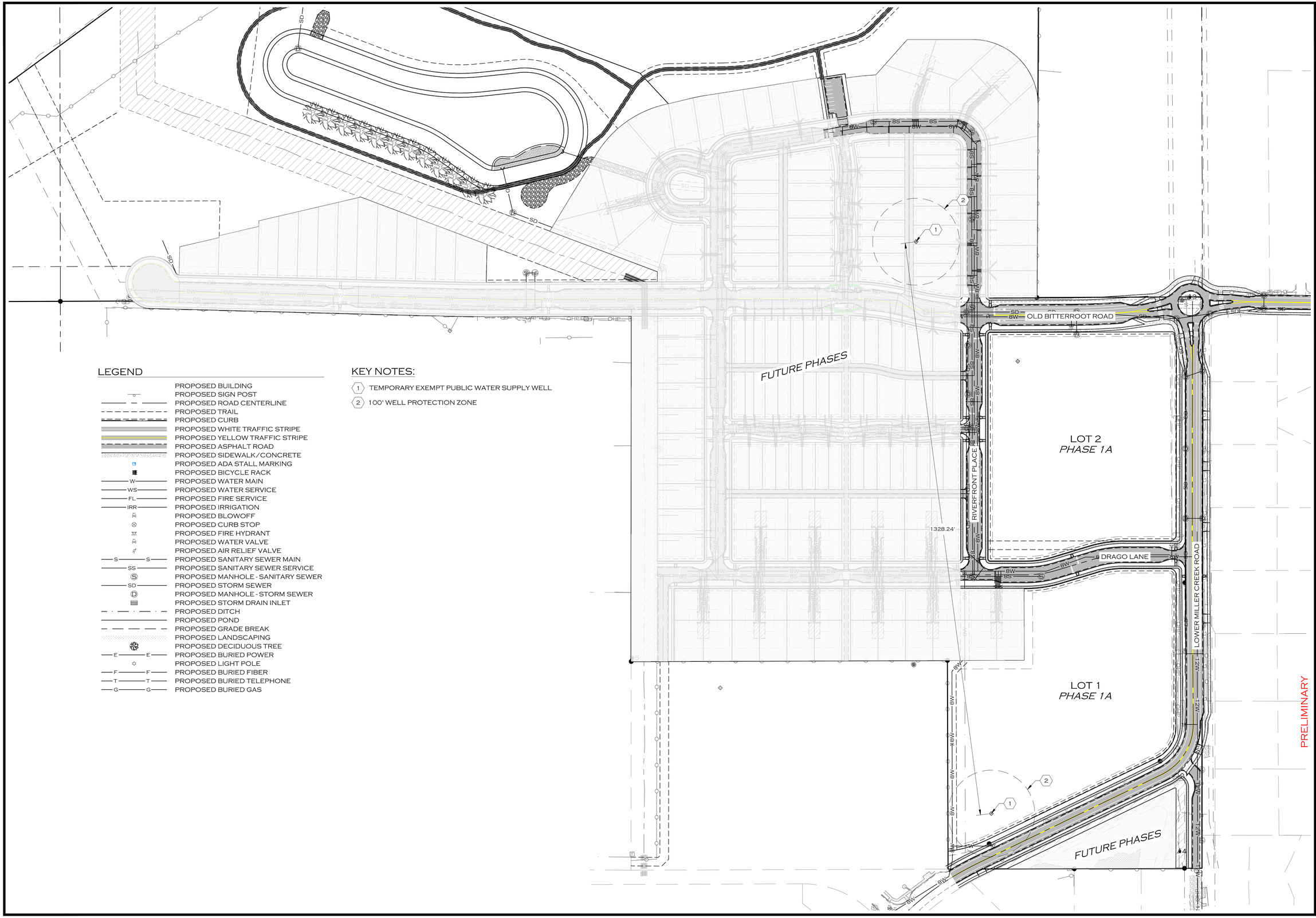
Adjacent developments include residential and residential-mixed use land uses, an educational facility and farmland.

1.1.13. FINANCING

Please reference the City of Missoula's PWS (PWSID: MT0000294) on file for detailed information.

1.1.14. FUTURE EXTENSIONS

At the time of this report, there are no known plans for future development near the proposed project that will continue extending the completed water main extensions proposed for this development.



LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- W — PROPOSED WATER MAIN
- WS — PROPOSED WATER SERVICE
- FL — PROPOSED FIRE SERVICE
- IRR — PROPOSED IRRIGATION
- PROPOSED BLOWOFF
- PROPOSED CURB STOP
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED AIR RELIEF VALVE
- S — PROPOSED SANITARY SEWER MAIN
- SS — PROPOSED SANITARY SEWER SERVICE
- PROPOSED MANHOLE - SANITARY SEWER
- SD — PROPOSED STORM SEWER
- PROPOSED MANHOLE - STORM SEWER
- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- E — PROPOSED BURIED POWER
- PROPOSED LIGHT POLE
- F — PROPOSED BURIED FIBER
- T — PROPOSED BURIED TELEPHONE
- G — PROPOSED BURIED GAS

KEY NOTES:

1. TEMPORARY EXEMPT PUBLIC WATER SUPPLY WELL
2. 100' WELL PROTECTION ZONE

PRELIMINARY

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
4		

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RIVERFRONT TRAILS
MISSOULA MONTANA

TEMPORARY PUBLIC WATER SUPPLY WELL LOCATIONS

EX-16

EX-16 TEMPORARY PWS WELL.DWG PLOTTED BY MATT HAMMERSTEIN ON JUL/22/2022

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INTRODUCTION

This design report provides the criteria used as a basis of design for the proposed subdivision that subdivision is to consist of 174 lots containing single-family residential homes, townhomes, and courtyard townhomes, a 4.99-acre lot intended for a religious assembly development, and a 5.53-acre lot intended for a senior living facility in Missoula, Montana. The 92.73-acre parcel to be subdivided can be more particularly described as Portion A and Tract 1 of Certificate of Survey 6449 located in Section 2, Township 12 North, Range 20 West, P.M.M., Missoula County, Montana. The subject parcel is divided by Old Bitterroot Road, an existing dirt roadway and lies adjacent to the Bitterroot River and Lower Miller Creek Road in Missoula. Adjacent Developments include the Jeanette Rankin School owned by Missoula County Public Schools, Linda Vista Subdivision, and Blue Vista Acreage Tracts. This report is organized following the outline recommended in DEQ-2, Chapter 10, Section 11.1.

The proposed sanitary sewer main extensions will connect into the existing 15" main that runs along the west side of the property from Bigfork Road to Old Bitterroot Road through a 20' wide sanitary sewer easement per book 810 micro, pages 1255, 1272-1273 and book 857 micro, page 1224. A total of four tie in locations are proposed, three of which are located in the Old Bitterroot Road right of way, and the other is located along the western boundary in the 20' easement. Doghouse pour-in place manholes are proposed at these locations in order to facilitate the main extensions per City of Missoula Standard Detail STD-512-2. Please refer to the attached record drawings for more information regarding the existing sanitary sewer system in the project area and tie in locations (Record Drawing LMC Sewer Main Extension P-08-028). The existing system is owned and operated by the City of Missoula and was constructed in 2010. The total sanitary sewer main extensions will include approximately 3,480 linear feet of 8" SDR-35 PVC pipe, 700 linear feet of 12" SDR-35 PVC pipe, a lift station, and twenty-seven 48" concrete sanitary sewer manholes at full build-out.

The proposed sanitary sewer improvements are an extension of the City of Missoula sanitary sewer collection system. The owner and developer contact information are as follows:

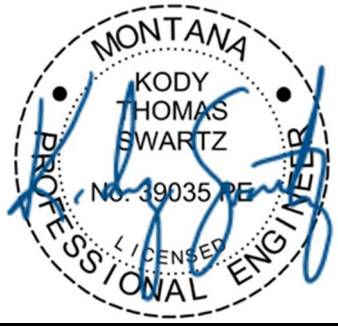
System Owner contact information:

City of Missoula
435 Ryman Street
Missoula, MT 59802

Developer contact information:

Tollefson Properties, LLC.
15311 Tyson Way
Frenchtown, MT 59834
(406) 360-4153

I hereby state that this Sanitary Sewer Engineering 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 within the standard accepted practices, and in accordance with the Missoula City Public Works Standards and Specifications Manual.



July 21, 2022

Approved By *Date*

11.11. PROBLEM DEFINED

The proposed subdivision development will include a mixture of uses including single family residential, multi-family residential and commercial. Development will occur on 176 separate lots including one 4.99-acre lot intended for a religious assembly development and one 5.53-acre lot proposed for a senior living facility.

The proposed development will include the improvement of the 80' Old Bitterroot Road right of way classified as an Urban Collector with parking as described by an opinion from the Missoula County Attorney to the Missoula Surveyors Office and Dated October 30,1992. A 90-foot right-of-way will be provided for Lower Miller Creek Road along the eastern boundary of the property. For the portion of Lower Miller Creek Road that splits the subject property, an 80-foot right-of-way will be provided. The proposed alignment of Old Bitterroot Road has been provided to the City of Missoula to preliminarily determine the location of a future roundabout at the intersection of Lower Miller Creek Road and Old Bitterroot Road. An easement has been provided for this future roundabout based on the location provided by the City. A provision has been made for the southern internal local street to be extended into the parcel to the west, should that parcel ever be developed. Additionally, a street connection to Jeannette Rankin elementary has been provided, in coordination with the school district and the City of Missoula. All roadways within the proposed subdivision will be located within dedicated public rights-of-way.

Several utility easements will be provided and maintained including the 20' sanitary sewer easement per book 810 micro, pages 1255, 1272-1273 and book 857 micro, page 1224. A 40'-wide public access and utility easement will be provided along the boundary of Lot 1 and the school parcel for construction and maintenance of a water transmission main to serve the proposed subdivision per certificate of survey 6568. The development will include four 20' Alleys, two 54' right of ways classified as Neighborhood Streets named Meyers Way and Anders Way, four 64' right of ways classified as Urban Local Streets named Riverfront Place, Naomi Lane, Tolley Lane, and Drago Lane, and one 56' right of way classified as a Neighborhood Yield Street named Cassidy Court. All proposed water main extensions will be located within the proposed rights of ways. Please refer to the Preliminary Plat and included drawings for more detailed information regarding the proposed road layout and utility configuration for the proposed development.

Phase 3 of the proposed subdivision will include 13 residential lots along the north side of Old Bitterroot Road. This extension will require a lift station to convey sanitary sewer flows into the gravity system, due to the topography of the site. The potential wastewater flows from parcels to the south and west of Riverfront Trails are included in the preliminary analysis of Phase 3 in this report.

At full build out the, the development could be expected to serve a total of 874 residents assuming 174 single family lots with 3 residents per lot, a 110 unit Assisted Living Facility with 1.25 residents per unit and 30 Employees, and 172 average daily users of the religious assembly facility. The existing 15" sewer main appears to be in good condition based on field visits and is relatively new. The existing 15" sewer main will require review of available capacity with each phase of Riverfront Trails submitted for final platting.

11.12. DESIGN CONDITIONS

Peak Design Flow:

The peak sanitary sewer design flow for the development was estimated using the wastewater flow rates outlined in Section 3.1 of Montana Department of Environmental Quality Circular 4. The total daily design flow for the entire development at full build-out, assuming the maximum estimated population, is calculated in Table 1.

TABLE 1. PEAK DAILY FLOW RATE

WASTEWATER SOURCE	UNIT	QUANTITY	UNIT FLOW (GPD)	TOTAL FLOW (GPD)
Single-family & Townhouse	Units	174	300	52200
Religious	Persons	172	5	860
Assisted Living	Residents	137.5	85	11687.5
	Employees	30	10	300
			TOTAL (GPD):	**65047.5**

A peaking factor is then applied to the total daily flow to determine the design flow rate:

Design Flow Rate (Total)

Population: 874 persons

Peaking Factor = $\frac{18+\sqrt{P}}{4+\sqrt{P}} = \frac{18\ \sqrt{874}}{4+\sqrt{874}}$ = 3.84

Q_{max} = $65{,}047.5\ \text{gpd} * \left(\frac{0.13\ \text{cf}}{\text{gal}}\right) * \left(\frac{\text{day}}{86{,}400\ \text{sec.}}\right) * 3.84$ = 0.376 cfs

All of the peak design flow for the development will flow through the proposed 8” mains and into the existing 15” main after traveling through the proposed system. The capacities of the proposed new 8” mains and existing 15” sanitary sewer main are calculated in the following section.

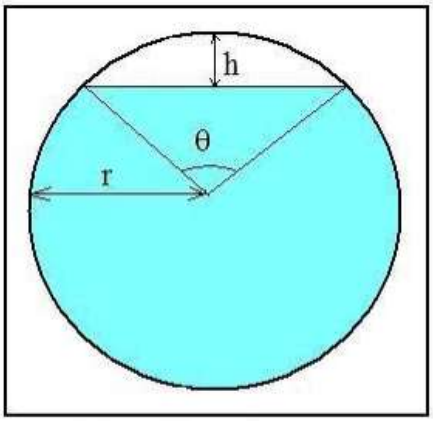
Capacity of Sewer Mains:
The capacities of the proposed and existing sanitary sewer mains at 75% full depth were calculated using the Chezy-Manning formula:

$$Q_C = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{s}$$

Where s = pipe slope (ft/ft)
n = manning’s coefficient for PVC pipe = 0.013
R = A/P = 0.2 ft (8” pipe); 0.36 ft (15” pipe)
A = cross-sectional area of flow = 0.28 ft^2 (8” pipe); 0.91 ft^2 (15” pipe)

The equations used to calculate the cross-sectional area for partially full pipe flow when the pipe is more than half full are given below in Figure 1:

FIGURE 1: PARTIALLY FULL PIPE FLOW PARAMETERS (MORE THAN HALF FULL)



$r = D/2 \qquad h = 2r - y$

$\theta = 2 \arccos\left(\frac{r - h}{r}\right)$

$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$

$P = 2\pi r - r\theta$

$R_h = A/P$

The cross-sectional area of flow and hydraulic radius were calculated as follows for an 8" pipe at 75% capacity:

Inside Diameter of 8" SDR-35 = 7.92" =0.66 ft

r = 0.33 ft

y = 0.75 * D = 0.75 * 0.66 ft = 0.495 ft

h = 2 * 0.33 ft – 0.495 ft = .165 ft

$\theta = 2 \arccos\left(\frac{0.33\ ft - 0.165\ ft}{0.33\ ft}\right)$= 2.094 radians

$A = \pi(0.33)^2 - (0.33)^2(\frac{2.094 - s \quad (2.94)}{2})$ = 0.28 ft^2

$P = 2\pi(0.33ft) - (0.33ft)(2.094) = 1.38$ ft

R= 0.28 ft^2 / 1.38 ft = 0.20 ft

The proposed 8" sanitary sewer main extensions will have a minimum slope of 0.4% in some areas. Thus, its capacity in the worst-case scenario is calculated as follows:

$$Q_C = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{s} = \left(\frac{1.49}{0.013}\right)(0.28)(0.2)^{\frac{2}{3}}\sqrt{0.004} = 0.694 \text{ cfs}$$

This proves that the proposed mains have more than enough capacity to serve the proposed development because they could technically convey the entire overall peak design flow. However, most of the proposed 8" mains will only see a fraction of the overall peak design flow rate. This process is repeated in order to analyze the existing 15" main.

The cross-sectional area of flow and hydraulic radius were calculated as follows for a 15" pipe at 75% capacity:

Inside Diameter of 15" SDR-35 = 14.42" =1.20 ft

r = 0.60 ft

y = 0.75 * D = 0.75 * 1.20 ft = 0.90 ft

h = 2 * 0.60 ft – 0.90 ft = .30 ft

$\theta = 2\arccos\left(\frac{0.60\ ft - 0.30\ ft}{0.60\ ft}\right)$= 2.094 radians

$A = \pi(0.60)^2 - (0.60)^2\left(\frac{2.094 - \sin(2.94)}{2}\right)$ = 0.91 ft²

$P = 2\pi(0.60ft) - (0.60ft)(2.094) = 2.51$ ft

R= 0.91 ft² / 2.51 ft = 0.36 ft

The existing 15" sanitary sewer main will has a minimum slope of 0.21% in some areas. Thus, its capacity in the worst-case scenario is calculated as follows:

$$Q_C = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{s} = \left(\frac{1.49}{0.013}\right)(0.91)(0.36)^{\frac{2}{3}}\sqrt{0.0021} = 2.42 \text{ cfs}$$

The existing 15" mains will have a capacity at 75% full-flow depth that is 6.44 times greater than the total peak design flow for the entire development.

Phase 3 and Lift Station Analysis:

Due to the relatively shallow depth of the existing 15" sanitary sewer main and the topography of the site, Phase 3 of Riverfront Trails will require a sanitary lift station to convey wastewater flows into the existing 15" main. In order to size the lift station and gravity main serving Phase 3, an analysis of future wastewater flows from the parcels to the southwest of Riverfront Trails, Parcel 1 of COS 2591 and Tract 2A of COS 5675, is necessary. Table 2 analyzes Phase 3 of Riverfront Trails, as well as the development potential of these parcels based on the City's Growth Policy, to determine the potential future wastewater flows at the lift station.

TABLE 2. POTENTIAL WASTEWATER FLOWS AT PHASE 3 LIFT STATION

Parcel	Area (acres)	Growth Policy Designation	Relatable Zoning	Density per Zoning (ft²/DU)	Maximum Dwelling Units
Riverfront Trails Phase 3					13
Parcel 1 COS 2591	33.52	Residential Medium	RT5.4	5,400	270
Tract 2A COS 5675	33.16	Residential Medium	RT5.4	5,400	267
TOTAL					550

Based on the growth policy, the gravity main serving Phase 3 and the lift stion could see wastewater flows from 550 dwelling units. The peak sanitary sewer design flow for Phase 3 and

the potential future development was estimated using the wastewater flow rates outlined in Section 3.1 of Montana Department of Environmental Quality Circular 4. The total daily design flow, assuming the maximum estimated population, is calculated in 2.

TABLE 3. PEAK DAILY FLOW RATE (PHASE 3 AND FUTURE)

WASTEWATER SOURCE	UNIT	QUANTITY	UNIT FLOW (GPD)	TOTAL FLOW (GPD)
Single-family & Townhouse	Units	550	300	165,000
			TOTAL (GPD):	**165,000**

A peaking factor is then applied to the total daily flow to determine the design flow rate:

Design Flow Rate (Total)

Population: 1,650 persons

Peaking Factor = $\frac{18+\sqrt{P}}{4+\sqrt{P}} = \frac{18+\sqrt{1{,}650}}{4+\sqrt{1{,}650}}$ = 3.65

Q_{max} = $165{,}000 \text{ gpd} * \left(\frac{0.13 \text{ cf}}{\text{gal}}\right) * \left(\frac{\text{day}}{86{,}400 \text{ sec.}}\right) * 3.65$ = 0.906 cfs

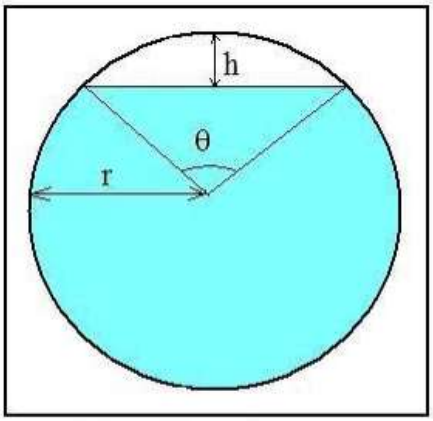
The gravity main serving Phase 3, as well as the lift station and connection to the existing 15" gravity main, will need to be sized to accommodate this flow. The capacity of the proposed 12" main serving Phase 3 is analyzed below:

$$Q_C = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{s}$$

Where s = pipe slope (ft/ft)
n = manning's coefficient for PVC pipe = 0.013
R = A/P = 0.29 ft (12" pipe)
A = cross-sectional area of flow = 0.606 ft^2 (12" pipe)

The equations used to calculate the cross-sectional area for partially full pipe flow when the pipe is more than half full are given below in Figure 1:

FIGURE 2: PARTIALLY FULL PIPE FLOW PARAMETERS (MORE THAN HALF FULL)



$r = D/2 \qquad h = 2r - y$

$\theta = 2 \arccos\left(\frac{r - h}{r}\right)$

$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$

$P = 2\pi r - r\theta$

$R_h = A/P$

The cross-sectional area of flow and hydraulic radius were calculated as follows for a 12" pipe at 75% capacity:

Inside Diameter of 12" SDR-35 = 11.78" =0.98 ft

r = 0.49 ft

y = 0.75 * D = 0.75 * 0.98 ft = 0.735 ft

h = 0.98 ft – 0.735 ft = .245 ft

$\theta = 2 \arccos\left(\frac{0.49\ ft - 0.245\ ft}{0.49\ ft}\right)$= 2.094 radians

$A = \pi(0.49)^2 - (0.49)^2\left(\frac{2.094 - \sin(2.094)}{2}\right)$ = 0.606 ft^2

$P = 2\pi(0.49ft) - (0.49ft)(2.094) = 2.05$ ft

R= 0.606 ft^2 / 2.05 ft = 0.29 ft

The proposed 12" gravity main serving Phase 3 will have a minimum slope of 0.22%. Thus, its capacity in the worst-case scenario is calculated as follows:

$$Q_C = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{s} = \left(\frac{1.49}{0.013}\right)(0.606)(0.29)^{\frac{2}{3}}\sqrt{0.0022} = 1.43 \text{ cfs}$$

This demonstrates that the proposed 12" gravity main will have capacity to serve both Phase 3 of Riverfront Trails, as well as any potential future development on the adjacent parcels. Lift station analysis, including total head calculations and pump sizing, will need to be completed at the time Phase 3 is submitted for final plat review. A new lift station easement is provided on Riverfront Trails property and shown on the preliminary plat.

Future Wastewater Flows:

Wastewater flows were only analyzed for the proposed subdivision development. There is not detailed information at this time about any future developments located near the subject parcel

and the corresponding contributing wastewater flows. Further assessment of the future requirements for service of the main extensions upon completion will be needed in order to analyze the additional allowable living units and capacities that can be served by future water main extensions to the east and west of the development based on the growth policy and densities permitted by zoning on adjacent future developments. The City of Missoula has expressed some concerns about the existing 15" sewer main in recent correspondence stating that a portion of the 15" main may be required to be replaced because their models show it being undersized for the 2037 demands based on their facility plan. Future coordination with the City of Missoula will be required.

11.13. Impact on Existing Wastewater Facilities

The capacities of the existing 15" sanitary sewer mains are discussed in the previous sections. It is anticipated that there should be more than sufficient capacity in the existing 15" and proposed 8" mains to serve current developments and the proposed development. Although concerns about the existing 15" main not meeting 2037 demands will need to be further coordinated with the City of Missoula as the project proceeds. The proposed sewer mains to be installed as part of the development will maintain a minimum 10-foot horizontal and 18-inch vertical edge-to-edge separation from all existing and proposed water transmission mains.

11.14. Project Description

The sanitary sewer extensions will include approximately 3,480 lineal feet of 8" SDR-35 PVC sanitary sewer main pipe, and twenty-three 48" concrete sanitary sewer manholes at full buildout. At full buildout, the development could be expected to serve a total of 874 residents assuming 174 single family lots with 3 residents per lot, a 110 unit Assisted Living Facility with 1.25 residents per unit and 30 Employees, and a 172 average daily religious facility users.

11.15. Drawings

Overall Water and Sewer Main Plans are attached.

11.16. Design Criteria

The design criteria for this project follows the guidelines set out by the City of Missoula and the Montana Department of Environmental Quality Circular 2. For Sewer main criteria used, refer to the sanitary sewer construction plan sheets.

The proposed conventional gravity sewer collection system is to be constructed to the current City of Missoula Public Works Standards and Specifications in effect at the time of approval and the 6th Edition of Montana Public Works Standard Specifications (MPWSS). In particular, the sewer main shall be 8-inch SDR-35 PVC pipe. The manholes shall be a standard 48" diameter eccentric-type precast concrete manholes per City of Missoula Standard detail STD-512.

11.17. Site Information

The project site is currently undeveloped vacant land that has been historically used primarily for agricultural grazing and haying purposes. The proposed subdivision would directly impact approximately 40 acres of land historically used for the production of grass hay and alfalfa, removing this land from production. There is no land currently or historically used for timber production on the subject parcel. According to the NRCS Soils Survey Report, approximately

47.7 acres of the parcel is classified as Farmland of Local Importance (Grassvalley silty clay loam). The remainder of the parcel is not prime farmland, and not identified as having significant importance to agriculture. A drainage ditch travels along the southern portion of the property's western boundary, crosses beneath Old Bitterroot Road and angles to the northwest toward the Bitterroot River away from the norther portion of the property's western boundary.

Geologically, this area is mapped on the MBMG Open File Report 373 - Missoula West 30' x 60' Quadrangle Geologic Map as Quaternary period Alluvium of Modern Channels and Flood Plains (Qal). These deposits are characterized as well-rounded gravel and sand with lesser amounts of clay. Lithologies from two nearby water wells associated with the recently constructed Jeanette Rankine Elementary School and dated based at the Montana Bureau of Mines and Geology were somewhat varied. The two wells were drilled to depths of 120 and 178 feet respectively. The shallower well was logged as 15 feet of silty sand and gravel overlying an 8-foot-thick moist clay layer, then moving into saturated sand with clay seams. Bedrock was encountered in the shallower well at a depth of 114 feet. The deeper of the two wells was logged as 35 feet of sand and gravel overlying saturated sand with clay seams. Bedrock was logged in the deeper well at a depth of 105 feet.

According to the project Geotechnical Report provided by Lorenzen Soil Mechanics Inc on March 8, 2021, a subsurface investigation was conducted on September 9th and 10th, 2020. Boland Drilling of Great Falls drilled a total of ten boreholes with their truck mounted Mobile B59 drill rig. In general, silty sands and sandy silts were found to lie above high-quality sand and gravel aggregates. The two above mentioned water wells indicated groundwater table depths of 19 and 35 feet, respectively. The groundwater table was also encountered in each of the subsurface investigation boreholes performed by Lorenzen Soil Mechanics that were drilled to 15 feet and deeper. The water table was found approximately twelve to fifteen feet beneath the project site. Please refer to the project geotechnical report for further information.

11.18. ALTERNATIVES ANALYSIS

The proposed sewer main extensions connect to existing gravity sewer mains directly adjacent to the proposed development. No other alternate plans were considered due to the proximity of the available City of Missoula sewer collection system.

11.19. ENVIRONMENTAL IMPACTS

Environmental impacts will be negligible since the sewer main is a closed piping system that has eliminated any path for water mitigation. There are no known potential sources of adverse environmental impact on the project site.

OPERATION AND MAINTENANCE

These sewer lines will be owned, operated, and maintained by the City of Missoula.

REFERENCES

Montana Department of Environmental Quality, “Design Standards for Public Sewage Systems”, Circular DEQ-2.

Montana Department of Environmental Quality, “Montana Standards for Subsurface Wastewater Treatment Systems”, Circular DEQ-4.

APPENDIX 1

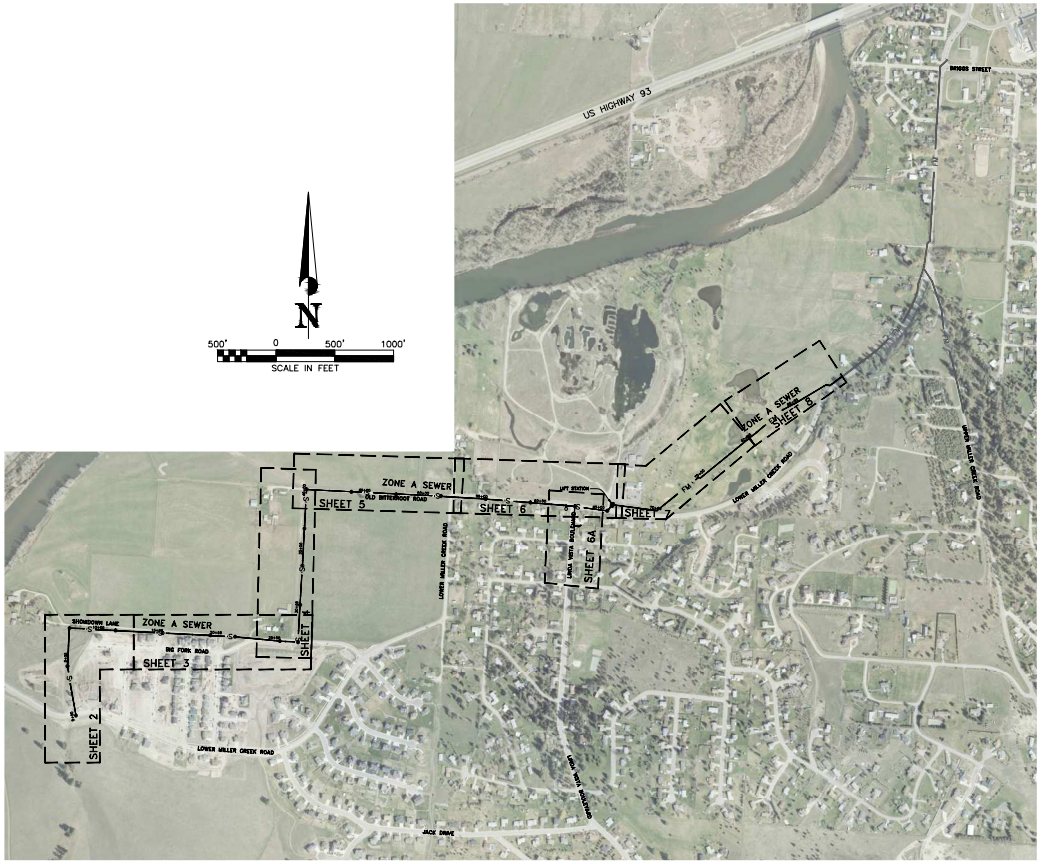
EXISTING SEWER MAIN AS-BUILTS

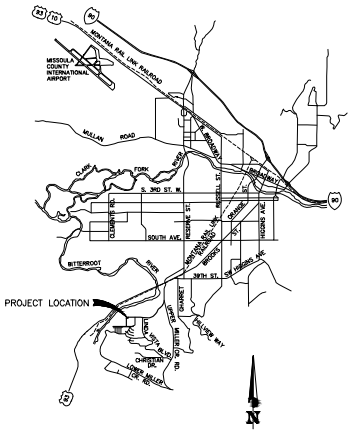
PROJECT LEGEND-EXISITNG

- EDGE OF ASPHALT
- CURB AND GUTTER
- CURB AND GUTTER W/DRIVEWAY OPENING
- EDGE OF GRAVEL
- W — WATER MAIN
- WS — WATER SERVICE
- S — SANITARY SEWER MAIN
- SS — SANITARY SEWER SERVICE
- SD — STORM DRAIN
- AP — AERIAL POWER LINE
- BE — BURIED ELECTRIC LINE
- AT — AERIAL TELEPHONE LINE
- T — BURIED TELEPHONE LINE
- FO — BURIED FIBER OPTIC
- ATV — AERIAL CABLE TELEVISION
- TV — BURIED CABLE TELEVISION
- G — GAS MAIN
- x — x — FENCE
- IRRIGATION DITCH
- CONTOUR (1 FOOT INTERVAL)
- W/V — WATER VALVE
- FIRE HYDRANT
- BLOW OFF
- WELL
- S — SANITARY SEWER MANHOLE
- SANITARY SEWER CLEANOUT
- G — GREASE TRAP MANHOLE
- STORM DRAIN MANHOLE
- ROOF DRAIN SUMP
- DRAINAGE SUMP
- POWER POLE
- GUY WIRE
- LIGHT POLE
- ELEC — ELECTRIC PEDESTAL
- TEL — TELEPHONE PEDESTAL
- TV — CABLE TELEVISION PEDESTAL
- GAS MAIN VALVE
- EVERGREEN TREE (SIZE AS NOTED)
- DECIDUOUS TREE (SIZE AS NOTED)
- BUSH
- DRIP LINE OF TREE
- MAIL BOX
- SIGN
- SURVEY MONUMENT
- CONTROL POINT
- MAPPING POINT
- TEMPORARY BENCH MARK

PROJECT LEGEND-PROPOSED

- S — GRAVITY SEWER MAIN
- FM — SEWER FORCE MAIN
- S — SEWER MANHOLE





VICINITY MAP
NO SCALE

GENERAL NOTES:

1) CONTRACTOR SHALL FIELD VERIFY ALL UTILITIES INCLUDING ALL SERVICES TO ALL PROPERTIES. THESE DRAWINGS MAY NOT SHOW ALL FACILITIES. SEE SPECIFICATIONS FOR REQUIREMENTS REGARDING UTILITIES. THE DEPTHS OF ALL EXISTING UTILITIES ARE UNKNOWN.

2) ALL WORK SHALL CONFORM TO THE MONTANA PUBLIC WORKS STANDARD SPECIFICATIONS, FIFTH EDITION, MARCH, 2003 AS REVISED BY SPECIAL PROVISIONS AND CITY OF MISSOULA SUPPLEMENTS.

3) CONTRACTOR SHALL USE BEST MANAGEMENT PRACTICES FOR EROSION CONTROL – SEE CITY STD'S 606, 607 AND 609.

4) WHERE GROUNDWATER IS ENCOUNTERED OR EVIDENCED IN THE TRENCH, CONTRACTOR SHALL USE CITY OF MISSOULA ADMINISTRATIVE RULE #600 PIPE BEDDING SPECIFICATIONS FOR WET CONDITIONS AND WATERPROOF (TYPE "C") MANHOLES.

5) ALL FITTINGS ON THE FORCE MAIN SEWER SHALL BE RESTRAINED WITH RESTRAINING GLANDS (MEGALUG OR APPROVED EQUAL).

UNCC
CALL BEFORE YOU DIG
1–800–424–5555
Utility Notification Center

CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

PROFESSIONAL CONSULTANTS, INC. ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS (HORIZONTAL AND VERTICAL). THE EXISTING UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY THE LOCATIONS OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

INDEX OF SHEETS

SHEET NO.	DRAWING DESCRIPTION
1	COVER SHEET
2	STA. 0+00 TO 13+00 PLAN & PROFILE
3	STA. 13+00 TO 27+00 PLAN & PROFILE
4	STA. 27+00 TO 40+00 PLAN & PROFILE
5	STA. 40+00 TO 53+00 PLAN & PROFILE
6	STA. 53+00 TO 67+00 PLAN & PROFILE
6A	SEWER LINES "F" AND "G"
7	STA. 67+00 TO 80+00 PLAN & PROFILE
8	STA. 80+00 TO 90+00 PLAN & PROFILE
9	SEWER DETAILS
10	LIFT STATION DETAILS
ELECTRICAL PLANS	
E1.0	ELECTRICAL SITE
E2.0	ELECTRICAL DETAILS
E3.0	ELECTRICAL SITE

LOWER MILLER CREEK SEWER EXTENSION

JANUARY 2010

RECORD DRAWING
BY: _____ DATE: _____

F:\2001\8525-01 Lloyd Tetra\dwg\PROJECT\SEWER\ZONE A LOWER MILLER CREEK SEWER\COVER SHEET1 8/8/11

Professional Consultants, Inc.
1711 28th St. West
Billings, MT 59102
(406) 652-6314
Fax (406) 652-4123
Engineers • Surveyors • Planners • Scientists

PROJECT #: 8525-01
DRN. BY:
CHECKED BY:
APPROVED BY:

REVISION	DATE	DESCRIPTION
REVISION	2-25-10	1st SUBMITTAL
REVISION	3-15-10	REVISIONS PER CONSTRUCTION
REVISION	4-14-10	REVISIONS PER CITY
REVISION	4-14-10	LIFT STATION REVISIONS
REVISION	4-26-10	FINAL SUBMITTAL
REVISION	8-26-10	MANHOLE A41 & LIFT STATION REVISIONS

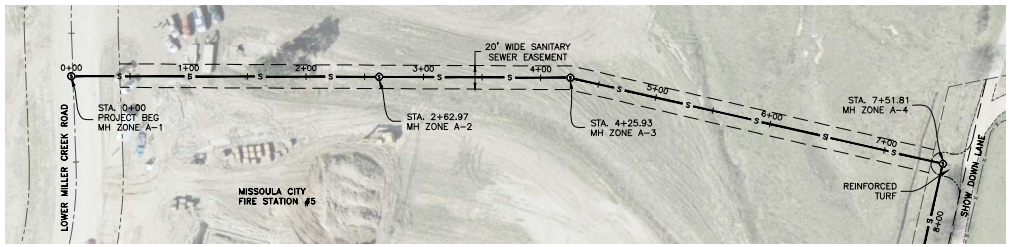
ZONE A SEWER EXTENSION
LOWER MILLER CREEK
LOCATED IN SEC 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

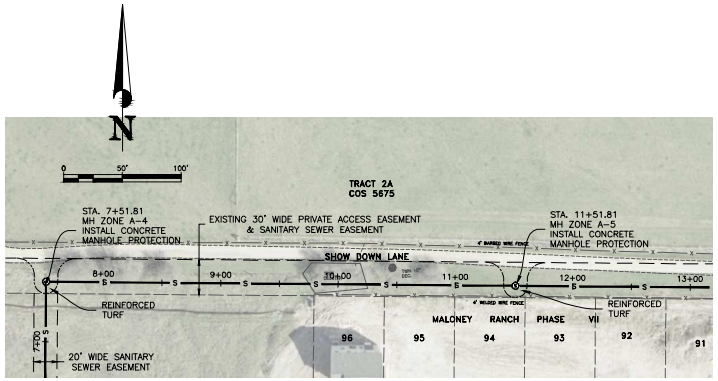
SEWER COVER

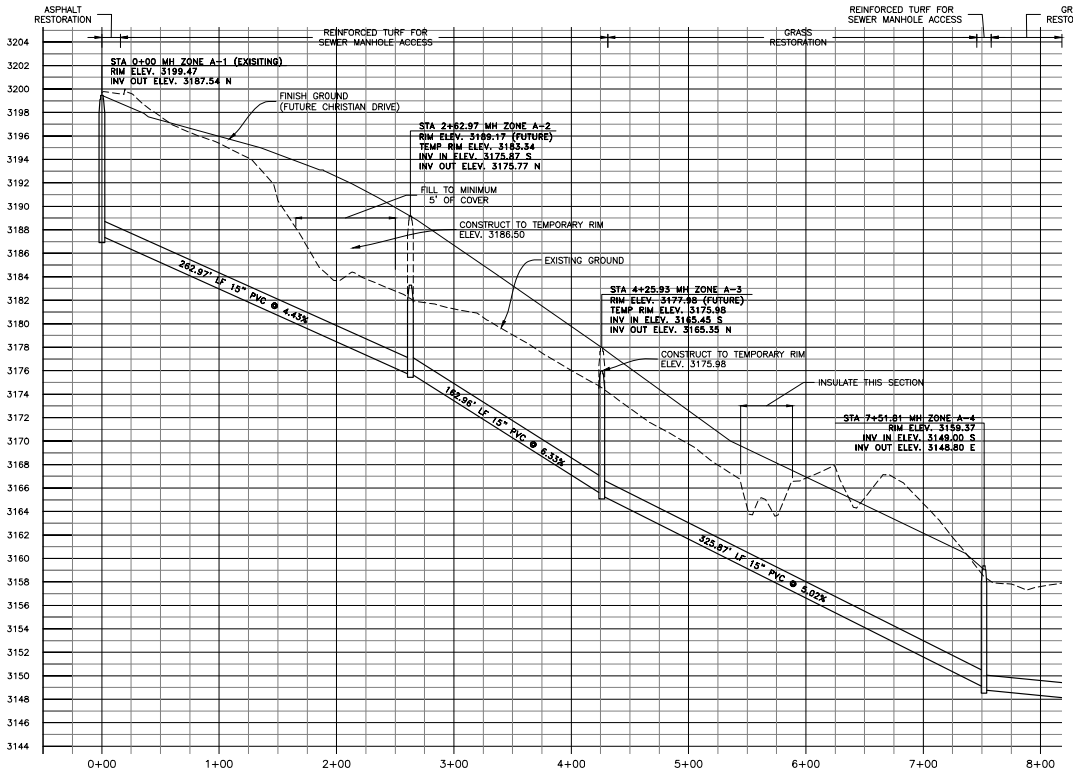
1

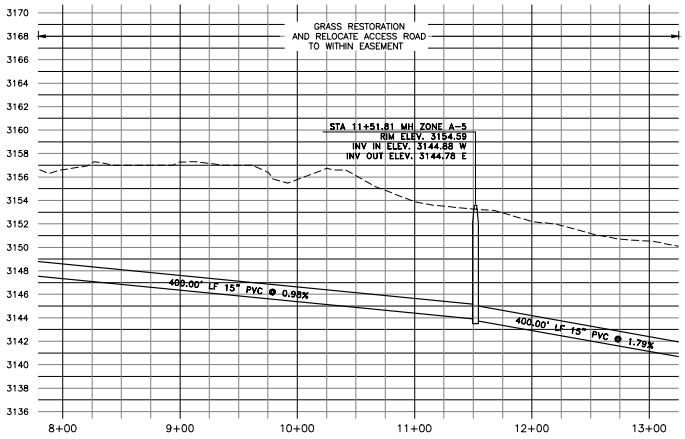
SHEET 1 OF 10

08-028(D & E)-1









RECORD DRAWING

BY: _____ DATE: _____

NOTE:

ALL MANHOLES SHALL HAVE POSITIVE DRAINAGE AWAY FROM MANHOLE IN ALL DIRECTIONS.

Professional Consultants Inc.
Engineers | Planners | Surveyors
1713 South 3rd West, PO Box 1258
Missoula, MT 59806-1258
(406) 728-4354 (406) 543-7308
FAX (406) 543-2317

PROJECT #:	6502-01
DRAWN BY:	
CHECKED BY:	
APPROVED BY:	
DATE:	

DATE	REVISION
2-25-15	1st SUBMITTAL
3-16-15	RESUBMIT FOR CONSTRUCTION
4-14-15	LIFT STATION
4-14-15	LIFT STATION REVISIONS
4-15-15	LIFT STATION
4-15-15	LIFT STATION & MHC REVISIONS

ZONE A SEWER EXTENSION

LOWER MILLER CREEK

LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M., MISSOULA COUNTY, MONTANA

PLAN & PROFILE

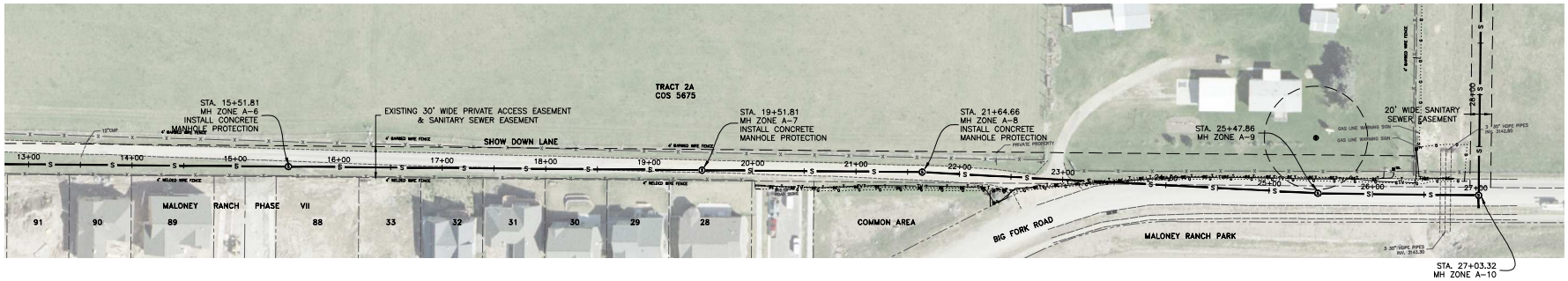
0+00 TO 13+00

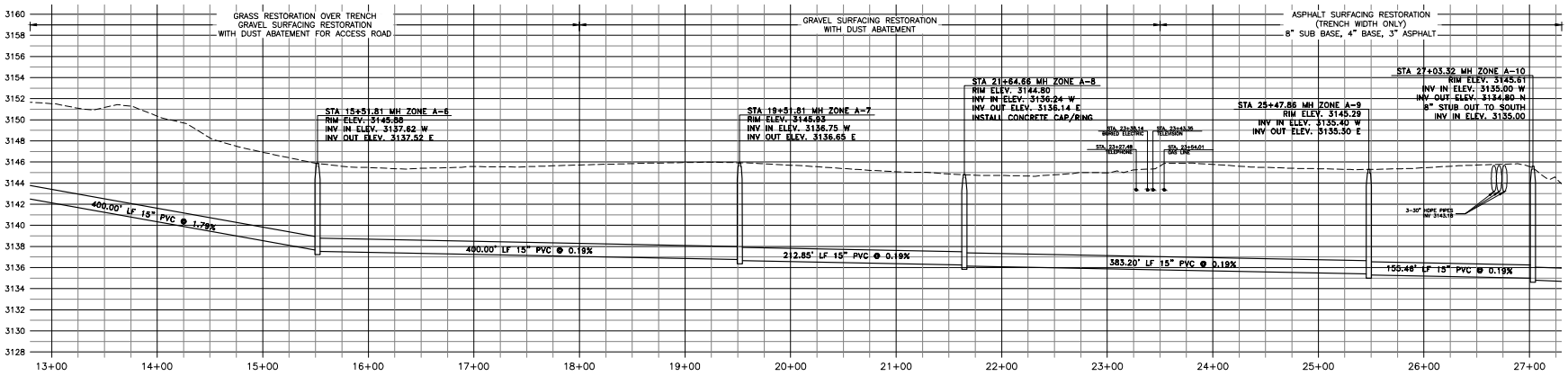
2

SHEET 2 OF 10

08-028(D & E)-2

P:\2015\6502-01 Lower Miller\Civil Project\Sewer\Zone A Lower Miller Creek Sewer\Sewer Prof1 6/1/11





RECORD DRAWING
BY: _____ DATE: _____

NOTE:
ALL MANHOLES SHALL HAVE POSITIVE DRAINAGE AWAY FROM MANHOLE IN ALL DIRECTIONS.

