DESIGN REPORT - SITE, GRADING, STORMWATER & EROSION PLAN

For Phil McNearney

RPP39050000040A aka McNearney Mill, Lot 6
Ponderay Idaho, 83852

Figure 1: Project Vicinity Map

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DANIEL W. LARSON

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Figure 1: Project Vicinity Map 1

Attachments

Soils Information and Map
Discharge Rates for ADS N-12 Pipe
Hydrocad Calculations for Stormwater

Introduction

This report has been prepared to address design considerations for a site plan application on Lot 6 of the McNearney Mill Subdivision for Phil McNearney. More specifically, this Site, Stormwater, and Erosion Control Plan addresses site changes to construct a new industrial building (Shop) as well as provide stormwater controls for improvements planned for the site at this time.

The property will be modified and regraded to direct runoff away from the proposed building with the use of gravel alley sections or valley gutter. Stormwater runoff will be directed to a wet pond and rock infiltration ditch for treatment and detention to reduce the impervious footprint (Idaho Catalog of Storm Water Best Management Practices, 2020).

This report, calculations, and drawings are for review by the City of Ponderay and shall become the property of the Owner when approved for construction. All other requirements for any future building permits must be met by the Owner. This report addresses design decisions and calculations that will aid the City, the Contractor, and the Owner in the review of this proposal.

Project Location

The site is located South West of the Intersection of Colville Lane and Republic Lane in Ponderay Idaho.

Property Identification Numbers *RPP390500000060A* aka Lot 6, McNearney Mill, City of Ponderay, Bonner County, Idaho. Section 2, Township 57 North, Range 2 West, Boise Meridian.

Property owner:	**Location:**	**Size of Lot:**
Phil McNearney	Section 2, T57N, R2W	0.6 Acres

Geotechnical

The USDA NRCS Web Soil Survey was used to categorize the soil characteristics at this site. A site visit confirmed the findings of the NRCS and the soils appeared to be consistent with the Survey. In general, the site consists of Odenson silt loams, soils in Hydrologic group B/D. These soils have a low infiltration rate (high runoff potential), are very deep and very poorly drained. These consist chiefly of volcanic ash and loess.

Soil amendment and underdrains (where feasible) are recommended for any infiltration treatment design. All required testing and inspections will be coordinated by the Owner and Contractor and/or his representative and will be submitted to the Engineer if required at the completion of construction.

Water System

The City of Sandpoint supplies water to the site.

Sewer System

The site is currently served by the Kootenai-Ponderay Sewer District.

Road Specifications

Colville Lane and Republic Lane are privately owned and maintained shared driveways.

Stormwater Facility Calculations

Treatment System

All new impervious surface areas are required to be treated per the standards of Ponderay Idaho. The Idaho Catalog of Storm Water Best Management Practices manual allows for a variety of treatment methods to be considered. The stormwater design concept presented here meets the requirements of Ponderay Code.

The Wet Pond Area (BMP 22: Wetpond) Best Management Practice from the Stormwater Catalog (State of Idaho Department of Environmental Quality, 2020). The wet pond was also sized to treat and detain to the pre-developed 25-year 24-hour runoff event.

The Design also uses a rock infiltration trench (BMP 17: Infiltration Trench) Best Management Practice from the Stormwater Catalog (State of Idaho Department of Environmental Quality, 2020). This infiltration trench was sized to treat and detain the site and roadway drainage to the pre-developed 25-year 24-hour runoff event.

Hydrology and Hydraulics

To protect the drainage and downstream properties from hazardous runoff flooding, the NRCS TR-20 was used for stormwater calculations. Existing drainage basins contributing runoff to the site were determined by site visit and analysis of the available maps. Calculations were made using the Type II, 25-Year, 24-Hour Unit Hydrograph. Rainfall amounts were taken from the NOAA Isopluvial precipitation maps for Idaho.

HydroCAD 10.10-7a was used to model the hydrology and hydraulics of the stormwater runoff. These procedures were developed by the Soil Conservation Service and in HydroCAD, fully-integrated with other H&H calculations to develop an interactive stormwater modeling system. The results of the stormwater model are presented in the following table.

Table 1: Stormwater Summary 25-Year, 24 Hr Storm Event

25 YR Stormwater Summary				
25-Year, 24 Hr Storm	Area (sf)	CN	24-Hr Peak Flow (CFS)	Post-Detention Peak (CFS)
Pre-Developed	28,017	89	1.33	n/a
Post-Developed	28,017	94	2.44	1.19

Calculations were made using the Type II, 2-Year and 25-Year, 24-Hour Unit Hydrograph to ensure that the proposed development will not flood. Refer to the attached HydroCAD calculations for details.

Drainage from the site is directed to the stormwater treatment areas by either an infiltration rock channel or sheet flow (gravel valley gutters). Site water will discharge south into the

existing drainage which flows towards natural drainage. To size the proposed conveyance, the post-development calculations were separated into four basins:

- **Basin A** (North and West side of the development) will be directed into the treatment area by a rock infiltration channel and underdrain network.
- **Basin B** (East and South side of the development) will be directed into the treatment area by shallow sheet flow over the unpaved surface.
- **Basin C** (East section of the existing roof of the shop) will be directed to the wet pond by a stormwater underdrain.
- **Basin D** (Southern section of the proposed shop) will directly enter the wet pond by sheet flow.

The following table shows the stormwater summary for the post developed basins 25 Year, 24 Hr Storm Event.

Table 2: Post Developed Basin Areas

25 YR Stormwater Summary			
Basin	Area (sf)	CN	24-Hr Peak Flow (CFS)
Basin A	10,590	93	0.92
Basin B	12,278	94	1.03
Basin C	2,199	98	0.22
Basin D	2,950	94	0.27

To treat the 25-Year, 24-Hour peak runoff event, the top of the rock infiltration conveyance channel was sized to treat and convey all of Basin A. The calculation assumes that the rock infiltration trench is 3 feet wide, 190 feet long, and has an average depth of 3.25 feet, providing a storage capacity of about 988 cubic feet, assuming the bottom 2 feet of the trench has about 30% voids. The infiltration trench has two outflows: a 6-inch underdrain that collects the infiltrated water, and a conveyance channel overflow. The overflow capacity of R-1 was also calculated in HydroCAD. It was determined that a rock-lined conveyance channel, 6 inches deep, 3 feet wide at the bottom, with 2:1 side slopes, 190 feet in length, and a 0.5% slope, has the capacity to handle 3.93 cubic feet per second (cfs). The peak outflow for the 25-Year, 24-Hour event of the infiltration trench was determined to be about 0.27 cfs.

Basins B, C, and D enter the wet pond for treatment and detention. Basin A enters the wet pond after treatment from the infiltration trench. The 25-Year, 24-Hour peak runoff event was calculated assuming the pond was completely full. HydroCAD determined that a wet pond with approximately 1,232 cubic feet of storage was sufficient to handle the event with a connection to the existing ditch which was rerouted per the city approved plan for "SP18-045" by others for Monarch Marble on the southwest corner of the property. The peak outflow for the 25-Year, 24-Hour event of the wet pond and system was determined to be

about 1.19 cfs. The existing ditch (Bypass ditch) has a capacity of about 1.77 cfs. This ditch is to be constructed by others as enforced by the City of Ponderay.

The wet pond will also have an emergency overflow that will discharge into the existing drainage ditch that flow east. The overflow is board-crested weir with a predefined crest profile ID #10 about 6 ft wide 2:1 side slope back to existing grade. The out flow elevation is set at 25 yr- 24 hr event about 2131.57 ft for the pond.

To determine the size of the underdrain network in the infiltration trench located in Basin A, additional calculations were performed assuming runoff from the front of the property, Colville Lane, and Republic Lane would enter the underdrain network. The calculations show that the north side of the property, Colville Lane, and Republic Lane generate a peak 25-Year, 24-Hour runoff of about 0.51 cfs. HydroCAD shows that a 6-inch ADS Corrugated Pipe with a smooth interior and a 0.50% slope has a flow capacity of 0.57 cfs. Therefore, it was determined that a 6-inch culvert would be sufficient. Refer to the attached HydroCAD calculations and discharge rates for ADS N-12, ADS Drainage Handbook (Figure 3-1). If pipe is blocked the channel of the infiltration trench has a capability of 3.93 cfs which is more that sufficient for a 25 yr- 24 hr event.

Stormwater Facility Construction and Maintenance

The storm water treatment and retention solution for this site is a wet pond facility and infiltration trench.

BMP 17: Infiltration Trenches

Infiltration trenches are shallow (3 to 12 feet deep), backfilled with a sand filter, coarse stone, and lined with filter fabric. The trench surface can be covered with grating and/or consist of stone, gabion, sand, or a grassed covered area with a surface inlet. Depending on the design, the trenches allow for the partial or total infiltration of storm water runoff into the underlying soil. The trenches also provide storage within the voids of the coarse stone and may include a perforated pipe or a prefabricated bottomless chamber at the bottom of the trench to increase its temporary storage capacity. The trenches may have underdrains to convey water away from the trench in case of storm water overflow

Constructions considerations

Construction Timing: An infiltration trench should not be constructed or placed into service until all of the contributing drainage area has been stabilized and approved by the appropriate agency.

Trench Preparation Excavate the trench to the design dimensions. Excavated materials should be placed away from the trench sides to enhance wall stability. Care should also be taken to keep this material away from slopes, neighboring property, sidewalks, and streets. Cover this material with plastic if it will be left in place for more than 30 days.

Fabric Laydown : Cut the geotextile fabric to the proper width before installation. The cut width should include sufficient material to conform to the trench perimeter irregularities and a 12-inch minimum top overlap. Place the geotextile over the trench and unroll a

sufficient length to place the fabric down into the trench. Stones or other anchoring objects should be placed on the geotextile at the edge of the trench to keep the lined trench open during windy periods. When overlaps are required between rolls, the upstream roll should overlap a minimum of 2 feet over the downstream roll to provide a shingled effect. The overlap ensures geotextile continuity and allows the geotextile to conform to the excavated surface during aggregate placement and compaction.

Maintenance Requirements

The observation well should be monitored periodically for water level. For the first year after completing construction, the well should be monitored after every large storm (greater than 1 inch in 24 hours), and during the period from October 15 to April 15, inspections should be conducted monthly. From April 16 through October 14, the facility should be monitored on a quarterly basis. Once the performance characteristics of the structure have been verified, the monitoring schedule can be reduced to an annual basis unless the performance data indicate that a more frequent schedule is required.

Sediment buildup in the top foot of stone aggregate or the surface inlet should be monitored on the same schedule as the observation well. A monitoring well in the top foot of the stone aggregate should be required when the trench has a stone surface. Sediment deposits should not be allowed to buildup to the point where it will reduce the rate of infiltration into the trench.

BMPs used for pretreatment should be inspected regularly. Sediment deposits should be removed, and grassy swales or filter strips should be mowed. Repair any erosion (e.g., rills) in pretreatment swales or filter strips that might concentrate runoff flow and cause erosion before the infiltration trench.

BMP 22: Wet Pond

A wet pond, or retention pond, is a constructed storm water pond with a permanent pool of water that removes pollutants such as suspended solids, organic matter, and metals through settling. The permanent pool of water is partially replaced by storm water runoff during a storm event. In an arid environment, the pool of water may evaporate in between storms. A shallow marsh area located around the perimeter of the pond within the permanent pool volume provides additional pollutant treatment, especially of nutrients and dissolved metals through biological processes

Constructions considerations

Widely acceptable construction standards and specifications, such as those developed by the NRCS or US Army Corp of Engineers, for embankment ponds and reservoirs may aid in building the wet pond.

If the pond area is used as a temporary sediment trap during construction, set the temporary bottom elevation higher than the final pond bottom elevation so accumulated sediment can be removed before final grading. If the sediment meets criteria for a low permeability liner, the pond could be excavated to just below final grade and the sediment left in the bottom of the pond after construction and used as a liner. Sediment used for a soil liner should be graded to provide uniform coverage and thickness.

As with all construction, appropriate erosion control techniques should be used during construction of a wet pond.

Maintenance Requirements

Inspections and maintenance should be performed regularly and within 24 hours after large storm events. Trash and debris removal should also be done regularly to prevent the facility from becoming a dumping ground for trash, construction debris, and yard waste.

The pond should be cleaned of sediment every 2 to 5 years or as needed for proper pond function. Embankments should be inspected for erosion and if erosion is a problem, erosion control devices such as reinforced turf matting or riprap should be installed.

Impoundment structures should be regularly inspected for signs of failure, such as seepage or cracks in the berm. Inspect the structures for animal burrows, erosion, and/or loss of material. Repairs and maintenance should be made immediately to preserve the integrity of the berm including stabilizing the slope, filling any burrow holes, repairing cracks, and stopping seepage.

Weed, mow, and trim vegetation on and around the pond to maintain its health and aesthetic value. The inlet and outlet should be inspected for erosion or undercutting, and clogged or damaged pipes. Erosion control, energy dissipation devices, and pipes should be replaced, cleaned, or repaired as necessary

BMP 32: Landscaping

Establish vegetative cover over all disturbed areas by following the landscaping plans. Methods include seeding, sodding, planting perennial grasses, legumes, native shrubs, wild flowers, bushes, and trees. Native vegetation is strongly encouraged for all landscaping efforts. See Bonner County Title 12; Appendix B: Native Plant List for additional information and guidance.

Maintenance Requirements

Before landscape and stormwater facility sites are fully constructed and established, inspect topsoil periodically and after major storm events for signs of erosion (rills or gullies). Repair damaged areas with additional topsoil, add additional erosion control measures, and reseed as needed.

After construction, monitor soil stability and vegetation. Adjust the soil with amendments, enhancements, microbial inoculants, irrigation, fertilizers, pesticides, and herbicides as needed. Replanting may be required during the first 2 years.

If non-native plants are used in the final landscape plantings, carefully monitor turn, shrubs, and perennial plantings. Add irrigation to water throughout the lifecycle of non-native species not accustomed to drought.

Native species require less maintenance, minimal watering after establishment, and need little or no chemical fertilizers or pesticides.

Grow plantings into dense groupings to reduce or eliminate unwanted weeds and invasive species. Mulch landscape areas with clean straw, bark chips, or wood shavings to preserve soils moisture and block weeds. Cut weeds or use herbicides to prevent damage to landscape plantings from pulling.

Inspect facilities monthly and after large storm events for the first two years. Clear outlets and pipes of sediment and debris. Once the facilities are functioning as designed and no sediment problems exist, reduce inspections to semiannually and after large storm events. Check for functional inlets, erosion, vegetation health, ponding, debris, and general conformance with the design.

Sediment should be removed after construction and before planting. Prevent presilting of facilities during construction by practicing good erosion control measures. Avoid over-compacting soils during construction. Remove sediment from landscape areas in early spring if it begins to inhibit the growth of grass. Avoid over irrigation (don't saturate the soils).

Erosion and Sediment Control BMP's

To properly construct this project, one-half acre of the site will be disturbed, including:

- Tree and brush removal
- Stripping and stockpiling of topsoil
- Driveway grading
- Building construction
- Fine grading of landscape and stormwater facilities
- Landscaping and planting

All disturbed exposed areas will be covered with suitable topsoil, mulched, and either landscaped or re-vegetated on slopes 2:1 or less. Slopes steeper than 2:1 will be stabilized with stone mulch, riprap or boulders.

Temporary Erosion and Sediment Controls

All temporary erosion control features shall be installed and maintained as detailed and shall prevent stormwater runoff or sediment migration off-site. Barriers shall be placed perpendicular to the direction of flow and shall be deployed before construction begins. Leave all temporary stormwater and erosion control measures in place until vegetation has been re-established. Construct fiber rolls as shown on plans or where overland flow may allow runoff to leave the construction site or enter the neighboring properties. Mulching of disturbed, final graded areas can be done with hay, straw, or grass clippings (8-10 pounds per 100 sf).

BMP 36: Constructing Timing

Construction activities for this site grading will proceed as follows:

Construction Schedule	Timing
Install Temporary Erosion Controls	Aug-24
Excavation and grading	Aug-24
Rough grade landscape areas and bioswales	Aug-24
Excavate and Pour Building Foundation	Aug-24
Utility Construction	Aug-24
Begin Framing	Aug-24
Finish grade landscape areas	Oct-24
Reseed slopes and distrubed areas	Oct-24

By constructing in the dry season, the risk of sediment laden runoff is minimized and the sequence of construction will occur during optimal conditions. The Owner and Contractor shall continually monitor the site conditions and progress of the work, keeping erosion control measures in good repair.

BMP 37: Staging Areas

Construction staging areas are limited by the site topography and available space on or adjacent to the property. The existing driveway will be utilized for staging until it is fully removed during construction. Additional staging areas along the developed private road network above the property will be required.

BMP 38: Preserve Topsoil and Vegetation

Construction fencing (orange or green) should be placed around all trees to be protected (see Plans) and areas of topsoil or natural areas to remain undisturbed to minimize bare soil exposure. Grading activity areas shall be limited to those shown on the Plan. Keep all construction equipment, materials, and waste within the areas designated on the Plan and out of areas to be preserved.

BMP 39: Clearing Limits

Minimize the total area of bare soil exposed to 1 acre and cover with straw or stone mulch within 14 days of disturbance. Mulch slopes and cover exposed driveway surfaces with rock as grading progresses to reduce dust and erosion potential. Do not disturb areas outside of the grading limits established by the Plan. At the end of construction, prepare all slopes and landscape areas for seeding or include seed in the erosion control mulch used.

BMP 40: Vehicle Sediment Control

A pad of coarse aggregate or a construction mat should be installed at the entry/exit of the project. If tracking onto the existing pavement is a problem, additional measures such as rattle plates, a wheel wash, or rumble strips should be included.

BMP 41: Stabilize Construction Roads and Staging Areas

A pad of coarse aggregate should be laid for staging areas if not already graveled or otherwise impervious.

BMP 43: Dust Control

Control dust and wind erosion by roughening the disturbed surface areas to reduce with velocity. Seed, sod, mulch, roughen surface, use sprinklers, or us soil binders on disturbed areas to be stabilized. For construction roadways, stabilize (BMP 41), sprinkle, or use chemical tackifiers to eliminate dust. Do not overwater roadways, creating erosion. Additional dust control measures to consider:

- Minimize disturbed surface area by limiting the amount of bare soil exposed at one time.
- Limit work on exposed soils on windy days.
- Clean up dusty spills immediately and plan ahead to limit dust.
- Establish vegetation on disturbed areas already graded.
- Consider using wind barriers (berms, silt fence, or similar)

- Roughen surface using tilling, disking, furrows across prevailing wind, rip or scarify to an irregular surface (BMP 58).
- Water or sweep often.
- Spray-on chemical soil treatments (palliatives), including mineral salts, petroleum resins, asphalt emulsion, acrylics, and adhesives.
- Reduce speed limits on unpaved surfaces (never exceed 25 mph).
- Prevent transport of dusty materials uncovered.
- Enclose storage and handling areas in storage silos, three-sided bunkers, or open-ended buildings. Wind fencing may be used in temporary situations. Use of water or foam spay bars may also be used to reduce emissions.
- Keep dusty storage piles covered.

