STORMWATER MANAGEMENT, GROUNDWATER RECHARGE AND WATER QUALITY ANALYSIS

For

Ashbel Associates, LLC Proposed Multifamily Residential Units

> Greenwood Road & Texas Road Block 146, Lot 25 & 26 Township of Marlboro Monmouth County, NJ

> > Prepared by:



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I. <u>SITE DESCRIPTION</u>

The project site consists of Block 119, Lot 16, located on the western side of Texas Road in the Township of Marlboro, Monmouth County, New Jersey. Currently, the site is vacant and mostly forested. The subject site is 1,562,410 square feet (35.9 acres). The site is bordered to the north and west by vacant forested land; to the east by a residential use; and the south by a residential use. The project consists of developing the parcel with five (5) multi-family residential dwelling units and one (1) community building, with two hundred and thirty-five (235) total vehicle parking spaces, driveways, landscaping, stormwater management facilities, and other related site improvements and structures. The majority of the developed area will be completed outside wetlands, and wetland buffers of Matawan Creek.

The existing conditions of the tract have been verified by Boundary and Topographic Survey, prepared by Dynamic Survey, LLC, dated 7/30/2020.

II. DESIGN OVERVIEW

This report has been prepared to define and analyze the stormwater drainage conditions that would occur as a result of the development of Block 119, Lot 16 in the Township of Marlboro, Monmouth County, New Jersey. The project includes new stormwater management facilities to address applicable aspects of the Township of Marlboro Stormwater Management rules, NJAC 5:21, and NJAC 7:8.

Based upon the fact that the proposed improvements will result in more than one (1) acre of land disturbance and increase the amount or impervious coverage by more than 0.25 acres, this project is classified as a "major development"; and therefore, has been designed to meet the stormwater runoff quantity, quality and groundwater recharge standards, set forth by the Township of Marlboro Land Use Ordinance, NJAC 5:21, and NJAC 7:8. Accordingly, the following items are addressed within this report:

- Erosion control, groundwater recharge and runoff quantity standards (7:8-5.4)
- Stormwater runoff quality standards (7:8-5.5)
- Calculation of stormwater runoff and groundwater recharge (7:8-5.6)
- Standards for structural stormwater management measures (7:8-5.7)

The scope of the report includes the proposed five (5) multi-family dwelling units, one (1) community clubhouse, basins, driveways, parking areas, landscaping and other related site improvements as shown on the engineering drawings. The proposed site plan has 10.1% impervious lot coverage. The storm systems on site have been designed using this coverage.

A hydrological evaluation is provided for the NJDEP Water Quality, 2, 10, and 100-year storm events utilizing the Urban Hydrology for Small Watersheds TR55 method.

NJAC 7:8-5.4(a)3 states the stormwater quantity impacts can be calculating to meet one the of the following below:

i. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10 and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;

iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed.

Per the above requirements, Study Point 1 (SP 1) will have runoff that will comply with the flow reductions indicated under iii as follows:

2-year:	50% reduction
10-year:	25% reduction
100-year:	20% reduction

This facility will comply with the Stormwater Management Best Management Practices.

It is important to note that the aforementioned flow reduction requirements are only required to be applied to onsite drainage areas within the limit of disturbance to satisfy the Township of Marlboro and NJDEP flow reduction requirements. Therefore, the proposed development satisfies the flow reduction requirements by applying the peak rate reduction requirements only to the onsite area that is to be disturbed.

III. EXISTING DRAINAGE CONDITIONS

The tract has been evaluated with the following drainage sub-watershed areas as depicted on the Existing Conditions Drainage Area Map. Each sub-watershed area has been calculated as a separate point of analysis.

Existing Study Area A: This study area is comprised of mostly wooded vegetation. It is analyzed as an area to be disturbed as a result of the proposed development. Currently, the stormwater runoff in this area, flows from the eastern side of the property to the wetlands located on the western side of the property. Runoff will continue to flow through the wetlands into Matawan Creek, also known as Study Point 1.

MONMOUTH COUNTY SOIL SURVEY INFORMATION								
SOIL TYPE (SYMBOL)	SOIL TYPE (NAME)	HYDROLOGIC SOIL GROUP						
AtsA	Atsion Sand	A/D						
EkaAr	Elkton Loam	C/D						
KkgB	Klej Loamy Sand	A/D						
KkgkB	Klej Loamy Sand, Clayey Substratum	A/D						
MakAt	Manahawkin Muck	D						
PHG	Pits, Sand, and Gravel	N/A						

Based on the Monmouth County soils survey information, the soil types native to the site include:

Per the soil investigation completed by Dynamic Earth, LLC, the soil borings and soil profile pits generally encountered approximately eleven to 14 inches of topsoil at the surface. Beneath the surface cover, natural coastal plain deposits were encountered that generally consisted of sand, loamy sand, sandy clay loam, silt loam, and clay loam with variable amounts of gravel. The natural coastal plain deposits were encountered to refusal (due to continuous wet cave-in) depths ranging between approximately ten feet and 12.0 feet below the ground surface.

Evidence of seasonal high groundwater (based on soil mottling) was encountered within the soil profile pits at depths ranging between approximately 0.9 feet and 4.1 feet below the ground surface. Groundwater was encountered at depths ranging between approximately two feet and 4.1 feet. Groundwater levels are expected to fluctuate seasonally and following significant periods of precipitation. A summary of the seasonal high groundwater levels and permeability test results is presented in the following table:

STORMWATER INVESTIGATION SUMMARY - Greenwood Road										
	Approximate		d Seasonal oundwater	Pe	Permeability Test Results					
Location	Surface Elevation (Feet)	Depth (Feet)	Elevation	Field USDA Classification	Sample Depth		eability s/Hour)			
	(Feel)	(reel)	(Feet)	Classification	(Inches)	Replicate A	Replicate B			
SPP-1	81.0	4.1	76.9	Sandy Clay Loam	53					
SPP-2	84.0	3.8	80.2	Loamy Sand	35	1.7	1.7			
SPP-2	64.0	5.0	80.2	Sandy Clay Loam	50	0.2	< 0.2			
SPP-3	71.5	0.9	70.6	Silt Loam	50					
SPP-4	74.5	0.9	73.6	Silt Loam	55	< 0.2	< 0.2			

IV. PROPOSED DRAINAGE CONDITIONS

The tract has been evaluated with the following drainage sub-watershed areas as depicted on the Proposed Conditions Drainage Area Map. Each sub-watershed area has been calculated as a separate point of analysis.

<u>Proposed Study Area A:</u> This portion of the site consists of the southern portion of the impervious asphalt drive aisles and parking lot. Stormwater runoff from this area is collected by a series of stormwater inlets which then flow to the proposed above ground detention Basin A. Stormwater runoff discharged from Basin A flows through the stormwater conveyance systems to the wetlands which ultimately flows to Matawan Creek located at Study Point 1.

<u>Proposed Study Area B:</u> This portion of the site consists of dwelling unit building #2 and the southwestern portion of the impervious asphalt drive aisles. Stormwater runoff from this area is collected by a series of roof drains and stormwater inlets that flow to the proposed above ground detention Basins B1 & B2. Stormwater runoff discharged from Basin B2 flows through the stormwater conveyance systems to the wetlands which ultimately flows to Matawan Creek located at Study Point 1.

<u>Proposed Study Area C:</u> This portion of the site consists of dwelling unit buildings # 1, 3, 4, & 5 and the northern portion of the impervious asphalt drive aisles and parking lots. Stormwater runoff from this area is collected by a series of roof drains and stormwater inlets that flow to the proposed above ground detention Basin C. Stormwater runoff discharged from Basin C flows through the stormwater conveyance systems to the wetlands which ultimately flows to Matawan Creek located at Study Point 1.

V. NON-STRUCTURAL STORMWATER MANAGEMENT STRATEGIES

The proposed project has been designed to the maximum extent practicable by incorporating the nonstructural stormwater management strategies set forth in NJAC 7:8-5.3 as follows:

- 1. **Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment lost:** The proposed impervious surface is minimized wherever possible under the proposed condition, therefore, increasing the water quality benefits on the site. By implementation of the manufactured treatment devices (MTD), the proposed development meets the water quality requirements set forth by NJAC 7:8.
- Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces: The impervious surfaces have been minimized wherever possible. Impervious surfaces have been diverted to multiple structural BMPs capable of providing water quality treatment.
- 3. <u>Maximize the protection of natural drainage features and vegetation</u>: In the proposed condition, there is a 10.1% increase in impervious coverage. The drainage pattern will remain unchanged from pre-developed to post-developed conditions.

- 4. <u>Minimize the decrease in the "time of concentration" from pre-construction to post-construction.</u> <u>"Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically</u> <u>most distant point of the drainage area to the point of interest within a watershed:</u> The decrease in the time of concentration has been minimized by maintaining existing overland flow slopes to the maximum extent practical.
- 5. <u>Minimize land disturbance including clearing and grading</u>: Land disturbance has been minimized where feasible. The site disturbance is limited to the development area.
- 6. <u>Minimize soil compaction</u>: Soil compaction will be minimized in the basins and proposed lawn and landscape areas. Areas for soil restoration and soil compaction testing are shown on the Soil Erosion and Sediment Control Plan.
- Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides: The project proposes low-maintenance trees, shrubs, and ground cover on the site. Refer to the Landscape Plan for plant information.
- 8. **Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas:** Due to the site constraints, it is not feasible to design a vegetated open-channel conveyance system on this project.
- 9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimizes the release of those pollutants into stormwater runoff: The proposed detention basins will detain the runoff from the site. The site also utilizes manufactured treatment devices to remove pollutants from stormwater.

VI. <u>DESIGN METHODOLOGY</u>

The intention of the proposed stormwater management facilities for this project is to provide applicable, required measures from the Township of Marlboro Land Use Ordinance, NJAC 5:21, and NJAC 7:8. In order to prepare the stormwater calculations for the subject project, an investigation of the property and topography was performed. An on-site review of the tract was performed by Dynamic Engineering Consultants, PC, verifying the existing site conditions and land cover characteristics. Dynamic Survey was contracted to prepare the Boundary and Topographic Survey for the existing site.

Based on our review of the existing site conditions and the Topographic Survey, the Drainage Area Maps for the existing and proposed site conditions as defined within this report were established. A grading plan was developed for the proposed site improvements with consideration to the existing drainage patterns. The plan was then designed to ensure runoff from the proposed development could be directed to stormwater management facilities to the maximum extent practicable in order to address the applicable sections of the Township of Marlboro Stormwater Management rules, NJAC 5:21, and NJAC 7:8.

The detention basins will temporarily store and attenuate stormwater runoff from the site. An outlet control structure for each basin has been implemented to release stormwater runoff at a controlled rate to satisfy the stormwater quantity requirements. Overflow from the basins is routed via the emergency spillways to the downstream Study Point 1.

According to the NJAC 7:8-5.5(a), a TSS removal rate of 80% is required for stormwater runoff generated as a result of a major development. Stormwater runoff generated by the water quality design storm is directed to proposed manufactured treatment devices (MTD) in each basin prior to discharging into the existing wetlands. These MTD's provide 80% removal rate of total suspended solids (TSS).

VII. <u>STORMWATER MANAGEMENT BASIN DESIGN AND RUNOFF QUANTITY</u> STANDARDS

In order to meet the stormwater runoff quantity and water quality requirements set forth in NJAC 7:8, the site design incorporates three (3) manufactured treatment devices and four (4) above ground detention basins. The basins accept stormwater runoff from the proposed parking areas, driveways, and tributary yard areas. The runoff flows over land by sheet flow and is then collected by inlets and transported by the stormwater conveyance systems to the basins.

A summary of the pre and post development flows are shown in the chart below:

<u>Design</u>	Existing Runoff Rate from Runoff Rate		Maximum Allowable	Proposed Runoff
<u>Storm</u>	Disturbed Areas (CFS)	Required Reduction	Runoff Rate (CFS)	Rate (CFS)
1 Year	0.81	0%	0.81	1.07
2 Year	4.97	50%	2.48	1.51
10 Year	10.66	25%	8.00	2.88
25 Year	14.95	0%	14.95	8.38
100 Year	23.17	20%	18.54	18.38

<u>Pre-development and Post Development Peak Runoff Results</u> Summary to POA 'A' to Study Point 1: Wetlands

VIII. GROUNDWATER RECHARGE & WATER QUALITY

As required by NJAC 7:8-5.5, a TSS removal rate of 80% is required for stormwater generated by the water quality design storm as a result of a major development. The design for the subject development meets the obligation for TSS removal by four (4) detention basins, and three (3) water quality manufactured treatment device (MTD).

Stormwater collected from the site is directed into onsite inlets and pipes and directed towards one of the onsite basins. Once collected, the detention basins, temporarily store and attenuate stormwater runoff from the development. The outlet control structures are implemented in each basin to release stormwater runoff at a controlled rate to satisfy the stormwater quantity and quality requirements. The Post-Development Annual Recharge Deficit has been calculated using the New Jersey Groundwater Recharge Spreadsheet. Per the NJGRS Spreadsheet and soils investigation, the site does not have any recharge deficits.

The stormwater management design for the project satisfies the requirements set forth in NJAC 7:8-5.5(a) by utilizing a Jellyfish MTD certified by the NJDEP to provide a minimum TSS removal rate of 80%. Each Basin has an 80% Water Quality Manhole after each outlet control structure before discharging offsite. As a result, the water quality requirements of the Township of Marlboro Land Use Ordinance and NJAC 7:8 are met. A copy of the NJDEP Certification Letter and sizing requirements for the Jellyfish MTD has been provided within the appendix of this report.

IX. STABILITY ANALYSIS

Per the NJ Soil Erosion Standards, Section 21, "Standard for Off-Site Stability," compliance has been met for the site. The conditions of the NJ SESC Standards Section 21-1 have been satisfied using the point of discharge method with a no well-defined waterway.

- a. Retain pre-developed runoff characteristics. Do not increase the rate of runoff from development. Discharge rates from the proposed stormwater improvements are equal to or below the flow rates in the existing conditions for the 2- and 10-year 24 hour storm events as shown in the tables below:
- b. Where there is no well-defined channel, no sandy condition, no trees or brush to substantially concentrate the flows and it can be reasonably assumed that the flow will disperse over a broad area. The combinations of slopes and soils in table 21-1 and the following criteria are considered stable for flows of 10cfs or less for a 25 year, 24hr design storm.
 - i. The maximum discharge rate shall be 10 cfs or less for the twenty-five (25) year storm: The discharge rate for each stability point is less than 10 cfs for the 25-year storm as shown in the above runoff rate charts.
 - ii. Multiple outlets may be utilized to reduce individual outlet flow rates to levels below the thresholds noted above. Outlets should be spaced no closer than 50 ft horizontally to avoid re-mixing of flows: One (1) outlet control structure and one (1) emergency spillway is provided for each basin. The outflow pipe from the outlet control structure and emergency spillway are no closer than 50 feet apart.

iii. Flow over the outlet area shall be less than 0.5 cfs/ft. Designers shall not design excessive widths which will cause flows to concentrate: Flow over the conduit outlet control structure is less than 0.5 cfs/ft as shown in the chart below:

Conduit Outlet Protection Flow Rate										
Basin #	2-yr flow	10-yr velocity								
	(cfs)	(cfs)	COP (ft.)	(cfs/ft)	(cfs/ft)					
Basin A	0.27	0.38	14	0.02	0.03					
Basin B	0.19	0.24	13	0.01	0.02					
Basin C	1.06	2.28	24	0.04	0.10					

- iv. Conduit outlet protection shall be provided in accordance with that Standard and may include: flat aprons, preformed scour holes, impact basins, stilling wells, plunge pools, etc. Level spreaders are not an acceptable design: Conduit Outlet Protection (COP) is provided at the outflow pipe of each basin. Calculations for each structure are provided in the appendix of the report.
- v. Topography shows broad uniform outlet area where flows will not concentrate: Topography is shown on the Grading Plan in the Preliminary and Final Site Plan Set.
- vi. Discharge locations shall contain perennial, erosion resistant vegetation: Vegetation outside of the discharge points will be unchanged. Existing vegetation is considered to be densely wooded.
- vii. Peak discharge velocities (in the last pipe section) do not exceed 2 fps: Peak discharge velocities

Discharge Velocity									
Basin #	Basin #2-yr flow (cfs)10-yr flow (cfs)Pipe Diameter (ft)10-yr Velocity								
Basin A	0.27	0.38	1.25	0.310					
Basin B	0.19	0.24	1.25	0.196					
Basin C	1.06	2.28	1.5	1.290					

viii. The maximum length of slope below the outlet(s) is 100 feet: The maximum length of slope below the outlet is 100 ft.

X. <u>CONCLUSION</u>

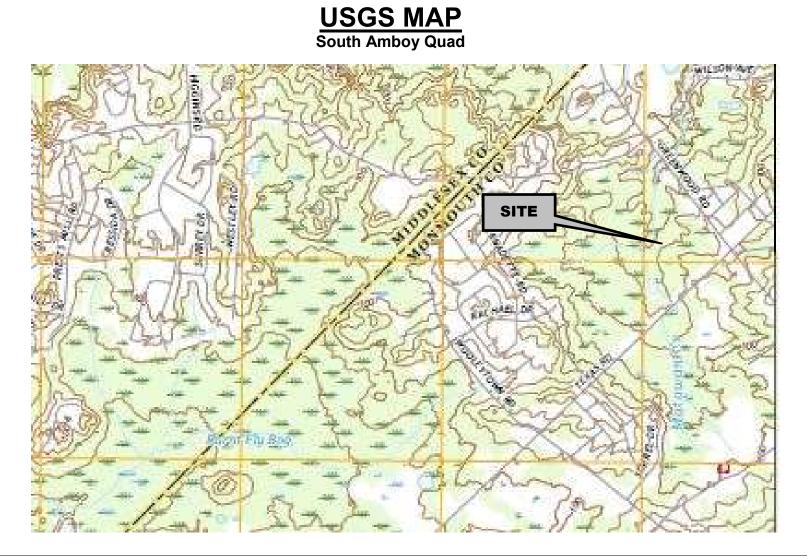
The proposed overall development has been designed with provisions for the safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns, adjacent roadways, or adjacent parcels. The TSS removal obligations set forth by NJAC 7:8 have been satisfied by utilizing four (4) detention basins, and three (3) water quality manufactured treatment devices to achieve the 80% TSS required removal rate for the development.

With this stated, it is evident that the proposed development will not have a negative impact on the existing drainage pattern, water quality, or groundwater recharge on site or within the vicinity of the subject parcel.

APPENDIX

1. USGS MAP



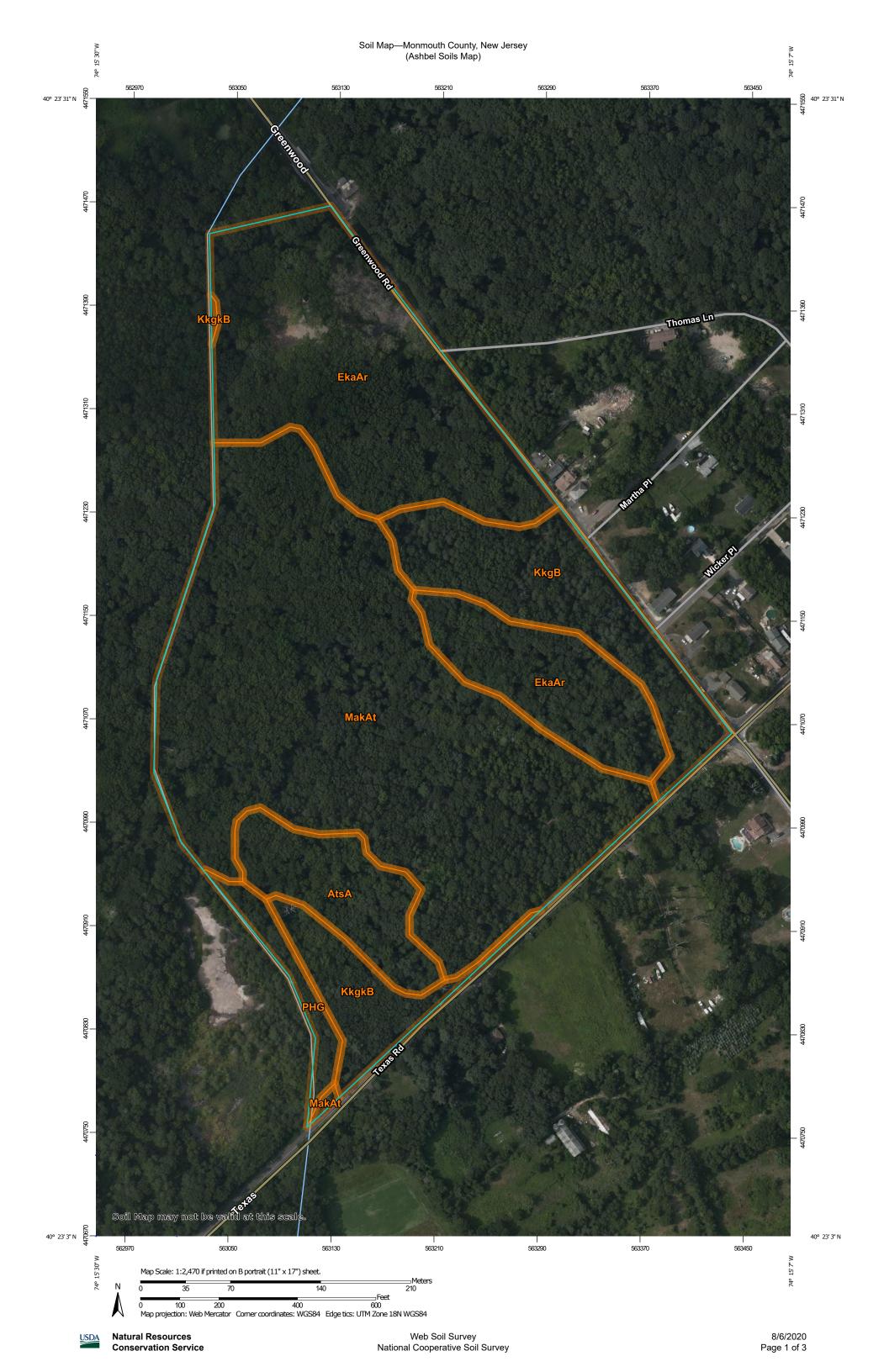


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2. NRCS SOILS MAPS



	MAP L	EGEND		MAP INFORMATION		
Soils Soils Soils Solution Special Poin Special Poin Special Poin Special Poin Classification Special Classification Special Classification	est (AOI) rea of Interest (AOI) oil Map Unit Polygons oil Map Unit Lines oil Map Unit Points nt Features lowout orrow Pit lay Spot losed Depression ravel Pit	EGEND	Spoil Area Stony Spot Very Stony Spot Wet Spot Other Special Line Features tures Streams and Canals	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 Mercato		
 ▲ ▲ ▲ ▲ ▲ M M	ravelly Spot andfill ava Flow larsh or swamp line or Quarry liscellaneous Water erennial Water ock Outcrop aline Spot andy Spot everely Eroded Spot inkhole lide or Slip odic Spot	Backgroun	Major Roads Local Roads nd Aerial Photography	 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 a of the version date(s) listed below. Soil Survey Area: Monmouth County, New Jersey Survey Area Data: Version 14, Jun 1, 2020 Soil map units are labeled (as space allows) for map scales 1:50,000 or larger. Date(s) aerial images were photographed: Jun 29, 2019—Jul 16, 2019 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
AtsA	Atsion sand, 0 to 2 percent slopes, Northern Coastal Plain	2.6	6.2%
EkaAr	Elkton loam, 0 to 2 percent slopes, rarely flooded	12.6	29.8%
KkgB	Klej loamy sand, 0 to 5 percent slopes	4.4	10.5%
KkgkB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes	1.9	4.6%
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	19.7	46.7%
PHG	Pits, sand and gravel	0.9	2.1%
Totals for Area of Interest		42.2	100.0%

3. RUNOFF CURVE NUMBER (CN) CALCULATIONS-EXISTING



EXISTING DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Greenwich Park Residential Development Job #: 2841-99-001 Location: Greenwood Road & Texas Road, Marlboro, NJ Computed By: SMM Checked By: SRC Date: 1/14/2021

Drainage Area	Impervious	Impervious	Curve	HSG A -	HSG A -	Curve	HSG D -	HSG D -	Curve	Avg.	Total	Total	TC (Min.)
	Area (acre)	Area (sf)	Number	Wooded Area	Wooded	Number	Wooded	Wooded	Number	Perv.	Pervious	Area	
			(CN) Used	(acre)	Area (sf)	(CN) Used	Area (acre)	Area (sf)	(CN)	Curve	Area	(acres)	
									Used	Number	(acres)		
Study Area A (Disturbed)	0.00	-	98	0.00	-	30	6.61	287,752	77	77	6.61	6.61	17
Total	0.00	-		0.00	-	-	6.61	287,752			6.61	6.61	

Per Monmouth County Soil Survey -	AtsA	HSG	A/D	Soil	Atsion sand
Per Monmouth County Soil Survey -	EkaAR	HSG	C/D	Soil	Elkton Loam
Per Monmouth County Soil Survey -	KkgB	HSG	A/D	Soil	Klej Loamy Sand
Per Monmouth County Soil Survey -	KkgkB	HSG	A/D	Soil	Klej Loamy Sand
Per Monmouth County Soil Survey -	LasC	HSG	А	Soil	Lakewood Sand
Per Monmouth County Soil Survey -	MakAt	HSG	A/D	Soil	Manahawkin Muck
Per Monmouth County Soil Survey -	PHG	HSG	None	Soil	Pits