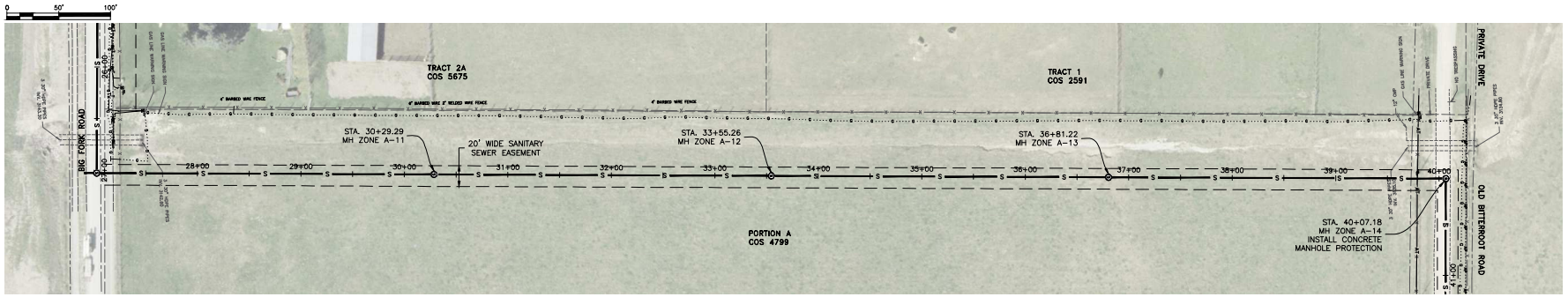
ZONE A SEWER EXTENSION
LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

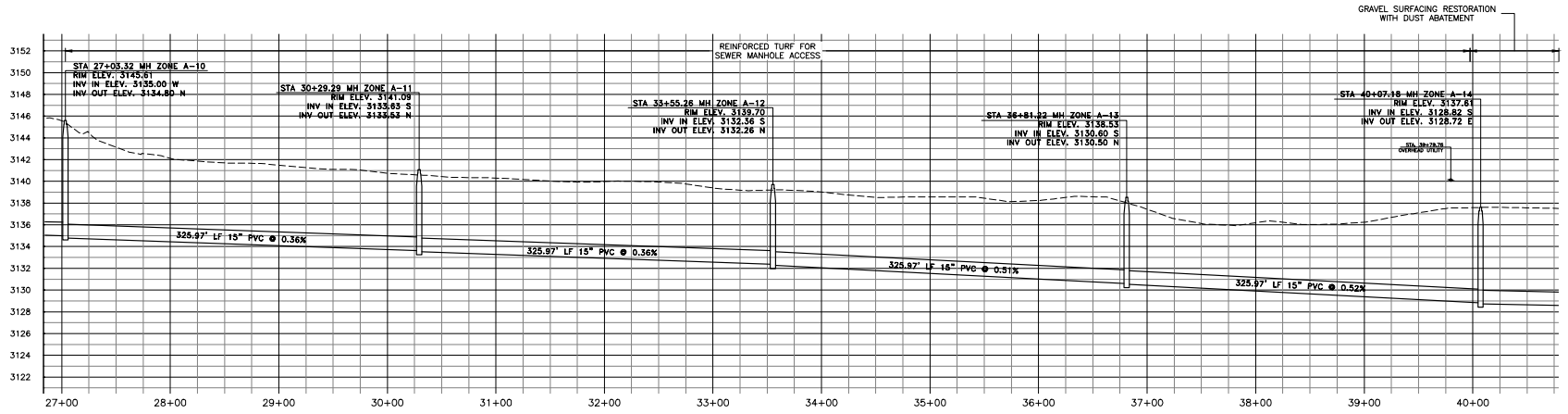
PLAN & PROFILE
13+00 TO 27+00

3

SHEET 3 OF 10

08-028(D & E)-3





RECORD DRAWING

BY: _____ DATE: _____

NOTE:

ALL MANHOLES SHALL HAVE POSITIVE DRAINAGE AWAY FROM MANHOLE IN ALL DIRECTIONS.

Professional Consultants Inc.

PROJECT #: 6502-01
DRAWN BY: JM
CHECKED BY: DJ

REVISION	DATE	DESCRIPTION
REVISION	2-26-13	1st SUBMITTAL
REVISION	3-14-13	RESUBMIT for CONSTRUCTION
REVISION	4-11-13	2nd SUBMITTAL
REVISION	4-16-13	LIFT STATION REVISIONS
REVISION	5-10-13	RESUBMIT
REVISION	5-15-13	LIFT STATION & SMC REVISIONS

ZONE A SEWER EXTENSION
LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

PLAN & PROFILE
27+00 TO 40+00

4

SHEET 4 OF 10

08-028(D & E)-4

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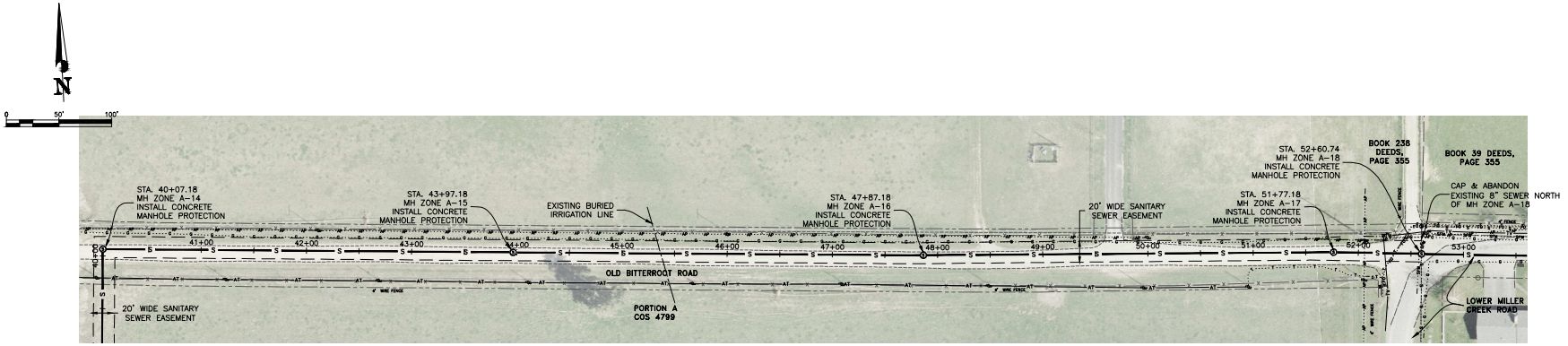
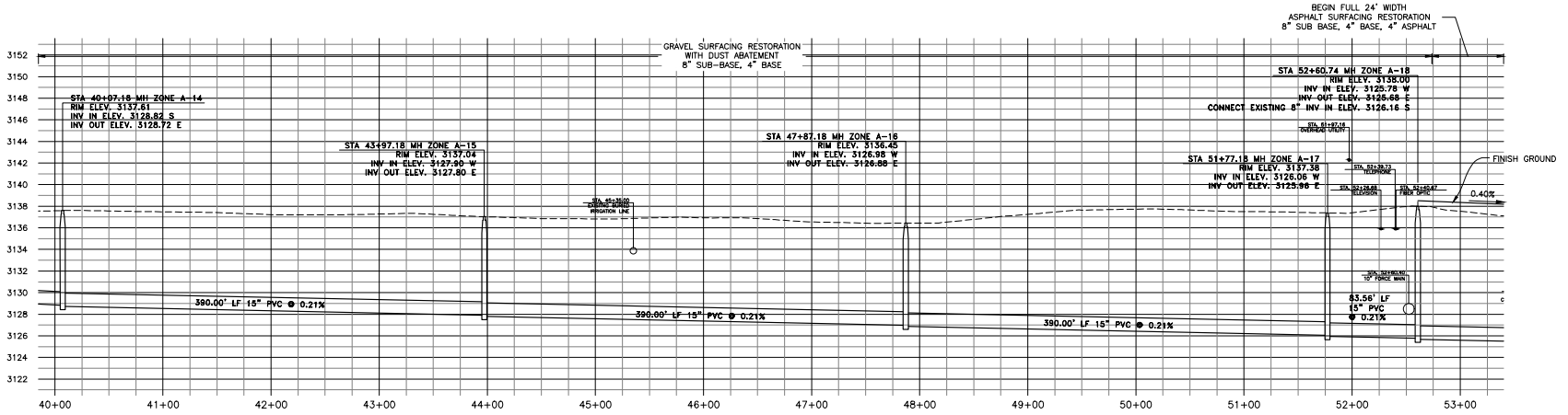




RECORD DRAWING

BY: _____ DATE: _____

NOTE:

ALL MANHOLES SHALL HAVE POSITIVE DRAINAGE AWAY FROM MANHOLE IN ALL DIRECTIONS.

STATION 39+95 TO 52+30, REFER TO MISSOULA COUNTY TRENCH DETAIL #401, WITH 8" DEPTH OF 3" MINUS CRUSHED SUB-BASE AND 4" DEPTH OF 3/4" MINUS CRUSHED BASE GRAVEL PLACED ON THE PREPARED SURFACE. PER MISSOULA COUNTY PUBLIC WORKS MANUAL, SECTION 2.9, #2.

Professional Consultants Inc.

PROJECT #: 6502-01
DES #:
ZONING: N/A
SURVEYED: 3-26-10
DESIGNED: RM
DRAWN: DJ/SG
CHECKED: 1M JUSTIN
REVISION: 3-26-10 1M JUSTIN
REVISION: 3-31-10 DELIVERED FOR CONSTRUCTION
REVISION: 4-14-10 1M JUSTIN
REVISION: 4-14-10 LIFT STATION REVISIONS
REVISION: 4-15-10 1M JUSTIN
REVISION: 8-13-10 LIFT STATION & SPEC REVISIONS

ZONE A SEWER EXTENSION
LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

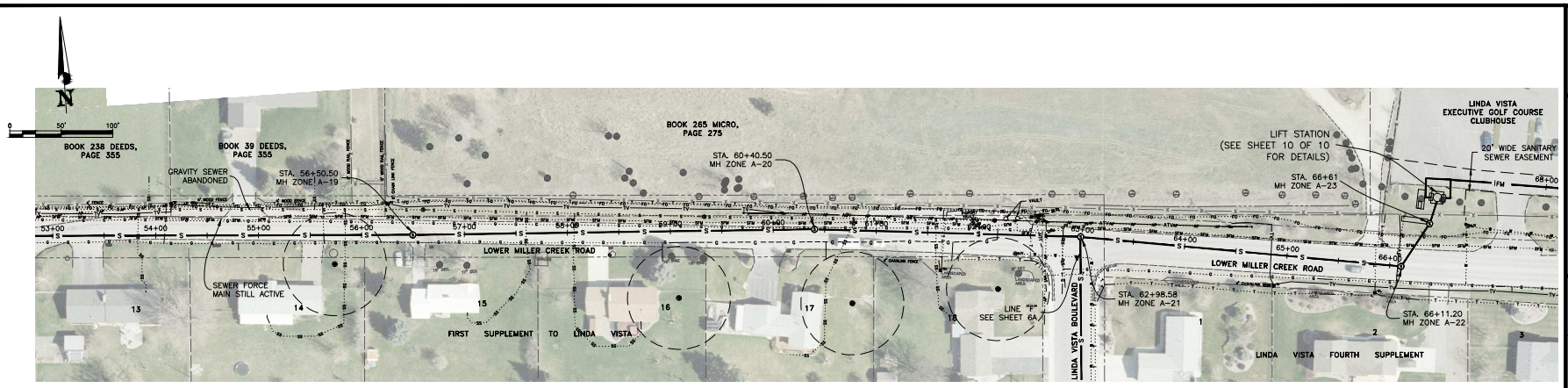
PLAN & PROFILE
40+00 TO 53+00

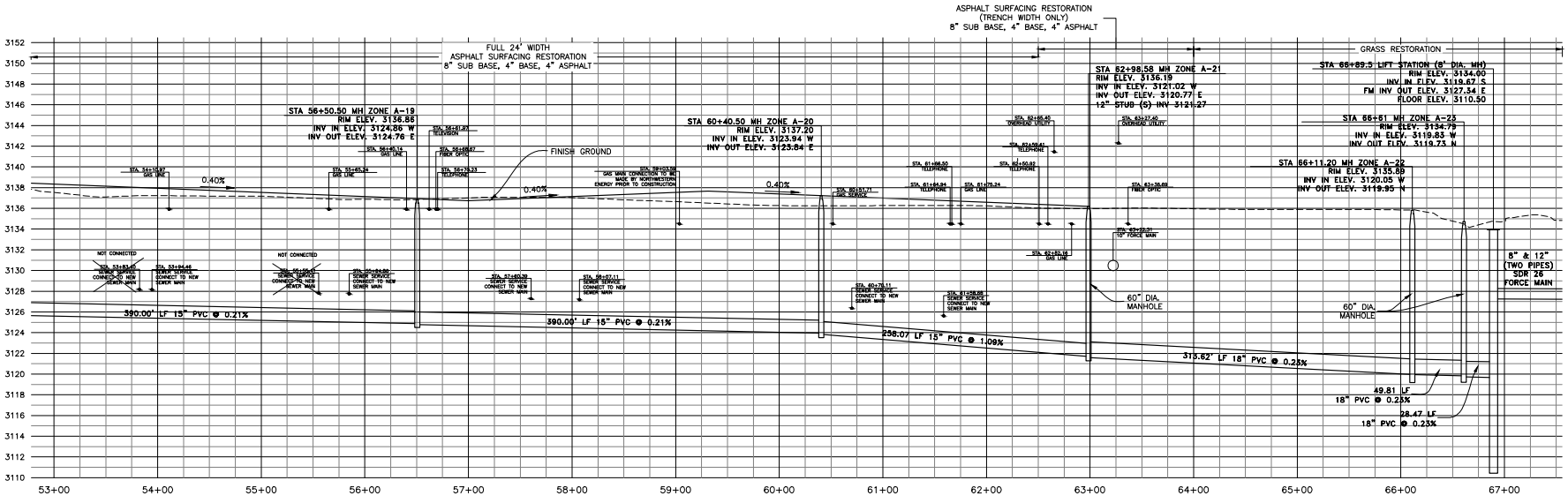
5

SHEET 5 OF 10

F:\2007\6502-01 Lloyd Tahkenyah PROJECT\SEWER\ZONE A LOWER MILLER CREEK SEWER\SEWER PHP5 6/21/11

08-028(D & E)-5





RECORD DRAWING

BY: _____ DATE: _____

NOTE:

ALL MANHOLES SHALL HAVE POSITIVE DRAINAGE AWAY FROM MANHOLE IN ALL DIRECTIONS.

STATION 40+00 TO 67+00, REFER TO MISSOULA COUNTY TRENCH DETAIL #401, WITH 8" OF 3" MINUS CRUSHED SUB-BASE AND 4" OF 3/4" MINUS CRUSHED BASE GRAVEL PLACED ON THE PREPARED SURFACE. PER MISSOULA COUNTY PUBLIC WORKS MANUAL, SECTION 2.9, #2.

Professional Consultants Inc.
1713 BRIDGE, P.O. BOX 7078
MISSOULA, MONTANA 59807
(406) 721-4830 FAX 721-4835

PROJECT #: 6502-01

DESIGN	DRAWN	CHECKED	REVISION	DATE	INITIALS
			REVISION	3-15-16	LM SUBMITTAL
			REVISION	3-16-16	RELEASED FOR CONSTRUCTION
			REVISION	4-14-16	LIFT STATION REVISIONS
			REVISION	4-25-16	MANHOLE A-1 SHEET REVISIONS

ZONE A SEWER EXTENSION

LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M., MISSOULA COUNTY, MONTANA

PLAN & PROFILE

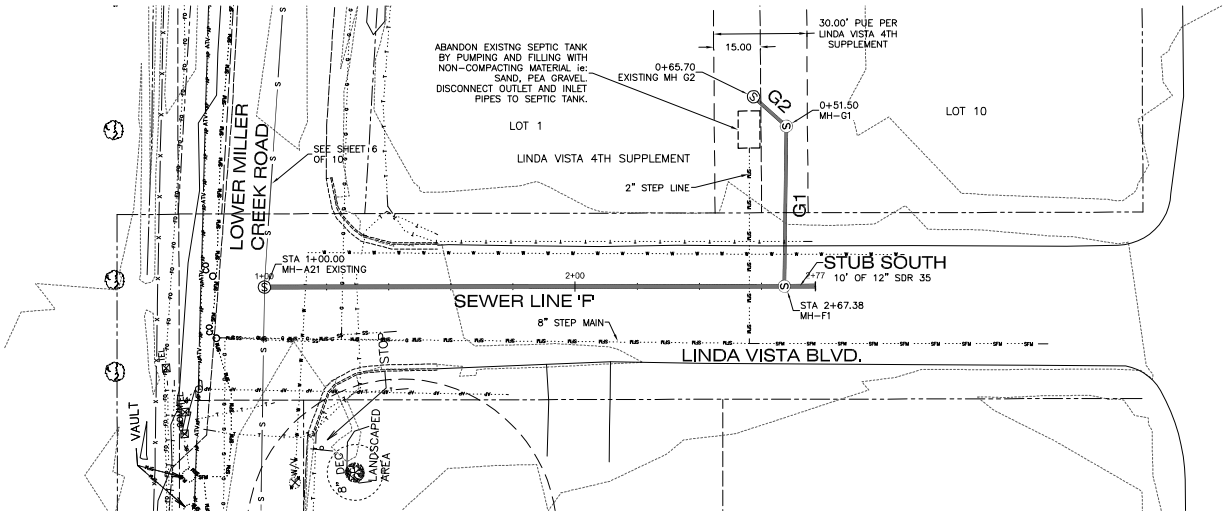
53+00 TO 67+00

6

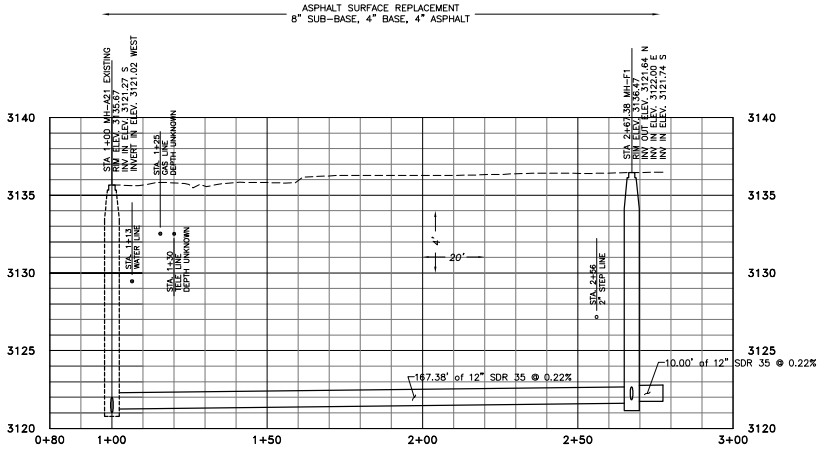
SHEET 6 OF 10

F:\2001\6502-01 Lmp Tahe\engr\ PROJECT\SEWER\ZONE A LOWER MILLER CREEK SEWER\SEWER PNP1 9/21/11

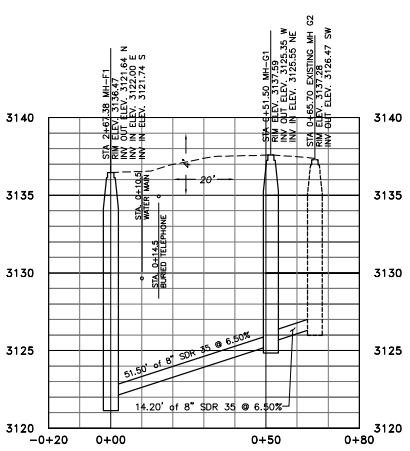
08-028(D & E)-6



NOTES:
1. RESTORE AFFECTED SURFACES OUTSIDE OF ASPHALT TO ORIGINAL CONDITION.
2. CITY TO PUMP THE SEPTIC TANK AND REMOVE THE PUMPS, CONTROLS AND OTHER SALVAGE ITEMS PRIOR TO THE ABANDONMENT OF THE SEPTIC TANK.



SEWER LINE F



SEWER LINE G

08-028(D & E)-7

RECORD DRAWING
BY: _____ DATE: _____

Professional Consultants Inc.
3115 E. BROADWAY, P.O. BOX 1750, HELENA, MONTANA 59624
(406) 443-3962 FAX (406) 443-3974
1713 NORTH FRONT STREET, HAMILTON, MONTANA 59840
(406) 363-3500 FAX (406) 363-3515

PROJECT #: 6825-01
DESIGN: RBC
DRAWN: RBC
CHECKED:
DATE: 8/29/05

REVISION	DATE	DESCRIPTION OF LINE "F" STUB TO SOUTH
REVISION	1-31-06	ADDED 6 LOTS TO LINE "F" STUB TO SOUTH
REVISION	2-01-11	REMOVE EX. SEPTIC TANK
REVISION		
REVISION		
REVISION		

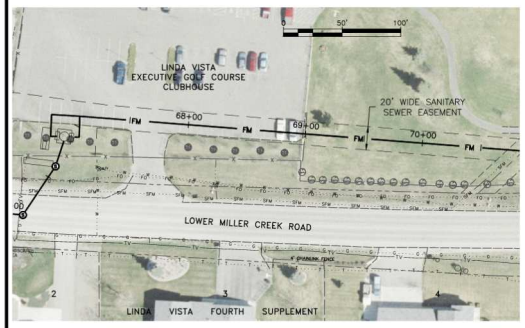
DEQ #:

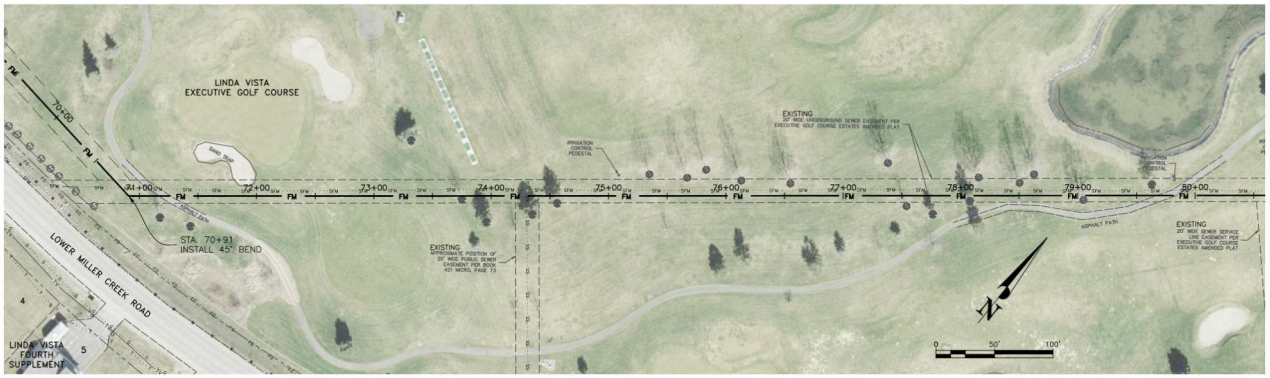
SEWER LINES 'F' & 'G'
LOWER MILLER CREEK
LOCATED IN SEC. 12, T.12N., R.20W., P.M.M.
MISSOULA COUNTY, MONTANA

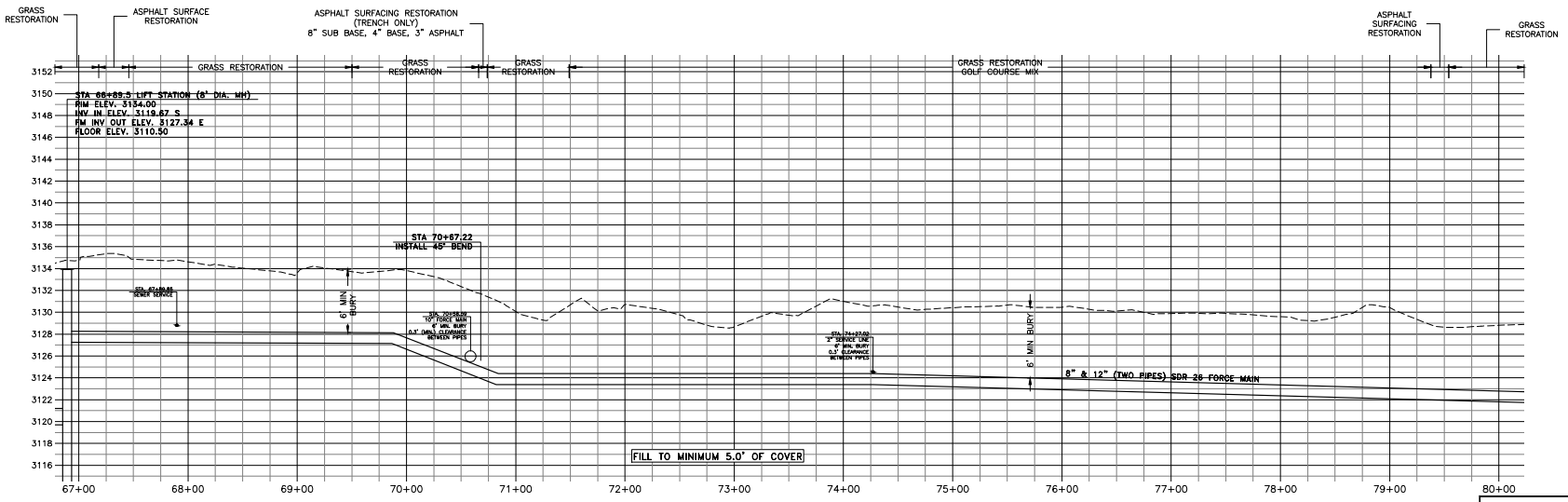
PLAN & PROFILE
SEWER 'F' & 'G'

6A

SHEET 6A OF 10







RECORD DRAWING
BY: _____ DATE: _____

Professional Consultants Inc.
1713 BOW VALLEY TRAIL
BILLINGS, MT 59102
(406) 652-6314 (FAX)
(406) 652-3633
1713 BOW VALLEY TRAIL
P.O. BOX 1238
BILLINGS, MONTANA 59103-1238
(406) 652-6314 (FAX)
(406) 652-3633

DESIGNED: JDK	DRAWN: JDK	CHECKED: RM	APPROVED: RM
DATE: 6/21/11			
REVISIONS: 8-26-15 1st SUBMITTAL			
REVISIONS: 9-18-15 RESUBMIT FOR CONSTRUCTION			
REVISIONS: 4-14-16 LIFT STATION REVISIONS			
REVISIONS: 4-14-16 LIFT STATION REVISIONS			
REVISIONS: 4-15-16 LIFT STATION & MPC REVISIONS			

DRG #: 1502-01

ZONE A SEWER EXTENSION
LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

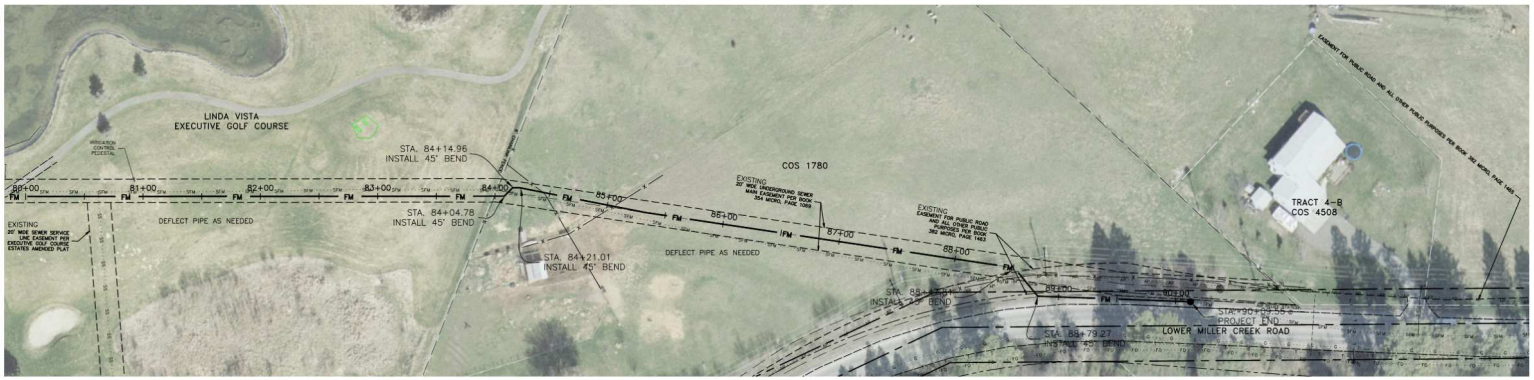
PLAN & PROFILE
67+00 TO 80+00

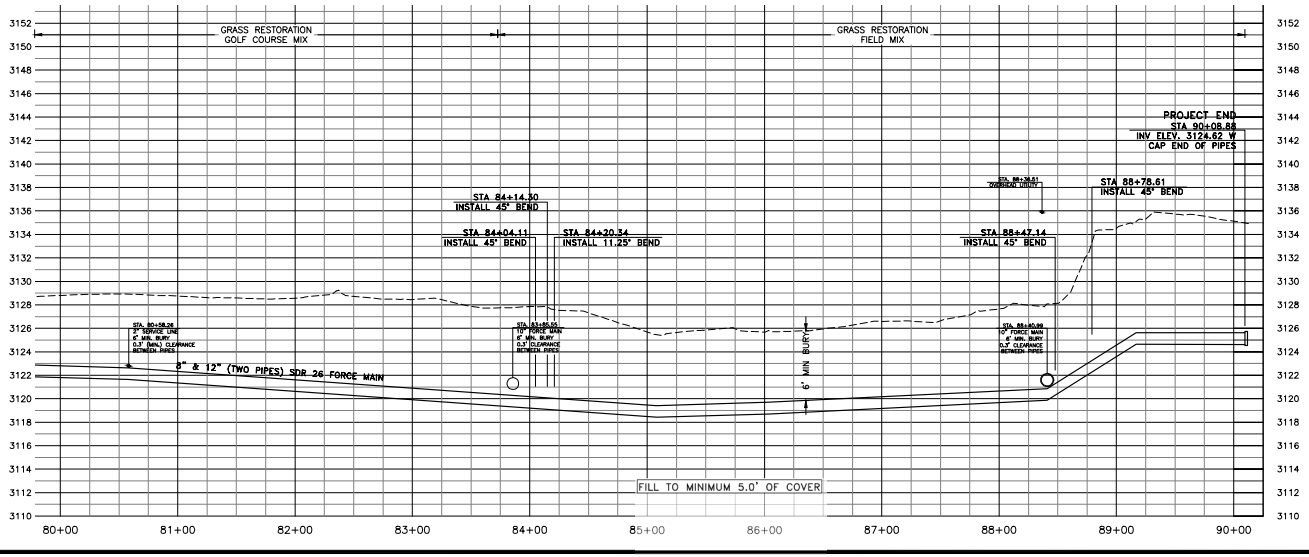
7

SHEET 7 OF 10

08-028(D & E)-8

P:\2011\1502-01 Lloyd Tuhy\dwg\x\ PROJECT\SEWER\ZONE A LOWER MILLER CREEK SEWER\SEWER PHP1 6/21/11





RECORD DRAWING
BY: _____ DATE: _____

Professional Consultants Inc.
Engineers, Planners, Surveyors
2111 MILL ST. #100
P.O. BOX 7814
MISSOULA, MT 59807-7814
(406) 721-4925 (PH)
(406) 721-4932 (FAX)

PROJECT #: 6502-01
DRAWN BY: JMC
CHECKED BY: MJ
APPROVED BY: MJ

DATE	REVISION
2-26-15	1st SUBMITTAL
3-16-15	RESUBMIT FOR CONSTRUCTION
4-14-15	1st BOOK REVIEWS
4-16-15	LIFT STATION REVISIONS
4-17-15	2nd BOOK REVIEWS
4-18-15	LIFT STATION & MHE REVISIONS

ZONE A SEWER EXTENSION

LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

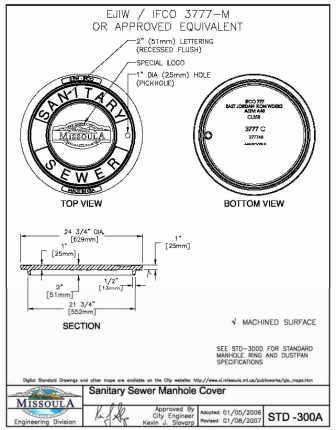
PLAN & PROFILE
80+00 TO 90+00

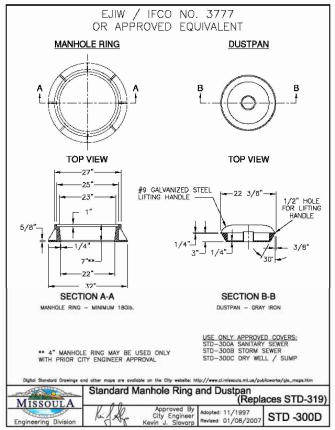
8

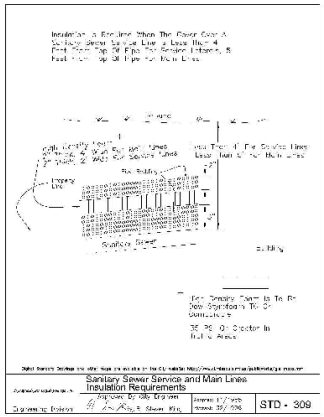
SHEET 8 OF 10

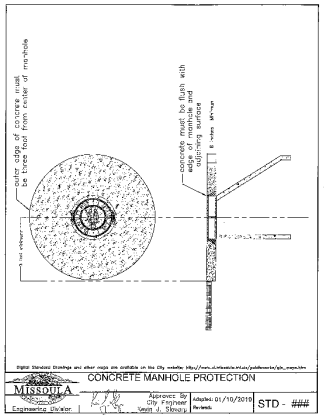
08-028(D & E)-9

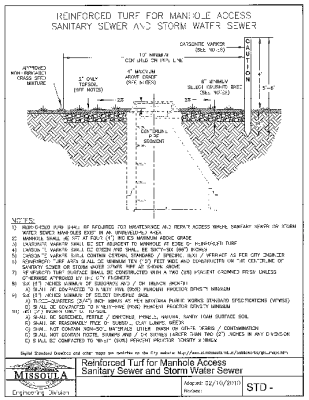
P:\2015\6502-01 Lower Miller\civil PROJECT\SEWER\ZONE A LOWER MILLER CREEK SEWER\SEWER PHP1 6/21/11

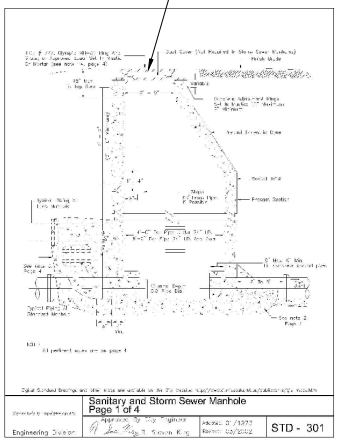


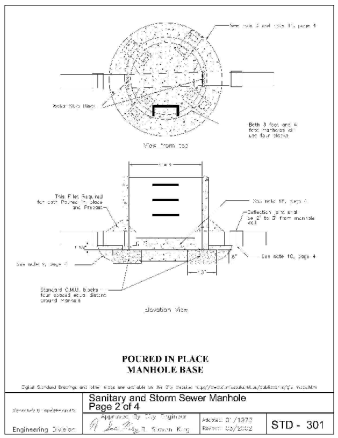


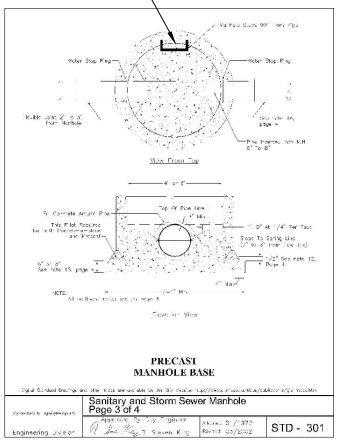


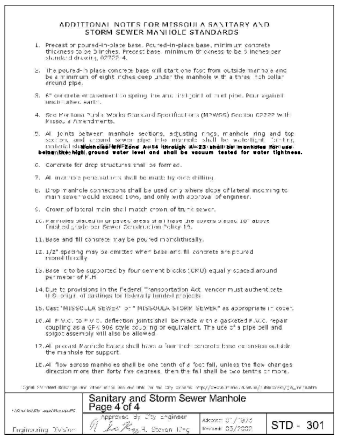










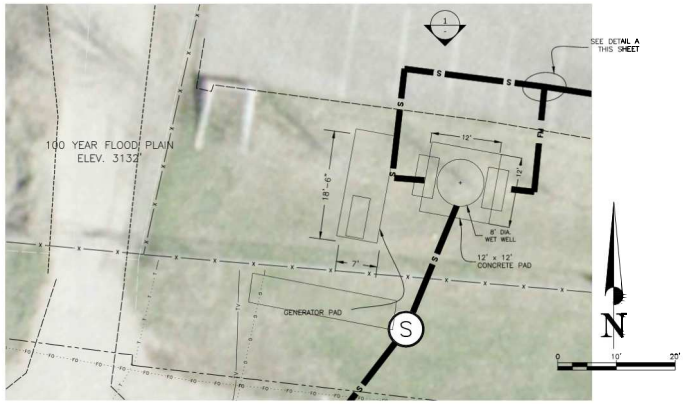


RECORD DRAWING
BY: _____ DATE: _____

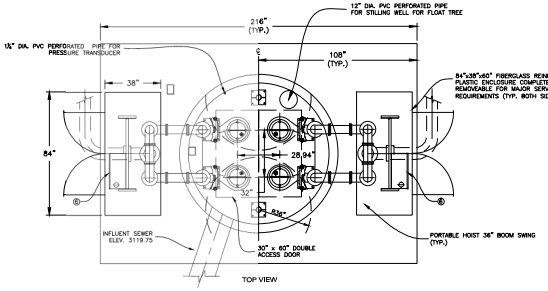
F:\2001\6525-01 Lloyd Tebb\dwg\R PROJECT\SEWER\ZONE A LOWER MILLER CREEK SEWER\COVER SHEET(6/21/11

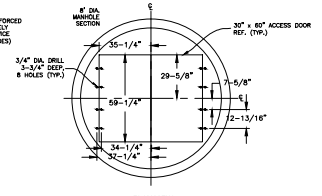
PROJECT #: 6525-01
DRG #:
ZONE A LOWER MILLER CREEK SEWER EXTENSION
LOCATED IN SEC 1, 11 & 12 OF T.12N., R.20W., P.M.M., MISSOULA COUNTY, MONTANA
SEWER DETAIL
9
SHEET 9 OF 10

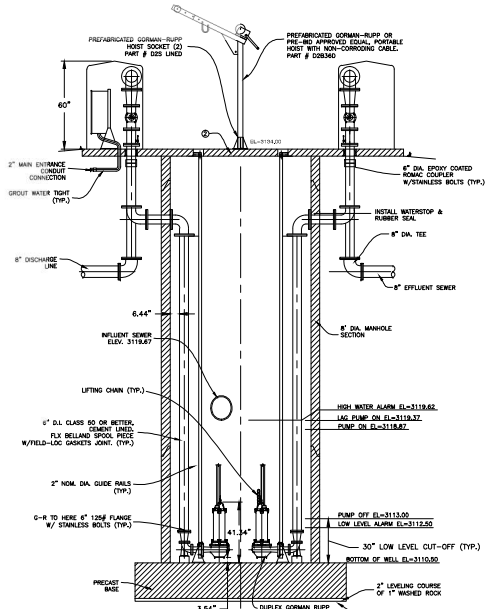
08-028(D & E)-10

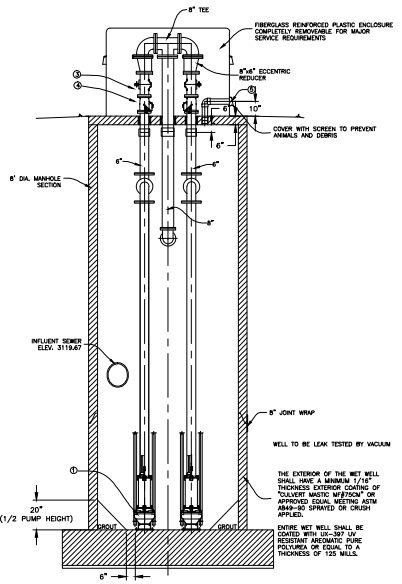


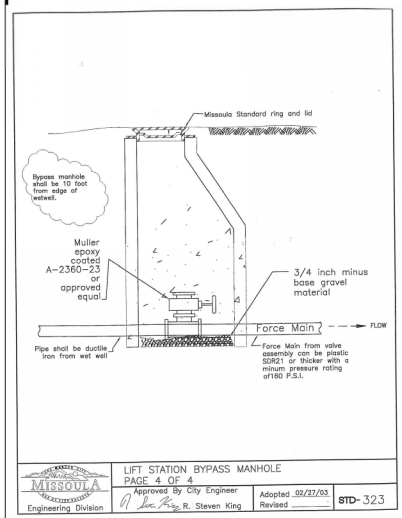
AS-BUILT PHOTO

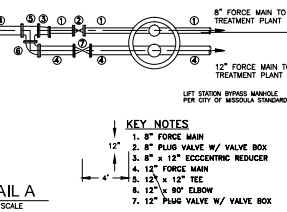












KEY NOTES
1. 8" FORCE MAIN
2. 8" PLUG VALVE W/ VALVE BOX
3. 8" x 12" ECCENTRIC REDUCER
4. 12" FORCE MAIN
5. 12" x 12" TEE
6. 12" x 90° ELBOW
7. 12" PLUG VALVE W/ VALVE BOX

LIFT STATION DETAIL

NO SCALE

ITEM	DESCRIPTION	MAT'L & SIZE
1	PUMP	CAST IRON
2	BASE	CAST CONCRETE
3	PLUG VALVE	CAST IRON 6"
4	CHECK VALVE	CAST IRON 6"
5	WETWELL VENT	PVC 4"
6	CONTROL PANEL	STEEL

RECORD DRAWING
BY: _____ DATE: _____

NOTES
ALL VALVES, FITTINGS AND APPURTANCES SHALL BE FUSION COATED OF A NOMINAL 10 MIL THICKNESS PROTECTING ALL INTERIOR AND EXTERIOR IRON SURFACES AND COMPLIES FULLY WITH AWWA C550 AND IS CERTIFIED TO NSF 61 OR APPROVED EQUAL.

INTERNAL PIPING SHALL BE CONNECTED BY FLANGE TO FLANGE PIPING.

ADD PIPE FOR STILLING WELL ON FLOATS AND PRESSURE TRANSDUCER.

PROJECT #: 6502-01
DRAWN BY: JM
CHECKED BY: RM
DATE: 3-26-15
REVISIONS:
3-26-15 1st SUBMITTAL
4-14-15 RESUBMIT FOR CONSTRUCTION
4-16-15 BID SET
4-16-15 LIFT STATION REVISIONS
4-20-15 BID SET
4-28-15 LIFT STATION & SPEC REVISIONS

Professional Consultants Inc.
Engineering • Surveying • Planning
1717 SOUTH 3RD STREET
MISSOULA, MONTANA 59801
(406) 721-4952 (406) 543-7313
FAX (406) 543-2463

ZONE A SEWER EXTENSION
LOWER MILLER CREEK
LOCATED IN SEC. 1, 11 & 12 OF T.12N., R.20W., P.M.M.,
MISSOULA COUNTY, MONTANA

LIFT STATION DETAILS

10

SHEET10 OF 10

08-028(D & E)-11

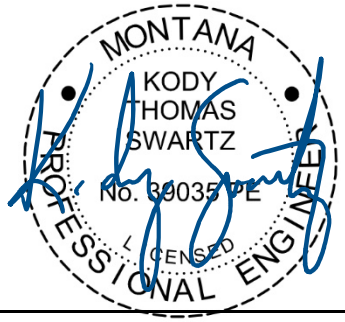
RIVERFRONT TRAILS

Preliminary Storm Drainage System Design Report

Missoula, Montana

CERTIFICATION

I hereby state that this Preliminary 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 within the standard accepted practices, and in accordance with the Missoula City Public Works Standards and Specifications Manual.



July 15, 2022

Approved By *Date*

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1. INTRODUCTION

Tollefson Properties, LLC. proposes subdividing the 92.73-acre parcel described as Tract 1 of C.O.S. 6449, Section 2, Township 12 North, Range 20 West, Principal Meridian Montana in Missoula County into 176 single-family, religious assembly, and senior living residential lots with a Neighborhood Character Overlay (/NC-RT). The proposed subdivision will include new streets, sidewalks, water and sanitary sewer utilities, and electrical and communication services to serve the proposed lots. The property is currently undeveloped. The purpose of this report is to provide a general overview of the storm drainage system design concepts, preliminary sizing of basins and piping, post-construction best management practices, and methodologies.

A. Location

The proposed subdivision is located along Old Bitterroot Road, east of Lower Miller Creek Road. Lower Miller Creek Road is classified as a major collector, and Old Bitterroot Road is classified as an urban collector. The subdivision will be served by the network of urban local streets, neighborhood streets, and alleys shown on the Preliminary Plat.

The Bitterroot River is located along the northwestern boundary of the proposed subdivision. The parcels adjacent to the proposed subdivision include agricultural, residential, and civic land uses, with adjacent zoning districts including R-20, R215, C-RR1 Residential, and OP-3 Public Lands and Institutional. Jeannette Rankin Elementary School is located immediately to the southwest, and the Linda Vista, Blue Acreage Tracts, and Maloney Ranch subdivisions all share boundaries with Riverfront Trails.

B. Description of Property

The existing 92.73-acre parcel consists primarily of meadow ground cover, with smooth brome pasture grass in good condition. The portions of the property immediately adjacent to the Bitterroot River contain black cottonwood/red-osier dogwood and spruce/red-osier dogwood riparian habitat types. The existing land use is vacant land, with historic agricultural usage for grazing and hay production. The land slopes on the property are minimal, generally ranging from 0.5% - 5% with the exception of the banks of the main Bitterroot River channel. The Bitterroot River serves as the primary receiving channel for runoff from the parcel. Approximately half of the parcel is subject to inundation by the 1% annual chance flood (100-year floodplain), shown on FEMA Flood Insurance Rate Map panel 30063C1455E. There are no existing irrigation ditches on the property. There are no major geologic or topographic limitations on the property which may limit the capability for building or excavation of storm drainage facilities using ordinary and reasonable construction techniques.

Existing drainage facilities on the property include a large open-channel swale, which conveys the outfall from the Maloney Ranch storm drainage system. The swale runs within a public storm drainage easement described on page 1924 of book 564 of Micro Records, recorded by the Missoula County Clerk and Recorder. This public storm drainage easement is depicted on the preliminary plat of Riverfront Trails, and the swale contained within will not be impacted by the

Riverfront Trails project, with the exception of replacement of the culverts conveying flows beneath Old Bitterroot Road.

C. Previous Drainage Studies

There are no previous drainage studies for the subject property. For reference, details of the contributing flows to the existing drainage channel which crosses the property are included in the Maloney Ranch and Teton Addition storm drainage reports. The grading and drainage plans for the adjacent Jeannette Rankin Elementary school were referenced to ensure continuity between the two projects.

D. General Project Description

The proposed subdivision and Neighborhood Character Overlay will create 176 residential, religious assembly, and senior living residential lots, in addition to a large tract of open space adjacent to the Bitterroot River. The development will create approximately 31.04 acres of residential lots, 15.34 acres of streets and roads, and 46.35 acres of open space and common area. The development will include 174 single-family residences, a religious assembly facility, a 5-unit townhome, and 110 senior living apartments. Lot 1 will contain the senior living facility, and Lot 2 will contain the religious assembly development. The subdivision will be served by the network of urban local streets, neighborhood streets, and alleys depicted on the preliminary plat. The proposed storm drainage system will include lot grading, street and gutter flow, underground piping, and an extended detention stormwater wetland. In addition, provisions have been made in the proposed system to receive flows from the City of Missoula's Lower Miller Creek Road improvements project.

Due to the presence of high seasonal groundwater across portions of the project site, the proposed storm drainage system primarily consists of piped storm drainage. Due to its location west of the existing drainage swale, the drainage system serving Phase 3 will be separate from the rest of the system, with its own extended detention wetland. Provisions will be made for Lot 1 and Lot 2, the proposed religious assembly and senior living developments, to discharge to the piped storm drainage system at the pre-developed flow rates for their parcels. These provisions are discussed in Section 4A of this report.

E. Local and State Regulations

The project is regulated under The Missoula City Public Works Standards and Specifications Manual, Chapter 6 – Storm Water System, and the Montana Department of Environmental Quality, Circular 8, Montana Standards for Subdivision Storm Drainage.

F. Geotechnical Investigation

A geotechnical investigation of the property has been completed by Lorenzen Soil Mechanics, Inc. It is dated March 8, 2021 and included in the Subdivision Application submittal for the project.