BMP 44: Stockpile Management

Cover stockpiles of erodible materials, particularly topsoil, sawdust, landscaping bark, compost, mulch, sand, fly ash, stucco, hydrated lime or gypsum, aggregates, cold mix asphalt, pressure treated wood, or sediments. Use plastic sheeting, pervious fabrics, or tarps and weight or stake down to prevent wind removal. Tie-down ropes, large rocks, tires, or other heavy objects may also be used. For long-term stockpiling, mulch, vegetation, or soil binders should be considered.

Additional erosion control measures around the stockpile may be required to reduce storm water runoff damage from the impervious surface of the stockpile. Use a sediment control barrier around the stockpile perimeter such as berms (BMP 70), dikes (BMP 69), fiber rolls (BMP 64), silt fences (BMP 65), or biofilter bags (BMP 63).

Locate stockpile 50 feet from storm water flows, drainages, inlets, outlets, lakes, or wetlands. Avoid placing in streets or paved areas if possible.

BMP 52: Mulching

Apply straw, grass, grass hay, compost, wood chips, or wood fibers onto exposed soils leaving no more than 1 acre exposed for no more than 14 days. Driveway graded surfaces should be mulched or covered by aggregate as soon as practical to prevent erosion and reduce dust. Slopes steeper than 2:1 may require netting or tacking agents to hold mulch in place.

If wood chips or fibers are used, especially if obtained by chipping trees or stumps on the site, limit use to slopes under 6%. If vegetation is desired, treat chipped areas with a nitrogen fertilizer to aid plant germination and growth – otherwise wood chips tent to reduce growth of undesirable plants.

Use wood or stone mulches in areas that are not desirable to mowed or maintain. Bark chips in particular should not be used on sloped areas as they tend to be carried away by spring runoff.

Gravel or crushed rock placed as mulch should be placed at 10 tons / 0.10 acre (4,400 sf) at a depth of 3 inches (average). Use where subject to traffic or on slopes where maintenance of vegetation is not desired.

Hay or straw mulch should be free of unwanted seeds and applied at 2 or 3 bales per 1,100 sf of exposed soil at a depth of 2 to 3 inches in a uniform mat. No more than 40% of the

original ground or exposed soils should be visible through the mat. Netting or tacking agents may be needed on slopes exposed to wind or steeper than 2:1.

Wood fiber mulches should be used where plant growth is to be inhibited, particularly on slopes steeper than 3:1 where mowing or maintenance of vegetation is not desired. If used in areas where growth is to be encouraged, nitrogen treatment will be needed. Apply to an average depth of 3 inches or about 25 lbs per 1,000 sf.

Compost used as mulching should be applied to the Grassed Infiltration Area and any other areas where growth (grasses) is desired. Apply compost at a depth of 3 inches over areas where seeding is to be done.

Inspect all mulched areas weekly and repair any damaged or exposed soils immediately. Mulching should cease once vegetation is re-established.

BMP 64: Fiber Rolls

A Fiber Roll (wattle/compost-filled socks) consists of straw, flax, or other similar materials bound into a biodegradable tubular plastic or similar encasing material. Fibers rolls should be placed along a contour unless otherwise shown in plans. For slope inclinations 2:1 or greater, fiber rolls should be placed a maximum interval of 10 ft. When placing, turn the ends of the fiber roll up slope to prevent runoff from going around the roll. If more than one wattle is placed in a row, the rolls shall be overlapped a minimum of 12 inches. Maintain rolls daily during extended rain events, after rain events, and two-week intervals during dry season. Sediment shall be removed when sediment accumulation reaches one-half of the exposed height of the roll.

BMP 70 Temporary Berms

A berm or ridge of compacted soil, compost, or sandbags which is created to intercept and divert runoff from small construction areas. They are often constructed along the top edge of a fill slope but may also be constructed along a roadway, across a roadway (a transverse berm) at an angle with the centerline.

Temporary berms are used to direct or divert runoff flow from newly constructed slopes until vegetation is established or other permanent measures are in place. They intercept the stormwater flow from the construction area and direct it to temporary slopes drains or protected outlets for safe discharge. They can also be used as barriers to collect and store runoff. They can be used at storm drain inlets, across minor ditches or swales, or other areas where the structure is temporary.

Soil berms have an approximate height of 12 to 20 inches with a minimum top width of 2 to 3 feet and side slopes of 2:1 or flatter. Berms should be high enough to prevent flow from overtopping and are normally constructed of embankment materials. Grade to drain to a slope or drain inlet. Compact the entire width of the berm with a bulldozer or loader/grader wheels.

Compost berms act as filter berms and are most effective when constructed 1 foot high by 2 feet wide or 1.5 feet high and 3 feet wide. Construct with 25-100% organic matter with particles not to exceed 3-inches thick or 6-inches long. Particle gradation should also be 90-100% passing a 1-in. filter, 70-100% passing the ¾ inch filter, and 30%-75% passing the ¼ inch filter.

Sandbag berms have the following dimensions

- Height: 20 in. minimum
- Top Width: 20 in. minimum
- Bottom Width: 4-1/4 to 5 feet
- Sandbag size – length 2 -2.6 ft, width 16-20 in., depth or thickness 6-8 inches. and weight 88 to 132 lbs.

Install so that flow between bags is prevented. Stack bags in an interlocking fashion but no more than 3 bags high without widening the base. Can be used to impound the volume of the design storm.

Operation and Maintenance Plan

Temporary and Permanent Erosion and Stormwater control measures will be the responsibility of the Owner:

Inspection Schedule & Maintenance Activities

As described above, both temporary and permanent erosion and sediment control measures should be inspected by the Owner and/or Contractor. Below is an inspection schedule table for convenience.

Stormwater Feature or Erosion Control Measure	Inspection Frequency	Maintenance Activities
Mulching	Weekly & following major rain event	Mulch exposed soil
Silt Fence	Weekly & following major rain event	Repair and remove sediment
Fiber Rolls	Weekly & following major rain event	Repair and remove sediment
Inlet Protection	Weekly & following major rain event	Repair and remove sediment
Riprap Slope Protection	Monthly the first year and bi-annually thereafter	Replace or repair stones that have moved
Slope Roughening	Weekly & following major rain event	Replace topsoil removed by erosion and seed
Riprap	Monthly the first year and bi-annually thereafter	Replace or repair stones that have moved
Stormwater Facilities Infiltration Trenches Wetpond	After significant storms the first year and quarterly thereafter	Remove sediment and debris. Replace aggregates as needed.

In conclusion, I find that the proposed permanent improvements if properly constructed and maintained as described herein and shown on the plans, will treat and detain the additional runoff to be generated with the future construction on this property.

References

Idaho Catalog of Storm Water Best Management Practices. (2020, April). *Idaho Catalog of Storm Water Best Management Practices.* Retrieved from deq.idaho.gov/water-quality/wastewater/storm-water/: https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14968

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Kennedy Engineers. (1992). *Stormwater Management Plan Criteria and Engineering Standards.* Spokane, WA: Interagency Stormwater Committee.

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Map Scale: 1:357 if printed on A portrait (8.5" x 11") sheet.

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Meters: 0 5 10 20 30

Feet: 0 15 30 60 90

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N 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: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties
Survey Area Data: Version 17, Sep 9, 2021

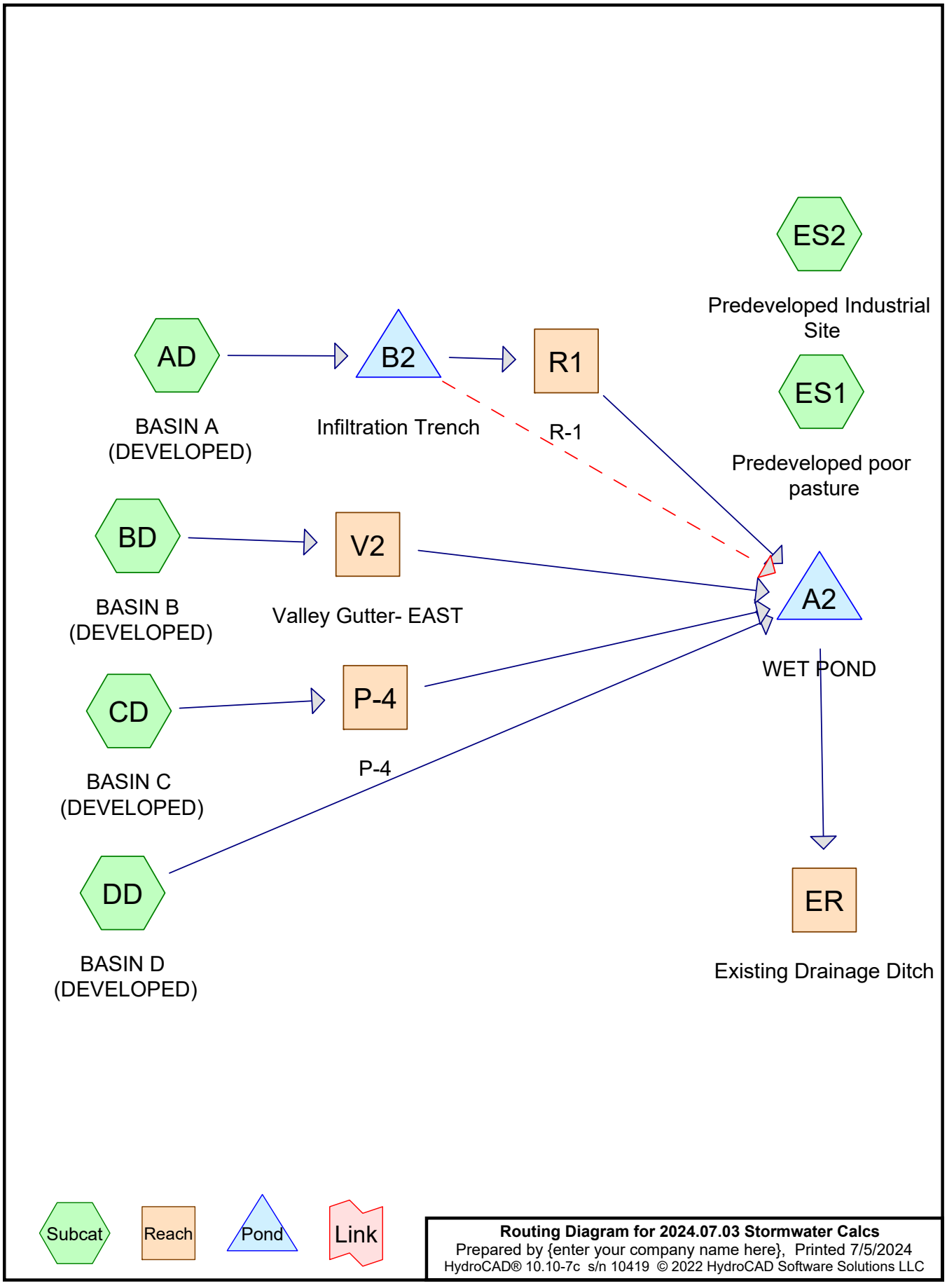
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 15, 2010—Aug 23, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
34	Odenson silt loam, 0 to 2 percent slopes	0.6	100.0%
Totals for Area of Interest		**0.6**	**100.0%**



Routing Diagram for 2024.07.03 Stormwater Calcs
Prepared by {enter your company name here}, Printed 7/5/2024

Project Notes

Rainfall events imported from "2023.03.12 Stormwater Calcs.hcp"
Rainfall events imported from "2023.03.12 Stormwater Calcs.hcp"
Rainfall events imported from "5_21_24 Hydrocad _DWL.hcp"

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR, 24HR	Type II 24-hr		Default	24.00	1	2.00	2
2	25-YR, 24-HR	Type II 24-hr		Default	24.00	1	3.00	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.268	96	Gravel surface, HSG D (AD, BD)
0.127	80	Pasture/grassland/range, Good, HSG D (AD, BD, DD)
0.643	89	Pasture/grassland/range, Poor, HSG D (ES1)
0.061	98	Paved roads w/curbs & sewers, HSG D (AD, BD)
0.187	98	Roof (AD, CD, DD)
0.643	93	Urban industrial, 72% imp, HSG D (ES2)
1.930	**92**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.742	HSG D	AD, BD, DD, ES1, ES2
0.187	Other	AD, CD, DD
1.930		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.268	0.000	0.268	Gravel surface	AD, BD
0.000	0.000	0.000	0.127	0.000	0.127	Pasture/grassland/range, Good	AD, BD, DD
0.000	0.000	0.000	0.643	0.000	0.643	Pasture/grassland/range, Poor	ES1
0.000	0.000	0.000	0.061	0.000	0.061	Paved roads w/curbs & sewers	AD, BD
0.000	0.000	0.000	0.000	0.187	0.187	Roof	AD, CD, DD
0.000	0.000	0.000	0.643	0.000	0.643	Urban industrial, 72% imp	ES2
0.000	**0.000**	**0.000**	**1.742**	**0.187**	**1.930**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	P-4	2,132.80	2,132.00	160.0	0.0050	0.009	0.0	6.0	0.0
2	B2	2,132.00	2,131.00	200.0	0.0050	0.009	0.0	6.0	0.0

Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment AD: BASIN A (DEVELOPED) Runoff Area=10,590 sf 44.73% Impervious Runoff Depth=1.24"
Tc=5.0 min CN=92 Runoff=0.55 cfs 0.025 af

Subcatchment BD: BASIN B (DEVELOPED) Runoff Area=12,278 sf 13.53% Impervious Runoff Depth=1.40"
Flow Length=200' Slope=0.0050 '/' Tc=7.9 min CN=94 Runoff=0.63 cfs 0.033 af

Subcatchment CD: BASIN C (DEVELOPED) Runoff Area=2,199 sf 100.00% Impervious Runoff Depth=1.77"
Tc=5.0 min CN=98 Runoff=0.15 cfs 0.007 af

Subcatchment DD: BASIN D (DEVELOPED) Runoff Area=2,950 sf 75.05% Impervious Runoff Depth=1.40"
Tc=5.0 min CN=94 Runoff=0.17 cfs 0.008 af

Subcatchment ES1: Predeveloped poor Runoff Area=28,017 sf 0.00% Impervious Runoff Depth=1.03"
Flow Length=200' Slope=0.0250 '/' Tc=20.8 min CN=89 Runoff=0.72 cfs 0.055 af

Subcatchment ES2: Predeveloped Runoff Area=28,017 sf 72.00% Impervious Runoff Depth=1.31"
Flow Length=200' Slope=0.0250 '/' Tc=20.8 min CN=93 Runoff=0.92 cfs 0.070 af

Reach ER: Existing Drainage Ditch Avg. Flow Depth=0.43' Max Vel=1.02 fps Inflow=0.62 cfs 0.051 af
n=0.025 L=245.0' S=0.0024 '/' Capacity=1.77 cfs Outflow=0.57 cfs 0.051 af

Reach P-4: P-4 Avg. Flow Depth=0.17' Max Vel=2.42 fps Inflow=0.15 cfs 0.007 af
6.0" Round Pipe n=0.009 L=160.0' S=0.0050 '/' Capacity=0.57 cfs Outflow=0.14 cfs 0.007 af

Reach R1: R-1 Avg. Flow Depth=0.01' Max Vel=0.21 fps Inflow=0.01 cfs 0.004 af
n=0.030 L=190.0' S=0.0057 '/' Capacity=3.93 cfs Outflow=0.01 cfs 0.004 af

Reach V2: Valley Gutter- EAST Avg. Flow Depth=0.14' Max Vel=0.53 fps Inflow=0.63 cfs 0.033 af
n=0.030 L=210.0' S=0.0040 '/' Capacity=1.35 cfs Outflow=0.51 cfs 0.033 af

Pond A2: WET POND Peak Elev=2,131.45' Storage=1,121 cf Inflow=0.74 cfs 0.052 af
Primary=0.62 cfs 0.051 af Secondary=0.00 cfs 0.000 af Outflow=0.62 cfs 0.051 af

Pond B2: Infiltration Trench Peak Elev=2,133.51' Storage=920 cf Inflow=0.55 cfs 0.025 af
Primary=0.01 cfs 0.004 af Secondary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.004 af

Total Runoff Area = 1.930 ac Runoff Volume = 0.199 af Average Runoff Depth = 1.24"
63.14% Pervious = 1.218 ac 36.86% Impervious = 0.711 ac

Summary for Subcatchment AD: BASIN A (DEVELOPED)

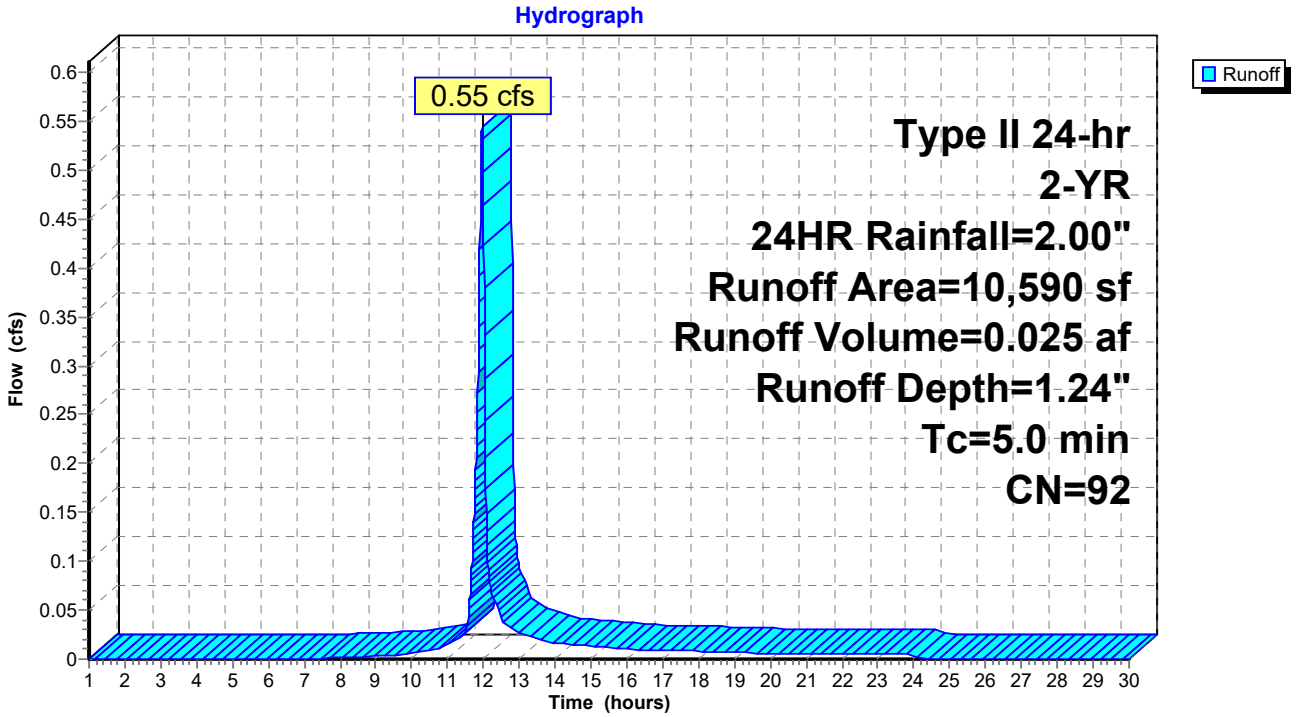
Runoff = 0.55 cfs @ 11.96 hrs, Volume= 0.025 af, Depth= 1.24"
Routed to Pond B2 : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-YR, 24HR Rainfall=2.00"