Description	Runoff Curve Number (CN)	Runoff Curve Number (CN) (HSG	Runoff Curve Number (CN)	Runoff Curve Number (CN)
Impervious Surface	98	98	98	98
Open Space (lawn) (good)	39	61	74	80
Woods (good)	30	55	70	77

4. RUNOFF CURVE NUMBER (CN) CALCULATIONS-PROPOSED



PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project:	Greenwich Park Residential Development	Computed By:	KSOOK
Job #:	2841-99-001	Checked By:	SRC
Location:	Greenwood Road & Texas Road, Hamilton, NJ	Date:	1/20/2021

Drainage Area	Imp	pervious	Impervious	Curve	HSG D -	HSG D -	Curve	HSG D -	HSG D -	Curve	Avg.	Total	Total	ТС
	Are	ea (acre)	Area (sf)	Number	Open	Open	Number	Wooded	Wooded	Number	Perv.	Pervious	Area	(Min.)
				(CN) Used	Space Area	Space	(CN) Used	Area (acre)	Area (sf)	(CN)	Curve	Area	(acres)	
					(acre)	Area (sf)				Used	Number	(acres)		
Study Area 1 - Basin A		0.16	6,800	98	0.30	13,108	80	0.00	-	77	80	0.30	0.46	10
Study Area 2 - Basin B		0.42	18,436	98	0.67	29,104	80	0.14	6,315	77	79	0.81	1.24	10
Study Area 3 - Basin C		2.96	129,117	98	0.65	28,397	80	0.00	-	77	80	0.65	3.62	10
Study Area 4 - Bypass		1.36	59,042	98	0.00	-	80	0.00	-	77	N/A	0.00	1.36	10
Т	otal	4.90	213,395		1.62	70,609		0.14	6,315			1.77	6.66	

Per Monmouth County Soil Survey -	AtsA	HSG	A/D	Soil	Atsion sand
Per Monmouth County Soil Survey -	EkaAR	HSG	C/D	Soil	Elkton Loam
Per Monmouth County Soil Survey -	KkgB	HSG	A/D	Soil	Klej Loamy Sand
Per Monmouth County Soil Survey -	KkgkB	HSG	A/D	Soil	Klej Loamy Sand
Per Monmouth County Soil Survey -	LasC	HSG	А	Soil	Lakewood Sand
Per Monmouth County Soil Survey -	MakAt	HSG	A/D	Soil	Manahawkin Muck
Per Monmouth County Soil Survey -	PHG	HSG	None	Soil	Pits

Description	Runoff Curve Number (CN) (HSG A)	Runoff Curve Number (CN) (HSG B)	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98	98	98
Open Space (lawn) (good)	39	61	74	80
Woods (good)	30	55	70	77

5. EXISTING TIME OF CONCENTRATION (Tc) CALCULATIONS

DYNAMIC ENGINEERING
ENGINEERING

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826 Newtown-Yardley Road, Suite 425, Newtown, PA 18940 (267) 685-0276

Date: 1/15/2021 Project: Greedwich Park Project No: 2841-99-001

Calculated By: SMM Checked By: SRC

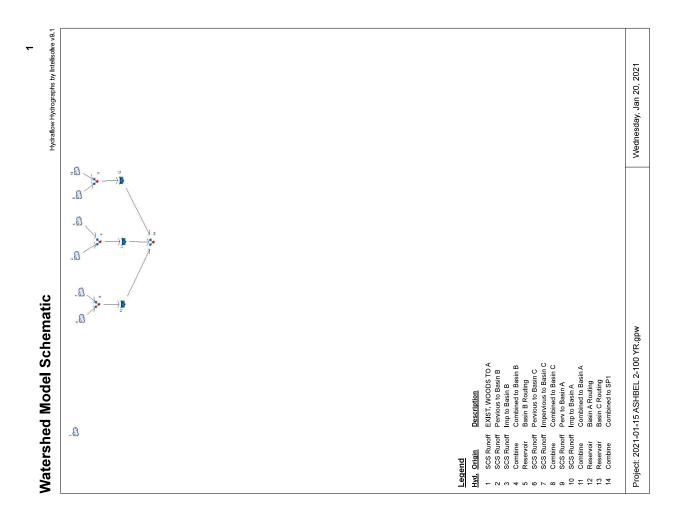
Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Existing				
Drainage Area: Study Area A				
Sheet Flow :	AB			
<u>Sheet now</u> .	Short Grass			
1. Surface Description	Prairie	3		
2. Manning's Roughness Coefficient, <i>n</i>	0.15			
3. Flow Length, $L \{ total L \le 100 \text{ ft} \}$	100.0 ft	0.001	0.00	
4. Two-Year 24-hour Rainfall, p_2 for Monmouth County	3.38 in	3.38 in	3.38	3 in
5. Land Slope, s (ft/ft)	0.026 ft/ft			
6. Travel Time, $T_t = \frac{0.007 (n L)^{0.8}}{p_2^{0.5} s^{0.4}}$	0.143 hr	+ 0.000 hr +	0.000 hr	=
ρ_2 s				
Shallow Concentrated Flow :	BC			
7. Surface Description	Unpaved			
8. Flow Length, <i>L</i>	1291.0 ft			
9. Watercourse Slope, s	0.026 ft/ft			
10. Average velocity, V { see Figure 3.1)	2.60 ft/s		<u> </u>	
11. Travel Time, $T_t = \frac{L}{3600 V}$	0.138 hr	+ 0.000 hr +	0.000 hr	=
3000 V				
Channel Flow :				
12. Pipe Diameter, D				
13. Cross-Sectional Flow Area, A				
14. Wetted Perimeter, p_w				
15. Hydraulic Radius, $r = A / p_w$				
16. Channel Slope, <i>s</i>				
17. Pipe Material				
18. Manning's Roughness Coefficient, $n \dots $				
19. Velocity, V = $\frac{1.49 r^{2/3} s^{1/2}}{n}$				
20. Flow Length, <i>L</i>				
	0.000 hr	+ 0.000 hr +	0.000 hr	_
3600 V		+ 0.000 hr +	0.000 hr	=
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6	, 11 and 21 }	· · · · · · · · · · · · ·		

6. HYDROGRAPH SUMMARY REPORTS – EXISTING & PROPOSED 2 YR., 10 YR., 25 YR. & 100 YR.

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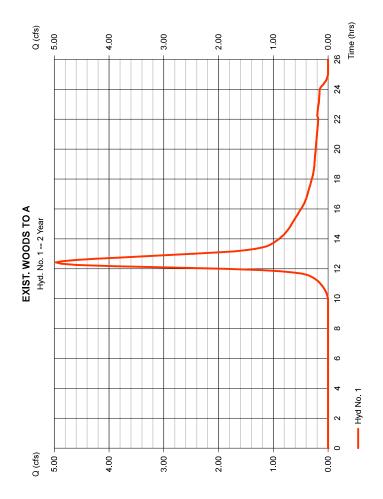
Нy	Hydrograph Summary Report	ph Sı	mmr	ary R	eport				Hydraffow Hydrographs by Intelisolve v9.1
Hyd No	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
-	SCS Runoff	4.969	5	745	33,182		1		EXIST WOODS TO A
0	SCS Runoff	0.809	5	735	4,305		1		Pervious to Basin B
e	SCS Runoff	0.830	2	730	4,767	ļ		1	Imp to Basin B
4	Combine	1.623	5	735	9,072	2, 3			Combined to Basin B
5	Reservoir	0.193	5	830	9,062	4	82.49	4,281	Basin B Routing
9	SCS Runoff	0.682	5	735	3,615	ļ			Pervious to Basin C
7	SCS Runoff	5.850	5	730	33,598	ļ			Impervious to Basin C
ø	Combine	6.515	£	730	37,213	6, 7		1	Combined to Basin C
თ	SCS Runoff	0.315	5	735	1,668				Perv to Basin A
10	SCS Runoff	0.316	5	730	1,816	ļ			Imp to Basin A
7	Combine	0.625	2	735	3,484	9, 10			Combined to Basin A
15	Reservoir	0.270	5	760	3,479	11	82.61	986	Basin A Routing
13	Reservoir	1.063	5	785	37,211	ø	75.50	14,973	Basin C Routing
4	Combine	1.508	2	780	49,752	5, 12, 13			Combined to SP1
202	2021-01-15 ASHBEL 2-100 YR.gpw	BEL 2-10	0 YR.gpv	3	Return Po	Return Period: 2 Year	ar	Wednesday	Wednesday, Jan 20, 2021



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 1			
EXIST. WOODS TO A	IO A		
Hydrograph type	= SCS Runoff	Peak discharge	П
Storm frequency	= 2 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 33,182 cuft
Drainage area	= 6.610 ac	Curve number	П
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 16.90 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.200 x 77) + (4.400 x 30)] / 6.610



Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Jan 20, 2021

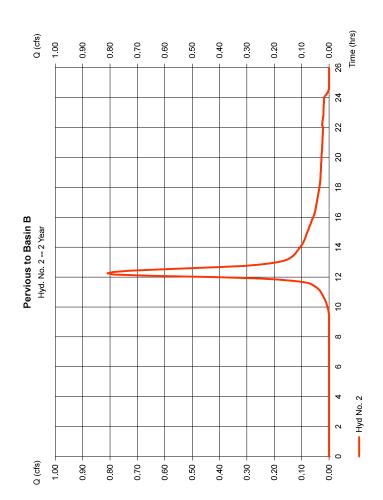
4

Hyd. No. 2

Pervious to Basin B

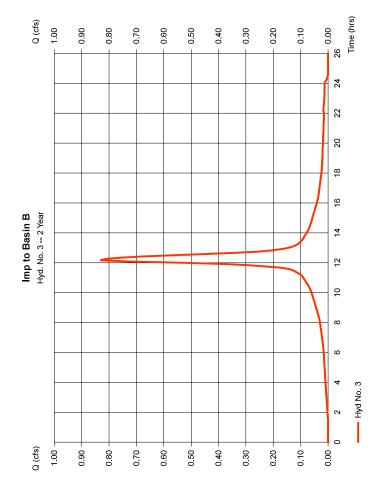
п	П	= 4,305 cuft	п	Ш	Ш	= Type III	= 285
Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor
SCS Runoff	2 yrs	: 5 min	0.810 ac	0.0%	USER	3.38 in	24 hrs
Hydrograph type =	Storm frequency =		Drainage area =	Basin Slope =	Tc method =	Total precip. =	Storm duration =

* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810



Hydrograph Report

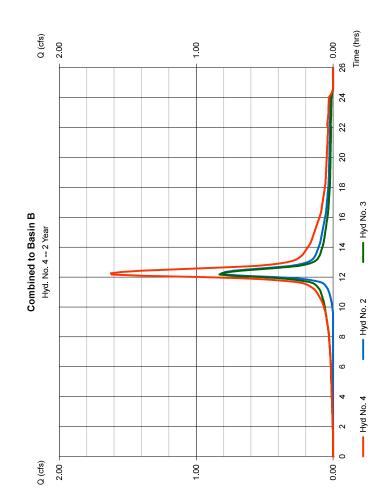
Wednesday, Jan 20, 2021 Peak discharge = 0.830 cfs Time to peak = 12.17 hrs Hyd. volume = 4,767 cuft Curve number = 98 Hydraulic length = 0.ft Time of conc. (Tc) = 10.00 min Distribution = Type III Shape factor = 285 = SCS Runoff = 2 yrs = 5 min = 0.420 ac = 0.9% = USER = 3.38 in = 24 hrs Hydraflow Hydrographs by Intelisolve v9.1 Hydrograph type Storm frequency Time interval Drainage area Basin Slope Tc method Total precip. Storm duration Imp to Basin B Hyd. No. 3



Hydrograph Report

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Peak discharge = 1.623 cfs Time to peak = 12.25 hrs Hyd. volume = 9,072 cuft Contrib. drain. area = 1.230 ac = Combine = 2 yrs = 2, 3 Hydraflow Hydrographs by Intelisolve v9.1 Combined to Basin B Hydrograph type Storm frequency Time interval Inflow hyds. Hyd. No. 4



Wednesday, Jan 20, 2021

Hydrograph Report	sh Report		2	Pond	Pond Report					8
Hydraftow Hydrographs by Intelisolve v9.1	by Intelsolve v9.1		Wednesday, Jan 20, 2021	Hydraflow Hydr Pond No. 1	Hydraflow Hydrographs by Intelisolve v9.1 Pond No. 1 - Basin B	/9.1			We	Wednesday, Jan 20, 2021
Hyd. No. 5				Pond Data Contours - Use	sr-defined contour area	s. Average end area m	Pond Data contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 81.00 ft	lation. Begining Elevation	1 = 81.00 ft	
Hydrograph type		Peak discharge	= 0.193 cfs	Stage / Storage Table	rage Table	Contour area (coff)	(t) Incr Storada (cuft)	Total storade (cuff)	_	
Storm frequency Time interval Inflow hyd. No. Reservoir name		Time to peak Hyd. volume Max. Elevation Max. Storage	= 13.83 hrs = 9,062 cuft = 82.49 ft = 4,281 cuft	0.00 0.50 0.50 0.50 1.50 0.5 2.50 0.5 2.50	81.00 81.50 82.00 83.00 83.00 83.50	2,042 2,042 5,929 7,502		511 511 2,042 4,315 7,049	_	
Storage Indication method used.	od used.			3.00 9.00 9.00 9.00	84.50 85.00	9,083 9,083 10,373 11,663	5,509 5,509	14,555 19,419 24,928		
				Culvert / Or	Culvert / Orifice Structures		Weir Structures	rres		
				Rise (in) Span (in) No Bornels		 	[PrfRsr] 0.00 Crest Len (ft) 0.00 Crest El. (ft) Mol: 0.00	[A] [B] = 14.00 20.00 = 84.20 84.50	C	[0] 0.00 0.00 0.00
Q (cfs)	Basin B Routing Hyd. No. 5 2 Year	ting Year	Q (cfs)	nu. barrets Invert EI. (ft) Length (ft) Slope (%)		00.0	0 0			0
2.00			2.00	N-Value Orifice Coeff Multi-Stage		.013 .013 n/a 0.60 0.60 0.60 Yes No No	0 Exfil (in/hr) TW Elev (ft)	= 0.000 (by Wet area)= 0.00	<u> </u>	
	•					Note: Culvert/Orifice outflows	Note: CulvertOrifice outflows are analyzed under niet (o) and outlet (oc) control. Weir risers checked for onfice conflictors (o) and submargence (b)	t (oc) control. Weir risers checked	d for orifice conditi	ons (ic) and submergence (s).
				Stage (ft)			Stage / Discharge			Elev (ft)
				4.00						85.00
			2							
00.1				3.00						84.00
				2.00						83.00
				1.00						82.00
0	5 10 15	20 25	30 35 0.00							
Hyd No. 5	Hyd No. 4	Total storage used = 4,281 cuft	cuft Time (hrs)	0.00	1 00 2 00	3.00 4.00	5 00 6 00	7.00 8.00	00 6	10 00 11 00

11.00 11.00 Discharge (cfs)

9.00 10.00

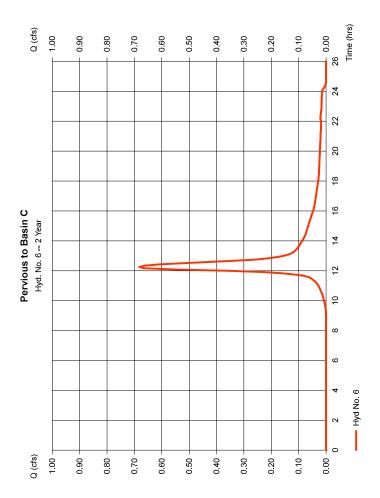
5.00 6.00 7.00 8.00

Hyd No. 5 2

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⊓yuranow ⊓yurograpris by			weattesday, Jail 20, 2021
Hyd. No. 6			
Pervious to Basin C	C		
Hydrograph type	= SCS Runoff	Peak discharge	= 0.682 cfs
Storm frequency	= 2 yrs	Time to peak	Ш
Time interval	= 5 min	Hyd. volume	П
Drainage area	= 0.650 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	П
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



Hydrograph Report

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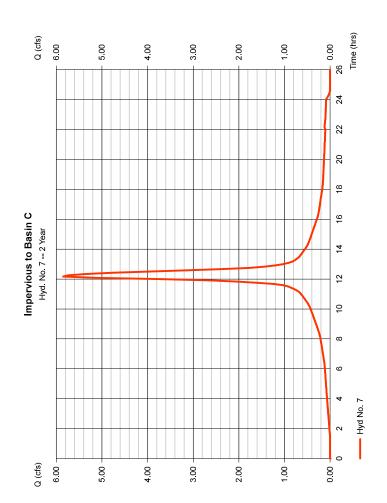
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 7

Impervious to Basin C

	0		
Hydrograph type	= SCS Runoff	Peak discharge	Ш
Storm frequency		Time to peak	п
Time interval	= 5 min	Hyd. volume	п
Drainage area	Q	Curve number	п
Basin Slope	= 0.0%	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	п
Total precip.	= 3.38 in	Distribution	п
Storm duration	= 24 hrs	Shape factor	п

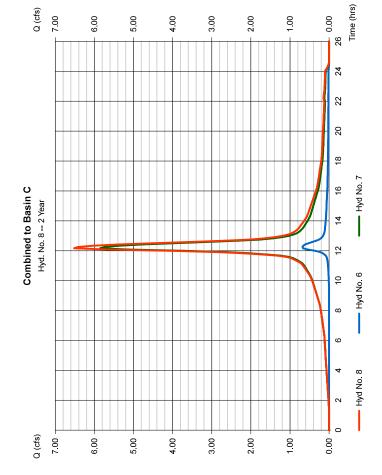
= 5.850 cfs = 12.17 hrs = 33,598 cuft = 98 = 0.61 = 10.00 min = 7ype III



Wednesday, Jan 20, 2021

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Hydrograph Report	F
Hydraflow Hydrographs by Intelsolve v9.1	Wednesday, Jan 20, 2021
Hyd. No. 8	
Combined to Basin C	
Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 6, 7	Peak discharge = 6.515 cfs Time to peak = 12.17 hrs Hyd. volume = 37,213 cuft Contrib. drain. area = 3.610 ac

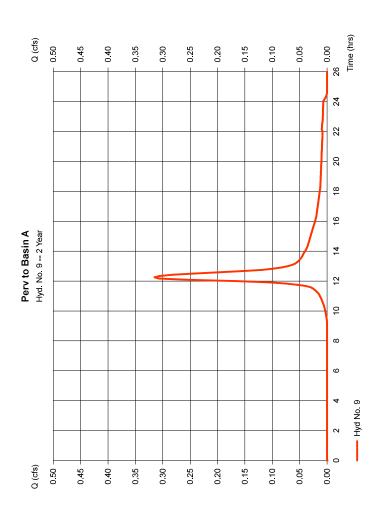


Hydrograph Report

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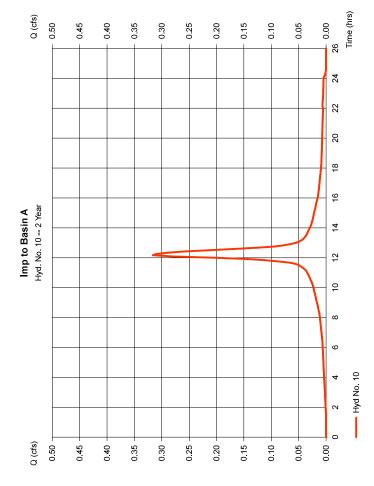
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.315 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 1,668 cuft
Drainage area	= 0.300 ac	Curve number	= 80*
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
Tc method	= USER	(i) E	= 10.00 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs		= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300



Hydrograph Report

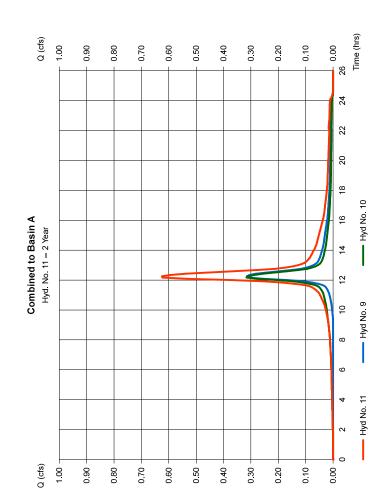
Hydraftow Hydrographs by Intelsolve v9.1 Wednesday, Jan 20, 2021 Hydr. No. 10 Imp to Basin A Hydrograph type = SCS Runoff Time interval = 5 min Drainage area = 0.160 ac Basin Slope = 0.36 cfs Time to peak discharge = 0.316 cfs Time to peak discharge = 12.17 hrs Hyd. volume = 1,816 cuft Curve number = 18.16 cuft Curve number = 1,816 cuft Curve number = 0.0,% Hydraulic length = 0,ft Time of conc. (Tc) = 10.00 min Distribution = 24 hrs Storm duration = 24 hrs



Hydrograph Report

33

Hydraflow Hydragraphs by Intelsolve v9.1 Wednesday, Jan 20, 2021
Hydr. No. 11
Combined to Basin A
Combined to Basin A
Hydrograph type = Combine
Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 5 min
Inflow hyds. = 9, 10
Contrib. drain. area = 0.460 ac

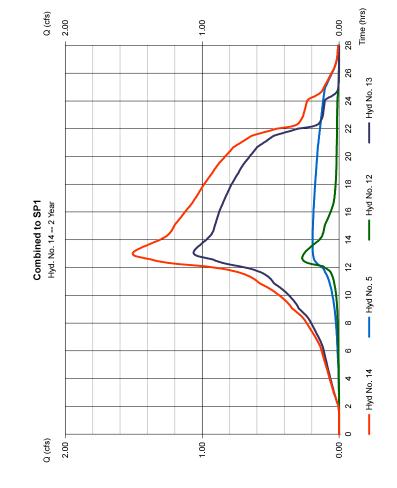


	Hydrograph Report	Report		2		eport						-	2
$\label{eq:product} \label{eq:product} eq:p$	draflow Hydrographs by Intel	isolve v9.1		Wednesday, Jan 20, 2021	Hydrallow Hydroc Pond No. 3	- Basin A	1.9.1					weanesda	y, Jan ∠u, ∠u
$ \begin{array}{c} \label{eq:constraints} \\ eq:con$	Hyd. No. 12				Pond Data Contours - User⊣	defined contour area:	s. Average end	area method u:	sed for volume calculat	tion. Begining Elev	vation = 81.50	ų	
$ \begin{array}{c} 2.93 \\ 1.6$			Peak discharge	= 0.270 cfs	Stage / Stora Stage (ft)	ge Table Elevation (ft)	Contour a		Incr. Storage (cuft)	Total storage	(cuft)		
Bit A Roting Control Control Sectore Control Sectore <		= 2 yrs = 5 min = 11 - Combined to Basin A : Basin A	Time to peak Hyd. volume Max. Elevation Max. Storage	= 12.67 hrs = 3.479 cuft = 82.61 ft = 986 cuft	0.50 0.50 1.50 2.50 2.50	81.50 82.50 83.00 83.50 83.50 84.00	00 975 1,314 2,088 2,526		0 573 741 1,154	245 245 818 2,453 2,453 3,647			
Bail Col Col <td>age Indication method use</td> <td></td> <td></td> <td></td> <td>3.00 Culvert / Orifi</td> <td>84.50 ice Structures</td> <td>3,026</td> <td></td> <td>1,388 Weir Structur</td> <td></td> <td></td> <td></td> <td></td>	age Indication method use				3.00 Culvert / Orifi	84.50 ice Structures	3,026		1,388 Weir Structur				
Bain Routing (Hori Ci-2 Var) C(H) Easin Routing (Hori Ci-2 Var) C(Hori Ci-2 Var)					Rise (in) Span (in) No. Barrels Invert El. (ft)		_		Crest Len (ft) Crest El. (ft) Weir Coeff. Weir Tone				
$ \begin{array}{ $	fs)	Basin A Routing Hyd. No. 12 2 Year		Q (cfs)	Length (ft) Slope (%) N-Value					= Yes		No	
Image: mark of the state of				1.00	Orifice Coeff. Multi-Stage			0.60 No		= 0.000 (by Wet = 0.00	t area)		
070 070 070 040 050 050 050 050 050 040 070 020	0.0			0.90	Stage (ft)			Stag	e / Discharge				
- - 0.50 -				0.70	3.00								
- - <td></td> <td></td> <td></td> <td>0.50</td> <td>5.00</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>~~~~~</td>				0.50	5.00								~~~~~
0 2 4 6 8 10 12 14 16 18 20 22 24 26 00 0.00 0.00 0.00 0.00 15.00 15.00 21.00 27.00 27.00 27.00 33.00 33.00 33.00 12.00 15.00 15.00 15.00 27.00				0.20	1.00								
	0	6 8 10 12	6 18 20 2: tal storage used = 986 cu	24 2	0.00	6.00							36.00 81.50