2. EXISTING SITE CONDITIONS

A. Major Basin Description

The proposed subdivision is located within the drainage basin of the Bitterroot River. The river's major drainage basin drains 2,889 square miles in Missoula and Ravalli counties. The Bitterroot River and its tributaries are snowmelt dominated systems which exhibit large variations in streamflow during a typical year. Stream flows in the Bitterroot River typically begin rising in early April, peak in early June, and recede to baseflow levels by the middle of July [1]. Discharge data for the USGS streamflow monitoring station no. 12352500 is available dating to 2007, respectively, and shown in Figure 1. The Bitterroot River discharge, and consequently, gauge height, is an important consideration in the design of the Riverfront Trails storm drainage system, with further discussion in Section 4 of this report.

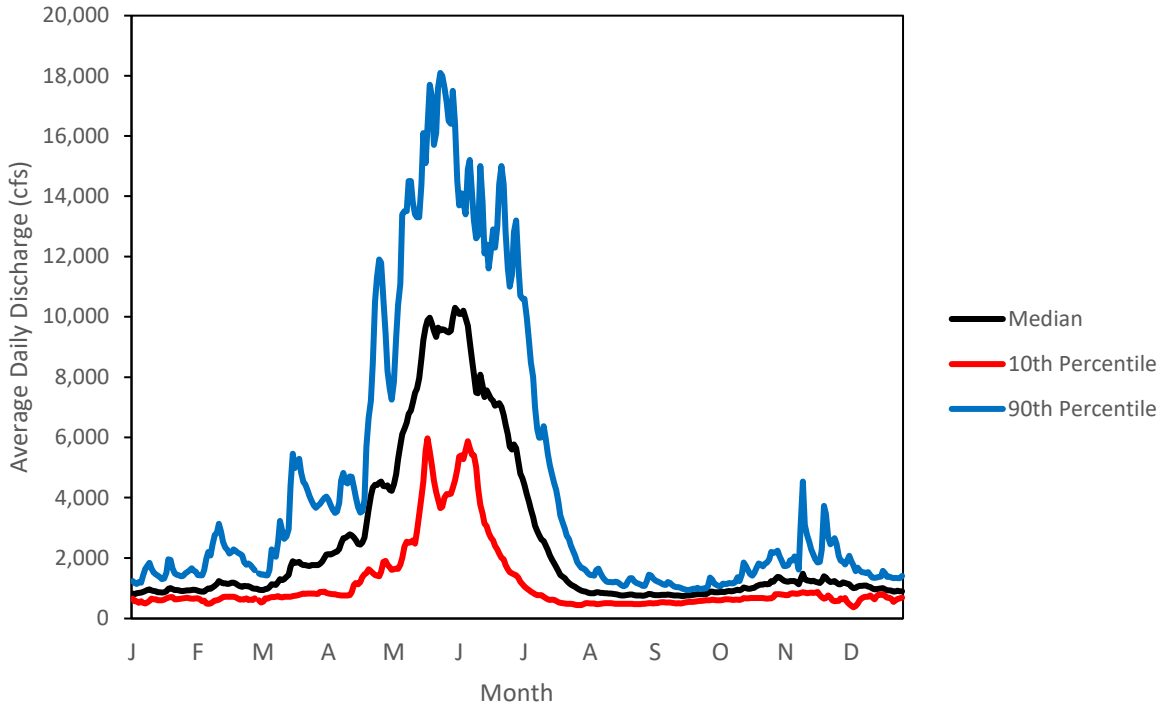


Figure 1. Average annual hydrographs for the Bitterroot River above the Clark Fork confluence, 2007-2021.

According to the Clark Fork Coalition's 2017 Bitterroot Watershed strategy, the Bitterroot watershed supports an abundant population of fish and wildlife, but degraded water quality has detrimentally impacted the native trout species in the basin. The top three water quality issues in the Bitterroot are (1) dewatering, (2) high water temperature, and (3) sediment [1]. The design of the Riverfront Trails storm drainage system must consider temperature and sediment pollutants in accordance with the Montana Department of Environmental Quality's MS4 Municipal Separate Storm Sewers permit, with further discussion in Section 5 of this report.

B. Sub-basin Description

The drainage sub-basin includes 92.73 acres of presently undeveloped land which has historically been used for agriculture. Drainage across the property generally flows from southeast to northwest, where overland flows enter the Bitterroot River. A significant portion of the property north of Old Bitterroot Road lies within the 100-year floodplain of the Bitterroot River, with a long, gentle step in the land providing a visual demarcation of the approximate floodplain boundary. The sub-basin does not contain any natural drainage channels, with stormwater primarily being conveyed through sheet flow and infiltration. The drainage outfall from the Maloney Ranch Subdivision crosses the western portion of the property prior to its confluence with the Bitterroot River. This channel will not be disturbed or altered, with the exception of replacement of the culverts conveying it beneath Old Bitterroot Road. Additional offsite flows across the property are limited to potential outfall from the City of Missoula's Lower Miller Creek Road improvements project, further discussed in Section 4 of this report.

The existing land cover can be classified as non-grazed meadow under the Soil Conservation Service (SCS) TR-55 methodology. According to the NRCS Soils Survey, the soils on the property are within hydrologic soil group (HSG) D. However, due to the flat topography of the site providing additional opportunity for pre-developed runoff to infiltrate, the existing soils are assumed to be in HSG C for the purpose of analyzing the pre-developed discharges. Therefore, a curve number (CN) of 71 is selected for the existing drainage sub-basins. The pre-developed values are calculated separately for the 37.19 acres that will be disturbed by the project east of the existing drainage swale and the 5.84 acres disturbed for Phase 3 west of the swale. The time of concentration (TOC) for the respective pre-developed basins are shown in **Error! Reference source not found.** and Table 2.

Table 1. Parameters for calculation of the pre-developed time of concentration (eastern basin, Phase 1A, 1, and 2).

Sheet Flow		Shallow Concentrated Flow	
Roughness	0.13	Length	500 ft.
Length	300 ft.	Slope	1%
Slope	1%	Surface Type	Shortgrass Pasture
Rainfall	1.17 in.	Velocity	0.7 ft/s
Time	45.92 min.	Time	11.91 min.

Table 2. Parameters for calculation of the pre-developed time of concentration (western basin, Phase 3).

Sheet Flow		Shallow Concentrated Flow	
Roughness	0.13	Length	400 ft.
Length	150 ft.	Slope	1%
Slope	1%	Surface Type	Shortgrass Pasture
Rainfall	1.17 in.	Velocity	0.7 ft/s
Time	26.37 min.	Time	9.52 min.

The pre-developed discharges to the Bitterroot River are shown in Table 3. The potential post-developed discharge rate from the City's Lower Miller Creek Road upgrades is included as a pass-through flow rate in the eastern basins. The flow rates shown in Table 3 were provided by WGM Group.

Table 3. Pre-developed runoff volumes, infiltration volumes, and discharge rates for the pre-developed conditions (eastern basin, Phase 1A, 1, and 2).

Design Storm	Runoff Volume (FT^3)	Peak Runoff Flow Rate (CFS)	Infiltration Volume (FT^3)	Offsite Pass-through (CFS)	Allowable Peak Surface Discharge (CFS)
2-year, 24-hour	3,790	0.11	154,170	3.75	3.86
10-year, 24-hour	19,471	1.44	204,659	5.81	7.25
100-year, 24-hour	52,090	5.84	255,689	8.38	17.65

Table 4. Pre-developed runoff volumes, infiltration volumes, and discharge rates for the pre-developed conditions (western basin, Phase 3).

Design Storm	Runoff Volume (FT^3)	Peak Runoff Flow Rate (CFS)	Infiltration Volume (FT^3)	Offsite Pass-through (CFS)	Allowable Peak Surface Discharge (CFS)
2-year, 24-hour	394	0.01	15,993	n/a	0.01
10-year, 24-hour	2,020	0.22	21,231	n/a	0.22
100-year, 24-hour	5,404	0.85	26,524	n/a	0.85

According to the City of Missoula Public Works Standards and Specifications, the developed storm drainage system must release the post-development storm water from the project site at pre-developed peak flow rates for each storm event. Therefore, the allowable peak discharge to the Bitterroot River for each of the 2-year, 10-year, and 100-year events are shown in the tables above.

C. Groundwater

During the project geotechnical investigation, a slotted 1-1/2" diameter PVC pipe was installed in five of the boreholes as a piezometer. The depth to groundwater was measured in September 2020 and June 2021. The measured depths to groundwater are shown in Table 5.

Table 5. Depths to high seasonal ground water table.

Borehole	Initial Depth to Groundwater (September 9, 2020)	Depth to High Seasonal Groundwater (June 1 or 7, 2021)
BH-01	16' - 0"	Not measured - Borehole filled
BH-02	12' - 1"	6' - 10"
BH-04	13' - 2"	8' - 2"
BH-06	12' - 0"	10' - 8"
BH-08	14' - 6"	12' - 2"
BH-09	13' - 0"	10' - 10"

The depths to groundwater were used to verify whether sumps are feasible for stormwater management on the project site. The City of Missoula Public Works Standards and Specifications require four feet of vertical separation from the bottom of a proposed infiltration facility to the

seasonal high groundwater table. Thus, a standard 8-foot dry well with 2 feet of drain rock requires a minimum of 14-foot clearance between the finished grade and the water table.

Sheet C6.11 in Appendix 1 shows the piezometer locations and depths to the seasonal high groundwater table. Lot 1 has adequate separation from groundwater for sumps to be utilized across most of the future development, if desired. The rest of the development will discharge to underground piping, an extended detention stormwater wetland, and the Bitterroot River.

D. Waterways and Wetlands

Wetlands are not present on the subdivision parcel. According to the National Wetlands Inventory, there may be a 0.88-acre Freshwater Forested/Shrub Wetland located in the Bitterroot River channel adjacent to the subdivision parcel, outside the subdivision property boundary. This area will not be disturbed by construction and will be adjacent to the proposed Open Space tract.

The proposed storm drainage system will include outfalls to the Bitterroot River. Proposed post-construction stormwater quality controls are discussed in Section 5 of this report. A Riparian Management Plan is included within the subdivision application packet for Riverfront Trails.

3. STORM WATER DESIGN CRITERIA

A. Design Concepts

This report will analyze the following specific design goals:

- Provide a piped storm drainage system and adequate detention storage to release the post-development storm water from the subdivision at pre-developed peak flow rates for the 2-year, 10-year, and 100-year storm events, respectively.

- Ensure the first half-inch of runoff from all impervious surfaces discharging to the piped storm drainage system is treated onsite using post-construction storm water management controls expected to remove 80 percent total suspended solids (TSS) and provide moderation of temperature in the BMPs.

- Provide provisions for management of offsite flows from the outfall of the Lower Miller Creek Road upgrades project.

B. Drainage Criteria

The application standard for the proposed subdivision is the Missoula City Public Works Standards and Specifications Manual. The project must also comply with the Montana Department of Environmental Quality Circular 8, Montana Standards for Subdivision Storm Drainage.

This report will include analysis of the 2-year, 10-year, and 100-year rainfall events. The design storm depths, shown in Table 6, are based on the 24-hour storm duration at the Missoula International Airport as published in MDT Hydraulics Manual Chapter 7, Appendix B.

Table 6. Rainfall depths per design storm return period [2] [3].

	2-YEAR, 24-HOUR STORM	10-YEAR, 24-HOUR STORM	100-YEAR, 6-HOUR STORM	100-YEAR, 24-HOUR STORM
Depth (inches)	1.17	1.66	1.53	2.28

Design storms were created using SCS synthetic hydrographs. The Type II distribution is a typical time distribution from rainfall records in Montana, however, Type I and Type IA distributions can be appropriate for certain parts of Montana. The appropriate distribution was determined by comparing the 6-hour rainfall total to the 24-hour rainfall total [3]:

$$\frac{P_6}{P_{24}} = \frac{1.53}{2.28} = 0.67$$

If P_6/P_{24} ranges between 0.518 and 0.639, the Type I distribution should be selected. The Type II distribution should be selected for all values between 0.640 and 0.767 [3]. Therefore, the SCS Type II storm was selected as the design storm for this project. The design storm hyetograph for each of the 2-year, 10-year, and 100-year design storms were prepared using the SCS dimensionless rainfall distribution and the rainfall depths shown above.

The runoff calculations are performed using the SCS Curve Number Method within the Autodesk Storm and Sanitary Analysis software. The time of concentration is calculated using the SCS TR-55 Method. In general, the most accurate results using the SCS curve number method are obtained when each subbasin is homogenous. The proposed extended detention basins were modelled in Autodesk Storm and Sanitary Analysis using stage-storage relationship curves.

4. PROPOSED DESIGN

A. Subbasin Hydrology

The analysis of the proposed storm drainage system begins with an analysis of the hydrology of each sub-basin contributing flows to an individual inlet or sump. This section provides an overview of the input assumptions and hydrology results from Autodesk Storm and Sanitary Analysis (SSA). As outlined in previous sections of this report, the project will be divided into two zones, one draining to shallow infiltration sumps and one draining to a piped system and the Bitterroot River. All curve number calculations assume the underlying soils are in hydrologic soil group D. The proposed subbasins are shown on Sheet C6.0 in Appendix 1. The hydrologic assumptions are as follows:

Single-family: For the sub-basins containing single-family residential lots, a composite curve number (CN) is calculated based on the area of paved road (CN = 98), landscaped boulevard (CN = 80), and residential lot area (CN = 92) draining to a particular inlet. The CN for the residential lots assumes of 65% impervious surface cover across all residential lots. A typical quad-court, the densest residential building type in the subdivision, contains approximately 14,000

square feet of impervious surfaces across 21,000 square feet of total lot area. A typical duplex lot contains up to 2,073 square feet of impervious surfaces across approximately 3,230 square feet of lot area. Single-family detached residential lots will likely have lower impervious coverage, but 65% coverage is still used in the model for a conservative estimate. The time of concentration (TOC) for these sub-basins assumes of 50 feet of sheet flow with a combined Manning's roughness of 0.15. This combined roughness assumes maintained lawns, with effects of landscaping, driveways, and roofs included in the combined value. Then, a shallow concentrated flow time is calculated based to the proposed road profiles to attain the total TOC for each sub-basin.

Senior Living (Lot 1): Firm site plans are not available for Lot 1 at this time. Lot 1 is in an area of the proposed subdivision where there is adequate clearance to high seasonal groundwater to allow the use of sumps for stormwater management. Thus, at the time of its development, the future site design for Lot 1 will need to show adequate retention and infiltration at sumps to accommodate the entire 100-year, 24-hour post-developed runoff volume. Should sumps be determined not to be feasible or desired during development of Lot 1, the downstream piping system has been sized to accommodate the pre-developed flow rates from Lot 1, allowing an alternate design with onsite detention storage to limit downstream discharge to the 2-year, 10-year, and 100-year peak pre-developed flow rates, respectively.

Religious Assembly (Lot 2): Similarly to Lot 1, because firm site development plans do not exist for Lot 2, the storm drainage system is sized to accommodate the pre-developed peak flow rate from Lot 2. However, Lot 2 is largely not in an area with adequate clearance to high seasonal groundwater to allow sumps for stormwater management. The Riverfront Trails storm drainage system includes structure SDMH43, at the end of a stub into Lot 2, to allow connection of a future storm drainage system. The future site design for Lot 2 will need to show adequate detention storage to limit post-developed flow rates discharged to the Riverfront Trails storm drainage system to the 2-year, 10-year, and 100-year peak pre-developed peak flow rates, respectively. These flow rates are accounted for in the design of the Riverfront Trails piping system, to ensure the downstream pipes are adequately sized to accommodate them.

Lot 176: Lot 176 is in an area of the proposed subdivision where there is adequate clearance to high seasonal groundwater to allow the use of sumps for stormwater management. Thus, at the time of its development, the future site design for Lot 176 will need to show adequate retention and infiltration at sumps to accommodate the entire 100-year, 24-hour post-developed runoff volume. Additionally, the site design will need to show how the existing drainages through the site in the existing easements are maintained.

Lower Miller Creek Road: The potential outfall from the Lower Miller Creek Road upgrades project is included in the SSA model. The composite curve number for each of the two basins was provided by WGM Group, with the minimum TOC of five minutes assumed for a conservative peak flow estimate.

Table 7 summarizes the hydrologic parameters for the sub-basins contributing to each individual inlet or sump.

Table 7. Summary of hydrologic parameters for proposed drainage sub-basins.

Sub-basin ID	Area (acres)	Inlet/Sump ID	Composite Curve Number	Time of Concentration (hh:mm:ss)
BASIN_1	2.17	SDMH24	93.03	0:14:06
BASIN_10	0.98	SDMH6	93.94	0:12:24
BASIN_11	1.14	SDMH15	93.20	0:13:28
BASIN_12	0.92	SDMH14	93.20	0:12:31
BASIN_13	1.06	SDMH20	92.83	0:13:01
BASIN_14	1.23	SDMH12	93.07	0:13:56
BASIN_15	1.07	SDMH19	93.46	0:11:30
BASIN_16	0.74	SDMH5	93.41	0:10:08
BASIN_17	0.69	SDMH4	94.79	0:05:00
BASIN_18	0.61	SDMH41	93.25	0:12:10
BASIN_19	1.22	SDMH42	92.50	0:11:58
BASIN_2	0.27	SDMH35	95.30	0:05:00
BASIN_20	0.52	SDMH40	92.00	0:11:18
BASIN_21	0.85	SDMH38	92.00	0:14:05
BASIN_22	0.89	SDMH37	92.00	0:12:16
BASIN_23	2.26	SDMH36	92.00	0:10:06
BASIN_24	0.45	SDMH43	92.00	0:05:00
BASIN_25	0.17	SDMH17	92.00	0:10:27
BASIN_26	0.56	SDMH16	92.00	0:10:42
BASIN_27	0.63	SDMH31	92.00	0:11:16
BASIN_28	0.32	SDMH32	98.00	0:05:00
BASIN_29	1.92	SDMH18	92.00	0:10:55
BASIN_3	1.19	SDMH29	93.20	0:13:45
BASIN_30	2.17	SDMH33	92.00	0:11:37
BASIN_38	0.50	SDMH22	94.40	0:09:18
BASIN_4	1.16	SDMH28	93.23	0:13:45
BASIN_5	0.48	SDMH34	95.30	0:05:00
BASIN_6	0.86	SDMH25	93.47	0:13:39
BASIN_7	0.78	SDMH23	93.82	0:20:49
BASIN_8	0.81	SDMH8	93.41	0:13:07
BASIN_9	0.31	SDMH21	95.03	0:11:23
BASIN_PH3_1 (PH3)	0.29	SDMH46	98.00	0:05:00
BASIN_PH3_2 (PH3)	1.13	SDMH45	92.00	0:05:00
BASIN_PH3_3 (PH3)	0.55	SDMH47	98.00	0:05:00
BASIN_PH3_4 (PH3)	1.89	SDMH44	92.00	0:05:00
LMC_ROAD_EAST	1.18	SDMH_LMC	95.30	0:05:00
LMC_ROAD_SOUTH	1.49	SDMH_LMC	95.30	0:05:00

Table 8. Continued.

RELIGIOUS	4.99	SDMH 43	71.00	0:05:00
SENIOR	5.53	SDMH33	71.00	0:05:00

SSA calculates the peak runoff flow rate and total runoff volume produced by each sub-basin. Table 9 shows the peak runoff flow rate and total volume for each of the design storm events.

Table 9. Calculated runoff parameters for proposed drainage sub-basins.

SUB-BASIN ID	PEAK RUNOFF (CFS)			RUNOFF VOLUME (FT^3)		
	2-YEAR	10-YEAR	100-YEAR	2-YEAR	10-YEAR	100-YEAR
BASIN_1	1.62	2.76	4.25	4647	7956	12412
BASIN_10	0.83	1.37	2.07	2277	3842	5881
BASIN_11	0.88	1.49	2.28	2483	4221	6574
BASIN_12	0.72	1.23	1.89	2004	3406	5318
BASIN_13	0.80	1.37	2.11	2232	3848	6014
BASIN_14	0.92	1.58	2.42	2634	4510	7044
BASIN_15	0.88	1.48	2.26	2369	4039	6258
BASIN_16	0.62	1.05	1.60	1639	2794	4296
BASIN_17	0.76	1.23	1.83	1753	2855	4343
BASIN_18	0.48	0.82	1.26	1329	2281	3518
BASIN_19	0.91	1.57	2.45	2480	4296	6793
BASIN_2	0.31	0.49	0.73	715	1157	1734
BASIN_20	0.37	0.65	1.03	1000	1774	2803
BASIN_21	0.57	1.01	1.59	1635	2900	4604
BASIN_22	0.63	1.10	1.73	1712	3037	4812
BASIN_23	1.66	2.92	4.60	4348	7712	12225
BASIN_24	0.38	0.67	1.05	866	1535	2423
BASIN_25	0.13	0.22	0.35	327	574	932
BASIN_26	0.41	0.72	1.13	1077	1911	3045
BASIN_27	0.45	0.79	1.25	1212	2150	3393
BASIN_28	0.46	0.67	0.94	1104	1673	2382
BASIN_29	1.39	2.44	3.84	3694	6551	10386
BASIN_3	0.91	1.54	2.37	2592	4406	6870
BASIN_30	1.55	2.72	4.28	4175	7404	11736
BASIN_38	0.47	0.77	1.16	1216	2015	3071
BASIN_4	0.89	1.51	2.31	2526	4295	6699
BASIN_5	0.56	0.88	1.30	1272	2073	3099
BASIN_6	0.68	1.14	1.73	1904	3247	5023
BASIN_7	0.54	0.89	1.36	1812	3030	4658
BASIN_8	0.64	1.09	1.66	1794	3058	4745

Table 8. Continued

BASIN_9	0.29	0.47	0.70	799	1305	1955
BASIN_PH3_1 (PH3)	0.41	0.60	0.84	1000	1516	2144
BASIN_PH3_2 (PH3)	0.95	1.69	2.65	2174	3856	6129
BASIN_PH3_3 (PH3)	0.79	1.15	1.61	1917	2875	4099
BASIN_PH3_4 (PH3)	1.59	2.81	4.42	3636	6449	10216
LMC_ROAD_EAST	1.36	2.16	3.18	3127	5097	7604
LMC_ROAD_SOUTH	1.73	2.74	4.02	3948	6436	9628
RELIGIOUS	0.02	0.73	2.57	543	2536	6994
SENIOR	0.02	0.81	2.84	602	2810	7746
TOTAL:				78576	137430	219606

B. Inlet and Manhole Considerations

Calculations and assumptions for gutter flow spread width and depth, interception efficiency of curb cuts and inlets, inlet grate intake capacity, and energy loss across manholes will be discussed in detail in the final storm drainage report for Riverfront Trails. However, several important considerations must be mentioned:

1. Spread widths and flow depth in gutters shall meet the requirements of Section 6.3.1 of the City of Missoula Public Works Standards and Specifications. Thus, additional inlets beyond those presented in this report may be required, to be determined based on final gutter flow and inlet interception calculations.

2. The final design will require analysis of energy loss across each manhole. The initial analysis presented in this report, using a hydrodynamic routing method which includes backflow conditions, indicated potential backflow causing street ponding at inlets located at the upstream end of the system during the 100-year storm event. The minimal head difference across the piping system causes energy losses at manholes and junctions to create the potential backflows at the upstream end of the system. Inlet and junction manholes may require chamfered pipe connections and benching to minimize energy losses.

C. Piping System Capacity

The capacity of the proposed storm drain piping was analyzed using Autodesk Storm and Sanitary Analysis. The storm drain piping must operate in a non-pressurized flow condition during the 10-year storm event. The piping may surcharge during the 100-year storm event as long as the City's requirements for street flow depths are not violated. The initial analysis presented in this report indicated that much of the piping system will operate in a pressurized state during the 100-year storm event, but street ponding will be minimal. The piping must maintain a minimum velocity of at least 2.5 feet per second but not exceed 12 feet per second during the 10-year storm event. The proposed piping system is shown on Sheet C6.1 – C6.9 in Appendix 1. The calculated flow

rates, flow depths, and flow velocities for each storm event are shown in Table 10, Table 11, and Table 12. The model nodes and links are shown on Exhibit EX-15 in Appendix A.

Table 10. Calculated pipe parameters for the 2-year, 24-hour rainfall event.

Pipe ID	Size (in)	Slope (%)	Flow Capacity (cfs)	Peak Flow (cfs)	Max. Flow Depth (ft)	Max. Flow Velocity (ft/sec)
SP49	18	0.50	9.66	0.02	0.04	1.15
SDP_OUTFALL	30	0.50	37.70	1.38	0.34	3.41
SP1	42	0.15	51.23	17.68	1.45	4.71
SP10	42	0.15	50.96	9.26	1.53	2.64
SP11	36	0.18	36.54	2.50	1.28	1.49
SP12	24	0.21	13.42	3.12	0.80	3.29
SP13	24	0.50	20.80	6.07	0.89	4.85
SP14	12	1.00	4.63	0.88	0.32	4.07
SP15	24	0.50	20.80	4.30	0.91	3.15
SP16	24	0.50	20.80	4.32	0.76	3.96
SP17	12	1.00	4.63	0.80	0.31	3.88
SP18	18	0.50	9.66	2.79	0.58	4.38
SP19	18	0.50	9.69	1.93	0.54	3.40
SP2	42	0.15	51.11	17.74	1.61	4.11
SP20	18	0.40	8.64	1.51	0.48	3.14
SP21	18	0.40	8.64	1.39	0.50	2.68
SP22	12	1.00	4.63	0.29	0.18	3.11
SP23	12	1.00	4.63	0.47	0.23	3.53
SP24	18	1.00	13.66	2.12	0.49	4.25
SP25	12	1.00	4.63	1.62	0.47	4.48
SP26	24	0.60	22.78	5.41	0.94	4.42
SP27	12	1.50	5.67	0.55	0.23	4.16
SP28	24	0.50	20.77	4.35	0.96	3.03
SP29	24	0.50	20.79	4.37	0.81	3.72
SP3	42	0.15	51.12	17.76	1.72	3.79
SP30	24	0.50	20.80	4.37	0.77	3.91
SP31	18	0.75	11.83	0.31	0.24	2.67
SP32	18	0.50	9.68	3.25	0.63	4.61
SP33	18	0.50	9.66	2.34	0.68	2.98
SP34	18	0.50	9.66	2.35	0.61	3.49
SP35	18	0.50	9.66	1.89	0.52	3.45
SP36	18	0.50	9.66	1.55	0.53	2.87
SP37	24	0.40	18.60	4.86	0.73	4.66
SP38	24	0.40	18.60	3.26	0.67	3.56
SP39	24	0.40	18.60	2.64	0.61	3.25

Table 9. Continued

SP4	42	0.15	51.09	17.79	1.87	3.40
SP40	18	0.40	8.63	2.07	0.54	3.61
SP41	18	0.40	8.64	2.07	0.52	3.80
SP42	18	0.40	8.63	1.39	0.49	2.78
SP43	12	1.50	5.67	0.91	0.30	4.50
SP44	12	1.50	5.67	0.38	0.23	3.66
SP45 (PH3)	24	0.40	18.60	3.68	0.65	4.15
SP46 (PH3)	18	0.40	8.64	1.35	0.50	2.62
SP47 (PH3)	12	0.40	2.93	0.41	0.29	2.25
SP48 (PH3)	12	0.40	2.93	0.78	0.53	2.06
SP5	42	0.15	51.00	17.51	1.97	3.15
SP6	42	0.15	51.12	11.08	1.88	2.11
SP7	42	0.15	51.14	10.07	1.72	2.40
SP8	42	0.15	51.02	10.13	1.64	2.64
SP9	42	0.15	51.02	9.16	1.59	2.50

Table 11. Calculated pipe parameters for the 10-year, 24-hour rainfall event.

Pipe ID	Size (in)	Slope (%)	Flow Capacity (cfs)	Peak Flow (cfs)	Max. Flow Depth (ft)	Max. Flow Velocity (ft/sec)
SDP_OUTFALL	30	0.50	37.70	2.90	0.50	4.13
SP1	42	0.15	51.23	30.27	1.94	5.52
SP10	42	0.15	50.96	16.16	2.41	2.66
SP11	36	0.18	36.54	3.84	2.15	1.47
SP12	24	0.21	13.42	4.87	1.62	3.20
SP13	24	0.50	20.80	10.28	1.66	4.91
SP14	12	1.00	4.63	1.48	0.55	4.55
SP15	24	0.50	20.80	7.33	1.58	3.13
SP16	24	0.50	20.80	7.47	1.19	4.12
SP17	12	1.00	4.63	1.37	0.42	4.40
SP18	18	0.50	9.66	4.87	0.81	5.00
SP19	18	0.50	9.69	3.39	0.74	3.89
SP2	42	0.15	51.11	30.35	2.24	4.68
SP20	18	0.40	8.64	2.66	0.66	3.56
SP21	18	0.40	8.64	2.44	0.71	2.96
SP22	12	1.00	4.63	0.47	0.31	3.53
SP23	12	1.00	4.63	0.78	0.53	3.98
SP24	18	1.00	13.66	3.60	1.05	4.43
SP25	12	1.00	4.63	2.76	0.66	5.02
SP26	24	0.60	22.78	9.63	1.77	4.47
SP27	12	1.50	5.67	0.88	0.52	4.65

Table 10. Continued

SP28	24	0.50	20.77	8.03	1.72	2.98
SP29	24	0.50	20.79	8.06	1.44	3.76
SP3	42	0.15	51.12	30.41	2.42	4.30
SP30	24	0.50	20.80	8.14	1.28	4.15
SP31	18	0.75	11.83	0.49	0.71	2.51
SP32	18	0.50	9.68	6.34	0.95	5.38
SP33	18	0.50	9.66	4.79	1.07	3.56
SP34	18	0.50	9.66	4.81	0.95	4.06
SP35	18	0.50	9.66	4.02	0.82	4.03
SP36	18	0.50	9.66	3.52	0.87	3.30
SP37	24	0.40	18.60	8.52	1.01	5.33
SP38	24	0.40	18.60	5.69	0.96	3.80
SP39	24	0.40	18.60	4.59	0.90	3.34
SP4	42	0.15	51.09	30.46	2.64	3.92
SP40	18	0.40	8.63	3.58	0.74	4.11
SP41	18	0.40	8.64	3.58	0.73	4.20
SP42	18	0.40	8.63	2.39	0.68	3.11
SP43	12	1.50	5.67	1.57	0.42	5.07
SP44	12	1.50	5.67	0.67	0.35	3.56
SP45 (PH3)	24	0.40	18.60	6.17	0.87	4.72
SP46 (PH3)	18	0.40	8.64	2.26	0.68	2.89
SP47 (PH3)	12	0.40	2.93	0.60	0.39	2.17
SP48 (PH3)	12	0.40	2.93	1.14	0.78	1.92
SP49	18	0.50	9.66	0.72	0.33	2.91
SP5	42	0.15	51.00	29.98	2.79	3.64
SP6	42	0.15	51.12	19.03	2.74	2.35
SP7	42	0.15	51.14	17.40	2.59	2.39
SP8	42	0.15	51.02	17.53	2.52	2.60
SP9	42	0.15	51.02	15.96	2.46	2.46

Table 12. Calculated pipe parameters for the 100-year, 24-hour rainfall event.

Pipe ID	Size (in)	Slope (%)	Flow Capacity (cfs)	Peak Flow (cfs)	Max. Flow Depth (ft)	Max. Flow Velocity (ft/sec)
SDP_OUTFALL	30	0.50	37.70	4.17	0.61	4.52
SP1	42	0.15	51.23	51.84	2.66	6.62
SP10	42	0.15	50.96	29.14	3.50	3.03
SP11	36	0.18	36.54	8.90	3.00	1.43
SP12	24	0.21	13.42	6.89	2.00	3.22
SP13	24	0.50	20.80	16.67	2.00	5.31
SP14	12	1.00	4.63	2.29	1.00	4.62

Table 11. Continued

SP15	24	0.50	20.80	11.97	2.00	3.81
SP16	24	0.50	20.80	11.94	2.00	4.10
SP17	12	1.00	4.63	2.18	1.00	4.72
SP18	18	0.50	9.66	7.88	1.50	5.33
SP19	18	0.50	9.69	5.63	1.50	4.24
SP2	42	0.15	51.11	52.02	3.26	5.63
SP20	18	0.40	8.64	4.40	1.50	3.95
SP21	18	0.40	8.64	3.94	1.50	3.22
SP22	12	1.00	4.63	0.72	1.00	3.61
SP23	12	1.00	4.63	1.22	1.00	4.00
SP24	18	1.00	13.66	5.52	1.50	4.42
SP25	12	1.00	4.63	4.19	1.00	5.33
SP26	24	0.60	22.78	16.49	2.00	5.25
SP27	12	1.50	5.67	1.28	1.00	4.72
SP28	24	0.50	20.77	13.78	2.00	4.39
SP29	24	0.50	20.79	13.77	2.00	4.38
SP3	42	0.15	51.12	52.71	3.48	5.52
SP30	24	0.50	20.80	13.78	2.00	4.39
SP31	18	0.75	11.83	0.76	1.50	2.53
SP32	18	0.50	9.68	11.03	1.50	6.24
SP33	18	0.50	9.66	8.85	1.50	5.01
SP34	18	0.50	9.66	8.85	1.50	5.01
SP35	18	0.50	9.66	7.63	1.50	4.34
SP36	18	0.50	9.66	6.84	1.50	3.87
SP37	24	0.40	18.60	13.27	1.36	5.82
SP38	24	0.40	18.60	8.85	1.35	3.93
SP39	24	0.40	18.60	7.14	1.28	3.37
SP4	42	0.15	51.09	52.68	3.50	5.48
SP40	18	0.40	8.63	5.55	0.99	4.49
SP41	18	0.40	8.64	5.56	1.01	4.41
SP42	18	0.40	8.63	3.70	0.92	3.30
SP43	12	1.50	5.67	2.45	0.55	5.57
SP44	12	1.50	5.67	1.05	0.51	3.57
SP45 (PH3)	24	0.40	18.60	9.43	1.12	5.19
SP46 (PH3)	18	0.40	8.64	3.46	0.90	3.13
SP47 (PH3)	12	0.40	2.93	0.84	0.51	2.13
SP48 (PH3)	12	0.40	2.93	1.61	1.00	2.05
SP49	18	0.50	9.66	2.63	1.50	3.80
SP5	42	0.15	51.00	51.24	3.50	5.33
SP6	42	0.15	51.12	34.63	3.50	3.60

Table 11. Continued

SP7	42	0.15	51.14	31.90	3.50	3.32
SP8	42	0.15	51.02	31.90	3.50	3.32
SP9	42	0.15	51.02	29.17	3.50	3.03

D. Peak Flow Attenuation – Phases 1A, 1, and 2

Attenuation of peak flows for Phase 1A, 1, and 2, east of the Maloney Ranch drainage swale, will be achieved through an extended detention stormwater wetland to ensure that the post-development storm water from the project site is released at the pre-developed peak flow rates for each storm event. The stormwater wetland will function as both a water quality best management practice (BMP) and flood control facility. The water quality aspects of the design are discussed in Section 5 of this report. A profile of the proposed facility is depicted on Sheet C6.10 in Appendix 1.

The proposed detention facility will be located within the open space tract adjacent to the Bitterroot River. The facility will be sized based on the required volume of the stormwater wetland permanent pool, discussed in the following section. The water quality volume is retained in the permanent pool below the invert elevation of the inlet pipes and outlet orifice. The extended detention volume is "stacked" on top of the water quality volume. Because the footprint of the facility is not constrained by land area, the basin will have side slopes of 10:1 or greater to create a gentle, natural appearance and blend with the open space. The stage-storage relationship curve for the proposed basin is shown in Figure 2. The initial foot of depth represents the permanent pool volume, discussed in Section 5.

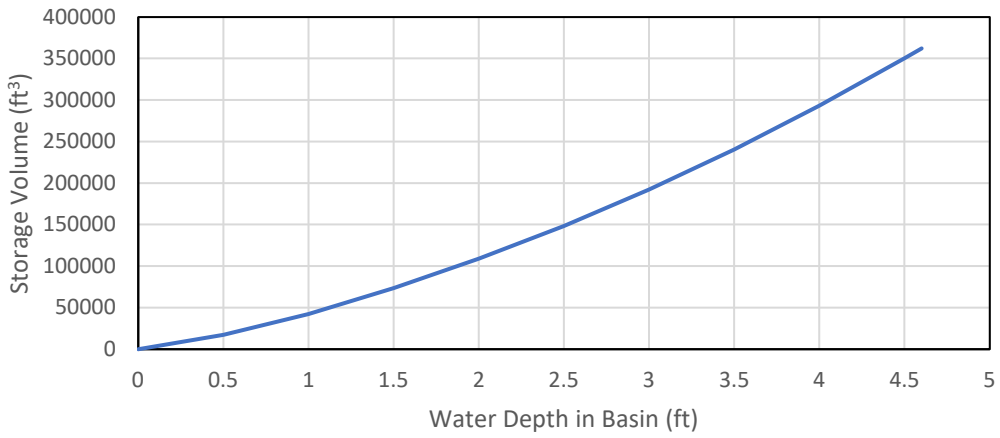


Figure 2. Stage-storage relationship curve for the proposed extended detention basin and shallow wetland.

The pond outlet structure will consist of a standard precast manhole structure elevated above the ground surface. The outlet will be sized with an 8-inch water quality orifice and 12-inch diameter flood control orifice. Due to the gentle side slopes of the basin, the 100-year rainfall event will accumulate 1.66 feet of additional water depth above the permanent pool in the detention basin. At this water depth, the orifices will discharge water at 4.80 cubic feet per second, below the

allowable peak discharge of 5.84 cubic feet per second calculated from the 100-year pre-developed conditions. The orifice flow rate is calculated in SSA from the orifice rating curve for a 12" circular orifice with an orifice coefficient of 0.614, shown in Figure 3. The 8" water quality orifice is modeled as a reverse pipe, because it cannot discharge freely due to the weir wall which retains the permanent pool. The operating characteristics of the detention basin during normal river flow conditions are shown in Table 13.

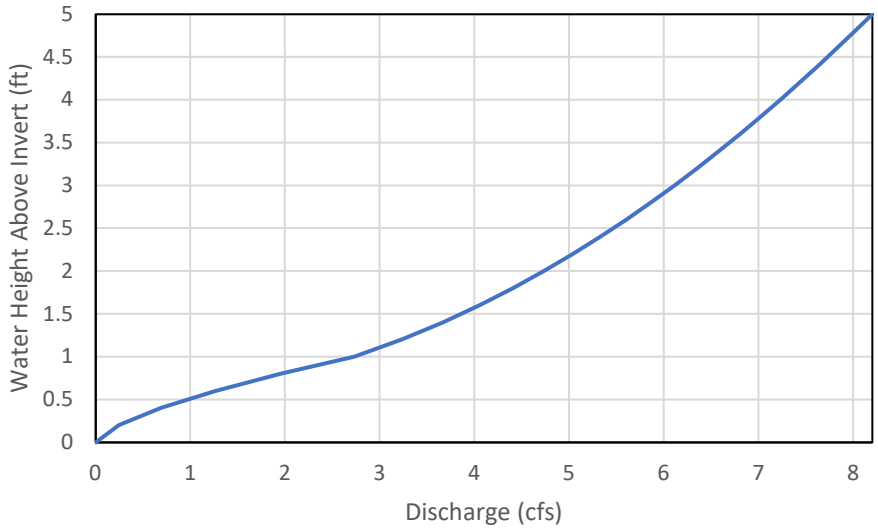


Figure 3. Orifice rating curve for a 12" circular orifice with an orifice coefficient of 0.614.

Table 13. Calculated operating characteristics of the proposed detention basin.

Rainfall Event	Initial Water Depth (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)	Max. Water Depth (ft)
2-year	1	22.15	0.92	1.70
10-year	1	38.09	2.47	2.10
100-year	1	65.11	4.80	2.66

Due to the flat topography of the project site, the inlet pipes entering the detention basin must be placed at an elevation that will place the detention basin and outfall control structure within the Bitterroot River floodplain. River floods higher than the banks of the main channel would back into the storm drainage system, creating a tail water condition. This condition will exist primarily during times of high seasonal runoff from snowmelt discussed previously. The 10-year and 100-year river events would submerge the detention basin and the crown of the inlet pipes entering the detention based. To prevent Bitterroot River floodwaters from backing into the Riverfront Trails storm drainage system, a backflow prevention device is proposed at each inlet pipe entering the detention basin, as well as at the outfall from the detention pond to the River. Furthermore, all inlet grate rim elevations in the street network will be above the 100-year base flood elevation for the Bitterroot River. The Bitterroot River base flood elevations are shown on Sheet C6.10.

E. Peak Flow Attenuation – Phase 3

Peak flow attenuation for Phase 3 will be accomplished in a similar manner to Phases 1A, 1, and 2. A separate, smaller extended detention stormwater wetland located west of the Maloney Ranch drainage swale, to be constructed at the time of Phase 3's construction. The preliminary specifications for the Phase 3 detention basin are shown in Table 14. An easement for the future Phase 3 stormwater wetland and outfall swale are shown on the preliminary plat.

Table 14. Preliminary design parameters for Phase 3 detention basin.

DESIGN PARAMETER	DESIGN VALUE
Total Depth	3.5 feet
Total Storage Volume	30,000 cubic feet
Flood Control Orifice	6" Ø

F. Outfall Considerations

The stormwater wetland storage volume is divided between permanent pool volume, water quality volume, and flood control volume, controlled by an outlet structure with a combination of orifices and weirs. The weirs create a permanent pool volume in the wetland, as well as provide primary overflow spillway for rainfall events larger than the 100-year storm. The outlet structure drains into a 24" diameter pipe, which conveys discharges to a swale, which ultimately discharges flows to the Bitterroot River channel.

The primary spillway weir has a 3'-8" width inside the control structure, for a flow capacity of 11.61 cubic feet per second with 1' water height. When flows overtop the spillway, they enter the 24" diameter outlet pipe, which is sized to convey these overflows, with a flow capacity of 18.65 cfs. In addition to the primary spillway, the basin has a secondary spillway proposed to be constructed through the top of the berm. The secondary spillway will be armored with rip-rap and have a width of 30 feet, providing an emergency overflow capacity of 76 cfs. The combined spillway capacity of approximately 87 cfs exceeds to peak 100-year post-developed inflow to the basin of 65.1 cfs. Section views of the control structure, as well as a plan layout of the outlet pipe, swale, and secondary spillway, are shown on Sheet C6.10 of the preliminary construction plans.

5. POST-CONSTRUCTION WATER QUALITY

Historical rainfall data supports the characterization that, on average, 90 percent of the rainfall events occurring across Montana's MS4 areas are 0.5 inches or less. Therefore, the Montana Department of Environmental Quality MS4 General Permit requires that all regulated projects implement post-construction stormwater best management practices that are designed to infiltrate, evapotranspire, and/or capture for reuse the post-construction runoff generated from the first 0.5 inches of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation [4]. Any portion of this runoff not infiltrated, evapotranspired, or captured for reuse must be treated by best management practices (BMPs) expected to remove 80 percent total suspended solids (TSS).

The runoff reduction volume (RRV), or the volume of storm water runoff generated from the first 0.5 inches of rainfall, was calculated using the procedure outlined in Chapter 3 of the Montana Post-Construction Storm Water BMP Design Guidance Manual:

$$\mathrm{RTV} = \frac{\mathrm{PR_V A}}{12} = \frac{(0.5)(0.68)(39.86)}{12} = 1.13 \text{ acre} - \text{feet}$$

Where RTV = Runoff Reduction Volume (Acre-feet)
P = Water Quality Rainfall Depth (Inches)
R_V = Dimensionless Runoff Coefficient, $R_V = 0.05 + 0.9(I)$
I = Percent Impervious Cover Draining to the Facility = 0.70
A = Area Draining to Facility (Acres) = 39.86

The runoff treatment volume calculation includes the 37.19 acres of Riverfront Trails draining to the detention basin as well as 2.67 acres of Lower Miller Creek Road which could drain to the facility. This preliminary report provides a general overview of the concept for a stormwater wetland based on design guidance in the Montana Post-Construction Storm Water BMP Design Guidance Manual [4] and supplemental guidance on stormwater wetlands from the Minnesota Stormwater Manual [5].

Stormwater wetlands contain a permanent pool and temporary storage for water quality control and runoff control. Extended detention can be provided above the wetland permanent pool elevation, shown in Figure 4. Stormwater wetlands can become an important aesthetic feature of a site. They are constructed with varying amounts of the following three components [5]:

- Shallow marsh area
- Permanent micropool area
- Storage volume above the normal water level

The proposed wetland will consist of a permanent pool below the invert elevation of the entering pipes and the outlet orifice. The permanent pool must contain the entire RTV, with additional dead storage required to achieve 80 percent TSS reduction, and will be allocated between a pretreatment forebay, deepwater zones, marsh zones, semi-wet zones, and an outlet micropool.

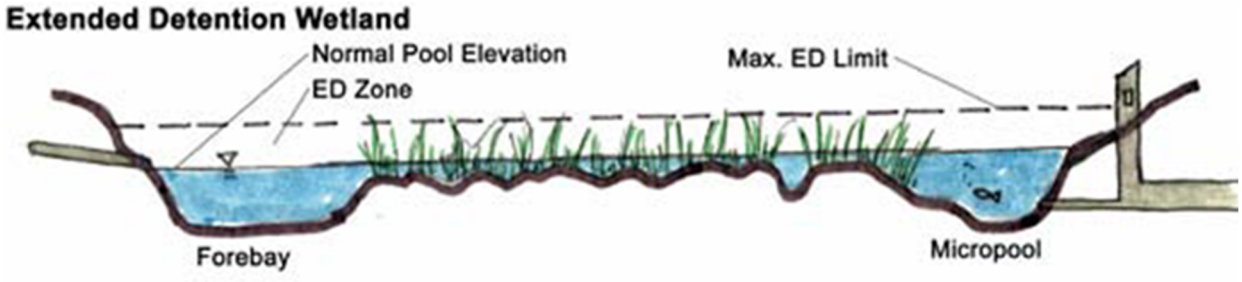


Figure 4. Conceptual profile of an extended detention shallow wetland. Source: Minnesota Pollution Control Agency.

Pretreatment Forebay: The pretreatment forebay, located at the major inlets to the basin, will provide an opportunity for larger particles to settle out prior to flows entering the main wetland cell. The pretreatment forebay will have a volume equal to 10 percent of the RTV [4]. The forebay will have a depth of two feet, with a concrete bottom to facilitate sediment removal. The headwall structure at the inlet pipes will maintain two feet of freeboard between the forebay bottom and the invert elevation of the pipe – this will prevent debris from impeding the operation of the backflow prevention devices at each inlet pipe. The forebay will be separated from the main treatment cell by a lined berm, which, together with the concrete bottom, will prevent interaction between high seasonal groundwater and storm water retained in the forebay.

Shallow Wetland: The shallow wetland portion of the basin will be irregularly shaped, with a long flow path provided between the forebay and outlet micropool. The depth of the permanent pool will vary between 6 and 18 inches in this section, providing microtopography to enhance wetland diversity. Additional design details, including a landscaping plan and water balance to ensure establishment and maintenance of wetland coverage, will be included with the final storm drainage design report. The shallow wetland portion of the basin will intercept the seasonal high-water table. This is a desired function to help sustain the permanent pool and wetland vegetation [5].

Outlet Micropool: The micropool is a small pool located in front of the outlet orifice, intended to prevent sediment resuspension, protect the outlet riser from clogging, and reduce mosquito breeding areas [4]. The micropool will have 3:1 side slopes, a depth of 3 feet, and a concrete bottom to facilitate sediment removal.

