Final Drainage Study and Stormwater Quality for Village Drive Development Plan

Original Date: March 13, 2019
Revised March 19, 2021
Revised September 15, 2021

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Note: City of Steamboat Springs plan review and approval is only for general conformance with City design criteria and the City code. The City is not responsible for the accuracy and adequacy of the design, dimensions, and elevations that shall be confirmed and correlated at the job site.

CERTIFICATION

I hereby affirm that this Drainage Study and Stormwater Quality Plan for the Development Plan of Village Drive was prepared by me (or under my direct supervision) for the owners thereof and is, to the best of my knowledge, in accordance with the provisions of the City of Steamboat Springs Storm Drainage Criteria and approved variances. I understand that the City of Steamboat Springs does not and will not assume liability for drainage facilities designed by others.

COLORADO LICENSED
RYAN DAVID SPAUSTAT
38972
PROFESSIONAL ENGINEER
7.15.2021

Ryan Spaustat, P.E.
State of Colorado No. 38972

INTRODUCTION AND LOCATION

The purpose of this report is to estimate peak stormwater runoff, evaluate existing infrastructure and design required infrastructure to manage the existing stormwater experienced onsite and the incremental stormwater generated by the proposed development of the property (the Project). This report includes all the base data, methods, assumptions and calculations used by Landmark Consultants, Inc. (Landmark) to design the stormwater management system for the project.

The subject property (1805 Walton Creek Rd.) is located in the Northwest ¼, of the Southwest ¼, of Section 27, Township 6 North, Range 84 West of the 6^{th} Principle Meridian, City of Steamboat Springs, Routt County, Colorado. The lot is currently zoned as Commercial Services.

Landmark prepared this report in accordance with City of Steamboat Springs Drainage Criteria for the purpose of designing the storm water infrastructure required by the project. This report may not be used by other parties without the express written consent of Landmark

The facts and opinions expressed in this report are based on Landmark's understanding of the project and data gathered from:

- Site visits
- Steamboat Springs GIS data
- FEMA FIRM Map Number 08107C0883D and FIS Study
- NRCS soil maps
- Field survey by Landmark Consultants, Inc.
- Citywide Stormwater Masterplan by SEH
- References listed at the end of this report

The location of the project is shown on **Figure 1: Vicinity Map**.

Figure 1- Vicinity Map

DRAINAGE CRITERIA AND METHODOLOGY

Landmark prepared this report in accordance with City of Steamboat Springs, Colorado Drainage Criteria, effective July, 2019. The methods used by Landmark are described below and the actual calculations are presented in the Appendices. The scope of this report is limited to flow determinations related to the described hydrological storm event. This report does not attempt to model subsurface flows nor is it intended to be used in the design of structure features including foundation drains and roof drains.

Methodology

Landmark used the Rational Method to determine peak runoff of small basins to design the on-site storm water runoff infrastructure associated with this project. The 5-year, 24-hour storm was used to analyze the minor storm event and the 100-year, 24-hour storm was used to analyze the major storm event. The recently updated IDF curves for Steamboat Springs following Atlas 14 data were utilized to calculate rainfall depths and intensities for runoff on-site. Detention conditions were calculated using a variety of tools. WQCV and BMP requirements were calculated through the use of Urban Drainage's design procedure forms for Full Spectrum Bioretention/Detention. Landmark sized the detention requirement of the pond based on the flat surface area of the pond required for functionality as a BMP, and detention/outflow conditions calculated through the use of Urban Drainage Software meeting existing outflow while sizing based on drain time.

Walton Creek Basin SEH Masterstudy

The Existing Infrastructure map shows the water (40 CFS, 100-year peak) from the basin WA07 crossing Village Drive just southwest of the site. This water is carried through a series of pipes and swales, crossing Whistler Road, and eventually crossing highway 40. The final outfall from this project is the Yampa River. The problems and needs map identifies culvert 1581 for immediate maintenance and scheduled replacement.

FEMA FLOODPLAIN

Landmark reviewed FEMA FIRM Number 08107C0713D dated February 4, 2005. The property falls within FEMA's Zone X designation. Zone X refers to areas of minimal flood hazard. **Figure 2** shows FEMA's flood plain mapping for this area. **APPENDIX C** includes a detailed FEMA Firmette exhibit for reference of the project area.

Figure 2 for more details.

Figure 2- FEMA FIRM

EXISTING SITE CONDITIONS

In this report the term “historic condition” refers to existing conditions on site at the time this report was created. Existing conditions show that the parcel is currently covered in short grass and vegetation. A sidewalk runs north to south adjacent to the site which sheet flows west into a road side swale on the west side of the site. The roadside swale currently carries the sheet flowing water from the site. There is an 18” CMP culvert that conveys water beneath the existing access on the southwest corner of the site. The runoff continues south and away from the site in the existing roadside swale.

Another swale borders the southeast-south edge of the site. This swale contains pass through flow from basin WA07 (as noted in the city’s masterstudy by SEH). The master study shows at the outfall junction to be responsible for passing 40 CFS, 100-Year peak flow. This water discharges into the roadside swale on village drive and travels south to the existing inlets within the ROW ditch.

Easements on the site include a 10’ utility and snow removal easements along the north and west boundaries of the site (Book 329, Page 367).

The southern edge of the site includes a 10’ electric easement (Book 715, Page 90), as well as a 10’ drainageway easement (Book 711, Page 817).

A sidewalk easement has also been recorded along the southeast corner of the site (Reception No. 762551)

Existing utilities include two tele pedestals just to the northwest of the site, as well as an existing e-box on the south-central portion of the site.

Electric and telecom lines traverse the site from southwest to southeast, offset from the property boundary.

Site Level

The soils on site consist of roughly 100% Routt Loam of hydrologic group C. The soils report from NRCS has been included for review in **APPENDIX B**.

EXISTING BASINS

H1: Basin H1 encompasses northern (roughly ¾) of the site. This basin is 0.44 acres and generally sheet flows from east to west. The site currently drains the approximate area in between the Pine Ridge Townhomes, Meadowlark Condominiums and village drive. The existing easterly swale on Village Drive carries the sheet flow from the project site from North to South. This basin was calculated to have a 2% level of imperviousness. The 5-year flow for this basin was calculated to be 0.06 CFS, while the 100-year was calculated to produce a runoff of approximately 1.28 CFS.

H2: Basin H2 is at the southern tip of the site. The basin is approximately 0.15 acres and generally sheet flows from east to southwest. The water eventually flows across the 6-ft. sidewalk that runs along the eastern edge of the site and into the roadside swale just to the south of the existing 18" CMP culvert. The 5-year flow from this basin was calculated to be 0.02 CFS, while the 100-year flow was calculated to produce 0.44 CFS in runoff.

Basin delineations for the existing drainage conditions can be found in the back pocket of this report as **Village Drive Existing Conditions Exhibit**. The full calculations of the existing drainage conditions have been attached and included in **Appendix A.**

Table 1: Existing Hydrological Summary

Hydrology Summary for Village Drive					
Basin	**Total Area (acres)**	**% IMP**	**$T_{c\ (min.)}$**	**Q_5 (cfs)**	**Q_{100} (cfs)**
H1	0.44	2%	11.11	0.06	1.28
H2	0.15	2%	10.74	0.02	0.44

APPENDIX A details the calculations involved in determining the existing hydrologic conditions on site.

PROPOSED SITE CONDITIONS

The project proposes the construction of a residential housing complex. Two buildings have been proposed for construction that total an approximate footprint of 6900 sf. Roadway infrastructure will be developed to access the complex on the southwest side of the property via Village Drive. Village Drive will also provide access to the parking required for the residential. Full build out conditions will incorporate the required drainage demands by sheet flowing the developed areas towards valley pans. These valley pans will direct the flow to curb and gutter where the flow will eventually break off towards two strategically placed bioretention ponds by the use of concrete flumes. The bioretention pond to the north is approximately 991 ft^3 and has been designed to manage WQCV, 5-year, and 100-year flows. The bioretention pond to the south is approximately 703 ft^3 has been designed to manage WQCV, 5-year, and 100-year flows. These ponds will discharge into a box inlet that will discharge into the ROW ditch along village drive. The existing 18" CMP that runs beneath the existing gravel drive area is to be removed and the swale is to be graded through and revegetated to match the existing conditions.

Proposed conditions also incorporate an extension of the storm system along the south east side of the property. It is proposed that the storm sewer in this area be piped further along the existing swale to avoid conflict with the proposed drive surface in front of the southern units. This diversion pipe is to match existing sizes and conditions.

The proposed conditions of this site assume a minimum, 5-minute time of concentration and were calculated to increase the imperviousness of the site as a whole from 2% to 61%.

PROPOSED BASINS

D1: Developed Basin 1 encompasses the majority of the proposed impervious areas to the site. The basin is about 0.27 acres in size, and is the largest sub-basin. The basin will drain most of the drive area to the north of the access. A valley pan runs the length of nearly the entire length of the basin, catching sheet flow from the eastern side of the site, as well as sheet flow from the impervious areas east of the building itself, and flow from the roof. The water on the west side of the site has been directed to flow into the pond. The conveyance path of the main valley pan in this basin will be directed into the pond by a concrete flume. The outlet pipe from the pond, will be daylighted to the roadside swale, where it will continue its pathing toward the Yampa River. The basin is proposed to be approximately 71% impervious. Post developed flows were calculated to be 0.66 CFS during a 5-year event, and 1.79 CFS in a 100-year event.

D2: Basin D2 mostly incorporates the area south of the access drive, with a portion extending to the north on the eastern side of the site to catch the sheet flow that has been graded in this direction. The basin basin will generally sheet flow towards a valley pan that runs the approximate length of the basin. Once the water is in the pan, it will flow towards the west, along the southern half of the access drive's curb and gutter. A concrete flume will direct the curb and gutter flow into the bioretention basin. A portion of the area to the west of the proposed building will sheet flow directly into the pond. The outlet pipe from the pond in this basin will daylight to the existing roadside swale and continue its path towards the Yampa River. This basin is shown to be 74% impervious. Post developed flows were calculated to be 0.49 CFS during a 5-year event, while the 100-year event flows were calculated to be 1.32 CFS.

D3: Basin D3 is a small impervious area within the access drive of the site. This basin is 0.01 acres, at just 581 ft^2. This area will be directed to sheet flow off the site and join the roadside swale. Basin D3 is 100% impervious, only containing asphaltic surface from the drive. This area contributes 0.04 CFS during a 5-year event, and 0.10 CFS during a 10-year event.

Table 2: **Proposed Direct Runoff Hydrological Summary**

Hydrology Summary for Village Drive					
Basin	**Total Area (acres)**	**% IMP**	**$T_{c\ (min.)}$**	**Q_5 (cfs)**	**Q_{100} (cfs)**
D1	0.27	71%	5.00	0.66	1.79
D2	0.20	74%	5.00	0.49	1.32
D3	0.01	100%	5.00	0.04	0.10

Proposed drainage hydrology for the site can be found in its entirety within **APPENDIX A.**

WATER QUALITY AND BMP SELECTION

Water quality in the Yampa River is degraded by the washing off of accumulated deposits on the urban landscape of Steamboat Springs. Metals, salts, sand, gravel, trash, debris, and organics (including oil and gasoline) all accumulate on the streets and in parking lots of Steamboat Springs over the course of time. During a rainstorm event, these pollutants are washed by the runoff into the Yampa River and its tributaries. Water quality problems caused by these pollutants include turbid water, nutrient enrichment, bacterial contamination, reduction in dissolved oxygen, and increased stress on aquatic life. The most prevalent pollutant in Steamboat Springs is sediment. BMP's included in this project are designed to minimize the amount of sediment leaving the site and entering the waterways.

Potential Pollutant Sources: The following are anticipated pollutant sources for this project:

1. Vehicles (operational and parked);
2. Landscaping maintenance;
3. Snow removal and related transport of sand, dirt and oils;
4. Potential snow melt chemicals.
5. Trash.

From the Urban Drainage and Flood Control District's (UDFCD) Criterial Manual (Volume 3), BMP selection involves many factors such as physical site characteristics, treatment objectives, aesthetics, safety, maintenance requirements, and costs. As each site is unique, there is not a standard BMP that can be implemented for every application and therefore there may be multiple solutions including standalone BMPs or 'treatment trains' that combine multiple BMPs to achieve the water quality objectives.

Runoff from impervious areas of the site will be funneled toward the proposed full spectrum detention ponds on site.

It will be the obligation of the owner to ensure that in concurrence with the development of Village Drive, the developer incorporates water quality in a way that is in line with the criteria designated by the City of Steamboat Springs

DETENTION

The City of Steamboat Springs drainage standards require that any increase runoff form the site be mitigated through detention to maintain historical flows leaving the site. Landmark estimated the required detention volumes for the pond under the DP conditions (current proposed project) and potential full build out conditions. The ponds have been designed as a full spectrum pond incorporating water quality into the design as well as managing the 5-year and 100-year flows as required in the City's design criteria.

The ponds were initially sized with the Water Quality Capture Volume (WQCV) methodology for Steamboat Springs, based on 0.34" average runoff producing storm. This methodology was used in order to determine the minimum flat surface area required for a bioretention and underdrain system (rain garden). The ponds were then sized using the FAA method to determine the expected runoff volumes based on 5-year and 100-year events. The pond north of the access drive sits at an elevation of 6841.25' where it has a flat surface area of ~660 ft², and vertical walls to an elevation of 6842.75. This pond has been calculated to have a total volume of 991 ft³. The pond south of the drive has a bottom elevation of 6840.00' where the flat surface area has been calculated to be 471ft² as was calculated with Urban Drainage's Design Procedure for bioretention. This pond will have vertical block walls to an elevation of 6841.75 to provide a total volume of 758 ft³. The shallow bioretention ponds have been designed to have vertical walls to maximize space and be more seamlessly incorporated into the sites landscaping features.

North Pond:

The WQCV has been designed to drain through filtration media and an underdrain to the outlet structure. The 4" perforated pipe underdrain will be sloped down to the outlet structure at a minimum of 0.5% will be capped to have an orifice diameter of 0.38 inches. The capped diameter of the underdrain has been sized to meet the 12-hour drain time requirement for WQCV.

The 5-year event has been designed to drain from a combination of the underdrain and a rectangular vertical orifice that will be cut in the side of the specified outlet structure at an elevation corresponding to the WSEL of the calculated WQCV. This orifice will be 0.5" in width cut at an elevation of 6842.12' (top of box).

The 100-year event has been designed to drain form a combination of the underdrain, the rectangular vertical orifice, and a standard grate to be installed at the top of the box. The grate has been sized based on a 2'x2' structure and set at a rim elevation of 6642.12, just below the 100-year WSEL.

The outlet configuration has been calculated to discharge 0.02 CFS during a 5-year event which is equal to the historic event under existing conditions. The peak outflow from the drop box structure during a 100-year event has been calculated to be 0.5 CFS which is less than the historic outflow that was calculated to be 0.88 CFS.

South Pond:

The WQCV has been designed to drain through filtration media and an underdrain to the outlet structure. The 4" perforated pipe underdrain will be sloped down to the outlet structure at a minimum of 0.5% will be capped to have an orifice diameter of 0.35 inches. The capped diameter of the underdrain has been sized to meet the 12-hour drain time requirement for WQCV.

The 5-year event has been designed to drain from a combination of the underdrain and a rectangular vertical orifice that will be cut in the side of the specified outlet structure at an elevation corresponding to the WSEL of the calculated WQCV. This orifice will be 0.4" in width cut at an elevation of 6841.00' (top of box).

The 100-year event has been designed to drain form a combination of the underdrain, the rectangular vertical orifice, and a standard grate to be installed at the top of the box. The grate has been sized based on a 2'x2' structure and set at a rim elevation of 6641.00, just below the 100-year WSEL.

The outlet configuration has been calculated to discharge 0.02 CFS during a 5-year event which is less that the 0.04 CFS historic event under existing conditions. The peak outflow from the drop box structure during a 100-year event has been calculated to be 0.5 CFS which is less than the historic outflow that was calculated to be 0.77 CFS.

Details and calculations for the pond designs can be seen in **APPENDIX E**.

BMP SUMMARY AND MAINTENANCE REQUIREMENTS

The post construction BMP's provided for this project are the two full spectrum bioretention ponds with a 4" perforated pipe underdrain and Type C inlet. The primary objective for bioretention is keep vegetation healthy, remove sediment and trash and ensure that the facility is drainage properly. The following maintenance should be provided at a minimum by the owner:

- Inspection two times per year following precipitation events to determine if proper infiltration is occurring
- Remove debris and litter as needed
- Maintain healthy ***weed free*** vegetation – this includes proper weeding, mowing and irrigation
- Replace wood mulch as needed only up to a depth of 3-inches
- If ponded water is observed for more than 24-hours after the end of a runoff event provide maintenance activities to restore infiltration capacity as appropriate. This may include:
    - removing blockages from underdrain outfall locations.
    - removing sediment accumulation on the filter surface and scarifying the surface with a rake.
    - removal and replacement of all or a portion of the growing media.

Construction specification and more detailed maintenance recommendations are included in the Ownership and Maintenance Plan and Notes in **APPENDIX F.**

TEMPORARY EROSION AND SEDIMENT CONTROL

The primary source of storm water contaminants in the City of Steamboat Springs are suspended sediments and are most susceptible during construction activities. Temporary erosion and sediment control during construction is the responsibility of the permit holder (including NPDES permitting). Appropriate best management practices (BMP's) for construction activities are detailed in Erosion and Sediment Control During Construction by Routt County, Colorado. It is the responsibility of the permit holder to identify and properly handle all materials that are potential pollution sources prior to mobilization. The following are some common examples of potential pollution sources:

- Stockpiling of materials that can be transported to receiving waterways

- Uncovered trash bins
- Exposed and stored soils, management of contaminated soils
- Off-site tracking of soils and sediment
- Loading and unloading operations
- Outdoor storage of building materials, chemicals, fertilizers, etc.
- Vehicle and equipment maintenance and fueling
- Significant dust or particulate generating processes
- Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.
- On-site waste disposal practices (waste piles, dumpsters, etc.)
- Concrete truck/equipment washing.
- Non-industrial waste sources that may be significant, such as worker trash and portable toilets.

It is not possible to identify all materials that will be used or stored on the construction site. It is the sole responsibility of the permit holder to identify and properly handle all materials that are potential pollutant sources prior to mobilization.

Some temporary BMP's include, but are not limited to, straw bales, silt fences, ditch checks, berms, slope drains, seeding and mulching, pipes, and sediment basins. In order to prevent mud from being transported into public right of ways, vehicle tracking pads and wheel wash areas should be utilized. Temporary BMP's should be coordinated with the site's permanent erosion control measures to assure continuous and economical erosion control. Because different BMP's are required at different stages of construction, the site should be periodically reviewed by the permit holder to verify the proper BMP's are in place.

Temporary BMP's should be inspected at a minimum once every two weeks, after each significant storm event, and at 24-hour intervals during extended storm events. Repairs or reconstruction of temporary BMP's shall occur within two working days in order to ensure continued performance. It is the responsibility of the Construction Site Operator to conduct bi-weekly inspections, maintain BMP's, and keep records of site conditions and inspections.

Areas used for material storage which are exposed to precipitation, disturbed areas, the construction site perimeter, and all applicable/installed erosion and sediment control measures shall be inspected for evidence of, or the potential for, pollutants entering the drainage system.

Preventative maintenance of all temporary BMP's shall be provided in order to ensure continued performance. Maintenance activities and actions shall be noted and recorded during inspections. All temporary erosion control measures must be kept in place and maintained until the site has been sufficiently stabilized in accordance with permit requirements.

It is recommended that a Stormwater Management Plan (SWMP) be completed prior to commencement of any land disturbing activities. Additionally, all pertinent local, state, and federal permits should be obtained prior to construction.

Future development projects for this property are required to submit a Draft Final Drainage Report including a Storm Water Quality Plan in conformance with City Engineering Standards.

CONCLUSIONS

The project described in this report outlines the drainage conditions required for the development of the Village Drive. The Village Drive project proposes the construction of residential units and all the parking, and utility infrastructure required therein.

Imperviousness on the site, by the proposed development, is shown to increase by 59% and detention has been provided to deal with the increase in runoff generated by the increase in this imperviousness. Water quality has also been addressed by means of on-site detention utilizing the Steamboat Springs WQCV standard. The outlet structure has been specified to control flows based on historic flows and is appropriately sized.

The design contained herein complies with the criteria set forth in the City's Drainage Design Manual.

LIMITATIONS

This study is intended to estimate and analyze peak stormwater runoff volumes generated by hydrologic events in order to evaluate existing drainage infrastructure and design new infrastructure needed to manage these flows. It does not account for groundwater, springs, or seeps and is not intended to be used for the evaluation or design of foundation drains or roof drains.