			Hydraflow Hydrog	Hydraffow Hydrographs by Intelisolve v9.1	E			>	Wednesday, Jan 20, 2021
Hydraftow Hydrographs by Intelsolve v9.1 Hyd. No. 13		Wednesday, Jan 20, 2021	Pond No. 2 - Basin C Pond Data Contours - User-defined cont	- Basin C defined contour areas.	Average end area	Pond No. 2 - Basin C Pond Data Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 72.00 ft	culation. Begining Elevati	on = 72.00 ft	
Basin C routing Hydrograph type = Reservoir	Peak discharge	= 1.063 cfs	Stage / Storage Table Stage (ft) Elevati	ige Table Elevation (ft)	Contour area (sqft)	qft) Incr. Storage (cuft)	t) Total storage (cuft)	ŧ	
storm requency = ∠ yrs Time interval = 5 min Inflow hyd. No. = 8 - Combined to Basin C Reservoir name = Basin C	lime to peak Hyd. volume Max. Elevation Max. Storage	= 13.08 nrs = 37,211 cuft = 75.50 ft = 14,973 cuft	0.00 0.50 2.50 2.50 2.50 2.50 2.50 2.50	72.00 73.00 74.00 74.00	00 641 3,422 5,531 6,781	0 160 1,172 2,2355 3,078	0 160 641 7,126 7,126		
Storage Indication method used.			3.00 4.05 5.50 5.50 5.50 5.50	75.00 76.00 76.00 77.00 77.50	8,030 8,715 9,400 10,075 10,749 11,413	3,703 4,186 4,529 4,529 5,586 5,541	10,829 15,015 19,544 29,618 29,618 35,159		
			Culvert / Orifi	ctures		Weir Structures			
Basin C Routing			Rise (in)	[A] [B] = 18.00 4.50	[C]	[PrfRsr] 0.00 Crest Len (ft)	[A] = 14.00		[D]
Hyd. No. 13 2 Year		Q (cfs)	Span (in) No. Barrels Invert El. (ft)		6.00 1 75.29	0.00 Crest EI. (ft) 0 Weir Coeff. 0.00 Weir Type	= 76.62 76.99 = 3.33 2.60 = Rect Broad	9 76.52 3.33 Id Rect	0.00 3.33
			Length (ft) Slope (%) N-Value	= 42.00 0.00 = 0.50 0.00 = 013 013	0.00 0.00 013	0.00 Multi-Stage n/a n/a			No
		6.00	Orifice Coeff. Multi-Stage		0.60 No	0.60 Exfil.(in/hr) No TW Elev. (ft)	= 0.000 (by Wet area)= 0.00	ea)	
				ž	ste: CulvertiOrifice outflov	Nets: CulverOnfrice outflows are analyzed under rield (ic) and outlet (ico) control. Weir risens checked for onfrice conditions (ic) and submergence (i).	ttlet (oc) control. Weir risers chec	ked for orifice con	ditions (ic) and submergence (s)
		2:00	Stage (ft)			Stage / Discharge			Elev (ft)
		4.00	6.00						78.00
			5.00						17.00
		3.00	<u> </u>						
			4.00						26.00
		7-00	3.00						75.00
		1.00	5.00						74.00
	18 20 30	0.00	1.00						23.00
d No. 13 - Hvd No. 8	storade lised = 14.9	I							42.00

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Hydraffow Hydrographs by Intelisolve v9.1	ntelisolve v9.1	>	Wednesday, Jan 20, 2021
Hyd. No. 14			
Combined to SP1			
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 2 yrs = 5 min = 5, 12, 13	Peak discharge = 1.508 cfs Time to peak = 13.00 hrs Hyd. volume = 49,752 cu Contrib. drain. area = 0.000 ac	= 1.508 cfs = 13.00 hrs = 49,752 cuft = 0.000 ac



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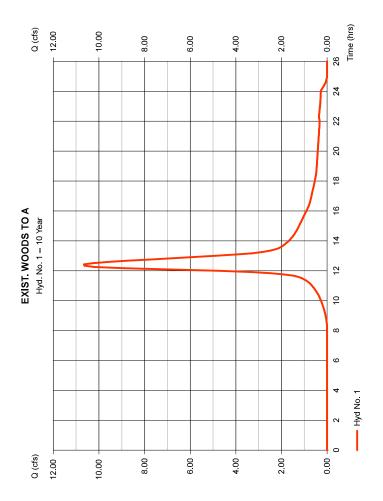
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Ę	Hydrograph Summary Report	ph Sı	mm	ary R	eport				20 Hydraffow Hydrographs by Intelisolve v9.1
Hyd No	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
-	SCS Runoff	10.66	2	745	69,641			+	EXIST. WOODS TO A
7	SCS Runoff	1.670	5	735	8,767				Pervious to Basin B
ы	SCS Runoff	1.295	5	730	7,564	1			Imp to Basin B
4	Combine	2.950	5	730	16,331	2, 3			Combined to Basin B
2	Reservoir	0.241	5	890	16,320	4	83.28	8,911	Basin B Routing
9	SCS Runoff	1.382	5	735	7,255	1			Pervious to Basin C
4	SCS Runoff	9.125	5	730	53,307				Impervious to Basin C
ø	Combine	10.50	ß	730	60,562	6, 7		ł	Combined to Basin C
თ	SCS Runoff	0.638	S	735	3,349		-	ļ	Perv to Basin A
10	SCS Runoff	0.493	5	730	2,881	ļ	1	1	Imp to Basin A
7	Combine	1.127	5	730	6,230	9, 10			Combined to Basin A
12	Reservoir	0.377	5	765	6,225	1	83.24	2,011	Basin A Routing
13	Reservoir	2.275	5	775	60,560	ø	76.58	25,179	Basin C Routing
14	Combine	2.883	2	775	83,106	5, 12, 13			Combined to SP1
202	2021-01-15 ASHBEL 2-100 YR.gpw	BEL 2-10	0 YR.gp/	8	Return P	Return Period: 10 Year	ear	Wednesday	Wednesday, Jan 20, 2021

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Hydraffow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 1			
EXIST WOODS TO A	IO A		
Hydrograph type	= SCS Runoff Pe	^b eak discharge	= 10.66 cfs
Storm frequency		ne to peak	= 12.42 hrs
Time interval	= 5 min Hyc	Hyd. volume	= 69,641 cuft
Drainage area	= 6.610 ac	urve number	= 77*
Basin Slope	= 0.0 % Hyd	draulic length	= 0 ft
Tc method	= USER Tim	ne of conc. (Tc)	= 16.90 min
Total precip.	= 5.23 in Dis	Distribution	= Type III
Storm duration	= 24 hrs Sh	shape factor	= 285

* Composite (Area/CN) = [(2.200 x 77) + (4.400 x 30)] / 6.610



Hydrograph Report

21

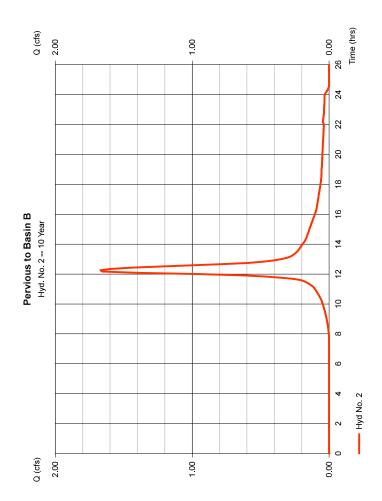
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 2

Pervious to Basin B

	п	п	= 8,767 cuft	п	Ш	Ш	= Type III	= 285
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (To	Distribution	Shape factor
1	= SCS Runoff	= 10 yrs	= 5 min	= 0.810 ac	= 0.0 %	= USER	= 5.23 in	= 24 hrs
	Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration

* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810

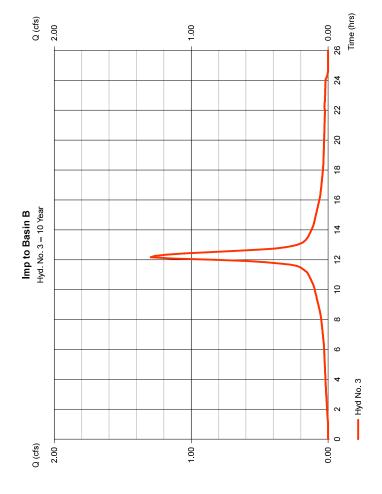


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Wednesday, Jan 20, 2021

Hydrograph Report

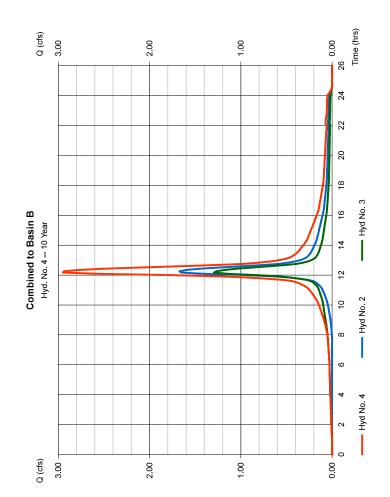
Hydraffow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 3			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 1.295 cfs
Storm frequency		Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 7,564 cuft
Drainage area	= 0.420 ac	Curve number	= 98
Basin Slope		Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

23

Peak discharge = 2.950 cfs Time to peak = 12.17 hrs Hyd. volume = 16,331 cuft Contrib. drain. area = 1.230 ac = Combine = 10 yrs = 2, 3 Hydraflow Hydrographs by Intelisolve v9.1 Combined to Basin B Hydrograph type Storm frequency Time interval Inflow hyds Hyd. No. 4

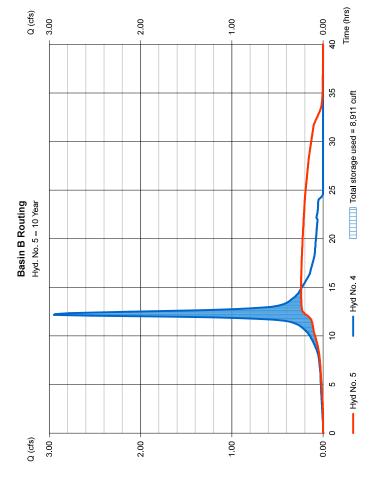


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Wednesday, Jan 20, 2021

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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 5			
Basin B Routing			
Hydrograph type	= Reservoir	Peak discharge	= 0.241 cfs
Storm frequency	= 10 yrs	Time to peak	= 14.83 hrs
Time interval	= 5 min	Hyd. volume	= 16,320 cuft
Inflow hyd. No.	= 4 - Combined to Basin B	Max. Elevation	= 83.28 ft
Reservoir name	= Basin B	Max. Storage	= 8,911 cuft
Storage Indication method used.	used.		



25

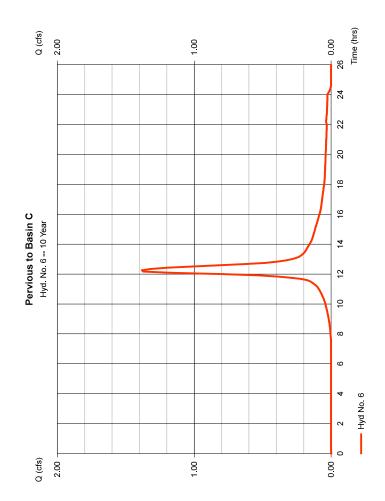
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 6

Pervious to Basin C

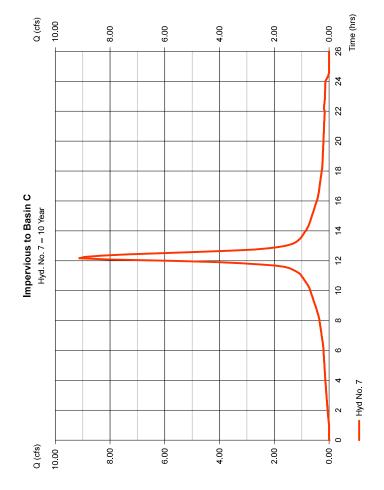
	п	П	= 7,255 cuft	П	Ш	Ш	= Type III	= 285	
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor	
3	= SCS Runoff	= 10 yrs	= 5 min	= 0.650 ac	= 0.0 %	= USER	= 5.23 in	= 24 hrs	
	Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration	

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



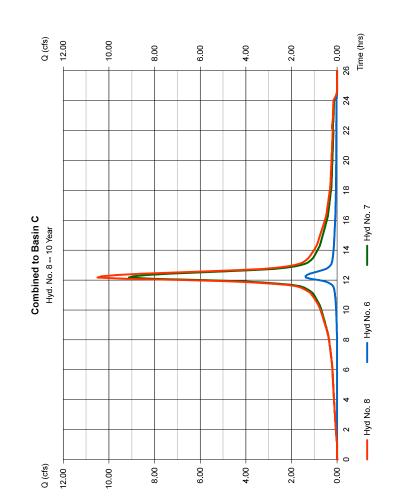
26

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 7			
Impervious to Basin C	in C		
Hydrograph type	= SCS Runoff	Peak discharge	= 9.125 cfs
Storm frequency	= 10 yrs	Time to peak	п
Time interval	= 5 min	Hyd. volume	= 53,307 cuft
Drainage area	= 2.960 ac	Curve number	п
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

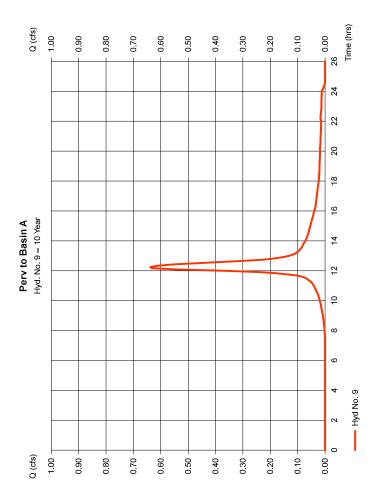
Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1	Wednesday, Jan 20, 2021
Hyd. No. 8		
Combined to Basin C	C	
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 10 yrs = 5 min	Peak discharge = 10.50 cfs Time to peak = 12.17 hrs Hyd. volume = 60,562 cuft Contrib chain, area = 3.610 ac
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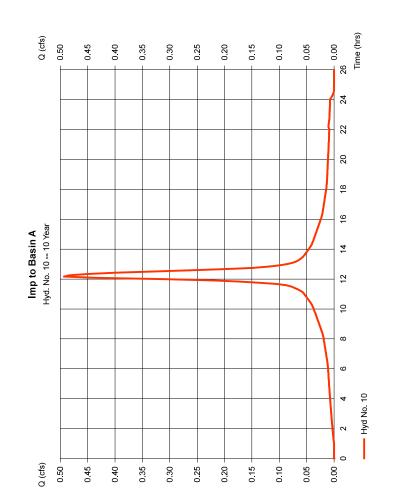
Hydraflow Hydrographs by Intelisolve v9.1	Intelsolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	П
Storm frequency	= 10 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 3,349 cuft
Drainage area	= 0.300 ac	Curve number	П
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	Ϊ
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300

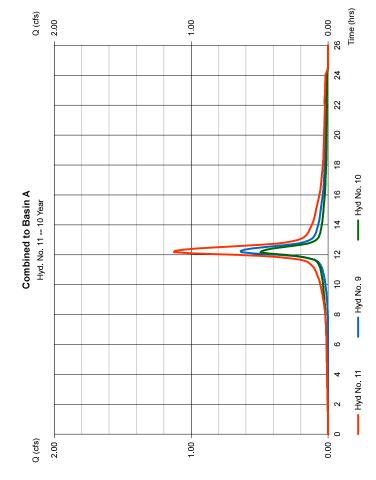


Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 10			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.493 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 2,881 cuft
Drainage area	= 0.160 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydraffow Hydrographs by Intelisolve v9.1	ntelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 11			
Combined to Basin A	A		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 10 yrs = 5 min = 9, 10	Peak discharge = 1.127 cfs Time to peak = 12.17 hrs Hyd. volume = 6,230 cuf Contrib. drain. area = 0.460 ac	= 1 127 cfs = 12 17 hrs = 6,230 cuft a = 0.460 ac

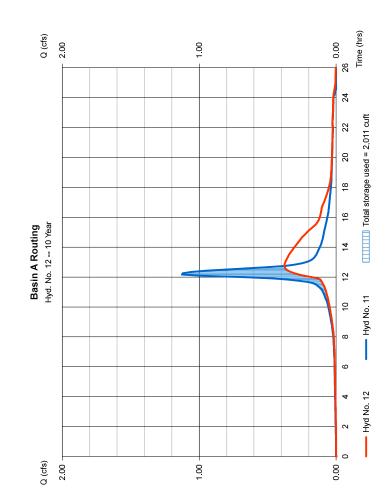


Hydrograph Report

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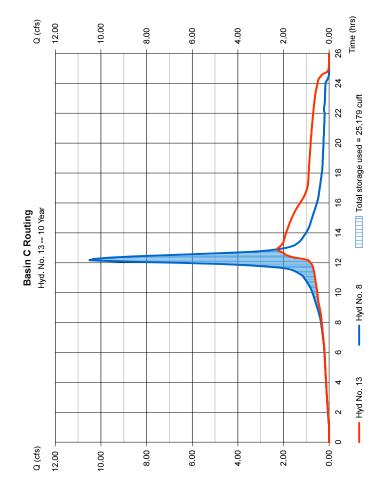
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 12			
Basin A Routing			
Hydrograph type	= Reservoir	Peak discharge	= 0.377 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.75 hrs
Time interval	= 5 min	Hyd. volume	= 6,225 cuft
Inflow hyd. No.	= 11 - Combined to Basin A	Max. Elevation	= 83.24 ft
Reservoir name	= Basin A	Max. Storage	= 2,011 cuft

Storage Indication method used.



Hydraftow Hydrographts by Intelsiolve v9.1 Hydr. No. 13 Basin C Routing Hydrograph type = Reservoir Storm frequency = 10 yrs Time interval = 5 min Inflow hyd. No. = 8 - Combined to Basin C Max. Elevation = 76.58 ft Max. Storage = 25,179 cuft

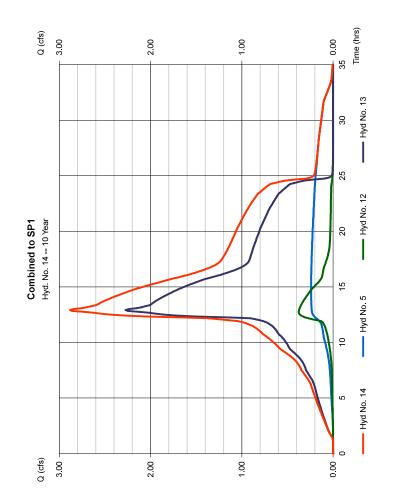
Storage Indication method used.



Hydrograph Report

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Hydraftow Hydrographs by Intelsolve v9.1 Wednesday, Jan 20, 2021 **Hyd. No. 14** Combined to SP1 Hydrograph type = Combine Storm frequency = 10 yrs Time interval = 5 min Inflow hyds. = 5, 12, 13 Contrib. drain. area = 0.000 ac

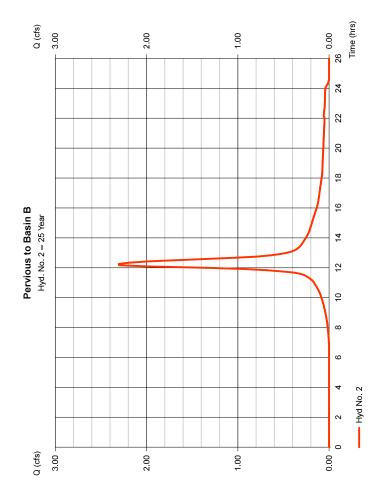


Нy	Hydrograph Summary Report	ph Sı	mm	ary R	keport	Ŀ			35 Hvdraflow Hvdrooraphs by Intelisative v9.1	Hydrograph Report	36
Hyd. No	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	Hydraftow Hydrographs by Intelsiolve v9.1 Wednesday, Jan 20, 2021 Hyd. No. 1 EXIST. WOODS TO A	Jan 20, 2021
- N 0 4 V 0 V	SCS Runoff SCS Runoff SCS Runoff Combine Reservoir SCS Runoff SCS Runoff	14.95 2.305 1.620 3.921 0.266 1.893 11.42	מ מ מ מ מ מ	740 735 730 925 730 735	97,564 12,144 9,531 21,675 21,664 9,994 67,171	, , , , , , , , , , , , , , , , , , ,	83.77	12,644	EXIST. WOODS TO A Pervious to Basin B Imp to Basin B Combined to Basin B Basin B Routing Pervious to Basin C Impervious to Basin C	Hydrograph type= SCS RunoffPeak discharge= 14.95 cfsStorm frequency= 25 yrsTime to peak= 12.33 hrsStorm frequency= 5 minHyd. volume= 97,564 cuftDrainage area= 6.610 acHydraulic length= 0.7*Basin Stope= 0.0 %Time of conc. (Tc)= 16.90 minTotal precip.= 6.53 inDistribution= 14.96 cfsTotal precip.= 24 hrsShape factor= 285	cfs hrs 4 cuft III
2 7 7 0 0 [∞]	Combine SCS Runoff SCS Runoff Combine Reservoir	13.31 0.874 0.617 1.491 0.432	່ດນາດນາດນາ	730 735 730 730	77,165 4,613 3,631 8,244 8,239	6, 7 9, 10	83.66	2,845	Combined to Basin C Perv to Basin A Imp to Basin A Combined to Basin A Basin A Routing	 Composite (Area/CN) = [(2.200 x 77) + (4.400 x 30)] / 6.610 EXIST. WOODS TO A Q (cfs) Hyd. No. 1 - 25 Year 	Q (cfs)
6 4	Reservoir Combine	8.383 9.042	ى س ى	750	77,163 107,066	5 10 13 13	76.82	27,608	Basin C Routing Combined to SP1	15.00	15.00
											0.00 6.00
										3.00 3.00 0.2 4 6 8 10 12 14 16 18 20 22 24 0.00 0.00 0.2 2 4 6 8 10 12 14 16 18 20 22 24 0.00 0.2 2 2 2 2 0.000 0.00 0.00 0.00 0.0000 0.000 0.000 0.00000 0.0000 0.000000 0.0000 0.0000000 0.0000 0.000000 0.00000000	3.00 26 0.00 7ime (hrs)
202	2021-01-15 ASHBEL 2-100 YR.gpw	BEL 2-10	10 YR.gp/	2	Return F	Return Period: 25 Year	'ear	Wednesda	Wednesday, Jan 20, 2021		

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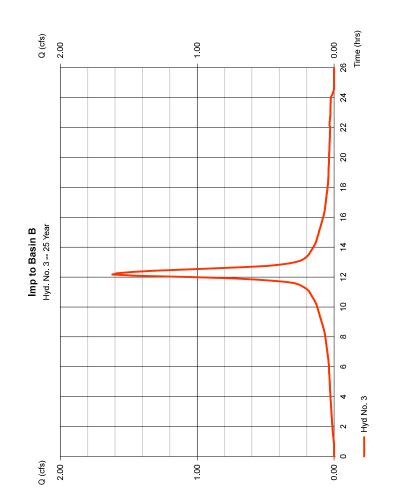
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 2			
Pervious to Basin B	В		
Hydrograph type	= SCS Runoff	Peak discharge	= 2.305 cfs
Storm frequency		Time to peak	п
Time interval	= 5 min	Hyd. volume	= 12,144 cuft
Drainage area	Q	Curve number	п
Basin Slope		Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	Π
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810

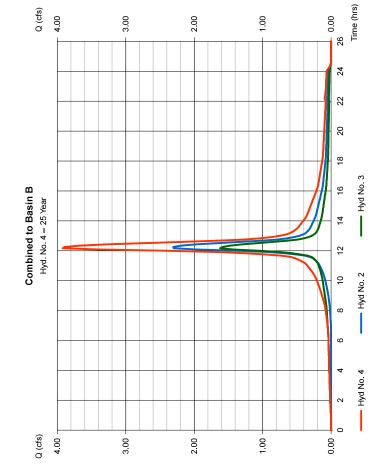


Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 3			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 1.620 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 9,531 cuft
Drainage area	= 0.420 ac	Curve number	11
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	Π
Storm duration	= 24 hrs	Shape factor	= 285



Hydraflow Hydrographs by Intelisolve v9.1	telisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 4			
Combined to Basin B	В		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 25 yrs = 5 min = 2, 3	Peak discharge Time to peak Hyd. volume Contrib. drain. area	e = 3.921 cfs = 12.17 hrs = 21,675 cuft area = 1.230 ac



Hydrograph Report

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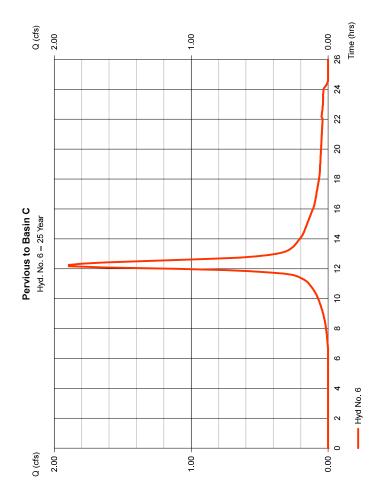
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 5			
Basin B Routing			
Hydrograph type Storm frequency Time interval Inflow hyd. No. Reservoir name	= Reservoir = 25 yrs = 5 min = 4 - Combined to Basin B = Basin B	Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage	= 0.266 cfs = 15.42 hrs = 21,664 cuft = 83.77 ft = 12,644 cuft
Storage Indication method used.	used.		