The stormwater wetland storage volume is divided between permanent pool volume, water quality volume, and flood control volume, controlled by an outlet structure with a combination of orifices and weirs. The proposed outlet control structure is shown on Sheet C6.10 of the preliminary construction plans. According to the Minnesota Pollution Control Agency, constructed ponds built to Design Level 2 specifications can be expected to remove 84 percent TSS [5]. The credits for Design Level 1 and 2, and how the proposed stormwater wetland will meet the requirements, are outlined below.

Design Level 1; must meet the following criteria [5]:

1. Provide dead (or permanent) storage of at least 1,800 cubic feet per acre that drains to the pond.

   The proposed wetland provides approximately 72,477 cubic feet of permanent pool storage volume below the outlet weir in the control structure. This retention volume also exceeds the RRV required by the Montana Department of Environmental Quality MS4 permit.

2. The pond's permanent storage volume must reach a minimum depth of at least 3 feet and must have no depth greater than ten feet. The basin must be configured such that scour or resuspension of solids is minimized.

The proposed wetland includes an outlet micropool with a depth of three feet below the invert elevation of the 8" water quality orifice to minimize scour and resuspension of solids. In addition, portions of the marsh zones will have permanent pool depths of three feet. No portion of the permanent pool will exceed four feet in depth.

3. **Flow path** length to pond width ratio less than 1:1 or greater than 10:1 (scouring occurs at ratios greater than 10:1).

   The proposed wetland has a flow length to pond width ratio of approximately 5:1 (Meets Design Level 3 requirements)

Design Level 2; meets all of the requirements for Design Levels 1 and 2 (except flow path) and does not meet all design requirements for Design Level 3 [5]:

1. Water Quality Volume (flood pool volume) >= 1 inch of impervious area.

   The proposed wetland provides approximately 105,510 cubic feet of water quality volume, including the permanent pool volume, below the 12" flood control orifice in the control structure. The portion of the water quality volume not included in the permanent pool volume can drain through the 8" water quality orifice in the control structure.

2. Discharge rate of water quality volume does not exceed 5.66 cubic feet per second per acre of surface area of the pond.
   The Water Quality Volume discharges through the 8" water quality orifice at rates of 0.68 cfs, 1.18 cfs, and 1.68 cfs during the 2-year, 10-year, and 100-year storm events, respectively. The wetland has a surface area of approximately 75,000 square feet.

3. Flow path length to pond width ratio = 1:1 to 3:1. A ratio of 3:1 is recommended.

   The proposed wetland has a flow length to pond width ratio of approximately 5:1 (Meets Design Level 3 requirements)

Based on the criteria for Design Level 1 and 2, the proposed extended detention stormwater wetland can be expected to exceed the requirement to remove 80 percent TSS. Maintenance access to the forebay will be provided via a gravel access driveway, to allow access for a vacuum truck to remove sediment. The access driveway is shown on the pond plan and profile sheet.

Riparian shade trees are proposed along the southern edge of the wetland to provide a level of temperature control. Further temperature control is achieved through the combination of an orifice and weir wall to release Water Quality flows from the wetland – this ensures water being released is from the bottom of the water column, helping to control temperature. Additional design details will be provided with the final storm drainage design report for each phase of the subdivision platted. Phase 3 will have a similar, but separate stormwater wetland. The runoff reduction volume (RRV) for Phase 3 is calculated as follows:

$$\text{RTV} = \frac{\text{PR}_\text{V}\text{A}}{12} = \frac{(0.5)(0.68)(3.86)}{12} = 0.11 \text{ acre} - \text{feet}$$

Where RTV = Runoff Reduction Volume (Acre-feet)
P = Water Quality Rainfall Depth (Inches)
R_V = Dimensionless Runoff Coefficient, $R_V = 0.05 + 0.9(I)$
I = Percent Impervious Cover Draining to the Facility = 0.70
A = Area Draining to Facility (Acres) = 3.86

The design specifications for the future stormwater wetland in Phase 3 are shown in Table 15. Additional design details will be provided at the time of construction and platting of Phase 3.

Table 15. Preliminary water quality design parameters for Phase 3 detention basin.

Design Parameter	Design Value
Permanent Pool Volume	7,000 cubic feet
Water Quality Volume	4,800 cubic feet
Pretreatment Forebay Volume	480 cubic feet
Water Quality Orifice	1" Ø

6. Compliance with Design Goals

This report shows that the specific design goals of the project are being met:

- Provide a piped storm drainage system and adequate detention storage to release the post-development storm water from the project site at pre-developed peak flow rates for the 100-year storm event.

  The proposed piping system will have sufficient capacity to convey flows from the 10-year storm event without surcharging, and capacity to convey the 100-year flows while meeting the City of Missoula requirements for street flow. The proposed detention basin and outfall structure will ensure post-developed runoff does not leave the site at rates exceeding the pre-developed peak flow rate for each design storm.

- Ensure the first half-inch of runoff from all impervious surfaces discharging to the piped storm drainage system is treated onsite using post-construction storm water management controls expected to remove 80 percent total suspended solids (TSS).

  The RTV will be treated at the proposed stormwater wetland, expected to remove approximately 84 percent TSS. Phase 3 of the proposed subdivision will have its own detention basin and stormwater wetland, which will also be designed to remove at least 80 percent TSS.

- Provide provisions for management of offsite flows from the outfall of the Lower Miller Creek Road upgrades project.

This preliminary storm drainage design has been prepared with accommodations for the potential outfall from the Lower Miller Creek Road upgrades project.

7. REFERENCES

[1] Clark Fork Coalition, "2017 Bitteroot Strategy," Clark Fork Coalition, Missoula, 2017.

[2] City of Missoula, "Missoula City Public Works Standards and Specifications Manual," City of Missoula, Missoula, 2020.

[3] Montana Department of Transportation, Hydraulics Manual, 2017.

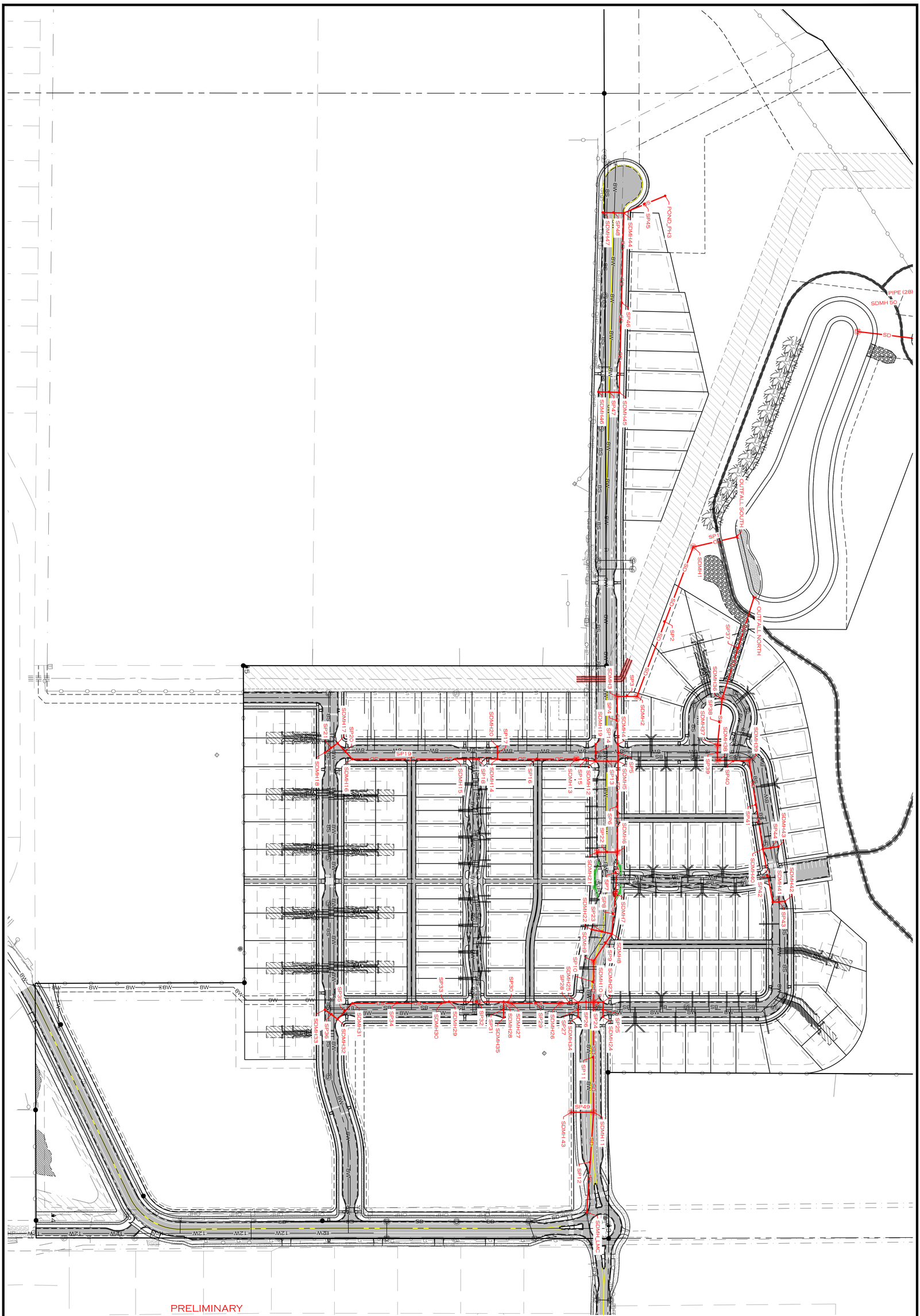
[4] HDR, Inc., Montana Post-Construction Storm Water BMP Design Guidance Manual, Montana Department of Environmental Quality, 2017.

[5] Minnesota Pollution Control Agency, "Minnesota Stormwater Manual," Minnesota Pollution Control Agency, 12 May 2021. [Online]. Available: https://stormwater.pca.state.mn.us/index.php/Main_Page.

[6] Contech Engineered Solutions, LLC., "ChamberMaxx Stormwater Chamber System," 2019. [Online]. [Accessed 7 October 2020].

APPENDIX 1

REFERENCE EXHIBITS



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EX-15

RIVERFRONT TRAILS

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STORM AND SANITARY ANALYSIS LINK AND NODE EXHIBIT

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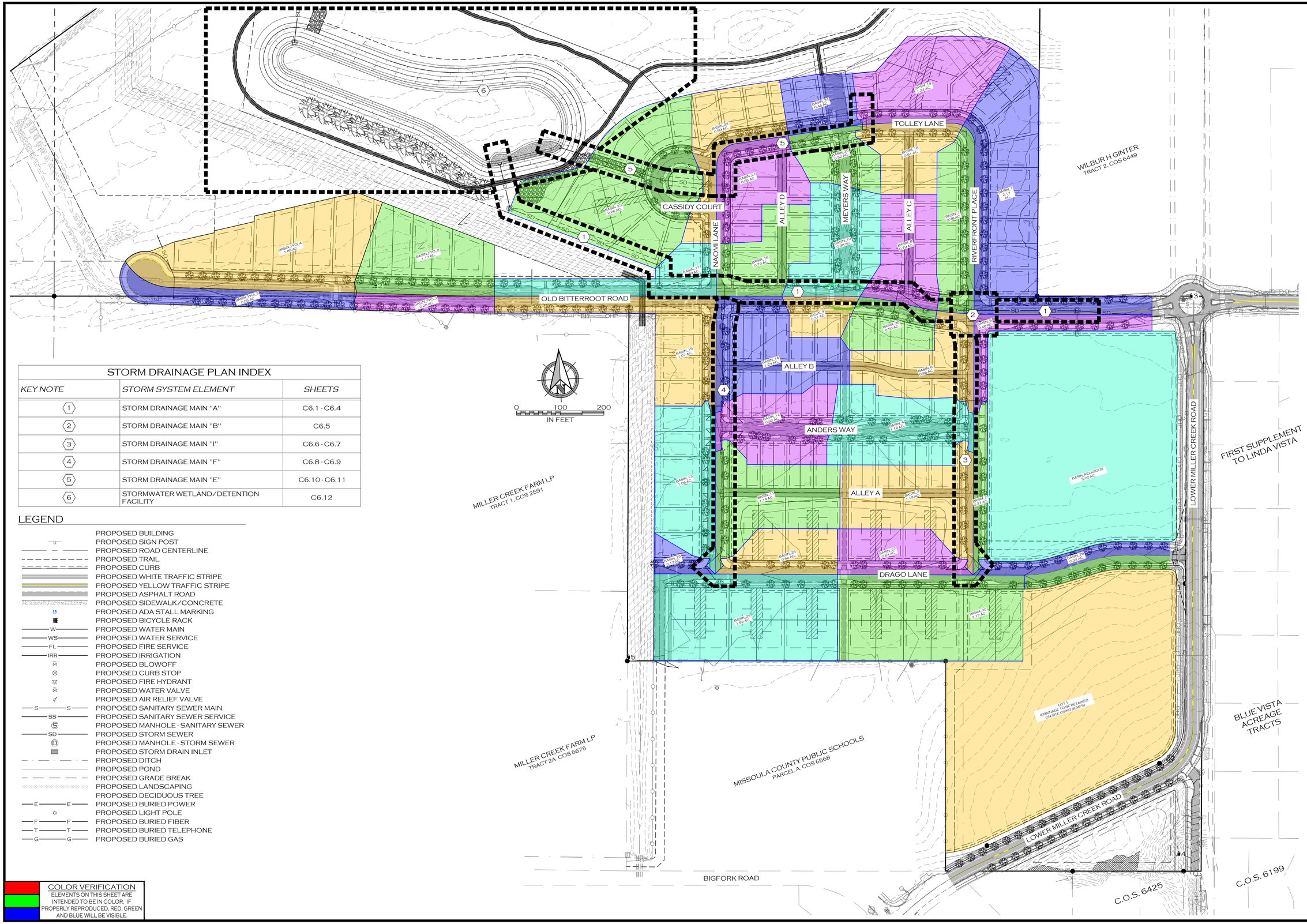
EX-15 STORMWATER MODEL NODES.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL/13/2022



STORM DRAINAGE PLAN INDEX

KEY NOTE	STORM SYSTEM ELEMENT	SHEETS
1	STORM DRAINAGE MAIN "A"	C6.1 - C6.4
2	STORM DRAINAGE MAIN "B"	C6.5
3	STORM DRAINAGE MAIN "I"	C6.6 - C6.7
4	STORM DRAINAGE MAIN "F"	C6.8 - C6.9
5	STORM DRAINAGE MAIN "E"	C6.10 - C6.11
6	STORMWATER WETLAND/DETENTION FACILITY	C6.12

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OVERALL STORM DRAINAGE PLAN

C6.0

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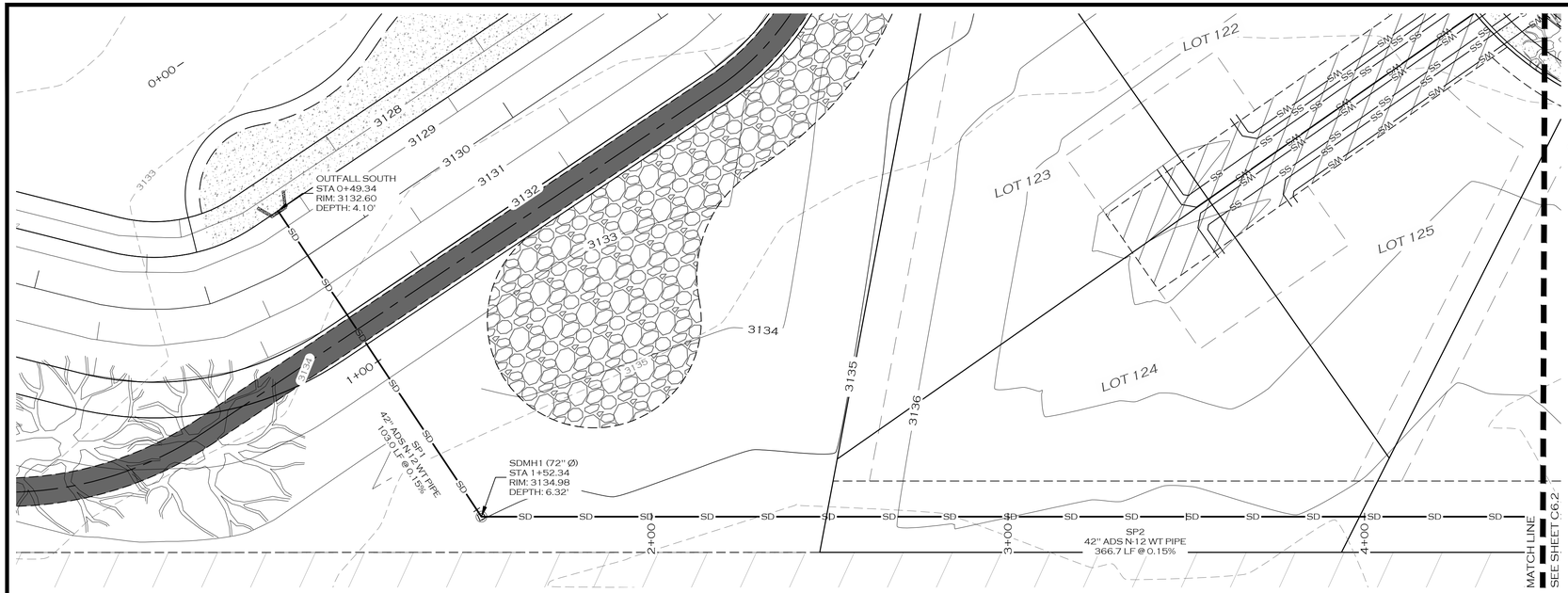

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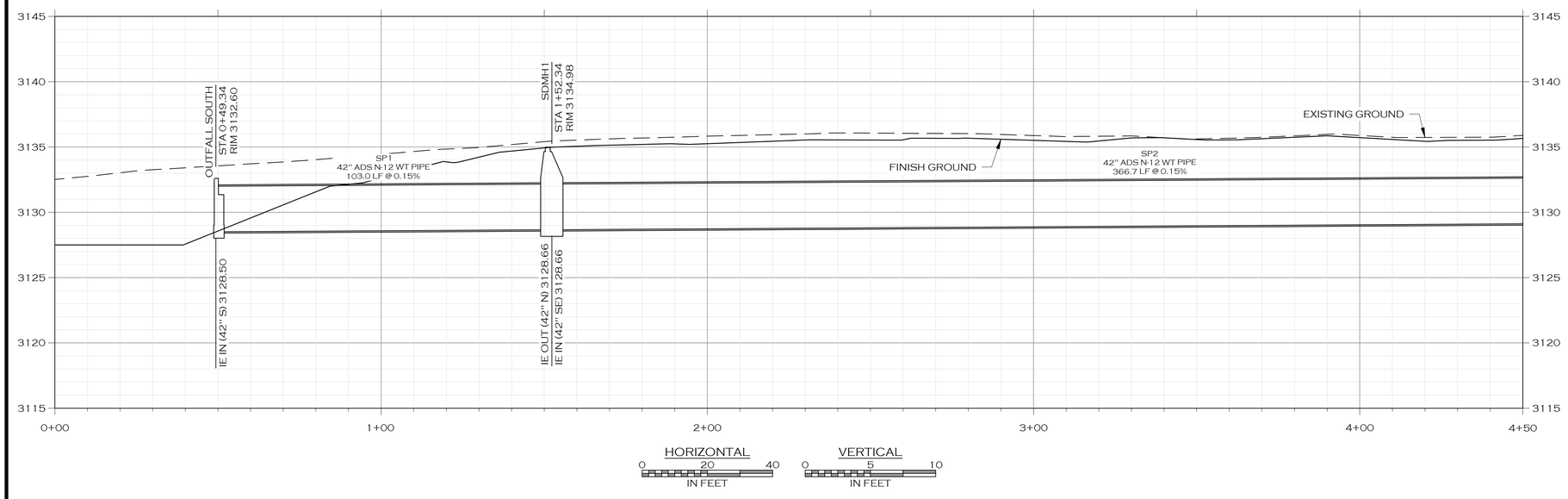

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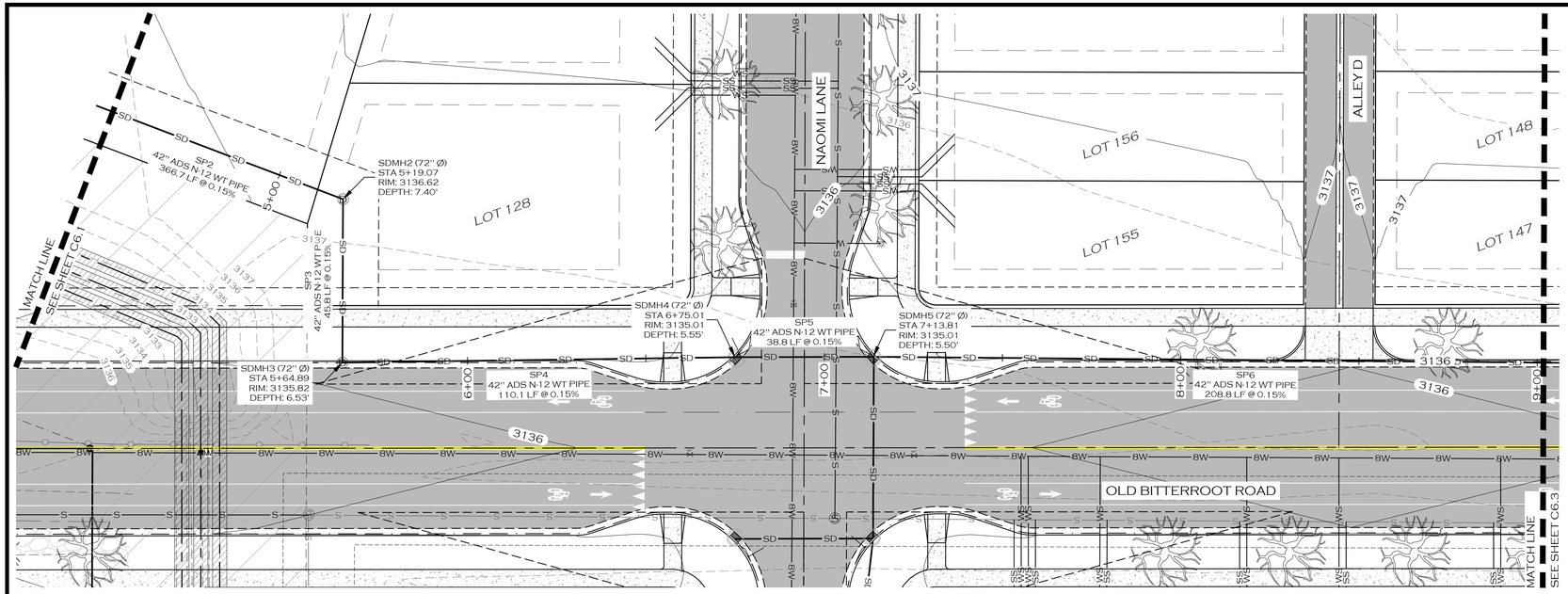

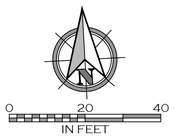

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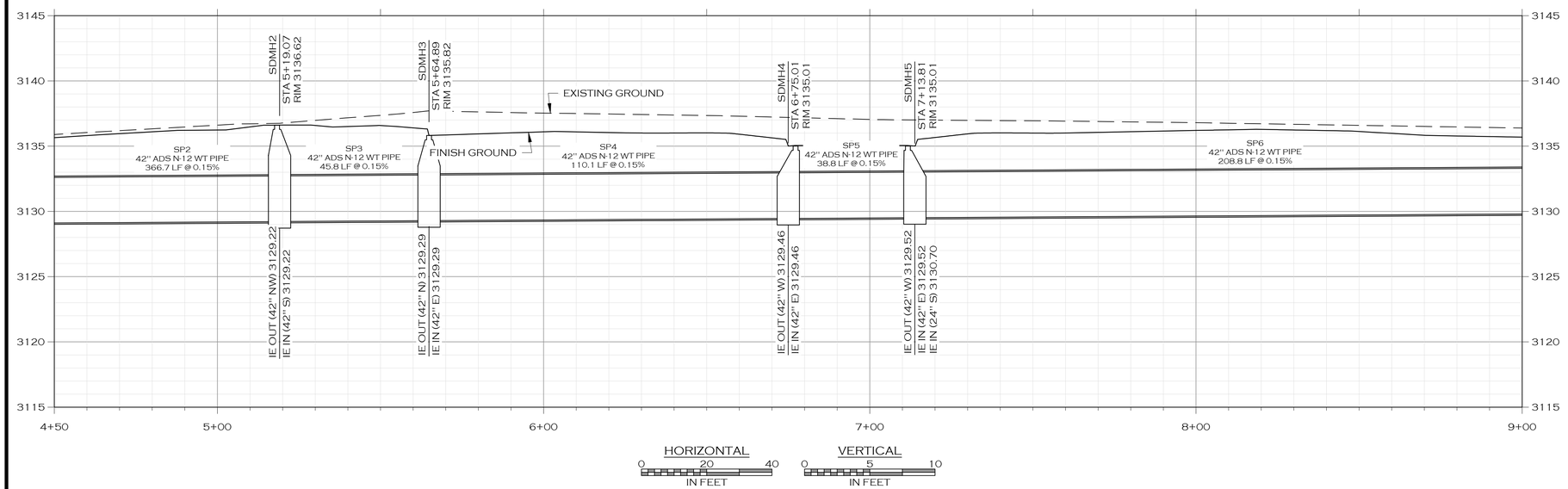

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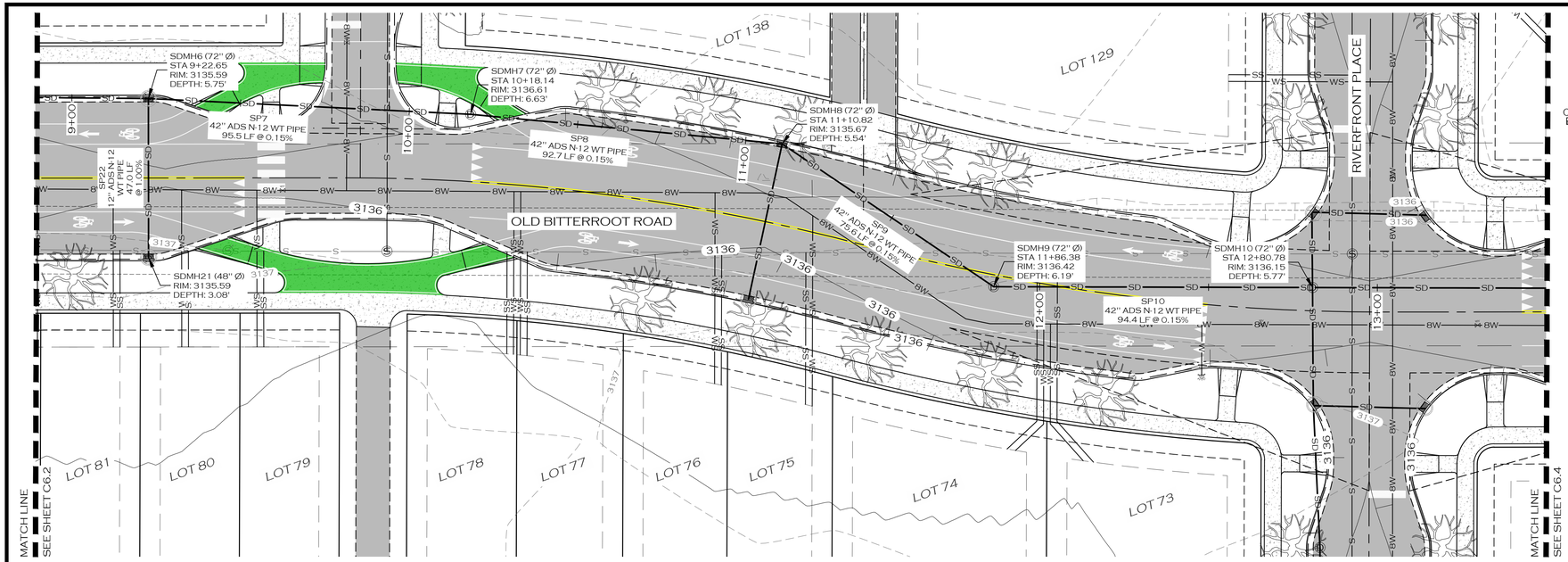

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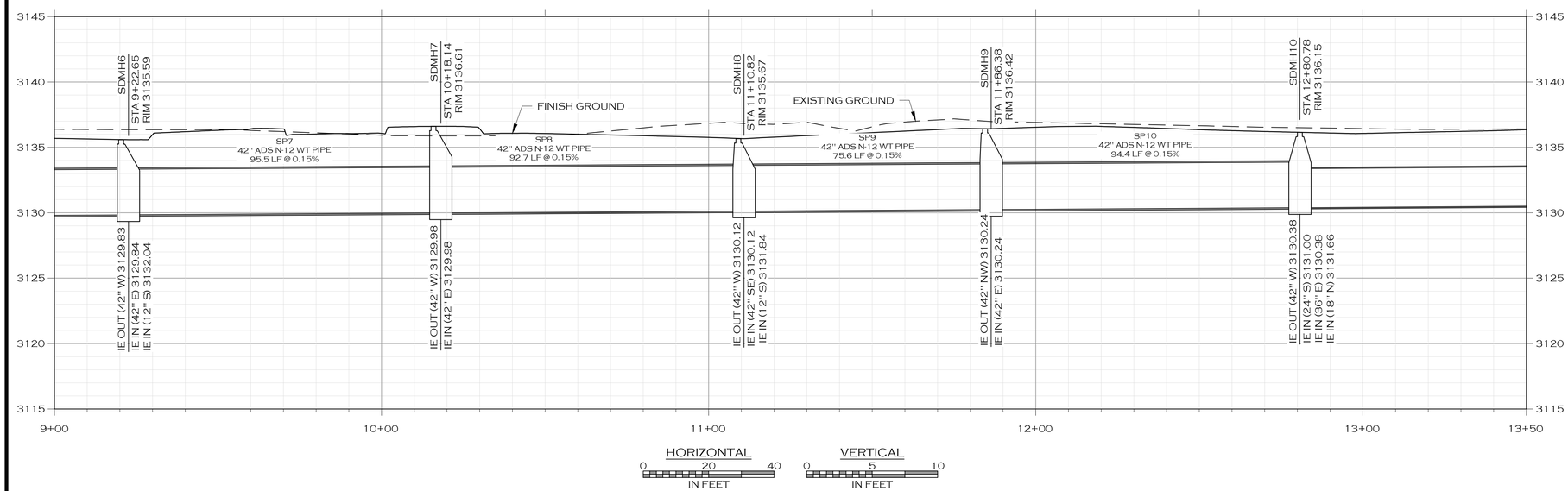

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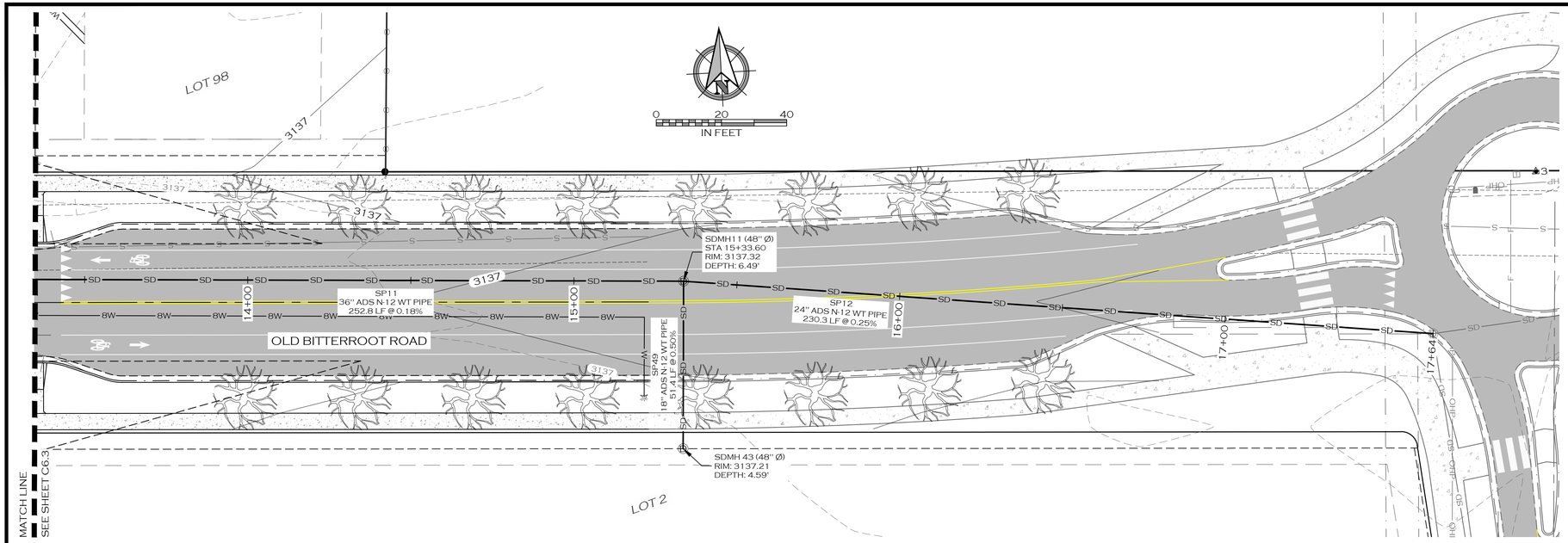

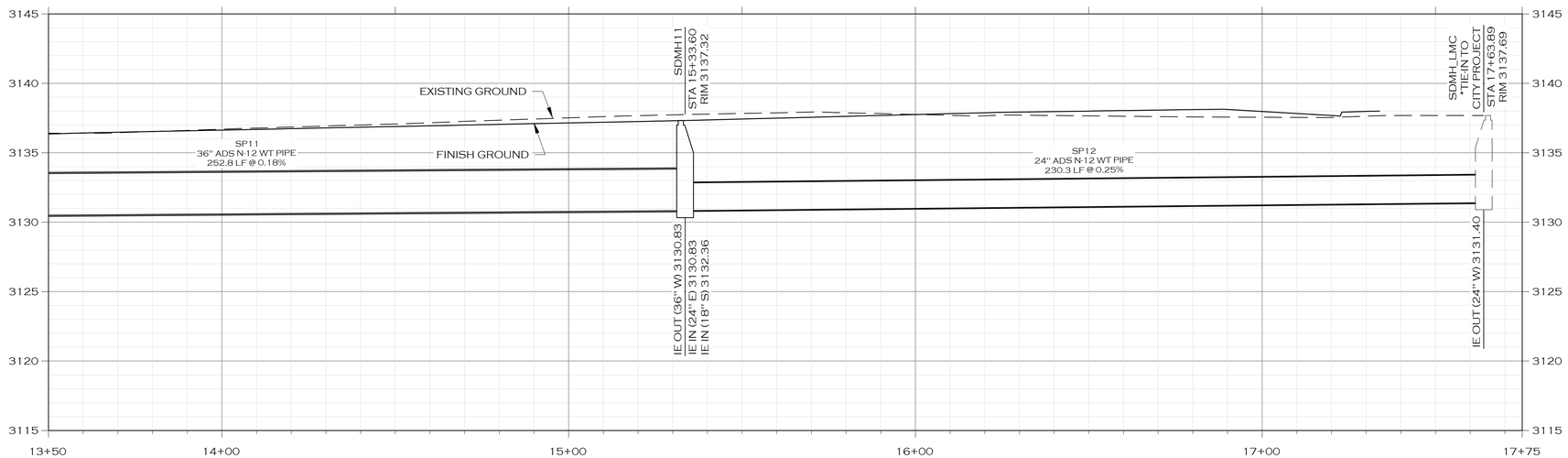

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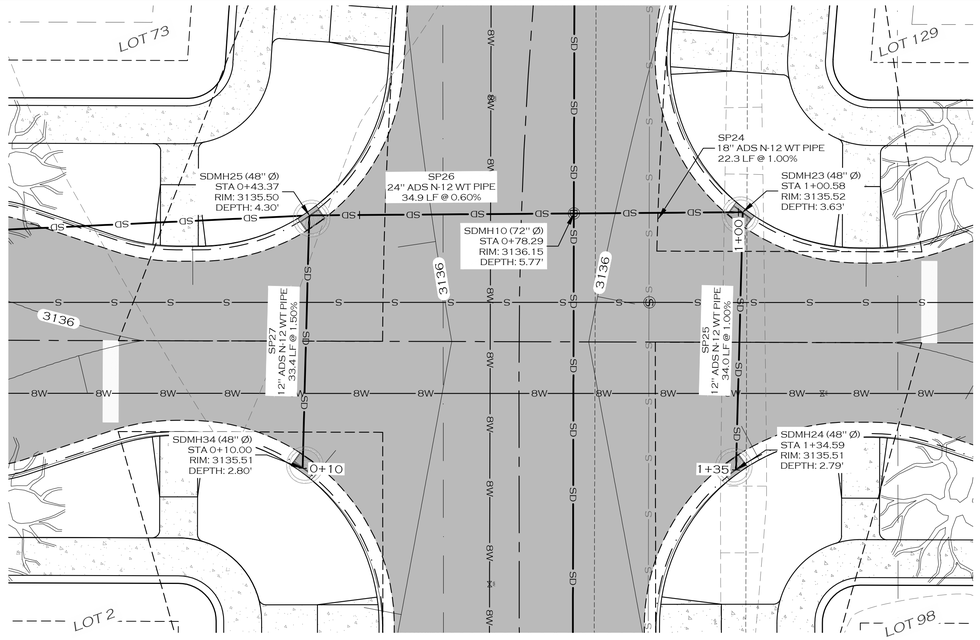

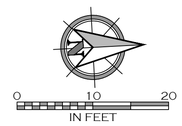

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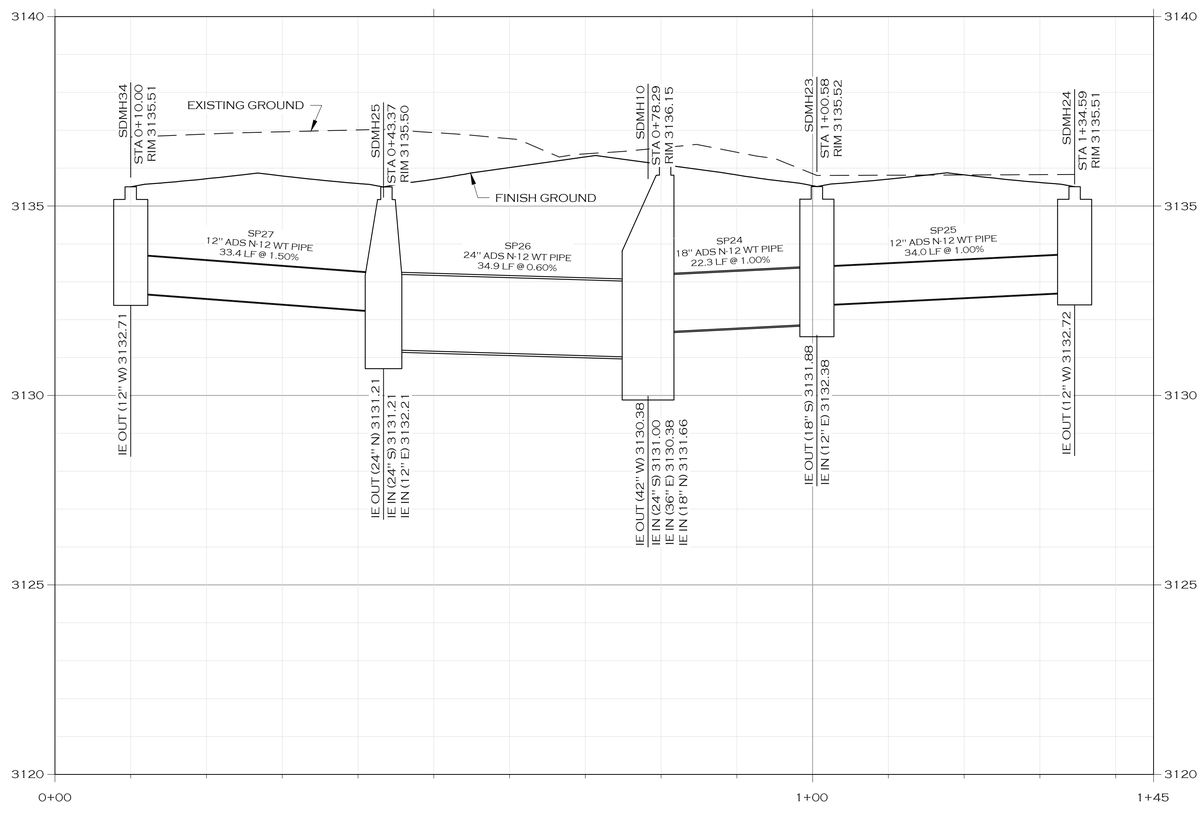
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- PROPOSED BURIED POWER
- PROPOSED LIGHT POLE
- PROPOSED BURIED FIBER
- PROPOSED BURIED TELEPHONE
- PROPOSED BURIED GAS



HORIZONTAL
0 10 20
IN FEET

VERTICAL
0 5 10
IN FEET

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

PRELIMINARY

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
1		

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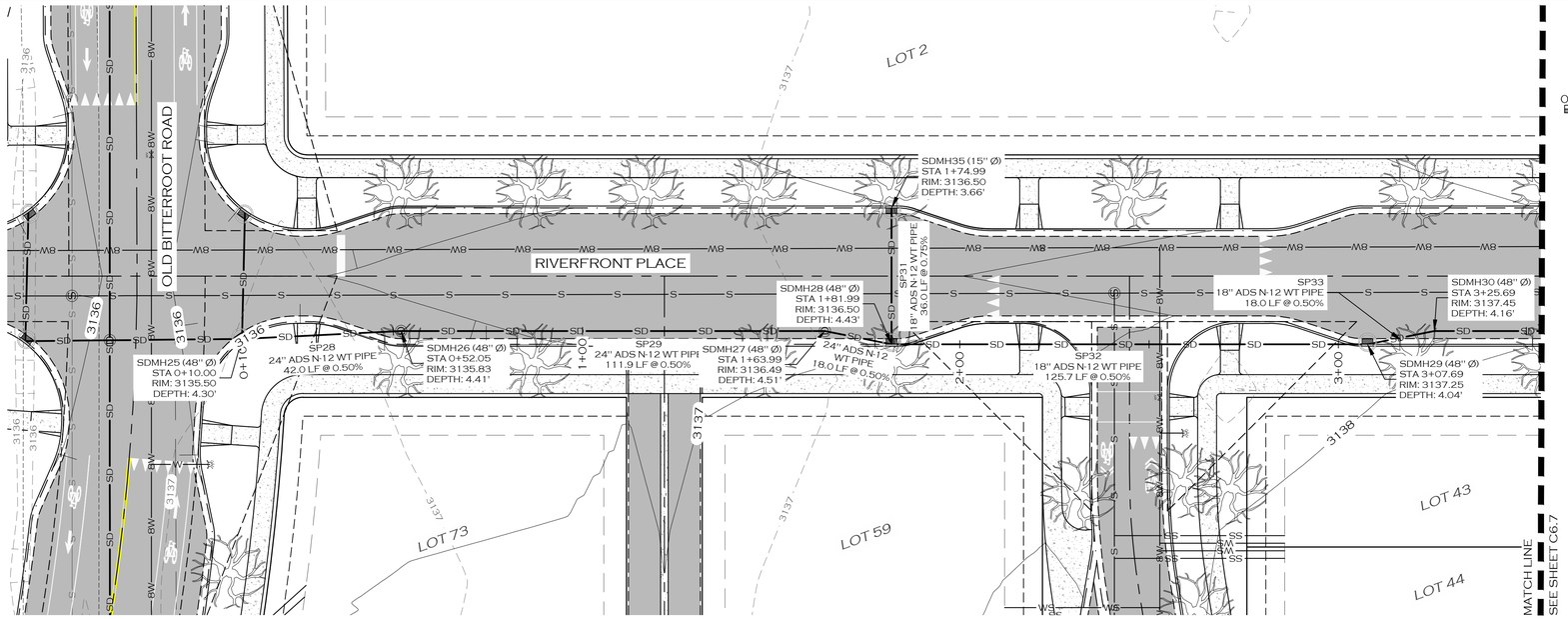
RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN B PLAN & PROFILE

C6.5

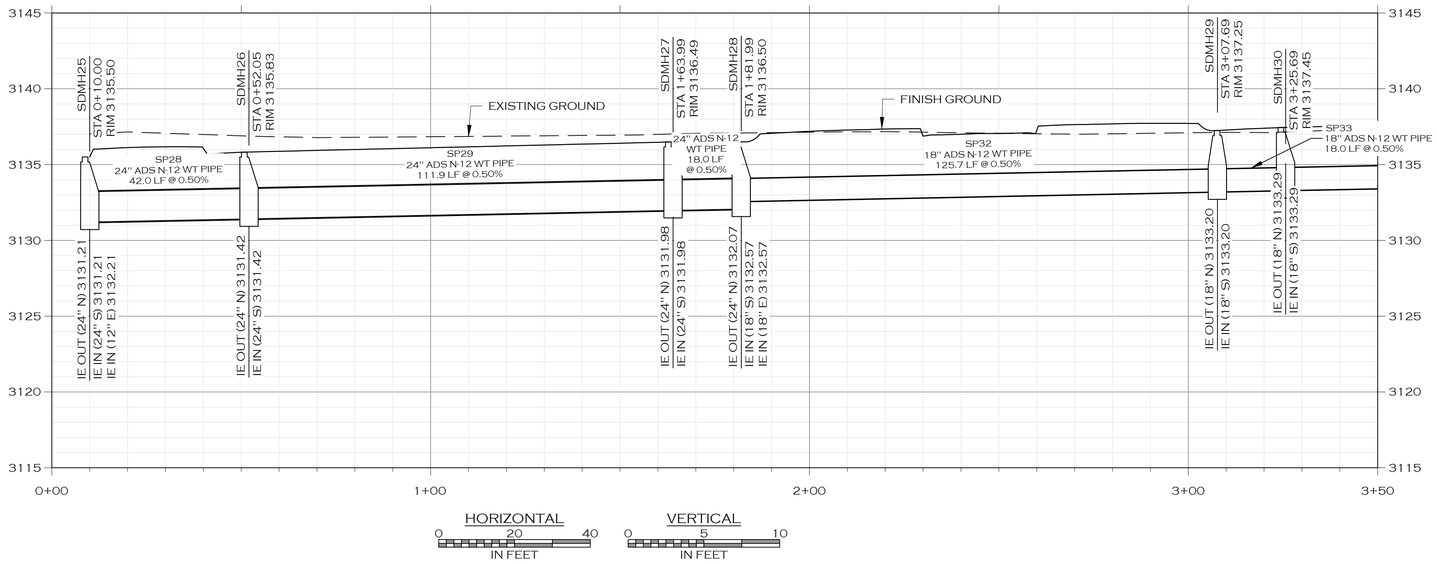
STRM B 0+00 TO 1+75.DWG PLOTTED BY MATT HAMMERSTEIN ON JUL 22, 2022



0 20 40
IN FEET

LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- PROPOSED WATER MAIN
- PROPOSED WATER SERVICE
- PROPOSED FIRE SERVICE
- PROPOSED IRRIGATION
- PROPOSED BLOWOFF
- PROPOSED CURB STOP
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED AIR RELIEF VALVE
- PROPOSED SANITARY SEWER MAIN
- PROPOSED SANITARY SEWER SERVICE
- PROPOSED MANHOLE - SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED MANHOLE - STORM SEWER
- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- PROPOSED BURIED POWER
- PROPOSED LIGHT POLE
- PROPOSED BURIED FIBER
- PROPOSED BURIED TELEPHONE
- PROPOSED BURIED GAS