	Area (sf)	CN	Description
	1,002	98	Paved roads w/curbs & sewers, HSG D
	2,909	96	Gravel surface, HSG D
*	3,735	98	Roof
	2,944	80	Pasture/grassland/range, Good, HSG D
	10,590	92	Weighted Average
	5,853		55.27% Pervious Area
	4,737		44.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment AD: BASIN A (DEVELOPED)



Summary for Subcatchment BD: BASIN B (DEVELOPED)

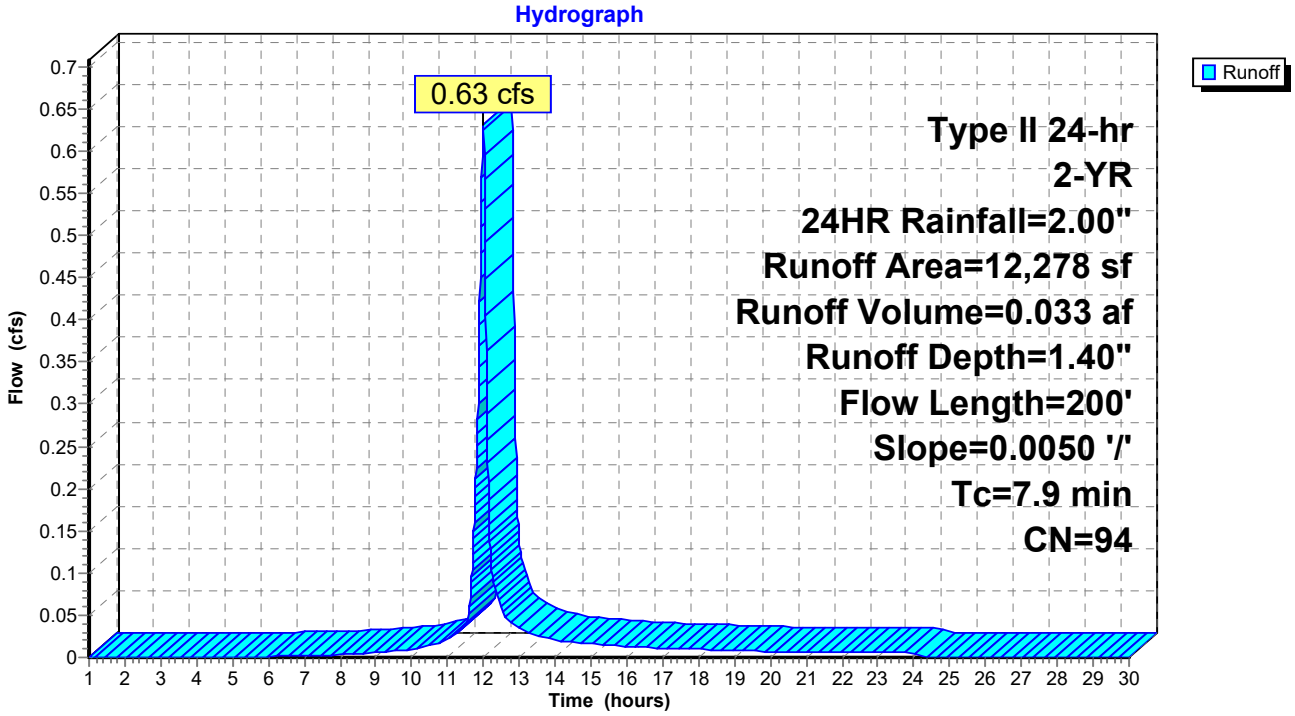
Runoff = 0.63 cfs @ 11.99 hrs, Volume= 0.033 af, Depth= 1.40"
Routed to Reach V2 : Valley Gutter- EAST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-YR, 24HR Rainfall=2.00"

Area (sf)	CN	Description
1,661	98	Paved roads w/curbs & sewers, HSG D
8,780	96	Gravel surface, HSG D
1,837	80	Pasture/grassland/range, Good, HSG D
12,278	94	Weighted Average
10,617		86.47% Pervious Area
1,661		13.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	200	0.0050	1.14		**Shallow Concentrated Flow, Gravel Valley** Unpaved Kv= 16.1 fps
5.0					**Direct Entry,**
7.9	200	Total			

Subcatchment BD: BASIN B (DEVELOPED)



Summary for Subcatchment CD: BASIN C (DEVELOPED)

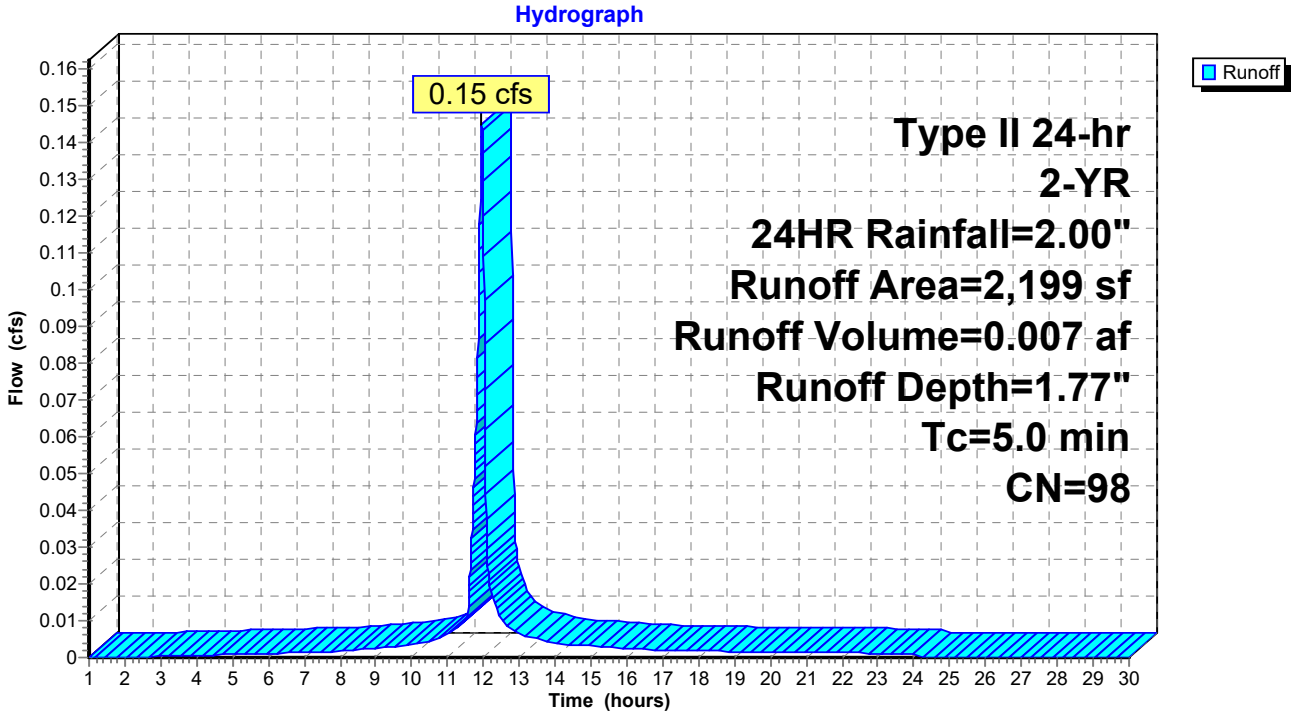
Runoff = 0.15 cfs @ 11.96 hrs, Volume= 0.007 af, Depth= 1.77"
Routed to Reach P-4 : P-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-YR, 24HR Rainfall=2.00"

	Area (sf)	CN	Description
*	2,199	98	Roof
	2,199		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment CD: BASIN C (DEVELOPED)



Summary for Subcatchment DD: BASIN D (DEVELOPED)

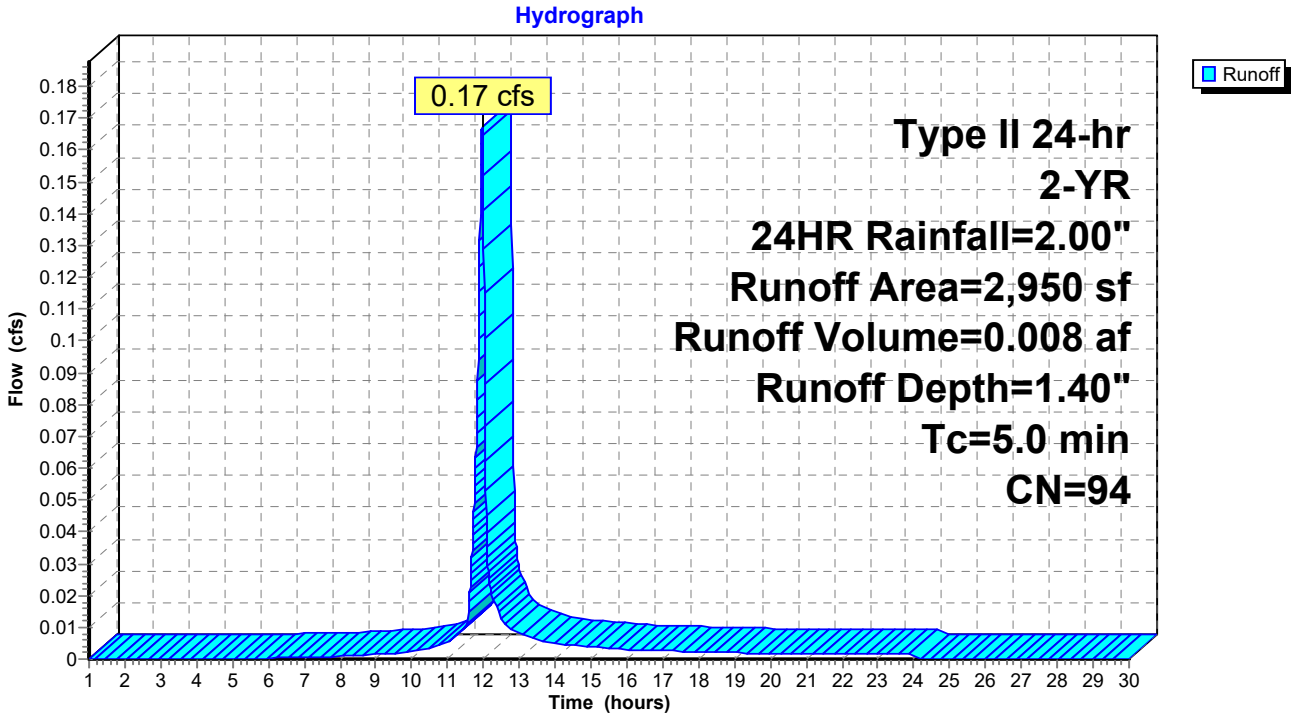
Runoff = 0.17 cfs @ 11.96 hrs, Volume= 0.008 af, Depth= 1.40"
Routed to Pond A2 : WET POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-YR, 24HR Rainfall=2.00"

	Area (sf)	CN	Description
*	2,214	98	Roof
	736	80	Pasture/grassland/range, Good, HSG D
	2,950	94	Weighted Average
	736		24.95% Pervious Area
	2,214		75.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment DD: BASIN D (DEVELOPED)



Summary for Subcatchment ES1: Predeveloped poor pasture

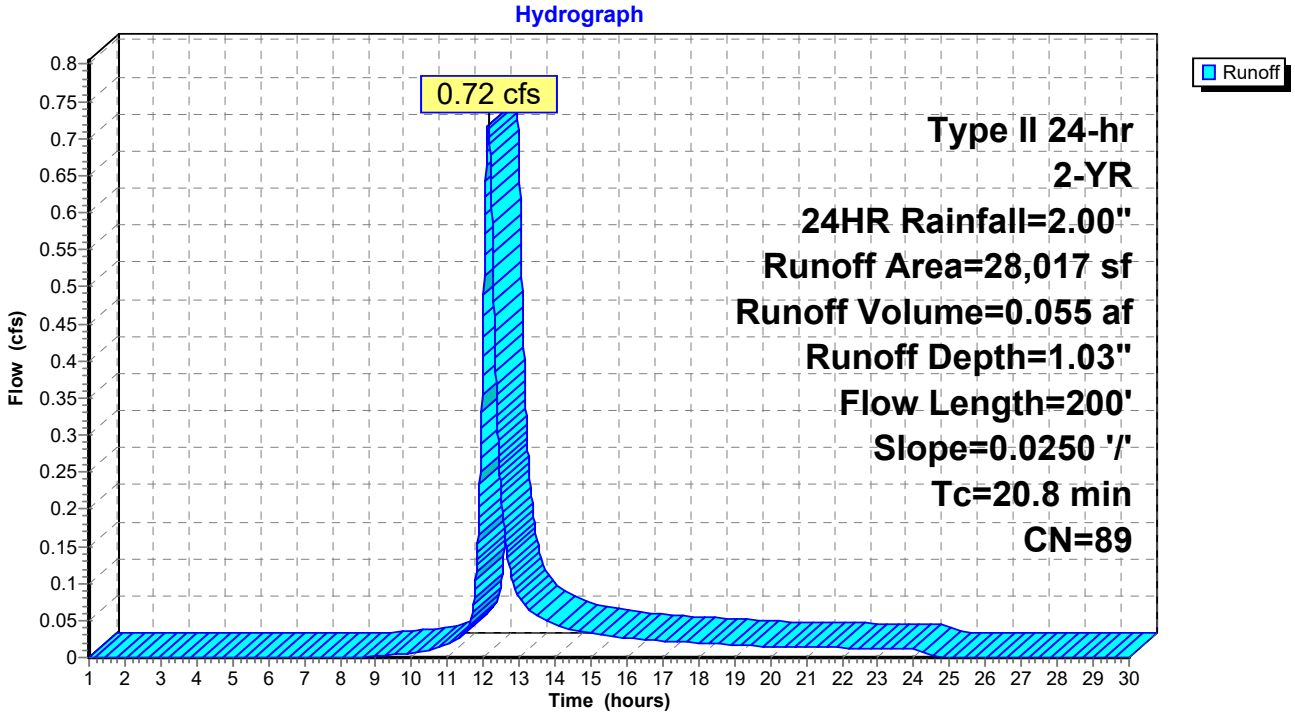
Runoff = 0.72 cfs @ 12.13 hrs, Volume= 0.055 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-YR, 24HR Rainfall=2.00"

Area (sf)	CN	Description
28,017	89	Pasture/grassland/range, Poor, HSG D
28,017		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	200	0.0250	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.80"

Subcatchment ES1: Predeveloped poor pasture



Summary for Subcatchment ES2: Predeveloped Industrial Site

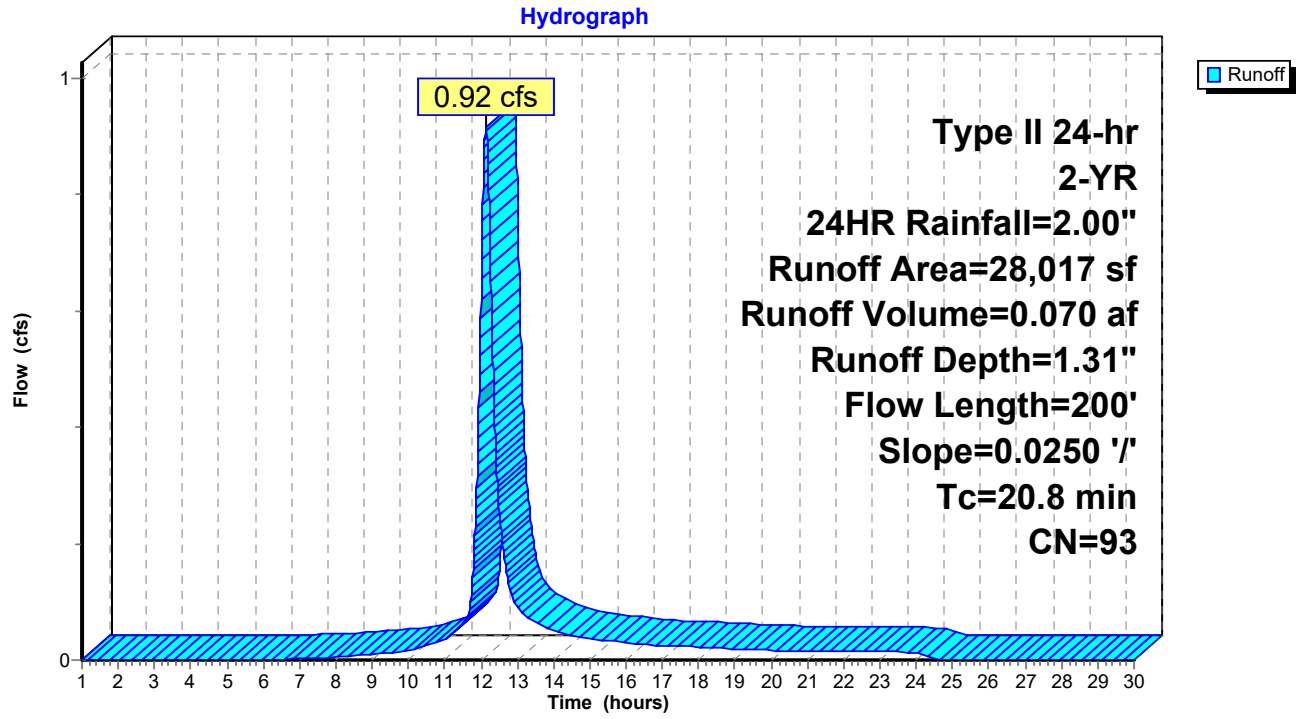
Runoff = 0.92 cfs @ 12.13 hrs, Volume= 0.070 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-YR, 24HR Rainfall=2.00"

Area (sf)	CN	Description
28,017	93	Urban industrial, 72% imp, HSG D
7,845		28.00% Pervious Area
20,172		72.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	200	0.0250	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.80"

Subcatchment ES2: Predeveloped Industrial Site



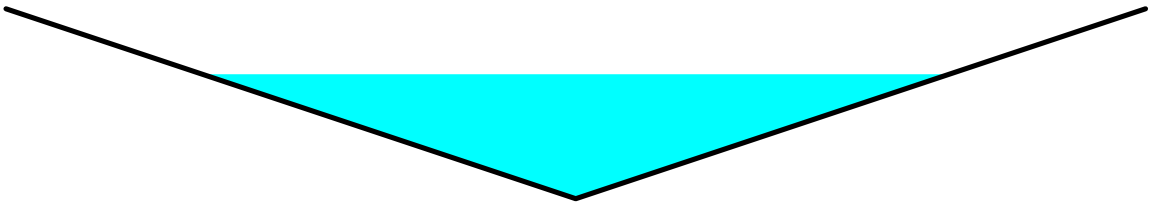
Summary for Reach ER: Existing Drainage Ditch