Time (hrs) Q (cfs) 4.00 1.00 0.00 3.00 2.00 45 40 Total storage used = 12,644 cuft 35 30 **Basin B Routing** Hyd. No. 5 -- 25 Year 25 20 Hyd No. 4 15 10 Hyd No. 5 ŝ 0 Q (cfs) 4.00 -3.00 2.00 -1.00 -0.00

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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 6			
Pervious to Basin C	O		
Hydrograph type	= SCS Runoff	Peak discharge	= 1.893 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 9,994 cuft
Drainage area	= 0.650 ac	Curve number	= 80*
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
Tc method	= USER	_	= 10.00 min
Total precip.	= 6.53 in		= Type III
Storm duration	= 24 hrs		= 285

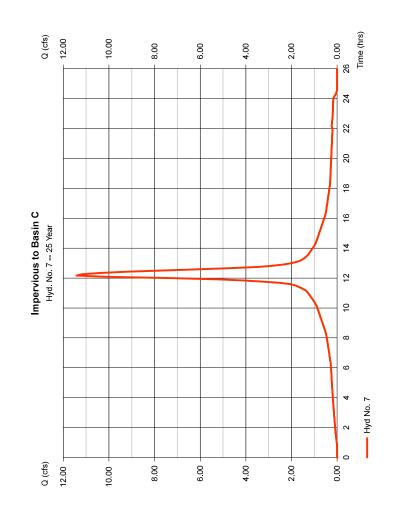
* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



Hydrograph Report

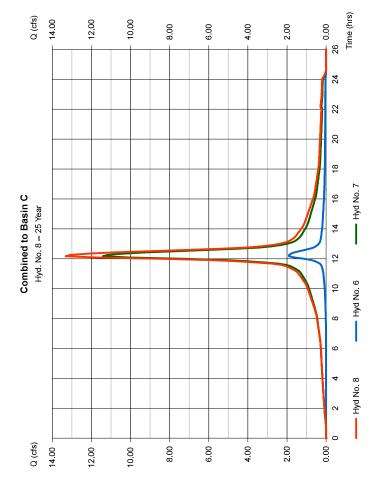
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Hydraflow Hydrographs by Intelsolve v6.1 Hydr. No. 7 Impervious to Basin C Hydrograph type = SCS Runoff Time interval = 5 min Drainage area = 2.960 ac Basin Slope = 0.0 % Time of conc. (Tc) = 12.17 hrs Hyd. volume = 67,171 cuft Curve number = 98 Hydraulic length = 0.ft Time of conc. (Tc) = 10.00 min Distribution = 24 hrs Storm duration = 24 hrs Storm duration = 24 hrs



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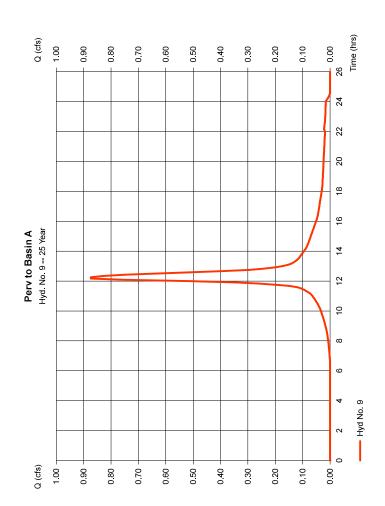
Hydraflow Hydrographs by Intelsolve v9.1	Wednesday, Jan 20, 2021
Hyd. No. 8	
Combined to Basin C	
Hydrograph type = Combine Storm frequency = 25 yrs Time interval = 5 min Inflow hyds. = 6, 7	Peak discharge = 13.31 cfs Time to peak = 12.17 hrs Hyd. volume = $77,165$ cuft Contrib. drain. area = 3.610 ac



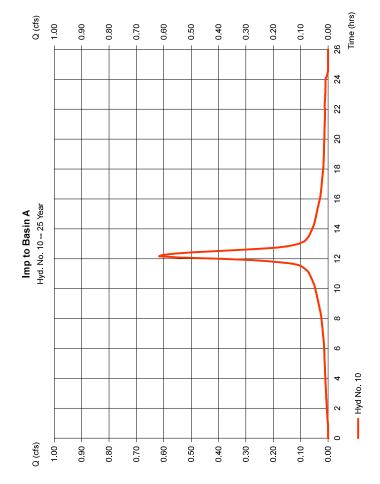
43

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.874 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 4,613 cuft
Drainage area	= 0.300 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	ίΩ	= 10.00 min
Total precip.	= 6.53 in	Distribution	= Type III
Storm duration	= 24 hrs		= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300

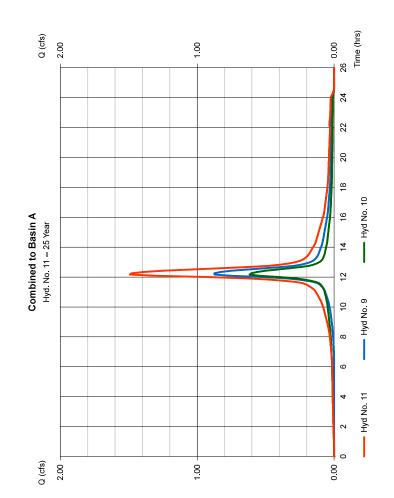


Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 10			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.617 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 3,631 cuft
Drainage area	= 0.160 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	= Type III
Storm duration	= 24 hrs		= 285



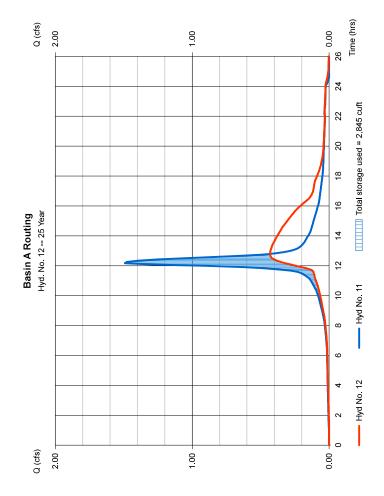
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Hydraflow Hydrographs by Intelisolve v9.1	olve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 11			
Combined to Basin A			
Hydrograph type = Storm frequency = Time interval = Inflow hyds. =	= Combine = 25 yrs = 5 min = 9, 10	Peak discharge = 1.491 cfs Time to peak = 12.17 hrs Hyd. volume = 8,244 cuf Contrib. drain. area = 0.460 ac	 = 1.491 cfs = 12.17 hrs = 8,244 cuft = 0.460 ac



Hydraftow Hydrographs by Intelsolve v9.1 Wednesday, Jan 20, 2021 **Hydr. No. 12**Basin A Routing
Hydrograph type = Reservoir
Hydrograph type = Reservoir
Time to peak discharge = 0,432 cfs
Fine to peak = 12.83 hrs
Hyd. volume = 8,239 cuft
Inflow hyd. No. = 11 - Combined to Basin A
Max. Storage = 2,845 cuft

Storage Indication method used.

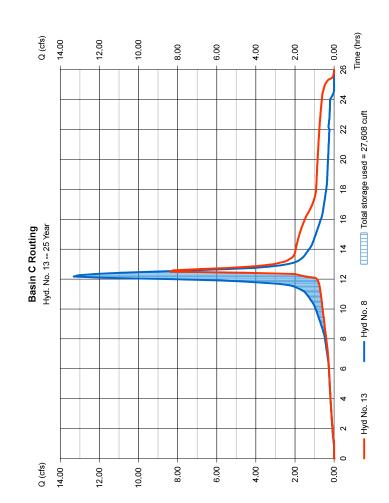


Hydrograph Report

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Hydrafow Hydragraphs by Intelsolve v3.1 Wednesdey, Jan 20, 2021 **Hydr. No. 13**Basin C Routing
Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow Hyd. No. = 8 - Combined to Basin C
Max. Elevation = 76, 82 ft
Reservoir name = Basin C
Max. Storage = 27, 608 cuft

Storage Indication method used.



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1	Wednesday, Jan 20, 2021	n 20, 2021
Hyd. No. 14			
Combined to SP1			
Hydrograph type Storm frequency Time interval Inflow hvds.	= Combine = 25 yrs = 5 min = 5. 12. 13	Peak discharge = 9.042 cfs Time to peak = 12.50 hrs Hyd. volume = 107,066 cuft Contrib. drain. area = 0.000 ac	fs rs cuft
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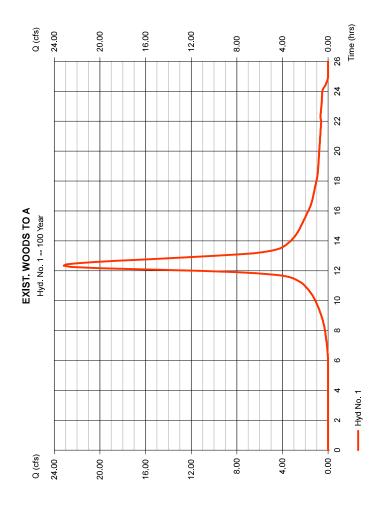
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Hyd No	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
٢	SCS Runoff	23.17	5	740	151,891	1		+	EXIST WOODS TO A
N	SCS Runoff	3.518	5	730	18,666			1	Pervious to Basin B
ę	SCS Runoff	2.222	5	730	13,180		ļ		Imp to Basin B
4	Combine	5.740	5	730	31,845	2, 3	ļ		Combined to Basin B
5	Reservoir	1.089	5	780	31,835	4	84.27	17,134	Basin B Routing
9	SCS Runoff	2.871	5	730	15,266				Pervious to Basin C
7	SCS Runoff	15.66	5	730	92,884			ļ	Impervious to Basin C
8	Combine	18.53	5	730	108,150	6, 7	1	1	Combined to Basin C
6	SCS Runoff	1.325	5	730	7,046		ļ		Perv to Basin A
10	SCS Runoff	0.847	5	730	5,021			ļ	Imp to Basin A
7	Combine	2.172	5	730	12,067	9, 10		ļ	Combined to Basin A
12	Reservoir	1.967	5	745	12,062	1	83.86	3,306	Basin A Routing
13	Reservoir	17.31	5	740	108,148	œ	76.99	29,415	Basin C Routing
14	Combine	18.38	5	740	152,045	5, 12, 13			Combined to SP1
202	2021-01-15 ASHBEL 2-100 YR.gpw	BEL 2-10	0 YR.gp	3	Return Period: 100 Year	eriod: 100	Year	vebaenbe///	Mudanadari Jan 20 2021
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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 1			
EXIST. WOODS TO A	TOA		
Hydrograph type	= SCS Runoff Pe	^b eak discharge	= 23.17 cfs
Storm frequency		Fime to peak	= 12.33 hrs
Time interval	= 5 min Hy	Hyd. volume	= 151,891 cuft
Drainage area	= 6.610 ac	urve number	= 77*
Basin Slope	= 0.0 % H	ydraulic length	= 0 ft
Tc method	= USER Tir	me of conc. (Tc)	= 16.90 min
Total precip.	= 8.94 in Di	Distribution	= Type III
Storm duration	= 24 hrs St	shape factor	= 285

* Composite (Area/CN) = [(2.200 x 77) + (4.400 x 30)] / 6.610



Hydrograph Report

5

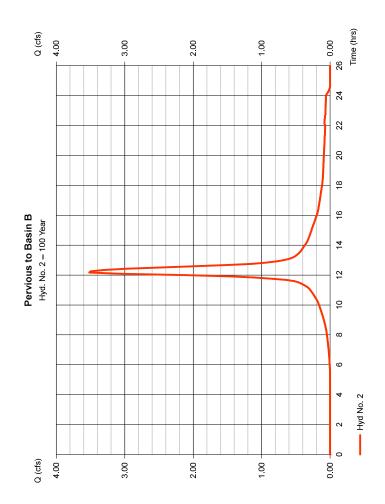
Hydraflow Hydrographs by Intelisolve v9 1

Hyd. No. 2

Pervious to Basin B

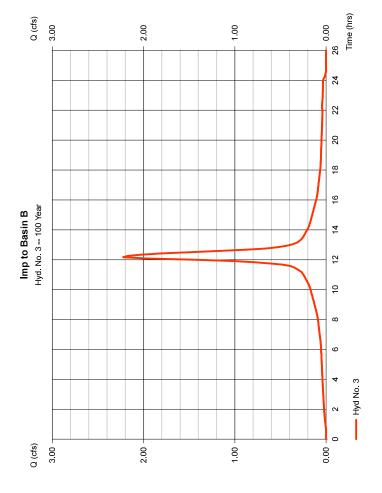
Hydrograph type	noff	^p eak discharge	
Storm frequency	= 100 yrs Time	e to peak	
Time interval		Hyd. volume	
Drainage area	= 0.810 ac Curv	ve number	
Basin Slope	= 0.0 % Hydr	Iraulic length	
Tc method	= USER Time	e of conc. (Tc)	
Total precip.	= 8.94 in Distr	Distribution	
Storm duration	= 24 hrs Shar	Shape factor	
* Composite (Area/CN) = [(* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810		

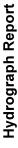
= 3.518 cfs = 12.17 hrs = 18,666 cuft = 79* = 0.ft = 10.00 min = 79Fe III



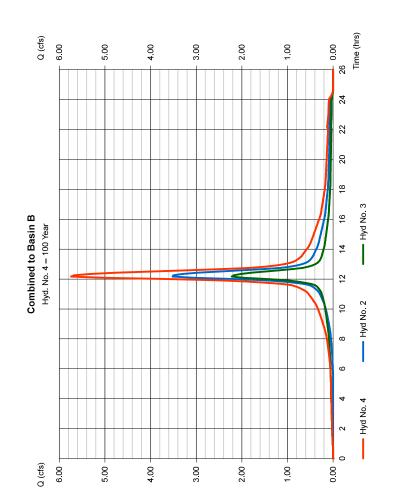
52

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 3			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 2.222 cfs
Storm frequency	= 100 yrs	Time to peak	п
Time interval	= 5 min	Hyd. volume	= 13,180 cuft
Drainage area	= 0.420 ac	Curve number	п
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	Ϊ
Storm duration	= 24 hrs	Shape factor	= 285



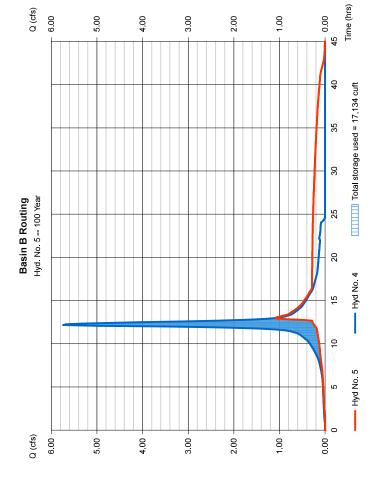


Hydraffow Hydrographs by Intelisolve v9.1	telisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 4			
Combined to Basin B	В		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 100 yrs = 2, 3	Peak discharge = 5.740 cfs Time to peak = 12.17 hrs Hyd. volume = 31,845 cr Contrib. drain. area = 1.230 ac	= 5.740 cfs = 12.17 hrs = 31,845 cuft = 1.230 ac



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Hydraffow Hydrographs by Intelisolve v9.1	ntelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 5			
Basin B Routing			
Hydrograph type	= Reservoir	Peak discharge	= 1.089 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.00 hrs
Time interval	= 5 min	Hyd. volume	= 31,835 cuft
Inflow hyd. No.	= 4 - Combined to Basin B	Max. Elevation	= 84.27 ft
Reservoir name	= Basin B	Max. Storage	= 17,134 cuft
Storage Indication method used.	used.		



55

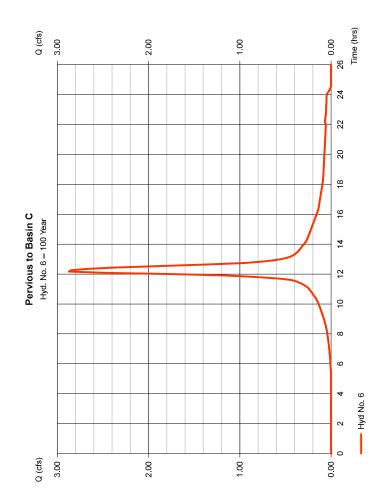
Hydraflow Hydrographs by Intelisolve v9.1

Hyd No. 6

Pervious to Basin C

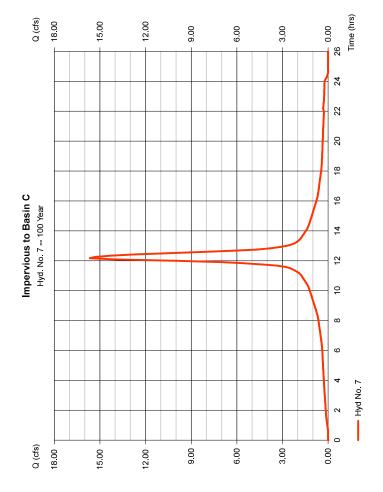
	= 2.871 cfs	= 12.17 hrs	= 15,266 cuft	= 80*	= 0 ft	= 10.00 min	= Type III	= 285	
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor	
5	= SCS Runoff	= 100 yrs	= 5 min	= 0.650 ac	= 0.0 %	= USER	= 8.94 in	= 24 hrs	
	Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration	

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



56

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 202
Hyd. No. 7			
Impervious to Basin C	in C		
Hydrograph type	= SCS Runoff	Peak discharge	= 15.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 92,884 cuft
Drainage area	= 2.960 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

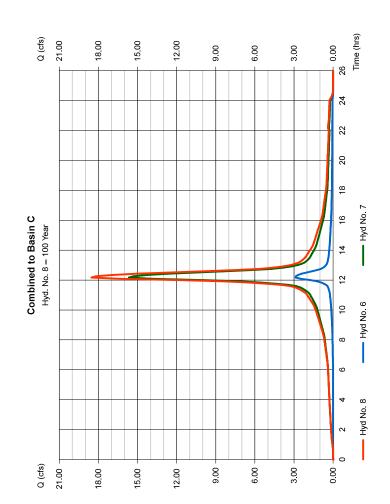


Hydrograph Report

2021

57

Peak discharge = 18.53 cfs Time to peak = 12.17 hrs Hyd. volume = 108,150 cuft Contrib. drain. area = 3.610 ac = Combine = 100 yrs = 5 min = 6, 7 Hydraflow Hydrographs by Intelisolve v9.1 Combined to Basin C Hydrograph type Storm frequency Time interval Inflow hyds. Hyd. No. 8



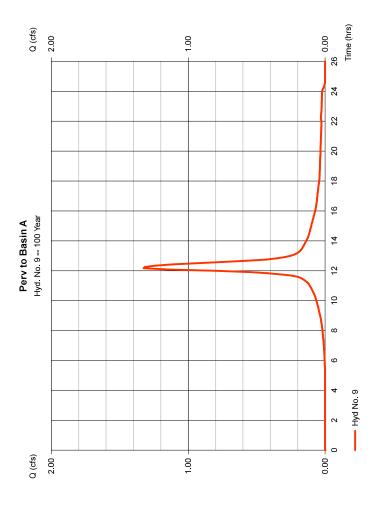
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Hydraflow Hydrographs by Intelisolve v9.1

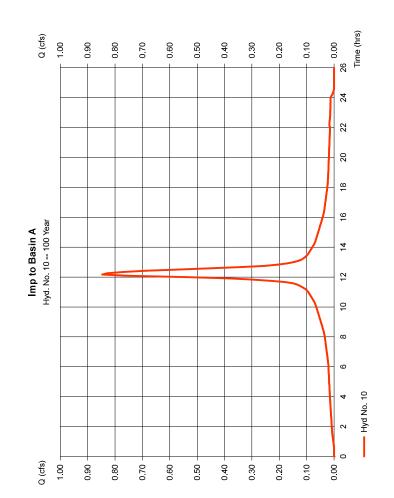
Hyd. No. 9			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	п
Storm frequency	= 100 yrs	Time to peak	п
Time interval	= 5 min	Hyd. volume	= 7,046 cuft
Drainage area	= 0.300 ac	Curve number	п
Basin Slope	= 0.0 %	Hydraulic length	П
Tc method	= USER	Time of conc. (Tc)	Ш
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300



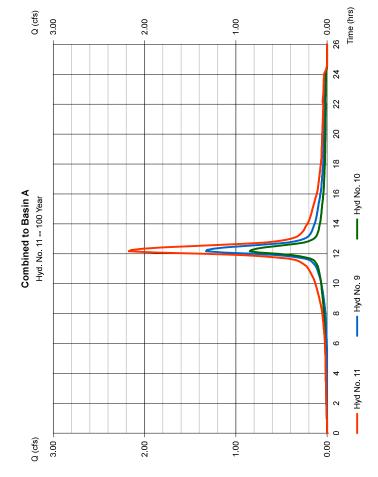
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 10			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.847 cfs
Storm frequency	= 100 yrs	Time to peak	II.
Time interval	= 5 min	Hyd. volume	= 5,021 cuft
Drainage area	= 0.160 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



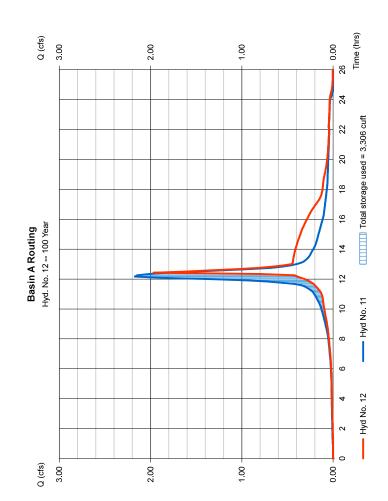
59

Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1	We	Wednesday, Jan 20, 2021
Hyd. No. 11			
Combined to Basin A	A		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 100 yrs = 5 min = 9, 10	Peak discharge = 2.172 cfs Time to peak = 12.17 hrs Hyd. volume = 12.067 cu Contrib. drain. area = 0.460 ac	: 2.172 cfs : 12.17 hrs : 12,067 cuft : 0.460 ac



Hydrograph Report

Hydraflow Hydrographs by IntelisoMe v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 12			
Basin A Routing			
Hydrograph type	= Reservoir	Peak discharge	= 1.967 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.42 hrs
Time interval	= 5 min	Hyd. volume	= 12,062 cuft
Inflow hyd. No.	= 11 - Combined to Basin A	Max. Elevation	= 83.86 ft
Reservoir name	= Basin A	Max. Storage	= 3,306 cuft
Storage Indication method used.	used.		



 Hydraftow Hydrographs by Intelsolve v9.1
 Wednesday, Jan 20, 2021

 Hydr. No. 13
 Wednesday, Jan 20, 2021

 Basin C Routing
 Feak discharge

 Hydrograph type
 = 17.31 cfs

 Storm frequency
 = 100 yrs

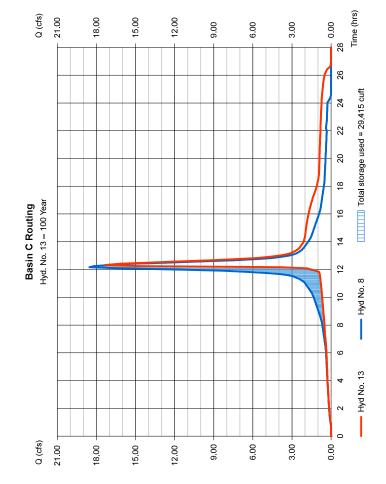
 Time interval
 = 5 min

 Inflow hyd. No.
 = 8 - Combined to Basin C

 Max. Elevation
 = 76.99 ft

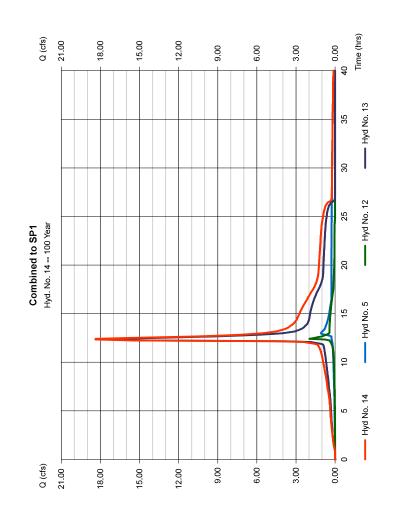
 Max. Storage
 = 29,415 cuft

Storage Indication method used.