HORIZONTAL
0 20 40
IN FEET

VERTICAL
0 5 10
IN FEET

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

PRELIMINARY

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
4		

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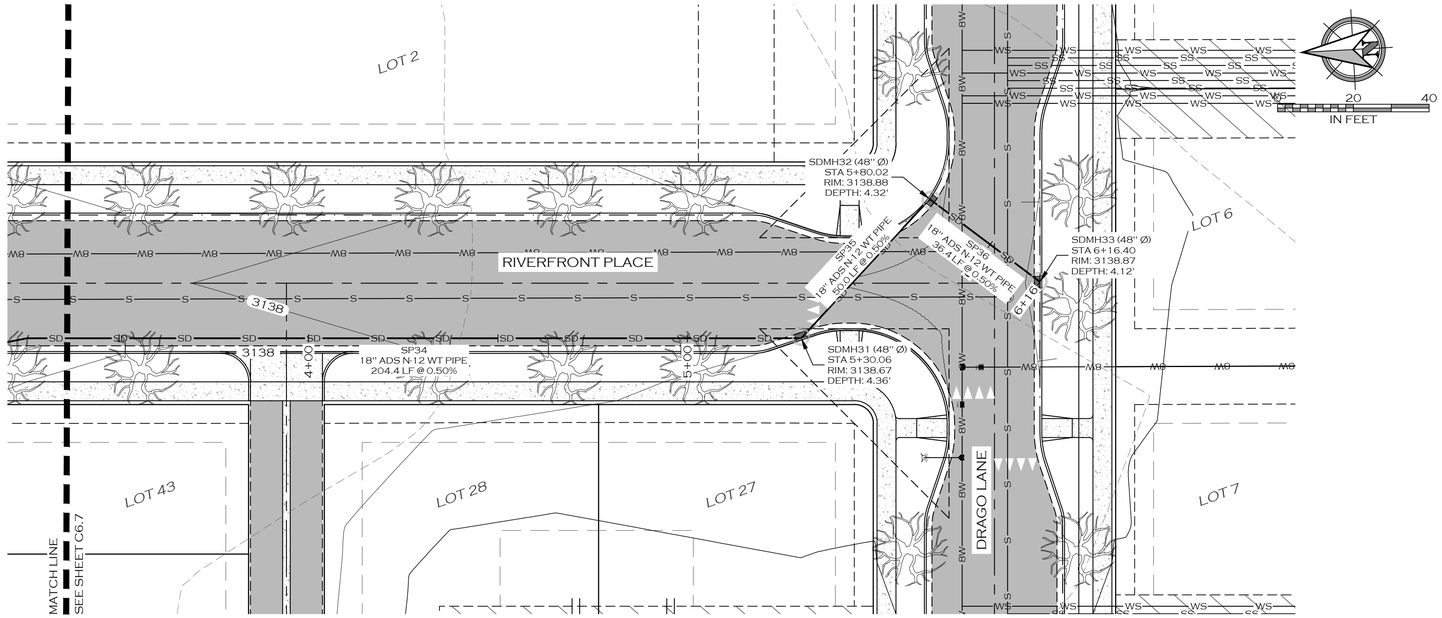
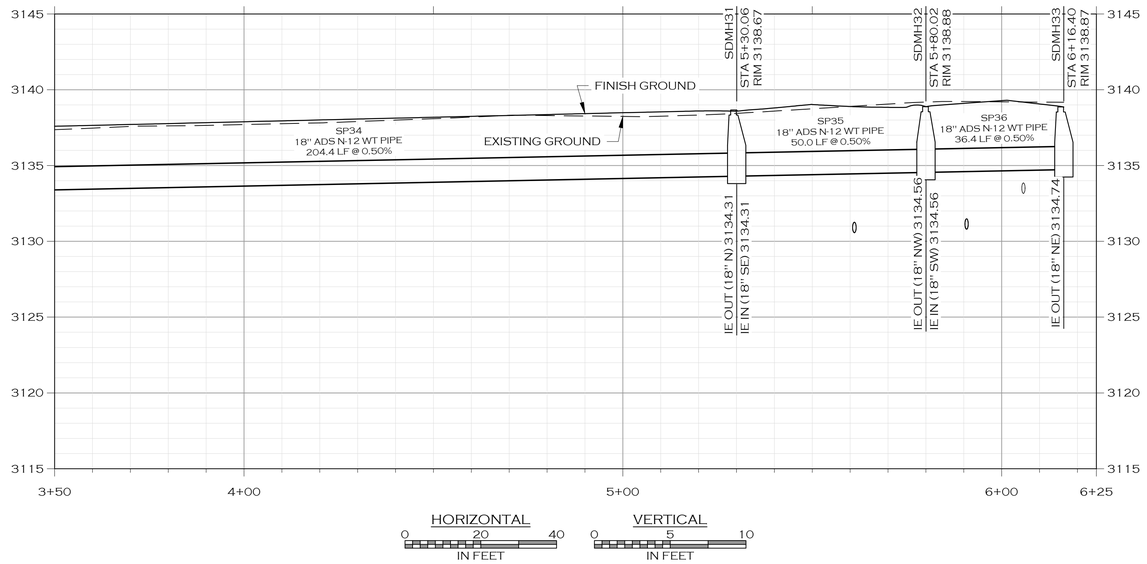
RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN I PLAN & PROFILE STA. 0+00 TO 3+50

C6.6

STORM MAIN I PLAN & PROFILE STA. 0+00 TO 3+50.DWG PLOTTED BY MATT HAMMERSTEIN ON JUL/22/2022





LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- PROPOSED WATER MAIN
- PROPOSED WATER SERVICE
- PROPOSED FIRE SERVICE
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- PROPOSED SANITARY SEWER MAIN
- PROPOSED SANITARY SEWER SERVICE
- PROPOSED MANHOLE - SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED MANHOLE - STORM SEWER
- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- PROPOSED BURIED POWER
- PROPOSED LIGHT POLE
- PROPOSED BURIED FIBER
- PROPOSED BURIED TELEPHONE
- PROPOSED BURIED GAS

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
4		

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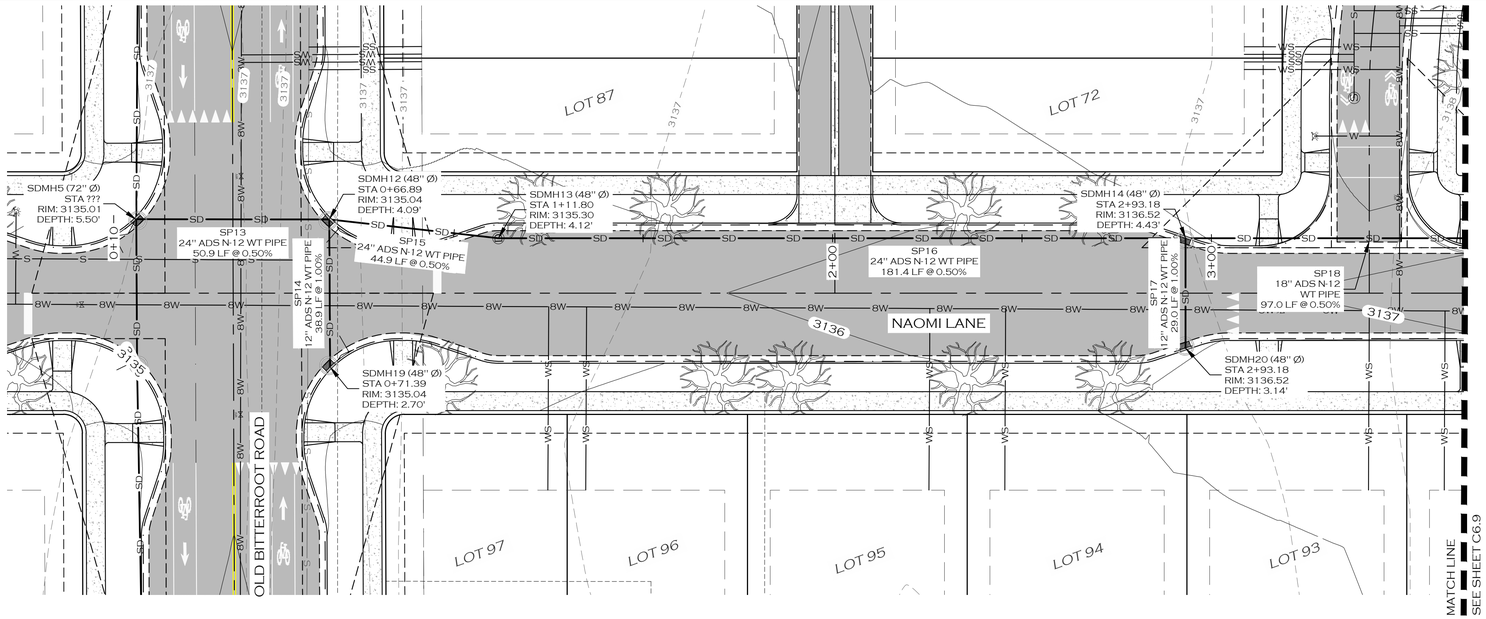
PRELIMINARY

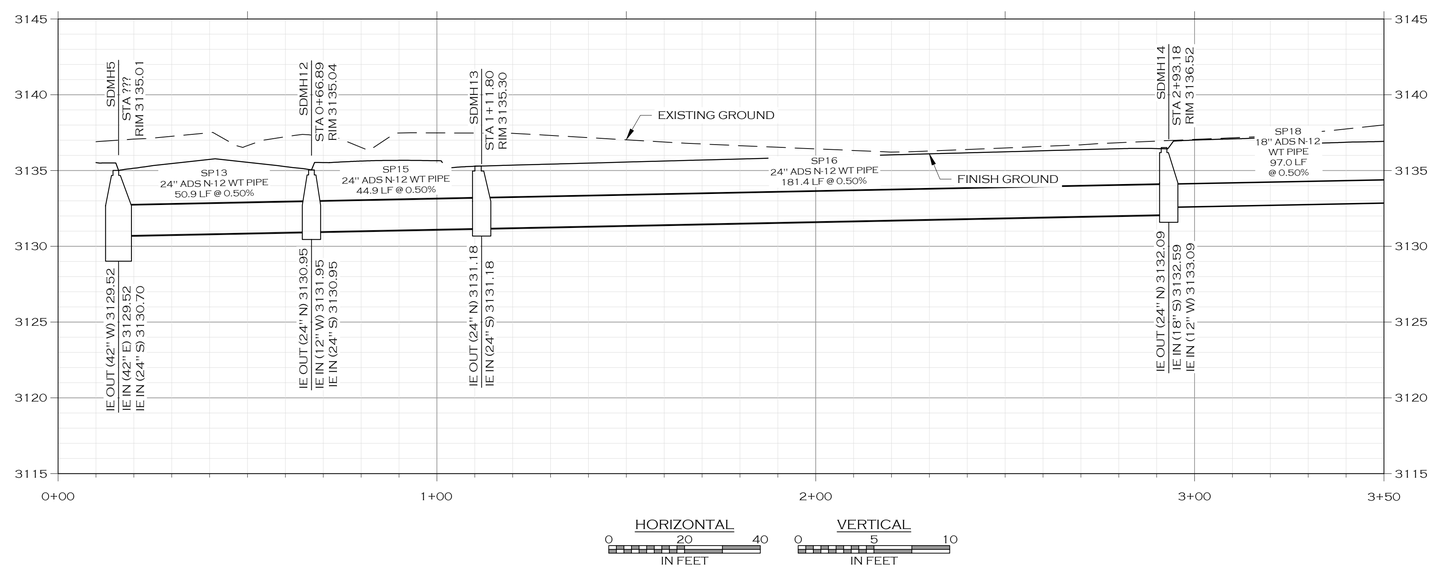
RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN I PLAN & PROFILE STA.3+50 TO 6+50

C6.7

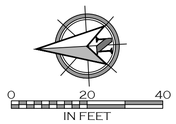
STRM1 3+50 TO END.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL/22/2022





HORIZONTAL
0 20 40
IN FEET

VERTICAL
0 5 10
IN FEET



LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- W — PROPOSED WATER MAIN
- WS — PROPOSED WATER SERVICE
- FL — PROPOSED FIRE SERVICE
- IRR — PROPOSED IRRIGATION
- PROPOSED BLOWOFF
- PROPOSED CURB STOP
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED AIR RELIEF VALVE
- S — S — PROPOSED SANITARY SEWER MAIN
- SS — PROPOSED SANITARY SEWER SERVICE
- PROPOSED MANHOLE - SANITARY SEWER
- SD — PROPOSED STORM SEWER
- PROPOSED MANHOLE - STORM SEWER
- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- E — E — PROPOSED BURIED POWER
- PROPOSED LIGHT POLE
- F — F — PROPOSED BURIED FIBER
- T — T — PROPOSED BURIED TELEPHONE
- G — G — PROPOSED BURIED GAS

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

PRELIMINARY

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
4		

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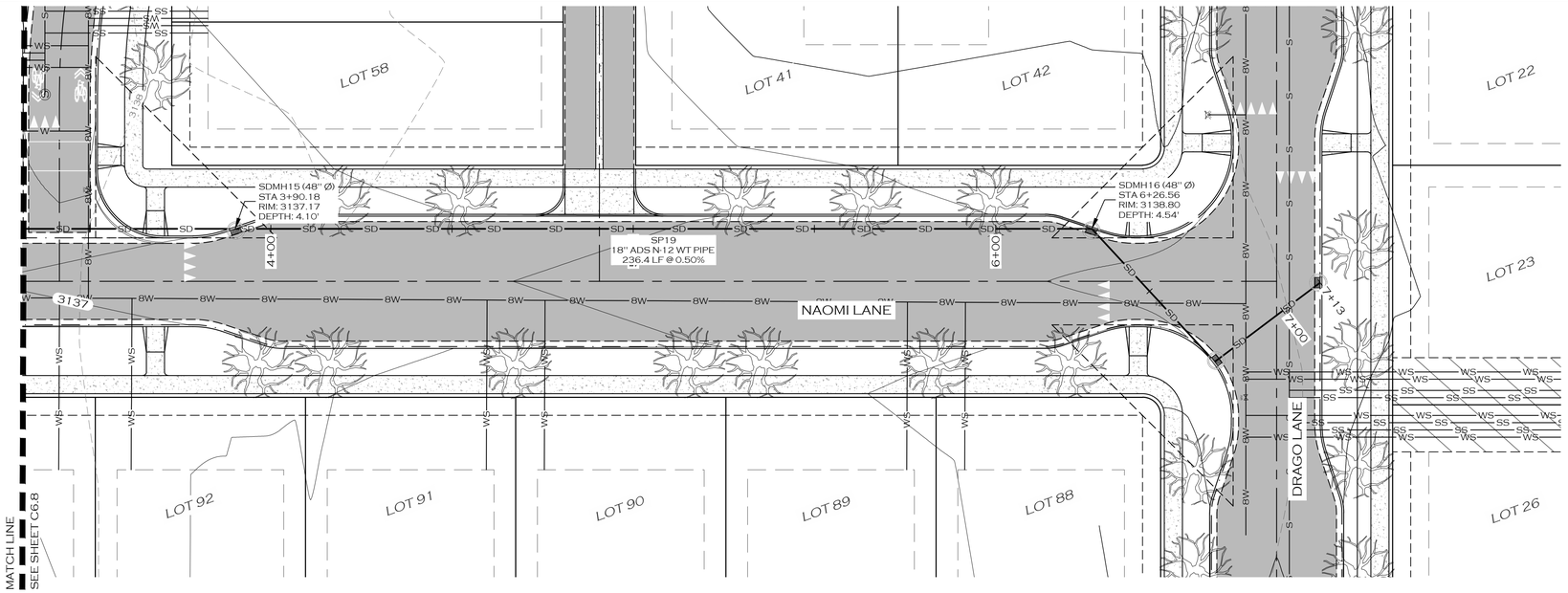
RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN F PLAN & PROFILE STA. 0+00 TO 3+50

C6.8

STORM MAIN F PLAN & PROFILE.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL 22, 2022



0 20 40
IN FEET

LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
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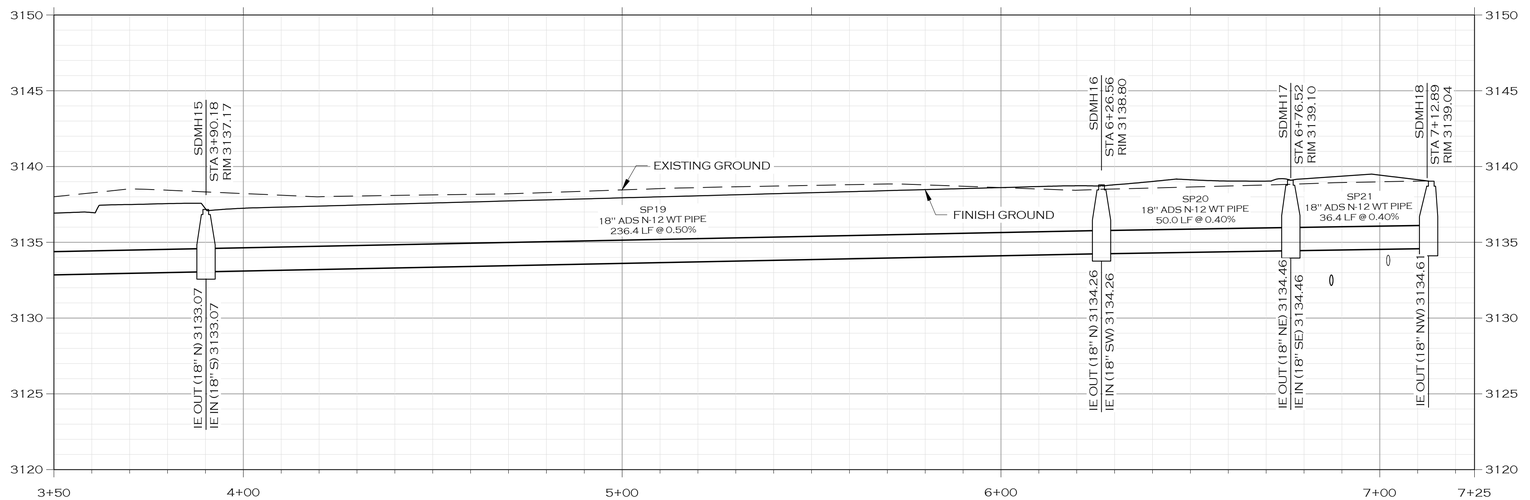
- F — F — PROPOSED BURIED FIBER
- T — T — PROPOSED BURIED TELEPHONE
- G — G — PROPOSED BURIED GAS



HORIZONTAL
0 20 40
IN FEET

VERTICAL
0 5 10
IN FEET

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
1		

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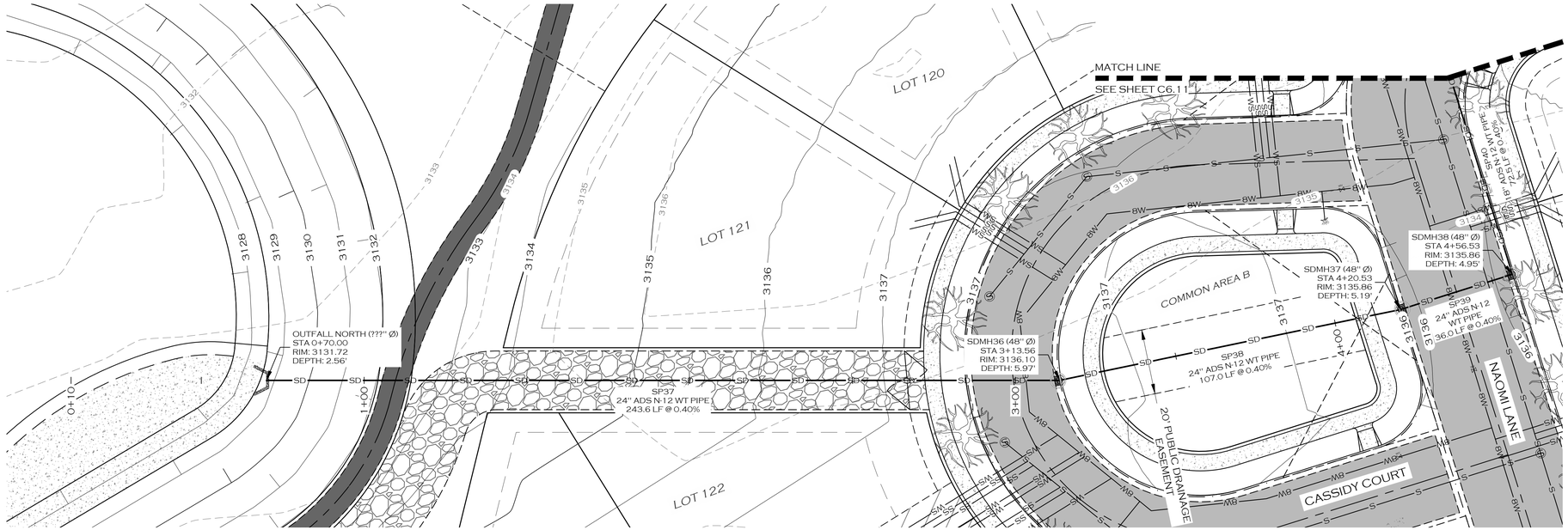
PRELIMINARY

RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN F PLAN & PROFILE STA. 3+50 TO 7+25

C6.9

STORM MAIN F PLAN & PROFILE STA. 3+50 TO 7+25.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL/22/2022



0 20 40
IN FEET

LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- W — PROPOSED WATER MAIN
- WS — PROPOSED WATER SERVICE
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- PROPOSED BLOWOFF
- PROPOSED CURB STOP
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
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- S — PROPOSED SANITARY SEWER MAIN
- SS — PROPOSED SANITARY SEWER SERVICE
- PROPOSED MANHOLE - SANITARY SEWER
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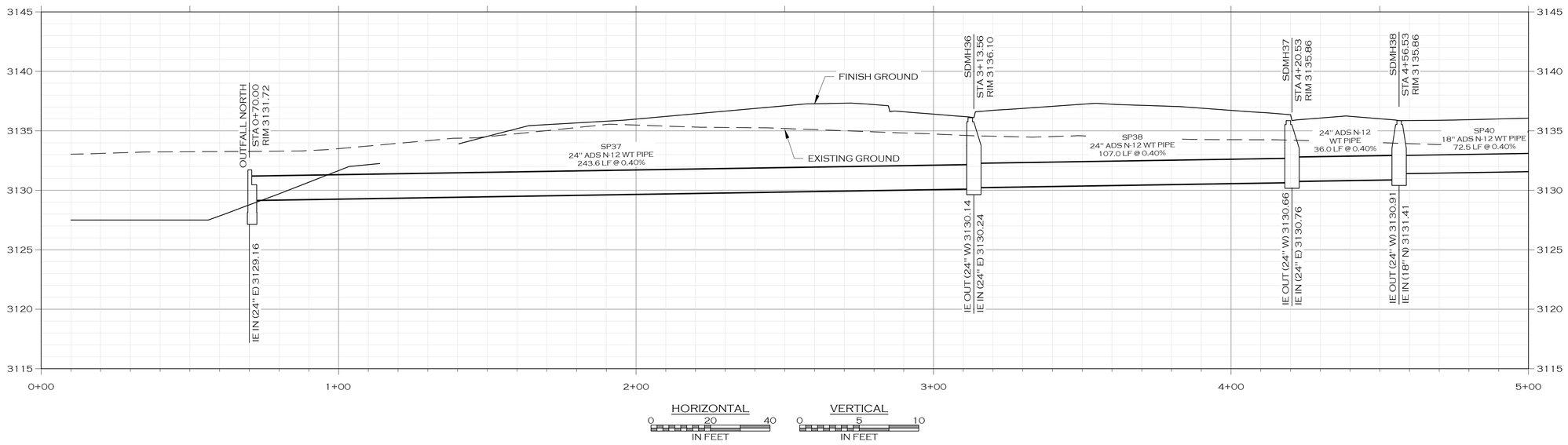
- PROPOSED MANHOLE - STORM SEWER
- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- E — PROPOSED BURIED POWER
- PROPOSED LIGHT POLE



HORIZONTAL
0 20 40
IN FEET

VERTICAL
0 5 10
IN FEET

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
4		

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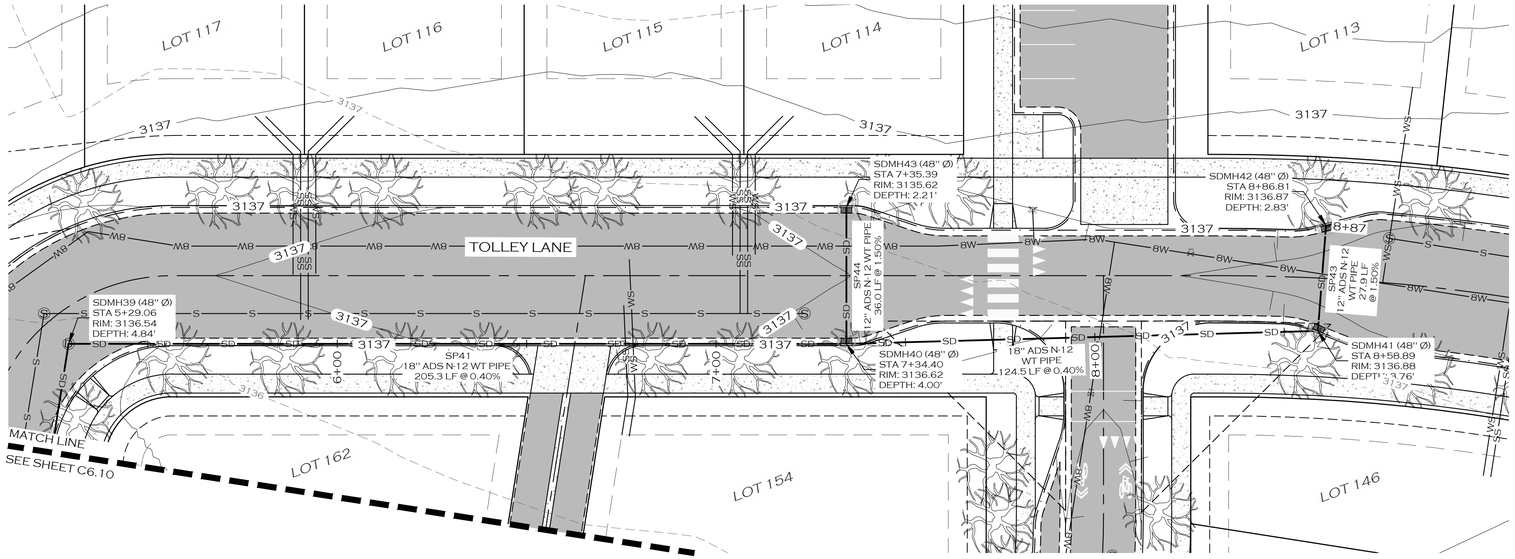
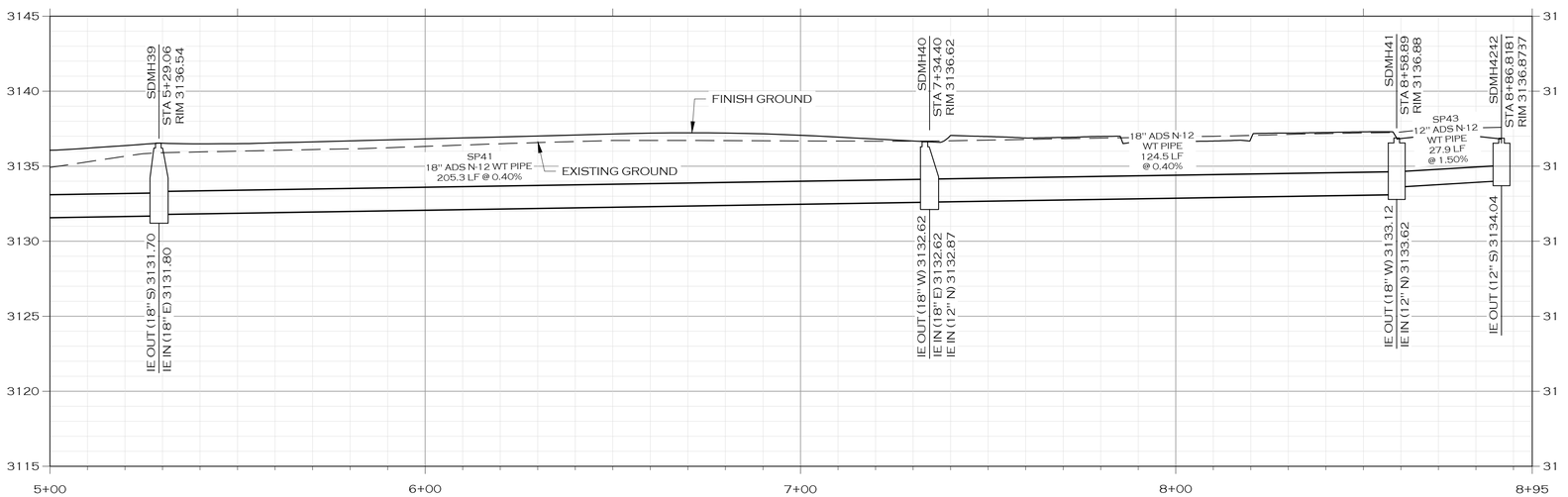
RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN E PLAN & PROFILE STA. 0+00 TO 5+00

C6.10

STRM E PNP.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL/22/2022





HORIZONTAL
0 20 40
IN FEET

VERTICAL
0 5 10
IN FEET

LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- PROPOSED WATER MAIN
- PROPOSED WATER SERVICE
- PROPOSED FIRE SERVICE
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- PROPOSED BLOWOFF
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- PROPOSED SANITARY SEWER MAIN
- PROPOSED SANITARY SEWER SERVICE
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- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- PROPOSED BURIED POWER
- PROPOSED LIGHT POLE

N

0 20 40
IN FEET

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

PRELIMINARY

JOB #:	2101
DRAWN:	MOH
DESIGN:	MOH
QA:	KTS
DATE:	7/21/2022

	DESCRIPTION	DATE
4		

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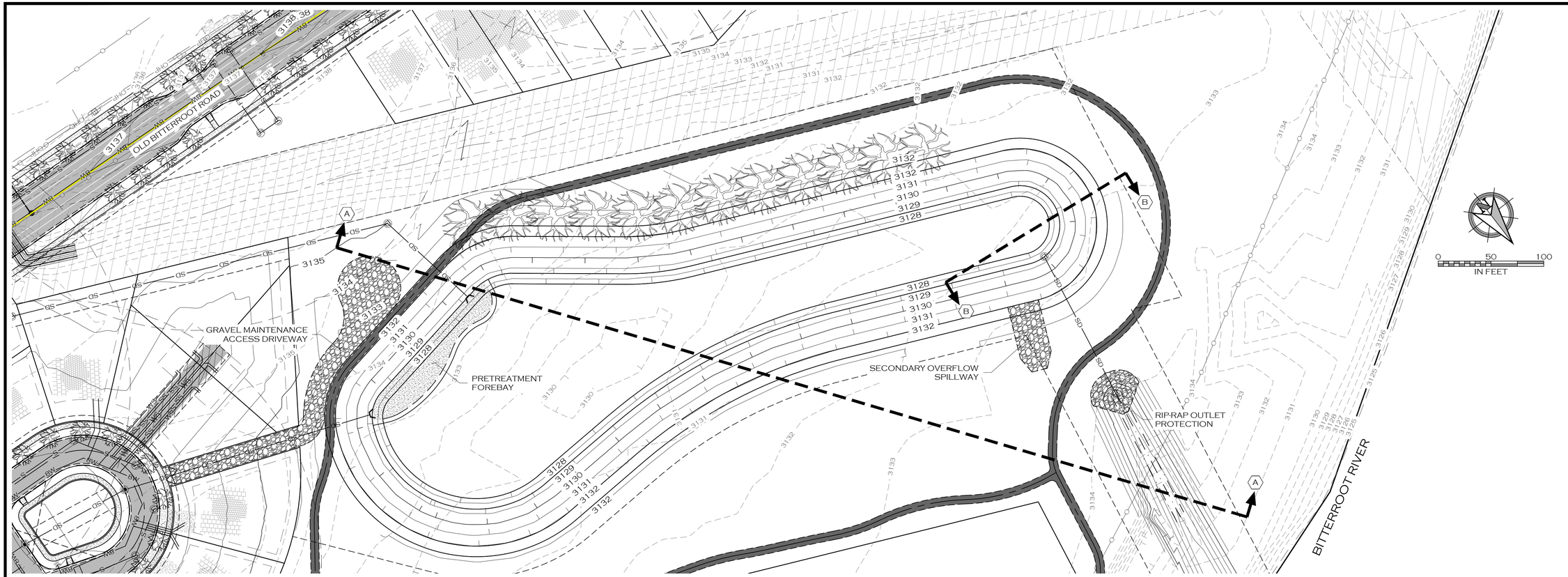
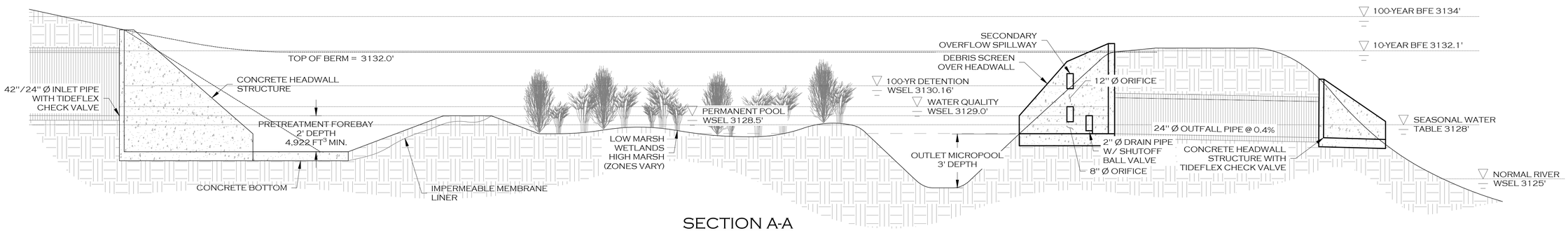
RIVERFRONT TRAILS
MISSOULA MONTANA

STORM MAIN E PLAN & PROFILE STA. 5+00 TO 8+85

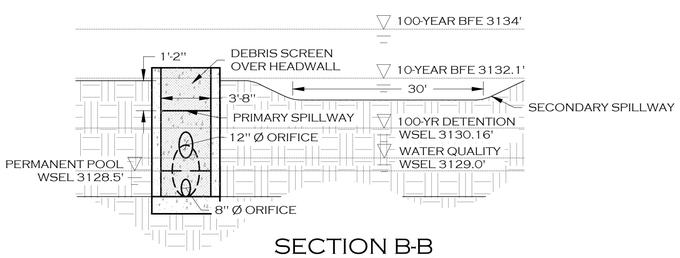
C6.11

STORM MAIN E PLAN & PROFILE STA. 5+00 TO 8+85.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL/22/2022





SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE

COLOR VERIFICATION
ELEMENTS ON THIS SHEET ARE INTENDED TO BE IN COLOR. IF PROPERLY REPRODUCED, RED, GREEN AND BLUE WILL BE VISIBLE.

PRELIMINARY

JOB #:	2101
DRAWN:	MOH
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QA:	KTS
DATE:	7/21/2022

#	DESCRIPTION	DATE

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RIVERFRONT TRAILS
MISSOULA MONTANA

STORMWATER WETLAND PLAN

C6.12

STORMWATER WETLAND PLAN.DWG PLOTTED BY: MATT HAMMERSTEIN ON JUL 22, 2022

LEGEND

- PROPOSED BUILDING
- PROPOSED SIGN POST
- PROPOSED ROAD CENTERLINE
- PROPOSED TRAIL
- PROPOSED CURB
- PROPOSED WHITE TRAFFIC STRIPE
- PROPOSED YELLOW TRAFFIC STRIPE
- PROPOSED ASPHALT ROAD
- PROPOSED SIDEWALK/CONCRETE
- PROPOSED ADA STALL MARKING
- PROPOSED BICYCLE RACK
- W — PROPOSED WATER MAIN
- WS — PROPOSED WATER SERVICE
- FL — PROPOSED FIRE SERVICE
- IRR — PROPOSED IRRIGATION
- PROPOSED BLOWOFF
- PROPOSED CURB STOP
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED AIR RELIEF VALVE
- S — PROPOSED SANITARY SEWER MAIN
- SS — PROPOSED SANITARY SEWER SERVICE
- PROPOSED MANHOLE - SANITARY SEWER
- SD — PROPOSED STORM SEWER
- PROPOSED MANHOLE - STORM SEWER
- PROPOSED STORM DRAIN INLET
- PROPOSED DITCH
- PROPOSED POND
- PROPOSED GRADE BREAK
- PROPOSED LANDSCAPING
- PROPOSED DECIDUOUS TREE
- E — PROPOSED BURIED POWER
- PROPOSED LIGHT POLE
- F — PROPOSED BURIED FIBER
- T — PROPOSED BURIED TELEPHONE
- G — PROPOSED BURIED GAS

COLOR VERIFICATION
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PRELIMINARY

	JOB #:	2101
	DRAWN:	MOH
	DESIGN:	MOH
	QA:	KTS
	DATE:	7/21/2022

	DESCRIPTION	DATE
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RIVERFRONT TRAILS
MISSOULA MONTANA
GROUNDWATER TESTING

C6.13

GROUNDWATER TESTING.DWG PLOTTED BY:MATT HAMMERSTEIN ON JUL 22, 2022

APPENDIX 2

AUTODESK STORM AND SANITARY ANALYSIS MODEL OUTPUT REPORT

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

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Project Description
****
File Name ..... 2101 - SWMM V10.1.SPF

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Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant flow
Starting Date JAN-01-2021 00:00:00
Ending Date JAN-08-2021 00:00:00
Report Time Step 00:00:30

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Element Count
****
Number of rain gages 1
Number of subbasins 41
Number of nodes 58
Number of links 56

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Subbasin Summary
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Subbasin ID	Total Area acres	Peak Rate Factor
BASIN_1	2.17	484.00
BASIN_10	0.98	484.00
BASIN_11	1.14	484.00
BASIN_12	0.92	484.00
BASIN_13	1.06	484.00
BASIN_14	1.23	484.00
BASIN_15	1.07	484.00
BASIN_16	0.73	484.00
BASIN_17	0.69	484.00
BASIN_18	0.61	484.00
BASIN_19	1.22	484.00
BASIN_2	0.27	484.00
BASIN_20	0.52	484.00
BASIN_21	0.85	484.00
BASIN_22	0.89	484.00
BASIN_23	2.26	484.00
BASIN_24	0.45	484.00
BASIN_25	0.17	484.00
BASIN_26	0.56	484.00
BASIN_27	0.63	484.00
BASIN_28	0.32	484.00
BASIN_29	1.92	484.00
BASIN_3	1.19	484.00
BASIN_30	2.17	484.00
BASIN_38	0.50	484.00
BASIN_4	1.16	484.00
BASIN_5	0.48	484.00
BASIN_6	0.86	484.00

BASIN_7	0.78	484.00
BASIN_8	0.81	484.00
BASIN_9	0.31	484.00
BASIN_EXISTING	37.19	484.00
BASIN_EXISTING_PH3	3.86	484.00
BASIN_PH3_1	0.28	484.00
BASIN_PH3_2	1.13	484.00
BASIN_PH3_3	0.55	484.00
BASIN_PH3_4	1.89	484.00
LMC_ROAD_EAST	1.18	484.00
LMC_ROAD_SOUTH	1.49	484.00
RELIGIOUS	4.99	484.00
SENIOR	5.53	484.00

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Node Summary
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Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
OUTFALL_BITTERROOT	JUNCTION	3119.60	3136.00	0.00	
OUTFALL_CONTROL	JUNCTION	3128.00	3132.60	0.00	
PH3_OUTLET	JUNCTION	3128.50	3132.50	0.00	
SDMH 43	JUNCTION	3132.62	3137.21	0.00	
SDMH_LMC	JUNCTION	3131.40	3138.21	0.00	
SDMH1	JUNCTION	3128.66	3134.98	0.00	
SDMH10	JUNCTION	3130.38	3136.15	0.00	
SDMH11	JUNCTION	3130.83	3137.32	0.00	
SDMH12	JUNCTION	3130.95	3135.04	0.00	
SDMH13	JUNCTION	3131.18	3135.30	0.00	
SDMH14	JUNCTION	3132.09	3136.52	0.00	
SDMH15	JUNCTION	3133.07	3137.17	0.00	
SDMH16	JUNCTION	3134.26	3138.80	0.00	
SDMH17	JUNCTION	3134.46	3139.10	0.00	
SDMH18	JUNCTION	3134.61	3139.04	0.00	
SDMH19	JUNCTION	3132.34	3135.05	0.00	
SDMH2	JUNCTION	3129.22	3136.62	0.00	
SDMH20	JUNCTION	3133.38	3136.52	0.00	
SDMH21	JUNCTION	3132.51	3135.59	0.00	
SDMH22	JUNCTION	3132.31	3135.67	0.00	
SDMH23	JUNCTION	3131.88	3135.52	0.00	
SDMH24	JUNCTION	3132.72	3135.51	0.00	
SDMH25	JUNCTION	3131.21	3135.50	0.00	
SDMH26	JUNCTION	3131.42	3135.83	0.00	
SDMH27	JUNCTION	3131.98	3136.49	0.00	
SDMH28	JUNCTION	3132.07	3136.50	0.00	
SDMH29	JUNCTION	3133.20	3137.25	0.00	
SDMH3	JUNCTION	3129.29	3135.82	0.00	
SDMH30	JUNCTION	3133.29	3137.45	0.00	
SDMH31	JUNCTION	3134.31	3138.67	0.00	
SDMH32	JUNCTION	3134.56	3138.88	0.00	
SDMH33	JUNCTION	3134.74	3139.11	0.00	
SDMH34	JUNCTION	3132.71	3135.51	0.00	
SDMH35	JUNCTION	3132.84	3136.50	0.00	
SDMH36	JUNCTION	3130.14	3136.10	0.00	
SDMH37	JUNCTION	3130.66	3135.86	0.00	
SDMH38	JUNCTION	3130.91	3135.86	0.00	
SDMH39	JUNCTION	3131.70	3136.54	0.00	
SDMH4	JUNCTION	3129.46	3135.01	0.00	
SDMH40	JUNCTION	3132.62	3136.62	0.00	
SDMH41	JUNCTION	3133.12	3136.88	0.00	
SDMH42	JUNCTION	3134.04	3136.87	0.00	
SDMH43	JUNCTION	3133.41	3135.62	0.00	
SDMH44	JUNCTION	3130.14	3135.37	0.00	
SDMH45	JUNCTION	3131.89	3136.18	0.00	

SDMH46	JUNCTION	3132.18	3136.18	0.00
SDMH47	JUNCTION	3130.43	3134.29	0.00
SDMH5	JUNCTION	3129.52	3135.01	0.00
SDMH6	JUNCTION	3129.84	3135.59	0.00
SDMH7	JUNCTION	3129.98	3136.61	0.00
SDMH8	JUNCTION	3130.12	3135.67	0.00
SDMH9	JUNCTION	3130.24	3136.42	0.00
BITTERROOT	OUTFALL	3119.57	3135.97	0.00
BITTERROOT_PH3	OUTFALL	3120.00	3122.50	0.00
OUTFALL_EXISTING	OUTFALL	0.00	0.00	0.00
OUTFALL_EXISTING_PH3	OUTFALL	0.00	0.00	0.00
POND	STORAGE	3127.50	3132.10	27000.00
POND_PH3	STORAGE	3128.50	3132.50	5000.00

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-04	PH3_OUTLET	BITTERROOT_PH3	CONDUIT	23.7	35.8801	0.0150
RIVER_02	OUTFALL_BITTERROOT	BITTERROOT	CHANNEL	50.0	0.1200	0.0400
SDP_OUTFALL	OUTFALL_CONTROL	OUTFALL_BITTERROOT	CONDUIT	100.0	0.5000	0.0100
SP1	SDMH1	POND	CONDUIT	103.0	0.1534	0.0100
SP10	SDMH10	SDMH9	CONDUIT	94.4	0.1518	0.0100
SP11	SDMH11	SDMH10	CONDUIT	252.8	0.1776	0.0100
SP12	SDMH_LMC	SDMH11	CONDUIT	274.0	0.2083	0.0100
SP13	SDMH12	SDMH5	CONDUIT	50.9	0.5000	0.0100
SP14	SDMH19	SDMH12	CONDUIT	38.9	0.9990	0.0100
SP15	SDMH13	SDMH12	CONDUIT	44.9	0.5000	0.0100
SP16	SDMH14	SDMH13	CONDUIT	181.4	0.5000	0.0100
SP17	SDMH20	SDMH14	CONDUIT	29.0	1.0000	0.0100
SP18	SDMH15	SDMH14	CONDUIT	97.0	0.5000	0.0100
SP19	SDMH16	SDMH15	CONDUIT	236.4	0.5032	0.0100
SP2	SDMH2	SDMH1	CONDUIT	366.7	0.1527	0.0100
SP20	SDMH17	SDMH16	CONDUIT	50.0	0.4000	0.0100
SP21	SDMH18	SDMH17	CONDUIT	36.4	0.4000	0.0100
SP22	SDMH21	SDMH6	CONDUIT	47.0	1.0000	0.0100
SP23	SDMH22	SDMH8	CONDUIT	47.0	1.0000	0.0100
SP24	SDMH23	SDMH10	CONDUIT	22.3	1.0000	0.0100
SP25	SDMH24	SDMH23	CONDUIT	34.0	1.0000	0.0100
SP26	SDMH25	SDMH10	CONDUIT	34.9	0.6000	0.0100
SP27	SDMH34	SDMH25	CONDUIT	33.4	1.5000	0.0100
SP28	SDMH26	SDMH25	CONDUIT	42.0	0.4988	0.0100
SP29	SDMH27	SDMH26	CONDUIT	111.9	0.4998	0.0100
SP3	SDMH3	SDMH2	CONDUIT	45.8	0.1528	0.0100
SP30	SDMH28	SDMH27	CONDUIT	18.0	0.5000	0.0100
SP31	SDMH35	SDMH28	CONDUIT	36.0	0.7500	0.0100
SP32	SDMH29	SDMH28	CONDUIT	125.7	0.5026	0.0100
SP33	SDMH30	SDMH29	CONDUIT	18.0	0.5000	0.0100
SP34	SDMH31	SDMH30	CONDUIT	204.4	0.5000	0.0100
SP35	SDMH32	SDMH31	CONDUIT	50.0	0.5000	0.0100
SP36	SDMH33	SDMH32	CONDUIT	36.4	0.5000	0.0100
SP37	SDMH36	POND	CONDUIT	243.6	0.3999	0.0100
SP38	SDMH37	SDMH36	CONDUIT	107.0	0.4001	0.0100
SP39	SDMH38	SDMH37	CONDUIT	36.0	0.4000	0.0100
SP4	SDMH4	SDMH3	CONDUIT	110.1	0.1526	0.0100
SP40	SDMH39	SDMH38	CONDUIT	72.5	0.3998	0.0100
SP41	SDMH40	SDMH39	CONDUIT	205.3	0.4000	0.0100
SP42	SDMH41	SDMH40	CONDUIT	124.5	0.3997	0.0100
SP43	SDMH42	SDMH41	CONDUIT	27.9	1.5000	0.0100
SP44	SDMH43	SDMH40	CONDUIT	36.0	1.5000	0.0100
SP45	SDMH44	POND_PH3	CONDUIT	102.9	0.4000	0.0100
SP46	SDMH45	SDMH44	CONDUIT	412.4	0.4000	0.0100
SP47	SDMH46	SDMH45	CONDUIT	48.0	0.4000	0.0100
SP48	SDMH47	SDMH44	CONDUIT	48.0	0.4000	0.0100