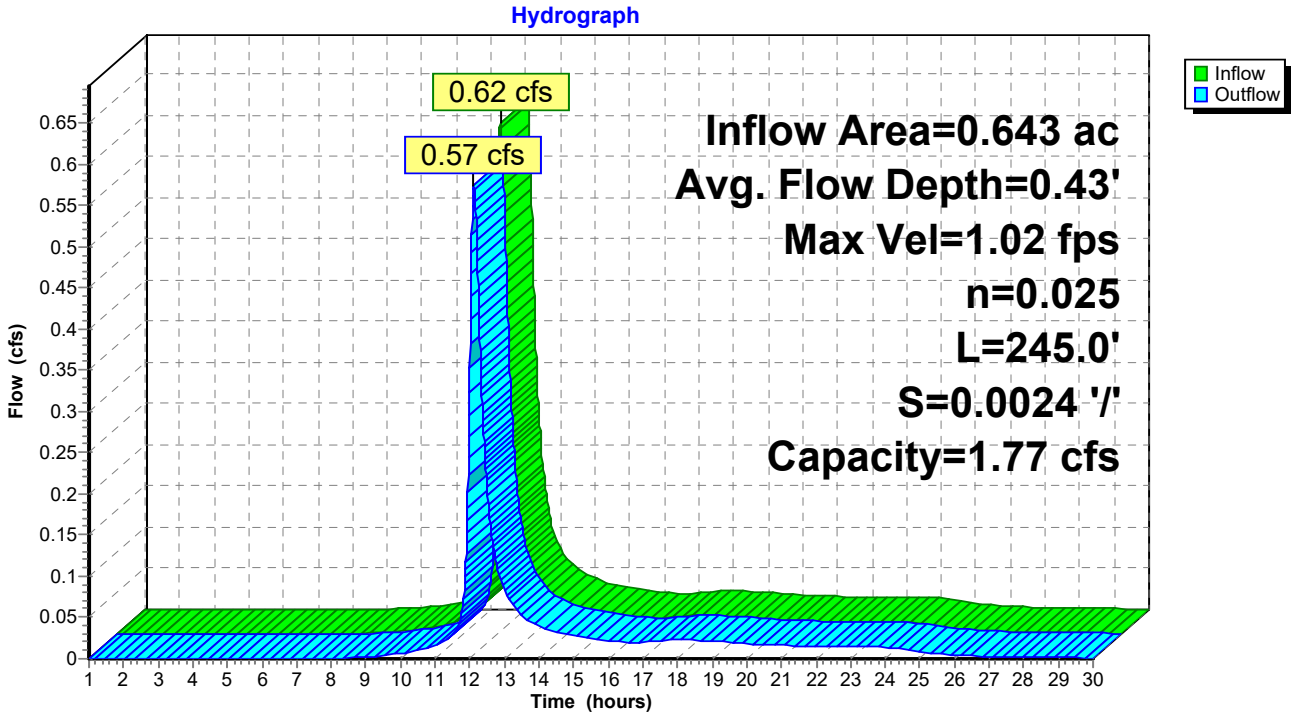
Inflow Area = 0.643 ac, 38.59% Impervious, Inflow Depth > 0.96" for 2-YR, 24HR event
Inflow = 0.62 cfs @ 12.07 hrs, Volume= 0.051 af
Outflow = 0.57 cfs @ 12.12 hrs, Volume= 0.051 af, Atten= 7%, Lag= 3.2 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.02 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.38 fps, Avg. Travel Time= 10.8 min

Peak Storage= 138 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.43' , Surface Width= 2.60'
Bank-Full Depth= 0.66' Flow Area= 1.3 sf, Capacity= 1.77 cfs

0.00' x 0.66' deep channel, n= 0.025 Short grass
Side Slope Z-value= 3.0 '/' Top Width= 3.96'
Length= 245.0' Slope= 0.0024 '/'
Inlet Invert= 2,131.00', Outlet Invert= 2,130.40'





Summary for Reach P-4: P-4

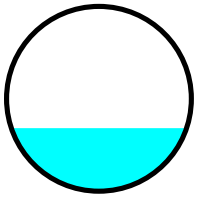
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.050 ac,100.00% Impervious, Inflow Depth = 1.77" for 2-YR, 24HR event
Inflow = 0.15 cfs @ 11.96 hrs, Volume= 0.007 af
Outflow = 0.14 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 1%, Lag= 0.7 min
Routed to Pond A2 : WET POND

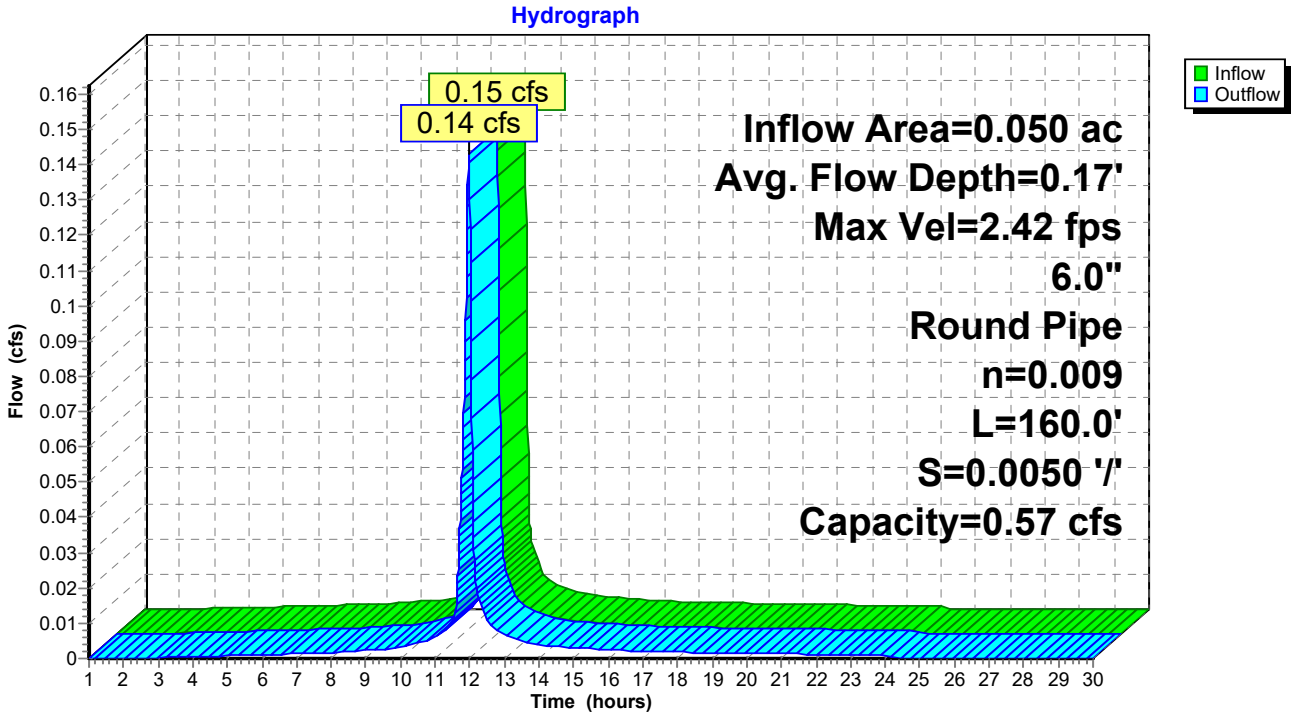
Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.42 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 3.8 min

Peak Storage= 9 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.17' , Surface Width= 0.47'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.57 cfs

6.0" Round Pipe
n= 0.009 Corrugated PE, smooth interior
Length= 160.0' Slope= 0.0050 '/'
Inlet Invert= 2,132.80', Outlet Invert= 2,132.00'



Reach P-4: P-4


Hydrograph
Inflow
Outflow
0.15 cfs
0.14 cfs
Inflow Area=0.050 ac
Avg. Flow Depth=0.17'
Max Vel=2.42 fps
6.0"
Round Pipe
n=0.009
L=160.0'
S=0.0050 '/'
Capacity=0.57 cfs
Flow (cfs)
0 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1 0.11 0.12 0.13 0.14 0.15 0.16
Time (hours)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Summary for Reach R1: R-1

Inflow Area = 0.243 ac, 44.73% Impervious, Inflow Depth > 0.20" for 2-YR, 24HR event
Inflow = 0.01 cfs @ 17.04 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 17.37 hrs, Volume= 0.004 af, Atten= 2%, Lag= 19.8 min
Routed to Pond A2 : WET POND

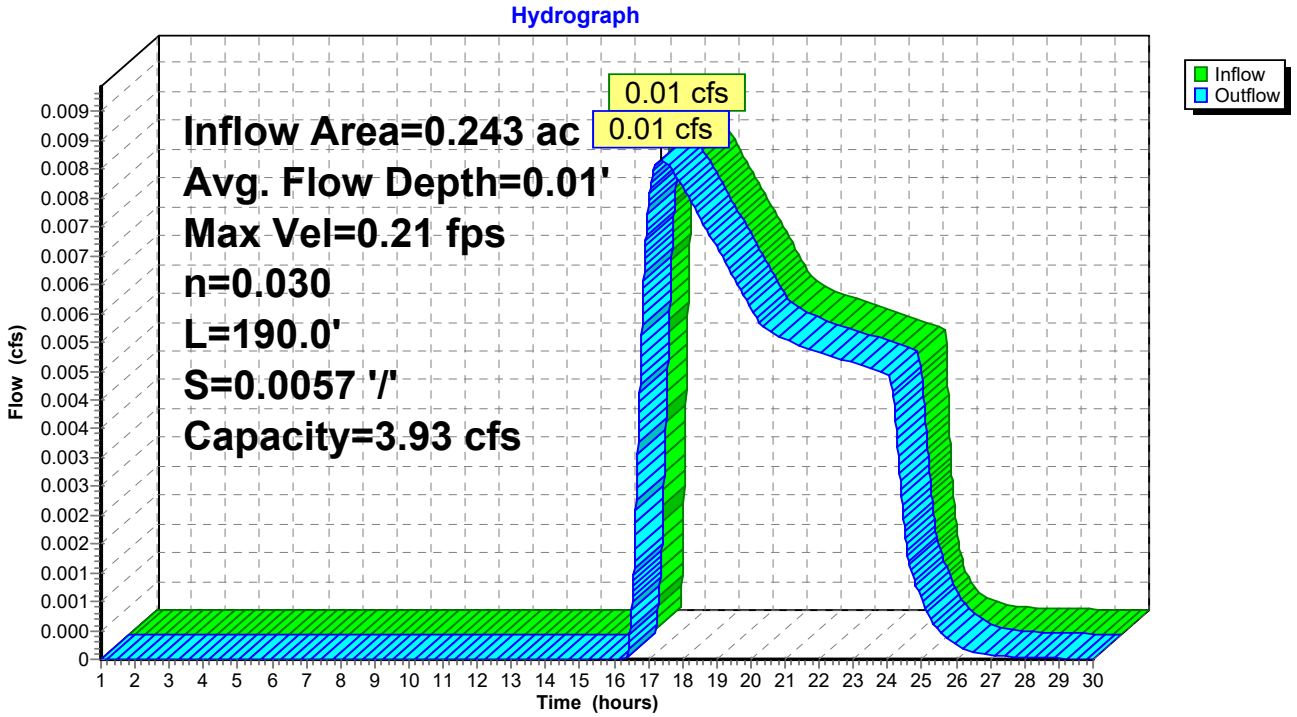
Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.21 fps, Min. Travel Time= 14.9 min
Avg. Velocity = 0.15 fps, Avg. Travel Time= 20.6 min

Peak Storage= 8 cf @ 17.37 hrs
Average Depth at Peak Storage= 0.01' , Surface Width= 3.05'
Bank-Full Depth= 0.50' Flow Area= 2.0 sf, Capacity= 3.93 cfs

3.00' x 0.50' deep channel, n= 0.030 Riprap, 1-inch
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 190.0' Slope= 0.0057 '/'
Inlet Invert= 2,133.50', Outlet Invert= 2,132.42'

‡

Reach R1: R-1



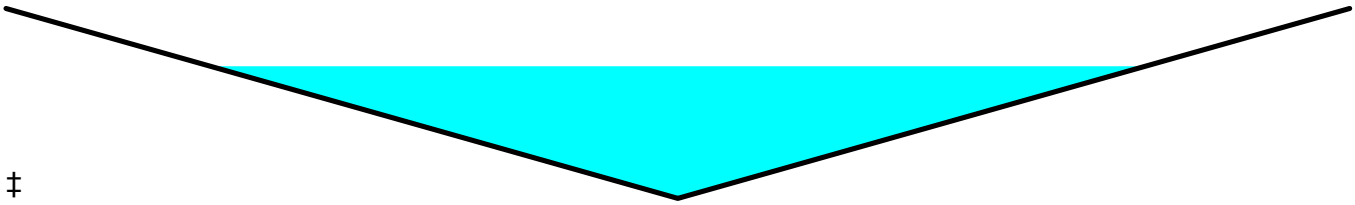
Summary for Reach V2: Valley Gutter- EAST

Inflow Area = 0.282 ac, 13.53% Impervious, Inflow Depth = 1.40" for 2-YR, 24HR event
Inflow = 0.63 cfs @ 11.99 hrs, Volume= 0.033 af
Outflow = 0.51 cfs @ 12.04 hrs, Volume= 0.033 af, Atten= 19%, Lag= 3.2 min
Routed to Pond A2 : WET POND

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.53 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 21.1 min

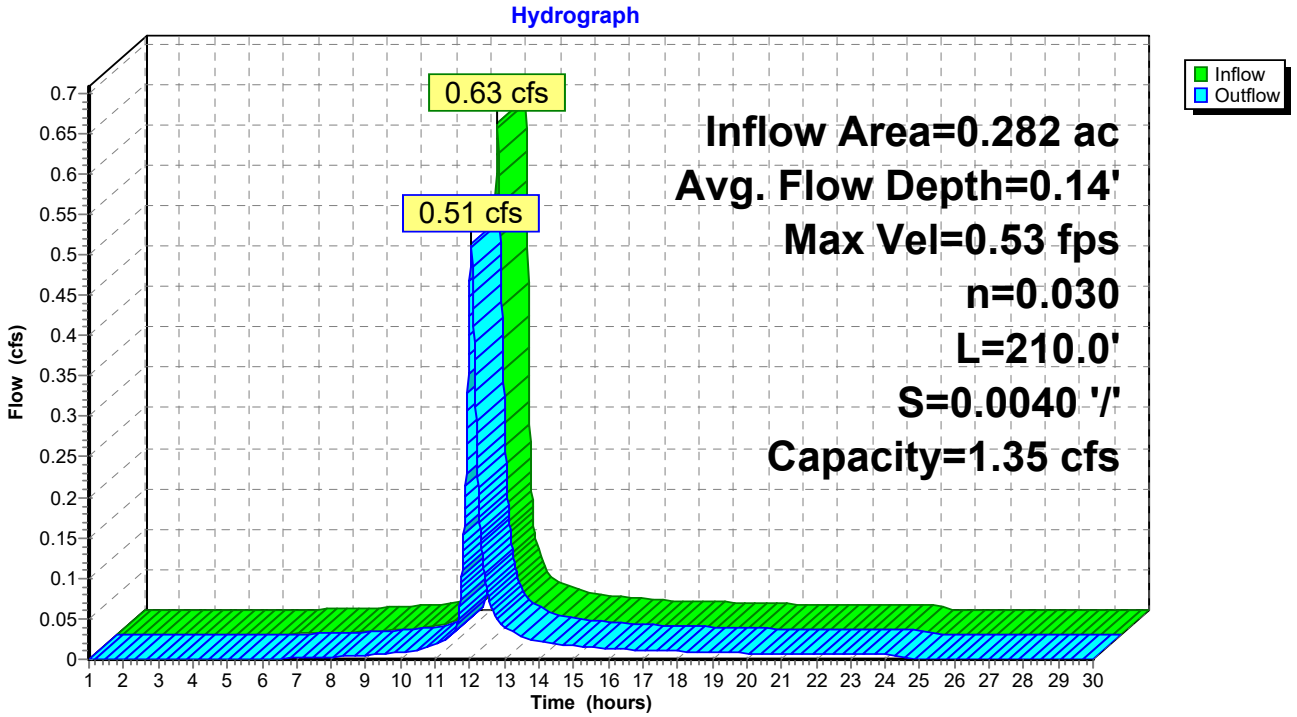
Peak Storage= 203 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.14' , Surface Width= 13.92'
Bank-Full Depth= 0.20' Flow Area= 2.0 sf, Capacity= 1.35 cfs

0.00' x 0.20' deep channel, n= 0.030 Riprap, 1-inch
Side Slope Z-value= 50.0 '/' Top Width= 20.00'
Length= 210.0' Slope= 0.0040 '/'
Inlet Invert= 2,134.50', Outlet Invert= 2,133.66'



‡

Reach V2: Valley Gutter- EAST



Summary for Pond A2: WET POND

Inflow Area = 0.643 ac, 38.59% Impervious, Inflow Depth = 0.98" for 2-YR, 24HR event
Inflow = 0.74 cfs @ 12.00 hrs, Volume= 0.052 af
Outflow = 0.62 cfs @ 12.07 hrs, Volume= 0.051 af, Atten= 16%, Lag= 4.0 min
Primary = 0.62 cfs @ 12.07 hrs, Volume= 0.051 af
Routed to Reach ER : Existing Drainage Ditch
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 2,131.00' Surf.Area= 745 sf Storage= 720 cf
Peak Elev= 2,131.45' @ 12.07 hrs Surf.Area= 977 sf Storage= 1,121 cf (401 cf above start)

Plug-Flow detention time= 257.2 min calculated for 0.035 af (67% of inflow)
Center-of-Mass det. time= 45.7 min (882.6 - 836.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,129.50'	1,261 cf	**Custom Stage Data (Prismatic)**Listed below

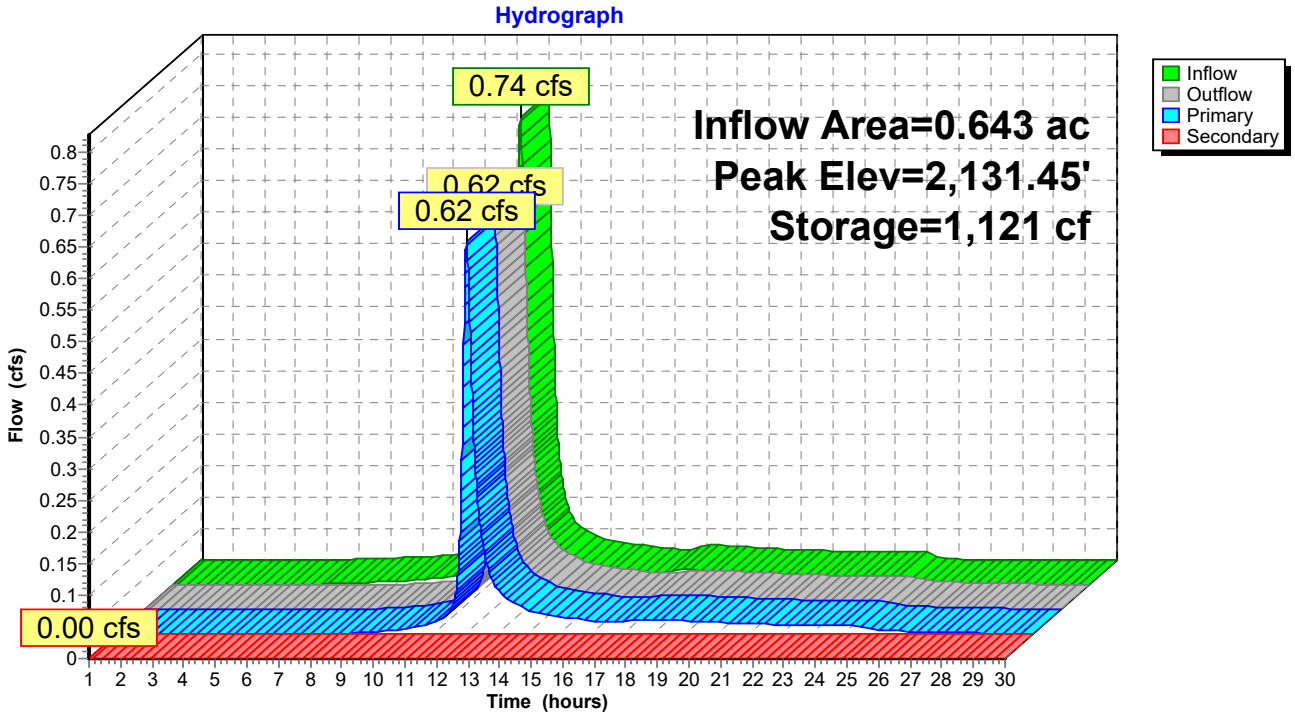
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,129.50	215	0	0
2,131.00	745	720	720
2,131.60	1,057	541	1,261