Basin delineations, areas, and soil characteristics are based on the best available information listed in the INTRODUCTION AND LOCATION section of the report. Actual conditions may vary. Landmark's assumptions, recommendations and opinions are based on this information and the proposed site plan. If any of the data is found to be inaccurate or the proposed site plan is changed, Landmark should be contacted to review this report and make any necessary revisions.

The 100-year event is defined as the rainfall, runoff, or flooding event which has a probability of 1-percent of occurring in any given year based on available data. The 100-year event could occur in successive years or even multiple times in a single year. Events greater than the 100-year event or lesser events combined with malfunctioning drainage works can occur on rare occasion and may cause flooding damage.

The data, opinions, and recommendations of this report are applicable to the specific design elements and location that is the subject of this report. The report is not applicable to any other design elements or to any other locations. Any and subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendation without the prior written consent of Landmark Consultants, Inc.

Landmark Consultants, Inc. has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the contractor, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the Final Construction Drawings and Specifications.

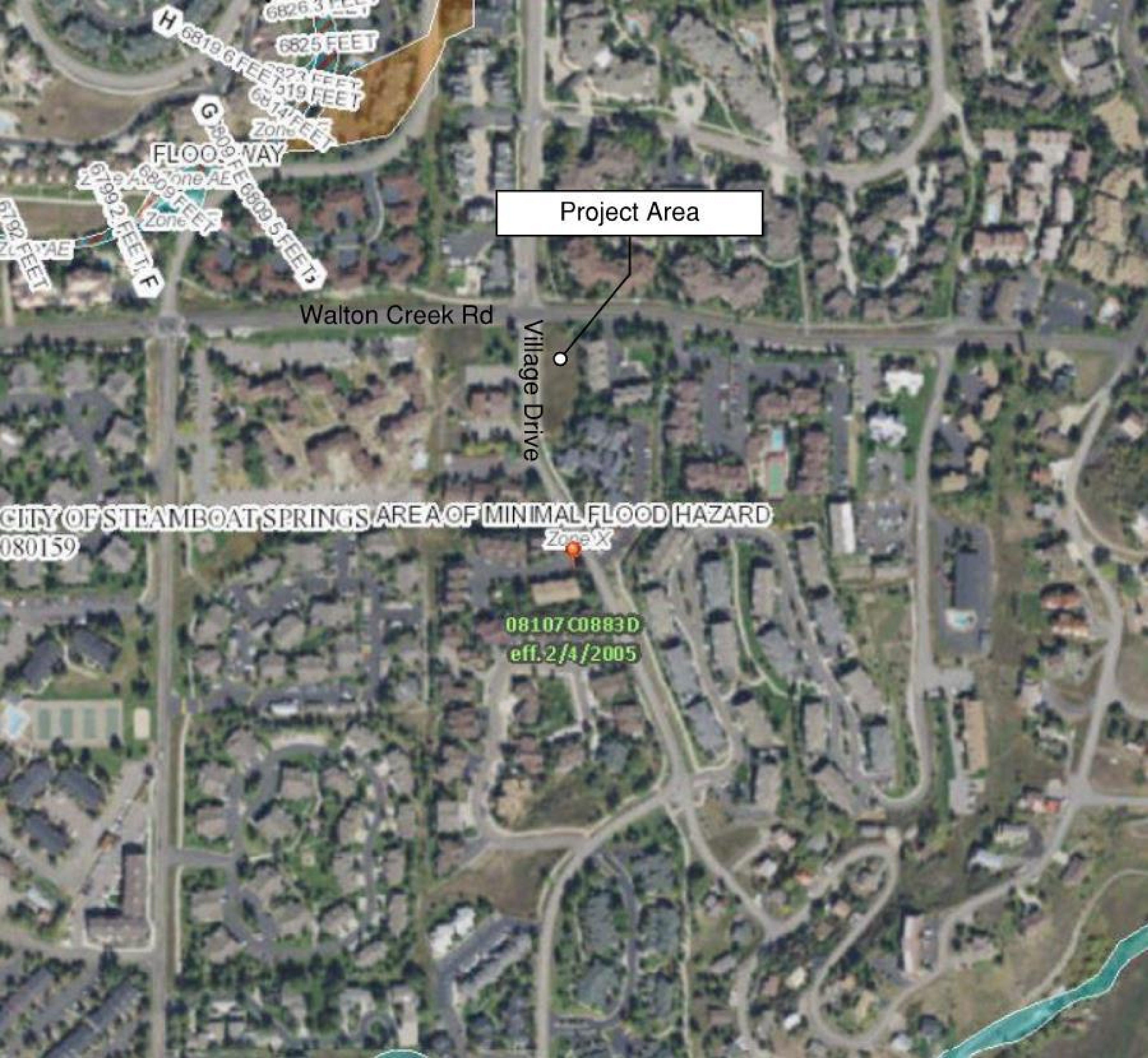
The only warranty or guarantee made by Landmark Consultants, Inc. in connection with the services performed for this project is that such services are performed with the care and skill ordinarily exercised by members of the profession practicing under similar conditions, at the same time, and in the same or similar locality. No other warranty, expressed or implied, is made or intended by rendering such services or by furnishing written reports of the findings.

This study is intended to estimate and analyze peak stormwater runoff volumes generated by hydrologic events in order to evaluate existing drainage infrastructure and design new infrastructure needed to manage these flows. It does not account for groundwater, springs, or seeps and is not intended to be used for the evaluation or design of foundation drains or roof drains.

REFERENCES

1. Section 5.0 Drainage Criteria, City of Steamboat Springs Department of Public Works, July 2019.
2. Drainage Criteria Manual (Volumes 1 – 3), Urban Drainage and Flood Control District, June 2001
3. Hydraulic Design of Highway Culverts (HDS-5), Federal Highway Administration, September 2001
4. Procedures for Determining Peak Flows in Colorado, Natural Resource Conservation Service, 1984
5. Urban Hydrology for Small Watersheds (TR-55), Natural Resource Conservation Service, June 1986

FIGURES



6825 FEET
FLOODWAY
Project Area
Walton Creek Rd
Village Drive
CITY OF STEAMBOAT SPRINGS
080159
AREA OF MINIMAL FLOOD HAZARD
Zone X
08107C0883D
eff. 2/4/2005


Project Area
Walton Creek Rd
Walton Creek Road
Medicine Springs Drive
Eagle Glen Drive
Burgess Creek Trail
Cascade Drive
Blackhawk Court
St Moritz Way
Mountain Sneak Trail
Village Drive
Whistler Road
Shadow Run Frontage
Shadow Run Court
Morgan Court
Alpine Vista Court
Mountain Village Circle

APPENDIX A

HYDROLOGIC CALCULATIONS

LANDMARK CONSULTANTS, INC.
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PROJECT	Village Drive
DESIGNER	Tom Paulson
DATE	3/13/2020
LOCATION	Steamboat Springs, CO

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Character of Surface	Percent Impervious
Asphalt Parking and Walkways	100%
Gravel	40%
Roof	90%
Lawns and Landscaping	2%
Hard Pack Gravel	80%
Residential Lots	85%

IDF	Soil Type
Steamboat Springs NOAA	C

Basin ID	Basin Area (sq.ft.)	Basin Area (acres)	Area of Asphalt Parking and Walkways(sq.ft.)	Area of Asphalt Parking and Walkways (acres)	Area of Gravel Surfaces (sq.ft)	Area of Gravel Surfaces (acres)	Area of Roof (sq.ft.)	Area of Roof (acres)	Area of Lawns and Landscaping (sq.ft.)	Area of Lawns and Landscaping (acres)	Area of Hard Pack Gravel (sq.ft.)	Area of Hard Pack Gravel (acres)	Area of Residential (sq.ft.)	Area of Residential (acres)	Percent Impervious	2-year Composite Runoff Coefficient	5-year Composite Runoff Coefficient	10-year Composite Runoff Coefficient	50-year Composite Runoff Coefficient	100-year Composite Runoff Coefficient
H1	19104.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	19104.00	0.44	0.00	0.00	0.00	0.00	2%	0.010	0.051	0.147	0.330	0.492
H2	6472.86	0.15	0.00	0.00	0.00	0.00	0.00	0.00	6472.86	0.15	0.00	0.00	0.00	0.00	2%	0.010	0.051	0.147	0.330	0.492
D1	11876.95	0.27	5071.57	0.12	0.00	0.00	3679.89	0.08	3125.49	0.07	0.00	0.00	0.00	0.00	71%	0.574	0.625	0.665	0.722	0.779
D2	8644.96	0.20	3317.10	0.08	0.00	0.00	3379.03	0.08	1948.83	0.04	0.00	0.00	0.00	0.00	74%	0.592	0.642	0.680	0.733	0.787
D3	580.45	0.01	580.45	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100%	0.830	0.855	0.872	0.879	0.894
D1 Allow	11876.95	0.27	0.00	0.00	0.00	0.00	0.00	0.00	11876.95	0.27	0.00	0.00	0.00	0.00	2%	0.010	0.051	0.147	0.330	0.492
D2 Allow	8644.96	0.20	0.00	0.00	1.00	0.00	0.00	0.00	8644.96	0.20	1.00	0.00	0.00	0.00	2%	0.016	0.060	0.154	0.336	0.496
Dtot	25576.86	0.59	8969.12	0.21	0.00	0.00	7058.92	0.16	9548.82	0.22	0.00	0.00	0.00	0.00	61%	0.477	0.535	0.583	0.661	0.734
Htot	25576.86	0.59	0.00	0.00	1.00	0.00	0.00	0.00	25576.86	0.59	0.00	0.00	0.00	0.00	2%	0.016	0.060	0.154	0.336	0.496

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PROJECT	Village Drive
DESIGNER	Tom Paulson
DATE	3/13/2020

DEVELOPED TIME OF CONCENTRATION COMPUTATIONS

Overland Flow, Time of Concentration:

$$T_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{1/3}}$$ (Equation RO-3)

Gutter/Swale Flow, Time of Concentration:

$T_t = L / 60V$

$T_c = T_i + T_t$ (Equation RO-2)

Intensity, i From Figures 3.3.1-2 (Area II)

Velocity (Gutter Flow), $V = 20 \cdot S^{1/2}$

Velocity (Swale Flow), $V = 15 \cdot S^{1/2}$

Rational Equation: Q = CiA (Equation RO-1)

		Overland Flow						Overland Flow					
Design Point	Basin(s)	C_5	Length, L (ft)	Upslope Elevation	Downslope Elevation	Slope, S (%)	T_i (min)	C_5	Length, L (ft)	Upslope Elevation	Downslope Elevation	Slope, S (%)	T_i (min)
h1	**H1**	**0.05**	116	6855	6846	7.88	10.39	**0.05**	85			**5.00**	**10.37**
h2	**H2**	**0.05**	134	6852	6841	8.53	10.89	**0.05**				**N/A**	**N/A**
d1	**D1**	**0.63**	29	6851	6850	3.30	3.12	**0.63**				**N/A**	**N/A**
d2	**D2**	**0.64**	32	6848	6847	1.67	4.03	**0.64**				**N/A**	**N/A**
d3	**D3**	**0.86**	47	6852	6849	7.40	1.58	**0.86**				**N/A**	**N/A**
d1 allow	**D1 Allow**	**0.05**	103	6654	6645	9.31	9.27	**0.05**				**N/A**	**N/A**
d2 allow	**D2 Allow**	**0.54**	139	6853	6842	7.94	6.12	**0.54**				**N/A**	**N/A**

		Conveyance		Swale Flow 1					
Design Point	Basin(s)		K	Length, L (ft)	Upslope Elevation	Downslope Elevation	Slope, S (%)	Velocity, V (ft/s)	T_t (min)
h1	**H1**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A
h2	**H2**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A
d1	**D1**	**Shallow Paved Swales**	**20**	171	6851	6843	4.77	4.37	0.65
d2	**D2**	**Shallow Paved Swales**	**20**	114	6847	6841	5.68	4.77	0.40
d3	**D3**	**Grassed Waterway**	**15**				N/A	N/A	N/A
d1 allow	**D1 Allow**	**Grassed Waterway**	**15**				N/A	N/A	N/A
d2 allow	**D2 Allow**	**Grassed Waterway**	**15**				N/A	N/A	N/A

		Conveyance		Swale Flow 2						Conveyance	
Design Point	Basin(s)		K	Length, L (ft)	Upslope Elevation	Downslope Elevation	Slope, S (%)	Velocity, V (ft/s)	T_t (min)		K
h1	**H1**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**
h2	**H2**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**
d1	**D1**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**
d2	**D2**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**
d3	**D3**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**
d1 allow	**D1 Allow**	**Shallow Paved Swales**	**20**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**
d2 allow	**D2 Allow**	**Grassed Waterway**	**15**				N/A	N/A	N/A	**Shallow Paved Swales**	**20**

		Swale Flow 3						Time of Concentration		
Design Point	Basin(s)	Length, L (ft)	Upslope Elevation	Downslope Elevation	Slope, S (%)	Velocity, V (ft/s)	T_t (min)	Comp. T_c (min)	$\frac{L}{180}+10$	Actual T_c (min)
h1	**H1**				N/A	N/A	N/A	20.75	11.11	11.11
h2	**H2**				N/A	N/A	N/A	10.89	10.74	10.74
d1	**D1**				N/A	N/A	N/A	3.77	11.11	5.00
d2	**D2**				N/A	N/A	N/A	4.43	10.81	5.00
d3	**D3**				N/A	N/A	N/A	1.58	10.26	5.00
d1 allow	**D1 Allow**				N/A	N/A	N/A	9.27	10.57	9.27
d2 allow	**D2 Allow**				N/A	N/A	N/A	6.12	10.77	6.12

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CIVIL ENGINEERS | SURVEYORS

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PROJECT	Village Drive
DESIGNER	Tom Paulson
DATE	3/13/2020

DIRECT RUNOFF COMPUTATIONS

Overland Flow, Time of Concentration:

$$T_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{1/3}}$$ (Equation RO-3)

Gutter/Swale Flow, Time of Concentration:

$T_t = L / 60V$

$T_c = T_i + T_t$ (Equation RO-2)

Intensity, I from Fig. RA-2 (Equation RO-4)

Velocity (Gutter Flow), $V = 20 \cdot S^{1/2}$

Velocity (Swale Flow), $V = 15 \cdot S^{1/2}$

Rational Equation: Q = CiA (Equation RO-1)

Design Point	Basin(s)	Area, A (acres)	T_c (min)	C_2	C_5	C_{10}	C_{50}	C_{100}	Intensity, I_2 (in/hr)	Intensity, I_5 (in/hr)	Intensity, I_{10} (in/hr)	Intensity, I_{50} (in/hr)	Intensity, I_{100} (in/hr)	Flow, Q_2 (cfs)	Q_2 per Acre (cfs/ac)	Flow, Q_5 (cfs)	Q_5 per Acre (cfs/ac)	Flow, Q_{10} (cfs)	Q_{10} per Acre (cfs/ac)	Flow, Q_{50} (cfs)	Q_{50} per Acre (cfs/ac)	Flow, Q_{100} (cfs)	Q_{100} per Acre (cfs/ac)
h1	H1	0.44	11.11	0.01	0.05	0.15	0.33	0.49	1.82	2.71	3.44	5.19	5.92	0.01	0.02	0.06	0.14	0.22	0.50	0.75	1.71	1.28	2.91
h2	H2	0.15	10.74	0.01	0.05	0.15	0.33	0.49	1.86	2.78	3.52	5.32	6.07	0.00	0.02	0.02	0.14	0.08	0.52	0.26	1.76	0.44	2.99
d1	D1	0.27	5.00	0.57	0.63	0.66	0.72	0.78	2.59	3.86	4.89	7.38	8.42	0.40	1.48	0.66	2.41	0.89	3.25	1.45	5.33	1.79	6.56
d2	D2	0.20	5.00	0.59	0.64	0.68	0.73	0.79	2.59	3.86	4.89	7.38	8.42	0.30	1.53	0.49	2.47	0.66	3.32	1.07	5.41	1.32	6.63
d3	D3	0.01	5.00	0.83	0.86	0.87	0.88	0.89	2.59	3.86	4.89	7.38	8.42	0.03	2.15	0.04	3.30	0.06	4.26	0.09	6.49	0.10	7.52
d1 allow	D1 Allow	0.27	9.27	0.01	0.05	0.15	0.33	0.49	2.02	3.01	3.81	5.75	6.56	0.01	0.02	0.04	0.15	0.15	0.56	0.52	1.90	0.88	3.23
d2 allow	D2 Allow	0.20	6.12	0.02	0.06	0.15	0.34	0.50	2.41	3.60	4.56	6.89	7.86	0.01	0.04	0.04	0.21	0.14	0.70	0.46	2.31	0.77	3.90

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Hydrology Summary for Village Drive

Basin	Total Area (acres)	C_2	C_5	C_{10}	C_{50}	C_{100}	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	%Imp
H1	0.44	0.01	0.05	0.15	0.33	0.49	0.01	0.02	0.22	0.75	1.28	2%
H2	0.15	0.01	0.05	0.15	0.33	0.49	0.00	0.02	0.08	0.26	0.44	2%
D1	0.27	0.57	0.63	0.66	0.72	0.78	0.40	0.66	0.89	1.45	1.79	71%
D2	0.20	0.59	0.64	0.68	0.73	0.79	0.30	0.49	0.66	1.07	1.32	74%
D3	0.01	0.83	0.86	0.87	0.88	0.89	0.03	0.04	0.06	0.09	0.10	100%
D1 Allow	0.27	0.01	0.05	0.15	0.33	0.49	0.01	0.02	0.15	0.52	0.88	2%
D2 Allow	0.20	0.02	0.06	0.15	0.34	0.50	0.01	0.04	0.14	0.46	0.77	2%

APPENDIX B

NRCS SOILS REPORT

United States Department of Agriculture

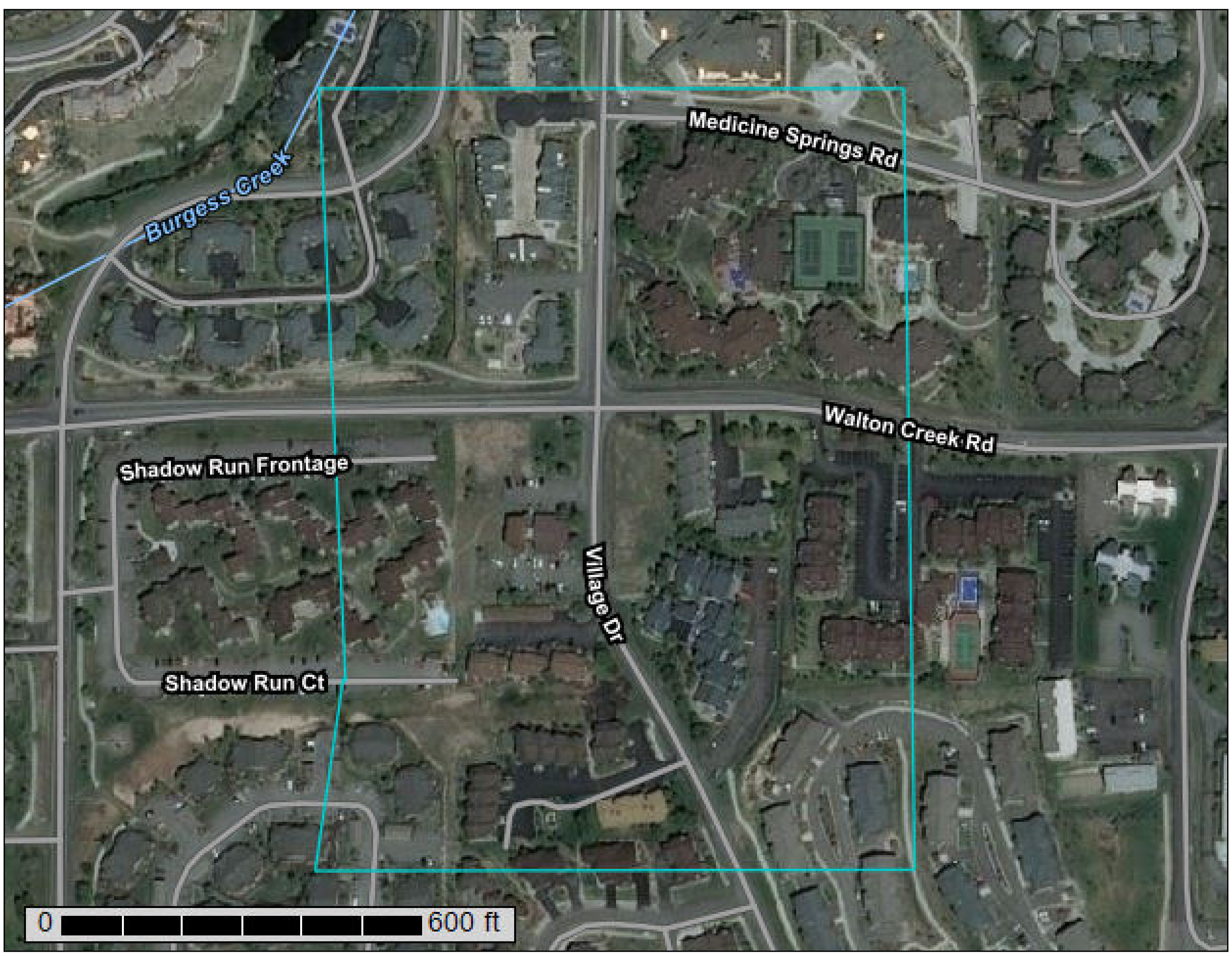
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Routt Area, Colorado, Parts of Rio Blanco and Routt Counties