Hydrograph Report

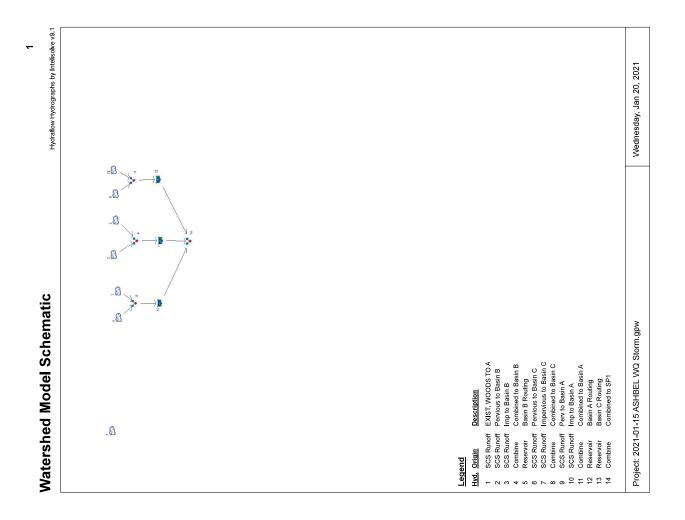
Hydraffow Hydrographs by Intelisolve v9.1	ntelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 14			
Combined to SP1			
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 100 yrs = 5, 12, 13	Peak discharge = 18.38 cfs Time to peak = 12.33 hrs Hyd. volume = 152,045 c Contrib. drain. area = 0.000 ac	= 18.38 cfs = 12.33 hrs = 152,045 cuft a = 0.000 ac



7. HYDROGRAPH SUMMARY REPORTS – WATER QUALITY STORM

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Í	Hydrograph Summary Report	ph Sı	mmr	ary R	eport				 Hydraffow Hydrographs by IntelisoMe v9.1
No N	I. Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
-	SCS Runoff	0.805	5	100	2,887				EXIST WOODS TO A
N	SCS Runoff	0.155	5	80	437	I			Pervious to Basin B
ę	SCS Runoff	0.680	2	70	1,567	ļ			Imp to Basin B
4	Combine	0.804	5	75	2,004	2, 3			Combined to Basin B
ŝ	Reservoir	0.138	5	120	1,994	4	81.81	1,466	Basin B Routing
9	SCS Runoff	0.142	5	80	392				Pervious to Basin C
4	SCS Runoff	4.793	5	70	11,042				Impervious to Basin C
ø	Combine	4.899	5	70	11,434	6, 7			Combined to Basin C
6	SCS Runoff	0.065	5	80	181				Perv to Basin A
10	SCS Runoff	0.259	5	70	597				Imp to Basin A
5	Combine	0.313	5	75	778	9, 10			Combined to Basin A
12	Reservoir	0.123	5	100	773	4	82.14	399	Basin A Routing
13	Reservoir	0.809	5	115	11,431	æ	74.61	7,932	Basin C Routing
14	Combine	1.066	2	110	14,198	5, 12, 13			Combined to SP1
20	2021-01-15 ASHBEL WQ Storm.gpw	BEL WQ	Storm.gr	MC	Return P.	Return Period: 1 Year	ar	Wednesday	Wednesday, Jan 20, 2021

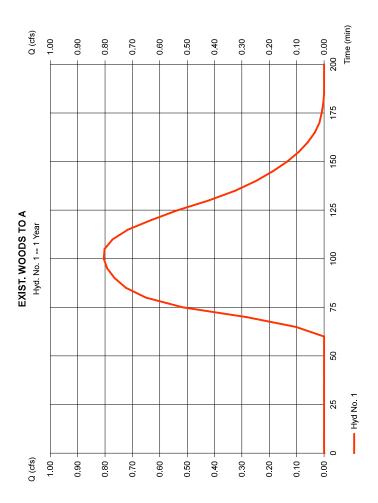


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Iraflow Hydrographs by Intelisolve v9.1		Wednesday, Jan 20, 2021
/d. No. 1		
KIST. WOODS TO A		
drograph type = SCS Runoff	Peak discharge	= 0.805 cfs
orm frequency = 1 yrs	Time to peak	= 100 min
		H 0 00 0 H

	Wednesday, Jan 20, 2			Peak discharge = 0.805 cfs	Time to peak = 100 min	Hyd. volume = 2,887 cuft	П	Hydraulic length = 0 ft	Time of conc. $(Tc) = 16.90 \text{ min}$	Distribution = Custom	Shape factor = 285
Hydrograph Report	Hydraflow Hydrographs by Intelisolve v9.1	Hyd. No. 1	EXIST WOODS TO A	Hydrograph type = SCS Runoff	Storm frequency = 1 yrs	Time interval = 5 min	Drainage area = 6.610 ac	Basin Slope = 0.0 %	Tc method = USER	Total precip. = 1.25 in	Storm duration = Water Quality Storm.cds

* Composite (Area/CN) = [(2.200 x 77) + (4.400 x 30)] / 6.610



Hydrograph Report

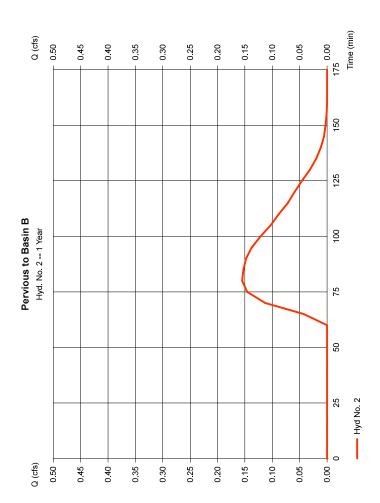
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Hydraflow Hydrographs by Intelisolve v9 1

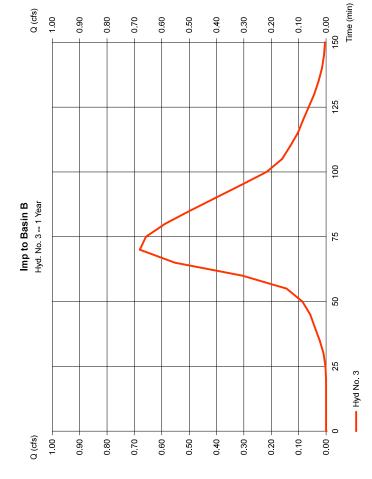
Hyd. No. 2

Pervious to Basin B	а		
Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip. Storm duration	= SCS Runoff = 1 yrs = 5 min = 0.810 ac = 0.0 % = USER = 1.25 in = Water Quality Storm.cds	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	 = 0.155 cfs = 80 min = 437 cuft = 79* = 0 ft = 10.00 min = 285

* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810



Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 3			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.680 cfs
Storm frequency	= 1 yrs	Time to peak	п
Time interval	= 5 min	Hyd. volume	= 1,567 cuft
Drainage area	= 0.420 ac	Curve number	п
Basin Slope	= 0.0 %	Hydraulic length	
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= Water Quality Storm.cds	Shape factor	= 285

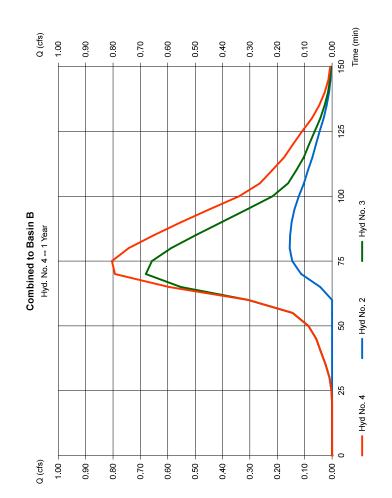


Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9 1

Hyd. No. 4			
Combined to Basin B	m		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 1 yrs = 5 min = 2, 3	Peak discharge = 0.804 cfs Time to peak = 75 min Hyd. volume = 2,004 cuff Contrib. drain. area = 1.230 ac	= 0.804 cfs = 75 min = 2,004 cuft = 1.230 ac



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Implementation Wethereder, Jan 2 											
$\frac{1}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \begin{array}{c} \frac{1}{1} \left\{ \end{array} \right\}}{1} \left\{ \end{array} \right}$	Hydraflow Hydrographs by Intelisolve v9.1		Wednesday, Jan 20, 2021	Hydraflow Hydr Pond No 1	ographs by Intelisolv - Basin B	s v9.1					Nednesday, Jan 20
Retroit Feat discription = 1.36 cm Storp and transmission Mark set of transmissin transmission	Hyd. No. 5			Pond Data Contours - Use	sr-defined contour are	as. Average en	l area method u	sed for volume calculati	on. Begining Eleval	tion = 81.00 ft	
$ \begin{array}{c} 1 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	П	Peak discharge		Stage / Stor Stage (ft)	age Table Elevation (ft)	Contour	area (sqft)	Incr. Storage (cuft)	Total storage (c	uft)	
Bail B fourier Control		Time to peak Hyd. volume Max. Elevation Max. Storage	= 120 min = 1,994 cuft = 81.81 ft = 1,466 cuft	0.00 0.50 2.50 2.50 2.50	81.00 81.50 82.50 83.50 83.50	2,00 2,00 2,00 2,00 2,00 2,00 2,00 2,00		0 511 2,532 2,734 2,734 3,334	0 511 4,315 7,049 10,408		
Basil B Cutific Owner / Cutific Mark Structures Mark Structures Basil B Cutific (a) (b) (c)	Storage Indication method used.			3.00 3.50 4.00	84.00 84.50 85.00	9,05 10,37 11,66	233	4,147 4,864 5,509	14,555 19,419 24,928		
Bain Bround Indiana Indiana Indiana <td></td> <td></td> <td></td> <td>Culvert / Or</td> <td>ifice Structures</td> <td></td> <td></td> <td>Weir Structure</td> <td>ş</td> <td></td> <td></td>				Culvert / Or	ifice Structures			Weir Structure	ş		
Basin B Kouting Hou No. 5-1 Year C(s) Hou No. 500				Rise (in) Span (in)			[PrfRsr] 0.00 0.00				[0] 00.0
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$			Q (cfs)	No. Barrels Invert El. (ft) Length (ft) Slowo (v)			0.00				3.33 No
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td< td=""><td>1.00</td><td></td><td>1.00</td><td>orope (//) N-Value Orifice Coeff. Multi-Stage</td><td></td><td></td><td>n/a 0.60 No</td><td>Exfil.(in/hr) TW Elev. (ft)</td><td>= 0.000 (by Wet a = 0.00</td><td>rea)</td><td></td></td<>	1.00		1.00	orope (//) N-Value Orifice Coeff. Multi-Stage			n/a 0.60 No	Exfil.(in/hr) TW Elev. (ft)	= 0.000 (by Wet a = 0.00	rea)	
Image:	0.0		0.00			Note: Culvert/Orific	s outflows are analy	ed under inlet (ic) and outlet (o) control. Weir risers che	acked for orifice co	nditions (ic) and submerg
	0.70		0.70	Stage (ft)			Stac	je / Discharge			
	0.60		0.60	4.00							
	0.50		0.50	3.00							
	0.30		0.40	5.00							
	0.10		0.00								

11.00 11.00 Discharge (cfs)

10.00

9.00

8.00

7.00

6.00

5.00

4.00

3.00

2.00

0.00 1.00 0.00 1.00

 Hydraftow Hydrographs by Intelscieve v9.1
 Weetnesstay, Jan 20, 2021

 Hydr. No. 6
 Weetnesstay, Jan 20, 2021

 Hydr. No. 6
 Pervious to Basin C

 Pervious to Basin C
 Peak discharge

 Hydrograph type
 = SCS Runoff

 Time interval
 = 1 yrs

 Time interval
 = 5 min

 Drainage area
 = 0.650 ac

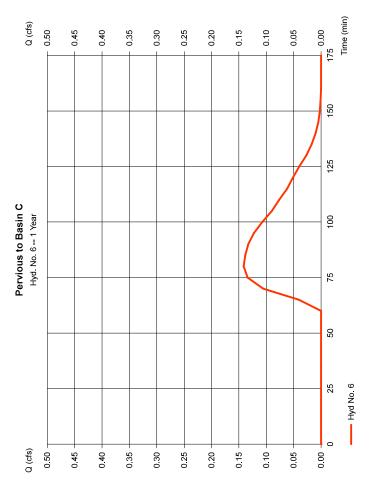
 Basin Slope
 = 0.0 R

 Distribution
 = 1.25 in

 Total precip.
 = 1.25 in

 Storm duration
 = Water Quality Storm.cds

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



Hydrograph Report

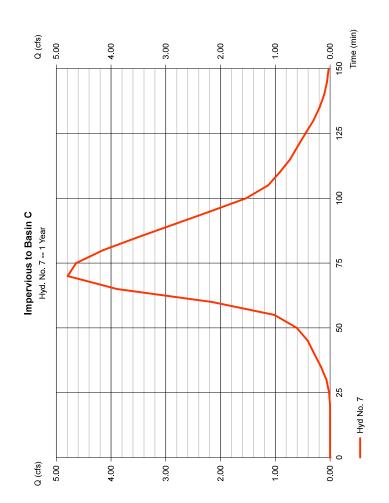
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Hydraflow Hydrographs by IntelisoNe v9.1

Hyd. No. 7

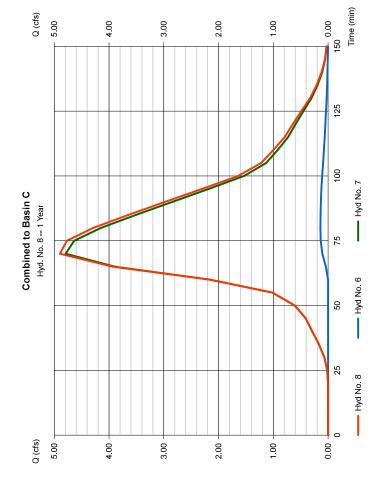
Impervious to

Impervious to Basin C	in C		
Hydrograph type Storm frequency Time interval Drainage area Basin Stope To method Total precip. Storm duration	 SCS Runoff 1 yrs 5 min 2.960 ac 2.960 ac 1.00 % USER 1.25 in Water Quality Storm.cds 	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	 = 4.793 cfs = 70 min = 11,042 cuft = 96 = 10.00 min = 285



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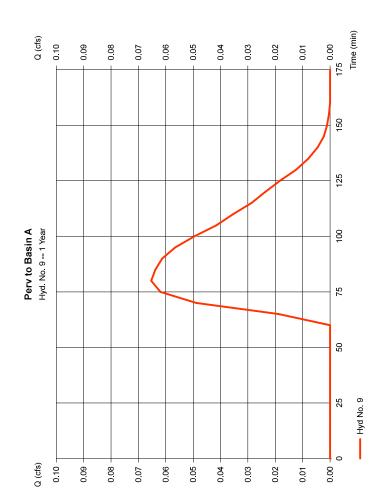
Hydraflow Hydrographs by Intelsolve v9.1	Wednesday, Jan 20, 2021
Hyd. No. 8	
Combined to Basin C	
Hydrograph type = Combine Storm frequency = 1 yrs Time interval = 5 min Inflow hyds. = 6, 7	Peak discharge = 4.899 cfs Time to peak = 70 min Hyd. volume = 11,434 cuft Contrib. drain. area = 3.610 ac



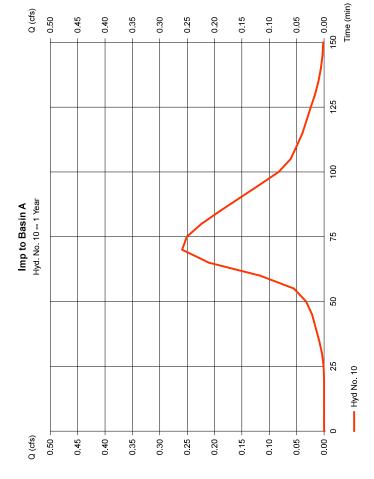
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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.065 cfs
Storm frequency	= 1 yrs	Time to peak	= 80 min
Time interval	= 5 min	Hyd. volume	= 181 cuft
Drainage area	= 0.300 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= Water Quality Storm.cds	Shape factor	= 285

* Composite (Area/CN) = [(0 200 x 39) + (0 100 x 80)] / 0 300



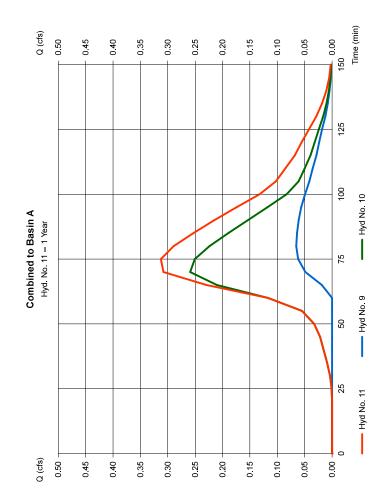
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 10			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.259 cfs
Storm frequency	= 1 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 597 cuft
Drainage area	= 0.160 ac	Curve number	п
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= Water Quality Storm.cds	Shape factor	= 285



Hydrograph Report

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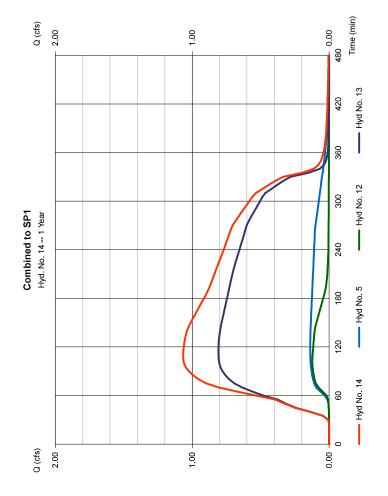
Hydraftow Hydrographs by Intelsolve v9.1 Wednesday, Jan 20. 2021 **Hyd. No. 11**Combined to Basin A
Hydrograph type = Combine
Hydrograph type = Combine
Time to peak discharge = 0.313 cfs
Time to peak = 778 cuft
Inflow hyds. = 9, 10
Contrib. drain. area = 0.450 ac



Hvd No 12		Wednesday, Jan 20, 2021	Dond No. 2 Dooin A							••••••••••••••••••••••••••••••
			Pond Data Contours - Userd	- Dasili A defined contour areas	Average end an	ea method use	Point NO. 5 - Dabilit A Pond Data Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 81.50 ft	on. Begining Elevati	on = 81.50 ft	
11	Peak discharge		Stage / Storage Table Stage (ft) Elevati	ge Table Elevation (ft)	Contour area (sqft)		Incr. Storage (cuft)	Total storage (cuft)	ŧ	
Storm trequency = 1 yrs Time interval = 5 min Inflow hyd. No. = 11 - Combined to Basin A Reservoir name = Basin A	Lime to peak Hyd. volume Max. Elevation Max. Storage	= 100 min = 773 cuft = 82.14 ft = 399 cuft	2.2.2.0 2.2.2.0 2.2.2.0 2.2.0 2.2.0 2.2.0 2.2.0 2.0	81.50 82.50 83.50 84.00 84.00	00 979 1,314 1,649 2,088		0 245 573 934 1,154	245 245 818 2,453 2,453 3,647		
Storage Indication method used.			3.00 Culvert / Orifi	3.00 84.50 Culvert / Orifice Structures	3,026		1,388 Weir Structures			
					į	(į
					5	PTTKSr				5
			Rise (in)	= 15.00 2.50		0.00	_	= 14.00 20.00	0.00	0.00
			Span (In) No Barrels		06.2 00	00.0	Crest EI. (ft) Wair Coeff	= 83./5 83.9 = 3.33 2.60		3.33
			-		50 82.10	0.00				n
				= 45.00 0.0	0.00	0.00			٩ ۶	No
Q (cfs)		Q (cfs)				n/a				
Hyd. No. 12 1 Year			N-Value			n/a				
		0.50	Orifice Coeff. Multi Stage	= 0.60 0.60 = n/a Yes	0 0.60 No	0.60 No	Exfil (in/hr) TW Elev. (ft)	= 0.000 (by Wet area) = 0.00	ea)	
		0.45		z	ote: Culvert/Orifice ou	tflows are analyzec	Note: CurvertOrlifice outflows are analyzed under inlet (co) and outlet (co) control. Weir risers checked for onlice conditions (to) and submergence (s).) control. Weir risers chec	ked for orifice cor	litions (ic) and subr
		0.40	3				, Discharter			
			Stage (ft)			Stage	stage / Discharge			
		0.35	3.00						ł	
							$\left \right $			
		0.30								
		0.25	<u> </u>							
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		0.05								
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0 60 120 180	240 300	360								
						-	_	-	-	

Hydrograph Report	h Report		17	Pond Report	Report	Ţ					abolt(18
	y Intelisolve v9.1		Wednesday, Jan 20, 2021	Pond No. 2 - Basin C	rrydrairow rrydrograpris by intellsolve va.r Pond No. 2 - Basin C						Medu	weunesaay, Jan zu, zuz i
Hyd. No. 13				Pond Data Contours - User-	-defined contour area	as. Average end a	rea method us	Pond Data Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 72.00 ft	ion. Begining Ek	evation = 72	00 ft	
Basin C Routing Hydrograph type	Ш	Peak discharge	= 0.809 cfs	Stage / Storage Table Stage (ft) Elevati	age Table Elevation (ff)	Contour area (sqft)		Incr. Storage (cuft)	Total storage (cuft)	le (cuft)		
Storm frequency Time interval Inflow hyd. No. Reservoir name	= 1 yrs = 5 min = 8 - Combined to Basin C = Basin C	Time to peak Hyd. volume Max. Elevation Max. Storage	= 115 min = 11,431 cuft = 7,932 cuft	0.00 2.50 2.50 50 50 50 50 50 50 50 50 50 50 50 50 5	72.00 72.50 73.50 73.50 74.50	00 641 3,427 5,531 6,731		160 160 1,172 3,235 3,078	0 160 1,813 4,048 7,126	0.0 - 0.0 0		
Storage Indication method used.	d used.			3.00 4.50 5.50 5.50 5.50 5.50	75.00 75.50 76.00 77.00 77.50	8,030 8,715 9,400 10,75 10,749 110,749		3,703 4,186 4,529 5,541 5,541	10,829 15,015 19,544 24,412 29,618 35,159			
				Culvert / Orif	Culvert / Orifice Structures			Weir Structures	es			
					[A]	[B]	[PrfRsr]		Ø	[8]	[] []	0
0 (refe)	Basin C Routing	D	(ofe)	Rise (in) Span (in)	0 0	4.50 6.00 4.50 6.00	0.00	÷-				0.00
5.00	Hyd. No. 13 1 Year	ar		No. Barrels Invert EI. (ft) Length (ft)			0.00		= 3.33 = Rect = Yes	2.60 3 Broad F No N	3 33 Rect No	
				Slope (%) N-Value Orifice Coeff.			n/a n/a 0.60		= 0.000 (by We	let area)		
				Multi-Stage	= n/a Y	Yes No	No	TW Elev. (ft)	= 0.00			
4.00			4.00			Note: Culvert/Orifice a	utflows are analyze	Nose. CuveriOrifice outflows are analyzed under inlet (ic) and outlet (co) control. Weir risers checked for onfrie conditions (ic) and submergence (p).	oc) control. Weir riser	rs checked for or	ffice conditions	(ic) and submergence (s).
				Stage (ft)			Stage	Stage / Discharge				Elev (ft)
3.00			3.00	6.00					_			78.00
				5.00								27.00
2.00			2.00	5								78 00
				200								0000
2				3.00								75.00
2			2	2.00								74.00
		ſ										
00.0	60 120 180 240	300	360 420	1.00								13.00
Hyd No. 13	Hyd No. 8	Total storage used = 7,932		0.00	40 U	0	07	30.00	00 CF	48.00		72.00
				_								

Hydraflow Hydrographs by Intelisolve v9.1	telisolve v9.1	Wec	Wednesday, Jan 20, 2021
Hyd. No. 14			
Combined to SP1			
Hydrograph type Storm frequency Time interval	= Combine = 1 yrs = 5 min = 5 12 13	Peak discharge = 1.066 cfs Time to peak = 110 min Hyd. volume = 14,198 cu Contrib drain area = 0.000 ac	1.066 cfs 110 min 14,198 cuft

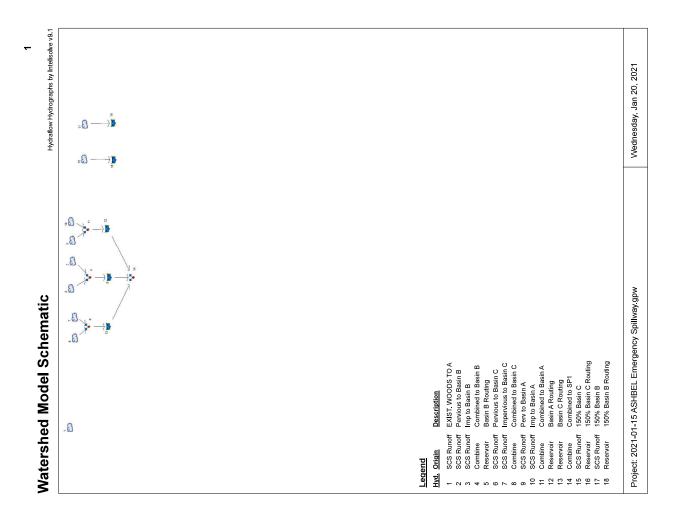


8. HYDROGRAPH SUMMARY REPORTS – EMERGENCY SPILLWAY

Hydrograph Summary Rep	e
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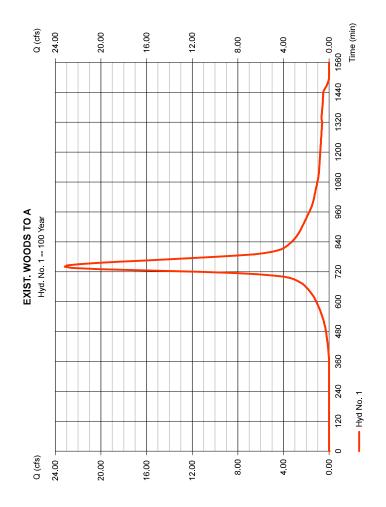
5	ogral	ph Sı	mmr	ary R	Hydrograph Summary Report				Hydraflow Hydrographs by Intelisolve v9.1
Hydrograph type (origin)	ء	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
SCS Runoff	<u>س</u>	23.17	5	740	151,891	1			EXIST WOODS TO A
SCS Runoff	*	3.518	5	730	18,666	ļ	1	ł	Pervious to Basin B
SCS Runoff	÷	2.222	5	730	13,180	-	-	ļ	Imp to Basin B
Combine		5.740	£	730	31,845	2, 3		}	Combined to Basin B
Reservoir		2.743	2	760	15,344	4	84.36	17,971	Basin B Routing
SCS Runoff	¥=	2.871	5	730	15,266	ļ			Pervious to Basin C
SCS Runoff	Ŧ	15.66	5	730	92,884	I			Impervious to Basin C
Combine		18.53	5	730	108,150	6, 7			Combined to Basin C
SCS Runoff	#	1.325	5	730	7,046	ļ			Perv to Basin A
SCS Runoff	ŧ	0.847	5	730	5,021	ļ			Imp to Basin A
Combine		2.172	ß	730	12,067	9, 10		ļ	Combined to Basin A
Reservoir		2.172	S	735	8,997	4	83.88	3,366	Basin A Routing
Reservoir		18.44	5	735	82,695	80	77.09	30,533	Basin C Routing
Combine		20.61	5	735	107,035	5, 12, 13		ļ	Combined to SP1
SCS Runoff	jį	30.58	2	730	164,902	I			150% Basin C
Reservoir		30.12	0	732	139,446	15	77.20	31,842	150% Basin C Routing
SCS Runoff	Ŧ	8.625	5	730	51,149	ļ		ł	150% Basin B
Reservoir		8.145	ŝ	740	34,648	17	84.52	19,543	150% Basin B Routing
1-01-15/	ASH	BEL Eme	rgency S	pillway.gp	wReturn Pe	2021-01-15 ASHBEL Emergency Spillway.gp.wReturn Period: 100 Year	Year	Wednesday	Wednesday, Jan 20, 2021