Device	Routing	Invert	Outlet Devices
#1	Secondary	2,131.58'	**6.0' long + 3.0 '/' SideZ (Profile 10) Emergency Overflow** Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.51 3.48 3.42 3.48 3.57
#2	Primary	2,131.00'	**Channel/Reach** using Reach ER: Existing Drainage Ditch

Primary OutFlow Max=0.62 cfs @ 12.07 hrs HW=2,131.45' TW=2,131.42' (Dynamic Tailwater)
↑—**2=Channel/Reach** (Channel Controls 0.62 cfs @ 1.04 fps)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=2,131.00' (Free Discharge)
↑—**1=Emergency Overflow** (Controls 0.00 cfs)

Pond A2: WET POND



Summary for Pond B2: Infiltration Trench

Inflow Area = 0.243 ac, 44.73% Impervious, Inflow Depth = 1.24" for 2-YR, 24HR event
Inflow = 0.55 cfs @ 11.96 hrs, Volume= 0.025 af
Outflow = 0.01 cfs @ 17.04 hrs, Volume= 0.004 af, Atten= 98%, Lag= 304.7 min
Primary = 0.01 cfs @ 17.04 hrs, Volume= 0.004 af
Routed to Reach R1 : R-1
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af
Routed to Pond A2 : WET POND

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 2,133.51' @ 17.04 hrs Surf.Area= 570 sf Storage= 920 cf

Plug-Flow detention time= 541.6 min calculated for 0.004 af (16% of inflow)
Center-of-Mass det. time= 387.9 min (1,199.8 - 811.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.50'	1,055 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

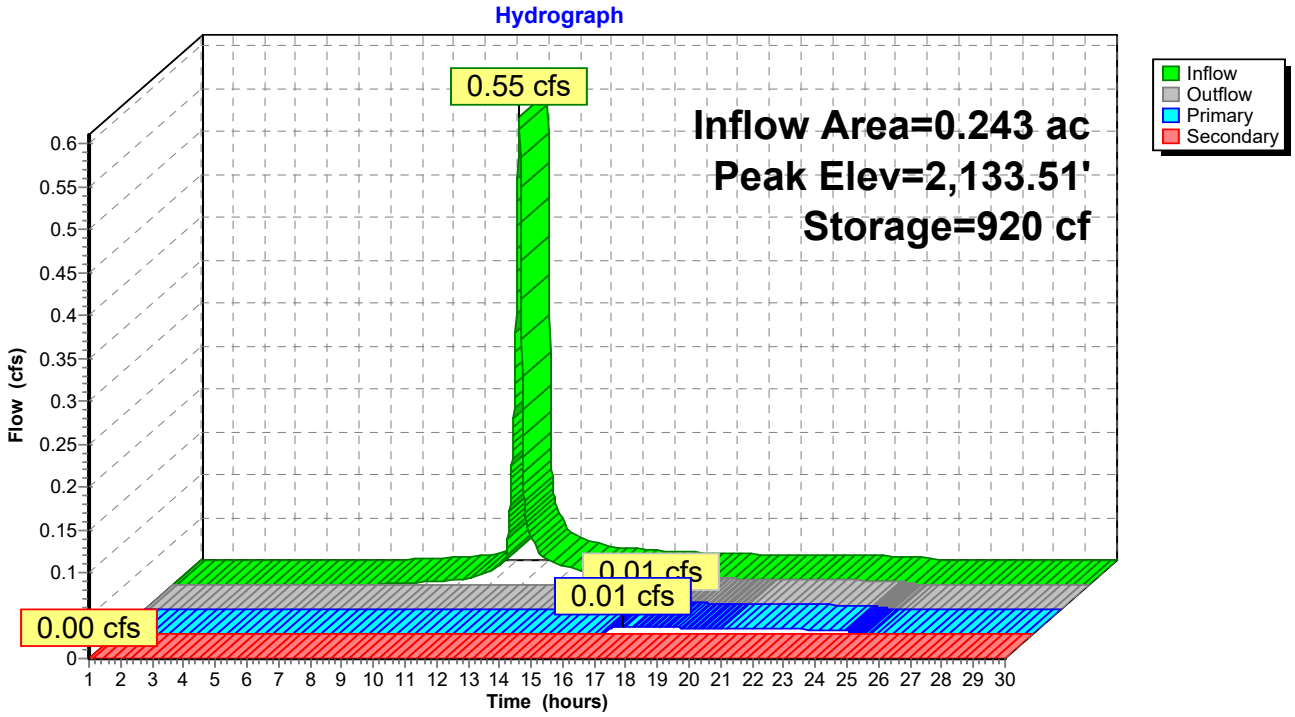
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,130.50	570	0.0	0	0
2,132.50	570	30.0	342	342
2,133.75	570	100.0	713	1,055

Device	Routing	Invert	Outlet Devices
#1	Device 2	2,131.00'	**3.000 in/hr Exfiltration over Surface area from 2,131.00' - 2,133.00'** Conductivity to Groundwater Elevation = 2,128.00' Excluded Surface area = 570 sf
#2	Secondary	2,132.00'	**6.0" Round Culvert** L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,132.00' / 2,131.00' S= 0.0050 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	2,133.50'	**Channel/Reach** using Reach R1: R-1
#4	Secondary	2,133.66'	**3.0" x 3.0" Horiz. Orifice/Grate X 4.00 columns** X 5 rows C= 0.600 in 18.0" x 18.0" Grate (56% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.01 cfs @ 17.04 hrs HW=2,133.51' TW=2,133.51' (Dynamic Tailwater)
└─**3=Channel/Reach** (Channel Controls 0.01 cfs @ 0.21 fps)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=2,130.50' TW=2,131.00' (Dynamic Tailwater)
├─**2=Culvert** (Controls 0.00 cfs)
│ └─**1=Exfiltration** (Controls 0.00 cfs)
└─**4=Orifice/Grate** (Controls 0.00 cfs)

Pond B2: Infiltration Trench



Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment AD: BASIN A (DEVELOPED) Runoff Area=10,590 sf 44.73% Impervious Runoff Depth=2.16"
Tc=5.0 min CN=92 Runoff=0.92 cfs 0.044 af

Subcatchment BD: BASIN B (DEVELOPED) Runoff Area=12,278 sf 13.53% Impervious Runoff Depth=2.35"
Flow Length=200' Slope=0.0050 '/' Tc=7.9 min CN=94 Runoff=1.03 cfs 0.055 af

Subcatchment CD: BASIN C (DEVELOPED) Runoff Area=2,199 sf 100.00% Impervious Runoff Depth=2.77"
Tc=5.0 min CN=98 Runoff=0.22 cfs 0.012 af

Subcatchment DD: BASIN D (DEVELOPED) Runoff Area=2,950 sf 75.05% Impervious Runoff Depth=2.35"
Tc=5.0 min CN=94 Runoff=0.27 cfs 0.013 af

Subcatchment ES1: Predeveloped poor Runoff Area=28,017 sf 0.00% Impervious Runoff Depth=1.90"
Flow Length=200' Slope=0.0250 '/' Tc=20.8 min CN=89 Runoff=1.33 cfs 0.102 af

Subcatchment ES2: Predeveloped Runoff Area=28,017 sf 72.00% Impervious Runoff Depth=2.25"
Flow Length=200' Slope=0.0250 '/' Tc=20.8 min CN=93 Runoff=1.54 cfs 0.121 af

Reach ER: Existing Drainage Ditch Avg. Flow Depth=0.56' Max Vel=1.21 fps Inflow=1.19 cfs 0.102 af
n=0.025 L=245.0' S=0.0024 '/' Capacity=1.77 cfs Outflow=1.14 cfs 0.102 af

Reach P-4: P-4 Avg. Flow Depth=0.21' Max Vel=2.72 fps Inflow=0.22 cfs 0.012 af
6.0" Round Pipe n=0.009 L=160.0' S=0.0050 '/' Capacity=0.57 cfs Outflow=0.22 cfs 0.012 af

Reach R1: R-1 Avg. Flow Depth=0.11' Max Vel=0.79 fps Inflow=0.40 cfs 0.023 af
n=0.030 L=190.0' S=0.0057 '/' Capacity=3.93 cfs Outflow=0.27 cfs 0.023 af

Reach V2: Valley Gutter- EAST Avg. Flow Depth=0.17' Max Vel=0.60 fps Inflow=1.03 cfs 0.055 af
n=0.030 L=210.0' S=0.0040 '/' Capacity=1.35 cfs Outflow=0.87 cfs 0.055 af

Pond A2: WET POND Peak Elev=2,131.57' Storage=1,232 cf Inflow=1.24 cfs 0.103 af
Primary=1.19 cfs 0.102 af Secondary=0.00 cfs 0.000 af Outflow=1.19 cfs 0.102 af

Pond B2: Infiltration Trench Peak Elev=2,133.63' Storage=988 cf Inflow=0.92 cfs 0.044 af
Primary=0.40 cfs 0.023 af Secondary=0.00 cfs 0.000 af Outflow=0.40 cfs 0.023 af

Total Runoff Area = 1.930 ac Runoff Volume = 0.347 af Average Runoff Depth = 2.16"
63.14% Pervious = 1.218 ac 36.86% Impervious = 0.711 ac

Summary for Subcatchment AD: BASIN A (DEVELOPED)

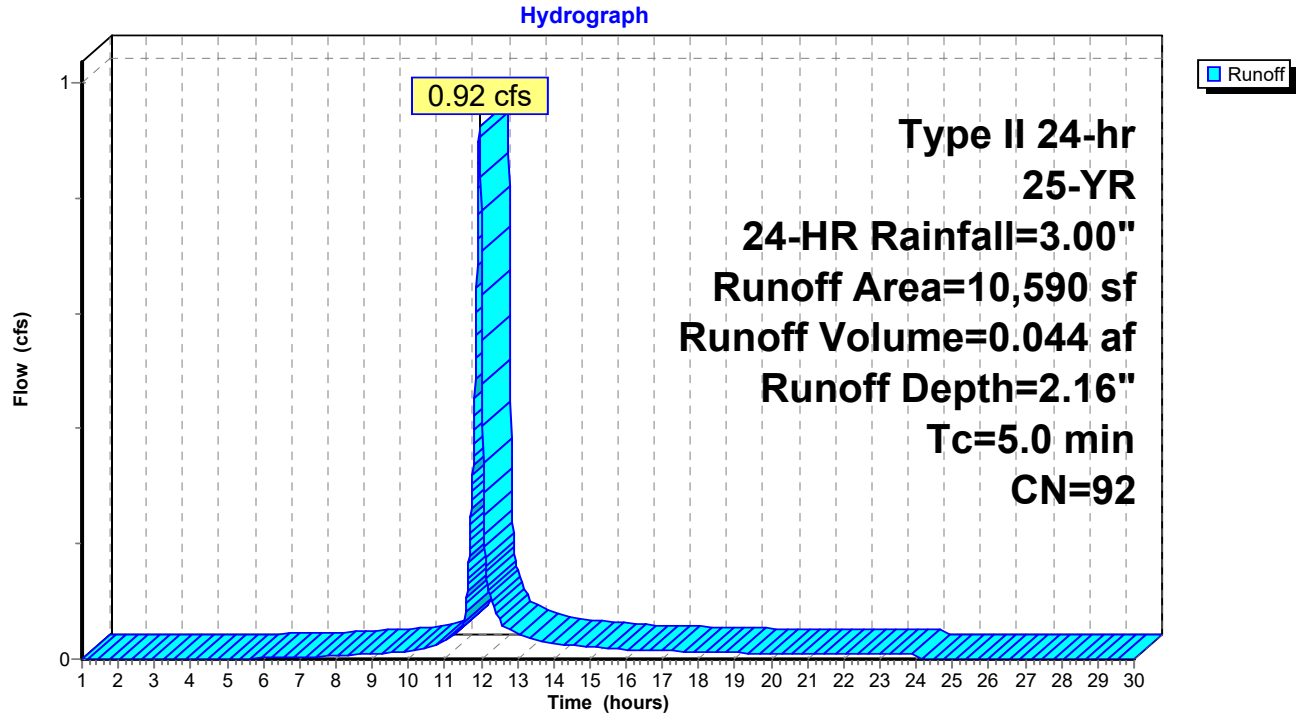
Runoff = 0.92 cfs @ 11.96 hrs, Volume= 0.044 af, Depth= 2.16"
Routed to Pond B2 : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

	Area (sf)	CN	Description
	1,002	98	Paved roads w/curbs & sewers, HSG D
	2,909	96	Gravel surface, HSG D
*	3,735	98	Roof
	2,944	80	Pasture/grassland/range, Good, HSG D
	10,590	92	Weighted Average
	5,853		55.27% Pervious Area
	4,737		44.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment AD: BASIN A (DEVELOPED)



Summary for Subcatchment BD: BASIN B (DEVELOPED)

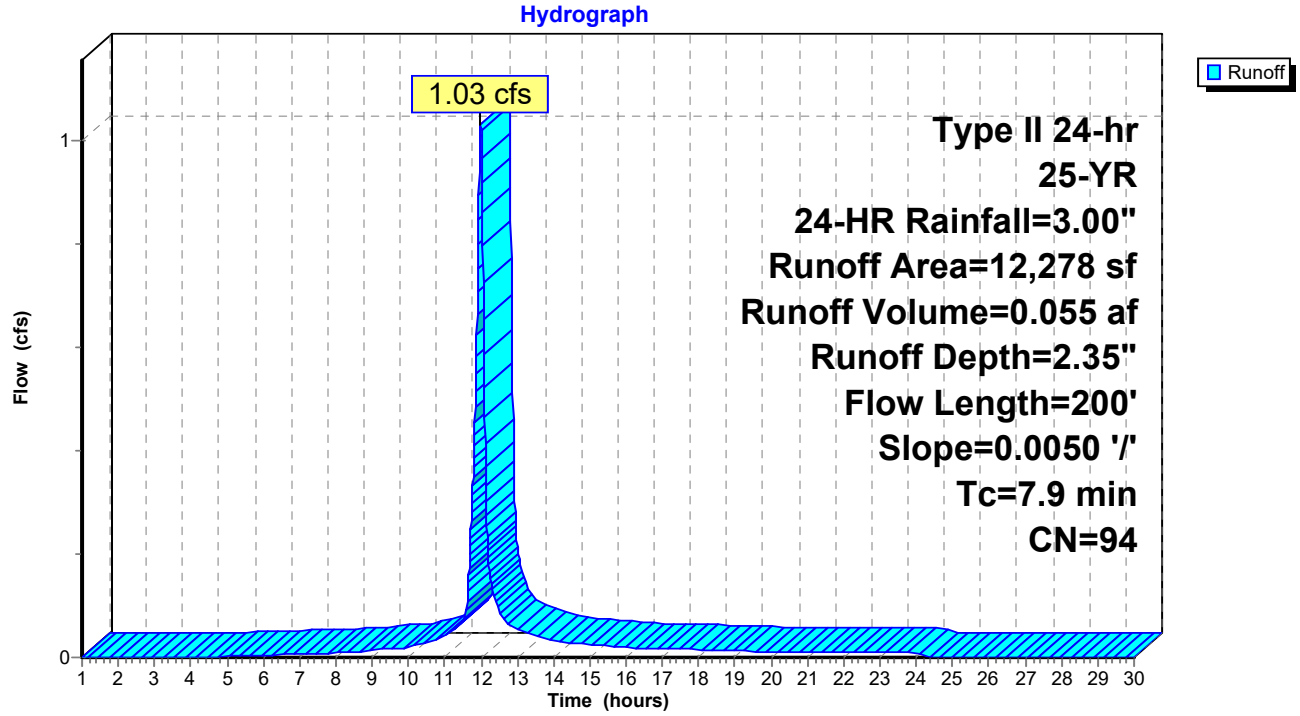
Runoff = 1.03 cfs @ 11.99 hrs, Volume= 0.055 af, Depth= 2.35"
Routed to Reach V2 : Valley Gutter- EAST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
1,661	98	Paved roads w/curbs & sewers, HSG D
8,780	96	Gravel surface, HSG D
1,837	80	Pasture/grassland/range, Good, HSG D
12,278	94	Weighted Average
10,617		86.47% Pervious Area
1,661		13.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	200	0.0050	1.14		**Shallow Concentrated Flow, Gravel Valley** Unpaved Kv= 16.1 fps
5.0					**Direct Entry,**
7.9	200	Total			

Subcatchment BD: BASIN B (DEVELOPED)



Summary for Subcatchment CD: BASIN C (DEVELOPED)

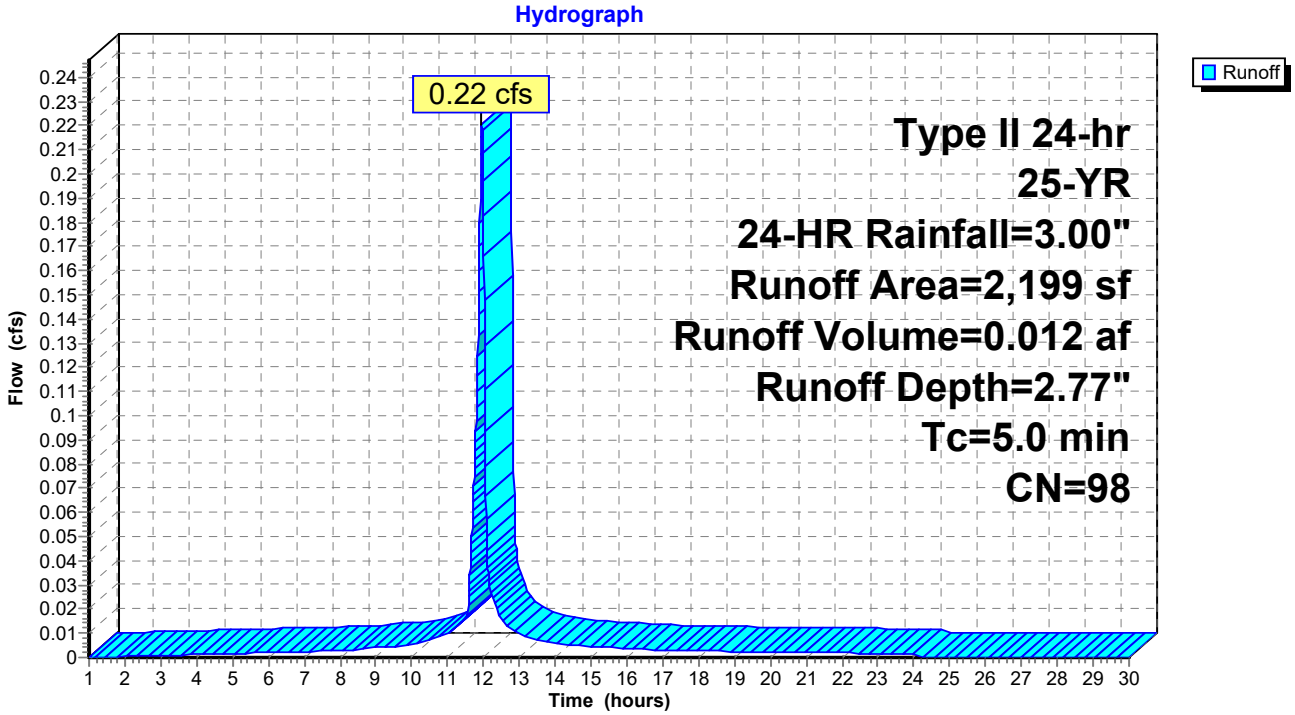
Runoff = 0.22 cfs @ 11.96 hrs, Volume= 0.012 af, Depth= 2.77"
Routed to Reach P-4 : P-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