Village Drive



February 19, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:2,360 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 30, 60, 120, 180

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Routt Area, Colorado, Parts of Rio Blanco and Routt Counties
Survey Area Data: Version 9, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 8, 2012—Oct 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
50F	Routt loam, 25 to 65 percent slopes, very stony	26.5	91.6%
52A	Slocum loam, 0 to 3 percent slopes	2.4	8.4%
Totals for Area of Interest		**28.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Routt Area, Colorado, Parts of Rio Blanco and Routt Counties

50F—Routt loam, 25 to 65 percent slopes, very stony

Map Unit Setting

National map unit symbol: k0gc
Elevation: 6,890 to 8,200 feet
Mean annual precipitation: 20 to 24 inches
Mean annual air temperature: 38 to 41 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition

Routt, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Routt, Very Stony

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from sandstone and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A1 - 1 to 12 inches: loam
A2 - 12 to 22 inches: loam
A3 - 22 to 27 inches: loam
B/E - 27 to 29 inches: clay loam
B/E - 29 to 31 inches: loam
Bt1 - 31 to 46 inches: clay
Bt2 - 46 to 65 inches: clay

Properties and qualities

Slope: 25 to 65 percent
Percent of area covered with surface fragments: 1.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.07 to 0.21 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C
Ecological site: Aspen Woodland (F048AY449CO)
Hydric soil rating: No

Minor Components

Impass
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Claypan (R048BY296CO)
Hydric soil rating: No

Venable
Percent of map unit: 5 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Mountain Meadow (R048AY241CO)
Hydric soil rating: Yes

Slater
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Aspen Woodland (F048AY449CO)
Other vegetative classification: ASPEN (null_3)
Hydric soil rating: No

52A—Slocum loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: k0gd
Elevation: 6,490 to 8,690 feet
Mean annual precipitation: 20 to 24 inches
Mean annual air temperature: 38 to 41 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition
Slocum and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slocum

Setting

Landform: Flood plains, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A1 - 0 to 17 inches: loam
A2 - 17 to 32 inches: clay loam
Bw - 32 to 39 inches: clay loam
Cg - 39 to 55 inches: loamy sand
2C - 55 to 60 inches: extremely cobbly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.21 to 0.71 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Rare
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 5w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: Mountain Meadow (R048AY241CO)
Hydric soil rating: No

Minor Components

Venable

Percent of map unit: 10 percent
Landform: Oxbows on flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Mountain Meadow (R048AY241CO)
Hydric soil rating: Yes

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APPENDIX C

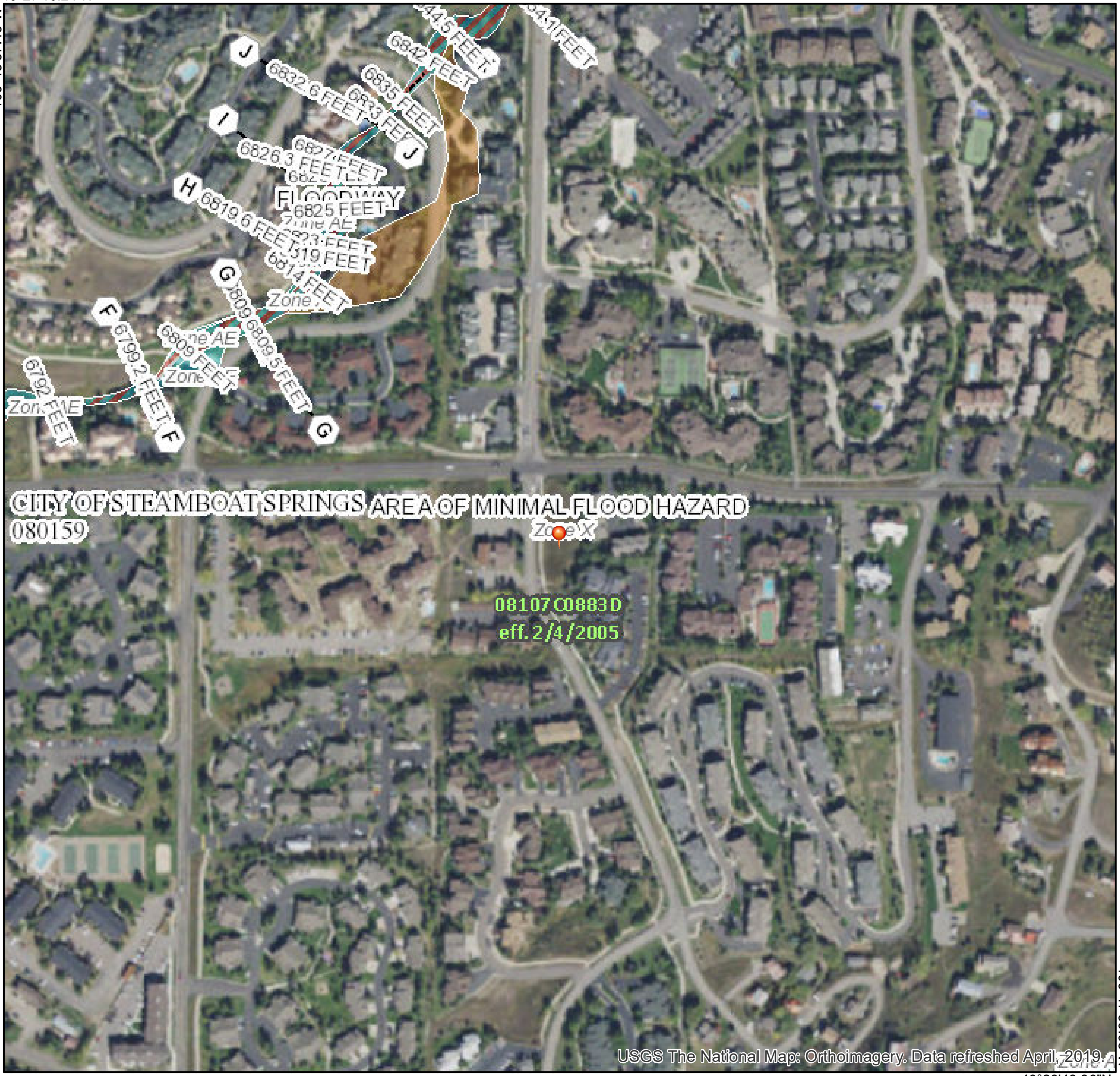
FEMA FIRMETTE

National Flood Hazard Layer FIRMette

FEMA

40°27'16.24"N

106°48'37.43"W



106°47'59.98"W

40°26'48.86"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/13/2020 at 12:56:10 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX D

HYDRAULIC CALCULATIONS

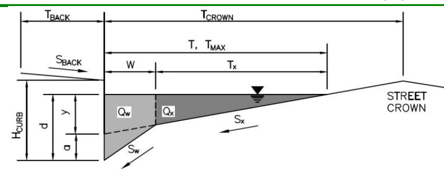
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Village Drive

Inlet ID: Curb



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	10.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.070	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	5.0	5.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.1**	**3.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

APPENDIX E

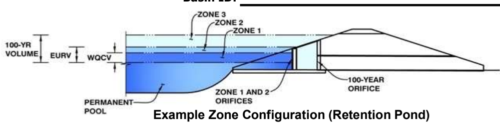
POND CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)

Project: **VILLAGE DRIVE NORTH POND**

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**RG**	
Watershed Area =	0.27	acres
Watershed Length =	238	ft
Watershed Length to Centroid =	80	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	71.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.005	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.019	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.56 in.) =	0.007	acre-feet	0.56	inches
5-yr Runoff Volume (P1 = 0.84 in.) =	0.012	acre-feet	0.84	inches
10-yr Runoff Volume (P1 = 1.06 in.) =	0.016	acre-feet	1.06	inches
25-yr Runoff Volume (P1 = 1.36 in.) =	0.023	acre-feet	1.36	inches
50-yr Runoff Volume (P1 = 1.6 in.) =	0.028	acre-feet	1.60	inches
100-yr Runoff Volume (P1 = 1.82 in.) =	0.033	acre-feet	1.82	inches
500-yr Runoff Volume (P1 = 2.35 in.) =	0.045	acre-feet	2.35	inches
Approximate 2-yr Detention Volume =	0.008	acre-feet		
Approximate 5-yr Detention Volume =	0.013	acre-feet		
Approximate 10-yr Detention Volume =	0.016	acre-feet		
Approximate 25-yr Detention Volume =	0.019	acre-feet		
Approximate 50-yr Detention Volume =	0.021	acre-feet		
Approximate 100-yr Detention Volume =	0.023	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.005	acre-feet	
Zone 2 Volume (5-year - Zone 1) =	0.008	acre-feet	
Zone 3 Volume (100-year - Zones 1 & 2) =	0.010	acre-feet	
Total Detention Basin Volume =	0.023	acre-feet	
Initial Surcharge Volume (ISV) =	N/A	ft^3	
Initial Surcharge Depth (ISD) =	N/A	ft	
Total Available Detention Depth (H_{total}) =	1.50	ft	
Depth of Trickle Channel (H_{TC}) =	N/A	ft	
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft	
Slopes of Main Basin Sides (S_{main}) =	0	H:V	**Vertical Walls**
Basin Length-to-Width Ratio ($R_{L/W}$) =	2.5		

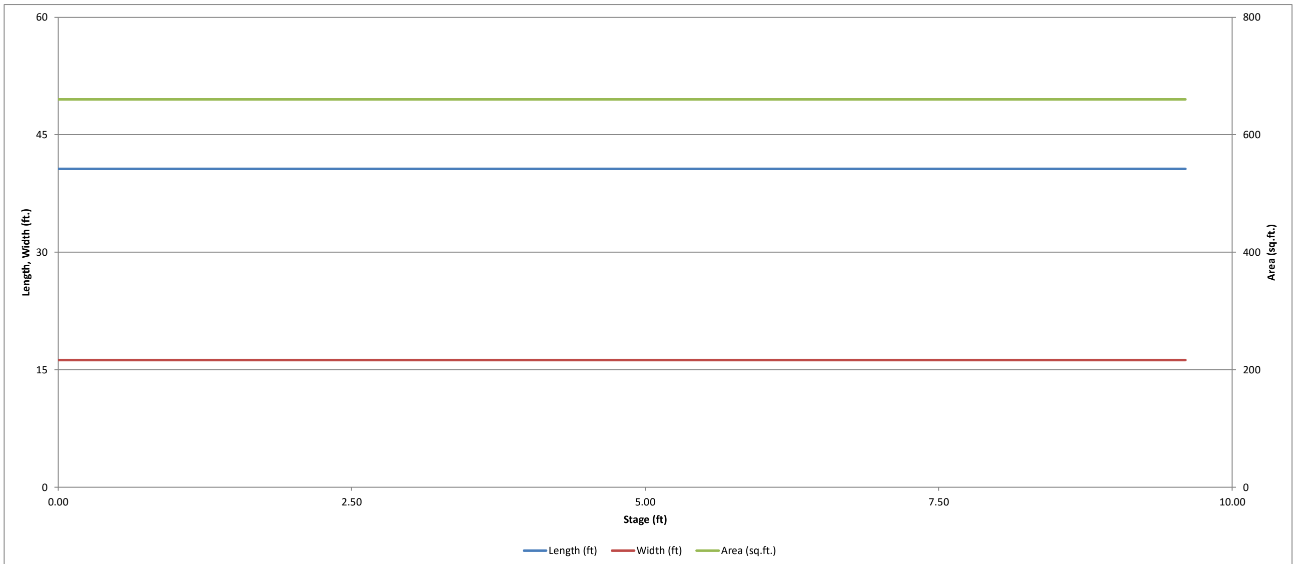
Initial Surcharge Area (A_{ISV}) =	0	ft^2
Surcharge Volume Length (L_{ISV}) =	0.0	ft
Surcharge Volume Width (W_{ISV}) =	0.0	ft
Depth of Basin Floor (H_{FLOOR}) =	0.00	ft
Length of Basin Floor (L_{FLOOR}) =	40.6	ft
Width of Basin Floor (W_{FLOOR}) =	16.3	ft
Area of Basin Floor (A_{FLOOR}) =	660	ft^2
Volume of Basin Floor (V_{FLOOR}) =	0	ft^3
Depth of Main Basin (H_{MAIN}) =	1.50	ft
Length of Main Basin (L_{MAIN}) =	40.6	ft
Width of Main Basin (W_{MAIN}) =	16.3	ft
Area of Main Basin (A_{MAIN}) =	660	ft^2
Volume of Main Basin (V_{MAIN}) =	991	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.023**	acre-feet

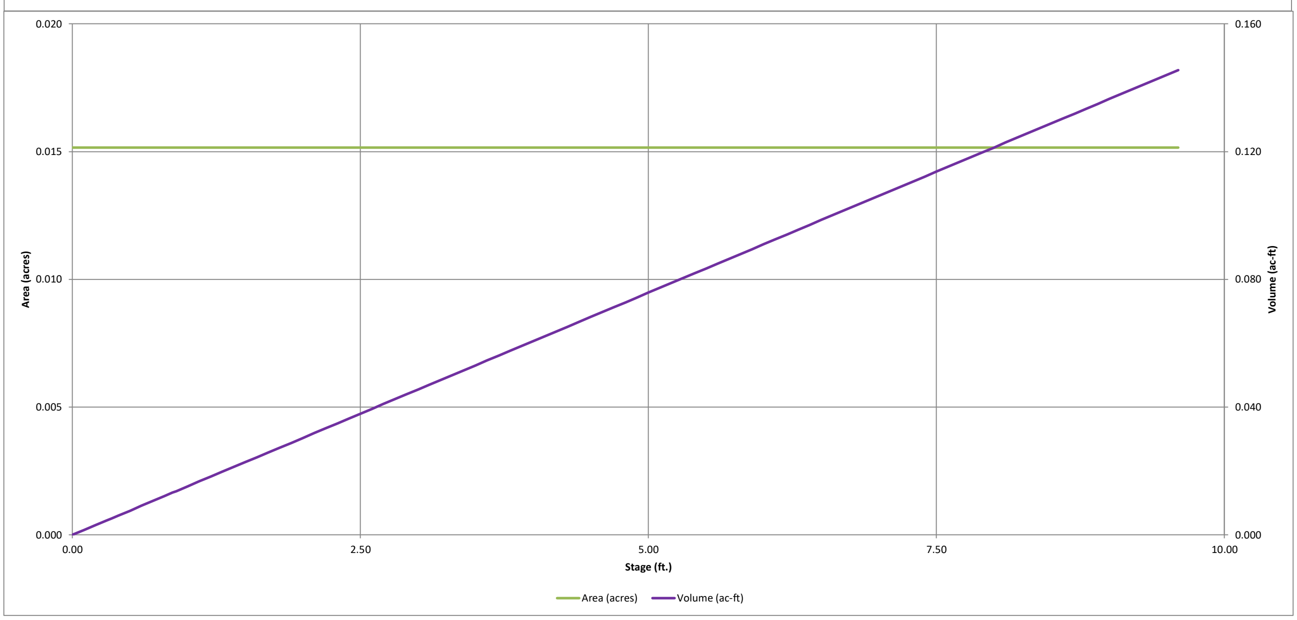
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	0.00		40.6	16.3	660		0.015		
	0.10		40.6	16.3	660		0.015	66	0.002
	0.20		40.6	16.3	660		0.015	132	0.003
	0.30		40.6	16.3	660		0.015	198	0.005
Zone 1 (WQCV)	0.34		40.6	16.3	660		0.015	225	0.005
	0.40		40.6	16.3	660		0.015	264	0.006
	0.50		40.6	16.3	660		0.015	330	0.008
	0.60		40.6	16.3	660		0.015	396	0.009
	0.70		40.6	16.3	660		0.015	462	0.011
	0.80		40.6	16.3	660		0.015	528	0.012
Zone 2 (5-year)	0.87		40.6	16.3	660		0.015	575	0.013
	0.90		40.6	16.3	660		0.015	594	0.014
	1.00		40.6	16.3	660		0.015	660	0.015
	1.10		40.6	16.3	660		0.015	727	0.017
	1.20		40.6	16.3	660		0.015	793	0.018
	1.30		40.6	16.3	660		0.015	859	0.020
	1.40		40.6	16.3	660		0.015	925	0.021
Zone 3 (100-year)	1.50		40.6	16.3	660		0.015	991	0.023
	1.60		40.6	16.3	660		0.015	1,057	0.024
	1.70		40.6	16.3	660		0.015	1,123	0.026
	1.80		40.6	16.3	660		0.015	1,189	0.027
	1.90		40.6	16.3	660		0.015	1,255	0.029
	2.00		40.6	16.3	660		0.015	1,321	0.030
	2.10		40.6	16.3	660		0.015	1,387	0.032
	2.20		40.6	16.3	660		0.015	1,453	0.033
	2.30		40.6	16.3	660		0.015	1,519	0.035
	2.40		40.6	16.3	660		0.015	1,585	0.036
	2.50		40.6	16.3	660		0.015	1,651	0.038
	2.60		40.6	16.3	660		0.015	1,717	0.039
	2.70		40.6	16.3	660		0.015	1,783	0.041
	2.80		40.6	16.3	660		0.015	1,849	0.042
	2.90		40.6	16.3	660		0.015	1,915	0.044
	3.00		40.6	16.3	660		0.015	1,981	0.045
	3.10		40.6	16.3	660		0.015	2,048	0.047
	3.20		40.6	16.3	660		0.015	2,114	0.049
	3.30		40.6	16.3	660		0.015	2,180	0.050
	3.40		40.6	16.3	660		0.015	2,246	0.052
	3.50		40.6	16.3	660		0.015	2,312	0.053
	3.60		40.6	16.3	660		0.015	2,378	0.055
	3.70		40.6	16.3	660		0.015	2,444	0.056
	3.80		40.6	16.3	660		0.015	2,510	0.058
	3.90		40.6	16.3	660		0.015	2,576	0.059
	4.00		40.6	16.3	660		0.015	2,642	0.061
	4.10		40.6	16.3	660		0.015	2,708	0.062
	4.20		40.6	16.3	660		0.015	2,774	0.064
	4.30		40.6	16.3	660		0.015	2,840	0.065
	4.40		40.6	16.3	660		0.015	2,906	0.067
	4.50		40.6	16.3	660		0.015	2,972	0.068
	4.60		40.6	16.3	660		0.015	3,038	0.070
	4.70		40.6	16.3	660		0.015	3,104	0.071
	4.80		40.6	16.3	660		0.015	3,170	0.073
	4.90		40.6	16.3	660		0.015	3,236	0.074
	5.00		40.6	16.3	660		0.015	3,302	0.076
	5.10		40.6	16.3	660		0.015	3,368	0.077
	5.20		40.6	16.3	660		0.015	3,435	0.079
	5.30		40.6	16.3	660		0.015	3,501	0.080
	5.40		40.6	16.3	660		0.015	3,567	0.082
	5.50		40.6	16.3	660		0.015	3,633	0.083
	5.60		40.6	16.3	660		0.015	3,699	0.085
	5.70		40.6	16.3	660		0.015	3,765	0.086
	5.80		40.6	16.3	660		0.015	3,831	0.088
	5.90		40.6	16.3	660		0.015	3,897	0.089
	6.00		40.6	16.3	660		0.015	3,963	0.091
	6.10		40.6	16.3	660		0.015	4,029	0.092
	6.20		40.6	16.3	660		0.015	4,095	0.094
	6.30		40.6	16.3	660		0.015	4,161	0.096
	6.40		40.6	16.3	660		0.015	4,227	0.097
	6.50		40.6	16.3	660		0.015	4,293	0.099
	6.60		40.6	16.3	660		0.015	4,359	0.100
	6.70		40.6	16.3	660		0.015	4,425	0.102
	6.80		40.6	16.3	660		0.015	4,491	0.103
	6.90		40.6	16.3	660		0.015	4,557	0.105
	7.00		40.6	16.3	660		0.015	4,623	0.106
	7.10		40.6	16.3	660		0.015	4,689	0.108
	7.20		40.6	16.3	660		0.015	4,756	0.109
	7.30		40.6	16.3	660		0.015	4,822	0.111
	7.40		40.6	16.3	660		0.015	4,888	0.112
	7.50		40.6	16.3	660		0.015	4,954	0.114
	7.60		40.6	16.3	660		0.015	5,020	0.115
	7.70		40.6	16.3	660		0.015	5,086	0.117
	7.80		40.6	16.3	660		0.015	5,152	0.118
	7.90		40.6	16.3	660		0.015	5,218	0.120
	8.00		40.6	16.3	660		0.015	5,284	0.121
	8.10		40.6	16.3	660		0.015	5,350	0.123
	8.20		40.6	16.3	660		0.015	5,416	0.124
	8.30		40.6	16.3	660		0.015	5,482	0.126
	8.40		40.6	16.3	660		0.015	5,548	0.127
	8.50		40.6	16.3	660		0.015	5,614	0.129
	8.60		40.6	16.3	660		0.015	5,680	0.130
	8.70		40.6	16.3	660		0.015	5,746	0.132
	8.80		40.6	16.3	660		0.015	5,812	0.133
	8.90		40.6	16.3	660		0.015	5,878	0.135
	9.00		40.6	16.3	660		0.015	5,944	0.136
	9.10		40.6	16.3	660		0.015	6,010	0.138
	9.20		40.6	16.3	660		0.015	6,076	0.139
	9.30		40.6	16.3	660		0.015	6,143	0.141
	9.40		40.6	16.3	660		0.015	6,209	0.143
	9.50		40.6	16.3	660		0.015	6,275	0.144
	9.60		40.6	16.3	660		0.015	6,341	0.146