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 1			
EXIST. WOODS TO A	FO A		
Hydrograph type	= SCS Runoff	Peak discharge	= 23.17 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 5 min	Hyd. volume	= 151,891 cuft
Drainage area	= 6.610 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 16.90 min
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(2.200 x 77) + (4.400 x 30)] / 6.610



Hydrograph Report

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Wednesday, Jan 20, 2021

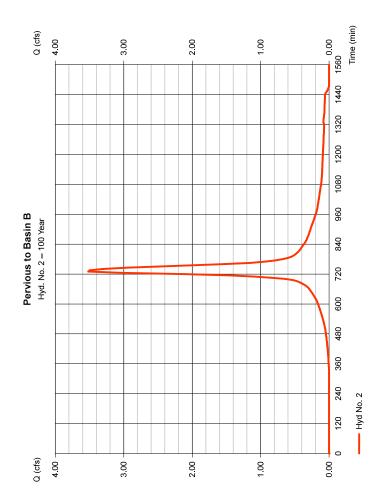
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 2

Pervious to Basin B

	11	П	Hyd. volume = 18,666 cuft	П	П	П	Distribution = Type III	Shape factor = 285	
2	П	= 100 yrs	П	= 0.810 ac	= 0.0 %	= USER	= 8.94 in	= 24 hrs	
	Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration	

* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810



 Hydraftow Hydrographts by Intelsiolve v6.1
 Wethnesday, Jan 20, 2021

 Hydr. No. 3
 Wethnesday, Jan 20, 2021

 Imp to Basin B
 Peak discharge

 Hydrograph type
 SCS Runoff

 Time interval
 2.222 cfs

 Storm frequency
 100 yrs

 Drainage area
 0.420 ac

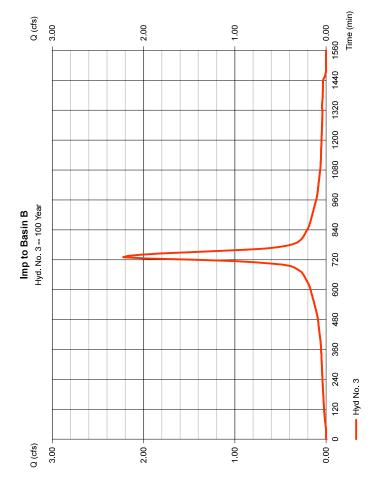
 Basin Slope
 0.0%

 Time of conc. (Tc)
 98

 Basin Slope
 0.0%

 Total precip.
 8.94 in

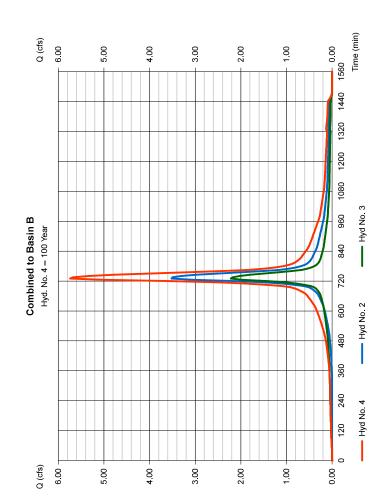
 Storm duration
 2.44 in



Hydrograph Report

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Hydraflow Hydrographs by Intelsolve v9.1 Wednesday. Jan 20. 2021 **Hyd. No. 4** Combined to Basin B Hydrograph type = Combine Storm frequency = 100 yrs Time to peak discharge = 5.740 cfs Time to peak = 730 min Hyd. volume = 31,845 cuft Inflow hyds. = 2, 3 Contrib. drain. area = 1.230 ac

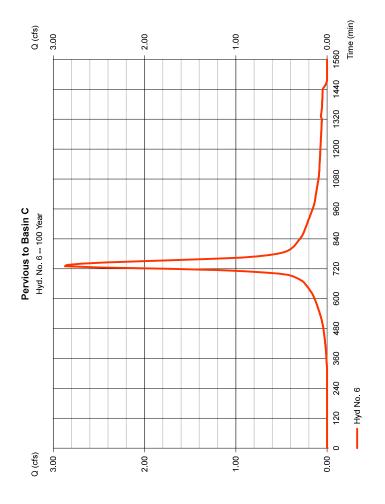


Hydrograph Report	n Report		7	Pond Report	Report	Ģ					Alada under and a second	8 202 0
Hydraftow Hydrographs by Intelisolve v9. Hyd. No. 5	Intelsalve v9.1		Wednesday, Jan 20, 2021	Hydratiow Hydrographs by Inte Pond No. 1 - Basin B Pond Data Contoure - Llear-defined contr	Hydraflow Hydrographs by Imelisolve v9.1 Pond No. 1 - Basin B Pond Data	s V9.1 Averade end	area method us	Hydratiow Hydrographs by Intelesove v9.1 Pond No. 1 - Basin B Comours - Lieex-defined contour areas Average end area method used for volume cak-takinon. Bentinion Flaveltion = 81 00 ∰	tion Reciping Flave	ation = 81 00 f	Wednesday, Jan 20, 2021	20, 2021
Basin B Routing Hydrograph type Storm frequency Time interval Inflow hyd. No. Reservoir name	 Reservoir 100 yrs 5 min 4 - Combined to Basin B Basin B 	Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage	= 2.743 cfs = 760 min = 15,344 cuft = 84.36 ft = 17,971 cuft	Stage / Storage Table Stage (ft) Elevativ 0.00 8130 0.50 8130 1.50 8230 1.50 8230 1.50 8230 2.20 8330 2.20 83300 2.20 833000 2.20 833000 2.20 8330000000000000000000000000000000000	age Table Elevation (ft) 81.00 81.50 82.00 82.50 82.50 82.50 82.50	Contour area (sqft) 00 2.042 5.007 5.007 5.007	rea (sqft)	Incr. Storage (cuft) 511 1,532 2,273 2,734	Total storage (cuft) 511 5.042 4.315 7.049	cuft)		
Storage Indication method used.	used.			2.50 3.50 4.00 Culvert / Or i	2.50 84.50 3.50 84.50 4.00 85.00 4.00 85.00 Culvert / Orifice Structures	7,300 9,083 10,373 11,663		4,159 4,147 4,864 5,509 Weir Structures				
Q (cfs)	Basin B Routing Hyd. No. 5 100 Year	ng Kear	Q (cfs)	Rise (in) Span (in) No. Barrels Invert EL (ft) Length (ft) Stope (%)	[A] = 15.00 = 15.00 = 15.00 = 25.00 = 2.50	ê _	[PrfRsr] 0.00 0.00 0.00 0.00 0.00	Crest Len (ft) Crest El. (ft) Weir Coeff. Weir Type Multi-Stage	[A] 14.00 84.20 3.33 Rect Yes	[B] [C] 20.00 0.00 84.50 0.00 2.60 3.33 Broad – Yes No	[] 0000 55 - 2	
0.00			0.00	N-Value Orffice Coeff. Multi-Stage	= .013 = 0.60 = n/a	013 013 060 060 Yes No Note: Culvert/Orifice	n/a 0.60 No outflows are analyze	213 .013 n/a .60 0.60 Extil.(in/hr) = 0.000 (by Wet area) .65 No TV Elev. (ft) = 0.00	 = 0.000 (by Wet area) = 0.00 control. Weir risers checked 	area) acked for orifice co	nditions (ic) and subme	gence (s).
2.00			00	Stage (ft)			Stag	Stage / Discharge				Elev (ft)
			4.00	4.00								85.00
5.00			2.00	3.00								· 84.00
1.00			1.0	00								82.00
0.00 0 120 24 0 120 24 0 Hyd No. 5	0 360 480 600 720 	840 960 1080 1200 1320 1320 1320 1320 1320 1320 132	20 1440 1560 20 14410 1560 I cuft Time (min)	0:00	1.00 2.00	3:00	4.00	00:9	8.00		10.00 11.00 bischall	81.00 11.00 Discharge (cfs)

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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 6			
Pervious to Basin C	U		
Hydrograph type	= SCS Runoff	Peak discharge	п
Storm frequency	= 100 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	Ш
Drainage area	= 0.650 ac	Curve number	= 80*
Basin Slope	= 0.0%	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



Hydrograph Report

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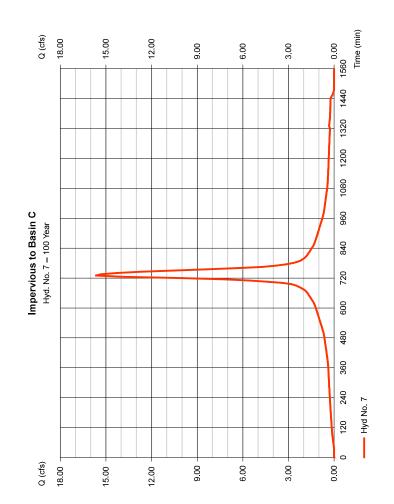
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 7

Impervious to Basin C

Hydrograph type	= SCS Runoff F	Peak discharge	Ш
Storm frequency	= 100 yrs T	Time to peak	п
Time interval		Hyd. volume	п
Drainage area	= 2.960 ac	Curve number	п
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER 1	Time of conc. (Tc)	п
Total precip.	= 8.94 in [Distribution	п
Storm duration	= 24 hrs	Shape factor	Ш

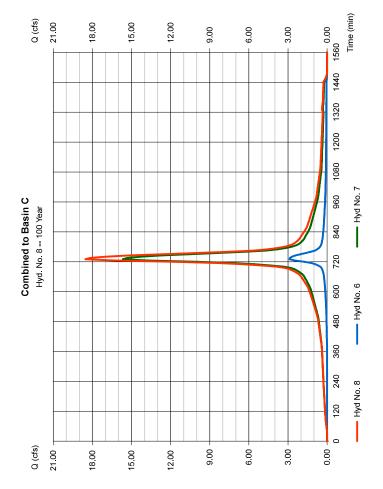
= 15.66 cfs = 730 min = 92,884 cuft = 98 = 04 = 10.00 min = 7ype III = 285



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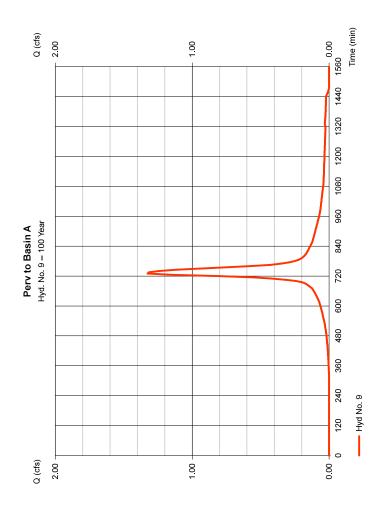
Hydraflow Hydrographs by Intelisolve v9.1	telisolve v9.1	Wednesday, Jan 20, 2021	0, 2021
Hyd. No. 8			
Combined to Basin C	C		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 100 yrs = 6, 7	Peak discharge = 18.53 cfs Time to peak = 730 min Hyd. volume = 108,150 cuft Contrib. drain. area = 3.610 ac	μ



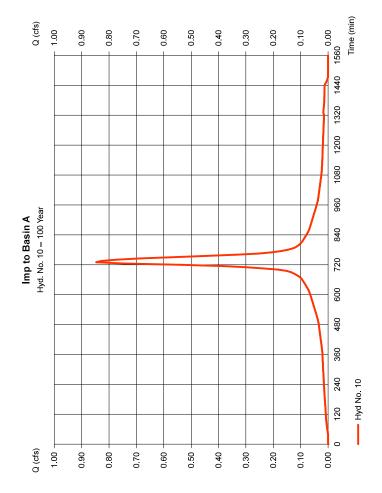
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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 1.325 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 5 min	Hyd. volume	= 7,046 cuft
Drainage area	= 0.300 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300



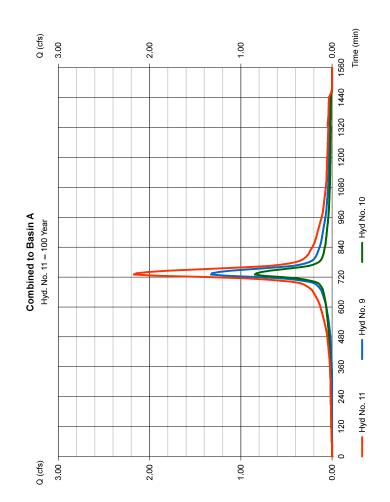
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 10			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.847 cfs
Storm frequency	= 100 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	П
Drainage area	= 0.160 ac	Curve number	П
Basin Slope	= 0.0 %	Hydraulic length	П
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	11
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

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Wednesday, Jan 20, 2021 Peak discharge = 2.172 cfs Time to peak = 730 min Hyd. volume = 12.067 cuft Contrib. drain. area = 0.460 ac = Combine = 100 yrs = 5 min = 9, 10 Hydraflow Hydrographs by Intelisolve v9.1 Combined to Basin A Hydrograph type Storm frequency Time interval Inflow hyds. Hyd. No. 11

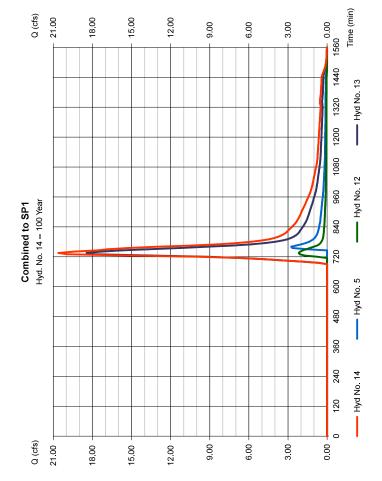


$ \int \left(\int \left(\int \left(\int \left(\int \right) \right) \right) \right) \right) = \int \left(\int \left(\int \left(\int \left(\int \left(\int \right) \right) \right) \right) \right) \right) = \int \left(\int \left(\int \left(\int \left(\int \right) \right) \right) \right) \right) \right) = \int \left(\int \left(\int \left(\int \left(\int \left(\int \right) \right) \right) \right) \right) \right) = \int \left(\int \left(\int \left(\int \left(\int \left(\int \right) \right) \right) \right) \right) = \int \left(\int $					Lindenflour Linden	ranka hu lataliaaho						Modeoodo	, oc act
No. 12 Actuing graph by Elements and the graph of the contract of a static st	aflow Hydrographs by	Intelisolve v9.1		Wednesday, Jan 20, 2021	Pond No. 3	- Basin A	-					Medileona	ay, Jali 20, 4
Base / Storage Table Stage / Storage Table Frequency = 100/sr Free to peak = 2.172 GF Stage / Storage Table Free to peak # 15 - Combined to Basin A Free to peak # 100 stage # 100 stage First All # 1 - Combined to Basin A Max. Electron # 100 stage # 100 stage # 100 stage First All # 1 - Combined to Basin A Max. Electron # 100 stage # 100 stag	Hyd. No. 12				Pond Data Contours - User-	defined contour area	. Average end a	rea method us	d for volume calculati	on. Begining Elev	ation = 81.50	Ŧ	
Terroration = 100 yrs Terroration = 100 yrs Terroration = 83.88 ft Max. Elevation = 8.99 ft Max. Elevation = 8.99 ct Max. Elevation = 8.90 ct Max.	Hydrograph type		Peak discharge		Stage / Stora Stage (ft)	ge Table Elevation (ft)	Contour are		Icr. Storage (cuft)	Total storage	(cuft)		
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	m trequency e interval w hyd. No ervoir name	= 100 yrs = 5 min = 11 - Combined to Basin A = Basin A	Lime to peak Hyd. volume Max. Elevation Max. Storage		0.00 0.50 1.00 2.50 2.50 2.50	81.50 82.00 82.50 83.00 83.00 84.00	00 979 1,314 1,649 2,088 2,526		0 573 573 934 1,154	0 245 818 1,559 2,493 3,647			
Basin A Routing Basin A Routing Hyd. No. 12 – 100 Year Hyd. No. 12 – 100 Year 0 (cb) Hyd. No. 12 – 100 Year 0 (cb) 1 Hyd. No. 12 – 100 Year 0 Hyd. No. 1	ge Indication method	used.			3.00 Culvert / Orifi	84.50 ice Structures	3,026		1,388 Weir Structure				
Basin A Routing Hyd. No. 12 - 100 Year Hyd. No. 12 -								[PrfRsr]				ē	
Basin A Ruting Hud. No. 12 - 100 Vert Hud. No. 12 -					Rise (in)				Crest Len (ft)	14.00			
Basin A Routing Hyd. No. 12 - 100 Yaar Hyd. No. 12 - 100 Yaar Hyd. No. 12 - 100 Yaar 100 100 100 100 100 100 100 100 100 100					Span (in)			0.00					
Basin A Routing Hyd. No: 12 - 100 Year Hyd. No: 12 - 100 Year 200 Hyd. No: 12 - 100 Hyd. Year 200 Hyd. Y					Invert El (ft)		_	0.00					
Hyt. No. 12 – 100 Year (c) (c) (c) (c) (c) (c) (c) (c) (c) (c)		Basin A Routing			Length (ft)			0.00					
300 Orifice Ceeff. = 0.00 V 100 Orifice Ceeff. = 0.00 V 0 Orifice Ceeff. = 0.00 V	(S)	Hyd. No. 12 – 100 Year		Q (cfs)	Slope (%) N-Value			n/a n/a					
				3.00	Orifice Coeff. Multi-Stage			0.60 No	_	 = 0.000 (by Wet = 0.00 	area)		
					Stage (ft)			Stage	/ Discharge				
					3.00								F
				5.00									
					5.00								
				1.00									
					1.00								
0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560				0.00									
	0	360 480 600 720 840	1080 1200	1440 156 -								_	

Month Month <th< th=""><th>Hydrograph Report</th><th></th><th>:</th><th></th><th>Hudraffow Hudrographs by Intelisobe v9.1</th><th>1.8</th><th></th><th></th><th>Wed</th><th>Wednesday, Jan 20, 2021</th></th<>	Hydrograph Report		:		Hudraffow Hudrographs by Intelisobe v9.1	1.8			Wed	Wednesday, Jan 20, 2021
Basin C Basin C Stage / Storage Table Imme to peak. = 18.44 cts Stage / Storage Imme to peak. = 72.695 cuth Free kitscharte Pist Linear in the to peak. = 77.000 Stage / Storage Imme to peak. = 77.000 Imme to peak. Pist Linear in the to peak. = 77.000 Imme to peak. Pist Linear in the top peak. = 77.000 Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. = 30.533 cuth Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. Imme to peak. <tr< th=""><th>Hydraflow Hydrographs by Intelsolve v9.1 Hyd. No. 13</th><th></th><th>Wednesday, Jan 20, 2021</th><th>Pond No. 2 Pond Data Contours - Use</th><th> Basin C Basin C Idefined contour areas </th><th>Average end area meth</th><th>od used for volume calcul</th><th>ation. Begining Elevation</th><th>= 72.00 ft</th><th></th></tr<>	Hydraflow Hydrographs by Intelsolve v9.1 Hyd. No. 13		Wednesday, Jan 20, 2021	Pond No. 2 Pond Data Contours - Use	 Basin C Basin C Idefined contour areas 	Average end area meth	od used for volume calcul	ation. Begining Elevation	= 72.00 ft	
Basin C Routing Hydr. No. 13 – 100 Year Hydr. No. 14 – 100 Year Hydr		Peak discharge Time to peak Hyd, volume Max. Elevation Max. Storage	= 18.44 cfs = 735 min = 82,695 cuft = 77.09 ft = 30,533 cuft	Stage / Storr Stage (ft) 0.00 0.50 1.00 1.00 2.00 2.00 2.00	age Table Elevation (ft) 72.50 73.50 73.50 74.00 74.00	Contour area (sqft) 00 641 1,282 3,407 5,531 6,781	Incr. Storage (cuft) 0 160 1.172 2.235 3.075	Total storage (cuft) 0 641 1.813 4.048 7.108		
Culvert / Orifice Structures Culvert / Orifice Structures (i) Fise (ii) = 18.00 Span (iii) = 18.00 18.00 18.00 18.00 18.00 18.00 19.00 10.0	cation method used.			3.00 3.50 5.50 5.50 5.50 5.50	75.00 75.50 76.00 77.00 77.50	8,030 8,715 9,400 10,775 11,413	5,703 5,703 5,229 5,206 5,241	10,829 19,544 24,412 29,618 35,159		
Q (cfs) (Cfs				Culvert / Ori	fice Structures		Weir Structures	res		
Q (cfs) No. Barrels 1 0.00 No. Barrels 1 0.00 No. Barrels 1 0.00 No. Barrels 1 0.00 Stope (%) = 0.00 0 Nature 1 0.00 Stope (%) = 0.00 0 0 1 1 0.00 Stope (%) = 0.00 0 0 0 0 1 1 0.00 Stope (%) = 0.00 0	Basin C R	outing		Rise (in)		[C] Inactive			n	[ப]
Stage (ft) 6.00 MultiStage = .013 5.00 4.00 2.00 2.00 2.00	Hyd. No. 13 -	100 Year	Q (cfs)	Span (in) No. Barrels Invert El. (ft) Length (ft) Slope (%)		6.00 75.29 0.00	Crest El. (tt) Weir Coeff. Weir Type Multi-Stage	= /0.02 /0.99 = 3.33 2.60 = Rect Broad = Yes No	/0.52 3.33 Rect No	0.00 No
Stage (f) 6.00 7.00 3.00 2.00			18.00	N-Value Orifice Coeff Multi-Stage		.013 0.60 No	Exfil.(in/hr) TW Elev. (ft)	= 0.000 (by Wet area)= 0.00		
Stage (f) 6.00 4.00 3.00 2.00 2.00					Ž	ote: Culvert/Orifice outflows are	nalyzed under inlet (ic) and outlet	(oc) control. Weir risers checked	for orifice conditio	ns (ic) and submergence (s).
			15.00	Stage (ft)		0	Stage / Discharge			Elev (ft)
			12.00	6.00						78.00
			00.6	5.00						00'22
				4.00						76.00
			6.00	3.00						75.00
			3.00	2.00						74.00
120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560	240 360 480 600 720	960 1080 1200	1440 1560	1.00						23.00
- Hyd No. 13 - Hyd No. 8 Time (min) 0,00 14,00 21,00 28,00 35,00 35,00 35,00 14,00 21,00 28,00 35,00 14,00 21,00 28,00 35,00 14,00 21,00 28,00 35,00 14,00 21,00 28,00 35,00 14,00 21,00 28,000 28,00	Hyd No. 8	Total storage used = 30,533		00.00				49.00 56.00	00 63.00	0 70.00

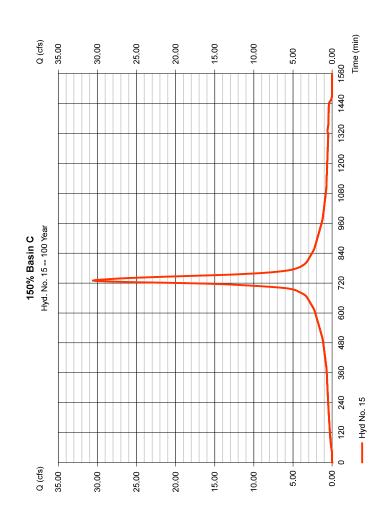
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Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1	3	Wednesday, Jan 20, 2021
Hyd. No. 14			
Combined to SP1			
Hydrograph type	= Combine	Peak discharge =	
Storm frequency	= 100 yrs	Time to peak =	735 min
Time interval	= 5 min	Hyd. volume =	107,035 cuft
Inflow hyds.	= 5, 12, 13	Contrib. drain. area = 0.000 ac	0.000 ac



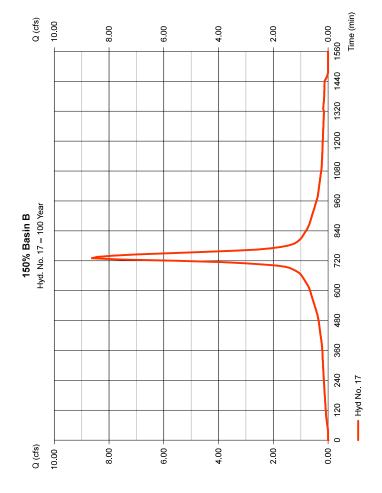
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 15			
150% Basin C			
Hydrograph type	= SCS Runoff	Peak discharge	= 30.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 164,902 cuft
Drainage area	= 5.255 ac	Curve number	п
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.94 in	Distribution	= Type III
Storm duration	= 24 hrs		= 285