	Area (sf)	CN	Description
*	2,199	98	Roof
	2,199		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment CD: BASIN C (DEVELOPED)



Summary for Subcatchment DD: BASIN D (DEVELOPED)

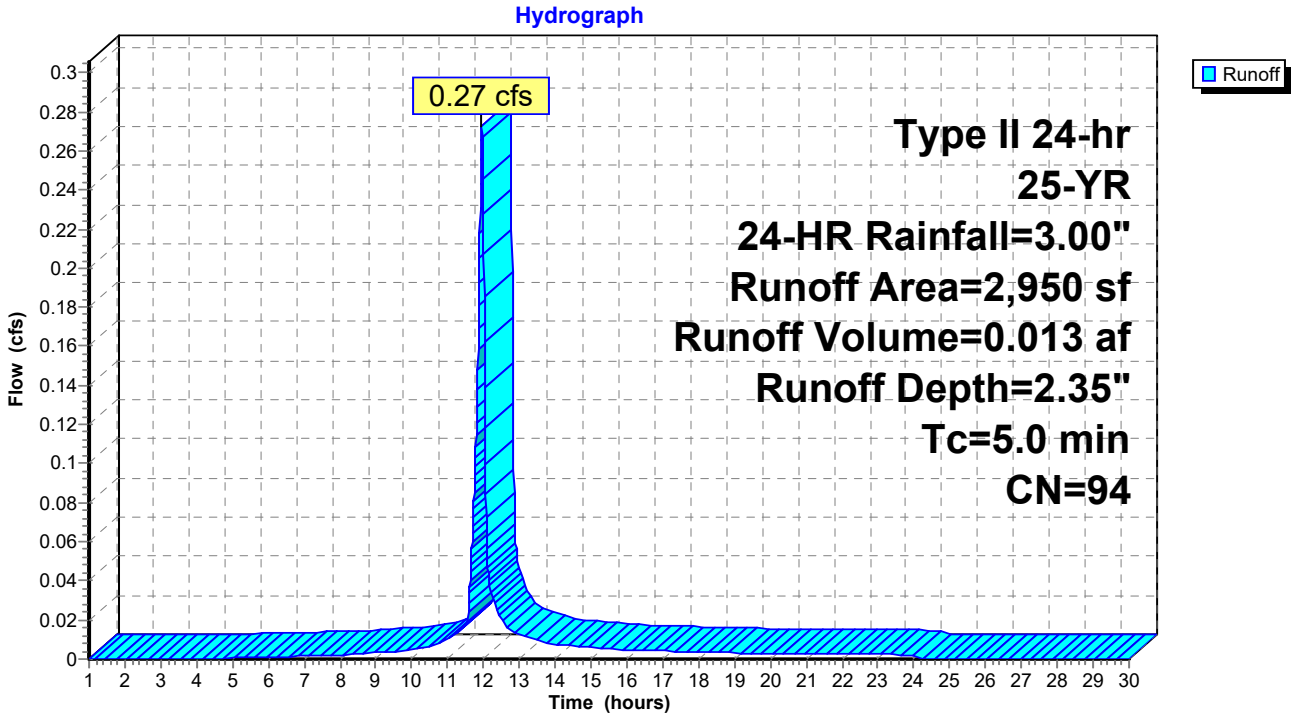
Runoff = 0.27 cfs @ 11.96 hrs, Volume= 0.013 af, Depth= 2.35"
Routed to Pond A2 : WET POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

	Area (sf)	CN	Description
*	2,214	98	Roof
	736	80	Pasture/grassland/range, Good, HSG D
	2,950	94	Weighted Average
	736		24.95% Pervious Area
	2,214		75.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment DD: BASIN D (DEVELOPED)



Summary for Subcatchment ES1: Predeveloped poor pasture

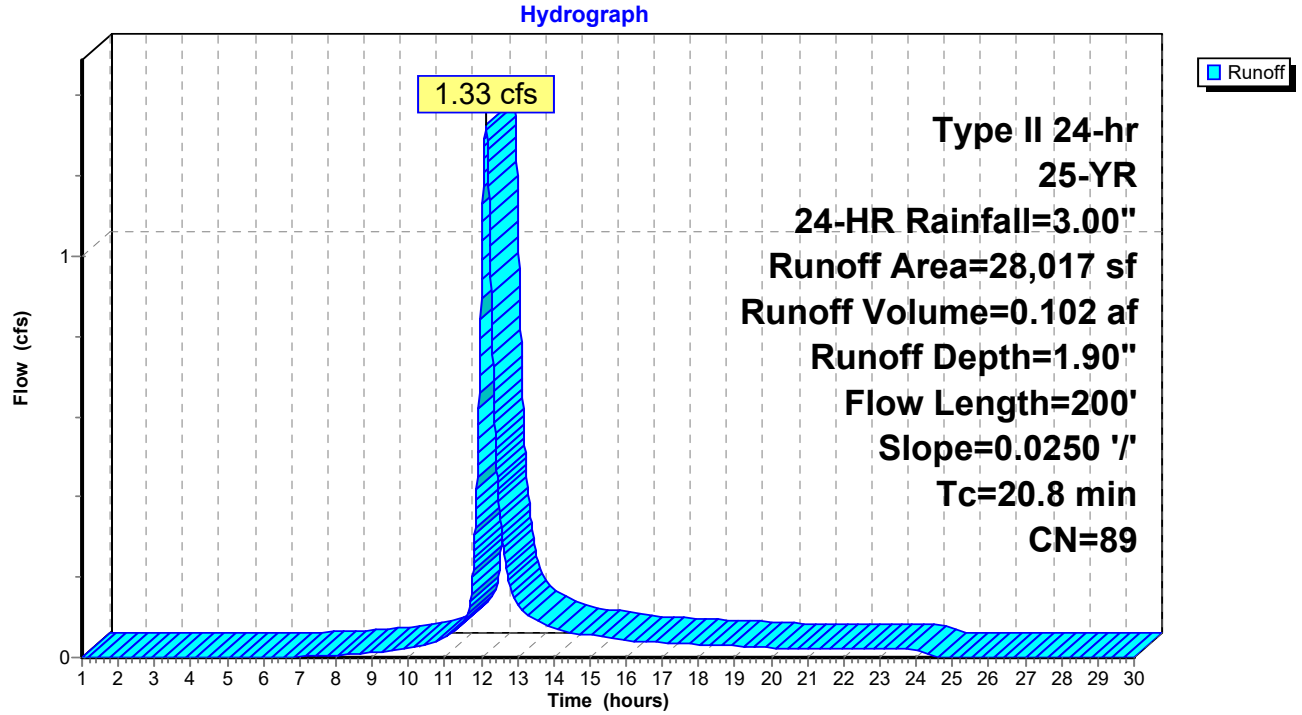
Runoff = 1.33 cfs @ 12.13 hrs, Volume= 0.102 af, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
28,017	89	Pasture/grassland/range, Poor, HSG D
28,017		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	200	0.0250	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.80"

Subcatchment ES1: Predeveloped poor pasture



Summary for Subcatchment ES2: Predeveloped Industrial Site

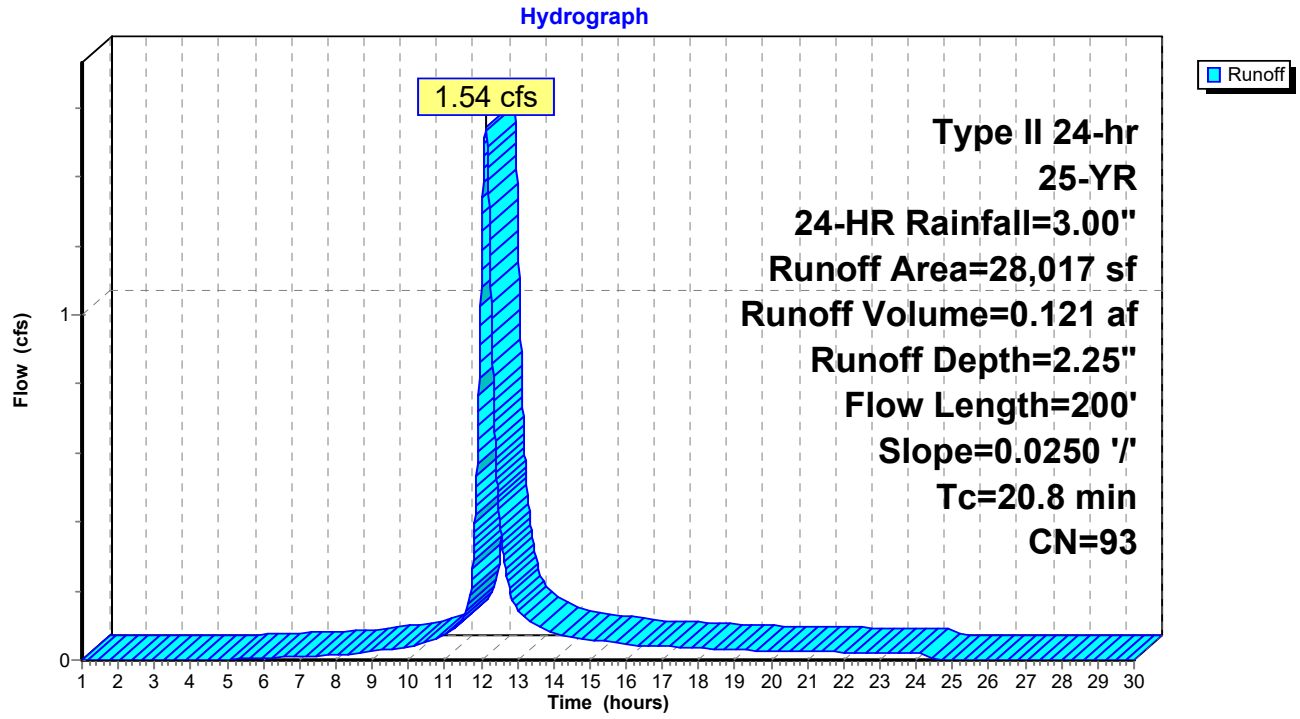
Runoff = 1.54 cfs @ 12.13 hrs, Volume= 0.121 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
28,017	93	Urban industrial, 72% imp, HSG D
7,845		28.00% Pervious Area
20,172		72.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	200	0.0250	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.80"

Subcatchment ES2: Predeveloped Industrial Site



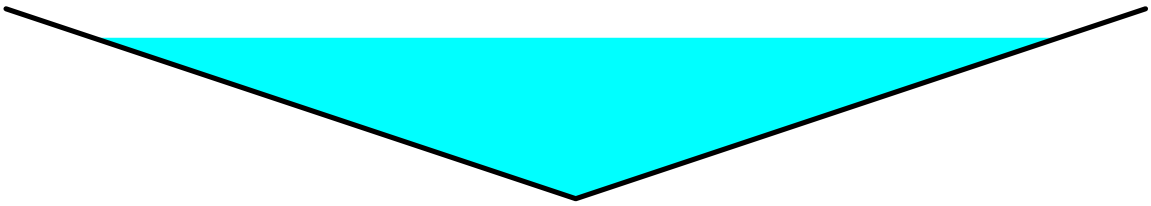
Summary for Reach ER: Existing Drainage Ditch

Inflow Area = 0.643 ac, 38.59% Impervious, Inflow Depth > 1.91" for 25-YR, 24-HR event
Inflow = 1.19 cfs @ 12.08 hrs, Volume= 0.102 af
Outflow = 1.14 cfs @ 12.12 hrs, Volume= 0.102 af, Atten= 4%, Lag= 2.2 min

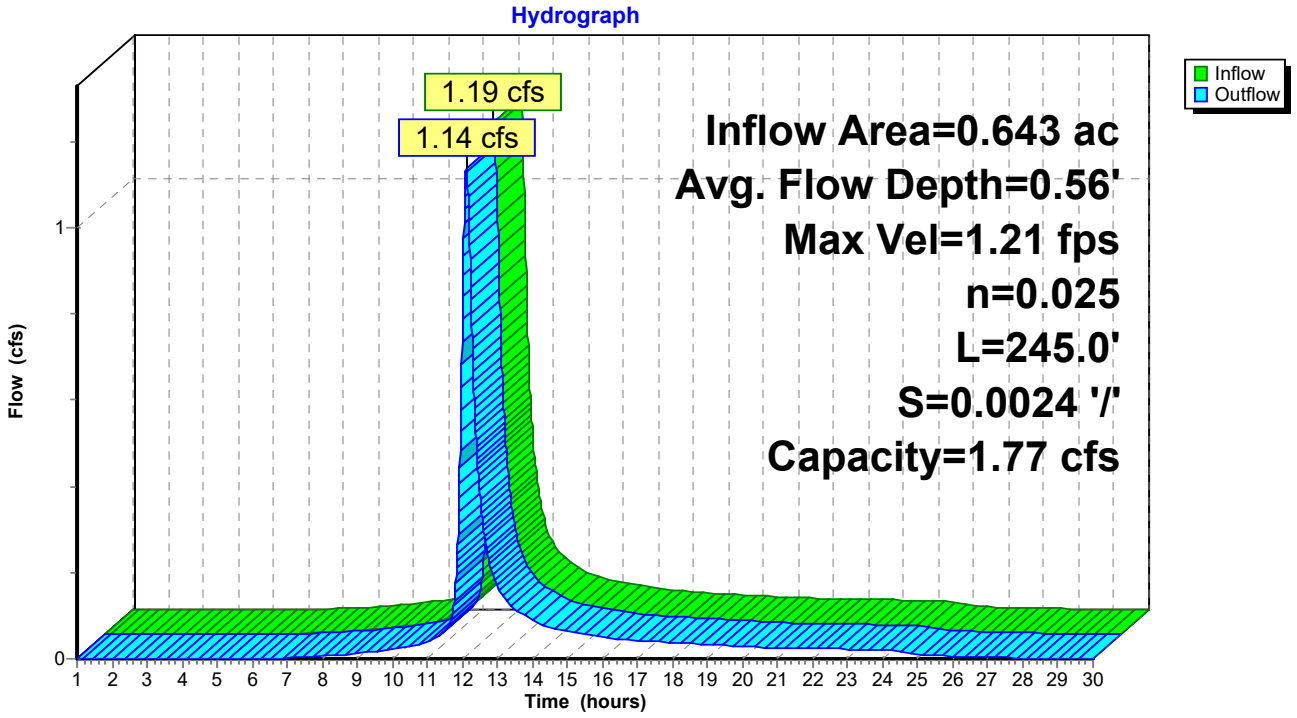
Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.21 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 9.4 min

Peak Storage= 230 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.56' , Surface Width= 3.36'
Bank-Full Depth= 0.66' Flow Area= 1.3 sf, Capacity= 1.77 cfs

0.00' x 0.66' deep channel, n= 0.025 Short grass
Side Slope Z-value= 3.0 '/' Top Width= 3.96'
Length= 245.0' Slope= 0.0024 '/'
Inlet Invert= 2,131.00', Outlet Invert= 2,130.40'



Reach ER: Existing Drainage Ditch



Summary for Reach P-4: P-4

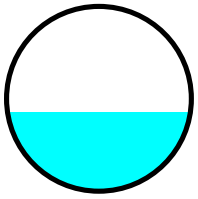
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.050 ac,100.00% Impervious, Inflow Depth = 2.77" for 25-YR, 24-HR event
Inflow = 0.22 cfs @ 11.96 hrs, Volume= 0.012 af
Outflow = 0.22 cfs @ 11.97 hrs, Volume= 0.012 af, Atten= 1%, Lag= 0.7 min
Routed to Pond A2 : WET POND

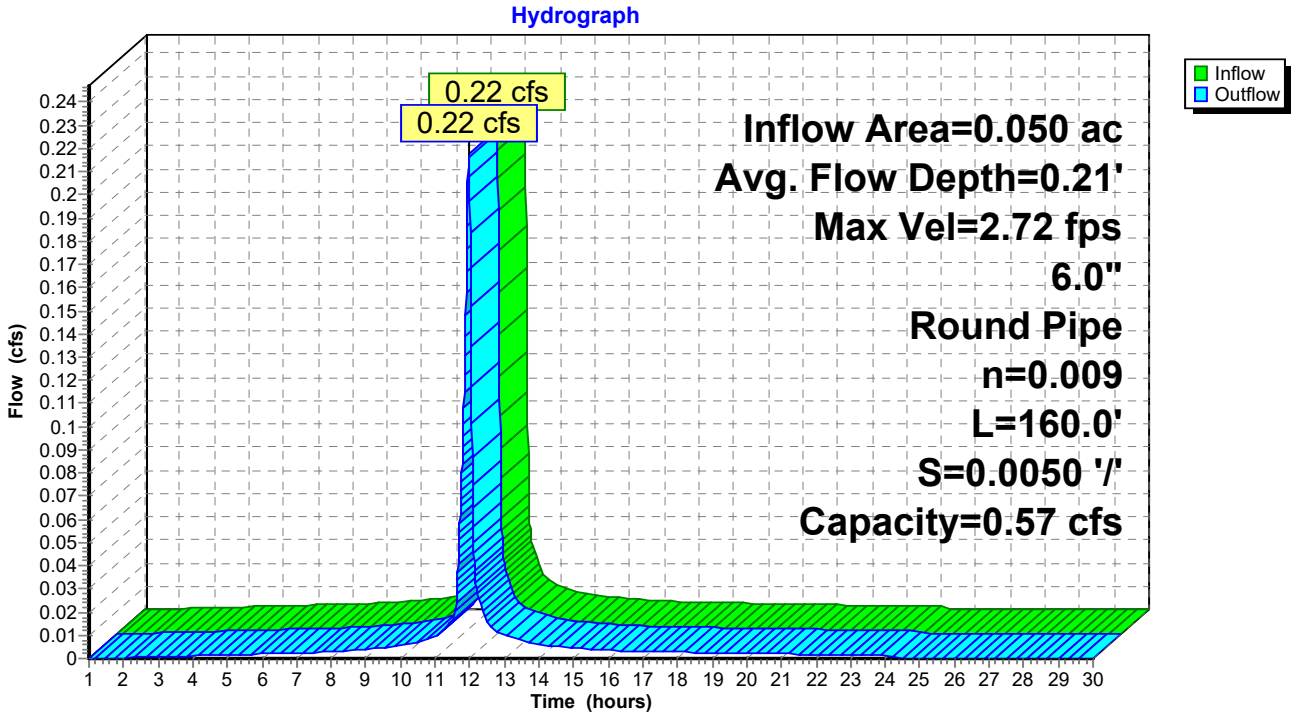
Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.72 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 3.4 min