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)



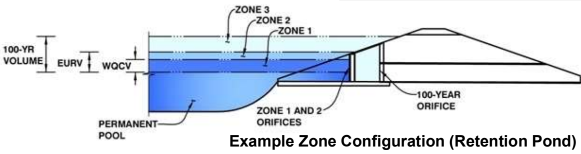


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)

Project: **VILLAGE DRIVE NORTH POND**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.34	0.005	Filtration Media
Zone 2 (5-year)	0.87	0.008	Rectangular Orifice
Zone 3 (100-year)	1.50	0.010	Weir&Pipe (Restrict)
Total (all zones)		0.023	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	1.68	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.38	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.02	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	0.34	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.87	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.36	N/A	inches
Vertical Orifice Width =	0.50		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.02	N/A	ft^2
Vertical Orifice Centroid =	0.27	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	0.87	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	0.87	N/A	feet
Overflow Weir Slope Length =	2.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =		N/A	
Overflow Grate Open Area w/o Debris =	3.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	1.50	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.68	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =			inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =		N/A	ft^2
Outlet Orifice Centroid =		N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =		N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =		feet
Spillway End Slopes =		H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=		feet
Stage at Top of Freeboard =		feet
Basin Area at Top of Freeboard =		acres
Basin Volume at Top of Freeboard =		acre-ft

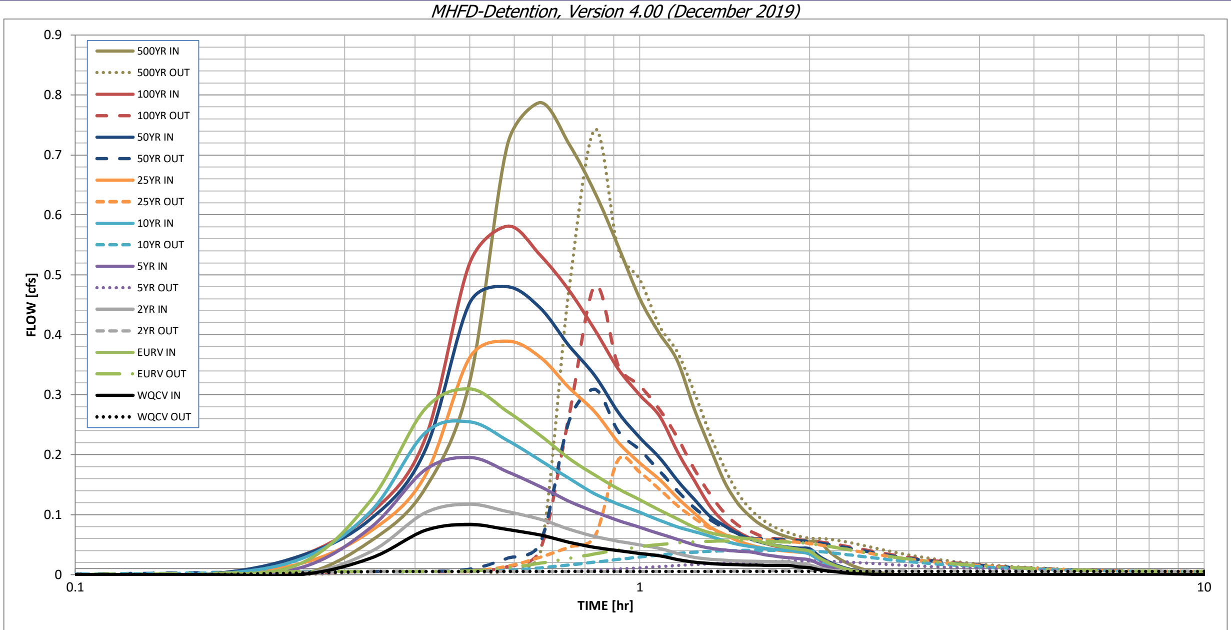
Routed Hydrograph Results

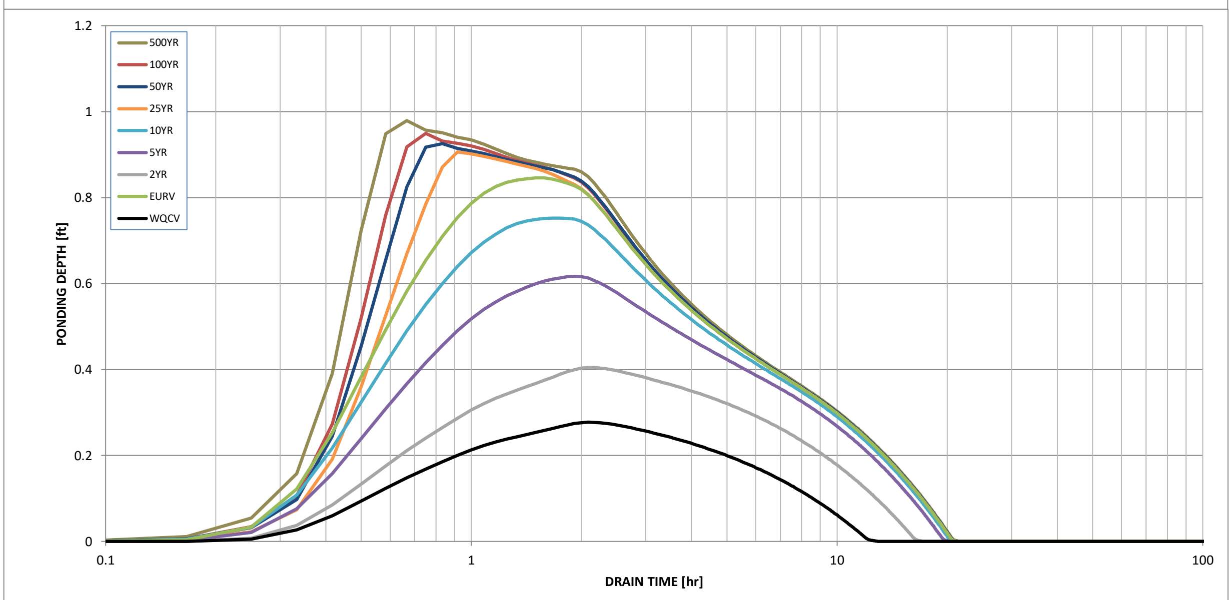
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

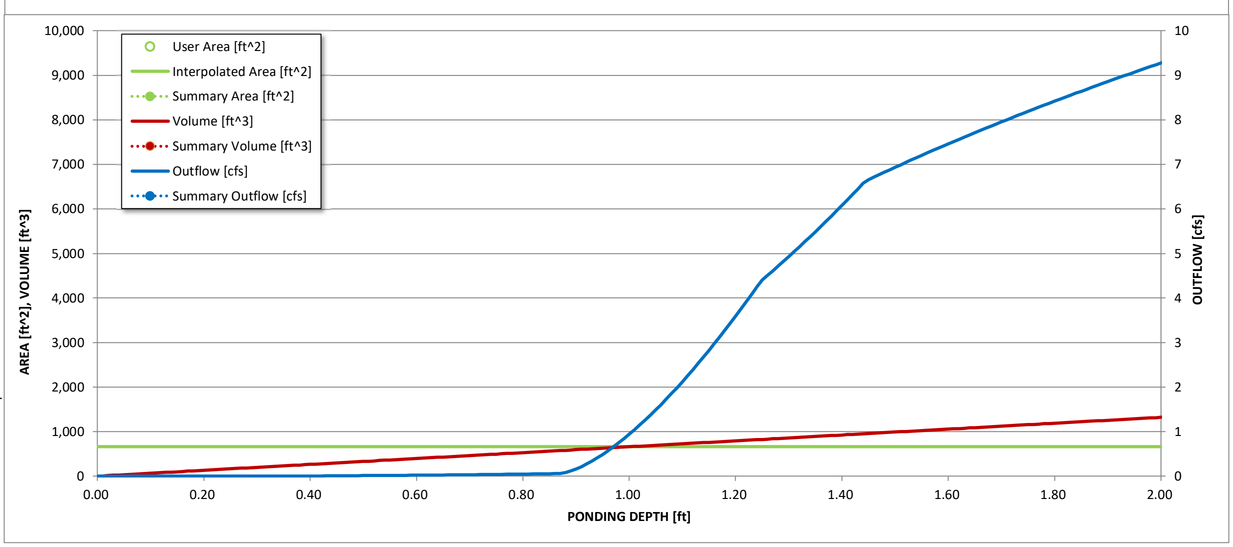
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.56	0.84	1.06	1.36	1.60	1.82	2.35
CUHP Runoff Volume (acre-ft) =	0.005	0.019	0.007	0.012	0.016	0.023	0.028	0.033	0.045
Inflow Hydrograph Volume (acre-ft) =	0.005	0.019	0.007	0.012	0.016	0.023	0.028	0.033	0.045
CUHP Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	0.0	0.0							
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.03	0.35	0.54	0.75	1.18
Peak Inflow Q (cfs) =	0.1	0.3	0.1	0.2	0.3	0.4	0.5	0.6	0.8
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.02	0.0	0.2	0.3	0.5	0.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	#DIV/0!	4.9	2.0	2.1	2.4	2.3
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	19	16	19	19	19	19	18	18
Time to Drain 99% of Inflow Volume (hours) =	**12**	20	16	19	20	20	20	20	20
Maximum Ponding Depth (ft) =	0.28	0.85	0.40	0.62	0.75	0.91	0.93	0.95	0.98
Area at Maximum Ponding Depth (acres) =	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Maximum Volume Stored (acre-ft) =	0.004	0.013	0.006	0.009	0.011	0.014	0.014	0.014	0.015

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

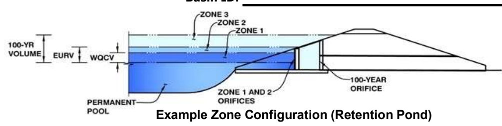
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:00	0.00	0.02	0.00	0.01	0.03	0.02	0.03	0.03	0.06
	0:20:00	0.03	0.12	0.04	0.08	0.10	0.07	0.09	0.10	0.14
	0:25:00	0.07	0.28	0.10	0.17	0.24	0.16	0.21	0.23	0.32
	0:30:00	0.08	0.31	0.12	0.20	0.25	0.36	0.45	0.52	0.72
	0:35:00	0.07	0.27	0.10	0.17	0.22	0.39	0.48	0.58	0.79
	0:40:00	0.07	0.23	0.09	0.15	0.19	0.36	0.44	0.53	0.72
	0:45:00	0.05	0.19	0.08	0.12	0.16	0.31	0.38	0.47	0.64
	0:50:00	0.05	0.17	0.06	0.10	0.13	0.27	0.33	0.41	0.55
	0:55:00	0.04	0.14	0.06	0.09	0.12	0.22	0.27	0.34	0.46
	1:00:00	0.04	0.12	0.05	0.08	0.10	0.19	0.23	0.30	0.40
	1:05:00	0.03	0.11	0.04	0.07	0.09	0.16	0.20	0.27	0.36
	1:10:00	0.03	0.09	0.04	0.06	0.08	0.13	0.16	0.20	0.28
	1:15:00	0.02	0.08	0.03	0.05	0.07	0.10	0.13	0.16	0.21
	1:20:00	0.02	0.07	0.03	0.04	0.06	0.08	0.10	0.11	0.15
	1:25:00	0.02	0.06	0.02	0.04	0.06	0.07	0.08	0.09	0.12
	1:30:00	0.02	0.06	0.02	0.04	0.05	0.06	0.07	0.07	0.09
	1:35:00	0.02	0.06	0.02	0.04	0.05	0.05	0.06	0.06	0.08
	1:40:00	0.02	0.05	0.02	0.03	0.04	0.04	0.05	0.05	0.07
	1:45:00	0.02	0.05	0.02	0.03	0.04	0.04	0.05	0.05	0.06
	1:50:00	0.02	0.04	0.02	0.03	0.04	0.04	0.05	0.04	0.06
	1:55:00	0.01	0.04	0.02	0.03	0.04	0.04	0.04	0.04	0.06
	2:00:00	0.01	0.04	0.02	0.02	0.03	0.04	0.04	0.04	0.05
	2:05:00	0.01	0.03	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	2:10:00	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	2:15:00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	2:20:00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:25:00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)

Project: VILLAGE DRIVE SOUTH POND

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**RG**	
Watershed Area =	0.20	acres
Watershed Length =	147	ft
Watershed Length to Centroid =	61	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	74.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.004	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.014	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.56 in.) =	0.005	acre-feet	0.56	inches
5-yr Runoff Volume (P1 = 0.84 in.) =	0.009	acre-feet	0.84	inches
10-yr Runoff Volume (P1 = 1.06 in.) =	0.012	acre-feet	1.06	inches
25-yr Runoff Volume (P1 = 1.36 in.) =	0.017	acre-feet	1.36	inches
50-yr Runoff Volume (P1 = 1.6 in.) =	0.021	acre-feet	1.60	inches
100-yr Runoff Volume (P1 = 1.82 in.) =	0.025	acre-feet	1.82	inches
500-yr Runoff Volume (P1 = 2.35 in.) =	0.033	acre-feet	2.35	inches
Approximate 2-yr Detention Volume =	0.006	acre-feet		
Approximate 5-yr Detention Volume =	0.010	acre-feet		
Approximate 10-yr Detention Volume =	0.013	acre-feet		
Approximate 25-yr Detention Volume =	0.015	acre-feet		
Approximate 50-yr Detention Volume =	0.016	acre-feet		
Approximate 100-yr Detention Volume =	0.017	acre-feet		

Define Zones and Basin Geometry

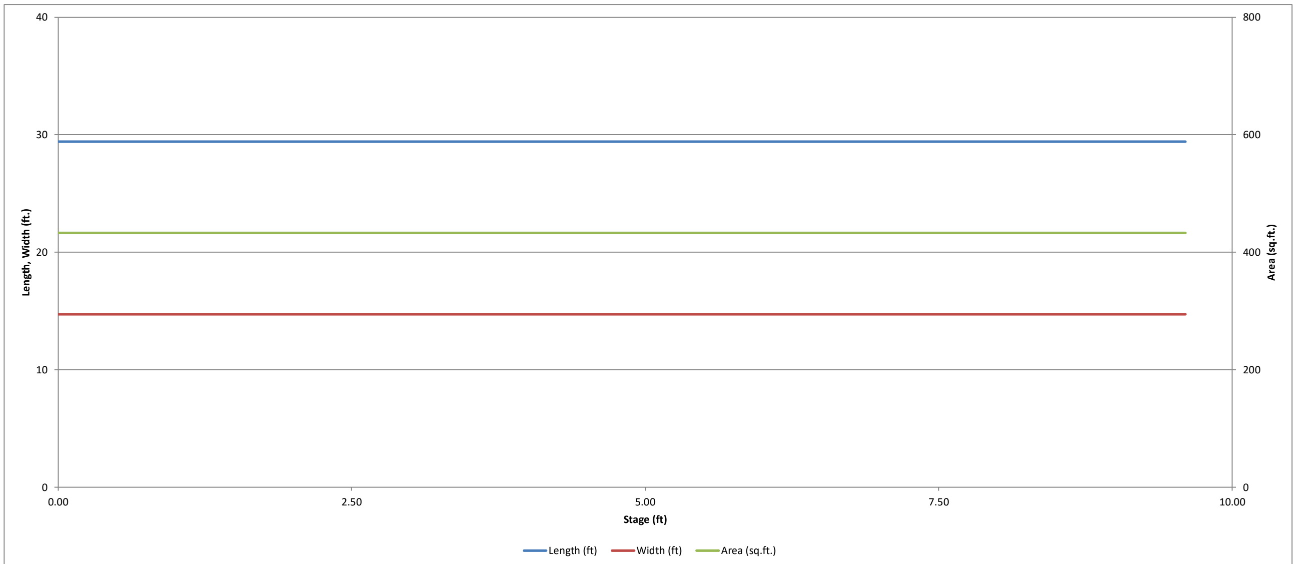
Zone 1 Volume (WQCV) =	0.004	acre-feet	
Zone 2 Volume (5-year - Zone 1) =	0.006	acre-feet	
Zone 3 Volume (100-year - Zones 1 & 2) =	0.007	acre-feet	
Total Detention Basin Volume =	0.017	acre-feet	
Initial Surcharge Volume (ISV) =	N/A	ft^3	
Initial Surcharge Depth (ISD) =	N/A	ft	
Total Available Detention Depth (H_{total}) =	1.75	ft	
Depth of Trickle Channel (H_{TC}) =	N/A	ft	
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft	
Slopes of Main Basin Sides (S_{main}) =	0	H:V	**Vertical Walls**
Basin Length-to-Width Ratio ($R_{L/W}$) =	2		
Initial Surcharge Area (A_{ISV}) =	0	ft^2	
Surcharge Volume Length (L_{ISV}) =	0.0	ft	
Surcharge Volume Width (W_{ISV}) =	0.0	ft	
Depth of Basin Floor (H_{FLOOR}) =	0.00	ft	
Length of Basin Floor (L_{FLOOR}) =	29.4	ft	
Width of Basin Floor (W_{FLOOR}) =	14.7	ft	
Area of Basin Floor (A_{FLOOR}) =	433	ft^2	
Volume of Basin Floor (V_{FLOOR}) =	0	ft^3	
Depth of Main Basin (H_{MAIN}) =	1.75	ft	
Length of Main Basin (L_{MAIN}) =	29.4	ft	
Width of Main Basin (W_{MAIN}) =	14.7	ft	
Area of Main Basin (A_{MAIN}) =	433	ft^2	
Volume of Main Basin (V_{MAIN}) =	758	ft^3	
Calculated Total Basin Volume (V_{total}) =	**0.017**	acre-feet	