SP49	SDMH 43	SDMH11	CONDUIT	51.4	0.5000	0.0100
SP5	SDMH5	SDMH4	CONDUIT	38.8	0.1521	0.0100
SP6	SDMH6	SDMH5	CONDUIT	208.8	0.1527	0.0100
SP7	SDMH7	SDMH6	CONDUIT	95.5	0.1529	0.0100
SP8	SDMH8	SDMH7	CONDUIT	92.7	0.1521	0.0100
SP9	SDMH9	SDMH8	CONDUIT	75.6	0.1522	0.0100
WQV_DRAIN	OUTFALL_CONTROL	POND	CONDUIT	68.6	1.4569	0.0100
Orifice-02	POND_PH3	PH3_OUTLET	ORIFICE			
Orifice-03	POND_PH3	PH3_OUTLET	ORIFICE			
Orifice-04	POND	OUTFALL_CONTROL	ORIFICE			

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Cross Section Summary
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Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-04	CIRCULAR	2.50	2.50	1	4.91	0.63	212.93
RIVER_02	TRAPEZOIDAL	16.40	265.60	1	3817.92	13.97	28496.32
SDP_OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	37.70
SP1	CIRCULAR	3.50	3.50	1	9.62	0.88	51.23
SP10	CIRCULAR	3.50	3.50	1	9.62	0.88	50.96
SP11	CIRCULAR	3.00	3.00	1	7.07	0.75	36.54
SP12	CIRCULAR	2.00	2.00	1	3.14	0.50	13.42
SP13	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP14	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP15	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP16	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP17	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP18	CIRCULAR	1.50	1.50	1	1.77	0.38	9.66
SP19	CIRCULAR	1.50	1.50	1	1.77	0.38	9.69
SP2	CIRCULAR	3.50	3.50	1	9.62	0.88	51.11
SP20	CIRCULAR	1.50	1.50	1	1.77	0.38	8.64
SP21	CIRCULAR	1.50	1.50	1	1.77	0.38	8.64
SP22	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP23	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP24	CIRCULAR	1.50	1.50	1	1.77	0.38	13.66
SP25	CIRCULAR	1.00	1.00	1	0.79	0.25	

4.63						
SP26	CIRCULAR	2.00	2.00	1	3.14	0.50
22.78						
SP27	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP28	CIRCULAR	2.00	2.00	1	3.14	0.50
20.77						
SP29	CIRCULAR	2.00	2.00	1	3.14	0.50
20.79						
SP3	CIRCULAR	3.50	3.50	1	9.62	0.88
51.12						
SP30	CIRCULAR	2.00	2.00	1	3.14	0.50
20.80						
SP31	CIRCULAR	1.50	1.50	1	1.77	0.38
11.83						
SP32	CIRCULAR	1.50	1.50	1	1.77	0.38
9.68						
SP33	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP34	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP35	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP36	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP37	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP38	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP39	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP4	CIRCULAR	3.50	3.50	1	9.62	0.88
51.09						
SP40	CIRCULAR	1.50	1.50	1	1.77	0.38
8.63						
SP41	CIRCULAR	1.50	1.50	1	1.77	0.38
8.64						
SP42	CIRCULAR	1.50	1.50	1	1.77	0.38
8.63						
SP43	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP44	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP45	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP46	CIRCULAR	1.50	1.50	1	1.77	0.38
8.64						
SP47	CIRCULAR	1.00	1.00	1	0.79	0.25
2.93						
SP48	CIRCULAR	1.00	1.00	1	0.79	0.25
2.93						
SP49	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP5	CIRCULAR	3.50	3.50	1	9.62	0.88
51.00						
SP6	CIRCULAR	3.50	3.50	1	9.62	0.88
51.12						
SP7	CIRCULAR	3.50	3.50	1	9.62	0.88
51.14						
SP8	CIRCULAR	3.50	3.50	1	9.62	0.88
51.02						
SP9	CIRCULAR	3.50	3.50	1	9.62	0.88
51.02						
WQV_DRAIN	CIRCULAR	0.67	0.67	1	0.35	0.17
1.90						

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	8.484	1.170
Surface Runoff	0.127	0.017
Continuity Error (%)	-0.000	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	2.392	0.779
Initial Stored Volume	1.627	0.530
Final Stored Volume	1.139	0.371
Continuity Error (%)	-0.001	

Composite Curve Number Computations Report

Subbasin BASIN_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.57	D	98.00
> 75% grass cover, Good	0.10	D	80.00
1/8 acre lots, 65% impervious	1.49	D	92.00
Composite Area & Weighted CN	2.17		93.03

Subbasin BASIN_10

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.49	D	98.00
> 75% grass cover, Good	0.09	D	80.00
1/8 acre lots, 65% impervious	0.40	D	92.00
Composite Area & Weighted CN	0.98		93.94

Subbasin BASIN_11

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.36	D	98.00
> 75% grass cover, Good	0.07	D	80.00
1/8 acre lots, 65% impervious	0.71	D	92.00
Composite Area & Weighted CN	1.14		93.20

Subbasin BASIN_12

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.29	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.57	D	92.00
Composite Area & Weighted CN	0.92		93.20

Subbasin BASIN_13

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.23	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.79	D	92.00
Composite Area & Weighted CN	1.06		92.83

Subbasin BASIN_14

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.35	D	98.00
> 75% grass cover, Good	0.07	D	80.00
1/8 acre lots, 65% impervious	0.81	D	92.00
Composite Area & Weighted CN	1.23		93.07

Subbasin BASIN_15

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.45	D	98.00
> 75% grass cover, Good	0.10	D	80.00
1/8 acre lots, 65% impervious	0.52	D	92.00
Composite Area & Weighted CN	1.07		93.46

Subbasin BASIN_16

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.22	D	98.00
> 75% grass cover, Good	0.02	D	80.00
1/8 acre lots, 65% impervious	0.49	D	92.00
Composite Area & Weighted CN	0.74		93.41

Subbasin BASIN_17

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.57	D	98.00
> 75% grass cover, Good	0.12	D	80.00
Composite Area & Weighted CN	0.69		94.79

Subbasin BASIN_18

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.20	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.38	D	92.00
Composite Area & Weighted CN	0.61		93.25

Subbasin BASIN_19

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.15	D	98.00
> 75% grass cover, Good	0.03	D	80.00
1/8 acre lots, 65% impervious	1.04	D	92.00
Composite Area & Weighted CN	1.22		92.50

Subbasin BASIN_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.23	D	98.00
> 75% grass cover, Good	0.04	D	80.00
Composite Area & Weighted CN	0.27		95.30

Subbasin BASIN_20

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.52	D	92.00
Composite Area & Weighted CN	0.52		92.00

Subbasin BASIN_21

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.85	D	92.00
Composite Area & Weighted CN	0.85		92.00

Subbasin BASIN_22

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.89	D	92.00
Composite Area & Weighted CN	0.89		92.00

Subbasin BASIN_23

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	2.26	D	92.00
Composite Area & Weighted CN	2.26		92.00

Subbasin BASIN_24

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.45	D	92.00
Composite Area & Weighted CN	0.45		92.00

Subbasin BASIN_25

Soil/Surface Description	Area	Soil

Soil/Surface Description	(acres)	Group	CN
1/8 acre lots, 65% impervious	0.17	D	92.00
Composite Area & Weighted CN	0.17		92.00

Subbasin BASIN_26

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.27	D	92.00
Composite Area & Weighted CN	0.27		92.00

Subbasin BASIN_27

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.32	D	92.00
Composite Area & Weighted CN	0.32		92.00

Subbasin BASIN_28

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.32	D	98.00
Composite Area & Weighted CN	0.32		98.00

Subbasin BASIN_29

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	1.92	D	92.00
Composite Area & Weighted CN	1.92		92.00

Subbasin BASIN_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.29	D	98.00
> 75% grass cover, Good	0.03	D	80.00
1/8 acre lots, 65% impervious	0.88	D	92.00
Composite Area & Weighted CN	1.19		93.20

Subbasin BASIN_30

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	1.13	D	92.00
Composite Area & Weighted CN	1.13		92.00

Subbasin BASIN_38

Soil/Surface Description	Area (acres)	Soil Group	CN

Paved roads with curbs & sewers	0.20	D	98.00
1/8 acre lots, 65% impervious	0.30	D	92.00
Composite Area & Weighted CN	0.50		94.40

Subbasin BASIN_4

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.37	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.73	D	92.00
Composite Area & Weighted CN	1.16		93.23

Subbasin BASIN_5

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.41	D	98.00
> 75% grass cover, Good	0.07	D	80.00
Composite Area & Weighted CN	0.48		95.30

Subbasin BASIN_6

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.33	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.48	D	92.00
Composite Area & Weighted CN	0.86		93.47

Subbasin BASIN_7

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.36	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.35	D	92.00
Composite Area & Weighted CN	0.78		93.82

Subbasin BASIN_8

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.19	D	98.00
1/8 acre lots, 65% impervious	0.62	D	92.00
Composite Area & Weighted CN	0.81		93.41

Subbasin BASIN_9

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.24	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.03	D	92.00
Composite Area & Weighted CN	0.31		95.03

Subbasin BASIN_EXISTING

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	28.39	C	71.00
Composite Area & Weighted CN	28.39		71.00

Subbasin BASIN_EXISTING_PH3

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	3.86	C	71.00
Composite Area & Weighted CN	3.86		71.00

Subbasin BASIN_PH3_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.28	B	98.00
Composite Area & Weighted CN	0.28		98.00

Subbasin BASIN_PH3_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Urban commercial, 85% imp	1.13	B	92.00
Composite Area & Weighted CN	1.13		92.00

Subbasin BASIN_PH3_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.55	B	98.00
Composite Area & Weighted CN	0.55		98.00

Subbasin BASIN_PH3_4

Soil/Surface Description	Area (acres)	Soil Group	CN
Urban commercial, 85% imp	1.89	B	92.00
Composite Area & Weighted CN	1.89		92.00

Subbasin LMC_ROAD_EAST

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	1.00	D	98.00
> 75% grass cover, Good	0.18	D	80.00
Composite Area & Weighted CN	1.18		95.30

Subbasin LMC_ROAD_SOUTH

```
--------------------------
```

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	1.27	D	98.00
> 75% grass cover, Good	0.22	D	80.00
Composite Area & Weighted CN	1.49		95.30

```
---------------------
Subbasin RELIGIOUS
---------------------
```

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	5.47	C	71.00
Composite Area & Weighted CN	5.47		71.00

```
------------------
Subbasin SENIOR
------------------
```

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	5.53	C	71.00
Composite Area & Weighted CN	5.53		71.00

```
************************************************
SCS TR-55 Time of Concentration Computations Report
************************************************

Sheet Flow Equation
-------------------

        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation
----------------------------------

        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
---------------------
```

```
          V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
          R  = Aq / Wp
          Tc = (Lf / V) / (3600 sec/hr)

          Where:

          Tc = Time of Concentration (hrs)
          Lf = Flow Length (ft)
          R  = Hydraulic Radius (ft)
          Aq = Flow Area (ft²)
          Wp = Wetted Perimeter (ft)
          V  = Velocity (ft/sec)
          Sf = Slope (ft/ft)
          n  = Manning's Roughness

  -------------------
  Subbasin BASIN_1
  -------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                       0.15                0.00
0.00
          Flow Length (ft):                         50.00                0.00
0.00
          Slope (%):                                 2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17                0.00
0.00
          Velocity (ft/sec):                         0.09                0.00
0.00
          Computed Flow Time (minutes):              9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                        435.00                0.00
0.00
          Slope (%):                                 0.55                0.00
0.00
          Surface Type:                             Paved              Unpaved
Unpaved
          Velocity (ft/sec):                         1.51                0.00
0.00
          Computed Flow Time (minutes):              4.80                0.00
0.00

=============================================================================================
          Total TOC (minutes):                      14.11

=============================================================================================


  --------------------
  Subbasin BASIN_10
  --------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                       0.15                0.00
0.00
```

Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	267.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.09	0.00	0.00

Total TOC (minutes):	12.40

Subbasin BASIN_11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	360.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	4.17	0.00	0.00

Total TOC (minutes):	13.47		

Subbasin BASIN_12

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	278.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.22	0.00	0.00

Total TOC (minutes):	12.52		

Subbasin BASIN_13

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00

Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	337.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	3.72	0.00	0.00

Total TOC (minutes):	13.03

Subbasin BASIN_14

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	400.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	4.63	0.00	0.00

Total TOC (minutes):	13.94

Subbasin BASIN_15

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	200.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	2.21	0.00	0.00

Total TOC (minutes): 11.51

Subbasin BASIN_16

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	102.00	0.00	

```
0.00
          Slope (%):                                1.00                0.00
0.00
          Surface Type:                            Paved              Unpaved
Unpaved
          Velocity (ft/sec):                        2.03                0.00
0.00
          Computed Flow Time (minutes):             0.84                0.00
0.00

=============================================================================================
          Total TOC (minutes):                     10.14

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  Subbasin BASIN_17
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          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin BASIN_18
  --------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                      0.15                0.00
0.00
          Flow Length (ft):                        50.00                0.00
0.00
          Slope (%):                                2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                1.17                0.00
0.00
          Velocity (ft/sec):                        0.09                0.00
0.00
          Computed Flow Time (minutes):             9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                       248.00                0.00
0.00
          Slope (%):                                0.50                0.00
0.00
          Surface Type:                            Paved              Unpaved
Unpaved
          Velocity (ft/sec):                        1.44                0.00
0.00
          Computed Flow Time (minutes):             2.87                0.00
0.00

=============================================================================================
          Total TOC (minutes):                     12.18

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  Subbasin BASIN_19
  --------------------
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Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	242.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	2.67	0.00	0.00

Total TOC (minutes): 11.98

Subbasin BASIN_2

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_20

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	173.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.00	0.00	0.00

Total TOC (minutes): 11.31

Subbasin BASIN_21

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	327.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Unpaved	Unpaved	Unpaved
Velocity (ft/sec):	1.14	0.00	0.00
Computed Flow Time (minutes):	4.78	0.00	0.00

Total TOC (minutes): 14.09

Subbasin BASIN_22

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	256.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.96	0.00	0.00

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Total TOC (minutes): 12.27

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Subbasin BASIN_23

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	139.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
Surface Type:	Paved	Unpaved	

```
Unpaved
          Velocity (ft/sec):                          2.87                0.00
0.00
          Computed Flow Time (minutes):               0.81                0.00
0.00

=============================================================================================================
          Total TOC (minutes):                       10.11

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  Subbasin BASIN_24
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          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin BASIN_25
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                        0.15                0.00
0.00
          Flow Length (ft):                          50.00                0.00
0.00
          Slope (%):                                  2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                  1.17                0.00
0.00
          Velocity (ft/sec):                          0.09                0.00
0.00
          Computed Flow Time (minutes):               9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                         122.00                0.00
0.00
          Slope (%):                                  0.75                0.00
0.00
          Surface Type:                              Paved              Unpaved
Unpaved
          Velocity (ft/sec):                          1.76                0.00
0.00
          Computed Flow Time (minutes):               1.16                0.00
0.00

=============================================================================================================
          Total TOC (minutes):                       10.46

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  Subbasin BASIN_26
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
```

C				
	Manning's Roughness:	0.15	0.00	
0.00				
	Flow Length (ft):	50.00	0.00	
0.00				
	Slope (%):	2.00	0.00	
0.00				
	2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00				
	Velocity (ft/sec):	0.09	0.00	
0.00				
	Computed Flow Time (minutes):	9.31	0.00	
0.00				

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	120.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	1.39	0.00	0.00

Total TOC (minutes):	10.70

Subbasin BASIN_27

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	170.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	

0.00
Computed Flow Time (minutes): 1.97 0.00
0.00

Total TOC (minutes): 11.27

Subbasin BASIN_28

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	430.00	0.00	0.00
Slope (%):	0.75	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.76	0.00	0.00
Computed Flow Time (minutes):	4.07	0.00	0.00

Total TOC (minutes): 4.07

Subbasin BASIN_29

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	140.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	

```
0.00
          Computed Flow Time (minutes):              1.62               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      10.93

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  Subbasin BASIN_3
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  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
0.00
          Velocity (ft/sec):                         0.09               0.00
0.00
          Computed Flow Time (minutes):              9.31               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A          Subarea B          Subarea
C
          Flow Length (ft):                        385.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          Surface Type:                             Paved             Unpaved
Unpaved
          Velocity (ft/sec):                         1.44               0.00
0.00
          Computed Flow Time (minutes):              4.46               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      13.76

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  Subbasin BASIN_30
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
```

```
0.00
          Velocity (ft/sec):                        0.09                0.00
0.00
          Computed Flow Time (minutes):             9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                          Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                     200.00                0.00
0.00
          Slope (%):                            0.50                0.00
0.00
          Surface Type:                         Paved              Unpaved
Unpaved
          Velocity (ft/sec):                    1.44                0.00
0.00
          Computed Flow Time (minutes):             2.31                0.00
0.00

================================================================================================
          Total TOC (minutes):                  11.62

================================================================================================


  --------------------
  Subbasin BASIN_38
  --------------------

  Sheet Flow Computations
  -----------------------
                                          Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                  0.15                0.00
0.00
          Flow Length (ft):                     50.00                0.00
0.00
          Slope (%):                            2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):            1.17                0.00
0.00
          Velocity (ft/sec):                    0.09                0.00
0.00
          Computed Flow Time (minutes):             9.31                0.00
0.00

================================================================================================
          Total TOC (minutes):                  9.31

================================================================================================


  -------------------
  Subbasin BASIN_4
  -------------------

  Sheet Flow Computations
  -----------------------
                                          Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                  0.15                0.00
0.00
          Flow Length (ft):                     50.00                0.00
0.00
          Slope (%):                            2.00                0.00
```

0.00

2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	385.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	
0.00			
Computed Flow Time (minutes):	4.46	0.00	
0.00			

Total TOC (minutes):	13.76

Subbasin BASIN_5

User-Defined TOC override (minutes):	5.00

Subbasin BASIN_6

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	
0.00			
Flow Length (ft):	50.00	0.00	
0.00			
Slope (%):	2.00	0.00	
0.00			
2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	376.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	

```
0.00
          Computed Flow Time (minutes):              4.35               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      13.66

=============================================================================================================


  --------------------
  Subbasin BASIN_7
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
0.00
          Velocity (ft/sec):                         0.05               0.00
0.00
          Computed Flow Time (minutes):             16.20               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A          Subarea B          Subarea
C
          Flow Length (ft):                        400.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          Surface Type:                             Paved             Unpaved
Unpaved
          Velocity (ft/sec):                         1.44               0.00
0.00
          Computed Flow Time (minutes):              4.63               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      20.83

=============================================================================================================


  --------------------
  Subbasin BASIN_8
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
```

0.00

Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	330.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.82	0.00	0.00

Total TOC (minutes): 13.13

Subbasin BASIN_9

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	180.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.08	0.00	0.00

Total TOC (minutes): 11.39

Subbasin BASIN_EXISTING

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.13	0.00	0.00
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	45.92	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	500.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
Surface Type:	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec):	0.70	0.00	0.00
Computed Flow Time (minutes):	11.90	0.00	0.00

==========
Total TOC (minutes): 57.83
==========

Subbasin BASIN_EXISTING_PH3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.13	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	26.37	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	400.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
Surface Type:	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec):	0.70	0.00	0.00
Computed Flow Time (minutes):	9.52	0.00	0.00

Total TOC (minutes): 35.90

Subbasin BASIN_PH3_1

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_2

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_3

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_4

User-Defined TOC override (minutes): 5.00

Subbasin LMC_ROAD_EAST

User-Defined TOC override (minutes): 5.00

Subbasin LMC_ROAD_SOUTH

User-Defined TOC override (minutes): 5.00

Subbasin RELIGIOUS

User-Defined TOC override (minutes): 5.00

Subbasin SENIOR

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
BASIN_1	1.17	0.59	1.62	93.030	0	00:14:06
BASIN_10	1.17	0.64	0.83	93.940	0	00:12:24
BASIN_11	1.17	0.60	0.88	93.200	0	00:13:28
BASIN_12	1.17	0.60	0.72	93.200	0	00:12:31
BASIN_13	1.17	0.58	0.80	92.830	0	00:13:01
BASIN_14	1.17	0.59	0.92	93.070	0	00:13:56
BASIN_15	1.17	0.61	0.88	93.460	0	00:11:30
BASIN_16	1.17	0.61	0.62	93.410	0	00:10:08
BASIN_17	1.17	0.70	0.76	94.790	0	00:05:00
BASIN_18	1.17	0.60	0.48	93.250	0	00:12:10
BASIN_19	1.17	0.56	0.91	92.500	0	00:11:58
BASIN_2	1.17	0.73	0.31	95.300	0	00:05:00
BASIN_20	1.17	0.53	0.37	92.000	0	00:11:18
BASIN_21	1.17	0.53	0.57	92.000	0	00:14:05
BASIN_22	1.17	0.53	0.63	92.000	0	00:12:16
BASIN_23	1.17	0.53	1.66	92.000	0	00:10:06
BASIN_24	1.17	0.53	0.38	92.000	0	00:05:00
BASIN_25	1.17	0.53	0.13	92.000	0	00:10:27
BASIN_26	1.17	0.53	0.41	92.000	0	00:10:42
BASIN_27	1.17	0.53	0.45	92.000	0	00:11:16
BASIN_28	1.17	0.95	0.46	98.000	0	00:05:00
BASIN_29	1.17	0.53	1.39	92.000	0	00:10:55
BASIN_3	1.17	0.60	0.91	93.200	0	00:13:45
BASIN_30	1.17	0.53	1.55	92.000	0	00:11:37
BASIN_38	1.17	0.67	0.47	94.400	0	00:09:18
BASIN_4	1.17	0.60	0.89	93.230	0	00:13:45
BASIN_5	1.17	0.73	0.56	95.300	0	00:05:00
BASIN_6	1.17	0.61	0.68	93.470	0	00:13:39
BASIN_7	1.17	0.64	0.54	93.820	0	00:20:49
BASIN_8	1.17	0.61	0.64	93.410	0	00:13:07
BASIN_9	1.17	0.71	0.29	95.030	0	00:11:23
BASIN_EXISTING	1.17	0.03	0.11	71.000	0	00:57:49
BASIN_EXISTING_PH3	1.17	0.03	0.01	71.000	0	00:35:54
BASIN_PH3_1	1.17	0.95	0.41	98.000	0	00:05:00
BASIN_PH3_2	1.17	0.53	0.95	92.000	0	00:05:00
BASIN_PH3_3	1.17	0.96	0.79	98.000	0	00:05:00
BASIN_PH3_4	1.17	0.53	1.59	92.000	0	00:05:00
LMC_ROAD_EAST	1.17	0.73	1.36	95.300	0	00:05:00
LMC_ROAD_SOUTH	1.17	0.73	1.73	95.300	0	00:05:00
RELIGIOUS	1.17	0.03	0.02	71.000	0	00:05:00
SENIOR	1.17	0.03	0.02	71.000	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
OUTFALL_BITTERROOT	0.01	4.37	3123.97	0	00:00	0	0	0:00:00
OUTFALL_CONTROL	0.07	0.29	3128.29	0	15:13	0	0	0:00:00
PH3_OUTLET	0.01	0.02	3128.52	1	00:04	0	0	0:00:00
SDMH 43	0.00	0.05	3132.67	0	13:27	0	0	0:00:00

SDMH_LMC	0.01	0.69	3132.09	0	11:55	0	0	0:00:00
SDMH1	0.07	1.61	3130.27	0	12:06	0	0	0:00:00
SDMH10	0.02	1.50	3131.88	0	12:04	0	0	0:00:00
SDMH11	0.01	1.05	3131.88	0	12:03	0	0	0:00:00
SDMH12	0.01	0.96	3131.91	0	12:04	0	0	0:00:00
SDMH13	0.01	0.86	3132.04	0	12:03	0	0	0:00:00
SDMH14	0.01	0.66	3132.75	0	12:02	0	0	0:00:00
SDMH15	0.01	0.62	3133.69	0	12:02	0	0	0:00:00
SDMH16	0.01	0.46	3134.72	0	12:01	0	0	0:00:00
SDMH17	0.01	0.50	3134.96	0	12:01	0	0	0:00:00
SDMH18	0.01	0.51	3135.11	0	12:01	0	0	0:00:00
SDMH19	0.01	0.34	3132.69	0	12:01	0	0	0:00:00
SDMH2	0.03	1.62	3130.83	0	12:05	0	0	0:00:00
SDMH20	0.01	0.33	3133.71	0	12:02	0	0	0:00:00
SDMH21	0.00	0.18	3132.69	0	12:00	0	0	0:00:00
SDMH22	0.01	0.24	3132.55	0	11:59	0	0	0:00:00
SDMH23	0.01	0.58	3132.46	0	12:03	0	0	0:00:00
SDMH24	0.01	0.53	3133.25	0	12:03	0	0	0:00:00
SDMH25	0.02	1.01	3132.22	0	12:03	0	0	0:00:00
SDMH26	0.01	0.91	3132.33	0	12:02	0	0	0:00:00
SDMH27	0.01	0.71	3132.69	0	12:02	0	0	0:00:00
SDMH28	0.01	0.83	3132.90	0	12:02	0	0	0:00:00
SDMH29	0.01	0.66	3133.86	0	12:02	0	0	0:00:00
SDMH3	0.03	1.82	3131.11	0	12:05	0	0	0:00:00
SDMH30	0.01	0.71	3134.00	0	12:02	0	0	0:00:00
SDMH31	0.01	0.51	3134.82	0	12:01	0	0	0:00:00
SDMH32	0.01	0.54	3135.10	0	12:01	0	0	0:00:00
SDMH33	0.01	0.52	3135.26	0	12:01	0	0	0:00:00
SDMH34	0.01	0.24	3132.95	0	11:55	0	0	0:00:00
SDMH35	0.00	0.18	3133.02	0	11:55	0	0	0:00:00
SDMH36	0.01	0.77	3130.90	0	12:02	0	0	0:00:00
SDMH37	0.01	0.67	3131.33	0	12:02	0	0	0:00:00
SDMH38	0.01	0.66	3131.56	0	12:02	0	0	0:00:00
SDMH39	0.01	0.58	3132.28	0	12:02	0	0	0:00:00
SDMH4	0.03	1.92	3131.38	0	12:04	0	0	0:00:00
SDMH40	0.01	0.54	3133.16	0	12:02	0	0	0:00:00
SDMH41	0.01	0.44	3133.56	0	12:01	0	0	0:00:00
SDMH42	0.01	0.34	3134.37	0	12:01	0	0	0:00:00
SDMH43	0.00	0.19	3133.60	0	11:55	0	0	0:00:00
SDMH44	0.08	0.70	3130.83	0	11:56	0	0	0:00:00
SDMH45	0.01	0.40	3132.29	0	11:56	0	0	0:00:00
SDMH46	0.01	0.29	3132.47	0	11:55	0	0	0:00:00
SDMH47	0.01	0.46	3130.90	0	11:56	0	0	0:00:00
SDMH5	0.03	2.01	3131.52	0	12:04	0	0	0:00:00
SDMH6	0.02	1.76	3131.60	0	12:04	0	0	0:00:00
SDMH7	0.02	1.68	3131.66	0	12:04	0	0	0:00:00
SDMH8	0.02	1.61	3131.73	0	12:04	0	0	0:00:00
SDMH9	0.02	1.56	3131.80	0	12:04	0	0	0:00:00
BITTERROOT	0.01	3.19	3122.76	0	00:00	0	0	0:00:00
BITTERROOT_PH3	0.02	0.02	3120.02	1	00:04	0	0	0:00:00
OUTFALL_EXISTING	0.00	0.00	0.00	0	00:00	0	0	0:00:00
OUTFALL_EXISTING_PH3	0.00	0.00	0.00	0	00:00	0	0	0:00:00
POND	1.13	1.70	3129.20	0	15:13	0	0	0:00:00
POND_PH3	1.42	2.07	3130.57	1	00:04	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
OUTFALL_BITTERROOT	JUNCTION	0.00	0.92	0	15:14	0.00		

OUTFALL_CONTROL	JUNCTION	0.00	0.92	0	15:13	0.00
PH3_OUTLET	JUNCTION	0.00	0.03	1	00:04	0.00
SDMH 43	JUNCTION	0.02	0.02	0	13:19	0.00
SDMH_LMC	JUNCTION	3.08	3.08	0	11:56	0.00
SDMH1	JUNCTION	0.00	17.74	0	12:05	0.00
SDMH10	JUNCTION	0.00	9.53	0	12:02	0.00
SDMH11	JUNCTION	0.00	3.12	0	11:56	0.00
SDMH12	JUNCTION	0.92	6.08	0	12:02	0.00
SDMH13	JUNCTION	0.00	4.32	0	12:02	0.00
SDMH14	JUNCTION	0.73	4.31	0	12:02	0.00
SDMH15	JUNCTION	0.88	2.80	0	12:01	0.00
SDMH16	JUNCTION	0.41	1.92	0	12:01	0.00
SDMH17	JUNCTION	0.13	1.51	0	12:01	0.00
SDMH18	JUNCTION	1.39	1.39	0	12:01	0.00
SDMH19	JUNCTION	0.88	0.88	0	12:01	0.00
SDMH2	JUNCTION	0.00	17.76	0	12:04	0.00
SDMH20	JUNCTION	0.80	0.80	0	12:02	0.00
SDMH21	JUNCTION	0.29	0.29	0	12:00	0.00
SDMH22	JUNCTION	0.47	0.47	0	11:59	0.00
SDMH23	JUNCTION	0.54	2.12	0	12:03	0.00
SDMH24	JUNCTION	1.62	1.62	0	12:02	0.00
SDMH25	JUNCTION	0.68	5.43	0	12:02	0.00
SDMH26	JUNCTION	0.00	4.37	0	12:02	0.00
SDMH27	JUNCTION	0.00	4.37	0	12:02	0.00
SDMH28	JUNCTION	0.89	4.37	0	12:02	0.00
SDMH29	JUNCTION	0.91	3.25	0	12:02	0.00
SDMH3	JUNCTION	0.00	17.79	0	12:04	0.00
SDMH30	JUNCTION	0.00	2.35	0	12:01	0.00
SDMH31	JUNCTION	0.45	2.34	0	12:01	0.00
SDMH32	JUNCTION	0.46	1.89	0	12:01	0.00
SDMH33	JUNCTION	1.55	1.55	0	12:01	0.00
SDMH34	JUNCTION	0.55	0.55	0	11:55	0.00
SDMH35	JUNCTION	0.31	0.31	0	11:55	0.00
SDMH36	JUNCTION	1.66	4.87	0	12:02	0.00
SDMH37	JUNCTION	0.62	3.26	0	12:02	0.00
SDMH38	JUNCTION	0.57	2.64	0	12:02	0.00
SDMH39	JUNCTION	0.00	2.07	0	12:02	0.00
SDMH4	JUNCTION	0.76	17.82	0	12:04	0.00
SDMH40	JUNCTION	0.37	2.08	0	12:01	0.00
SDMH41	JUNCTION	0.48	1.39	0	12:01	0.00
SDMH42	JUNCTION	0.91	0.91	0	12:01	0.00
SDMH43	JUNCTION	0.38	0.38	0	11:56	0.00
SDMH44	JUNCTION	1.59	3.70	0	11:56	0.00
SDMH45	JUNCTION	0.95	1.37	0	11:56	0.00
SDMH46	JUNCTION	0.41	0.41	0	11:55	0.00
SDMH47	JUNCTION	0.79	0.79	0	11:55	0.00
SDMH5	JUNCTION	0.62	17.55	0	12:04	0.00
SDMH6	JUNCTION	0.83	11.12	0	12:04	0.00
SDMH7	JUNCTION	0.00	10.13	0	12:03	0.00
SDMH8	JUNCTION	0.64	10.22	0	12:03	0.00
SDMH9	JUNCTION	0.00	9.26	0	12:03	0.00
BITTERROOT	OUTFALL	0.00	1786.22	0	00:00	0.00
BITTERROOT_PH3	OUTFALL	0.00	0.03	1	00:04	0.00
OUTFALL_EXISTING	OUTFALL	0.11	0.11	0	14:09	0.00
OUTFALL_EXISTING_PH3	OUTFALL	0.01	0.01	0	13:39	0.00
POND	STORAGE	0.00	22.15	0	12:05	0.00
POND_PH3	STORAGE	0.00	3.66	0	11:57	0.00

****
Storage Node Summary
****

Storage Node ID	Maximum	Maximum	Time of Max	Average	Average	Maximum

Node ID	Maximum Ponded Volume 1000 ft³	Ponded Volume (%)	Ponded Volume days hh:mm	Ponded Volume 1000 ft³	Ponded Volume (%)	Storage Outflow cfs	Maximum Exfiltration Rate cfm	Total Exfiltrated Volume 1000 ft³
POND	86.063	27	0 15:13	50.434	16	0.92	0.00	0.000
POND_PH3	13.027	43	1 00:04	8.426	28	0.03	0.00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
BITTERROOT	94.86	0.16	1786.22
BITTERROOT_PH3	94.37	0.01	0.03
OUTFALL_EXISTING	8.04	0.08	0.11
OUTFALL_EXISTING_PH3	7.26	0.01	0.01
System	51.13	0.26	1786.22

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time minutes	Reported Condition
Link-04	CONDUIT	1 00:04	3.55	1.00	0.03	212.93	0.00	0.01	0	Calculated
RIVER_02	CHANNEL	0 00:00	2.44	1.00	1786.22	28496.32	0.06	0.22	0	Calculated
SDP_OUTFALL	CONDUIT	0 15:14	2.95	1.00	0.92	37.70	0.02	0.11	0	Calculated
SP1	CONDUIT	0 12:06	4.71	1.00	17.68	51.23	0.35	0.41	0	Calculated
SP10	CONDUIT	0 12:03	2.64	1.00	9.26	50.96	0.18	0.44	0	Calculated
SP11	CONDUIT	0 11:56	1.49	1.00	2.50	36.54	0.07	0.43	0	Calculated
SP12	CONDUIT	0 11:56	3.29	1.00	3.12	13.42	0.23	0.40	0	Calculated
SP13	CONDUIT	0 12:02	4.85	1.00	6.07	20.80	0.29	0.44	0	Calculated

SP14		CONDUIT	0	12:01	4.07	1.00	0.88	4.63	0.19
0.32	0	Calculated							
SP15		CONDUIT	0	12:03	3.15	1.00	4.30	20.80	0.21
0.45	0	Calculated							
SP16		CONDUIT	0	12:02	3.96	1.00	4.32	20.80	0.21
0.38	0	Calculated							
SP17		CONDUIT	0	12:02	3.88	1.00	0.80	4.63	0.17
0.31	0	Calculated							
SP18		CONDUIT	0	12:02	4.38	1.00	2.79	9.66	0.29
0.39	0	Calculated							
SP19		CONDUIT	0	12:01	3.40	1.00	1.93	9.69	0.20
0.36	0	Calculated							
SP2		CONDUIT	0	12:05	4.11	1.00	17.74	51.11	0.35
0.46	0	Calculated							
SP20		CONDUIT	0	12:01	3.14	1.00	1.51	8.64	0.18
0.32	0	Calculated							
SP21		CONDUIT	0	12:01	2.68	1.00	1.39	8.64	0.16
0.33	0	Calculated							
SP22		CONDUIT	0	12:00	3.11	1.00	0.29	4.63	0.06
0.18	0	Calculated							
SP23		CONDUIT	0	11:59	3.53	1.00	0.47	4.63	0.10
0.23	0	Calculated							
SP24		CONDUIT	0	12:03	4.25	1.00	2.12	13.66	0.16
0.33	0	Calculated							
SP25		CONDUIT	0	12:03	4.48	1.00	1.62	4.63	0.35
0.47	0	Calculated							
SP26		CONDUIT	0	12:02	4.42	1.00	5.41	22.78	0.24
0.47	0	Calculated							
SP27		CONDUIT	0	11:55	4.16	1.00	0.55	5.67	0.10
0.23	0	Calculated							
SP28		CONDUIT	0	12:02	3.03	1.00	4.35	20.77	0.21
0.48	0	Calculated							
SP29		CONDUIT	0	12:02	3.72	1.00	4.37	20.79	0.21
0.40	0	Calculated							
SP3		CONDUIT	0	12:04	3.79	1.00	17.76	51.12	0.35
0.49	0	Calculated							
SP30		CONDUIT	0	12:02	3.91	1.00	4.37	20.80	0.21
0.39	0	Calculated							
SP31		CONDUIT	0	11:55	2.67	1.00	0.31	11.83	0.03
0.16	0	Calculated							
SP32		CONDUIT	0	12:02	4.61	1.00	3.25	9.68	0.34
0.42	0	Calculated							
SP33		CONDUIT	0	12:02	2.98	1.00	2.34	9.66	0.24
0.46	0	Calculated							
SP34		CONDUIT	0	12:01	3.49	1.00	2.35	9.66	0.24
0.41	0	Calculated							
SP35		CONDUIT	0	12:01	3.45	1.00	1.89	9.66	0.20
0.35	0	Calculated							
SP36		CONDUIT	0	12:01	2.87	1.00	1.55	9.66	0.16
0.35	0	Calculated							
SP37		CONDUIT	0	12:03	4.66	1.00	4.86	18.60	0.26
0.37	0	Calculated							
SP38		CONDUIT	0	12:02	3.56	1.00	3.26	18.60	0.18
0.33	0	Calculated							
SP39		CONDUIT	0	12:02	3.25	1.00	2.64	18.60	0.14
0.31	0	Calculated							
SP4		CONDUIT	0	12:04	3.40	1.00	17.79	51.09	0.35
0.53	0	Calculated							
SP40		CONDUIT	0	12:02	3.61	1.00	2.07	8.63	0.24
0.36	0	Calculated							
SP41		CONDUIT	0	12:02	3.80	1.00	2.07	8.64	0.24
0.35	0	Calculated							
SP42		CONDUIT	0	12:01	2.78	1.00	1.39	8.63	0.16
0.33	0	Calculated							
SP43		CONDUIT	0	12:01	4.50	1.00	0.91	5.67	0.16
0.30	0	Calculated							
SP44		CONDUIT	0	11:56	3.66	1.00	0.38	5.67	0.07

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0.23           0  Calculated
  SP45                CONDUIT      0  11:57      4.15    1.00        3.66       18.60      0.20
0.32           0  Calculated
  SP46                CONDUIT      0  11:56      2.63    1.00        1.35        8.64      0.16
0.33           0  Calculated
  SP47                CONDUIT      0  11:55      2.25    1.00        0.41        2.93      0.14
0.29           0  Calculated
  SP48                CONDUIT      0  11:55      2.09    1.00        0.78        2.93      0.27
0.53           0  Calculated
  SP49                CONDUIT      0  13:27      1.15    1.00        0.02        9.66      0.00
0.03           0  Calculated
  SP5                 CONDUIT      0  12:04      3.15    1.00       17.51       51.00      0.34
0.56           0  Calculated
  SP6                 CONDUIT      0  12:04      2.11    1.00       11.08       51.12      0.22
0.54           0  Calculated
  SP7                 CONDUIT      0  12:04      2.40    1.00       10.07       51.14      0.20
0.49           0  Calculated
  SP8                 CONDUIT      0  12:03      2.64    1.00       10.13       51.02      0.20
0.47           0  Calculated
  SP9                 CONDUIT      0  12:03      2.50    1.00        9.16       51.02      0.18
0.45           0  Calculated
  WQV_DRAIN           CONDUIT      0  15:13      2.58    1.00        0.68        1.90      0.36
0.71           0  Calculated
  Orifice-02          ORIFICE      1  00:04                          0.03
1.00
  Orifice-03          ORIFICE      0  00:00                          0.00
0.00
  Orifice-04          ORIFICE      0  15:13                          0.24
0.20


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.



  WARNING 005 : Minimum slope used for Conduit RIVER_02.

  Analysis began on:  Wed Jul 13 16:03:21 2022
  Analysis ended on:  Wed Jul 13 16:03:45 2022
  Total elapsed time: 00:00:24
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Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 2101 - SWMM V10.1.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant flow
Starting Date JAN-01-2021 00:00:00
Ending Date JAN-08-2021 00:00:00
Report Time Step 00:00:30

****
Element Count
****
Number of rain gages 1
Number of subbasins 41
Number of nodes 58
Number of links 56

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Peak Rate Factor
BASIN_1	2.17	484.00
BASIN_10	0.98	484.00
BASIN_11	1.14	484.00
BASIN_12	0.92	484.00
BASIN_13	1.06	484.00
BASIN_14	1.23	484.00
BASIN_15	1.07	484.00
BASIN_16	0.73	484.00
BASIN_17	0.69	484.00
BASIN_18	0.61	484.00
BASIN_19	1.22	484.00
BASIN_2	0.27	484.00
BASIN_20	0.52	484.00
BASIN_21	0.85	484.00
BASIN_22	0.89	484.00
BASIN_23	2.26	484.00
BASIN_24	0.45	484.00
BASIN_25	0.17	484.00
BASIN_26	0.56	484.00
BASIN_27	0.63	484.00
BASIN_28	0.32	484.00
BASIN_29	1.92	484.00
BASIN_3	1.19	484.00
BASIN_30	2.17	484.00
BASIN_38	0.50	484.00
BASIN_4	1.16	484.00
BASIN_5	0.48	484.00
BASIN_6	0.86	484.00

BASIN_7	0.78	484.00
BASIN_8	0.81	484.00
BASIN_9	0.31	484.00
BASIN_EXISTING	37.19	484.00
BASIN_EXISTING_PH3	3.86	484.00
BASIN_PH3_1	0.28	484.00
BASIN_PH3_2	1.13	484.00
BASIN_PH3_3	0.55	484.00
BASIN_PH3_4	1.89	484.00
LMC_ROAD_EAST	1.18	484.00
LMC_ROAD_SOUTH	1.49	484.00
RELIGIOUS	4.99	484.00
SENIOR	5.53	484.00

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Node Summary
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Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
OUTFALL_BITTERROOT	JUNCTION	3119.60	3136.00	0.00	
OUTFALL_CONTROL	JUNCTION	3128.00	3132.60	0.00	
PH3_OUTLET	JUNCTION	3128.50	3132.50	0.00	
SDMH 43	JUNCTION	3132.62	3137.21	0.00	
SDMH_LMC	JUNCTION	3131.40	3138.21	0.00	
SDMH1	JUNCTION	3128.66	3134.98	0.00	
SDMH10	JUNCTION	3130.38	3136.15	0.00	
SDMH11	JUNCTION	3130.83	3137.32	0.00	
SDMH12	JUNCTION	3130.95	3135.04	0.00	
SDMH13	JUNCTION	3131.18	3135.30	0.00	
SDMH14	JUNCTION	3132.09	3136.52	0.00	
SDMH15	JUNCTION	3133.07	3137.17	0.00	
SDMH16	JUNCTION	3134.26	3138.80	0.00	
SDMH17	JUNCTION	3134.46	3139.10	0.00	
SDMH18	JUNCTION	3134.61	3139.04	0.00	
SDMH19	JUNCTION	3132.34	3135.05	0.00	
SDMH2	JUNCTION	3129.22	3136.62	0.00	
SDMH20	JUNCTION	3133.38	3136.52	0.00	
SDMH21	JUNCTION	3132.51	3135.59	0.00	
SDMH22	JUNCTION	3132.31	3135.67	0.00	
SDMH23	JUNCTION	3131.88	3135.52	0.00	
SDMH24	JUNCTION	3132.72	3135.51	0.00	
SDMH25	JUNCTION	3131.21	3135.50	0.00	
SDMH26	JUNCTION	3131.42	3135.83	0.00	
SDMH27	JUNCTION	3131.98	3136.49	0.00	
SDMH28	JUNCTION	3132.07	3136.50	0.00	
SDMH29	JUNCTION	3133.20	3137.25	0.00	
SDMH3	JUNCTION	3129.29	3135.82	0.00	
SDMH30	JUNCTION	3133.29	3137.45	0.00	
SDMH31	JUNCTION	3134.31	3138.67	0.00	
SDMH32	JUNCTION	3134.56	3138.88	0.00	
SDMH33	JUNCTION	3134.74	3139.11	0.00	
SDMH34	JUNCTION	3132.71	3135.51	0.00	
SDMH35	JUNCTION	3132.84	3136.50	0.00	
SDMH36	JUNCTION	3130.14	3136.10	0.00	
SDMH37	JUNCTION	3130.66	3135.86	0.00	
SDMH38	JUNCTION	3130.91	3135.86	0.00	
SDMH39	JUNCTION	3131.70	3136.54	0.00	
SDMH4	JUNCTION	3129.46	3135.01	0.00	
SDMH40	JUNCTION	3132.62	3136.62	0.00	
SDMH41	JUNCTION	3133.12	3136.88	0.00	
SDMH42	JUNCTION	3134.04	3136.87	0.00	
SDMH43	JUNCTION	3133.41	3135.62	0.00	
SDMH44	JUNCTION	3130.14	3135.37	0.00	
SDMH45	JUNCTION	3131.89	3136.18	0.00	

SDMH46	JUNCTION	3132.18	3136.18	0.00
SDMH47	JUNCTION	3130.43	3134.29	0.00
SDMH5	JUNCTION	3129.52	3135.01	0.00
SDMH6	JUNCTION	3129.84	3135.59	0.00
SDMH7	JUNCTION	3129.98	3136.61	0.00
SDMH8	JUNCTION	3130.12	3135.67	0.00
SDMH9	JUNCTION	3130.24	3136.42	0.00
BITTERROOT	OUTFALL	3119.57	3135.97	0.00
BITTERROOT_PH3	OUTFALL	3120.00	3122.50	0.00
OUTFALL_EXISTING	OUTFALL	0.00	0.00	0.00
OUTFALL_EXISTING_PH3	OUTFALL	0.00	0.00	0.00
POND	STORAGE	3127.50	3132.10	27000.00
POND_PH3	STORAGE	3128.50	3132.50	5000.00

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-04	PH3_OUTLET	BITTERROOT_PH3	CONDUIT	23.7	35.8801	0.0150
RIVER_02	OUTFALL_BITTERROOT	BITTERROOT	CHANNEL	50.0	0.1200	0.0400
SDP_OUTFALL	OUTFALL_CONTROL	OUTFALL_BITTERROOT	CONDUIT	100.0	0.5000	0.0100
SP1	SDMH1	POND	CONDUIT	103.0	0.1534	0.0100
SP10	SDMH10	SDMH9	CONDUIT	94.4	0.1518	0.0100
SP11	SDMH11	SDMH10	CONDUIT	252.8	0.1776	0.0100
SP12	SDMH_LMC	SDMH11	CONDUIT	274.0	0.2083	0.0100
SP13	SDMH12	SDMH5	CONDUIT	50.9	0.5000	0.0100
SP14	SDMH19	SDMH12	CONDUIT	38.9	0.9990	0.0100
SP15	SDMH13	SDMH12	CONDUIT	44.9	0.5000	0.0100
SP16	SDMH14	SDMH13	CONDUIT	181.4	0.5000	0.0100
SP17	SDMH20	SDMH14	CONDUIT	29.0	1.0000	0.0100
SP18	SDMH15	SDMH14	CONDUIT	97.0	0.5000	0.0100
SP19	SDMH16	SDMH15	CONDUIT	236.4	0.5032	0.0100
SP2	SDMH2	SDMH1	CONDUIT	366.7	0.1527	0.0100
SP20	SDMH17	SDMH16	CONDUIT	50.0	0.4000	0.0100
SP21	SDMH18	SDMH17	CONDUIT	36.4	0.4000	0.0100
SP22	SDMH21	SDMH6	CONDUIT	47.0	1.0000	0.0100
SP23	SDMH22	SDMH8	CONDUIT	47.0	1.0000	0.0100
SP24	SDMH23	SDMH10	CONDUIT	22.3	1.0000	0.0100
SP25	SDMH24	SDMH23	CONDUIT	34.0	1.0000	0.0100
SP26	SDMH25	SDMH10	CONDUIT	34.9	0.6000	0.0100
SP27	SDMH34	SDMH25	CONDUIT	33.4	1.5000	0.0100
SP28	SDMH26	SDMH25	CONDUIT	42.0	0.4988	0.0100
SP29	SDMH27	SDMH26	CONDUIT	111.9	0.4998	0.0100
SP3	SDMH3	SDMH2	CONDUIT	45.8	0.1528	0.0100
SP30	SDMH28	SDMH27	CONDUIT	18.0	0.5000	0.0100
SP31	SDMH35	SDMH28	CONDUIT	36.0	0.7500	0.0100
SP32	SDMH29	SDMH28	CONDUIT	125.7	0.5026	0.0100
SP33	SDMH30	SDMH29	CONDUIT	18.0	0.5000	0.0100
SP34	SDMH31	SDMH30	CONDUIT	204.4	0.5000	0.0100
SP35	SDMH32	SDMH31	CONDUIT	50.0	0.5000	0.0100
SP36	SDMH33	SDMH32	CONDUIT	36.4	0.5000	0.0100
SP37	SDMH36	POND	CONDUIT	243.6	0.3999	0.0100
SP38	SDMH37	SDMH36	CONDUIT	107.0	0.4001	0.0100
SP39	SDMH38	SDMH37	CONDUIT	36.0	0.4000	0.0100
SP4	SDMH4	SDMH3	CONDUIT	110.1	0.1526	0.0100
SP40	SDMH39	SDMH38	CONDUIT	72.5	0.3998	0.0100
SP41	SDMH40	SDMH39	CONDUIT	205.3	0.4000	0.0100
SP42	SDMH41	SDMH40	CONDUIT	124.5	0.3997	0.0100
SP43	SDMH42	SDMH41	CONDUIT	27.9	1.5000	0.0100
SP44	SDMH43	SDMH40	CONDUIT	36.0	1.5000	0.0100
SP45	SDMH44	POND_PH3	CONDUIT	102.9	0.4000	0.0100
SP46	SDMH45	SDMH44	CONDUIT	412.4	0.4000	0.0100
SP47	SDMH46	SDMH45	CONDUIT	48.0	0.4000	0.0100
SP48	SDMH47	SDMH44	CONDUIT	48.0	0.4000	0.0100

SP49	SDMH 43	SDMH11	CONDUIT	51.4	0.5000	0.0100
SP5	SDMH5	SDMH4	CONDUIT	38.8	0.1521	0.0100
SP6	SDMH6	SDMH5	CONDUIT	208.8	0.1527	0.0100
SP7	SDMH7	SDMH6	CONDUIT	95.5	0.1529	0.0100
SP8	SDMH8	SDMH7	CONDUIT	92.7	0.1521	0.0100
SP9	SDMH9	SDMH8	CONDUIT	75.6	0.1522	0.0100
WQV_DRAIN	OUTFALL_CONTROL	POND	CONDUIT	68.6	1.4569	0.0100
Orifice-02	POND_PH3	PH3_OUTLET	ORIFICE			
Orifice-03	POND_PH3	PH3_OUTLET	ORIFICE			
Orifice-04	POND	OUTFALL_CONTROL	ORIFICE			

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Cross Section Summary
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Link ID	Shape	Depth/ Diameter	Width	No. of Barrels	Cross Sectional Area	Full Flow Hydraulic Radius	Design Flow Capacity
		ft	ft		ft²	ft	cfs
Link-04	CIRCULAR	2.50	2.50	1	4.91	0.63	212.93
RIVER_02	TRAPEZOIDAL	16.40	265.60	1	3817.92	13.97	28496.32
SDP_OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	37.70
SP1	CIRCULAR	3.50	3.50	1	9.62	0.88	51.23
SP10	CIRCULAR	3.50	3.50	1	9.62	0.88	50.96
SP11	CIRCULAR	3.00	3.00	1	7.07	0.75	36.54
SP12	CIRCULAR	2.00	2.00	1	3.14	0.50	13.42
SP13	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP14	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP15	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP16	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP17	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP18	CIRCULAR	1.50	1.50	1	1.77	0.38	9.66
SP19	CIRCULAR	1.50	1.50	1	1.77	0.38	9.69
SP2	CIRCULAR	3.50	3.50	1	9.62	0.88	51.11
SP20	CIRCULAR	1.50	1.50	1	1.77	0.38	8.64
SP21	CIRCULAR	1.50	1.50	1	1.77	0.38	8.64
SP22	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP23	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP24	CIRCULAR	1.50	1.50	1	1.77	0.38	13.66
SP25	CIRCULAR	1.00	1.00	1	0.79	0.25	

4.63						
SP26	CIRCULAR	2.00	2.00	1	3.14	0.50
22.78						
SP27	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP28	CIRCULAR	2.00	2.00	1	3.14	0.50
20.77						
SP29	CIRCULAR	2.00	2.00	1	3.14	0.50
20.79						
SP3	CIRCULAR	3.50	3.50	1	9.62	0.88
51.12						
SP30	CIRCULAR	2.00	2.00	1	3.14	0.50
20.80						
SP31	CIRCULAR	1.50	1.50	1	1.77	0.38
11.83						
SP32	CIRCULAR	1.50	1.50	1	1.77	0.38
9.68						
SP33	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP34	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP35	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP36	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP37	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP38	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP39	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP4	CIRCULAR	3.50	3.50	1	9.62	0.88
51.09						
SP40	CIRCULAR	1.50	1.50	1	1.77	0.38
8.63						
SP41	CIRCULAR	1.50	1.50	1	1.77	0.38
8.64						
SP42	CIRCULAR	1.50	1.50	1	1.77	0.38
8.63						
SP43	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP44	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP45	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP46	CIRCULAR	1.50	1.50	1	1.77	0.38
8.64						
SP47	CIRCULAR	1.00	1.00	1	0.79	0.25
2.93						
SP48	CIRCULAR	1.00	1.00	1	0.79	0.25
2.93						
SP49	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP5	CIRCULAR	3.50	3.50	1	9.62	0.88
51.00						
SP6	CIRCULAR	3.50	3.50	1	9.62	0.88
51.12						
SP7	CIRCULAR	3.50	3.50	1	9.62	0.88
51.14						
SP8	CIRCULAR	3.50	3.50	1	9.62	0.88
51.02						
SP9	CIRCULAR	3.50	3.50	1	9.62	0.88
51.02						
WQV_DRAIN	CIRCULAR	0.67	0.67	1	0.35	0.17
1.90						

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	12.037	1.660
Surface Runoff	0.243	0.034
Continuity Error (%)	-0.000	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	4.136	1.348
Initial Stored Volume	1.627	0.530
Final Stored Volume	1.141	0.372
Continuity Error (%)	-0.001	

Composite Curve Number Computations Report

Subbasin BASIN_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.57	D	98.00
> 75% grass cover, Good	0.10	D	80.00
1/8 acre lots, 65% impervious	1.49	D	92.00
Composite Area & Weighted CN	2.17		93.03

Subbasin BASIN_10

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.49	D	98.00
> 75% grass cover, Good	0.09	D	80.00
1/8 acre lots, 65% impervious	0.40	D	92.00
Composite Area & Weighted CN	0.98		93.94

Subbasin BASIN_11

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.36	D	98.00
> 75% grass cover, Good	0.07	D	80.00
1/8 acre lots, 65% impervious	0.71	D	92.00
Composite Area & Weighted CN	1.14		93.20

Subbasin BASIN_12

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.29	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.57	D	92.00
Composite Area & Weighted CN	0.92		93.20

Subbasin BASIN_13

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.23	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.79	D	92.00
Composite Area & Weighted CN	1.06		92.83

Subbasin BASIN_14

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.35	D	98.00
> 75% grass cover, Good	0.07	D	80.00
1/8 acre lots, 65% impervious	0.81	D	92.00
Composite Area & Weighted CN	1.23		93.07

Subbasin BASIN_15

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.45	D	98.00
> 75% grass cover, Good	0.10	D	80.00
1/8 acre lots, 65% impervious	0.52	D	92.00
Composite Area & Weighted CN	1.07		93.46

Subbasin BASIN_16

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.22	D	98.00
> 75% grass cover, Good	0.02	D	80.00
1/8 acre lots, 65% impervious	0.49	D	92.00
Composite Area & Weighted CN	0.74		93.41

Subbasin BASIN_17

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.57	D	98.00
> 75% grass cover, Good	0.12	D	80.00
Composite Area & Weighted CN	0.69		94.79

Subbasin BASIN_18

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.20	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.38	D	92.00
Composite Area & Weighted CN	0.61		93.25

Subbasin BASIN_19

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.15	D	98.00
> 75% grass cover, Good	0.03	D	80.00
1/8 acre lots, 65% impervious	1.04	D	92.00
Composite Area & Weighted CN	1.22		92.50

Subbasin BASIN_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.23	D	98.00
> 75% grass cover, Good	0.04	D	80.00
Composite Area & Weighted CN	0.27		95.30

Subbasin BASIN_20

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.52	D	92.00
Composite Area & Weighted CN	0.52		92.00

Subbasin BASIN_21

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.85	D	92.00
Composite Area & Weighted CN	0.85		92.00

Subbasin BASIN_22

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.89	D	92.00
Composite Area & Weighted CN	0.89		92.00

Subbasin BASIN_23

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	2.26	D	92.00
Composite Area & Weighted CN	2.26		92.00

Subbasin BASIN_24

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.45	D	92.00
Composite Area & Weighted CN	0.45		92.00

Subbasin BASIN_25

Soil/Surface Description	Area	Soil

Soil/Surface Description	(acres)	Group	CN
1/8 acre lots, 65% impervious	0.17	D	92.00
Composite Area & Weighted CN	0.17		92.00

Subbasin BASIN_26

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.27	D	92.00
Composite Area & Weighted CN	0.27		92.00

Subbasin BASIN_27

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.32	D	92.00
Composite Area & Weighted CN	0.32		92.00

Subbasin BASIN_28

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.32	D	98.00
Composite Area & Weighted CN	0.32		98.00

Subbasin BASIN_29

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	1.92	D	92.00
Composite Area & Weighted CN	1.92		92.00

Subbasin BASIN_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.29	D	98.00
> 75% grass cover, Good	0.03	D	80.00
1/8 acre lots, 65% impervious	0.88	D	92.00
Composite Area & Weighted CN	1.19		93.20

Subbasin BASIN_30

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	1.13	D	92.00
Composite Area & Weighted CN	1.13		92.00

Subbasin BASIN_38

Soil/Surface Description	Area (acres)	Soil Group	CN

Paved roads with curbs & sewers	0.20	D	98.00
1/8 acre lots, 65% impervious	0.30	D	92.00
Composite Area & Weighted CN	0.50		94.40

Subbasin BASIN_4

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.37	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.73	D	92.00
Composite Area & Weighted CN	1.16		93.23

Subbasin BASIN_5

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.41	D	98.00
> 75% grass cover, Good	0.07	D	80.00
Composite Area & Weighted CN	0.48		95.30

Subbasin BASIN_6

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.33	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.48	D	92.00
Composite Area & Weighted CN	0.86		93.47

Subbasin BASIN_7

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.36	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.35	D	92.00
Composite Area & Weighted CN	0.78		93.82

Subbasin BASIN_8

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.19	D	98.00
1/8 acre lots, 65% impervious	0.62	D	92.00
Composite Area & Weighted CN	0.81		93.41

Subbasin BASIN_9

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.24	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.03	D	92.00
Composite Area & Weighted CN	0.31		95.03

Subbasin BASIN_EXISTING

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	28.39	C	71.00
Composite Area & Weighted CN	28.39		71.00

Subbasin BASIN_EXISTING_PH3

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	3.86	C	71.00
Composite Area & Weighted CN	3.86		71.00

Subbasin BASIN_PH3_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.28	B	98.00
Composite Area & Weighted CN	0.28		98.00

Subbasin BASIN_PH3_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Urban commercial, 85% imp	1.13	B	92.00
Composite Area & Weighted CN	1.13		92.00

Subbasin BASIN_PH3_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.55	B	98.00
Composite Area & Weighted CN	0.55		98.00

Subbasin BASIN_PH3_4

Soil/Surface Description	Area (acres)	Soil Group	CN
Urban commercial, 85% imp	1.89	B	92.00
Composite Area & Weighted CN	1.89		92.00

Subbasin LMC_ROAD_EAST

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	1.00	D	98.00
> 75% grass cover, Good	0.18	D	80.00
Composite Area & Weighted CN	1.18		95.30

Subbasin LMC_ROAD_SOUTH

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	1.27	D	98.00
> 75% grass cover, Good	0.22	D	80.00
Composite Area & Weighted CN	1.49		95.30

Subbasin RELIGIOUS

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	5.47	C	71.00
Composite Area & Weighted CN	5.47		71.00

Subbasin SENIOR

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	5.53	C	71.00
Composite Area & Weighted CN	5.53		71.00

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