Peak Storage= 13 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.21' , Surface Width= 0.49'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.57 cfs

6.0" Round Pipe
n= 0.009 Corrugated PE, smooth interior
Length= 160.0' Slope= 0.0050 '/'
Inlet Invert= 2,132.80', Outlet Invert= 2,132.00'



Reach P-4: P-4


Hydrograph
Inflow
Outflow
0.22 cfs
0.22 cfs
Inflow Area=0.050 ac
Avg. Flow Depth=0.21'
Max Vel=2.72 fps
6.0"
Round Pipe
n=0.009
L=160.0'
S=0.0050 '/'
Capacity=0.57 cfs
Flow (cfs)
Time (hours)

Summary for Reach R1: R-1

Inflow Area = 0.243 ac, 44.73% Impervious, Inflow Depth = 1.13" for 25-YR, 24-HR event
Inflow = 0.40 cfs @ 12.05 hrs, Volume= 0.023 af
Outflow = 0.27 cfs @ 12.11 hrs, Volume= 0.023 af, Atten= 32%, Lag= 3.3 min
Routed to Pond A2 : WET POND

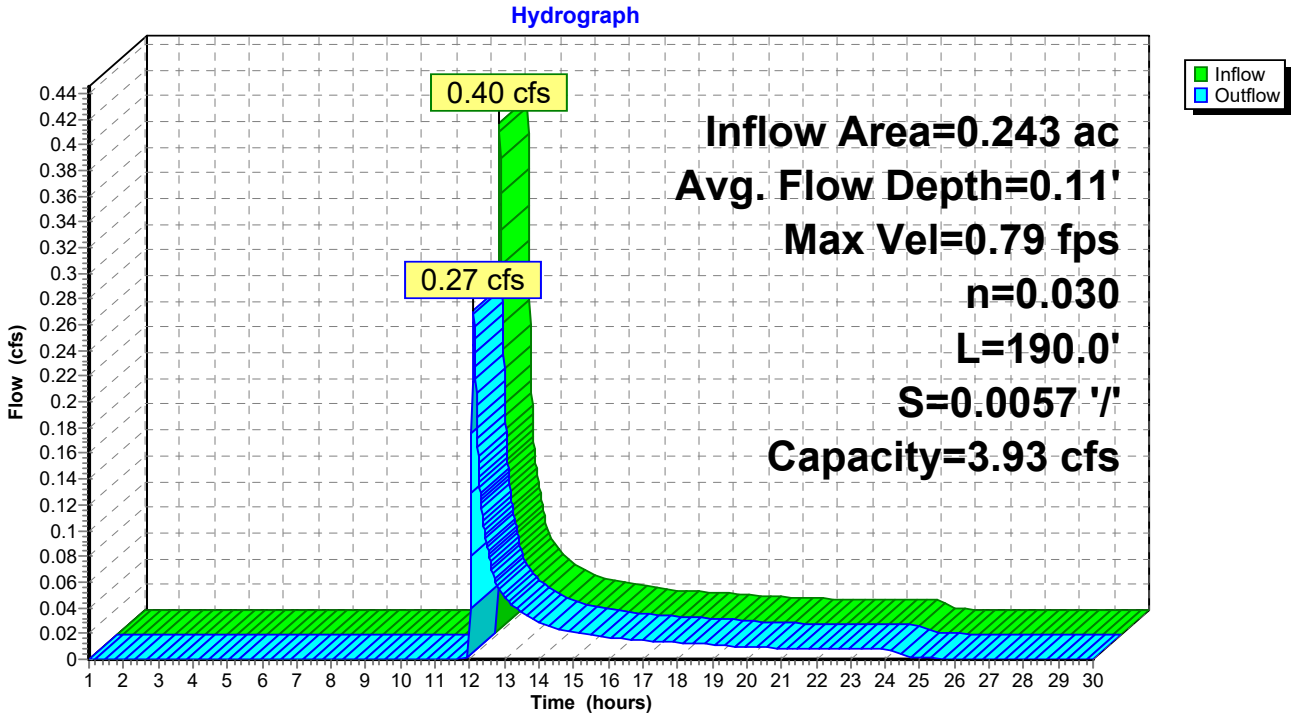
Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.79 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.23 fps, Avg. Travel Time= 14.0 min

Peak Storage= 65 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.11' , Surface Width= 3.42'
Bank-Full Depth= 0.50' Flow Area= 2.0 sf, Capacity= 3.93 cfs

3.00' x 0.50' deep channel, n= 0.030 Riprap, 1-inch
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 190.0' Slope= 0.0057 '/'
Inlet Invert= 2,133.50', Outlet Invert= 2,132.42'

‡

Reach R1: R-1



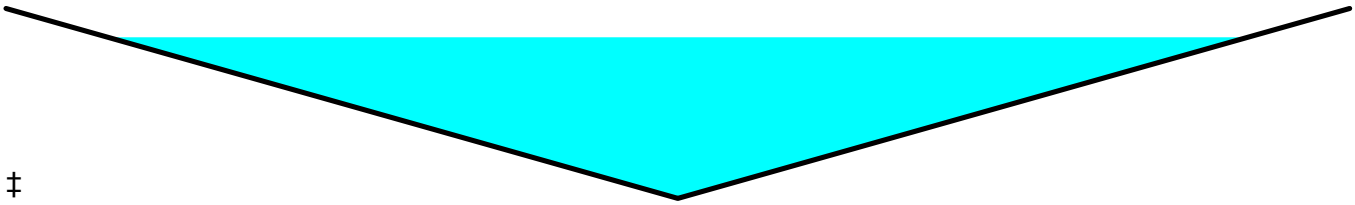
Summary for Reach V2: Valley Gutter- EAST

Inflow Area = 0.282 ac, 13.53% Impervious, Inflow Depth = 2.35" for 25-YR, 24-HR event
Inflow = 1.03 cfs @ 11.99 hrs, Volume= 0.055 af
Outflow = 0.87 cfs @ 12.04 hrs, Volume= 0.055 af, Atten= 16%, Lag= 2.9 min
Routed to Pond A2 : WET POND

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.60 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 18.8 min

Peak Storage= 302 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.17' , Surface Width= 16.96'
Bank-Full Depth= 0.20' Flow Area= 2.0 sf, Capacity= 1.35 cfs

0.00' x 0.20' deep channel, n= 0.030 Riprap, 1-inch
Side Slope Z-value= 50.0 '/' Top Width= 20.00'
Length= 210.0' Slope= 0.0040 '/'
Inlet Invert= 2,134.50', Outlet Invert= 2,133.66'



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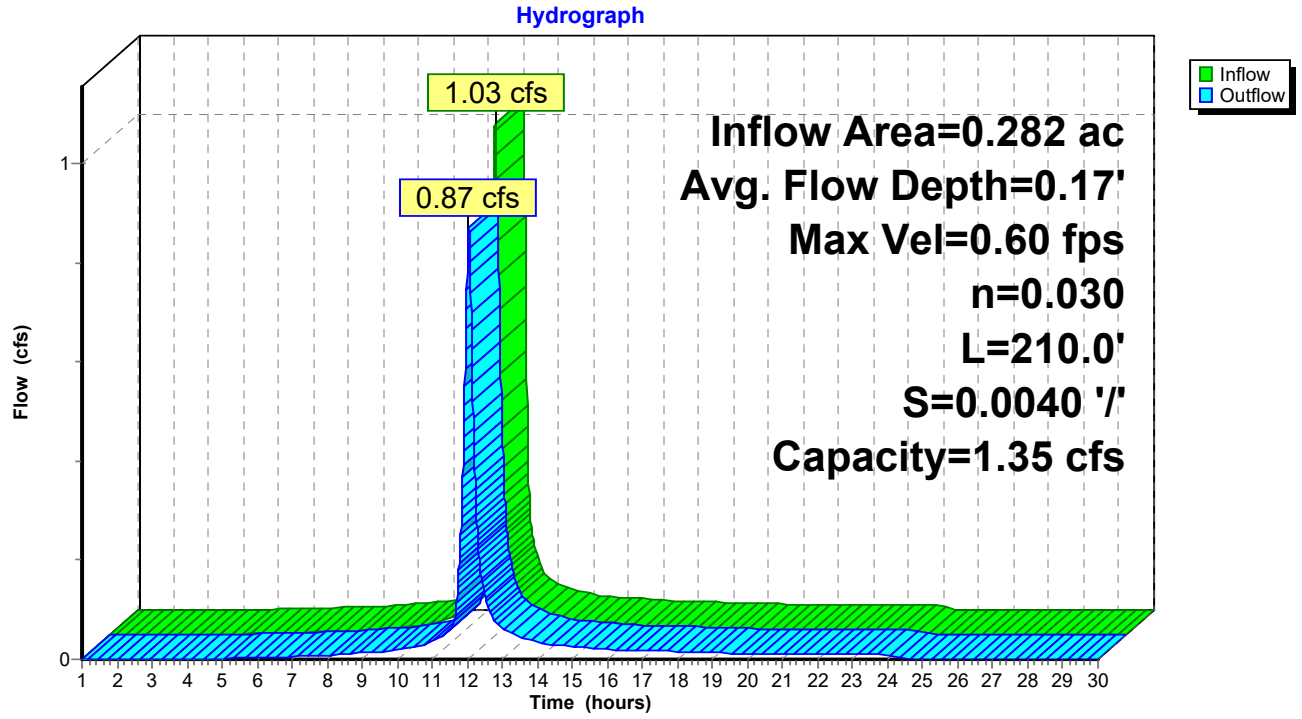
Reach V2: Valley Gutter- EAST



Summary for Pond A2: WET POND

Inflow Area = 0.643 ac, 38.59% Impervious, Inflow Depth = 1.92" for 25-YR, 24-HR event
Inflow = 1.24 cfs @ 12.00 hrs, Volume= 0.103 af
Outflow = 1.19 cfs @ 12.08 hrs, Volume= 0.102 af, Atten= 4%, Lag= 5.0 min
Primary = 1.19 cfs @ 12.08 hrs, Volume= 0.102 af
Routed to Reach ER : Existing Drainage Ditch
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 2,131.00' Surf.Area= 745 sf Storage= 720 cf
Peak Elev= 2,131.57' @ 12.08 hrs Surf.Area= 1,040 sf Storage= 1,232 cf (512 cf above start)

Plug-Flow detention time= 147.2 min calculated for 0.086 af (83% of inflow)
Center-of-Mass det. time= 32.2 min (851.0 - 818.8)

Volume	Invert	Avail.Storage	Storage Description
#1	2,129.50'	1,261 cf	**Custom Stage Data (Prismatic)** Listed below

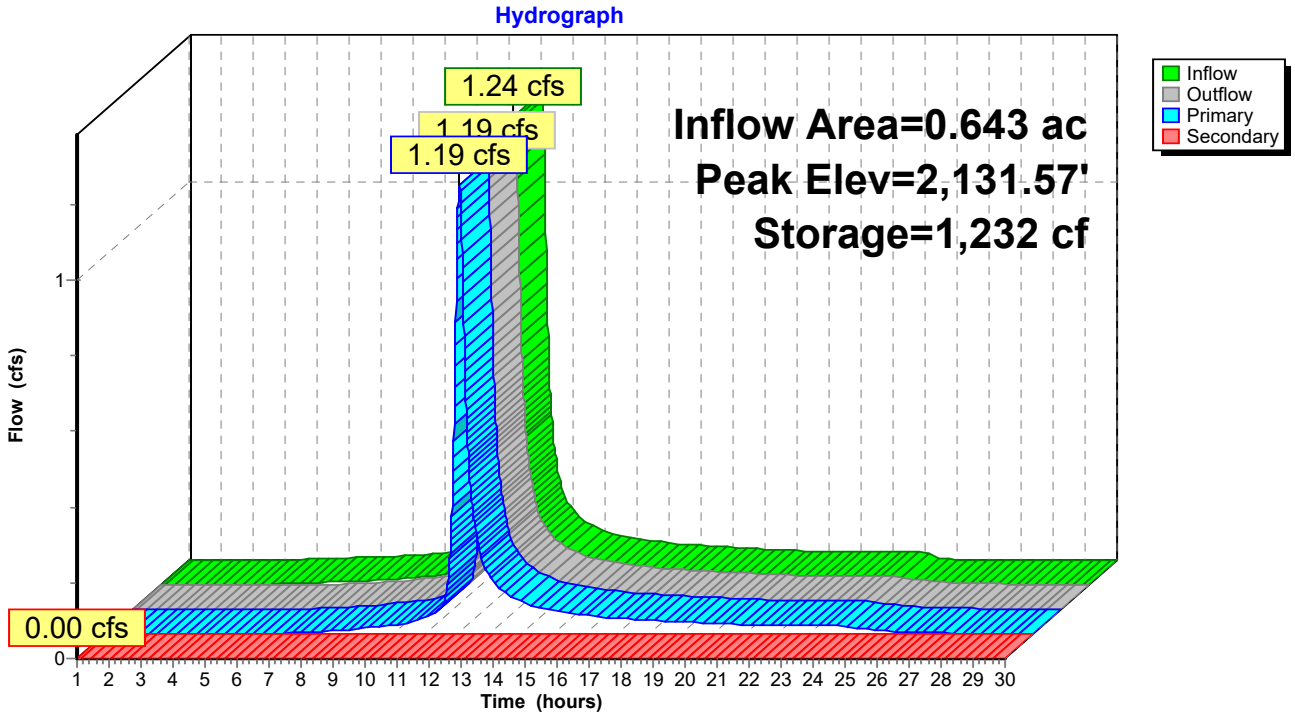
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,129.50	215	0	0
2,131.00	745	720	720
2,131.60	1,057	541	1,261

Device	Routing	Invert	Outlet Devices
#1	Secondary	2,131.58'	**6.0' long + 3.0 '/' SideZ (Profile 10) Emergency Overflow**
			Head (feet) 1.97 2.46 2.95 3.94 4.92
			Coef. (English) 3.51 3.48 3.42 3.48 3.57
#2	Primary	2,131.00'	**Channel/Reach** using Reach ER: Existing Drainage Ditch

Primary OutFlow Max=1.19 cfs @ 12.08 hrs HW=2,131.57' TW=2,131.55' (Dynamic Tailwater)
↑—**2=Channel/Reach** (Channel Controls 1.19 cfs @ 1.23 fps)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=2,131.00' (Free Discharge)
↑—**1=Emergency Overflow** (Controls 0.00 cfs)

Pond A2: WET POND



Summary for Pond B2: Infiltration Trench

Inflow Area = 0.243 ac, 44.73% Impervious, Inflow Depth = 2.16" for 25-YR, 24-HR event
Inflow = 0.92 cfs @ 11.96 hrs, Volume= 0.044 af
Outflow = 0.40 cfs @ 12.05 hrs, Volume= 0.023 af, Atten= 57%, Lag= 5.6 min
Primary = 0.40 cfs @ 12.05 hrs, Volume= 0.023 af
Routed to Reach R1 : R-1
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af
Routed to Pond A2 : WET POND

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 2,133.63' @ 12.05 hrs Surf.Area= 570 sf Storage= 988 cf

Plug-Flow detention time= 225.5 min calculated for 0.023 af (52% of inflow)
Center-of-Mass det. time= 114.2 min (910.2 - 796.0)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.50'	1,055 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

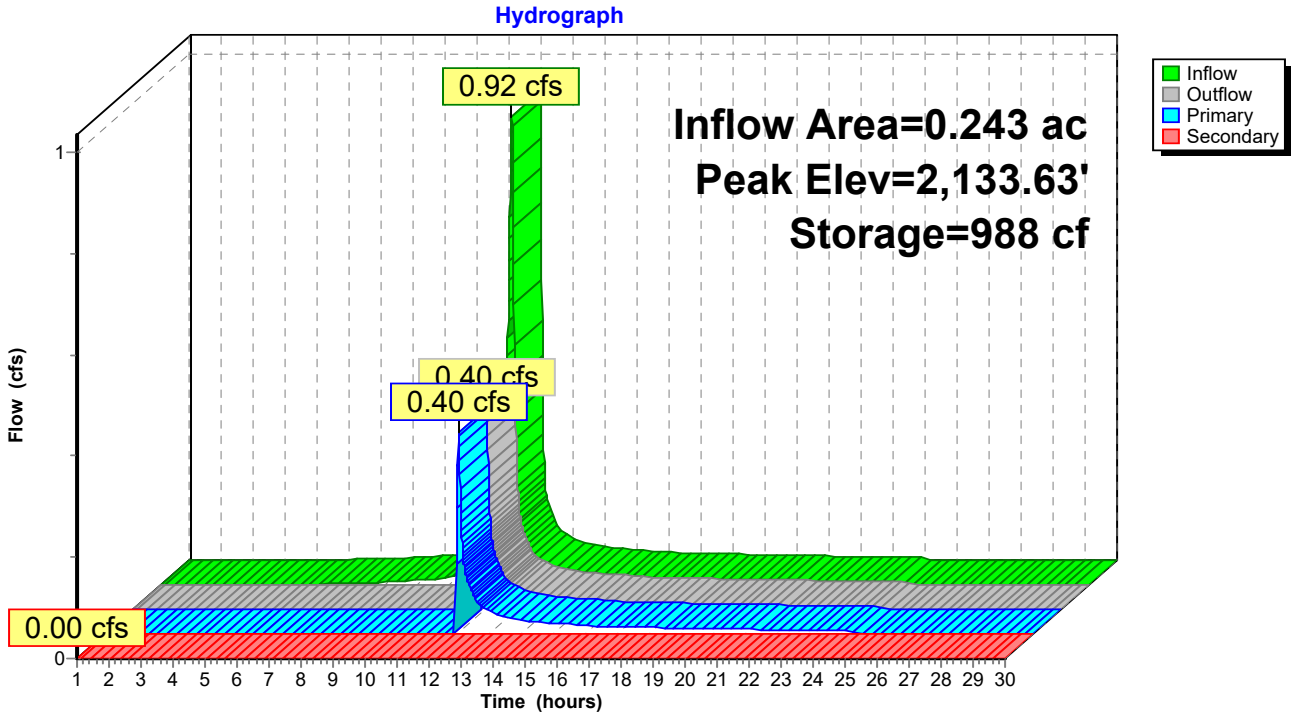
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,130.50	570	0.0	0	0
2,132.50	570	30.0	342	342
2,133.75	570	100.0	713	1,055