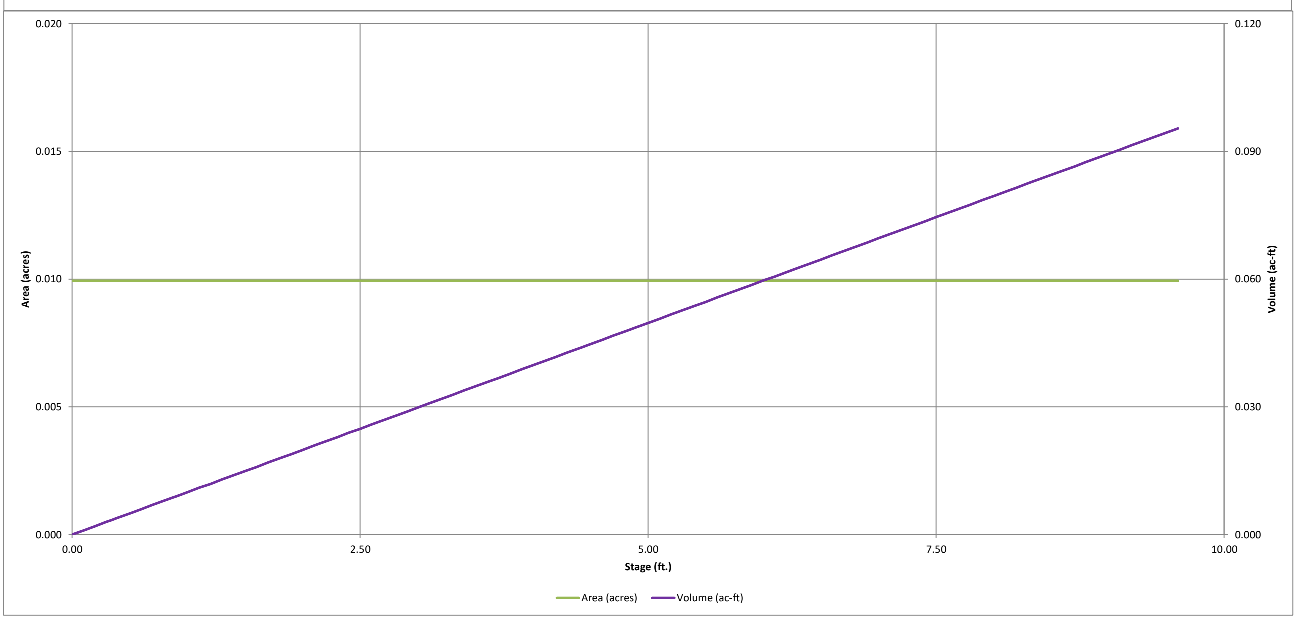
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	0.00		29.4	14.7	433		0.010		
	0.10		29.4	14.7	433		0.010	43	0.001
	0.20		29.4	14.7	433		0.010	87	0.002
	0.30		29.4	14.7	433		0.010	130	0.003
Zone 1 (WQCV)	0.34		29.4	14.7	433		0.010	147	0.003
	0.40		29.4	14.7	433		0.010	173	0.004
	0.50		29.4	14.7	433		0.010	216	0.005
	0.60		29.4	14.7	433		0.010	260	0.006
	0.70		29.4	14.7	433		0.010	303	0.007
	0.80		29.4	14.7	433		0.010	346	0.008
Zone 2 (5-year)	0.87		29.4	14.7	433		0.010	377	0.009
	0.90		29.4	14.7	433		0.010	390	0.009
	1.00		29.4	14.7	433		0.010	433	0.010
	1.10		29.4	14.7	433		0.010	476	0.011
	1.20		29.4	14.7	433		0.010	520	0.012
	1.30		29.4	14.7	433		0.010	563	0.013
	1.40		29.4	14.7	433		0.010	606	0.014
Zone 3 (100-year)	1.50		29.4	14.7	433		0.010	649	0.015
	1.60		29.4	14.7	433		0.010	693	0.016
	1.70		29.4	14.7	433		0.010	736	0.017
	1.80		29.4	14.7	433		0.010	779	0.018
	1.90		29.4	14.7	433		0.010	823	0.019
	2.00		29.4	14.7	433		0.010	866	0.020
	2.10		29.4	14.7	433		0.010	909	0.021
	2.20		29.4	14.7	433		0.010	952	0.022
	2.30		29.4	14.7	433		0.010	996	0.023
	2.40		29.4	14.7	433		0.010	1,039	0.024
	2.50		29.4	14.7	433		0.010	1,082	0.025
	2.60		29.4	14.7	433		0.010	1,126	0.026
	2.70		29.4	14.7	433		0.010	1,169	0.027
	2.80		29.4	14.7	433		0.010	1,212	0.028
	2.90		29.4	14.7	433		0.010	1,256	0.029
	3.00		29.4	14.7	433		0.010	1,299	0.030
	3.10		29.4	14.7	433		0.010	1,342	0.031
	3.20		29.4	14.7	433		0.010	1,385	0.032
	3.30		29.4	14.7	433		0.010	1,429	0.033
	3.40		29.4	14.7	433		0.010	1,472	0.034
	3.50		29.4	14.7	433		0.010	1,515	0.035
	3.60		29.4	14.7	433		0.010	1,559	0.036
	3.70		29.4	14.7	433		0.010	1,602	0.037
	3.80		29.4	14.7	433		0.010	1,645	0.038
	3.90		29.4	14.7	433		0.010	1,688	0.039
	4.00		29.4	14.7	433		0.010	1,732	0.040
	4.10		29.4	14.7	433		0.010	1,775	0.041
	4.20		29.4	14.7	433		0.010	1,818	0.042
	4.30		29.4	14.7	433		0.010	1,862	0.043
	4.40		29.4	14.7	433		0.010	1,905	0.044
	4.50		29.4	14.7	433		0.010	1,948	0.045
	4.60		29.4	14.7	433		0.010	1,991	0.046
	4.70		29.4	14.7	433		0.010	2,035	0.047
	4.80		29.4	14.7	433		0.010	2,078	0.048
	4.90		29.4	14.7	433		0.010	2,121	0.049
	5.00		29.4	14.7	433		0.010	2,165	0.050
	5.10		29.4	14.7	433		0.010	2,208	0.051
	5.20		29.4	14.7	433		0.010	2,251	0.052
	5.30		29.4	14.7	433		0.010	2,295	0.053
	5.40		29.4	14.7	433		0.010	2,338	0.054
	5.50		29.4	14.7	433		0.010	2,381	0.055
	5.60		29.4	14.7	433		0.010	2,424	0.056
	5.70		29.4	14.7	433		0.010	2,468	0.057
	5.80		29.4	14.7	433		0.010	2,511	0.058
	5.90		29.4	14.7	433		0.010	2,554	0.059
	6.00		29.4	14.7	433		0.010	2,598	0.060
	6.10		29.4	14.7	433		0.010	2,641	0.061
	6.20		29.4	14.7	433		0.010	2,684	0.062
	6.30		29.4	14.7	433		0.010	2,727	0.063
	6.40		29.4	14.7	433		0.010	2,771	0.064
	6.50		29.4	14.7	433		0.010	2,814	0.065
	6.60		29.4	14.7	433		0.010	2,857	0.066
	6.70		29.4	14.7	433		0.010	2,901	0.067
	6.80		29.4	14.7	433		0.010	2,944	0.068
	6.90		29.4	14.7	433		0.010	2,987	0.069
	7.00		29.4	14.7	433		0.010	3,031	0.070
	7.10		29.4	14.7	433		0.010	3,074	0.071
	7.20		29.4	14.7	433		0.010	3,117	0.072
	7.30		29.4	14.7	433		0.010	3,160	0.073
	7.40		29.4	14.7	433		0.010	3,204	0.074
	7.50		29.4	14.7	433		0.010	3,247	0.075
	7.60		29.4	14.7	433		0.010	3,290	0.076
	7.70		29.4	14.7	433		0.010	3,334	0.077
	7.80		29.4	14.7	433		0.010	3,377	0.078
	7.90		29.4	14.7	433		0.010	3,420	0.079
	8.00		29.4	14.7	433		0.010	3,463	0.080
	8.10		29.4	14.7	433		0.010	3,507	0.081
	8.20		29.4	14.7	433		0.010	3,550	0.081
	8.30		29.4	14.7	433		0.010	3,593	0.082
	8.40		29.4	14.7	433		0.010	3,637	0.083
	8.50		29.4	14.7	433		0.010	3,680	0.084
	8.60		29.4	14.7	433		0.010	3,723	0.085
	8.70		29.4	14.7	433		0.010	3,767	0.086
	8.80		29.4	14.7	433		0.010	3,810	0.087
	8.90		29.4	14.7	433		0.010	3,853	0.088
	9.00		29.4	14.7	433		0.010	3,896	0.089
	9.10		29.4	14.7	433		0.010	3,940	0.090
	9.20		29.4	14.7	433		0.010	3,983	0.091
	9.30		29.4	14.7	433		0.010	4,026	0.092
	9.40		29.4	14.7	433		0.010	4,070	0.093
	9.50		29.4	14.7	433		0.010	4,113	0.094
	9.60		29.4	14.7	433		0.010	4,156	0.095

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)

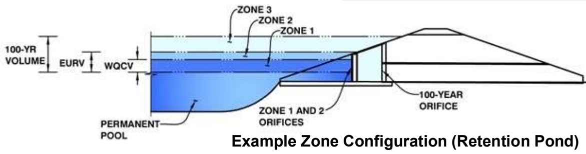




DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)

Project: **VILLAGE DRIVE SOUTH POND**
Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.40	0.004	Filtration Media
Zone 2 (5-year)	1.02	0.006	Rectangular Orifice
Zone 3 (100-year)	1.75	0.007	Weir&Pipe (Restrict)
Total (all zones)		0.017	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	1.68	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.35	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.01	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	0.29	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	8.52	N/A	inches
Vertical Orifice Width =	0.40		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.02	N/A	ft^2
Vertical Orifice Centroid =	0.36	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.00	N/A	feet
Overflow Weir Slope Length =	2.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =		N/A	
Overflow Grate Open Area w/o Debris =	2.80	N/A	ft^2
Overflow Grate Open Area w/ Debris =	1.40	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.88	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =			inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =		N/A	ft^2
Outlet Orifice Centroid =		N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =		N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =		feet
Spillway End Slopes =		H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=		feet
Stage at Top of Freeboard =		feet
Basin Area at Top of Freeboard =		acres
Basin Volume at Top of Freeboard =		acre-ft

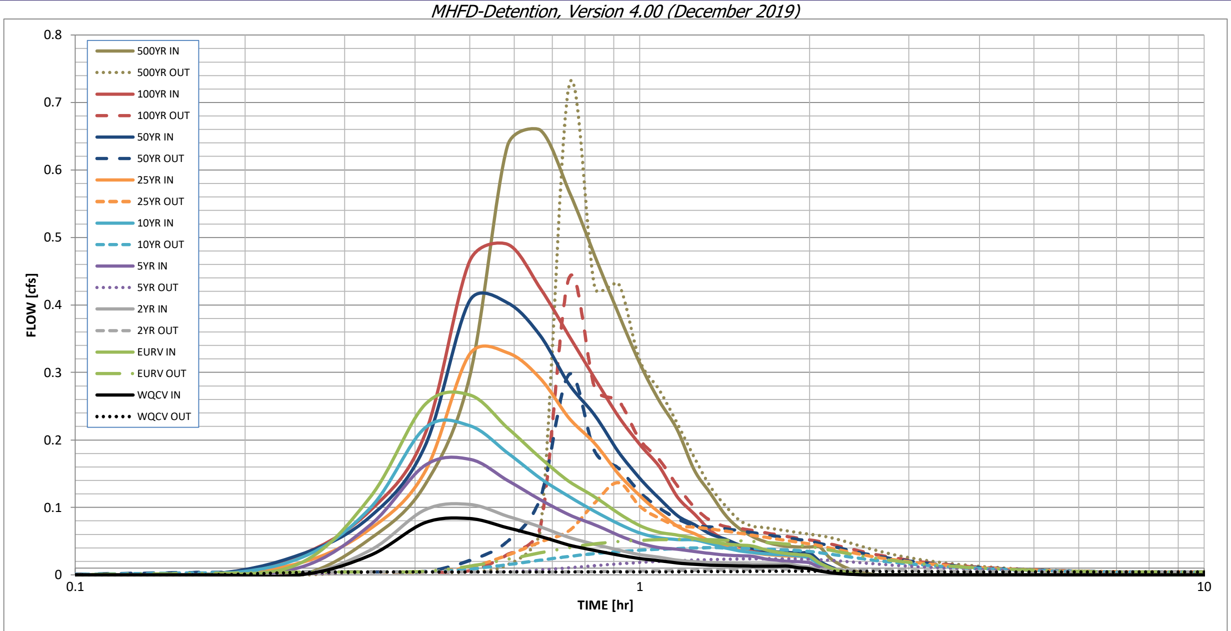
Routed Hydrograph Results

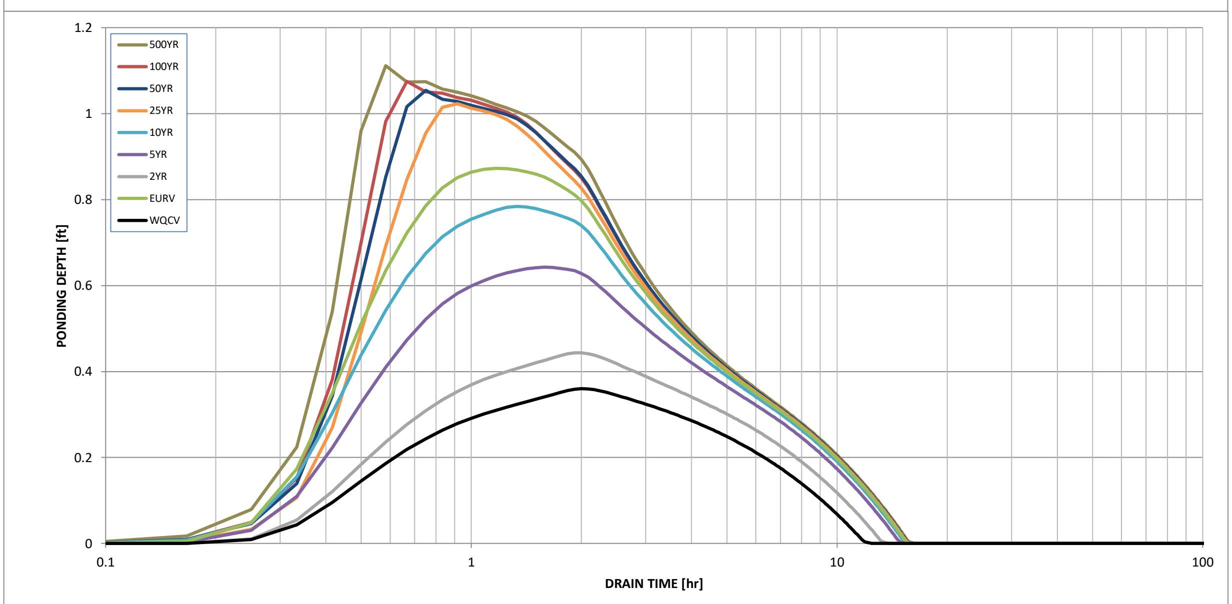
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

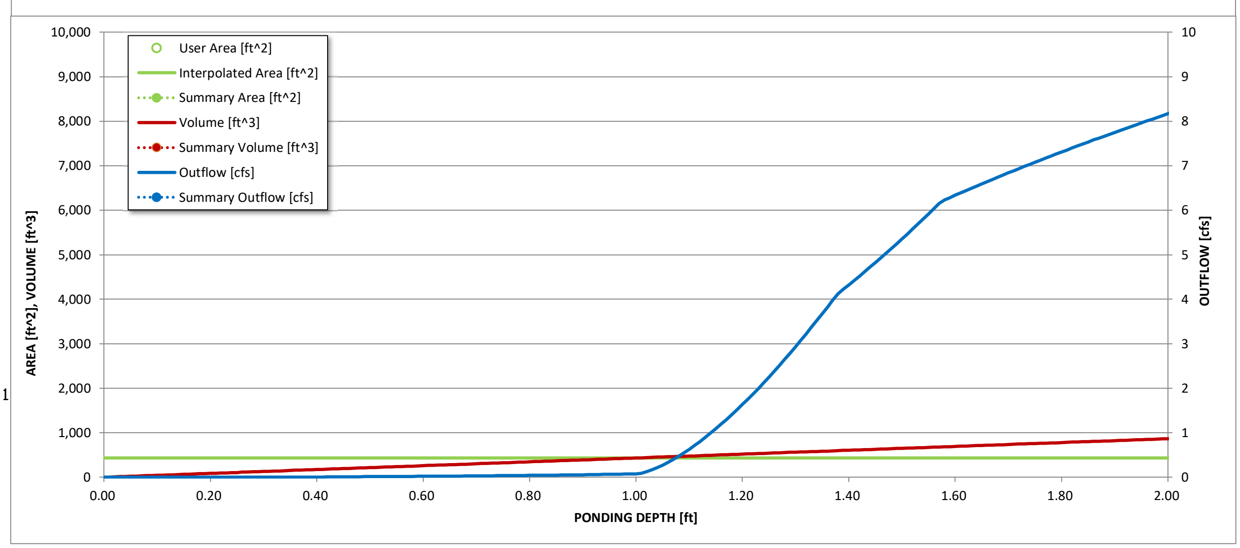
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.56	0.84	1.06	1.36	1.60	1.82	2.35
CUHP Runoff Volume (acre-ft) =	0.004	0.014	0.005	0.009	0.012	0.017	0.021	0.025	0.033
Inflow Hydrograph Volume (acre-ft) =	0.004	0.014	0.005	0.009	0.012	0.017	0.021	0.025	0.033
CUHP Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	0.0	0.0							
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.04	0.42	0.64	0.87	1.38
Peak Inflow Q (cfs) =	0.08	0.3	0.1	0.2	0.2	0.3	0.4	0.5	0.7
Peak Outflow Q (cfs) =	0.01	0.1	0.01	0.02	0.04	0.14	0.30	0.44	0.73
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	#DIV/0!	5.3	1.6	2.3	2.5	2.6
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	14	13	14	14	14	14	14	13
Time to Drain 99% of Inflow Volume (hours) =	**11.9**	15	13	15	15	15	15	15	15
Maximum Ponding Depth (ft) =	0.36	0.87	0.44	0.64	0.78	1.02	1.05	1.08	1.11
Area at Maximum Ponding Depth (acres) =	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.004	0.009	0.004	0.006	0.008	0.010	0.010	0.011	0.011

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

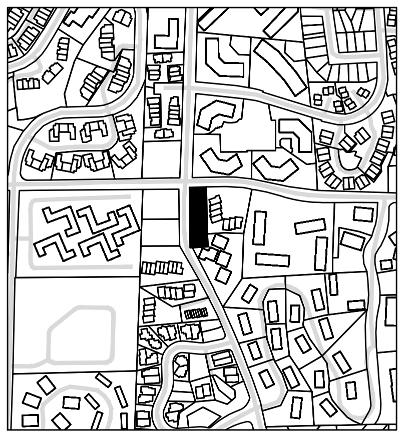
The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:00	0.00	0.02	0.00	0.01	0.02	0.02	0.03	0.03	0.05
	0:20:00	0.03	0.12	0.04	0.07	0.10	0.07	0.09	0.10	0.13
	0:25:00	0.08	0.25	0.10	0.16	0.22	0.15	0.19	0.21	0.29
	0:30:00	0.08	0.27	0.10	0.17	0.22	0.33	0.41	0.47	0.64
	0:35:00	0.07	0.22	0.09	0.14	0.18	0.33	0.40	0.49	0.66
	0:40:00	0.06	0.17	0.07	0.11	0.14	0.29	0.35	0.43	0.57
	0:45:00	0.04	0.14	0.06	0.09	0.12	0.23	0.28	0.35	0.47
	0:50:00	0.04	0.12	0.05	0.07	0.09	0.19	0.24	0.29	0.39
	0:55:00	0.03	0.09	0.04	0.06	0.08	0.15	0.18	0.24	0.31
	1:00:00	0.02	0.07	0.03	0.05	0.06	0.12	0.14	0.19	0.26
	1:05:00	0.02	0.06	0.03	0.04	0.06	0.09	0.11	0.16	0.21
	1:10:00	0.02	0.06	0.02	0.04	0.05	0.07	0.09	0.12	0.15
	1:15:00	0.02	0.05	0.02	0.03	0.05	0.06	0.07	0.09	0.12
	1:20:00	0.01	0.05	0.02	0.03	0.05	0.05	0.06	0.07	0.09
	1:25:00	0.01	0.05	0.02	0.03	0.04	0.04	0.05	0.05	0.07
	1:30:00	0.01	0.04	0.02	0.03	0.04	0.04	0.04	0.04	0.06
	1:35:00	0.01	0.04	0.02	0.03	0.03	0.03	0.04	0.04	0.05
	1:40:00	0.01	0.04	0.02	0.02	0.03	0.03	0.04	0.03	0.04
	1:45:00	0.01	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	1:50:00	0.01	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	1:55:00	0.01	0.03	0.01	0.02	0.03	0.03	0.03	0.03	0.04
	2:00:00	0.01	0.03	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	2:05:00	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	2:10:00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	2:15:00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	2:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX F

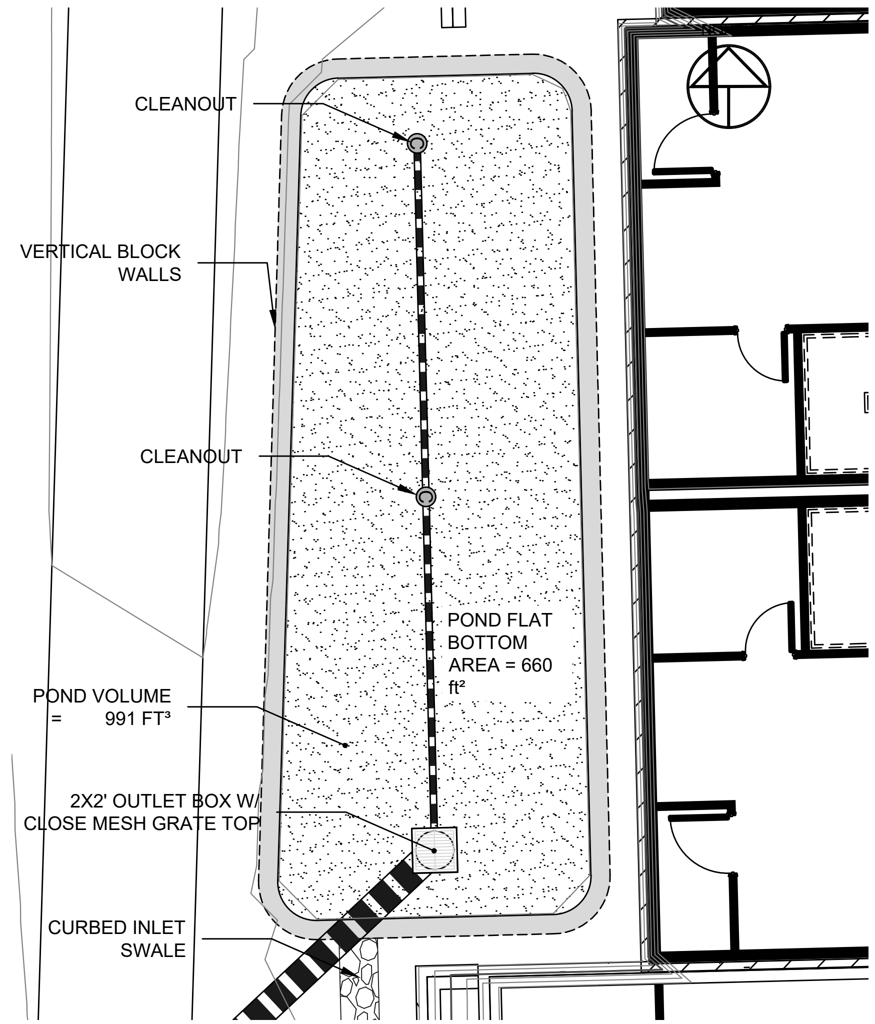
POND OWNERSHIP/MAINTENANCE PLAN AND SWQP CHECKLIST

FULL-SPECTRUM POROUS LANDSCAPE DETENTION POND (NORTH) FOR VILLAGE DRIVE
OWNERSHIP AND MAINTENANCE PLAN

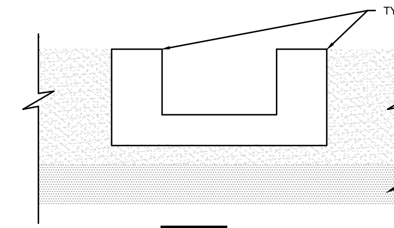


VICINITY MAP
SCALE: 1" = 1000'

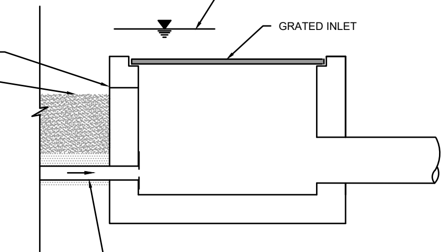
NOTES:
1. FOR ADDITIONAL DESIGN INFORMATION REFER TO THE CONSTRUCTION DRAWINGS FOR THIS PROJECT.
2. DISTURBANCE OF WETLAND AREAS SHALL BE AVOIDED DURING MAINTENANCE OPERATIONS.
3. SEE DETAILED NOTES ON THE SECOND SHEET OF THIS PLAN FOR ALL MAINTENANCE REQUIREMENTS.