```
          V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
          R  = Aq / Wp
          Tc = (Lf / V) / (3600 sec/hr)

          Where:

          Tc = Time of Concentration (hrs)
          Lf = Flow Length (ft)
          R  = Hydraulic Radius (ft)
          Aq = Flow Area (ft²)
          Wp = Wetted Perimeter (ft)
          V  = Velocity (ft/sec)
          Sf = Slope (ft/ft)
          n  = Manning's Roughness
```

Subbasin BASIN_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	435.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	4.80	0.00	0.00

Total TOC (minutes):	14.11

Subbasin BASIN_10

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00

Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	267.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.09	0.00	0.00

Total TOC (minutes):	12.40

Subbasin BASIN_11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	360.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	4.17	0.00	0.00

Total TOC (minutes):	13.47		

Subbasin BASIN_12

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	278.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.22	0.00	0.00

Total TOC (minutes):	12.52		

Subbasin BASIN_13

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00

Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	337.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	3.72	0.00	0.00

Total TOC (minutes):	13.03

Subbasin BASIN_14

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	400.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	4.63	0.00	0.00

Total TOC (minutes):	13.94

Subbasin BASIN_15

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	200.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	2.21	0.00	0.00

Total TOC (minutes): 11.51

Subbasin BASIN_16

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	102.00	0.00	

```
0.00
          Slope (%):                                1.00                0.00
0.00
          Surface Type:                            Paved              Unpaved
Unpaved
          Velocity (ft/sec):                        2.03                0.00
0.00
          Computed Flow Time (minutes):             0.84                0.00
0.00

================================================================================================
          Total TOC (minutes):                     10.14

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  Subbasin BASIN_17
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          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin BASIN_18
  --------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                      0.15                0.00
0.00
          Flow Length (ft):                        50.00                0.00
0.00
          Slope (%):                                2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                1.17                0.00
0.00
          Velocity (ft/sec):                        0.09                0.00
0.00
          Computed Flow Time (minutes):             9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                       248.00                0.00
0.00
          Slope (%):                                0.50                0.00
0.00
          Surface Type:                            Paved              Unpaved
Unpaved
          Velocity (ft/sec):                        1.44                0.00
0.00
          Computed Flow Time (minutes):             2.87                0.00
0.00

================================================================================================
          Total TOC (minutes):                     12.18

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  Subbasin BASIN_19
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Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	242.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	2.67	0.00	0.00

Total TOC (minutes): 11.98

Subbasin BASIN_2

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_20

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	173.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.00	0.00	0.00

Total TOC (minutes): 11.31

Subbasin BASIN_21

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	327.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Unpaved	Unpaved	Unpaved
Velocity (ft/sec):	1.14	0.00	0.00
Computed Flow Time (minutes):	4.78	0.00	0.00

Total TOC (minutes): 14.09

Subbasin BASIN_22

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	256.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.96	0.00	0.00

==========

Total TOC (minutes): 12.27

==========

Subbasin BASIN_23

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	139.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
Surface Type:	Paved	Unpaved	

```
Unpaved
          Velocity (ft/sec):                          2.87                0.00
0.00
          Computed Flow Time (minutes):               0.81                0.00
0.00

================================================================================================
          Total TOC (minutes):                       10.11

================================================================================================


  --------------------
  Subbasin BASIN_24
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin BASIN_25
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                        0.15                0.00
0.00
          Flow Length (ft):                          50.00                0.00
0.00
          Slope (%):                                  2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                  1.17                0.00
0.00
          Velocity (ft/sec):                          0.09                0.00
0.00
          Computed Flow Time (minutes):               9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                         122.00                0.00
0.00
          Slope (%):                                  0.75                0.00
0.00
          Surface Type:                              Paved              Unpaved
Unpaved
          Velocity (ft/sec):                          1.76                0.00
0.00
          Computed Flow Time (minutes):               1.16                0.00
0.00

================================================================================================
          Total TOC (minutes):                       10.46

================================================================================================


  --------------------
  Subbasin BASIN_26
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
```

C			
	Manning's Roughness:	0.15	0.00
0.00			
	Flow Length (ft):	50.00	0.00
0.00			
	Slope (%):	2.00	0.00
0.00			
	2 yr, 24 hr Rainfall (in):	1.17	0.00
0.00			
	Velocity (ft/sec):	0.09	0.00
0.00			
	Computed Flow Time (minutes):	9.31	0.00
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	120.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	1.39	0.00	0.00

Total TOC (minutes):	10.70

Subbasin BASIN_27

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	170.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	

0.00			
Computed Flow Time (minutes):	1.97	0.00	
0.00			

Total TOC (minutes):	11.27	

Subbasin BASIN_28

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	430.00	0.00	0.00
Slope (%):	0.75	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.76	0.00	0.00
Computed Flow Time (minutes):	4.07	0.00	0.00

Total TOC (minutes):	4.07

Subbasin BASIN_29

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	140.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	

```
0.00
          Computed Flow Time (minutes):               1.62                0.00
0.00

=============================================================================================================
          Total TOC (minutes):                       10.93

=============================================================================================================


  --------------------
  Subbasin BASIN_3
  --------------------

  Sheet Flow Computations
  -----------------------
                                                   Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                          0.15                0.00
0.00
          Flow Length (ft):                            50.00                0.00
0.00
          Slope (%):                                    2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                    1.17                0.00
0.00
          Velocity (ft/sec):                            0.09                0.00
0.00
          Computed Flow Time (minutes):                 9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                   Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                           385.00                0.00
0.00
          Slope (%):                                    0.50                0.00
0.00
          Surface Type:                                Paved             Unpaved
Unpaved
          Velocity (ft/sec):                            1.44                0.00
0.00
          Computed Flow Time (minutes):                 4.46                0.00
0.00

=============================================================================================================
          Total TOC (minutes):                       13.76

=============================================================================================================


  --------------------
  Subbasin BASIN_30
  --------------------

  Sheet Flow Computations
  -----------------------
                                                   Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                          0.15                0.00
0.00
          Flow Length (ft):                            50.00                0.00
0.00
          Slope (%):                                    2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                    1.17                0.00
```

```
0.00
          Velocity (ft/sec):                          0.09                0.00
0.00
          Computed Flow Time (minutes):               9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                        200.00                0.00
0.00
          Slope (%):                                  0.50                0.00
0.00
          Surface Type:                              Paved              Unpaved
Unpaved
          Velocity (ft/sec):                          1.44                0.00
0.00
          Computed Flow Time (minutes):               2.31                0.00
0.00

================================================================================================
          Total TOC (minutes):                       11.62

================================================================================================


  --------------------
  Subbasin BASIN_38
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                        0.15                0.00
0.00
          Flow Length (ft):                          50.00                0.00
0.00
          Slope (%):                                  2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                  1.17                0.00
0.00
          Velocity (ft/sec):                          0.09                0.00
0.00
          Computed Flow Time (minutes):               9.31                0.00
0.00

================================================================================================
          Total TOC (minutes):                        9.31

================================================================================================


  -------------------
  Subbasin BASIN_4
  -------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                        0.15                0.00
0.00
          Flow Length (ft):                          50.00                0.00
0.00
          Slope (%):                                  2.00                0.00
```

0.00

2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	385.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	
0.00			
Computed Flow Time (minutes):	4.46	0.00	
0.00			

Total TOC (minutes):	13.76

Subbasin BASIN_5

User-Defined TOC override (minutes):	5.00

Subbasin BASIN_6

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	
0.00			
Flow Length (ft):	50.00	0.00	
0.00			
Slope (%):	2.00	0.00	
0.00			
2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	376.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	

```
0.00
          Computed Flow Time (minutes):              4.35               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      13.66

=============================================================================================================


  --------------------
  Subbasin BASIN_7
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
0.00
          Velocity (ft/sec):                         0.05               0.00
0.00
          Computed Flow Time (minutes):             16.20               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A          Subarea B          Subarea
C
          Flow Length (ft):                        400.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          Surface Type:                             Paved             Unpaved
Unpaved
          Velocity (ft/sec):                         1.44               0.00
0.00
          Computed Flow Time (minutes):              4.63               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      20.83

=============================================================================================================


  --------------------
  Subbasin BASIN_8
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
```

0.00

Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	330.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.82	0.00	0.00

Total TOC (minutes): 13.13

Subbasin BASIN_9

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	180.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.08	0.00	0.00

Total TOC (minutes): 11.39

Subbasin BASIN_EXISTING

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.13	0.00	0.00
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	45.92	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	500.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
Surface Type:	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec):	0.70	0.00	0.00
Computed Flow Time (minutes):	11.90	0.00	0.00

==========
Total TOC (minutes): 57.83
==========

Subbasin BASIN_EXISTING_PH3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.13	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	26.37	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	400.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
Surface Type:	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec):	0.70	0.00	0.00
Computed Flow Time (minutes):	9.52	0.00	0.00

Total TOC (minutes): 35.90

Subbasin BASIN_PH3_1

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_2

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_3

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_4

User-Defined TOC override (minutes): 5.00

Subbasin LMC_ROAD_EAST

User-Defined TOC override (minutes): 5.00

Subbasin LMC_ROAD_SOUTH

User-Defined TOC override (minutes): 5.00

Subbasin RELIGIOUS

User-Defined TOC override (minutes): 5.00

Subbasin SENIOR

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
BASIN_1	1.66	1.01	2.76	93.030	0	00:14:06
BASIN_10	1.66	1.08	1.37	93.940	0	00:12:24
BASIN_11	1.66	1.02	1.49	93.200	0	00:13:28
BASIN_12	1.66	1.02	1.23	93.200	0	00:12:31
BASIN_13	1.66	0.99	1.37	92.830	0	00:13:01
BASIN_14	1.66	1.01	1.58	93.070	0	00:13:56
BASIN_15	1.66	1.04	1.48	93.460	0	00:11:30
BASIN_16	1.66	1.04	1.05	93.410	0	00:10:08
BASIN_17	1.66	1.14	1.23	94.790	0	00:05:00
BASIN_18	1.66	1.02	0.82	93.250	0	00:12:10
BASIN_19	1.66	0.97	1.57	92.500	0	00:11:58
BASIN_2	1.66	1.18	0.49	95.300	0	00:05:00
BASIN_20	1.66	0.94	0.65	92.000	0	00:11:18
BASIN_21	1.66	0.94	1.01	92.000	0	00:14:05
BASIN_22	1.66	0.94	1.10	92.000	0	00:12:16
BASIN_23	1.66	0.94	2.92	92.000	0	00:10:06
BASIN_24	1.66	0.94	0.67	92.000	0	00:05:00
BASIN_25	1.66	0.93	0.22	92.000	0	00:10:27
BASIN_26	1.66	0.94	0.72	92.000	0	00:10:42
BASIN_27	1.66	0.94	0.79	92.000	0	00:11:16
BASIN_28	1.66	1.44	0.67	98.000	0	00:05:00
BASIN_29	1.66	0.94	2.44	92.000	0	00:10:55
BASIN_3	1.66	1.02	1.54	93.200	0	00:13:45
BASIN_30	1.66	0.94	2.72	92.000	0	00:11:37
BASIN_38	1.66	1.11	0.77	94.400	0	00:09:18
BASIN_4	1.66	1.02	1.51	93.230	0	00:13:45
BASIN_5	1.66	1.19	0.88	95.300	0	00:05:00
BASIN_6	1.66	1.04	1.14	93.470	0	00:13:39
BASIN_7	1.66	1.07	0.89	93.820	0	00:20:49
BASIN_8	1.66	1.04	1.09	93.410	0	00:13:07
BASIN_9	1.66	1.16	0.47	95.030	0	00:11:23
BASIN_EXISTING	1.66	0.14	1.44	71.000	0	00:57:49
BASIN_EXISTING_PH3	1.66	0.14	0.20	71.000	0	00:35:54
BASIN_PH3_1	1.66	1.44	0.60	98.000	0	00:05:00
BASIN_PH3_2	1.66	0.94	1.69	92.000	0	00:05:00
BASIN_PH3_3	1.66	1.44	1.15	98.000	0	00:05:00
BASIN_PH3_4	1.66	0.94	2.81	92.000	0	00:05:00
LMC_ROAD_EAST	1.66	1.19	2.16	95.300	0	00:05:00
LMC_ROAD_SOUTH	1.66	1.19	2.74	95.300	0	00:05:00
RELIGIOUS	1.66	0.14	0.73	71.000	0	00:05:00
SENIOR	1.66	0.14	0.81	71.000	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
OUTFALL_BITTERROOT	0.01	4.37	3123.97	0	00:00	0	0	0:00:00
OUTFALL_CONTROL	0.09	0.49	3128.49	0	13:37	0	0	0:00:00
PH3_OUTLET	0.02	0.06	3128.56	0	14:21	0	0	0:00:00
SDMH 43	0.01	0.32	3132.94	0	12:02	0	0	0:00:00

SDMH_LMC	0.02	1.33	3132.73	0	12:03	0	0	0:00:00
SDMH1	0.10	2.19	3130.85	0	12:05	0	0	0:00:00
SDMH10	0.03	2.38	3132.76	0	12:04	0	0	0:00:00
SDMH11	0.02	1.92	3132.75	0	12:03	0	0	0:00:00
SDMH12	0.02	1.65	3132.61	0	12:04	0	0	0:00:00
SDMH13	0.02	1.52	3132.69	0	12:04	0	0	0:00:00
SDMH14	0.02	0.89	3132.97	0	12:01	0	0	0:00:00
SDMH15	0.01	0.87	3133.94	0	12:01	0	0	0:00:00
SDMH16	0.01	0.62	3134.89	0	12:00	0	0	0:00:00
SDMH17	0.01	0.70	3135.16	0	12:00	0	0	0:00:00
SDMH18	0.01	0.72	3135.33	0	12:00	0	0	0:00:00
SDMH19	0.01	0.49	3132.83	0	12:01	0	0	0:00:00
SDMH2	0.04	2.29	3131.51	0	12:05	0	0	0:00:00
SDMH20	0.01	0.46	3133.84	0	12:02	0	0	0:00:00
SDMH21	0.01	0.24	3132.75	0	12:00	0	0	0:00:00
SDMH22	0.01	0.31	3132.62	0	11:58	0	0	0:00:00
SDMH23	0.01	1.01	3132.89	0	12:04	0	0	0:00:00
SDMH24	0.01	0.76	3133.49	0	12:02	0	0	0:00:00
SDMH25	0.02	1.78	3132.99	0	12:03	0	0	0:00:00
SDMH26	0.02	1.67	3133.08	0	12:03	0	0	0:00:00
SDMH27	0.02	1.22	3133.19	0	12:03	0	0	0:00:00
SDMH28	0.02	1.34	3133.41	0	12:03	0	0	0:00:00
SDMH29	0.02	1.01	3134.21	0	12:02	0	0	0:00:00
SDMH3	0.04	2.56	3131.84	0	12:04	0	0	0:00:00
SDMH30	0.02	1.12	3134.42	0	12:02	0	0	0:00:00
SDMH31	0.01	0.78	3135.10	0	12:01	0	0	0:00:00
SDMH32	0.01	0.87	3135.43	0	12:01	0	0	0:00:00
SDMH33	0.01	0.88	3135.63	0	12:01	0	0	0:00:00
SDMH34	0.01	0.32	3133.02	0	11:55	0	0	0:00:00
SDMH35	0.01	0.57	3133.41	0	12:03	0	0	0:00:00
SDMH36	0.02	1.08	3131.21	0	12:02	0	0	0:00:00
SDMH37	0.02	0.95	3131.62	0	12:02	0	0	0:00:00
SDMH38	0.01	0.95	3131.86	0	12:02	0	0	0:00:00
SDMH39	0.01	0.81	3132.51	0	12:01	0	0	0:00:00
SDMH4	0.04	2.73	3132.19	0	12:04	0	0	0:00:00
SDMH40	0.01	0.75	3133.37	0	12:01	0	0	0:00:00
SDMH41	0.01	0.61	3133.73	0	12:01	0	0	0:00:00
SDMH42	0.01	0.47	3134.51	0	12:01	0	0	0:00:00
SDMH43	0.01	0.27	3133.68	0	11:56	0	0	0:00:00
SDMH44	0.12	0.94	3131.08	0	11:56	0	0	0:00:00
SDMH45	0.01	0.52	3132.41	0	11:56	0	0	0:00:00
SDMH46	0.01	0.36	3132.55	0	11:55	0	0	0:00:00
SDMH47	0.04	0.71	3131.14	0	11:56	0	0	0:00:00
SDMH5	0.04	2.86	3132.37	0	12:04	0	0	0:00:00
SDMH6	0.03	2.63	3132.46	0	12:04	0	0	0:00:00
SDMH7	0.03	2.56	3132.54	0	12:04	0	0	0:00:00
SDMH8	0.03	2.49	3132.61	0	12:04	0	0	0:00:00
SDMH9	0.03	2.44	3132.68	0	12:04	0	0	0:00:00
BITTERROOT	0.01	3.19	3122.76	0	00:00	0	0	0:00:00
BITTERROOT_PH3	0.02	0.06	3120.06	0	14:21	0	0	0:00:00
OUTFALL_EXISTING	0.00	0.00	0.00	0	00:00	0	0	0:00:00
OUTFALL_EXISTING_PH3	0.00	0.00	0.00	0	00:00	0	0	0:00:00
POND	1.16	2.10	3129.60	0	13:37	0	0	0:00:00
POND_PH3	1.50	2.34	3130.84	0	14:21	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
OUTFALL_BITTERROOT	JUNCTION	0.00	2.47	0	13:37	0.00		

OUTFALL_CONTROL	JUNCTION	0.00	2.47	0	13:37	0.00
PH3_OUTLET	JUNCTION	0.00	0.20	0	14:21	0.00
SDMH 43	JUNCTION	0.73	0.73	0	12:01	0.00
SDMH_LMC	JUNCTION	4.90	4.90	0	11:55	0.00
SDMH1	JUNCTION	0.00	30.35	0	12:05	0.00
SDMH10	JUNCTION	0.00	16.63	0	12:02	0.00
SDMH11	JUNCTION	0.00	5.11	0	11:56	0.00
SDMH12	JUNCTION	1.57	10.36	0	12:02	0.00
SDMH13	JUNCTION	0.00	7.47	0	12:02	0.00
SDMH14	JUNCTION	1.23	7.46	0	12:01	0.00
SDMH15	JUNCTION	1.49	4.87	0	12:01	0.00
SDMH16	JUNCTION	0.72	3.38	0	12:00	0.00
SDMH17	JUNCTION	0.22	2.66	0	12:00	0.00
SDMH18	JUNCTION	2.44	2.44	0	12:00	0.00
SDMH19	JUNCTION	1.48	1.48	0	12:00	0.00
SDMH2	JUNCTION	0.00	30.41	0	12:04	0.00
SDMH20	JUNCTION	1.37	1.37	0	12:01	0.00
SDMH21	JUNCTION	0.47	0.47	0	12:00	0.00
SDMH22	JUNCTION	0.77	0.77	0	11:58	0.00
SDMH23	JUNCTION	0.89	3.61	0	12:03	0.00
SDMH24	JUNCTION	2.76	2.76	0	12:02	0.00
SDMH25	JUNCTION	1.14	9.69	0	12:02	0.00
SDMH26	JUNCTION	0.00	8.06	0	12:02	0.00
SDMH27	JUNCTION	0.00	8.14	0	12:02	0.00
SDMH28	JUNCTION	1.51	8.16	0	12:02	0.00
SDMH29	JUNCTION	1.54	6.34	0	12:02	0.00
SDMH3	JUNCTION	0.00	30.46	0	12:04	0.00
SDMH30	JUNCTION	0.00	4.81	0	12:01	0.00
SDMH31	JUNCTION	0.79	4.80	0	12:01	0.00
SDMH32	JUNCTION	0.67	4.02	0	12:01	0.00
SDMH33	JUNCTION	3.52	3.52	0	12:01	0.00
SDMH34	JUNCTION	0.88	0.88	0	11:55	0.00
SDMH35	JUNCTION	0.49	0.49	0	11:55	0.00
SDMH36	JUNCTION	2.92	8.53	0	12:01	0.00
SDMH37	JUNCTION	1.10	5.69	0	12:02	0.00
SDMH38	JUNCTION	1.01	4.59	0	12:02	0.00
SDMH39	JUNCTION	0.00	3.58	0	12:01	0.00
SDMH4	JUNCTION	1.23	30.51	0	12:04	0.00
SDMH40	JUNCTION	0.65	3.59	0	12:01	0.00
SDMH41	JUNCTION	0.82	2.39	0	12:01	0.00
SDMH42	JUNCTION	1.57	1.57	0	12:01	0.00
SDMH43	JUNCTION	0.67	0.67	0	11:56	0.00
SDMH44	JUNCTION	2.81	6.20	0	11:56	0.00
SDMH45	JUNCTION	1.68	2.29	0	11:55	0.00
SDMH46	JUNCTION	0.60	0.60	0	11:55	0.00
SDMH47	JUNCTION	1.15	1.15	0	11:55	0.00
SDMH5	JUNCTION	1.05	30.07	0	12:04	0.00
SDMH6	JUNCTION	1.37	19.14	0	12:03	0.00
SDMH7	JUNCTION	0.00	17.53	0	12:03	0.00
SDMH8	JUNCTION	1.08	17.70	0	12:03	0.00
SDMH9	JUNCTION	0.00	16.16	0	12:03	0.00
BITTERROOT	OUTFALL	0.00	1786.22	0	00:00	0.00
BITTERROOT_PH3	OUTFALL	0.00	0.20	0	14:21	0.00
OUTFALL_EXISTING	OUTFALL	1.44	1.44	0	12:42	0.00
OUTFALL_EXISTING_PH3	OUTFALL	0.19	0.19	0	12:25	0.00
POND	STORAGE	0.00	38.09	0	12:05	0.00
POND_PH3	STORAGE	0.00	6.14	0	11:56	0.00

****
Storage Node Summary
****

Storage Node ID	Maximum	Maximum	Time of Max	Average	Average	Maximum

Node ID	Maximum Ponded Volume 1000 ft³	Total Ponded Volume (%)	Ponded Volume days hh:mm	Ponded Volume 1000 ft³	Ponded Volume (%)	Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Total Exfiltrated Volume 1000 ft³
POND	113.772	35	0 13:37	52.712	16	2.47	0.00	0.000
POND_PH3	15.158	51	0 14:21	8.976	30	0.20	0.00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
BITTERROOT	95.89	0.25	1786.22
BITTERROOT_PH3	95.42	0.02	0.20
OUTFALL_EXISTING	8.64	0.37	1.44
OUTFALL_EXISTING_PH3	7.81	0.04	0.19
System	51.94	0.69	1786.22

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Total Reported Time Condition	Maximum Surcharged Depth minutes
Link-04	CONDUIT	0 14:21	6.62	1.00	0.20	212.93	0.00	0.02	0 Calculated
RIVER_02	CHANNEL	0 00:00	2.44	1.00	1786.22	28496.32	0.06	0.22	0 Calculated
SDP_OUTFALL	CONDUIT	0 13:37	3.94	1.00	2.47	37.70	0.07	0.19	0 Calculated
SP1	CONDUIT	0 12:05	5.52	1.00	30.27	51.23	0.59	0.56	0 Calculated
SP10	CONDUIT	0 12:03	2.66	1.00	16.16	50.96	0.32	0.69	0 Calculated
SP11	CONDUIT	0 11:56	1.47	1.00	3.84	36.54	0.11	0.72	0 Calculated
SP12	CONDUIT	0 11:55	3.20	1.00	4.87	13.42	0.36	0.81	0 Calculated
SP13	CONDUIT	0 12:02	4.91	1.00	10.28	20.80	0.49	0.83	0 Calculated

SP14		CONDUIT	0	12:01	4.55	1.00	1.48	4.63	0.32
0.55	0	Calculated							
SP15		CONDUIT	0	12:02	3.13	1.00	7.33	20.80	0.35
0.79	0	Calculated							
SP16		CONDUIT	0	12:02	4.12	1.00	7.47	20.80	0.36
0.60	0	Calculated							
SP17		CONDUIT	0	12:02	4.40	1.00	1.37	4.63	0.29
0.42	0	Calculated							
SP18		CONDUIT	0	12:02	5.00	1.00	4.87	9.66	0.50
0.54	0	Calculated							
SP19		CONDUIT	0	12:01	3.89	1.00	3.39	9.69	0.35
0.50	0	Calculated							
SP2		CONDUIT	0	12:05	4.68	1.00	30.35	51.11	0.59
0.64	0	Calculated							
SP20		CONDUIT	0	12:00	3.56	1.00	2.66	8.64	0.31
0.44	0	Calculated							
SP21		CONDUIT	0	12:00	2.96	1.00	2.44	8.64	0.28
0.47	0	Calculated							
SP22		CONDUIT	0	12:01	3.53	1.00	0.47	4.63	0.10
0.31	0	Calculated							
SP23		CONDUIT	0	11:59	3.98	1.00	0.78	4.63	0.17
0.53	0	Calculated							
SP24		CONDUIT	0	12:03	4.43	1.00	3.60	13.66	0.26
0.70	0	Calculated							
SP25		CONDUIT	0	12:02	5.02	1.00	2.76	4.63	0.60
0.66	0	Calculated							
SP26		CONDUIT	0	12:02	4.47	1.00	9.63	22.78	0.42
0.88	0	Calculated							
SP27		CONDUIT	0	11:55	4.65	1.00	0.88	5.67	0.16
0.52	0	Calculated							
SP28		CONDUIT	0	12:03	2.98	1.00	8.03	20.77	0.39
0.86	0	Calculated							
SP29		CONDUIT	0	12:02	3.76	1.00	8.06	20.79	0.39
0.72	0	Calculated							
SP3		CONDUIT	0	12:04	4.30	1.00	30.41	51.12	0.59
0.69	0	Calculated							
SP30		CONDUIT	0	12:02	4.15	1.00	8.14	20.80	0.39
0.64	0	Calculated							
SP31		CONDUIT	0	11:55	2.51	1.00	0.49	11.83	0.04
0.47	0	Calculated							
SP32		CONDUIT	0	12:02	5.38	1.00	6.34	9.68	0.65
0.63	0	Calculated							
SP33		CONDUIT	0	12:02	3.56	1.00	4.79	9.66	0.50
0.71	0	Calculated							
SP34		CONDUIT	0	12:01	4.06	1.00	4.81	9.66	0.50
0.64	0	Calculated							
SP35		CONDUIT	0	12:01	4.03	1.00	4.02	9.66	0.42
0.55	0	Calculated							
SP36		CONDUIT	0	12:01	3.30	1.00	3.52	9.66	0.36
0.58	0	Calculated							
SP37		CONDUIT	0	12:02	5.33	1.00	8.52	18.60	0.46
0.51	0	Calculated							
SP38		CONDUIT	0	12:02	3.80	1.00	5.69	18.60	0.31
0.48	0	Calculated							
SP39		CONDUIT	0	12:02	3.34	1.00	4.59	18.60	0.25
0.45	0	Calculated							
SP4		CONDUIT	0	12:04	3.92	1.00	30.46	51.09	0.60
0.76	0	Calculated							
SP40		CONDUIT	0	12:01	4.11	1.00	3.58	8.63	0.41
0.49	0	Calculated							
SP41		CONDUIT	0	12:01	4.20	1.00	3.58	8.64	0.41
0.49	0	Calculated							
SP42		CONDUIT	0	12:01	3.11	1.00	2.39	8.63	0.28
0.45	0	Calculated							
SP43		CONDUIT	0	12:01	5.07	1.00	1.57	5.67	0.28
0.42	0	Calculated							
SP44		CONDUIT	0	11:56	3.56	1.00	0.67	5.67	0.12

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0.35           0  Calculated
  SP45              CONDUIT      0  11:56      4.71    1.00        6.14       18.60      0.33
0.46           0  Calculated
  SP46              CONDUIT      0  11:56      2.90    1.00        2.26        8.64      0.26
0.45           0  Calculated
  SP47              CONDUIT      0  11:55      2.17    1.00        0.60        2.93      0.21
0.39           0  Calculated
  SP48              CONDUIT      0  11:55      1.95    1.00        1.14        2.93      0.39
0.77           0  Calculated
  SP49              CONDUIT      0  12:01      2.91    1.00        0.72        9.66      0.07
0.22           0  Calculated
  SP5               CONDUIT      0  12:04      3.64    1.00       29.98       51.00      0.59
0.80           0  Calculated
  SP6               CONDUIT      0  12:04      2.35    1.00       19.03       51.12      0.37
0.78           0  Calculated
  SP7               CONDUIT      0  12:03      2.39    1.00       17.40       51.14      0.34
0.74           0  Calculated
  SP8               CONDUIT      0  12:03      2.60    1.00       17.53       51.02      0.34
0.72           0  Calculated
  SP9               CONDUIT      0  12:03      2.46    1.00       15.96       51.02      0.31
0.70           0  Calculated
  WQV_DRAIN         CONDUIT      0  13:37      4.02    1.00        1.18        1.90      0.62
0.79           0  Calculated
  Orifice-02        ORIFICE      0  14:21                          0.03
1.00
  Orifice-03        ORIFICE      0  14:21                          0.17
0.49
  Orifice-04        ORIFICE      0  13:37                          1.29
0.60


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.



  WARNING 005 : Minimum slope used for Conduit RIVER_02.