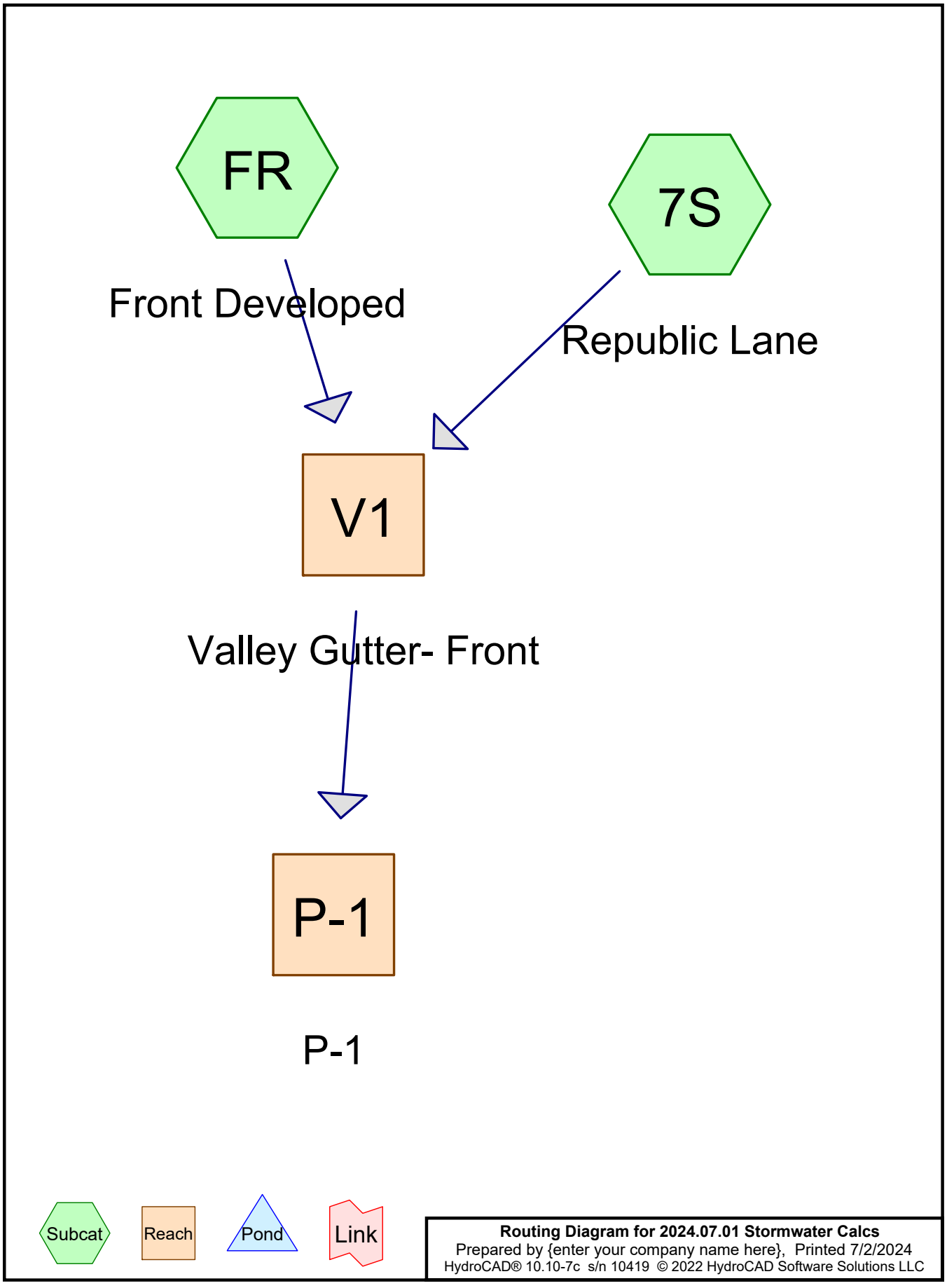
Device	Routing	Invert	Outlet Devices
#1	Device 2	2,131.00'	**3.000 in/hr Exfiltration over Surface area from 2,131.00' - 2,133.00'** Conductivity to Groundwater Elevation = 2,128.00' Excluded Surface area = 570 sf
#2	Secondary	2,132.00'	**6.0" Round Culvert** L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,132.00' / 2,131.00' S= 0.0050 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	2,133.50'	**Channel/Reach** using Reach R1: R-1
#4	Secondary	2,133.66'	**3.0" x 3.0" Horiz. Orifice/Grate X 4.00 columns** X 5 rows C= 0.600 in 18.0" x 18.0" Grate (56% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.40 cfs @ 12.05 hrs HW=2,133.63' TW=2,133.57' (Dynamic Tailwater)
└─**3=Channel/Reach** (Channel Controls 0.40 cfs @ 0.91 fps)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=2,130.50' TW=2,131.00' (Dynamic Tailwater)
├─**2=Culvert** (Controls 0.00 cfs)
│ └─**1=Exfiltration** (Controls 0.00 cfs)
└─**4=Orifice/Grate** (Controls 0.00 cfs)

Pond B2: Infiltration Trench





Routing Diagram for 2024.07.01 Stormwater Calcs
Prepared by {enter your company name here}, Printed 7/2/2024
HydroCAD® 10.10-7c s/n 10419 © 2022 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "2023.03.12 Stormwater Calcs.hcp"
Rainfall events imported from "2023.03.12 Stormwater Calcs.hcp"
Rainfall events imported from "5_21_24 Hydrocad _DWL.hcp"

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-YR, 24-HR	Type II 24-hr		Default	24.00	1	3.00	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.023	98	Gravel roads, HSG D (FR)
0.067	91	Gravel roads, HSG D (FR)
0.038	98	Paved roads w/curbs & sewers, HSG D (7S)
0.128	**94**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.128	HSG D	7S, FR
0.000	Other	
0.128		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.090	0.000	0.090	Gravel roads	FR
0.000	0.000	0.000	0.038	0.000	0.038	Paved roads w/curbs & sewers	7S
0.000	**0.000**	**0.000**	**0.128**	**0.000**	**0.128**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	P-1	2,131.80	2,131.00	160.0	0.0050	0.009	0.0	6.0	0.0

Time span=1.00-30.00 hrs, dt=0.01 hrs, 2901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 7S: Republic Lane Runoff Area=1,660 sf 100.00% Impervious Runoff Depth=2.77"
Tc=5.0 min CN=98 Runoff=0.17 cfs 0.009 af

Subcatchment FR: Front Developed Runoff Area=3,905 sf 25.61% Impervious Runoff Depth=2.25"
Tc=5.0 min CN=93 Runoff=0.35 cfs 0.017 af

Reach P-1: P-1 Avg. Flow Depth=0.36' Max Vel=3.29 fps Inflow=0.51 cfs 0.026 af
6.0" Round Pipe n=0.009 L=160.0' S=0.0050 '/' Capacity=0.57 cfs Outflow=0.50 cfs 0.026 af

Reach V1: Valley Gutter- Front Avg. Flow Depth=0.12' Max Vel=0.74 fps Inflow=0.52 cfs 0.026 af
n=0.030 L=60.0' S=0.0100 '/' Capacity=0.99 cfs Outflow=0.51 cfs 0.026 af

Total Runoff Area = 0.128 ac Runoff Volume = 0.026 af Average Runoff Depth = 2.41"
52.20% Pervious = 0.067 ac 47.80% Impervious = 0.061 ac

Summary for Subcatchment 7S: Republic Lane

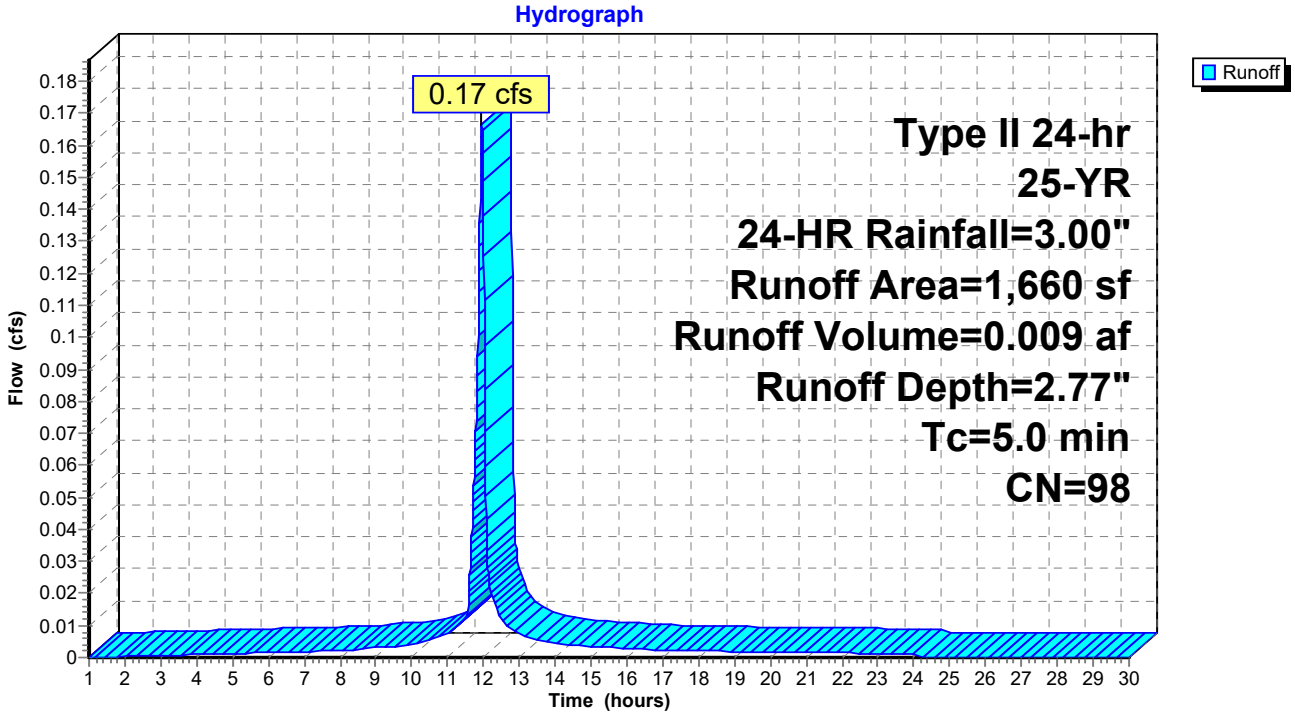
Runoff = 0.17 cfs @ 11.96 hrs, Volume= 0.009 af, Depth= 2.77"
Routed to Reach V1 : Valley Gutter- Front

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
1,660	98	Paved roads w/curbs & sewers, HSG D
1,660		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 7S: Republic Lane



Summary for Subcatchment FR: Front Developed

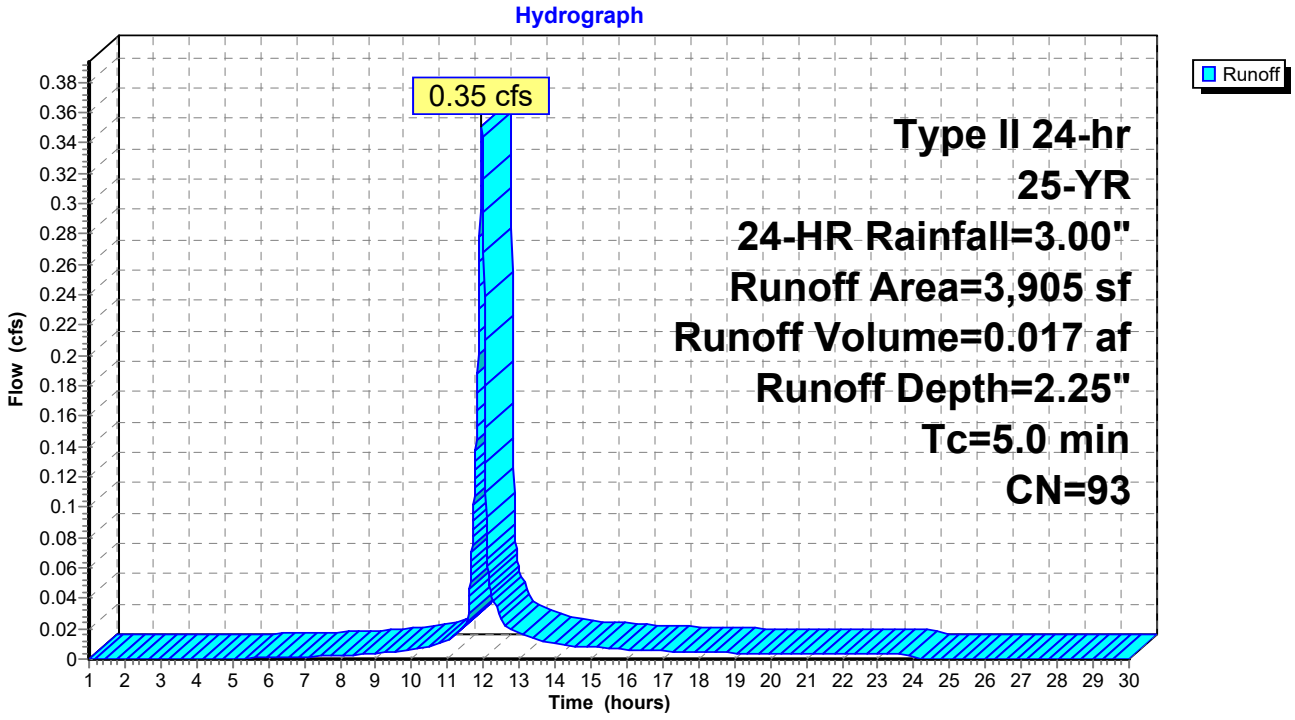
Runoff = 0.35 cfs @ 11.96 hrs, Volume= 0.017 af, Depth= 2.25"
Routed to Reach V1 : Valley Gutter- Front

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

	Area (sf)	CN	Description
*	1,000	98	Gravel roads, HSG D
	2,905	91	Gravel roads, HSG D
	3,905	93	Weighted Average
	2,905		74.39% Pervious Area
	1,000		25.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment FR: Front Developed



Summary for Reach P-1: P-1

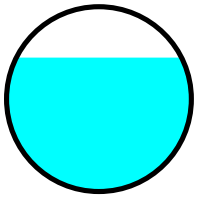
[52] Hint: Inlet/Outlet conditions not evaluated

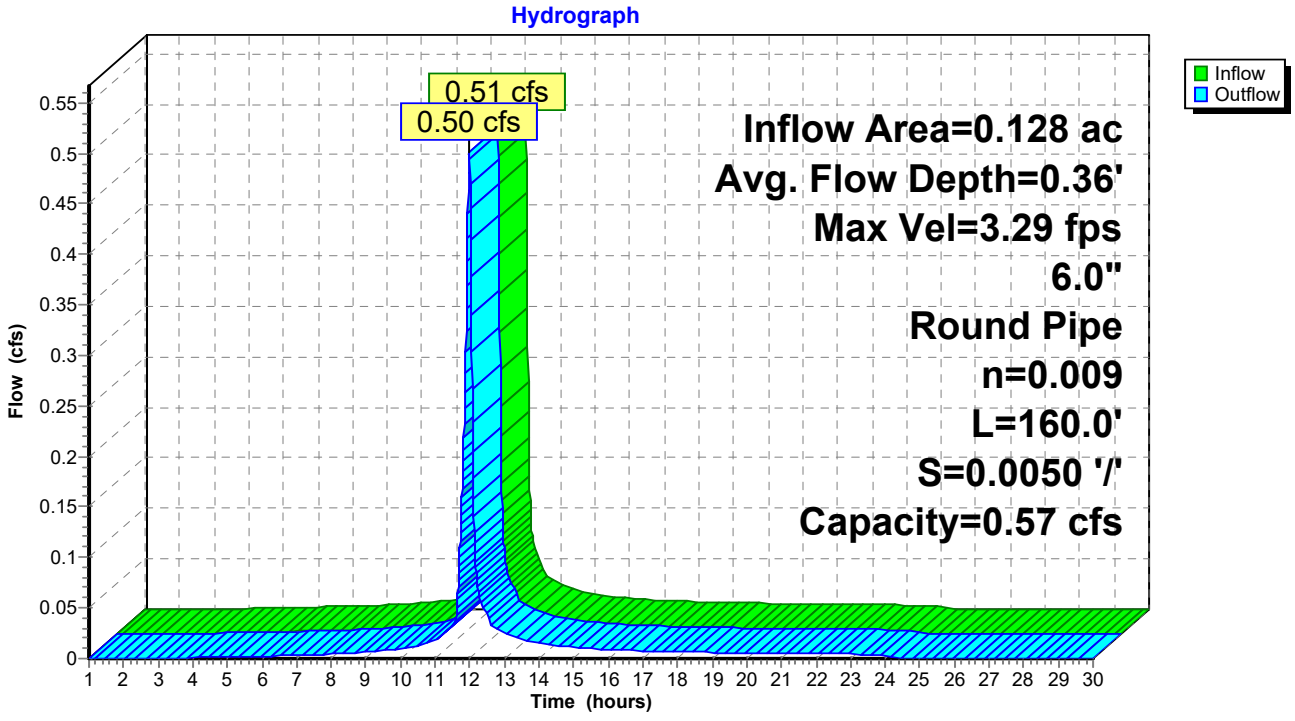
Inflow Area = 0.128 ac, 47.80% Impervious, Inflow Depth = 2.41" for 25-YR, 24-HR event
Inflow = 0.51 cfs @ 11.97 hrs, Volume= 0.026 af
Outflow = 0.50 cfs @ 11.98 hrs, Volume= 0.026 af, Atten= 1%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.29 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.96 fps, Avg. Travel Time= 2.8 min

Peak Storage= 24 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.36' , Surface Width= 0.45'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.57 cfs

6.0" Round Pipe
n= 0.009 Corrugated PE, smooth interior
Length= 160.0' Slope= 0.0050 '/'
Inlet Invert= 2,131.80', Outlet Invert= 2,131.00'





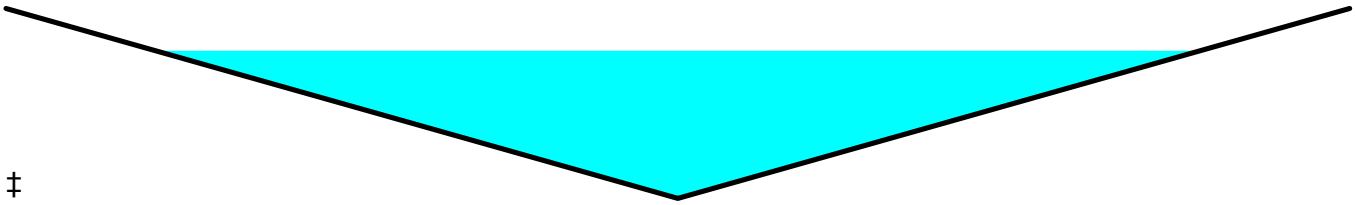
Summary for Reach V1: Valley Gutter- Front

Inflow Area = 0.128 ac, 47.80% Impervious, Inflow Depth = 2.41" for 25-YR, 24-HR event
Inflow = 0.52 cfs @ 11.96 hrs, Volume= 0.026 af
Outflow = 0.51 cfs @ 11.97 hrs, Volume= 0.026 af, Atten= 2%, Lag= 0.9 min
Routed to Reach P-1 : P-1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.74 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 4.1 min

Peak Storage= 41 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.12' , Surface Width= 11.66'
Bank-Full Depth= 0.15' Flow Area= 1.1 sf, Capacity= 0.99 cfs

0.00' x 0.15' deep channel, n= 0.030 Riprap, 1-inch
Side Slope Z-value= 50.0 '/' Top Width= 15.00'
Length= 60.0' Slope= 0.0100 '/'
Inlet Invert= 2,134.50', Outlet Invert= 2,133.90'



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Reach V1: Valley Gutter- Front