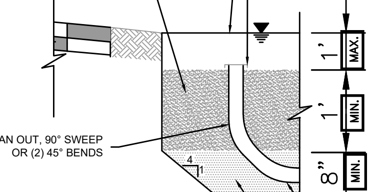
PLAN
SCALE: 1" = 10'



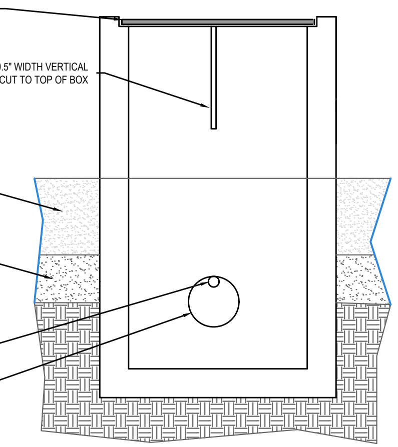
INLET
NTS



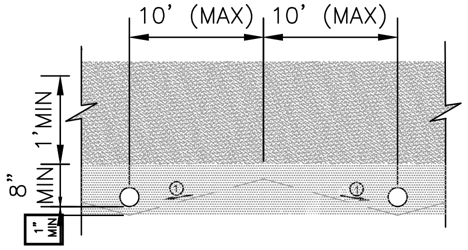
BOX SIDE VIEW
NTS



CLEANOUT
NTS

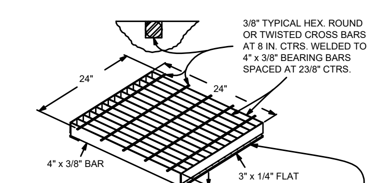


BOX FRONT VIEW
NTS

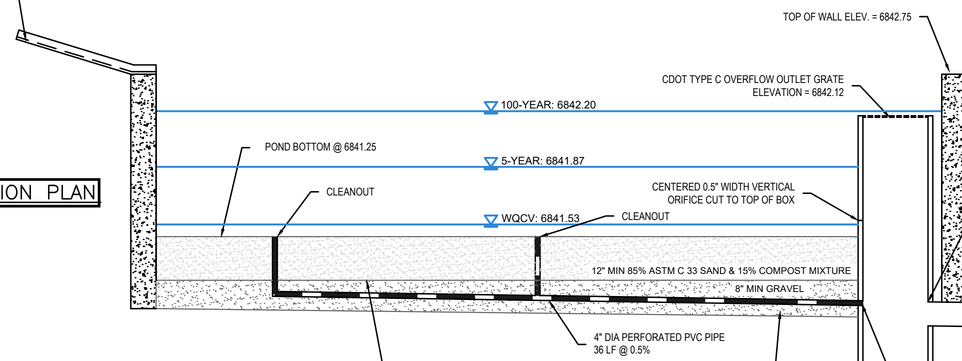


① SLOPE (STRAIGHT GRADE) SUBGRADE (2-10%) TO UNDERDRAIN TO REDUCE SATURATED SOIL CONDITIONS BETWEEN STORM EVENTS (OPTIONAL)

PERFORATED PIPE PLAN
NTS



CLOSE MESH GRATE
NTS



POND ELEVATION PLAN
NTS

PROJECT: 2136-017	NO.	DATE:	BY:	DESCRIPTION:
DATE: 3/13/20				
DRAWN BY: TSP				
CHECKED BY: LCI				

NOT FOR CONSTRUCTION REVIEW SET 03/13/20

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VILLAGE DRIVE
FULL SPECTRUM LANDSCAPE DETENTION POND
OWNERSHIP AND MAINTENANCE PLAN

SHEET
1
Of 2 Sheets

DRAWING FILENAME: P:\2136-017\Engineering\Drainage\2136-017 - O&M.dwg LAYOUT NAME: NORTH POND DATE: Mar 12, 2020 - 10:32pm CAD OPERATOR: tom
LIST OF XREFS: [2136-017-xSite] [2136-017-xUtil] [####-###-xBORDER-11x17] [xVICMAP]

FULL-SPECTRUM POROUS LANDSCAPE DETENTION POND FOR VILLAGE DRIVE NORTH POND OWNERSHIP AND MAINTENANCE PLAN

1. GENERAL PROJECT INFORMATION

A. 1805 WALTON CREEK ROAD NW $\frac{1}{4}$ OF SW$\frac{1}{4}$, S27, T6N, R84W, 6PM, STEAMBOAT SPRINGS, CO.

B. RECEIVING WATER: YAMPA RIVER

C. PROPERTY OWNER:

D. AGENCY RESPONSIBLE FOR MAINTENANCE: (SEE ABOVE)

E. DESIGN ENGINEER: TOM PAULSON, LANDMARK CONSULTANTS INC., 970.819.6380, TOMP@LANDMARK-CO.COM, PE LICENSE NUMBER: 51715

2. GENERAL FACILITY DESCRIPTION

THIS FACILITY IS A FULL SPECTRUM POROUS LANDSCAPE DETENTION POND THAT WILL RESPONSIBLE FOR CONTROLLING RUNOFF INCREASE FROM THE DEVELOPMENT OF THE SUNLIGHT CROSSING SITE. THE FACILITY HAS BEEN ADOPTED AND APPROVED BY THE CITY OF STEAMBOAT SPRINGS AS A PART OF THE VILLAGE DRIVE PROJECT. IT WILL RECEIVE RUNOFF FROM 0.27 ACRES AND WILL OCCUPY A PARCEL OF APPROXIMATELY 0.015 ACRES THAT WILL BE USED TO TREAT AND RELEASE EXCESS RUNOFF GENERATED BY A PORTION OF THE DEVELOPED SITE.

3. INSPECTION & MAINTENANCE FREQUENCY & PROCEDURE

A.

INSPECTION ITEMS	REQUIRED FREQUENCY
DEBRIS AT OUTLET	TWICE ANNUALLY
UNDERDRAIN	WHEN PONDING > 24 HOURS
INFILTRATION RATE AFTER RAINFALL EVENT	TWICE ANNUALLY

B. REVISIONS TO MAINTENANCE FREQUENCY:

DATES/REASONS FOR CHANGES:

C. TRAFFIC CONTROL IF NECESSARY SHALL BE PROVIDED BY OWNER.

D. THE FACILITY DOES NOT REQUIRE CONFINED SPACE ENTRY PROCEDURES.

E. DEWATERING AND WATER CONTROL
CLEANING THE POND AND OUTLET STRUCTURE MAY REQUIRE DEWATERING. LANDMARK RECOMMENDS THAT ANY CLEANING COINCIDES SEASONALLY WITH TIMES OF NON-PEAK RUNOFF. ANY DEWATERING WORK OR PERMITS SHALL BE THE RESPONSIBILITY OF THE OWNER.

F. SEDIMENT, DEBRIS, & TRASH REMOVAL & DISPOSAL
SEDIMENT REMOVAL AND/OR REPLACEMENT OF MEDIA SHALL BE CONDUCTED WHEN PONDING LASTS LONGER THAN 24 HOURS. TRASH/DEBRIS REMOVAL SHALL BE CONDUCTED AS NEEDED, BUT ESPECIALLY WHEN ANY DEBRIS BLOCKS FLOW OF THE PONDS OUTLET STRUCTURE. MULCH REPLACEMENT SHALL OCCUR AS NEEDED TO MAINTAIN 3" DEPTH. SEDIMENT AND DEBRIS SHALL BE REMOVED AND DISPOSED OF BY A METHOD AND LOCATION THAT COINCIDES WITH THE CITY OF STEAMBOAT SPRINGS' ALLOWANCES. THE LONGEST DISTANCE BETWEEN THE EDGE OF AN ACCESS ROAD AND THE FAR CORNER OF A STRUCTURE REQUIRING SEDIMENT REMOVAL IS 81 FEET.

G. VEGETATION MANAGEMENT
SEE SECTION 4 OF THE NOTES ON THIS SHEET

H. WETLAND AREAS ARE NOT ANTICIPATED ON SITE. SEE SECTION 8.0 OF THE NOTES ON THIS SHEET.

4. EQUIPMENT, STAFFING, AND VEGETATION MANAGEMENT

A. EQUIPMENT REQUIRED:
HAND TOOLS, MOWING, WEED WHACKING, TRIMMERS

B. STAFFING:
TO BE SPECIFIED BY OWNER

C. SEED: [X] SEED MIXES HAVE BEEN PLANTED AT THE SITE. THE [NAME OF SEED MIX, TYPICALLY UPLAND, RIPARIAN, WETLAND, ETC.] SEED MIX HAS BEEN PLANTED [DESCRIBE LOCATION]. [REPEAT AS NECESSARY TO DESCRIBE ALL MIXES.] [THE INVERT OF THE LOW FLOW CHANNEL SHALL REMAIN UNDISTURBED.] SEED MIXES ARE AS FOLLOWS:

BOTANICAL NAME	COMMON NAME	LBS PURE LIVE SEED/AC
Xxxxxx xxxxxxxxxxx	Xxxxxx Xxxxxxx	X.X

D. MOWING: THE POND AREA SHALL BE MOWED AS NEEDED TO MAINTAIN VEGETATIVE HEALTH. AT COMPLETION OF CONSTRUCTION, REQUIRED MOW AREA WAS ESTIMATED TO BE (TBD)

E. WEEDS & UNDESIRABLE VEGETATION: WEEDS SHALL BE MOWED. NOXIOUS WEEDS AND OTHER UNDESIRABLE VEGETATION SHALL BE REMOVED BY:HAND TOOLS, MOWING, WEED WHACKING, TRIMMERS.

5. SNOW AND ICE CONTROL

FACILITY IS NOT LOCATED WITHIN A SNOW STORAGE AREA.

6. RIGHT-OF-WAY, ADJACENT OWNERSHIP, & ACCESS

A. RIGHT-OF-WAY DESCRIPTION: VILLAGE DRIVE

B. ADJACENT OWNERSHIP: STEAMBOAT SPRINGS ROW

C. ACCESS INFORMATION AND DETAILS: ACCESS THROUGH MAIN ENTRANCE OF DEVELOPMENT

D. MAINTENANCE OPERATIONS WILL LIKELY NOT IMPACT OR OBSTRUCT RIGHT-OF-WAY AND A RIGHT-OF-WAY PERMIT IS LIKELY NOT REQUIRED. IF RIGHT-OF-WAY PERMIT **IS** REQUIRED FOR ANY MAINTENANCE ACTIONS, IT IS THE RESPONSIBILITY OF THE OWNER TO OBTAIN NECESSARY PERMITS.

7. HYDRAULIC DESIGN

A. FLOW RATES (CFS):

	INFLOW	OUTFLOW
WQ EVENT:	0.08 CFS	0.01 CFS
5-YEAR:	1.48 CFS	0.02 CFS
100-YEAR:	1.79 CFS	0.5 CFS

B.

ITEM	VOLUME	WSEL	DEPTH	INVERT
WQCV	0.005 AF	6841.53	3.4"	6841.25
5 YEAR WEIR	0.012 AF	6841.87	7.4"	6841.54
100 YEAR DROP BOX	0.033 AF	6842.2	11.4"	6842.2

C. WQCV DRAIN TIME = 12 HOURS
5-YEAR DRAIN TIME = 19 HOURS
100-YEAR DRAIN TIME = 20 HOURS

8. SENSITIVE AREAS, WETLANDS, & PERMITS

THE SITE HAS NO WETLANDS

9. MISCELLANEOUS INFORMATION

A. PROJECT SURVEY:
EXISTING CONDITIONS TOPOGRAPHIC SURVEY WAS PREPARED BY LANDMARK CONSULTANTS INC. SEE EXISTING CONDITIONS EXHIBIT FOR DETAILS

DRAWING FILENAME: P:\2136-017\Engineering\Drainage\2136-017 - O&M.dwg LAYOUT NAME: O&M NOTES NORTH POND DATE: Mar 12, 2020 - 10:32pm CAD OPERATOR: tom
LIST OF XREFS: [2136-017-xSite] [2136-017-xUtil] [####-###-xBORDER-11x17] [xVICMAP]

PROJECT: 2136-017	NO.	DATE:	BY:	DESCRIPTION:
DATE: 3/13/20				
DRAWN BY: TSP				
CHECKED BY: LCI				

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REVIEW SET
03/13/20

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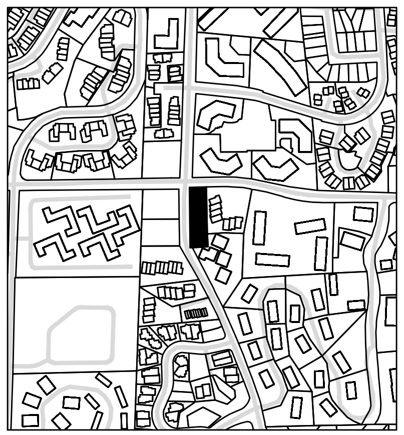
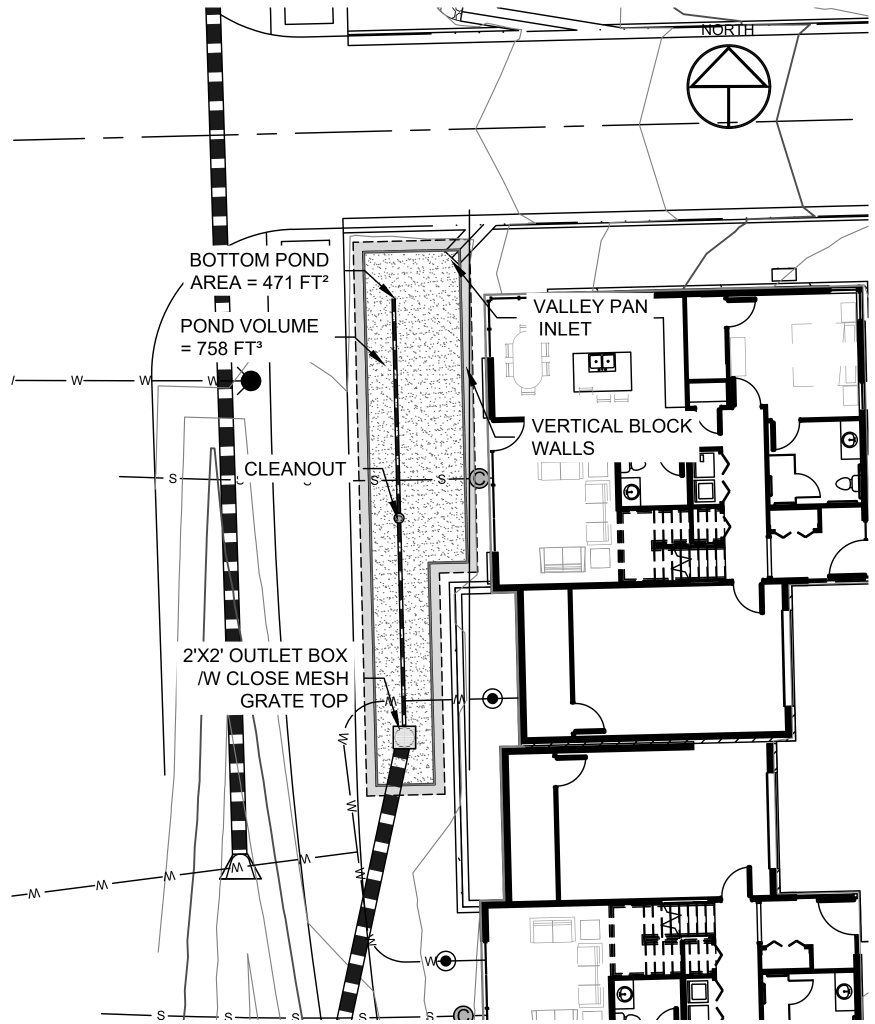
VILLAGE DRIVE
FULL SPECTRUM LANDSCAPE DETENTION POND
OWNERSHIP AND MAINTENANCE PLAN
NORTH POND

FULL-SPECTRUM POROUS LANDSCAPE DETENTION POND (SOUTH) FOR VILLAGE DRIVE OWNERSHIP AND MAINTENANCE PLAN

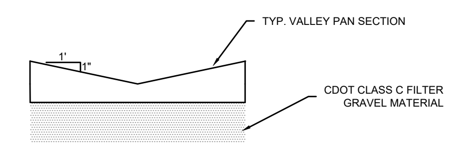


VICINITY MAP
SCALE: 1" = 1000'

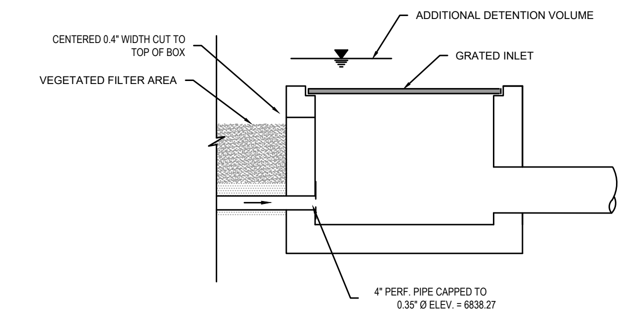
NOTES:
1. FOR ADDITIONAL DESIGN INFORMATION REFER TO THE CONSTRUCTION DRAWINGS FOR THIS PROJECT.
2. DISTURBANCE OF WETLAND AREAS SHALL BE AVOIDED DURING MAINTENANCE OPERATIONS.
3. SEE DETAILED NOTES ON THE SECOND SHEET OF THIS PLAN FOR ALL MAINTENANCE REQUIREMENTS.