  Analysis began on:  Wed Jul 13 16:09:24 2022
  Analysis ended on:  Wed Jul 13 16:09:49 2022
  Total elapsed time: 00:00:25
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Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 2101 - SWMM V10.1.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant flow
Starting Date JAN-01-2021 00:00:00
Ending Date JAN-08-2021 00:00:00
Report Time Step 00:00:30

****
Element Count
****
Number of rain gages 1
Number of subbasins 41
Number of nodes 58
Number of links 56

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Peak Rate Factor
BASIN_1	2.17	484.00
BASIN_10	0.98	484.00
BASIN_11	1.14	484.00
BASIN_12	0.92	484.00
BASIN_13	1.06	484.00
BASIN_14	1.23	484.00
BASIN_15	1.07	484.00
BASIN_16	0.73	484.00
BASIN_17	0.69	484.00
BASIN_18	0.61	484.00
BASIN_19	1.22	484.00
BASIN_2	0.27	484.00
BASIN_20	0.52	484.00
BASIN_21	0.85	484.00
BASIN_22	0.89	484.00
BASIN_23	2.26	484.00
BASIN_24	0.45	484.00
BASIN_25	0.17	484.00
BASIN_26	0.56	484.00
BASIN_27	0.63	484.00
BASIN_28	0.32	484.00
BASIN_29	1.92	484.00
BASIN_3	1.19	484.00
BASIN_30	2.17	484.00
BASIN_38	0.50	484.00
BASIN_4	1.16	484.00
BASIN_5	0.48	484.00
BASIN_6	0.86	484.00

BASIN_7	0.78	484.00
BASIN_8	0.81	484.00
BASIN_9	0.31	484.00
BASIN_EXISTING	37.19	484.00
BASIN_EXISTING_PH3	3.86	484.00
BASIN_PH3_1	0.28	484.00
BASIN_PH3_2	1.13	484.00
BASIN_PH3_3	0.55	484.00
BASIN_PH3_4	1.89	484.00
LMC_ROAD_EAST	1.18	484.00
LMC_ROAD_SOUTH	1.49	484.00
RELIGIOUS	4.99	484.00
SENIOR	5.53	484.00

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Node Summary
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Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
OUTFALL_BITTERROOT	JUNCTION	3119.60	3136.00	0.00	
OUTFALL_CONTROL	JUNCTION	3128.00	3132.60	0.00	
PH3_OUTLET	JUNCTION	3128.50	3132.50	0.00	
SDMH 43	JUNCTION	3132.62	3137.21	0.00	
SDMH_LMC	JUNCTION	3131.40	3138.21	0.00	
SDMH1	JUNCTION	3128.66	3134.98	0.00	
SDMH10	JUNCTION	3130.38	3136.15	0.00	
SDMH11	JUNCTION	3130.83	3137.32	0.00	
SDMH12	JUNCTION	3130.95	3135.04	0.00	
SDMH13	JUNCTION	3131.18	3135.30	0.00	
SDMH14	JUNCTION	3132.09	3136.52	0.00	
SDMH15	JUNCTION	3133.07	3137.17	0.00	
SDMH16	JUNCTION	3134.26	3138.80	0.00	
SDMH17	JUNCTION	3134.46	3139.10	0.00	
SDMH18	JUNCTION	3134.61	3139.04	0.00	
SDMH19	JUNCTION	3132.34	3135.05	0.00	
SDMH2	JUNCTION	3129.22	3136.62	0.00	
SDMH20	JUNCTION	3133.38	3136.52	0.00	
SDMH21	JUNCTION	3132.51	3135.59	0.00	
SDMH22	JUNCTION	3132.31	3135.67	0.00	
SDMH23	JUNCTION	3131.88	3135.52	0.00	
SDMH24	JUNCTION	3132.72	3135.51	0.00	
SDMH25	JUNCTION	3131.21	3135.50	0.00	
SDMH26	JUNCTION	3131.42	3135.83	0.00	
SDMH27	JUNCTION	3131.98	3136.49	0.00	
SDMH28	JUNCTION	3132.07	3136.50	0.00	
SDMH29	JUNCTION	3133.20	3137.25	0.00	
SDMH3	JUNCTION	3129.29	3135.82	0.00	
SDMH30	JUNCTION	3133.29	3137.45	0.00	
SDMH31	JUNCTION	3134.31	3138.67	0.00	
SDMH32	JUNCTION	3134.56	3138.88	0.00	
SDMH33	JUNCTION	3134.74	3139.11	0.00	
SDMH34	JUNCTION	3132.71	3135.51	0.00	
SDMH35	JUNCTION	3132.84	3136.50	0.00	
SDMH36	JUNCTION	3130.14	3136.10	0.00	
SDMH37	JUNCTION	3130.66	3135.86	0.00	
SDMH38	JUNCTION	3130.91	3135.86	0.00	
SDMH39	JUNCTION	3131.70	3136.54	0.00	
SDMH4	JUNCTION	3129.46	3135.01	0.00	
SDMH40	JUNCTION	3132.62	3136.62	0.00	
SDMH41	JUNCTION	3133.12	3136.88	0.00	
SDMH42	JUNCTION	3134.04	3136.87	0.00	
SDMH43	JUNCTION	3133.41	3135.62	0.00	
SDMH44	JUNCTION	3130.14	3135.37	0.00	
SDMH45	JUNCTION	3131.89	3136.18	0.00	

SDMH46	JUNCTION	3132.18	3136.18	0.00
SDMH47	JUNCTION	3130.43	3134.29	0.00
SDMH5	JUNCTION	3129.52	3135.01	0.00
SDMH6	JUNCTION	3129.84	3135.59	0.00
SDMH7	JUNCTION	3129.98	3136.61	0.00
SDMH8	JUNCTION	3130.12	3135.67	0.00
SDMH9	JUNCTION	3130.24	3136.42	0.00
BITTERROOT	OUTFALL	3119.57	3135.97	0.00
BITTERROOT_PH3	OUTFALL	3120.00	3122.50	0.00
OUTFALL_EXISTING	OUTFALL	0.00	0.00	0.00
OUTFALL_EXISTING_PH3	OUTFALL	0.00	0.00	0.00
POND	STORAGE	3127.50	3132.10	27000.00
POND_PH3	STORAGE	3128.50	3132.50	5000.00

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-04	PH3_OUTLET	BITTERROOT_PH3	CONDUIT	23.7	35.8801	0.0150
RIVER_02	OUTFALL_BITTERROOT	BITTERROOT	CHANNEL	50.0	0.1200	0.0400
SDP_OUTFALL	OUTFALL_CONTROL	OUTFALL_BITTERROOT	CONDUIT	100.0	0.5000	0.0100
SP1	SDMH1	POND	CONDUIT	103.0	0.1534	0.0100
SP10	SDMH10	SDMH9	CONDUIT	94.4	0.1518	0.0100
SP11	SDMH11	SDMH10	CONDUIT	252.8	0.1776	0.0100
SP12	SDMH_LMC	SDMH11	CONDUIT	274.0	0.2083	0.0100
SP13	SDMH12	SDMH5	CONDUIT	50.9	0.5000	0.0100
SP14	SDMH19	SDMH12	CONDUIT	38.9	0.9990	0.0100
SP15	SDMH13	SDMH12	CONDUIT	44.9	0.5000	0.0100
SP16	SDMH14	SDMH13	CONDUIT	181.4	0.5000	0.0100
SP17	SDMH20	SDMH14	CONDUIT	29.0	1.0000	0.0100
SP18	SDMH15	SDMH14	CONDUIT	97.0	0.5000	0.0100
SP19	SDMH16	SDMH15	CONDUIT	236.4	0.5032	0.0100
SP2	SDMH2	SDMH1	CONDUIT	366.7	0.1527	0.0100
SP20	SDMH17	SDMH16	CONDUIT	50.0	0.4000	0.0100
SP21	SDMH18	SDMH17	CONDUIT	36.4	0.4000	0.0100
SP22	SDMH21	SDMH6	CONDUIT	47.0	1.0000	0.0100
SP23	SDMH22	SDMH8	CONDUIT	47.0	1.0000	0.0100
SP24	SDMH23	SDMH10	CONDUIT	22.3	1.0000	0.0100
SP25	SDMH24	SDMH23	CONDUIT	34.0	1.0000	0.0100
SP26	SDMH25	SDMH10	CONDUIT	34.9	0.6000	0.0100
SP27	SDMH34	SDMH25	CONDUIT	33.4	1.5000	0.0100
SP28	SDMH26	SDMH25	CONDUIT	42.0	0.4988	0.0100
SP29	SDMH27	SDMH26	CONDUIT	111.9	0.4998	0.0100
SP3	SDMH3	SDMH2	CONDUIT	45.8	0.1528	0.0100
SP30	SDMH28	SDMH27	CONDUIT	18.0	0.5000	0.0100
SP31	SDMH35	SDMH28	CONDUIT	36.0	0.7500	0.0100
SP32	SDMH29	SDMH28	CONDUIT	125.7	0.5026	0.0100
SP33	SDMH30	SDMH29	CONDUIT	18.0	0.5000	0.0100
SP34	SDMH31	SDMH30	CONDUIT	204.4	0.5000	0.0100
SP35	SDMH32	SDMH31	CONDUIT	50.0	0.5000	0.0100
SP36	SDMH33	SDMH32	CONDUIT	36.4	0.5000	0.0100
SP37	SDMH36	POND	CONDUIT	243.6	0.3999	0.0100
SP38	SDMH37	SDMH36	CONDUIT	107.0	0.4001	0.0100
SP39	SDMH38	SDMH37	CONDUIT	36.0	0.4000	0.0100
SP4	SDMH4	SDMH3	CONDUIT	110.1	0.1526	0.0100
SP40	SDMH39	SDMH38	CONDUIT	72.5	0.3998	0.0100
SP41	SDMH40	SDMH39	CONDUIT	205.3	0.4000	0.0100
SP42	SDMH41	SDMH40	CONDUIT	124.5	0.3997	0.0100
SP43	SDMH42	SDMH41	CONDUIT	27.9	1.5000	0.0100
SP44	SDMH43	SDMH40	CONDUIT	36.0	1.5000	0.0100
SP45	SDMH44	POND_PH3	CONDUIT	102.9	0.4000	0.0100
SP46	SDMH45	SDMH44	CONDUIT	412.4	0.4000	0.0100
SP47	SDMH46	SDMH45	CONDUIT	48.0	0.4000	0.0100
SP48	SDMH47	SDMH44	CONDUIT	48.0	0.4000	0.0100

SP49	SDMH 43	SDMH11	CONDUIT	51.4	0.5000	0.0100
SP5	SDMH5	SDMH4	CONDUIT	38.8	0.1521	0.0100
SP6	SDMH6	SDMH5	CONDUIT	208.8	0.1527	0.0100
SP7	SDMH7	SDMH6	CONDUIT	95.5	0.1529	0.0100
SP8	SDMH8	SDMH7	CONDUIT	92.7	0.1521	0.0100
SP9	SDMH9	SDMH8	CONDUIT	75.6	0.1522	0.0100
WQV_DRAIN	OUTFALL_CONTROL	POND	CONDUIT	68.6	1.4569	0.0100
Orifice-02	POND_PH3	PH3_OUTLET	ORIFICE			
Orifice-03	POND_PH3	PH3_OUTLET	ORIFICE			
Orifice-04	POND	OUTFALL_CONTROL	ORIFICE			

****
Cross Section Summary
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Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-04	CIRCULAR	2.50	2.50	1	4.91	0.63	212.93
RIVER_02	TRAPEZOIDAL	16.40	265.60	1	3817.92	13.97	28496.32
SDP_OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	37.70
SP1	CIRCULAR	3.50	3.50	1	9.62	0.88	51.23
SP10	CIRCULAR	3.50	3.50	1	9.62	0.88	50.96
SP11	CIRCULAR	3.00	3.00	1	7.07	0.75	36.54
SP12	CIRCULAR	2.00	2.00	1	3.14	0.50	13.42
SP13	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP14	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP15	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP16	CIRCULAR	2.00	2.00	1	3.14	0.50	20.80
SP17	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP18	CIRCULAR	1.50	1.50	1	1.77	0.38	9.66
SP19	CIRCULAR	1.50	1.50	1	1.77	0.38	9.69
SP2	CIRCULAR	3.50	3.50	1	9.62	0.88	51.11
SP20	CIRCULAR	1.50	1.50	1	1.77	0.38	8.64
SP21	CIRCULAR	1.50	1.50	1	1.77	0.38	8.64
SP22	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP23	CIRCULAR	1.00	1.00	1	0.79	0.25	4.63
SP24	CIRCULAR	1.50	1.50	1	1.77	0.38	13.66
SP25	CIRCULAR	1.00	1.00	1	0.79	0.25	

4.63						
SP26	CIRCULAR	2.00	2.00	1	3.14	0.50
22.78						
SP27	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP28	CIRCULAR	2.00	2.00	1	3.14	0.50
20.77						
SP29	CIRCULAR	2.00	2.00	1	3.14	0.50
20.79						
SP3	CIRCULAR	3.50	3.50	1	9.62	0.88
51.12						
SP30	CIRCULAR	2.00	2.00	1	3.14	0.50
20.80						
SP31	CIRCULAR	1.50	1.50	1	1.77	0.38
11.83						
SP32	CIRCULAR	1.50	1.50	1	1.77	0.38
9.68						
SP33	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP34	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP35	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP36	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP37	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP38	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP39	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP4	CIRCULAR	3.50	3.50	1	9.62	0.88
51.09						
SP40	CIRCULAR	1.50	1.50	1	1.77	0.38
8.63						
SP41	CIRCULAR	1.50	1.50	1	1.77	0.38
8.64						
SP42	CIRCULAR	1.50	1.50	1	1.77	0.38
8.63						
SP43	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP44	CIRCULAR	1.00	1.00	1	0.79	0.25
5.67						
SP45	CIRCULAR	2.00	2.00	1	3.14	0.50
18.60						
SP46	CIRCULAR	1.50	1.50	1	1.77	0.38
8.64						
SP47	CIRCULAR	1.00	1.00	1	0.79	0.25
2.93						
SP48	CIRCULAR	1.00	1.00	1	0.79	0.25
2.93						
SP49	CIRCULAR	1.50	1.50	1	1.77	0.38
9.66						
SP5	CIRCULAR	3.50	3.50	1	9.62	0.88
51.00						
SP6	CIRCULAR	3.50	3.50	1	9.62	0.88
51.12						
SP7	CIRCULAR	3.50	3.50	1	9.62	0.88
51.14						
SP8	CIRCULAR	3.50	3.50	1	9.62	0.88
51.02						
SP9	CIRCULAR	3.50	3.50	1	9.62	0.88
51.02						
WQV_DRAIN	CIRCULAR	0.67	0.67	1	0.35	0.17
1.90						

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	16.533	2.280
Surface Runoff	0.424	0.058
Continuity Error (%)	-0.000	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	6.839	2.228
Initial Stored Volume	1.627	0.530
Final Stored Volume	1.141	0.372
Continuity Error (%)	-0.001	

Composite Curve Number Computations Report

Subbasin BASIN_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.57	D	98.00
> 75% grass cover, Good	0.10	D	80.00
1/8 acre lots, 65% impervious	1.49	D	92.00
Composite Area & Weighted CN	2.17		93.03

Subbasin BASIN_10

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.49	D	98.00
> 75% grass cover, Good	0.09	D	80.00
1/8 acre lots, 65% impervious	0.40	D	92.00
Composite Area & Weighted CN	0.98		93.94

Subbasin BASIN_11

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.36	D	98.00
> 75% grass cover, Good	0.07	D	80.00
1/8 acre lots, 65% impervious	0.71	D	92.00
Composite Area & Weighted CN	1.14		93.20

Subbasin BASIN_12

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.29	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.57	D	92.00
Composite Area & Weighted CN	0.92		93.20

Subbasin BASIN_13

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.23	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.79	D	92.00
Composite Area & Weighted CN	1.06		92.83

Subbasin BASIN_14

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.35	D	98.00
> 75% grass cover, Good	0.07	D	80.00
1/8 acre lots, 65% impervious	0.81	D	92.00
Composite Area & Weighted CN	1.23		93.07

Subbasin BASIN_15

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.45	D	98.00
> 75% grass cover, Good	0.10	D	80.00
1/8 acre lots, 65% impervious	0.52	D	92.00
Composite Area & Weighted CN	1.07		93.46

Subbasin BASIN_16

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.22	D	98.00
> 75% grass cover, Good	0.02	D	80.00
1/8 acre lots, 65% impervious	0.49	D	92.00
Composite Area & Weighted CN	0.74		93.41

Subbasin BASIN_17

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.57	D	98.00
> 75% grass cover, Good	0.12	D	80.00
Composite Area & Weighted CN	0.69		94.79

Subbasin BASIN_18

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.20	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.38	D	92.00
Composite Area & Weighted CN	0.61		93.25

Subbasin BASIN_19

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.15	D	98.00
> 75% grass cover, Good	0.03	D	80.00
1/8 acre lots, 65% impervious	1.04	D	92.00
Composite Area & Weighted CN	1.22		92.50

Subbasin BASIN_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.23	D	98.00
> 75% grass cover, Good	0.04	D	80.00
Composite Area & Weighted CN	0.27		95.30

Subbasin BASIN_20

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.52	D	92.00
Composite Area & Weighted CN	0.52		92.00

Subbasin BASIN_21

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.85	D	92.00
Composite Area & Weighted CN	0.85		92.00

Subbasin BASIN_22

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.89	D	92.00
Composite Area & Weighted CN	0.89		92.00

Subbasin BASIN_23

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	2.26	D	92.00
Composite Area & Weighted CN	2.26		92.00

Subbasin BASIN_24

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.45	D	92.00
Composite Area & Weighted CN	0.45		92.00

Subbasin BASIN_25

Soil/Surface Description	Area	Soil

Soil/Surface Description	(acres)	Group	CN
1/8 acre lots, 65% impervious	0.17	D	92.00
Composite Area & Weighted CN	0.17		92.00

Subbasin BASIN_26

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.27	D	92.00
Composite Area & Weighted CN	0.27		92.00

Subbasin BASIN_27

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	0.32	D	92.00
Composite Area & Weighted CN	0.32		92.00

Subbasin BASIN_28

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.32	D	98.00
Composite Area & Weighted CN	0.32		98.00

Subbasin BASIN_29

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	1.92	D	92.00
Composite Area & Weighted CN	1.92		92.00

Subbasin BASIN_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.29	D	98.00
> 75% grass cover, Good	0.03	D	80.00
1/8 acre lots, 65% impervious	0.88	D	92.00
Composite Area & Weighted CN	1.19		93.20

Subbasin BASIN_30

Soil/Surface Description	Area (acres)	Soil Group	CN
1/8 acre lots, 65% impervious	1.13	D	92.00
Composite Area & Weighted CN	1.13		92.00

Subbasin BASIN_38

Soil/Surface Description	Area (acres)	Soil Group	CN

Paved roads with curbs & sewers	0.20	D	98.00
1/8 acre lots, 65% impervious	0.30	D	92.00
Composite Area & Weighted CN	0.50		94.40

Subbasin BASIN_4

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.37	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.73	D	92.00
Composite Area & Weighted CN	1.16		93.23

Subbasin BASIN_5

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.41	D	98.00
> 75% grass cover, Good	0.07	D	80.00
Composite Area & Weighted CN	0.48		95.30

Subbasin BASIN_6

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.33	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.48	D	92.00
Composite Area & Weighted CN	0.86		93.47

Subbasin BASIN_7

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.36	D	98.00
> 75% grass cover, Good	0.06	D	80.00
1/8 acre lots, 65% impervious	0.35	D	92.00
Composite Area & Weighted CN	0.78		93.82

Subbasin BASIN_8

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.19	D	98.00
1/8 acre lots, 65% impervious	0.62	D	92.00
Composite Area & Weighted CN	0.81		93.41

Subbasin BASIN_9

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.24	D	98.00
> 75% grass cover, Good	0.04	D	80.00
1/8 acre lots, 65% impervious	0.03	D	92.00
Composite Area & Weighted CN	0.31		95.03

Subbasin BASIN_EXISTING

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	28.39	C	71.00
Composite Area & Weighted CN	28.39		71.00

Subbasin BASIN_EXISTING_PH3

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	3.86	C	71.00
Composite Area & Weighted CN	3.86		71.00

Subbasin BASIN_PH3_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.28	B	98.00
Composite Area & Weighted CN	0.28		98.00

Subbasin BASIN_PH3_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Urban commercial, 85% imp	1.13	B	92.00
Composite Area & Weighted CN	1.13		92.00

Subbasin BASIN_PH3_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.55	B	98.00
Composite Area & Weighted CN	0.55		98.00

Subbasin BASIN_PH3_4

Soil/Surface Description	Area (acres)	Soil Group	CN
Urban commercial, 85% imp	1.89	B	92.00
Composite Area & Weighted CN	1.89		92.00

Subbasin LMC_ROAD_EAST

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	1.00	D	98.00
> 75% grass cover, Good	0.18	D	80.00
Composite Area & Weighted CN	1.18		95.30

Subbasin LMC_ROAD_SOUTH

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	1.27	D	98.00
> 75% grass cover, Good	0.22	D	80.00
Composite Area & Weighted CN	1.49		95.30

Subbasin RELIGIOUS

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	5.47	C	71.00
Composite Area & Weighted CN	5.47		71.00

Subbasin SENIOR

Soil/Surface Description	Area (acres)	Soil Group	CN
Meadow, non-grazed	5.53	C	71.00
Composite Area & Weighted CN	5.53		71.00

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

```
          V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
          R  = Aq / Wp
          Tc = (Lf / V) / (3600 sec/hr)

          Where:

          Tc = Time of Concentration (hrs)
          Lf = Flow Length (ft)
          R  = Hydraulic Radius (ft)
          Aq = Flow Area (ft²)
          Wp = Wetted Perimeter (ft)
          V  = Velocity (ft/sec)
          Sf = Slope (ft/ft)
          n  = Manning's Roughness

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  Subbasin BASIN_1
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  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                       0.15                0.00
0.00
          Flow Length (ft):                         50.00                0.00
0.00
          Slope (%):                                 2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17                0.00
0.00
          Velocity (ft/sec):                         0.09                0.00
0.00
          Computed Flow Time (minutes):              9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                        435.00                0.00
0.00
          Slope (%):                                 0.55                0.00
0.00
          Surface Type:                             Paved              Unpaved
Unpaved
          Velocity (ft/sec):                         1.51                0.00
0.00
          Computed Flow Time (minutes):              4.80                0.00
0.00

=============================================================================================
          Total TOC (minutes):                      14.11

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  Subbasin BASIN_10
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  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                       0.15                0.00
0.00
```

Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	267.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.09	0.00	0.00

Total TOC (minutes):	12.40

Subbasin BASIN_11

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	360.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	4.17	0.00	0.00

Total TOC (minutes):	13.47		

Subbasin BASIN_12

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	278.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.22	0.00	0.00

Total TOC (minutes):	12.52		

Subbasin BASIN_13

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00

Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	337.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	3.72	0.00	0.00

Total TOC (minutes):	13.03

Subbasin BASIN_14

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	400.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	4.63	0.00	0.00

Total TOC (minutes):	13.94

Subbasin BASIN_15

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	200.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	2.21	0.00	0.00

Total TOC (minutes): 11.51

Subbasin BASIN_16

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	102.00	0.00	

```
0.00
          Slope (%):                                1.00                0.00
0.00
          Surface Type:                            Paved              Unpaved
Unpaved
          Velocity (ft/sec):                        2.03                0.00
0.00
          Computed Flow Time (minutes):             0.84                0.00
0.00

=============================================================================================
          Total TOC (minutes):                     10.14

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  Subbasin BASIN_17
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          User-Defined TOC override (minutes):      5.00

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  Subbasin BASIN_18
  --------------------

  Sheet Flow Computations
  -----------------------
                                                Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                      0.15                0.00
0.00
          Flow Length (ft):                        50.00                0.00
0.00
          Slope (%):                                2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                1.17                0.00
0.00
          Velocity (ft/sec):                        0.09                0.00
0.00
          Computed Flow Time (minutes):             9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                       248.00                0.00
0.00
          Slope (%):                                0.50                0.00
0.00
          Surface Type:                            Paved              Unpaved
Unpaved
          Velocity (ft/sec):                        1.44                0.00
0.00
          Computed Flow Time (minutes):             2.87                0.00
0.00

=============================================================================================
          Total TOC (minutes):                     12.18

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  Subbasin BASIN_19
  --------------------
```

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	242.00	0.00	0.00
Slope (%):	0.55	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.51	0.00	0.00
Computed Flow Time (minutes):	2.67	0.00	0.00

Total TOC (minutes): 11.98

Subbasin BASIN_2

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_20

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	173.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.00	0.00	0.00

Total TOC (minutes): 11.31

Subbasin BASIN_21

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	327.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Unpaved	Unpaved	Unpaved
Velocity (ft/sec):	1.14	0.00	0.00
Computed Flow Time (minutes):	4.78	0.00	0.00

Total TOC (minutes): 14.09

Subbasin BASIN_22

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	256.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.96	0.00	0.00

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Total TOC (minutes): 12.27

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Subbasin BASIN_23

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	139.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
Surface Type:	Paved	Unpaved	

```
Unpaved
          Velocity (ft/sec):                          2.87                0.00
0.00
          Computed Flow Time (minutes):               0.81                0.00
0.00

================================================================================================
          Total TOC (minutes):                       10.11

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  Subbasin BASIN_24
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          User-Defined TOC override (minutes):      5.00

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  Subbasin BASIN_25
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                        0.15                0.00
0.00
          Flow Length (ft):                          50.00                0.00
0.00
          Slope (%):                                  2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):                  1.17                0.00
0.00
          Velocity (ft/sec):                          0.09                0.00
0.00
          Computed Flow Time (minutes):               9.31                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                         122.00                0.00
0.00
          Slope (%):                                  0.75                0.00
0.00
          Surface Type:                              Paved              Unpaved
Unpaved
          Velocity (ft/sec):                          1.76                0.00
0.00
          Computed Flow Time (minutes):               1.16                0.00
0.00

================================================================================================
          Total TOC (minutes):                       10.46

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  Subbasin BASIN_26
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A           Subarea B           Subarea
```

C				
	Manning's Roughness:	0.15	0.00	
0.00				
	Flow Length (ft):	50.00	0.00	
0.00				
	Slope (%):	2.00	0.00	
0.00				
	2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00				
	Velocity (ft/sec):	0.09	0.00	
0.00				
	Computed Flow Time (minutes):	9.31	0.00	
0.00				

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	120.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	1.39	0.00	0.00

Total TOC (minutes):	10.70

Subbasin BASIN_27

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	170.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	

0.00			
Computed Flow Time (minutes):	1.97	0.00	
0.00			

Total TOC (minutes):	11.27		

Subbasin BASIN_28

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	430.00	0.00	0.00
Slope (%):	0.75	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.76	0.00	0.00
Computed Flow Time (minutes):	4.07	0.00	0.00

Total TOC (minutes):	4.07		

Subbasin BASIN_29

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	140.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	

```
0.00
          Computed Flow Time (minutes):              1.62               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      10.93

=============================================================================================================


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  Subbasin BASIN_3
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
0.00
          Velocity (ft/sec):                         0.09               0.00
0.00
          Computed Flow Time (minutes):              9.31               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A          Subarea B          Subarea
C
          Flow Length (ft):                        385.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          Surface Type:                             Paved             Unpaved
Unpaved
          Velocity (ft/sec):                         1.44               0.00
0.00
          Computed Flow Time (minutes):              4.46               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      13.76

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  Subbasin BASIN_30
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
```

0.00

Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea
C			
Flow Length (ft):	200.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	
0.00			
Computed Flow Time (minutes):	2.31	0.00	
0.00			

Total TOC (minutes):	11.62

Subbasin BASIN_38

Sheet Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.15	0.00	
0.00			
Flow Length (ft):	50.00	0.00	
0.00			
Slope (%):	2.00	0.00	
0.00			
2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Total TOC (minutes):	9.31

Subbasin BASIN_4

Sheet Flow Computations

	Subarea A	Subarea B	Subarea
C			
Manning's Roughness:	0.15	0.00	
0.00			
Flow Length (ft):	50.00	0.00	
0.00			
Slope (%):	2.00	0.00	

0.00

2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	385.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	
0.00			
Computed Flow Time (minutes):	4.46	0.00	
0.00			

Total TOC (minutes):	13.76

Subbasin BASIN_5

User-Defined TOC override (minutes):	5.00

Subbasin BASIN_6

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	
0.00			
Flow Length (ft):	50.00	0.00	
0.00			
Slope (%):	2.00	0.00	
0.00			
2 yr, 24 hr Rainfall (in):	1.17	0.00	
0.00			
Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	376.00	0.00	
0.00			
Slope (%):	0.50	0.00	
0.00			
Surface Type:	Paved	Unpaved	
Unpaved			
Velocity (ft/sec):	1.44	0.00	

```
0.00
          Computed Flow Time (minutes):              4.35               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      13.66

=============================================================================================================


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  Subbasin BASIN_7
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
0.00
          Velocity (ft/sec):                         0.05               0.00
0.00
          Computed Flow Time (minutes):             16.20               0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                                 Subarea A          Subarea B          Subarea
C
          Flow Length (ft):                        400.00               0.00
0.00
          Slope (%):                                 0.50               0.00
0.00
          Surface Type:                             Paved             Unpaved
Unpaved
          Velocity (ft/sec):                         1.44               0.00
0.00
          Computed Flow Time (minutes):              4.63               0.00
0.00

=============================================================================================================
          Total TOC (minutes):                      20.83

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  Subbasin BASIN_8
  --------------------

  Sheet Flow Computations
  -----------------------
                                                 Subarea A          Subarea B          Subarea
C
          Manning's Roughness:                       0.15               0.00
0.00
          Flow Length (ft):                         50.00               0.00
0.00
          Slope (%):                                 2.00               0.00
0.00
          2 yr, 24 hr Rainfall (in):                 1.17               0.00
```

0.00

Velocity (ft/sec):	0.09	0.00	
0.00			
Computed Flow Time (minutes):	9.31	0.00	
0.00			

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	330.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	3.82	0.00	0.00

Total TOC (minutes): 13.13

Subbasin BASIN_9

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.15	0.00	0.00
Flow Length (ft):	50.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	9.31	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	180.00	0.00	0.00
Slope (%):	0.50	0.00	0.00
Surface Type:	Paved	Unpaved	Unpaved
Velocity (ft/sec):	1.44	0.00	0.00
Computed Flow Time (minutes):	2.08	0.00	0.00

Total TOC (minutes): 11.39

Subbasin BASIN_EXISTING

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.13	0.00	0.00
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	45.92	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	500.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
Surface Type:	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec):	0.70	0.00	0.00
Computed Flow Time (minutes):	11.90	0.00	0.00

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Total TOC (minutes): 57.83

==========

Subbasin BASIN_EXISTING_PH3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.13	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	1.17	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	26.37	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	400.00	0.00	0.00
Slope (%):	1.00	0.00	0.00
Surface Type:	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec):	0.70	0.00	0.00
Computed Flow Time (minutes):	9.52	0.00	0.00

Total TOC (minutes): 35.90

Subbasin BASIN_PH3_1

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_2

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_3

User-Defined TOC override (minutes): 5.00

Subbasin BASIN_PH3_4

User-Defined TOC override (minutes): 5.00

Subbasin LMC_ROAD_EAST

User-Defined TOC override (minutes): 5.00

Subbasin LMC_ROAD_SOUTH

User-Defined TOC override (minutes): 5.00

Subbasin RELIGIOUS

User-Defined TOC override (minutes): 5.00

Subbasin SENIOR

User-Defined TOC override (minutes): 5.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
BASIN_1	2.28	1.58	4.25	93.030	0	00:14:06
BASIN_10	2.28	1.66	2.07	93.940	0	00:12:24
BASIN_11	2.28	1.59	2.28	93.200	0	00:13:28
BASIN_12	2.28	1.59	1.89	93.200	0	00:12:31
BASIN_13	2.28	1.56	2.11	92.830	0	00:13:01
BASIN_14	2.28	1.58	2.42	93.070	0	00:13:56
BASIN_15	2.28	1.61	2.26	93.460	0	00:11:30
BASIN_16	2.28	1.61	1.60	93.410	0	00:10:08
BASIN_17	2.28	1.73	1.83	94.790	0	00:05:00
BASIN_18	2.28	1.59	1.26	93.250	0	00:12:10
BASIN_19	2.28	1.53	2.45	92.500	0	00:11:58
BASIN_2	2.28	1.78	0.73	95.300	0	00:05:00
BASIN_20	2.28	1.49	1.03	92.000	0	00:11:18
BASIN_21	2.28	1.49	1.59	92.000	0	00:14:05
BASIN_22	2.28	1.49	1.73	92.000	0	00:12:16
BASIN_23	2.28	1.49	4.60	92.000	0	00:10:06
BASIN_24	2.28	1.49	1.05	92.000	0	00:05:00
BASIN_25	2.28	1.49	0.35	92.000	0	00:10:27
BASIN_26	2.28	1.49	1.13	92.000	0	00:10:42
BASIN_27	2.28	1.49	1.25	92.000	0	00:11:16
BASIN_28	2.28	2.05	0.94	98.000	0	00:05:00
BASIN_29	2.28	1.49	3.84	92.000	0	00:10:55
BASIN_3	2.28	1.59	2.37	93.200	0	00:13:45
BASIN_30	2.28	1.49	4.28	92.000	0	00:11:37
BASIN_38	2.28	1.70	1.16	94.400	0	00:09:18
BASIN_4	2.28	1.59	2.31	93.230	0	00:13:45
BASIN_5	2.28	1.78	1.30	95.300	0	00:05:00
BASIN_6	2.28	1.61	1.73	93.470	0	00:13:39
BASIN_7	2.28	1.64	1.36	93.820	0	00:20:49
BASIN_8	2.28	1.61	1.66	93.410	0	00:13:07
BASIN_9	2.28	1.75	0.70	95.030	0	00:11:23
BASIN_EXISTING	2.28	0.39	5.84	71.000	0	00:57:49
BASIN_EXISTING_PH3	2.28	0.39	0.85	71.000	0	00:35:54
BASIN_PH3_1	2.28	2.05	0.84	98.000	0	00:05:00
BASIN_PH3_2	2.28	1.49	2.65	92.000	0	00:05:00
BASIN_PH3_3	2.28	2.05	1.61	98.000	0	00:05:00
BASIN_PH3_4	2.28	1.49	4.42	92.000	0	00:05:00
LMC_ROAD_EAST	2.28	1.78	3.18	95.300	0	00:05:00
LMC_ROAD_SOUTH	2.28	1.78	4.02	95.300	0	00:05:00
RELIGIOUS	2.28	0.39	2.57	71.000	0	00:05:00
SENIOR	2.28	0.39	2.84	71.000	0	00:05:00

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Node Depth Summary
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Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
OUTFALL_BITTERROOT	0.02	4.37	3123.97	0	00:00	0	0	0:00:00
OUTFALL_CONTROL	0.10	0.71	3128.71	0	13:09	0	0	0:00:00
PH3_OUTLET	0.02	0.11	3128.61	0	12:40	0	0	0:00:00
SDMH 43	0.01	4.06	3136.68	0	11:58	0	0	0:00:00

SDMH_LMC	0.03	5.53	3136.93	0	11:58	0	0	0:00:00
SDMH1	0.15	3.06	3131.72	0	12:02	0	0	0:00:00
SDMH10	0.05	4.86	3135.24	0	11:58	0	0	0:00:00
SDMH11	0.03	5.30	3136.13	0	11:58	0	0	0:00:00
SDMH12	0.03	3.94	3134.89	0	12:01	0	0	0:00:00
SDMH13	0.03	4.01	3135.19	0	12:01	0	0	0:00:00
SDMH14	0.02	3.96	3136.05	0	11:59	0	0	0:00:00
SDMH15	0.02	4.10	3137.17	0	11:59	0.00	0	0:00:00
SDMH16	0.02	3.61	3137.87	0	12:01	0	0	0:00:00
SDMH17	0.02	3.63	3138.10	0	12:01	0	0	0:00:00
SDMH18	0.02	3.62	3138.22	0	12:01	0	0	0:00:00
SDMH19	0.01	2.70	3135.05	0	12:01	0.00	0	0:00:00
SDMH2	0.07	3.47	3132.69	0	12:01	0	0	0:00:00
SDMH20	0.01	2.92	3136.30	0	11:59	0	0	0:00:00
SDMH21	0.01	3.08	3135.59	0	11:58	0.00	0	0:00:00
SDMH22	0.01	2.63	3134.94	0	11:58	0	0	0:00:00
SDMH23	0.02	3.43	3135.32	0	11:58	0	0	0:00:00
SDMH24	0.02	2.79	3135.51	0	11:58	0.05	5	0:00:00
SDMH25	0.04	4.29	3135.50	0	11:58	0.00	0	0:00:00
SDMH26	0.03	4.35	3135.77	0	12:01	0	0	0:00:00
SDMH27	0.03	4.17	3136.14	0	11:58	0	0	0:00:00
SDMH28	0.03	4.28	3136.35	0	11:58	0	0	0:00:00
SDMH29	0.03	4.04	3137.25	0	12:01	0.00	0	0:00:00
SDMH3	0.07	3.86	3133.15	0	12:01	0	0	0:00:00
SDMH30	0.03	4.16	3137.45	0	11:58	0.08	5	0:00:00
SDMH31	0.02	4.23	3138.54	0	11:59	0	0	0:00:00
SDMH32	0.02	4.32	3138.88	0	11:58	0.00	0	0:00:00
SDMH33	0.02	4.37	3139.11	0	11:56	0.03	4	0:00:00
SDMH34	0.01	2.80	3135.51	0	11:58	0.00	0	0:00:00
SDMH35	0.01	3.52	3136.36	0	11:58	0	0	0:00:00
SDMH36	0.02	1.48	3131.62	0	12:02	0	0	0:00:00
SDMH37	0.02	1.33	3131.99	0	12:02	0	0	0:00:00
SDMH38	0.02	1.33	3132.23	0	12:02	0	0	0:00:00
SDMH39	0.02	1.10	3132.80	0	12:01	0	0	0:00:00
SDMH4	0.06	4.41	3133.87	0	12:01	0	0	0:00:00
SDMH40	0.02	1.02	3133.64	0	12:01	0	0	0:00:00
SDMH41	0.01	0.83	3133.95	0	12:01	0	0	0:00:00
SDMH42	0.01	0.64	3134.67	0	12:01	0	0	0:00:00
SDMH43	0.01	0.34	3133.75	0	11:54	0	0	0:00:00
SDMH44	0.14	1.24	3131.38	0	11:56	0	0	0:00:00
SDMH45	0.01	0.66	3132.55	0	11:56	0	0	0:00:00
SDMH46	0.01	0.47	3132.65	0	11:56	0	0	0:00:00
SDMH47	0.06	1.06	3131.49	0	11:56	0	0	0:00:00
SDMH5	0.07	4.74	3134.25	0	12:01	0	0	0:00:00
SDMH6	0.05	4.66	3134.50	0	12:01	0	0	0:00:00
SDMH7	0.05	4.67	3134.65	0	12:01	0	0	0:00:00
SDMH8	0.05	4.73	3134.85	0	11:58	0	0	0:00:00
SDMH9	0.05	4.79	3135.02	0	11:58	0	0	0:00:00
BITTERROOT	0.01	3.19	3122.76	0	00:00	0	0	0:00:00
BITTERROOT_PH3	0.02	0.10	3120.10	0	12:41	0	0	0:00:00
OUTFALL_EXISTING	0.00	0.00	0.00	0	00:00	0	0	0:00:00
OUTFALL_EXISTING_PH3	0.00	0.00	0.00	0	00:00	0	0	0:00:00
POND	1.20	2.65	3130.15	0	13:09	0	0	0:00:00
POND_PH3	1.52	2.75	3131.25	0	12:40	0	0	0:00:00

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Node Flow Summary
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Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
OUTFALL_BITTERROOT	JUNCTION	0.00	4.80	0	13:09	0.00		

OUTFALL_CONTROL	JUNCTION	0.00	4.80	0	13:09	0.00			
PH3_OUTLET	JUNCTION	0.00	0.65	0	12:40	0.00			
SDMH 43	JUNCTION	2.57	2.57	0	12:01	0.00			
SDMH_LMC	JUNCTION	7.20	7.20	0	11:55	0.00			
SDMH1	JUNCTION	0.00	52.00	0	12:01	0.00			
SDMH10	JUNCTION	0.00	29.15	0	11:59	0.00			
SDMH11	JUNCTION	0.00	9.12	0	11:57	0.00			
SDMH12	JUNCTION	2.42	16.64	0	12:01	0.00			
SDMH13	JUNCTION	0.00	11.95	0	12:01	0.00			
SDMH14	JUNCTION	1.89	11.91	0	12:01	0.00			
SDMH15	JUNCTION	2.28	7.86	0	12:01	1.75	0	11:59	
SDMH16	JUNCTION	1.13	5.52	0	12:01	0.00			
SDMH17	JUNCTION	0.35	4.28	0	12:01	0.00			
SDMH18	JUNCTION	3.84	3.84	0	12:00	0.00			
SDMH19	JUNCTION	2.26	2.26	0	12:00	0.02	0	12:01	
SDMH2	JUNCTION	0.00	52.71	0	12:01	0.00			
SDMH20	JUNCTION	2.11	2.11	0	12:01	0.00			
SDMH21	JUNCTION	0.69	0.69	0	12:00	0.42	0	11:58	
SDMH22	JUNCTION	1.15	1.15	0	11:58	0.00			
SDMH23	JUNCTION	1.36	5.51	0	12:03	0.00			
SDMH24	JUNCTION	4.25	4.25	0	12:02	1.09	0	12:01	
SDMH25	JUNCTION	1.73	16.48	0	11:58	1.54	0	11:58	
SDMH26	JUNCTION	0.00	13.78	0	11:58	0.00			
SDMH27	JUNCTION	0.00	13.79	0	11:58	0.00			
SDMH28	JUNCTION	2.31	13.79	0	11:58	0.00			
SDMH29	JUNCTION	2.37	11.03	0	11:58	0.00	0	12:01	
SDMH3	JUNCTION	0.00	52.67	0	12:01	0.00			
SDMH30	JUNCTION	0.00	8.85	0	11:58	1.34	0	12:01	
SDMH31	JUNCTION	1.25	8.85	0	11:58	0.00			
SDMH32	JUNCTION	0.94	7.63	0	11:58	0.04	0	11:58	
SDMH33	JUNCTION	7.11	7.11	0	12:01	0.53	0	12:01	
SDMH34	JUNCTION	1.29	1.29	0	11:55	0.20	0	11:58	
SDMH35	JUNCTION	0.72	0.83	0	11:56	0.00			
SDMH36	JUNCTION	4.60	13.30	0	12:01	0.00			
SDMH37	JUNCTION	1.73	8.85	0	12:02	0.00			
SDMH38	JUNCTION	1.59	7.14	0	12:02	0.00			
SDMH39	JUNCTION	0.00	5.56	0	12:01	0.00			
SDMH4	JUNCTION	1.83	52.61	0	12:01	0.00			
SDMH40	JUNCTION	1.03	5.57	0	12:00	0.00			
SDMH41	JUNCTION	1.26	3.70	0	12:01	0.00			
SDMH42	JUNCTION	2.45	2.45	0	12:01	0.00			
SDMH43	JUNCTION	1.05	1.05	0	11:56	0.00			
SDMH44	JUNCTION	4.41	9.47	0	11:56	0.00			
SDMH45	JUNCTION	2.65	3.49	0	11:55	0.00			
SDMH46	JUNCTION	0.84	0.84	0	11:55	0.00			
SDMH47	JUNCTION	1.61	1.61	0	11:55	0.00			
SDMH5	JUNCTION	1.60	51.17	0	12:01	0.00			
SDMH6	JUNCTION	2.07	34.65	0	11:59	0.00			
SDMH7	JUNCTION	0.00	31.92	0	11:59	0.00			
SDMH8	JUNCTION	1.66	31.88	0	11:59	0.00			
SDMH9	JUNCTION	0.00	29.16	0	11:59	0.00			
BITTERROOT	OUTFALL	0.00	1786.22	0	00:00	0.00			
BITTERROOT_PH3	OUTFALL	0.00	0.65	0	12:41	0.00			
OUTFALL_EXISTING	OUTFALL	5.84	5.84	0	12:37	0.00			
OUTFALL_EXISTING_PH3	OUTFALL	0.85	0.85	0	12:19	0.00			
POND	STORAGE	0.00	65.10	0	12:02	0.00			
POND_PH3	STORAGE	0.00	9.40	0	11:56	0.00			

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Storage Node Summary
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Storage Node ID	Maximum	Maximum	Time of Max	Average	Average	Maximum

	Maximum Ponded Volume	Ponded Volume	Ponded	Ponded Volume	Ponded Volume	Ponded Volume	Storage Node	Total Exfiltration Rate	Exfiltrated Volume
	1000 ft³	(%)	days hh:mm	1000 ft³	(%)		cfs	cfm	1000 ft³
POND	153.686	48	0 13:09	55.320	17		4.80	0.00	0.000
POND_PH3	18.488	62	0 12:40	9.153	31		0.65	0.00	0.000

****
Outfall Loading Summary
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Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
BITTERROOT	96.84	0.38	1786.22
BITTERROOT_PH3	96.35	0.04	0.65
OUTFALL_EXISTING	8.94	0.99	5.84
OUTFALL_EXISTING_PH3	8.11	0.12	0.85
System	52.56	1.52	1786.22

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Link Flow Summary
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Link ID	Element Type	Time of Peak Flow Occurrence	Maximum Velocity Attained	Length Factor	Peak Flow during Analysis	Design Flow Capacity	Ratio of Maximum /Design Flow	Ratio of Total Reported Maximum Depth	Time Surcharged minutes	Condition
		days hh:mm	ft/sec		cfs	cfs				
Link-04	CONDUIT	0 12:41	9.35	1.00	0.65	212.93	0.00	0.04	0	Calculated
RIVER_02	CHANNEL	0 00:00	2.44	1.00	1786.22	28496.32	0.06	0.22	0	Calculated
SDP_OUTFALL	CONDUIT	0 13:09	4.68	1.00	4.80	37.70	0.13	0.26	0	Calculated
SP1	CONDUIT	0 12:02	6.62	1.00	51.83	51.23	1.01	0.76	0	> CAPACITY
SP10	CONDUIT	0 11:59	3.03	1.00	29.16	50.96	0.57	1.00	7	SURCHARGED
SP11	CONDUIT	0 11:58	1.43	1.00	8.93	36.54	0.24	1.00	7	SURCHARGED
SP12	CONDUIT	0 11:57	3.22	1.00	6.89	13.42	0.51	1.00	12	SURCHARGED
SP13	CONDUIT	0 12:01	5.31	1.00	16.68	20.80	0.80	1.00	13	SURCHARGED

SP14		CONDUIT	0	11:59	4.62	1.00	2.27	4.63	0.49
1.00	11	SURCHARGED							
SP15		CONDUIT	0	12:01	3.81	1.00	11.98	20.80	0.58
1.00	12	SURCHARGED							
SP16		CONDUIT	0	12:01	4.10	1.00	11.95	20.80	0.57
1.00	8	SURCHARGED							
SP17		CONDUIT	0	11:59	4.72	1.00	2.14	4.63	0.46
1.00	7	SURCHARGED							
SP18		CONDUIT	0	12:01	5.33	1.00	7.88	9.66	0.82
1.00	7	SURCHARGED							
SP19		CONDUIT	0	12:05	4.24	1.00	5.64	9.69	0.58
1.00	3	SURCHARGED							
SP2		CONDUIT	0	12:01	5.63	1.00	52.00	51.11	1.02
0.93	0	> CAPACITY							
SP20		CONDUIT	0	12:01	3.96	1.00	4.41	8.64	0.51
1.00	2	SURCHARGED							
SP21		CONDUIT	0	12:01	3.22	1.00	3.94	8.64	0.46
1.00	2	SURCHARGED							
SP22		CONDUIT	0	11:58	3.61	1.00	0.73	4.63	0.16
1.00	7	SURCHARGED							
SP23		CONDUIT	0	11:57	4.00	1.00	1.22	4.63	0.26
1.00	11	SURCHARGED							
SP24		CONDUIT	0	12:03	4.42	1.00	5.52	13.66	0.40
1.00	13	SURCHARGED							
SP25		CONDUIT	0	12:03	5.33	1.00	4.19	4.63	0.90
1.00	13	SURCHARGED							
SP26		CONDUIT	0	11:58	5.25	1.00	16.49	22.78	0.72
1.00	15	SURCHARGED							
SP27		CONDUIT	0	11:54	4.72	1.00	1.28	5.67	0.23
1.00	12	SURCHARGED							
SP28		CONDUIT	0	11:58	4.38	1.00	13.77	20.77	0.66
1.00	15	SURCHARGED							
SP29		CONDUIT	0	11:58	4.39	1.00	13.78	20.79	0.66
1.00	12	SURCHARGED							
SP3		CONDUIT	0	12:01	5.50	1.00	52.71	51.12	1.03
1.00	0	> CAPACITY							
SP30		CONDUIT	0	11:58	4.39	1.00	13.79	20.80	0.66
1.00	12	SURCHARGED							
SP31		CONDUIT	0	11:56	2.53	1.00	0.75	11.83	0.06
1.00	11	SURCHARGED							
SP32		CONDUIT	0	11:58	6.25	1.00	11.04	9.68	1.14
1.00	12	SURCHARGED							
SP33		CONDUIT	0	11:58	5.01	1.00	8.85	9.66	0.92
1.00	12	SURCHARGED							
SP34		CONDUIT	0	11:58	5.01	1.00	8.85	9.66	0.92
1.00	10	SURCHARGED							
SP35		CONDUIT	0	11:58	4.34	1.00	7.63	9.66	0.79
1.00	9	SURCHARGED							
SP36		CONDUIT	0	11:58	3.87	1.00	6.84	9.66	0.71
1.00	9	SURCHARGED							
SP37		CONDUIT	0	12:02	5.82	1.00	13.27	18.60	0.71
0.68	0	Calculated							
SP38		CONDUIT	0	12:02	3.93	1.00	8.85	18.60	0.48
0.68	0	Calculated							
SP39		CONDUIT	0	12:02	3.37	1.00	7.14	18.60	0.38
0.64	0	Calculated							
SP4		CONDUIT	0	12:01	5.47	1.00	52.67	51.09	1.03
1.00	5	SURCHARGED							
SP40		CONDUIT	0	12:01	4.49	1.00	5.55	8.63	0.64
0.66	0	Calculated							
SP41		CONDUIT	0	12:01	4.41	1.00	5.56	8.64	0.64
0.67	0	Calculated							
SP42		CONDUIT	0	12:01	3.30	1.00	3.70	8.63	0.43
0.62	0	Calculated							
SP43		CONDUIT	0	12:01	5.57	1.00	2.45	5.67	0.43
0.55	0	Calculated							
SP44		CONDUIT	0	11:56	3.57	1.00	1.05	5.67	0.19

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0.51           0  Calculated
  SP45                CONDUIT      0  11:56      5.19    1.00        9.40       18.60      0.51
0.66           0  Calculated
  SP46                CONDUIT      0  11:56      3.14    1.00        3.46        8.64      0.40
0.60           0  Calculated
  SP47                CONDUIT      0  11:55      2.13    1.00        0.84        2.93      0.29
0.51           0  Calculated
  SP48                CONDUIT      0  11:55      2.05    1.00        1.61        2.93      0.55
1.00           4  SURCHARGED
  SP49                CONDUIT      0  11:58      3.80    1.00        2.64        9.66      0.27
1.00           6  SURCHARGED
  SP5                 CONDUIT      0  12:01      5.33    1.00       51.23       51.00      1.00
1.00           8  SURCHARGED
  SP6                 CONDUIT      0  11:59      3.60    1.00       34.65       51.12      0.68
1.00           8  SURCHARGED
  SP7                 CONDUIT      0  11:59      3.32    1.00       31.93       51.14      0.62
1.00           8  SURCHARGED
  SP8                 CONDUIT      0  11:59      3.32    1.00       31.92       51.02      0.63
1.00           8  SURCHARGED
  SP9                 CONDUIT      0  11:59      3.03    1.00       29.15       51.02      0.57
1.00           7  SURCHARGED
  WQV_DRAIN           CONDUIT      0  13:09      5.22    1.00        1.68        1.90      0.88
0.87           0  Calculated
  Orifice-02          ORIFICE      0  12:40                          0.04
1.00
  Orifice-03          ORIFICE      0  12:40                          0.61
1.00
  Orifice-04          ORIFICE      0  13:09                          3.12
1.00


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.



  WARNING 005 : Minimum slope used for Conduit RIVER_02.

  Analysis began on:  Wed Jul 13 16:11:40 2022
  Analysis ended on:  Wed Jul 13 16:12:05 2022
  Total elapsed time: 00:00:25
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