Hydrograph Report	ih Report		21	Pond Report	eport					22
Hudraffow Hudrographs h	w Intelieotvo vO 1		Mednaschav Jon 20 2021	Hydraflow Hydrog	Hydraflow Hydrographs by Intelisolve v9.1	v9.1			Wednesda	Wednesday, Jan 20, 2021
Hydrallow Hydrographs by Intellsolve v9. I	by Intellsolve va. I		weanesaay, Jan Zu, Zuz I	Pond No. 2 - Basin C	Basin C					
Hyd. No. 16				Pond Data	anna matana kangal		te de la construcción de la constru La construcción de la construcción d	n	4 00 02	
150% Basin C Routing	outing					as. Average enu area men				
Hydrograph type	e = Reservoir - 100 vrc	Peak discharge	= 30.12 cfs - 732 min	Stage / Storage Table Stage (ft) Elevati	ge Table Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)		
Time interval Inflow hyd. No. Reservoir name		Hyd. volume Max. Elevation Max. Storage	= / /2/ mm = 139,446 cuft = 77.20 ft = 31,842 cuft	0.00 0.50 2.1.50 2.50	72.00 72.50 73.00 74.00 74.50	00 641 3,407 5,531 6,781	0 160 1,172 3,078	0 160 1,813 4,048 7,126		
Storage Indication method used				200 200 200 200 200 200 200 200 200 200	75.00 75.50 76.50 77.00 77.00	8,030 8,715 9,4715 10,075 11,413	3,703 4,5186 4,869 5,5206 5,541	10,829 15,015 29,544 29,618 35,159		
				Culvert / Orifi	Culvert / Orifice Structures		Weir Structures	es		
						[B] [C] [PrfRsr]			[0]	
Q (cfs)	150% Basin Hvd No 16	150% Basin C Routing Hvd No 16 – 100 Year	Q (cfs)	Rise (in) Span (in) No Barrels	= 18.00 = 18.00 = 1 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4	Inactive Inactive 0.00 4.50 6.00 0.00 1 1 0	Crest Len (ft) Crest El. (ft) Weir Coeff		Inactive 0.00 76.52 0.00	
35.00			35.00	Ê.		-		Broad No	Rect No	
30.00			30.00	Slope (%) N-Value Orifice Coeff. Multi-Stage		u.uu u.uu n/a .013 .013 n/a 0.60 0.60 0.60 Yes No No	Exfil (in/hr) TW Elev (ft)	= 0.000 (by Wet area)= 0.00		
						Note: Culvert/Orifice outflows are a	Note: Culver/Driftee outflows are analyzed under inlet (ic) and outlet (ico) control. Weir risens checked for orifice conditions (ic) and submergence (is)	oc) control. Weir risers checked for	orifice conditions (ic) a	nd submergence (s).
25.00			25.00			c				
				Stage (ft) 6.00		" 	otage / Lischarge	_	_	Elev (ft) 78.00
20.00			20.00							
15.00			15.00	2:00						27.00
				4.00						76.00
10.00			10.00	3.00						75.00
5.00			5.00	2.00						74.00
				1.00						73.00
0	360 480 600 720	840 960 1080 1200 1320	1440 156							
Hyd No. 16	Hyd No. 15	Total storage used = 31,842 cuft		0.00	7.00 14.00	21.00 28.00	0 35.00 42.00	49.00 56.00	63.00	72.00 70.00 Discharge (cfs)
				10	 Total Q 					

Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 17			
150% Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 8.625 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 5 min	Hyd. volume	= 51,149 cuft
Drainage area	= 1.630 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	() Lo	= 10.00 min
Total precip.	= 8.94 in		= Type III
Storm duration	= 24 hrs		= 285



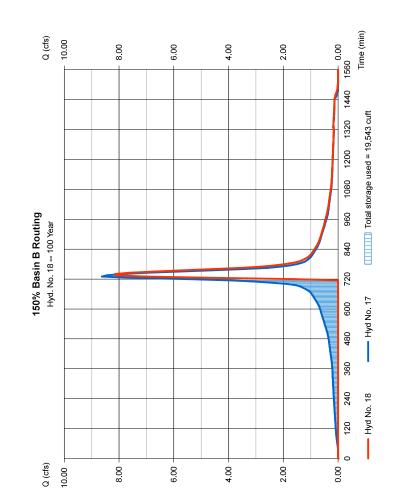
Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 18150% Basin B Routing150% Basin B RoutingHydrograph typeReservoirRequencyStorm frequency100 yrsTime interval5 minInflow hyd. No.17. - 150% Basin BReservoir name8 Basin BReservoir name100 yrsReservoir name100 yrs100 yrs100 yrs100 yrs100 yrs100 yrs100 yrs100 yrs100 yrs17. 150% Basin BMax. Storage19,543 cuft

Storage Indication method used.



Pond Report

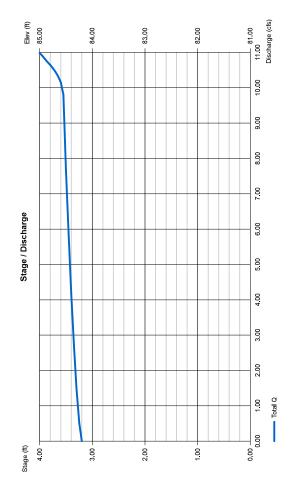
Hydraffow Hydrographs by Intelisolve v9.1 Pond No. 1 - Basin B Pond Data Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 81.00 ft

Contour area (sqft) Incr. Storage (cuft) Total storage (cuft)

Stage / Storage Table Stage (ft) Elevation (ft)

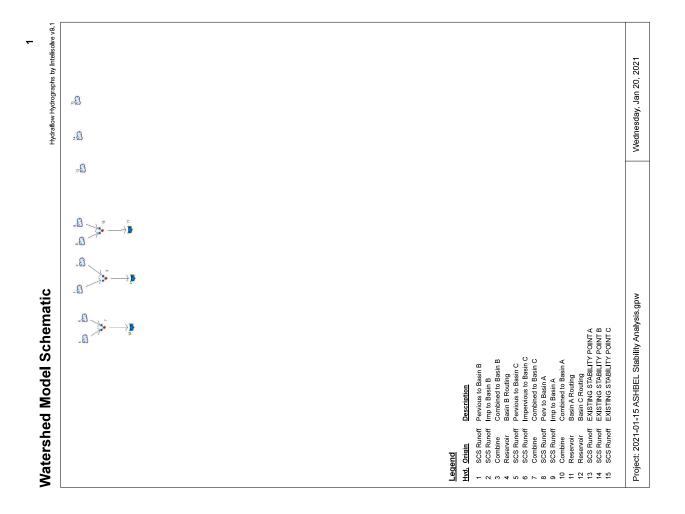
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		<u>ত</u>	0.00	00.0	3.33	ł	٩				
0 511 2,042 4,315 4,315 1,049 14,555 19,419 24,928 24,928		8	20.00	84.50	2.60	Broad	Yes			= 0.000 (by Wet area)	
2,4,7,0,4,0 2,4,7,0,4,0 4,	res	[4]	= 14.00	= 84.20	= 3.33	= Rect	= Yes			d) 000.0 =	= 0.00
0 511 2,532 2,733 3,359 4,147 5,509	Weir Structures		Crest Len (ft)	Crest EI. (ft)	Weir Coeff.	Weir Type	Multi-Stage			Exfil.(in/hr)	TW Elev. (ft)
		[PrfRsr]	0.00	00.0	0	00.0	0.00	n/a	n/a	09.0	No
00 2,042 5,042 5,007 7,506 9,083 10,373 11,663		<u>ত</u>	00.00	0.00	0	0.00	0.00	0.00	013	0.60	٩
	se	8	nactive	2.50	-	81.00	0.50	0.50	.013	09.0	Yes
81.00 81.50 82.50 83.50 83.50 84.50 84.50 84.50 84.50	Culvert / Orifice Structures	[A]	= 15.00	= 15.00	= 1	= 80.90	= 72.00	= 2.50	= .013	09.0 =	= n/a
0.00 0.50 1.50 2.50 3.50 4.00	Culvert / Ori		Rise (in)	Span (in)	No. Barrels	Invert EI. (ft)	Length (ft)	Slope (%)	N-Value	Orifice Coeff	Multi-Stage

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submargence (s).



9. HYDROGRAPH SUMMARY REPORTS – STABILITY ANALYSIS

-																	
Hydraflow Hydrographs by Intelisolve v9.1	Hydrograph description	Pervious to Basin B	Imp to Basin B	Combined to Basin B	Basin B Routing	Pervious to Basin C	Impervious to Basin C	Combined to Basin C	Perv to Basin A	Imp to Basin A	Combined to Basin A	Basin A Routing	Basin C Routing	EXISTING STABILITY POINT A	EXISTING STABILITY POINT B	EXISTING STABILITY POINT C	Wednesday, Jan 20, 2021
	Total strge used (cuft)				4,281							986	14,973				Wednesday
	Maximum elevation (ft)			-	82.49						1	82.61	75.50		1		ar
_	Inflow hyd(s)		ļ	1, 2	3	ļ	ļ	5, 6	ļ	ļ	8, 9	10	7	ļ	1	ļ	Return Period: 2 Year
eport	Hyd. volume (cuft)	4,305	4,767	9,072	9,062	3,615	33,598	37,213	1,668	1,816	3,484	3,479	37,211	3,001	1,162	5,712	Return P
	Time to peak (min)	735	730	735	830	735	730	730	735	730	735	760	785	735	735	735	ysis.gpw
	Time interval (min)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	ility Anal
5	Peak flow (cfs)	0.809	0.830	1.623	0.193	0.682	5.850	6.515	0.315	0.316	0.625	0.270	1.063	0.558	0.216	1.061	BEL Stat
i yu ogi apir oummary ivepor i	Hydrograph type (origin)	SCS Runoff	SCS Runoff	Combine	Reservoir	SCS Runoff	SCS Runoff	Combine	SCS Runoff	SCS Runoff	Combine	Reservoir	Reservoir	SCS Runoff	SCS Runoff	SCS Runoff	2021-01-15 ASHBEL Stability Analysis gpw
	hyd. No	1	7	e	4	5	9	7	80	ი	10	£	12	13	14	15	202

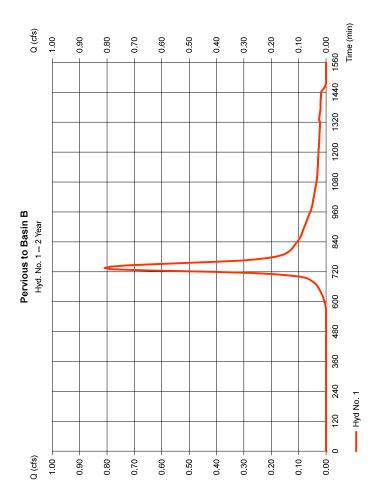


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riyurallow riyurograpirs vy			weallesday, Jall 20, 2021
Hyd. No. 1			
Pervious to Basin B	В		
Hydrograph type	= SCS Runoff	Peak discharge	= 0.809 cfs
Storm frequency	= 2 yrs	Time to peak	п
Time interval	= 5 min	Hyd. volume	п
Drainage area	= 0.810 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	П
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

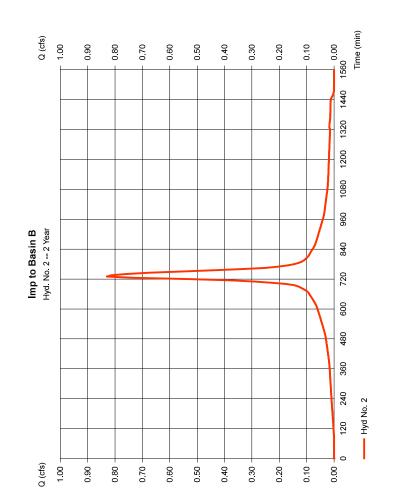
* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810



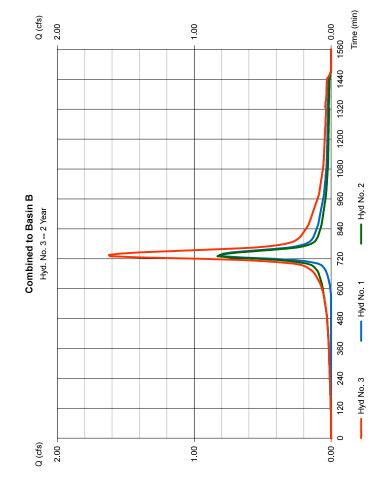
Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 2			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.830 cfs
Storm frequency	= 2 yrs	Time to peak	
Time interval	= 5 min	Hyd. volume	= 4,767 cuft
Drainage area	= 0.420 ac	Curve number	ш
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	П
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydraflow Hydrographs by Intelisolve v9.1	Wednesday, Jan 20, 2021
Hyd. No. 3	
Combined to Basin B	
Hydrograph type = Combine Storm frequency = 2 yrs Time interval = 5 min Inflow hyds. = 1, 2	Peak discharge = 1.623 cfs Time to peak = 735 min Hyd. volume = 9,072 cuft Contrib. drain. area = 1.230 ac

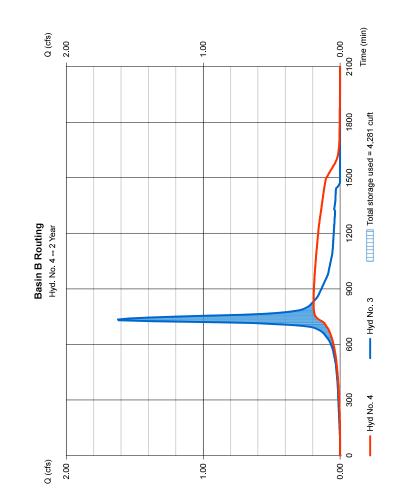


Hydrograph Report

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Hydrafbw Hydrographs by Intelsolve v9.1 Wednesday, Jan 20, 2021 **Hydr. No. 4**Basin B Routing
Hydrograph type = Reservoir
Time to peak discharge = 0.193 cfs
Storm frequency = 2 yrs
Time interval = 5 min
Inflow hyd. No. = 3 - Combined to Basin B
Max. Elevation = 82.49 ft
Max. Storage = 4,281 cuft

Storage Indication method used.



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Hydraflow Hydrographs by Intellsolve v9.1 Pond No. 1 - Basin B

Pond Data

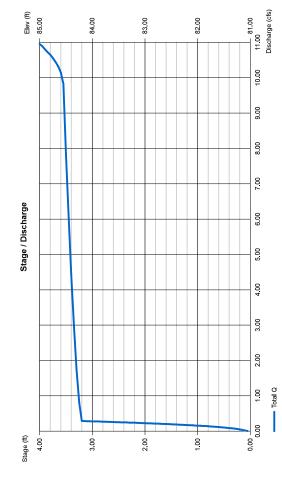
Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 81.00 ft

Contour area (sqft) Incr. Storage (cuft) Total storage (cuft)

Elevation (ft) Stage / Storage Table Stage (ft) Elevatio

ē	0.0	0.0	ł	٥N			
ប្	0.00	0.00 3.33	ł	No			
[8]	20.00	84 5U 2.60	Broad	Yes			0.000 (by Wet area)
[A]	= 14.00	= 84.20 = 3.33	= Rect	= Yes			q) 000'0 =
	Crest Len (ft)	Crest EI. (TT) Weir Coeff	Weir Type	Multi-Stage			Exfil.(in/hr)
F							
[PrfRs	0.00	00 ⁻ 0	00.0	0.00	n/a	n/a	0.60
<u>ত</u>	0.00	00 0	00.0	00.00	0.00	.013	0.60
a B	2.50	1.00	81.00	0.50	0.50	.013	09.0
[A]	15.00	1 1	80.90	72.00	2.50	013	0.60
			Ш	Ш	"	н	I
	Rise (in)	Span (in) No. Barrels	Invert EI. (ft)	Length (ft)	Slope (%)	N-Value	Orifice Coeff
	tures wen succures [B] [C] [PrfRsr] [A] [B] [C]	Image: Number of the state of the	Weil Subutions [B] [C] [PrfRsr] [A] [B] [C] 2.50 0.00 0.00 Creast Len (tt) = 14.00 20.00 0.00 2.50 0.00 0.00 Creast Len (tt) = 84.20 0.00 1 0 0 Weif Coeff. = 3.33 2.60 3.33	Image: Control of the second	Immediate Weil Suburts [A] [B] [C] [PrRsr] [A] [B] [C] I = 15.00 2.50 0.00 0.00 Crest Len (ft) = 14.00 20.00 0.00 0.00 100	Image: Control of the second	Image: Control of the section of the secting of the secting of the sectin





Hydrograph Report

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Wednesday, Jan 20, 2021

Hydraflow Hydrographs by Intelisolve v9.1

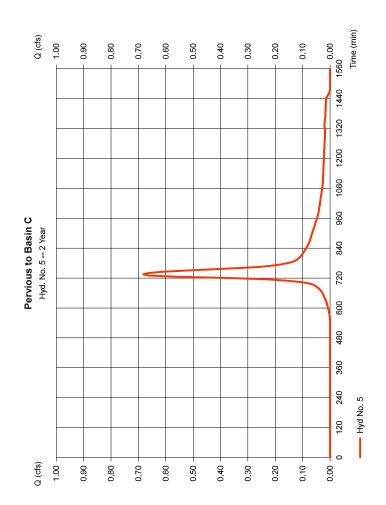
Wednesday, Jan 20, 2021

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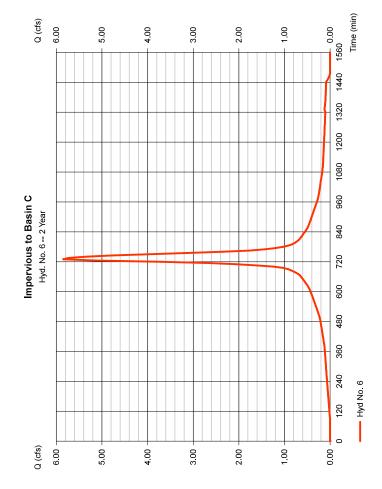
Hyd. No. 5

Pervious to Basin C	0		
Hydrograph type	= SCS Runoff	Peak discharge	= 0.682 cfs
Storm frequency	= 2 yrs	Time to peak	= 735 min
Time interval	= 5 min	Hyd. volume	= 3,615 cuft
Drainage area	= 0.650 ac	Curve number	= 80*
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
To method	= USER	Time of conc. (Tc)	= 10.0 min
Total precip.	= 3.38 in	Distribution	= 7ype III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



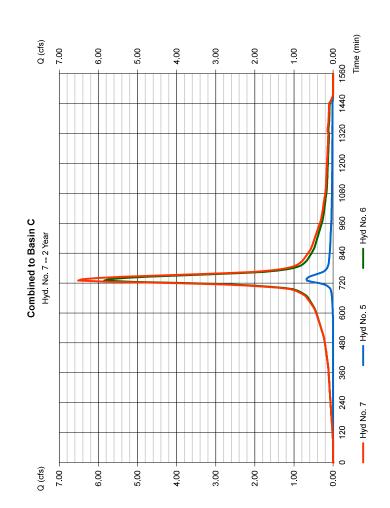
Hydraftow Hydrographs by Intelsolve v9.1 Wednesday, Jan 20, 2021
Hydr. No. 6
Impervious to Basin C
Hydrograph type = SCS Runoff
Hydrograph type = 5.850 cfs
Time interval = 5 min
Time interval = 2 yrs
Time interval = 2.960 ac
Basin Slope = 0.0 %
Hydraulic length = 0.6
Hydraulic length = 0.6
Time of corror. (Tc) = 10.00 min
Total precip. = 2.4 hrs
Storm duration = 2.4 hrs



Hydrograph Report

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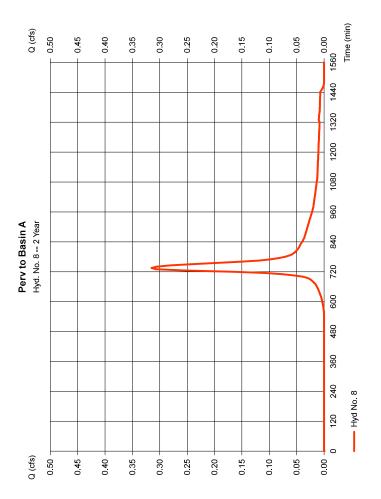
Hydrafow Hydragraphs by Intelsolve v9.1 Wednesday, Jan 20, 2021 **Hyd. No. 7** Combined to Basin C Hydrograph type = Combine Storm frequency = 2 yrs Time to peak = 730 min Hyd. volume = 37, 213 cuft Inflow hyds. = 5, 6 Contrib. drain. area = 3.610 ac



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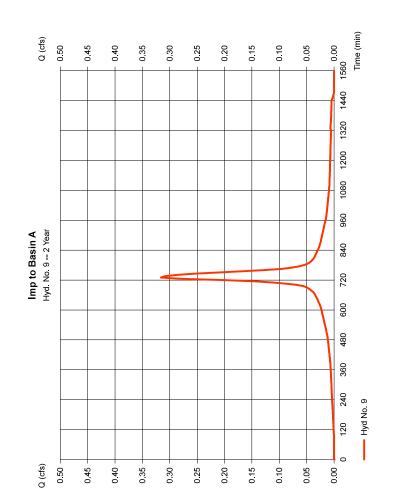
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 8			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.315 cfs
Storm frequency	= 2 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 1,668 cuft
Drainage area	= 0.300 ac	Curve number	п
Basin Slope	= 0.0%	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	<u>ـ</u>	= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300

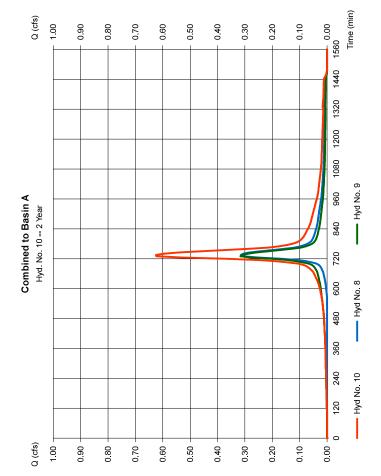


Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1	Intelisove v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.316 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 5 min	Hyd. volume	
Drainage area	= 0.160 ac	Curve number	
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1	>	Wednesday, Jan 20, 2021
Hyd. No. 10			
Combined to Basin A	٩		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 2 yrs = 8, 9	Peak discharge = (Time to peak = Hyd. volume = Contrib. drain. area = (= 0.625 cfs = 735 min = 3,484 cuft = 0.460 ac

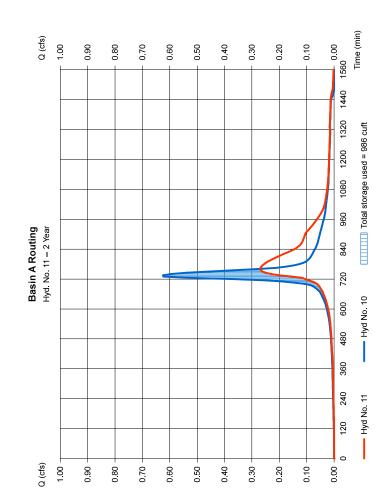


Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 11			
Basin A Routing			
Hydrograph type	= Reservoir	Peak discharge	= 0.270 cfs
Storm frequency	= 2 yrs	Time to peak	= 760 min
Time interval	= 5 min	Hyd. volume	= 3,479 cuft
Inflow hyd. No.	= 10 - Combined to Basin A	Max. Elevation	= 82.61 ft
Reservoir name	= Basin A	Max. Storage	= 986 cuft

Storage Indication method used.