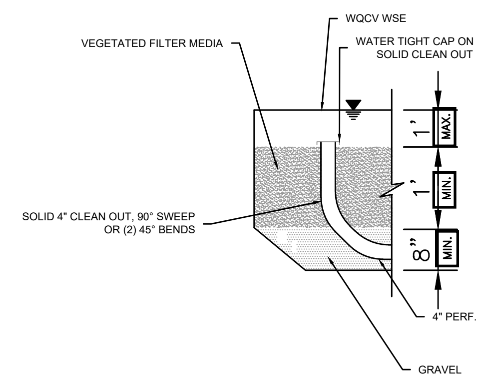
PLAN
SCALE: 1" = 20'



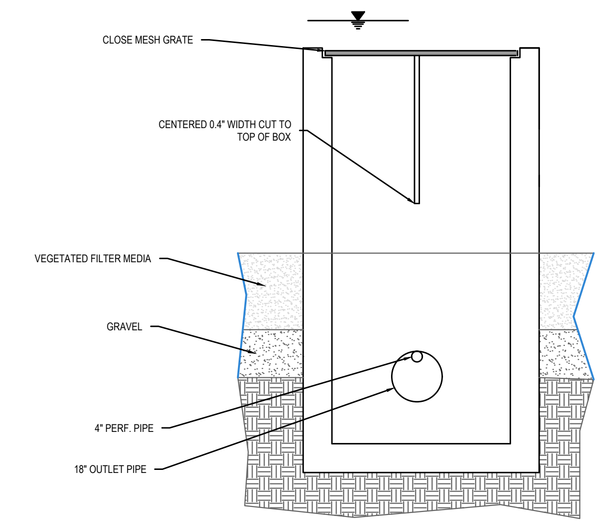
INLET
NTS



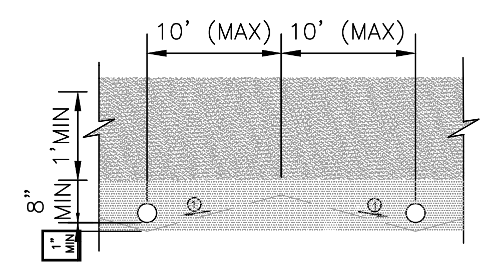
BOX SIDE VIEW
NTS



CLEANOUT
NTS

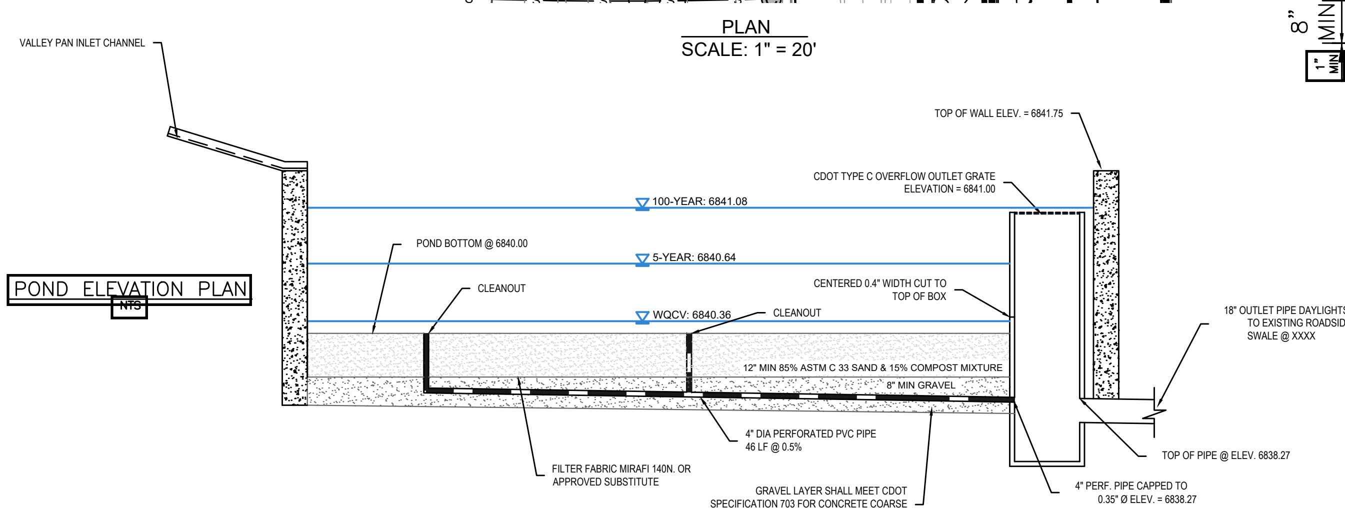


BOX FRONT VIEW
NTS

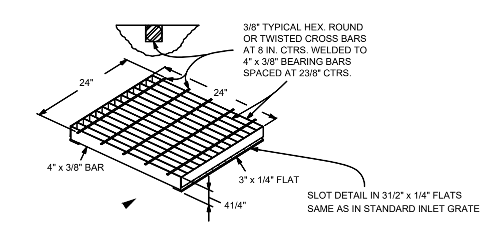


① SLOPE (STRAIGHT GRADE) SUBGRADE (2-10%) TO UNDERDRAIN TO REDUCE SATURATED SOIL CONDITIONS BETWEEN STORM EVENTS (OPTIONAL)

PERFORATED PIPE PLAN
NTS



POND ELEVATION PLAN
NTS



CLOSE MESH GRATE
NTS

PROJECT: 2136-017	NO.	DATE:	BY:	DESCRIPTION:
DATE: 3/13/20				
DRAWN BY: TSP				
CHECKED BY: LCI				

NOT FOR CONSTRUCTION
REVIEW SET
03/13/20

These drawings are instruments of service provided by Landmark Consultants, Inc. and are not to be used for any type of construction or contracting unless signed and sealed by a Professional Engineer in the employ of Landmark Consultants, Inc.

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VILLAGE DRIVE
FULL SPECTRUM LANDSCAPE DETENTION POND
OWNERSHIP AND MAINTENANCE PLAN

SHEET
1
Of 2 Sheets

DRAWING FILENAME: P:\2136-017\Engineering\Drainage\2136-017 - O&M.dwg LAYOUT NAME: SOUTH POND DATE: Mar 12, 2020 - 10:33pm CAD OPERATOR: tom
LIST OF XREFS: [2136-017-xSite] [2136-017-xUtil] [####-###-xBORDER-11x17] [xVICMAP]

FULL-SPECTRUM POROUS LANDSCAPE DETENTION POND FOR VILLAGE DRIVE SOUTH POND OWNERSHIP AND MAINTENANCE PLAN

1. GENERAL PROJECT INFORMATION

A. 1805 WALTON CREEK ROAD NW $\frac{1}{4}$ OF SW$\frac{1}{4}$, S27, T6N, R84W, 6PM, STEAMBOAT SPRINGS, CO.

B. RECEIVING WATER: YAMPA RIVER

C. PROPERTY OWNER:

D. AGENCY RESPONSIBLE FOR MAINTENANCE: (SEE ABOVE)

E. DESIGN ENGINEER: TOM PAULSON, LANDMARK CONSULTANTS INC., 970.819.6380, TOMP@LANDMARK-CO.COM, PE LICENSE NUMBER: 51715

2. GENERAL FACILITY DESCRIPTION

THIS FACILITY IS A FULL SPECTRUM POROUS LANDSCAPE DETENTION POND THAT WILL RESPONSIBLE FOR CONTROLLING RUNOFF INCREASE FROM THE DEVELOPMENT OF THE SUNLIGHT CROSSING SITE. THE FACILITY HAS BEEN ADOPTED AND APPROVED BY THE CITY OF STEAMBOAT SPRINGS AS A PART OF THE VILLAGE DRIVE PROJECT. IT WILL RECEIVE RUNOFF FROM 0.20 ACRES AND WILL OCCUPY A PARCEL OF APPROXIMATELY 0.011 ACRES THAT WILL BE USED TO TREAT AND RELEASE EXCESS RUNOFF GENERATED BY A PORTION OF THE DEVELOPED SITE.

3. INSPECTION & MAINTENANCE FREQUENCY & PROCEDURE

A.

INSPECTION ITEMS	REQUIRED FREQUENCY
DEBRIS AT OUTLET	TWICE ANNUALLY
UNDERDRAIN	WHEN PONDING > 24 HOURS
INFILTRATION RATE AFTER RAINFALL EVENT	TWICE ANNUALLY

B. REVISIONS TO MAINTENANCE FREQUENCY:

DATES/REASONS FOR CHANGES:

C. TRAFFIC CONTROL IF NECESSARY SHALL BE PROVIDED BY OWNER.

D. THE FACILITY DOES NOT REQUIRE CONFINED SPACE ENTRY PROCEDURES.

E. DEWATERING AND WATER CONTROL
CLEANING THE POND AND OUTLET STRUCTURE MAY REQUIRE DEWATERING. LANDMARK RECOMMENDS THAT ANY CLEANING COINCIDES SEASONALLY WITH TIMES OF NON-PEAK RUNOFF. ANY DEWATERING WORK OR PERMITS SHALL BE THE RESPONSIBILITY OF THE OWNER.

F. SEDIMENT, DEBRIS, & TRASH REMOVAL & DISPOSAL
SEDIMENT REMOVAL AND/OR REPLACEMENT OF MEDIA SHALL BE CONDUCTED WHEN PONDING LASTS LONGER THAN 24 HOURS. TRASH/DEBRIS REMOVAL SHALL BE CONDUCTED AS NEEDED, BUT ESPECIALLY WHEN ANY DEBRIS BLOCKS FLOW OF THE PONDS OUTLET STRUCTURE. MULCH REPLACEMENT SHALL OCCUR AS NEEDED TO MAINTAIN 3" DEPTH. SEDIMENT AND DEBRIS SHALL BE REMOVED AND DISPOSED OF BY A METHOD AND LOCATION THAT COINCIDES WITH THE CITY OF STEAMBOAT SPRINGS' ALLOWANCES. THE LONGEST DISTANCE BETWEEN THE EDGE OF AN ACCESS ROAD AND THE FAR CORNER OF A STRUCTURE REQUIRING SEDIMENT REMOVAL IS 58 FEET.

G. VEGETATION MANAGEMENT
SEE SECTION 4 OF THE NOTES ON THIS SHEET

H. WETLAND AREAS ARE NOT ANTICIPATED ON SITE. SEE SECTION 8.0 OF THE NOTES ON THIS SHEET.

4. EQUIPMENT, STAFFING, AND VEGETATION MANAGEMENT

A. EQUIPMENT REQUIRED:
HAND TOOLS, MOWING, WEED WHACKING, TRIMMERS

B. STAFFING:
TO BE SPECIFIED BY OWNER

C. SEED: [X] SEED MIXES HAVE BEEN PLANTED AT THE SITE. THE [NAME OF SEED MIX, TYPICALLY UPLAND, RIPARIAN, WETLAND, ETC.] SEED MIX HAS BEEN PLANTED [DESCRIBE LOCATION]. [REPEAT AS NECESSARY TO DESCRIBE ALL MIXES.] [THE INVERT OF THE LOW FLOW CHANNEL SHALL REMAIN UNDISTURBED.] SEED MIXES ARE AS FOLLOWS:

BOTANICAL NAME	COMMON NAME	LBS PURE LIVE SEED/AC
Xxxxxx xxxxxxxxxxx	Xxxxxx Xxxxxxx	X.X

D. MOWING: THE POND AREA SHALL BE MOWED AS NEEDED TO MAINTAIN VEGETATIVE HEALTH. AT COMPLETION OF CONSTRUCTION, REQUIRED MOW AREA WAS ESTIMATED TO BE (TBD)

E. WEEDS & UNDESIRABLE VEGETATION: WEEDS SHALL BE MOWED. NOXIOUS WEEDS AND OTHER UNDESIRABLE VEGETATION SHALL BE REMOVED BY:HAND TOOLS, MOWING, WEED WHACKING, TRIMMERS.

5. SNOW AND ICE CONTROL

FACILITY IS NOT LOCATED WITHIN A SNOW STORAGE AREA.

6. RIGHT-OF-WAY, ADJACENT OWNERSHIP, & ACCESS

A. RIGHT-OF-WAY DESCRIPTION: VILLAGE DRIVE

B. ADJACENT OWNERSHIP: STEAMBOAT SPRINGS ROW

C. ACCESS INFORMATION AND DETAILS: ACCESS THROUGH MAIN ENTRANCE OF DEVELOPMENT

D. MAINTENANCE OPERATIONS WILL LIKELY NOT IMPACT OR OBSTRUCT RIGHT-OF-WAY AND A RIGHT-OF-WAY PERMIT IS LIKELY NOT REQUIRED. IF RIGHT-OF-WAY PERMIT **IS** REQUIRED FOR ANY MAINTENANCE ACTIONS, IT IS THE RESPONSIBILITY OF THE OWNER TO OBTAIN NECESSARY PERMITS.

7. HYDRAULIC DESIGN

A. FLOW RATES (CFS):

	INFLOW	OUTFLOW
WQ EVENT:	0.08 CFS	0.01 CFS
5-YEAR:	0.49 CFS	0.02 CFS
100-YEAR:	1.32 CFS	0.5 CFS

B.

ITEM	VOLUME	WSEL	DEPTH	INVERT
WQCV	0.004 AF	6840.36	4.3"	6840.00
5 YEAR WEIR	0.009 AF	6840.64	7.4"	6840.36
100 YEAR DROP BOX	0.033 AF	6841.08	13.0"	6841.00

C. WQCV DRAIN TIME = 12 HOURS
5-YEAR DRAIN TIME = 15 HOURS
100-YEAR DRAIN TIME = 15 HOURS

8. SENSITIVE AREAS, WETLANDS, & PERMITS

THE SITE HAS NO WETLANDS

9. MISCELLANEOUS INFORMATION

A. PROJECT SURVEY:
EXISTING CONDITIONS TOPOGRAPHIC SURVEY WAS PREPARED BY LANDMARK CONSULTANTS INC. SEE EXISTING CONDITIONS EXHIBIT FOR DETAILS

PROJECT: 2136-017	NO.	DATE:	BY:	DESCRIPTION:
DATE: 3/13/20				
DRAWN BY: TSP				
CHECKED BY: LCI				

NOT FOR CONSTRUCTION
REVIEW SET
03/13/20

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VILLAGE DRIVE
FULL SPECTRUM LANDSCAPE DETENTION POND
OWNERSHIP AND MAINTENANCE PLAN
SOUTH POND

APPENDIX G

CITY CHECKLIST/SCOPE OF APPROVAL FORM

PROJECT SHEET – BASE DESIGN STANDARDS (Site is not constrained)

Complete a Project Sheet for each project that includes Permanent Stormwater Treatment Facilities.

SITE INFORMATION

Project Name: Village Drive Townhomes	
Project Location: 1805 Walton Creek Road	
Submitted Date: 3/19/2021	Submitted By: RSpaustat
Acreage Disturbed: 3.6-acres	
Existing Impervious: 2%	New Net Impervious: 74%
Review Date:	Reviewed By:

Preparer	City	Requirements
Landmark		Design Details are included for all Treatment Facilities
		List or include a description of any source controls or other non-structural practices: Site completely stabilized with landscaping and pavement.

DESIGN STANDARDS

Multiple Design Standards may be used on a site, as necessary, to meet the requirements, but only one Design Standard may be used for each treatment facility's tributary area. Evaluation of suitability of permanent stormwater treatment facilities is based on meeting the specified Design Standard and ease of long-term maintenance. Facilities must be designed in accordance with the most current versions of the City's Engineering Standards and Volume 3 of the USDCM and meet the specific requirements for each Design Standard used.

1. Indicate below, which Design Standard(s) will be used for the project, and
2. Complete a separate, corresponding Design Standards checklist for each facility (e.g., WQCV)

Design Standard	*Quantity*	*Tributary Area*	*Location/Identifying information*
WQCV	2	0.47 acres	Bio-Retention Basins on the South Side of the Site
Pollutant Removal			
Runoff Reduction			

Standard Form No. 4 Stormwater Quality Plan Checklist

This list is not an exhaustive list of every possible item that may be required or requested in a Stormwater Quality Plan but provides a general guideline for preparation of the Stormwater Quality Plan.

Instructions:

1. The applicant shall identify with a "check mark" if information is provided within the Stormwater Quality Plan. If applicant believes information is not required, indicate with "N/A" and attach separate sheet with explanation. If information is included with the associated drainage letter or study, indicated with a "D."
2. The reviewer will determine if information labeled "N/A" is required and whether additional information must be submitted.

I. General

D A. Report typed and legible in 8½" x 11" format.
D B. Report bound (comb, spiral, or staple – no notebook) and in digital PDF format.
D C. Drawings that are 11" x 17" bound within letter, larger drawings (up to 24" x 36") included in a pocket attached to the letter, and a digital PDF copy. Drawings shall be at an appropriate size and scale to be legible and include project area.

II. Cover

D A. Report Type – Stormwater Quality Plan.
D B. Project Name, Subdivision or Development, Original Date, Revision Date.
D C. Preparer's name, firm, address, and phone number.
D D. "DRAFT" for 1st submittal and revisions; "FINAL" once approved.

III. Title Sheet

D A. Table of Contents.
D B. Certification, PE Stamp, signature and date from licensed Colorado PE (for Final).
D C. Note: City of Steamboat Springs plan review and approval is only for general conformance with City design criteria and City code. The City is not responsible for the accuracy and adequacy of the design, dimensions, and elevations that shall be confirmed and correlated at the job site. The City of Steamboat Springs assumes no responsibility for the completeness or accuracy of this document.

IV. Introduction and Background

D A. Description of site location, study limits, size in acres, existing and proposed land use, soil data, permeability of the site, drainage patterns, and any pertinent background info.
D B. State purpose and goal of Stormwater Quality Plan and report along with any special requirements of the desired outcome.
D C. List any project stakeholders and/or requestors.
D D. Describe the background of the flooding source and any previous studies.

V. Design Criteria and Methodology Used

D A. Identify design rainfall and storm frequency used to design permanent stormwater treatment facilities.
D B Identify the runoff calculation method used to design permanent stormwater treatment facilities.
D C. Identify the standard the design will meet and the means and methodologies by which it will use to meet the standard.
D D. Provide all details supporting the use of the selected design standard.

VI. Proposed Conditions

D A. Identify total site area, total site imperviousness, area to be treated, and impervious area to be treated. Include justification for treating less than the total site area.
D B. Describe potential site contaminant sources including sediment.
D C. Identify source and quantity of on-site and off-site stormwater flows that need to be managed and how they will be managed.
D D. For each permanent treatment facility, identify the design standard, MDCIA level (if applicable), area treated (& percentage of total), imperviousness of area treated, C values of area treated, soil types, and all pertinent data for design.
D E. Volume based facilities: Provide total storage pond volume, WQCV, drain time, release rate, sediment storage, outlet & overflow structures, area and depth of pond, micropool, forebays, etc. (include all calculations in the appendix).
N/A F. Flow based facilities: Provide design flow rate and all treatment calculations and how flows larger than the water quality design flow rate will be handled. If proprietary facilities are proposed, provide the justification and sizing requirements from manufacturer.
D G. If stormwater detention is provided, discuss how water quality is provided within the detention facility. No underground detention is allowed.

VII. Operation and Maintenance Plan Requirements

See template O&M plan and guidance document.

D A. Describe general project information, facility description, ROW and access information, vegetation management, hydraulic design parameters, environmental permitting, snow and ice control, and additional pertinent information in the notes.
D B. Indicate, describe, and detail the permanent stormwater treatment facilities.
D C Include section details where necessary of the permanent treatment facilities.
D D. Provide an inspection and maintenance schedule and procedure of permanent treatment facilities and who is responsible for them.
D E. Identify design specifications for construction.

Acknowledgements

Standard Form No. 4 prepared by: TCS P.C. 3/13/20
Date

Include appropriate Project Sheet(s) and Design Checklist(s) (See Section 5.12)
Include this form as part of the Stormwater Quality Plan.

Standard Form No. 3 Final Drainage Study Checklist

Instructions:

1. The applicant shall identify with a "check mark" if information is provided with letter. If applicant believes information is not required, indicate with "N/A" and attach separate sheet with explanation.
2. The reviewer will determine if information labeled "N/A" is required and whether additional information must be submitted.

I. General

X A. Report typed and legible in 8½" x 11" format.
X B. Report bound (comb, spiral, or staple – no notebook).
X C. Drawings that are 8½ x 11 or 11 x 17 bound within report, larger drawings (up to 24 x 36) included in a pocket attached to the report. Drawings shall be at an appropriate size and scale to be legible and include project area.

II. Cover

X A. Report Type – Final Drainage Study.
X B. Project Name, Subdivision, Original Date, Revision Date.
X C. Preparer's name, firm, address, phone number.
X D. "DRAFT" for 1st submittal and revisions; "FINAL" once approved.

III. Title Sheet

X A. Table of Contents.
X B. Certification, PE Stamp, signature, and date from licensed Colorado PE.
X C. Note: City of Steamboat Springs plan review and approval is only for general conformance with City design criteria and the City code. The City is not responsible for the accuracy and adequacy of the design, dimensions, and elevations that shall be confirmed and correlated at the job site. The City of Steamboat Springs assumes no responsibility for the completeness or accuracy of this document.

IV. Introduction

X A. Description of site location, size in acres, existing and proposed land use, and any pertinent background info.
X B. Reference planning application type and plan set date and preparer.
X C. Identify drainage reports for adjacent development.

V. Drainage Criteria and Methodology Used

X A. Identify design rainfall and storm frequency.
X B. Identify the runoff calculation method used.
X C. Identify culvert and storm sewer design methodology.
X D. Identify detention discharge and storage methodology.
N/A E. Discuss HEC-HMS methodologies and parameters, if HEC-HMS is used.

VI. Existing Conditions (Pre-Development/Historic)

X A. Indicate ground cover, imperviousness, topography, and size of site (acres).
X B. Describe existing stormwater system (sizes, materials, etc.).
X C. Describe other notable features (canals, major utilities, etc.).
X D. Note site outfall locations and ultimate outfall location (typically Yampa River).
X E. Note capacity of existing system and identify any constraints.
X F. Identify NRCS soil type.
X G. Discuss any existing easements.
X H. Identify the FEMA Map reviewed, if site is in floodplain/way, and zone designation.

VII. Proposed Conditions

X A. Indicate ground cover, imperviousness, topography, and disturbed area (acres).
X B. Describe proposed stormwater system (sizes, materials, etc.).
X C. Describe proposed outlets and indicate historic and proposed flow for each.
X D. Include calculations for all culverts, ditches, ponds, etc. in appendix.
X E. Include a summary table for the 5- and 100-year events showing historic flow and proposed flow for total site and each basin.
X F. Discuss proposed easements.
X G. Describe off-site flows to be passed thru site.
X H. Summarize any impacts to downstream properties or indicate none. Reference CLOMR/LOMR and impacts.

I. Detention Ponds.
X 1. Indicate pond volume and area (size and depth) requirement.
X 2. Indicate release rates.
X 3. Discuss outfall design, location, and overflow location.
X 4. Discuss maintenance requirements.

J. Curb and Gutter
X 1. Indicate gutter capacity.
X 2. Indicate curb capacity.
X 3. Indicate design velocity
X 4. Indicate design depth of flow in street.

K. Culverts
X 1. Indicate whether each culvert is under inlet or outlet control.
X 2. Show that headwater is less than the maximum allowable.
X 3. Indicate design velocity.
X 4. Indicate required and provided flow rates.
X 5. Discuss whether outlet protection is required and what will be used.

L. Inlets
X 1. Indicate inlet capacity.
X 2. Indicate the type of inlet(s) used.

M. Channels
X 1. Indicate design velocity (and type of dissipation if required).
X 2. Indicate required and provided flow capacity.
X 3. Show critical cross-section(s) including water surface.

N. Site Discharge
X 1. Discuss use and design of detention to ensure discharge is less than or equal to historic flow.
X 2. Provide documentation that downstream facilities are adequate and no adverse impacts to downstream property owners (i.e. no rise certification)

VIII. Post Construction Stormwater Management

__X__ A. Discuss in general terms which permanent BMP practices will be used to control pollutant and sediment discharge after construction is complete. Exhibit A, Storm Water Quality Plan shall be attached that will give details (see separate checklist)

IX. Conclusions

__X__ A. Provide general summary.
__X__ B. Note if site complies with criteria and any variances to criteria.
__X__ C. Indicate if peak proposed flow is less than, equal to, or greater than peak historic flow for each outfall, design point, and for the total site.
__X__ D. List proposed new stormwater system requirements.

X. References

__X__ A. Provide a reference list of all criteria, master plans, drainage reports and technical information used.

XI. Tables

__X__ A. Include a copy of all tables prepared for the study.

XII. Figures

__X__ A. Vicinity Map.
__X__ B. Site Plan (include the horizontal and vertical datum used and all benchmarks).
C. Existing conditions.
__X__ 1. Delineate existing basin boundaries.
__X__ 2. Delineate offsite basins impacting the site.
__X__ 3. Show existing and proposed topography at an interval of at least 2-ft.
__X__ 4. Show existing runoff flow arrows.
__X__ 5. Show existing stormwater features (structures, sizes, materials, etc.).
__X__ 6. Show floodplain limits and information.
__X__ 7. For each basin show bubble with basin number, acreage and % impervious.
__X__ 8. For each outlet show bubble with acreage and historic flow and proposed flow or provide information in summary table on figure.
D. Proposed Conditions
__X__ 1. Delineate proposed basin boundaries.
__X__ 2. Show proposed runoff flow arrows.
__X__ 3. Show existing and proposed topography at an interval of at least 2-ft.
__X__ 4. For each basin show bubble with basin number, acreage and percent impervious or provide a summary table or figure.
__X__ 5. For each outlet show bubble with acreage, historic flow, and proposed flow or provide a summary table or figure.
__X__ 6. Show floodplain limits and information.
__X__ 7. Show proposed building footprints and FFE for commercial and multi-family
__X__ 8. Show property lines and easements (existing and proposed).
__X__ 9. Label public and private facilities. A general note can be placed on the plans in lieu of labeling all facilities, if applicable.

XIII. Appendices

__X__ A. Runoff Calculations.
__X__ B. Culvert Calculations.
__X__ C. Pond Calculations.
__X__ D. Other Calculations.

Acknowledgements

Standard Form No. 3 was prepared by: TLS, PC 3/13/20
Date

Include Attachment A – Scope Approval Form (see Standard Form No. 5)
Include Attachment B – Storm Water Quality Plan (see Standard Form No. 4)

Standard Form No. 5 Drainage and Stormwater Treatment Scope Approval Form

Prior to starting a development plan and before the first drainage submittal, a Drainage and Stormwater Treatment Scope Approval Form must be submitted for review and signed by the City Engineer. A signed form shall also be included in every drainage submittal as Attachment A. This Scope Approval Form is for City requirements only. Values may be approximate. The City encourages supporting calculations and figures to be attached.

Project Information	
Project name:	WALTON CREEK AND VILLAGE DRIVE MULTIFAMILY
Project location:	1805 WALTON CREEK RD.
Developer name/contact info:	
Drainage engineer name/contact info:	THOMAS S. PAULSON P.E. (970)819-6380 tomp@landmark-co.com
Application Type:	DP/PP
Proposed Land Use:	MULTIFAMILY

Project Site Parameters	
Total parcel area (acres):	0.65 AC
Disturbed area (acres):	0.01 AC
Existing impervious area (acres, if applicable):	0.01 AC
Proposed new impervious area (acres):	0.36 AC
Proposed total impervious area (acres):	0.36 AC
Proposed number of project outfalls:	2, ONE AT EACH FULL SPECTRUM POND
Number of additional parking spaces:	9 EXTERIOR
Description and site percentage of existing cover/land use(s):	CURRENTLY UNDEVELOPED, GRASSED SITE W/ PORTION OF SIDEWALK RUNNING THROUGH SW CORNER 3% IMP.
Description and site percentage of proposed cover/land use(s):	53% IMP. MULTIFAMILY UNITS
Expected maximum proposed conveyance gradient (%):	≤10%
Description of size (acres) and cover/land use(s) of offsite areas draining to the site	16 AC @ 57% IMP. (BY SEH MASTERSTUDY)

Type of Study Required:

- [ ] Drainage Letter
- [x] Final Drainage Study
- [ ] Conceptual Drainage Study
- [ ] Stormwater Quality Plan

Hydrologic Evaluation:

- [x] Rational Method
- [ ] CUHP/SWMM
- [ ] HEC-HMS
- [ ] Other________________

Project Drainage	
Number of subbasins to be evaluated:	1
Presence of pass through flow (circle):	YES NO 40 CFS TO BE PIPED/SEPARATED
Description of proposed stormwater conveyance on site:	AREA DRAINS/ROOF DRAINS TO HDPE STORM SEWER
Project includes roadway conveyance as part of design evaluation (circle):	YES NO
Description of conveyance of site runoff downstream of site, identify any infrastructure noted in Stormwater Master Plan noted as lacking capacity for minor or major storm event:	NO IDENTIFIED DOWNSTREAM INFRASTRUCTURE LACKING CAPACITY WITHIN MASTERSTUDY
Detention expected onsite (circle):	YES NO
Presence of Floodway or Floodplain on site (circle):	YES NO
Anticipated modification of Floodway or Floodplain proposed (circle):	YES NO
Describe culvert or storm sewer conveyance evaluative method:	HY-8/SSA

Permanent Stormwater Treatment Facility Design Standard (check all that apply with only one standard per tributary basin):

- [x] WQCV Standard
- [ ] TSS Standard
- [ ] Infiltration Standard
- [ ] Constrained Redevelopment WQCV Standard
- [ ] Constrained Redevelopment TSS Standard
- [ ] Constrained Redevelopment Infiltration Standard
- [ ] Does not Require Permanent Stormwater Treatment (attach Exclusion Tracking Form)

Project Permanent Stormwater Treatment	
Justification of choice of proposed design standard, including how the site meets the constrained redevelopment standard, infiltration test results, etc.:	SITE REQUIRES DETENTION TO MATCH HISTORICAL FLOWS AS WELL AS WQ TO TREAT INCREASE IN IMPERVIOUSNESS.
Concept-level permanent stormwater treatment facility design details (type, location of facilities, proprietary structure selection, treatment train concept, etc.):	TWO BIORETENTION / FULL SPECTRUM PONDS WQCV → 5YR → 100YR
Proposed LID measures to reduce runoff volume:	N/A
Will treatment evaluation include off-site, pass through flow (circle):	YES NO

Approvals

THOMAS S. PAULSON P.E. — 1/30/20 — 970-819-6380

Prepared By: (Insert drainage engineer name & firm) — Date — Phone number

Approved By:

Ben Beall — 2/20/20 — 970-871-8293

Printed Name: City Engineer — Date

DESIGN CHECKLIST – Water Quality Capture Volume (WQCV) Standard

WQCV STANDARD Criteria

Treatment facilities must be designed to provide treatment and/or infiltration of the WQCV for 100% of the site. Under certain conditions, up to 20% of the site may be excluded, not to exceed 1 acre. This may apply if it is not practicable to capture runoff from portions of the site and where it is not practicable to construct a separate treatment facility for those same portions of the site.

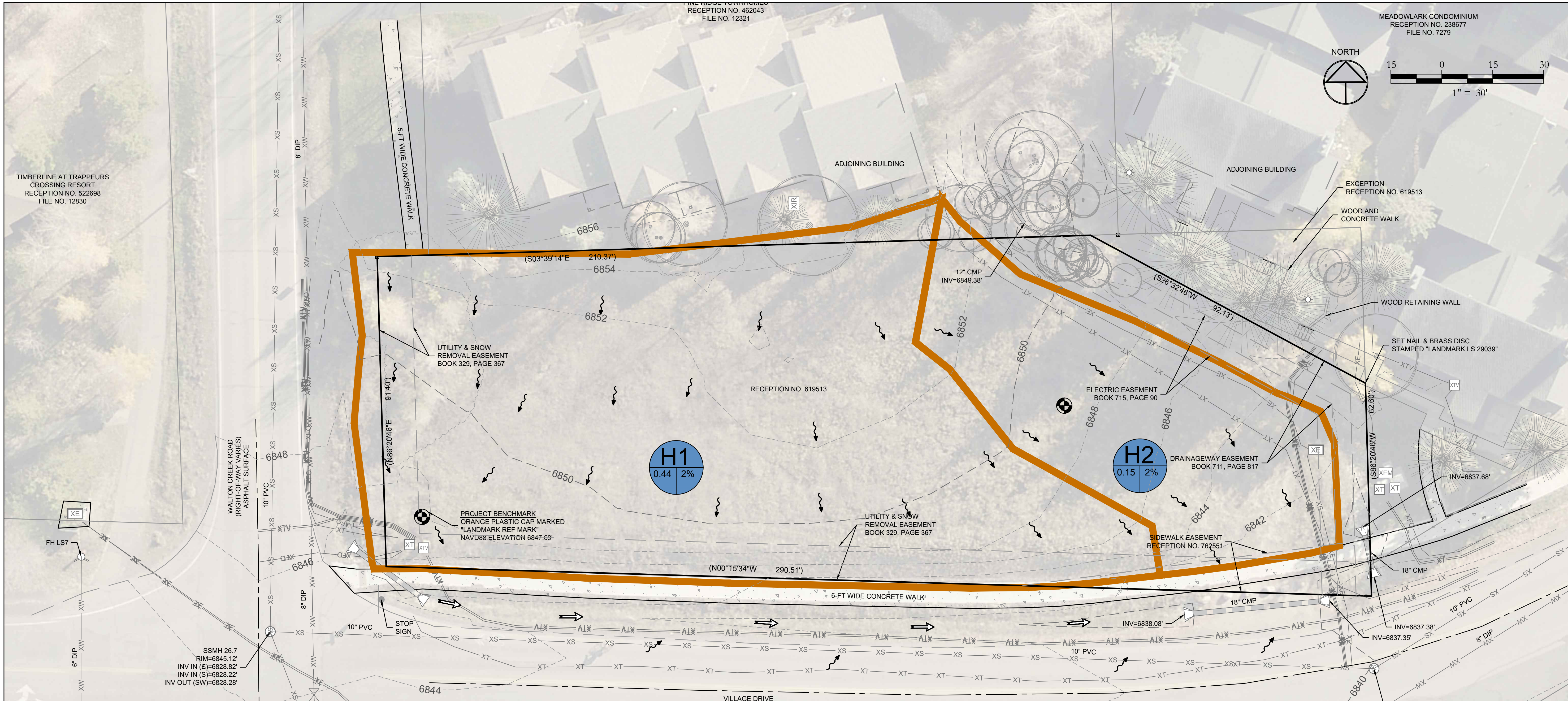
Complete checklist if using the WQCV Standard to meet Design Standard requirements.

Project Name:

Preparer	City	Requirements	
RS		Facilities provide treatment and/or infiltration of the WQCV for 100% of the site	
RS		% of site treated: 98%	
RS		Facility Type: TWO BIORETENTION PONDS	Facility Location: SOUTH SIDE OF BUILDINGS
RS		See Drainage Report section: SEE PAGE 6	

If less than 100% of the site is treated, complete the following:

Preparer	City	Requirements			
		% of site not treated by control measures (not to exceed 20% or 1 acre):			
RS		98%	%	0.01 ACRES	Size (acres)
		Provide explanation of why the excluded area is impractical to treat: SMALL PORTION OF THE DRIVEWAY THAT IS TOO LOW TO DRAIN TO THE BIORETENTION PONDS BASED ON THE EXISTING ELEVATION OF VILLAGE DRIVE.			
		Provide explanation of why another facility is not practicable for the untreated area: THE AREA IS VERY SMALL AND DRAINS TO THE VILLAGE DRIVE ROADSIDE DITCH IN A LIMITED AMOUNT OF SPACE.			



Hydrology Summary for Village Drive

Basin	Total Area (acres)	C2	C5	C10	C50	C100	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	%Imp
H1	0.44	0.01	0.05	0.15	0.33	0.49	0.01	0.02	0.22	0.75	1.28	2%
H2	0.15	0.01	0.05	0.15	0.33	0.49	0.00	0.02	0.08	0.26	0.44	2%
D1	0.27	0.57	0.63	0.66	0.72	0.78	0.40	1.48	0.89	1.45	1.79	71%
D2	0.20	0.59	0.64	0.68	0.73	0.79	0.30	1.53	0.66	1.07	1.32	74%
D3	0.01	0.83	0.86	0.87	0.88	0.89	0.03	2.15	0.06	0.09	0.10	100%
D1 Allow	0.27	0.01	0.05	0.15	0.33	0.49	0.01	0.02	0.15	0.52	0.88	2%
D2 Allow	0.20	0.02	0.06	0.15	0.34	0.50	0.01	0.04	0.14	0.46	0.77	2%

PROJECT:	2136-017	NO.	DATE:	BY:	DESCRIPTION:
DATE:	03/13/20				
DRAWN BY:	TSP				
CHECKED BY:	LCI				

NOT FOR CONSTRUCTION
REVIEW SET
03/13/20

These drawings are instruments of service provided by Landmark Consultants, Inc. and are not to be used for any type of construction or contracting unless signed and sealed by a Professional Engineer in the employ of Landmark Consultants, Inc.

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CIVIL ENGINEERS | SURVEYORS

141 9th Street ~ P.O. Box 774943
Steamboat Springs, Colorado 80477
(970) 871-9494 www.LANDMARK-CO.com

Village Drive
Existing Drainage Exhibit

SHEET
1
Of 2 Sheets

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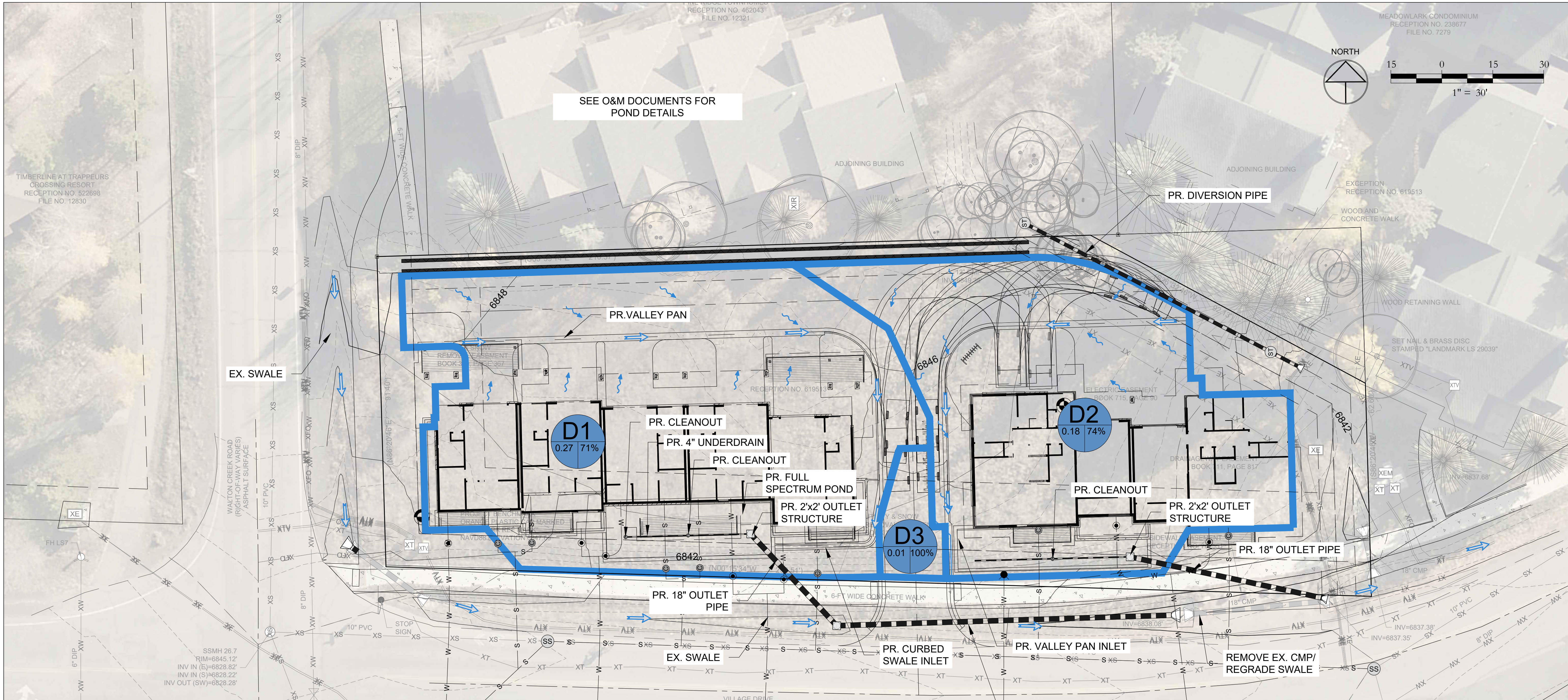

Hydrology Summary for Village Drive

Basin	Total Area (acres)	C2	C5	C10	C50	C100	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	%Imp
H1	0.44	0.01	0.05	0.15	0.33	0.49	0.01	0.02	0.22	0.75	1.28	2%
H2	0.15	0.01	0.05	0.15	0.33	0.49	0.00	0.02	0.08	0.26	0.44	2%
D1	0.27	0.57	0.63	0.66	0.72	0.78	0.40	1.48	0.89	1.45	1.79	71%
D2	0.20	0.59	0.64	0.68	0.73	0.79	0.30	1.53	0.66	1.07	1.32	74%
D3	0.01	0.83	0.86	0.87	0.88	0.89	0.03	2.15	0.06	0.09	0.10	100%
D1 Allow	0.27	0.01	0.05	0.15	0.33	0.49	0.01	0.02	0.15	0.52	0.88	2%
D2 Allow	0.20	0.02	0.06	0.15	0.34	0.50	0.01	0.04	0.14	0.46	0.77	2%

PROJECT: 2136-017	NO.	DATE:	BY:	DESCRIPTION:
DATE: 03/13/20	1	3-19-21	RS	DRT COMMENTS
DRAWN BY: TSP				
CHECKED BY: LCI				

NOT FOR CONSTRUCTION
REVIEW SET
03/13/20

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Village Drive
Proposed Drainage Exhibit

SHEET
2
Of 2 Sheets

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