Pond Report

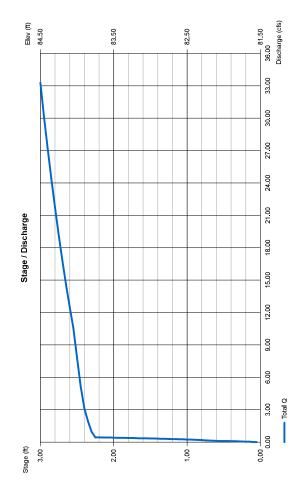
Hydraflow Hydrographs by Intelisolve v9.1 Pond No. 3 - Basin A

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 81.50 ft Pond Data

Stage / Storage Table

			ً	00.0	0.00	3.33	ł	٩				
			ច	0.00	0.00	3.33	ł	No				
Total storage (cuft)	0 245 818 1,559 2,493 5,035		[8]	20.00	83.90	2.60	Broad	No			= 0.000 (by Wet area)	
Total sto	ר ⁻ שׂישׂע	es.	[A]	= 14.00	= 83.75	= 3.33	= Rect	= Yes			(b) 0000 =	= 0.00
Incr. Storage (cuft)	0 245 573 741 1,154 1,388	Weir Structures		Crest Len (ft)	Crest EI. (ft)	Weir Coeff.	Weir Type	Multi-Stage			Exfil (in/hr)	TW Elev. (ft)
ea (sqft)			[PrfRsr]	00.0	00.0	0	00.0	00.0	n/a	n/a	0.60	No
Contour area (sqft)	00 979 1,314 2,649 2,088 3,026		<u>0</u>	2.50	2.50	-	82.10	0.00	0.00	.013	09.0	No
		ş	8	2.50	2.50	-	81.50	0.00	0.00	.013	09.0	Yes
Elevation (ft)	81.50 82.50 83.00 83.50 83.50 84.00	ice Structure	[A]	= 15.00	= 15.00	= 1	= 81.40	= 45.00	= 0.50	= .013	= 0.60	= n/a
Stage (ft)	0.00 0.50 1.50 3.00 3.00	Culvert / Orifice Structures		Rise (in)	Span (in)	No. Barrels	Invert EI. (ft)	Length (ft)	Slope (%)	N-Value	Orifice Coeff.	Multi-Stage

under inlet (ic) and outlet (oc) control. Weir risers checked for orlifice conditions (ic) and submergence (s). = 0.000 (by Wet area)= 0.00 Exfil (in/hr) TW Elev (ft) 0.00 0.00 0.00 0.60 No No Note: Culvert/Orifice outflows are 2.50 1 82.10 0.00 0.00 0.13 0.60 No 2.50 1 81.50 0.00 0.00 0.13 0.60 Yes = 15.00 = 1 = 81.40 = 45.00 = 0.50 = 0.13 = 0.13 = n/a



Hydrograph Report

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Wednesday, Jan 20, 2021

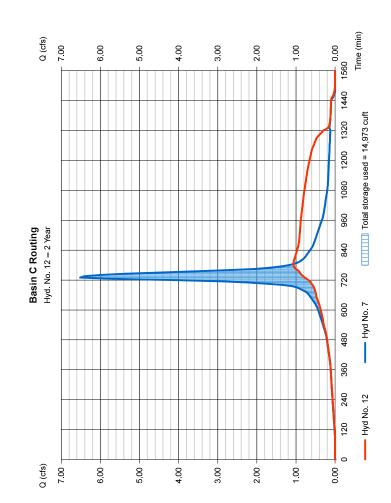
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 12

Basin C Routing

= 1.063 cfs = 785 min = 37,211 cuft = 75.50 ft = 14,973 cuft
Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage
 Reservoir 2 yrs 5 min 7 - Combined to Basin C Basin C
Hydrograph type Storm frequency Time interval Inflow hyd. No. Reservoir name





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Hydraflow Hydrographs by Intelisolve v9.1

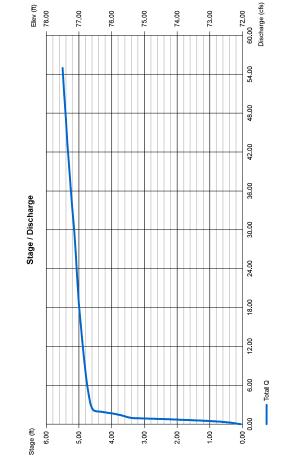
Pond No. 2 - Basin C Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 72.00 ft

Table	Elevation (ft)
Stage / Storage	Stage (ft)

			ً	0.00	00.0	3.33	I	No				
			<u>כ</u>	5.00	76.52	3.33	Rect	٩				
Total storage (cuft)	0 160 641 1,813 4,048 4,048 7,126 15,015 19,544 15,015 29,618 29,618 35,159		[8]	20.00	76.99	2.60	Broad	No			= 0.000 (by Wet area)	
Total sto	4 4 7 0 2 1 3 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2 8 2	sə.	[A]	= 14.00	= 76.62	= 3.33	= Rect	= Yes			q) 000'0 =	= 0.00
Incr. Storage (cuft)	0 1172 1172 1172 1172 1172 1172 1172 117	Weir Structures		Crest Len (ft)	Crest EI. (ft)	Weir Coeff.	Weir Type	Multi-Stage			Exfil.(in/hr)	TW Elev. (ft)
ea (sqft)			[PrfRsr]	0.00	00.00	0	00.0	00.0	n/a	n/a	09.0	No
Contour area (sqft)	00 641 3,407 5,531 6,781 6,781 8,715 9,400 9,400 10,775 11,749 11,749		<u>0</u>	6.00	6.00	-	75.29	0.00	00.00	.013	0.60	No
		es	8	4.50	4.50	٢	72.00	0.00	00.0	.013	09.0	Yes
Elevation (ft)	72.00 72.50 73.50 73.50 73.50 74.50 75.50 75.50 75.50 76.50 76.50 77.50	Culvert / Orifice Structures	[A]	= 18.00	= 18.00	= 1	= 71.90	= 42.00	= 0.50	= .013	= 0.60	= n/a
Stage (ft)	0.00 0.50 1.50 3.50 3.50 3.50 5.50 5.50 5.50 5.50 5	Culvert / Ori		Rise (in)	Span (in)	No. Barrels	Invert EI. (ft)	Length (ft)	Slope (%)	N-Value	Orifice Coeff.	Multi-Stage





Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Jan 20, 2021

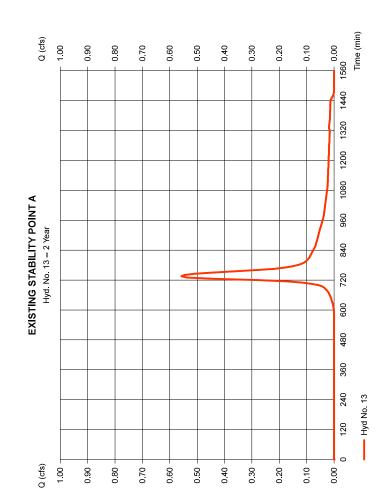
1

Hyd. No. 13

EXISTING STABILITY POINT A

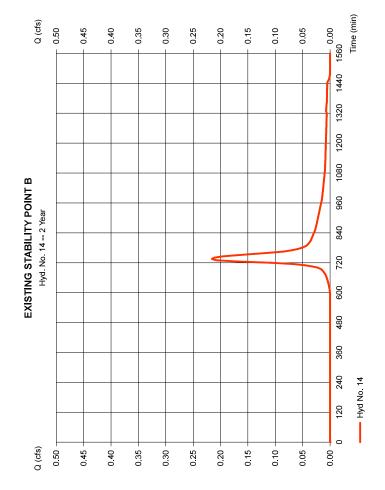
	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	 SCS Runoff Syrs 2 yrs 2 yrs 2 yrs 2 yrs 2 yrs 1 me to peak <l< th=""></l<>
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= 0.558 cfs = 735 min = 3,001 cuft = 77 = 0 ft = 10.00 min = 285



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 14			
EXISTING STABILITY POINT B	LITY POINT B		
Hydrograph type	= SCS Runoff	Peak discharge	= 0.216 cfs
Storm frequency	= 2 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 1,162 cuft
Drainage area	= 0.240 ac	Curve number	п
Basin Slope	= 0.0%	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	п
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



19

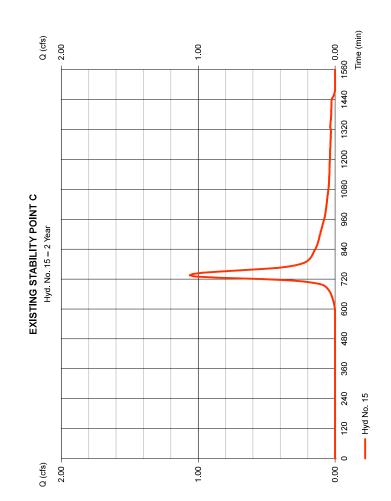
Hydraftow Hydrographs by Intelisolve v9.1

Hyd. No. 15

EXISTING STABILITY POINT C

= Je	II		ا ب	gth =	(Tc) =	П	II	
Peak discharge	Time to peak	Hyd. volume	Curve numbe	Hydraulic leng	Time of conc.	Distribution	Shape factor	
= SCS Runoff	= 2 yrs	= 5 min	= 1.180 ac	= 0.0 %	= USER	= 3.38 in	= 24 hrs	
Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration	

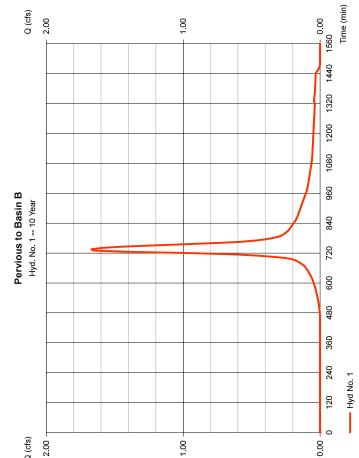
= 1.061 cfs = 735 min = 5,712 cuft = 77 = 0.ft = 10.00 min = Type III = 285



20

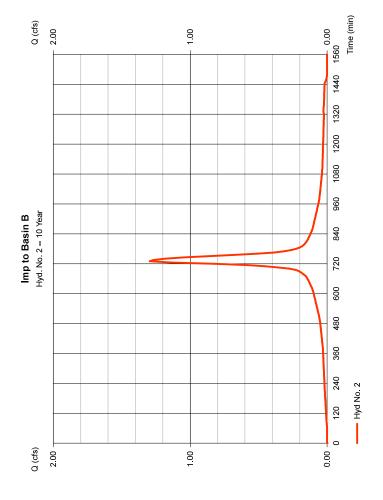
Í	Hydrograph Summary Report	ph S	nmm	lary F	Seport				Hydraffow Hydrographs by Intelisolve v9.1	Hydrograph Report
Ч N N	Hyd. Hydrograph No. type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	Hydraflow Hydrographs by Intelsolve v9.1 Hyd. No. 1 Pervious to Basin B
-	SCS Runoff	1.670	5	735	8,767	ł			Pervious to Basin B	11
N	SCS Runoff	1.295	£	730	7,564	ł			Imp to Basin B	Storm frequency = 10 yrs Time interval = 5 min
n	Combine	2.950	5	730	16,331	1, 2		ļ	Combined to Basin B	1 11
4	Reservoir	0.241	5	890	16,320	ю	83.28	8,911	Basin B Routing	II Đ
ŝ	SCS Runoff	1.382	5	735	7,255	ł		ļ	Pervious to Basin C	II
9	SCS Runoff	9.125	5	730	53,307	ł			Impervious to Basin C	Iotal precip. = 0.20 III Storm duration = 24 hrs
7	Combine	10.50	5	730	60,562	5, 6			Combined to Basin C	
80	SCS Runoff	0.638	5	735	3,349	1			Perv to Basin A	* Composite (Area/CN) = [(0.670 x 80) + (0.140 x 77)] / 0.810
თ	SCS Runoff	0.493	5	730	2,881	ł			Imp to Basin A	
10	Combine	1.127	5	730	6,230	8, 9		ļ	Combined to Basin A	
£	Reservoir	0.377	5	765	6,225	10	83.24	2,011	Basin A Routing	Par
12	Reservoir	2.275	5	775	60,560	7	76.58	25,179	Basin C Routing	Q (cfs)
13	SCS Runoff	1.200	5	735	6,299	1			EXISTING STABILITY POINT A	2.00
14	I SCS Runoff	0.464	ŝ	735	2,438	1		ļ	EXISTING STABILITY POINT B	
15	SCS Runoff	2.283	5	735	11,988	ł	ł	ļ	EXISTING STABILITY POINT C	
										Hyd No. 1
5(2021-01-15 ASHBEL Stability	IBEL Stal		Analysis.gpw		Return Period: 10 Year	ear	Wednesday	Wednesday, Jan 20, 2021	

Wednesday, Jan 20, 2021 Peak discharge1.670 cfsTime to peak735 minHyd. volume8.767 cuftHyd. volume 79^* Hydraulic length0 ffTime of conc. (Tc)10.00 minDistribution785



22

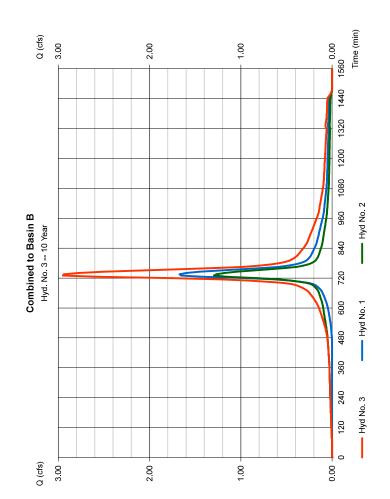
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 2			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 1.295 cfs
Storm frequency	= 10 yrs	Time to peak	
Time interval	= 5 min	Hyd. volume	
Drainage area	= 0.420 ac	Curve number	
Basin Slope	= 0.0 %	Hydraulic length	
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	Π
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

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Peak discharge = 2.950 cfs Time to peak = 730 min Hyd. volume = 16,331 cuft Contrib. drain. area = 1.230 ac = Combine = 10 yrs = 1, 2 Hydraflow Hydrographs by Intelisolve v9.1 Combined to Basin B Hydrograph type Storm frequency Time interval Inflow hyds Hyd. No. 3

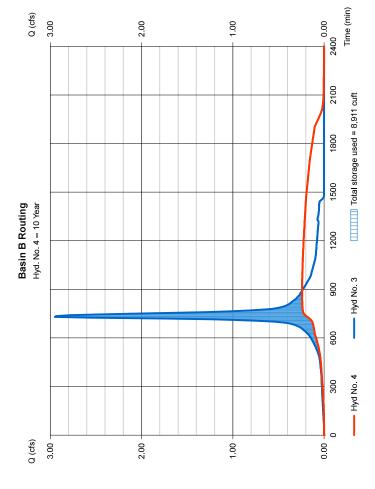


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Hydrograph Report	Report		8
Hydraflow Hydrographs by Intelisolve v9.1	telisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 4			
Basin B Routing			
Hydrograph type Storm frequency Time interval Inflow hyd. No. Reservoir name	 Reservoir 10 yrs 5 min 3 - Combined to Basin B Basin B 	Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage	= 0.241 cfs = 890 min = 16,320 cuft = 83.28 ft = 8,911 cuft

Storage Indication method used.



Hydrograph Report

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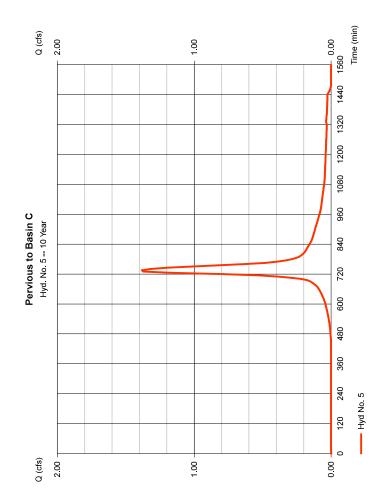
Hydraflow Hydrographs by Intelisolve v9 1

Hyd. No. 5

Pervious to Basin C

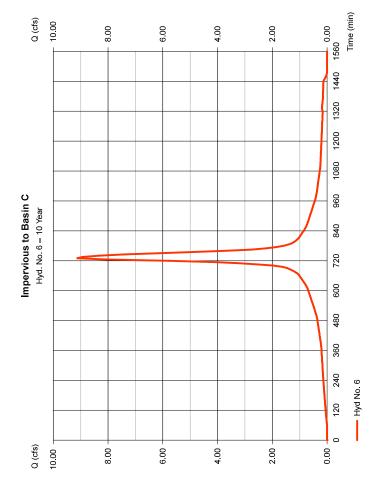
	= 1.382 cfs	п	= 7,255 cuft	П	Ш	ш	= Type III	= 285	
	Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor	
c	= SCS Runoff	= 10 yrs	= 5 min	= 0.650 ac	= 0.0 %	= USER	= 5.23 in	= 24 hrs	
Pervious to basin C	Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration	

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



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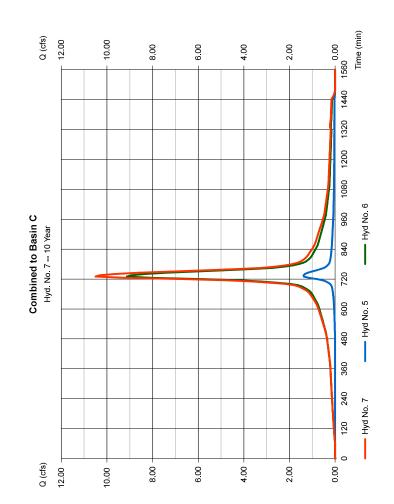
Hydrafow Hydrographs by Intelsolve v9.1 weetnesday. Jan 20. 2021 Hydr. No. 6 Impervious to Basin C Hydrograph type = SCS Runoff Storm frequency = 10 yrs Time interval = 5 min Drainage area = 2.960 ac Basin Slope = 0.0 % Time of conc. (Tc) = 10.00 min Time of conc. (Tc) = 10.00 min Distribution = 24 hrs Storm duration = 24 hrs Storm duration = 24 hrs



Hydrograph Report

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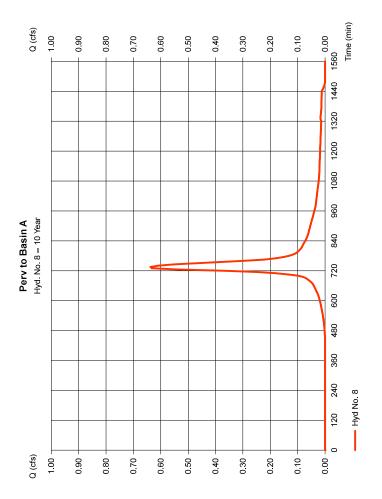
Hydraftow Hydraftow Hydraftow 49.1 Wechnesday, Jan 20. 2021 **Hydr. No. 7** Combined to Basin C Hydrograph type = Combine Storm frequency = 10 yrs Time interval = 5 min Inflow hyds. = 5, 6 Contrib. drain. area = 3.610 ac



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 8			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.638 cfs
Storm frequency	= 10 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 3,349 cuft
Drainage area	= 0.300 ac	Curve number	П
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	Ϊ
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300



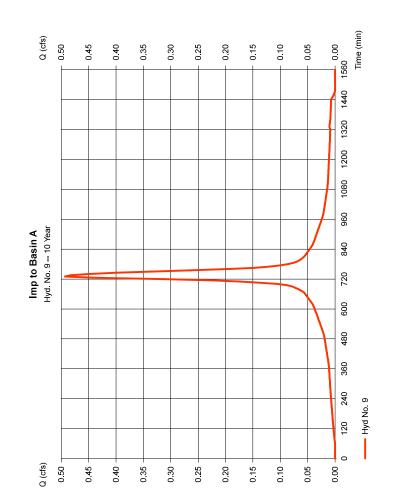
Hydrograph Report

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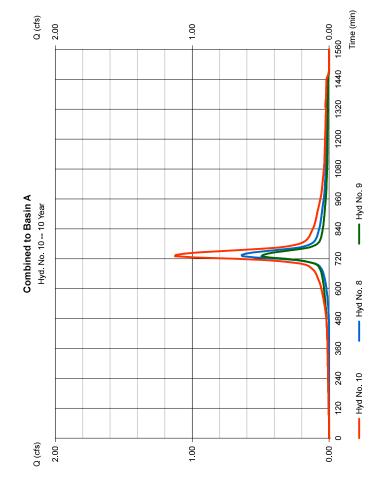
 Hydraftow Hydrographs by Intelsolve v9.1
 Wednesday, Jan 20, 2021

 Hydr. No. 9
 Wednesday, Jan 20, 2021

 Imp to Basin A
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Hydraflow Hydrographs by Intelisolve v9.1	elisolve v9.1	~	Wednesday, Jan 20, 2021
Hyd. No. 10			
Combined to Basin A	٩		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 10 yrs = 8, 9	Peak discharge = 1.127 cfs Time to peak = 730 min Hyd. volume = 6,230 cuf Contrib. drain. area = 0.460 ac	= 1.127 cfs = 730 min = 6,230 cuft = 0.460 ac

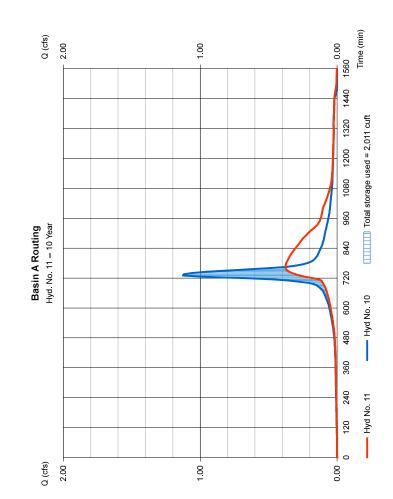


Hydrograph Report

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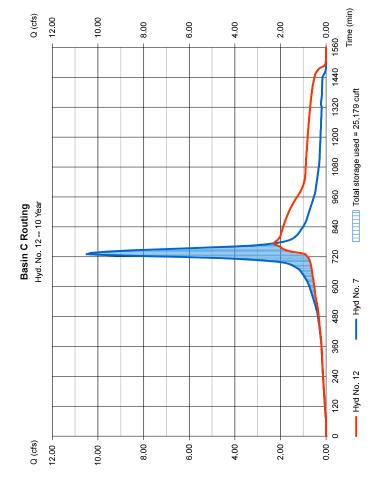
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 11			
Basin A Routing			
Hydrograph type	= Reservoir	Peak discharge	= 0.377 cfs
Storm frequency	= 10 yrs	Time to peak	= 765 min
Time interval	= 5 min	Hyd. volume	= 6,225 cuft
Inflow hyd. No.	= 10 - Combined to Basin A	Max Elevation	= 83.24 ft
Reservoir name	= Basin A	Max. Storage	= 2,011 cuft

Storage Indication method used.



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 12			
Basin C Routing			
Hydrograph type = Storm frequency = Time interval = Inflow hyd. No. = Reservoir name = storage Indication method used.	 Reservair 10 yrs 5 min 7 - Combined to Basin C Basin C 	Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage	= 2.275 cfs = 775 min = 60,560 cuft = 76.58 ft = 25,179 cuft
Stolage Indication memor	usea.		



33

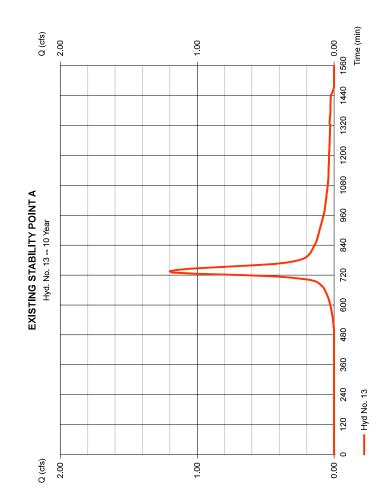
Hydraftow Hydrographs by Intelisolve v9.1

Hyd. No. 13

EXISTING STABILITY POINT A

Hydrograph type	= SCS Runoff Peak discharge	charge =	11
Storm frequency		beak :	
Time interval		Hyd. volume	
Drainage area	ac	imber :	
Basin Slope		c length =	
Tc method		conc. (Tc)	
Total precip.	= 5.23 in Distribution		
Storm duration	= 24 hrs Shape factor	actor =	

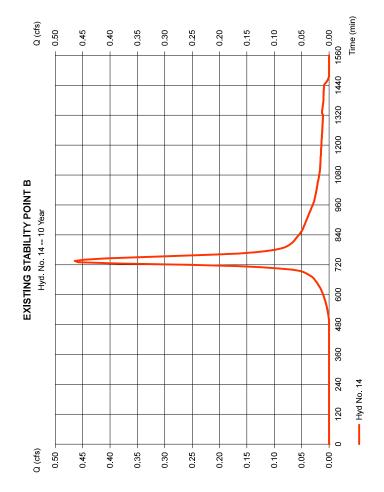
= 1.200 cfs = 735 min = 6,299 cuft = 77 = 17 = 10.00 min = 77pe III = 285



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 14			
EXISTING STABILITY POINT B	LITY POINT B		
Hydrograph type	= SCS Runoff	Peak discharge	= 0.464 cfs
Storm frequency	= 10 yrs	Time to peak	Ш
Time interval	= 5 min	Hyd. volume	= 2,438 cuft
Drainage area	= 0.240 ac	Curve number	п
Basin Slope	= 0.0%	Hydraulic length	П
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.23 in	Distribution	П
Storm duration	= 24 hrs	Shape factor	= 285



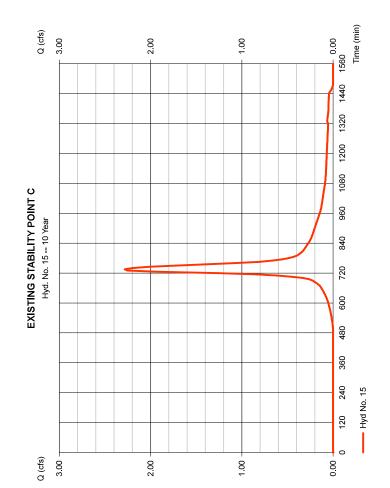
35

Hydraftow Hydrographs by Intelsolve v9.1 Hydd. No. 15

EXISTING STABILITY POINT C

SCS Runoff 10 yrs 5 min 1.180 ac 0.0 % USER 5.23 in 24 hrs	Trychauric Jerugun = Time of conc. (Tc) = Distribution = Shape factor =	Time of conc. (Tc) =	Hydraulic length =		Hyd. volume =		Peak discharge =
	0.0% USER 5.23 in 24 hrs	USER	0.0 %	1.180 ac	5 min	10 yrs	SCS Runoff

= 2.283 cfs = 735 min = 11,988 cuft = 77 = 0.00 min = 7ype III = 285



36

Ŧ	Hydrograph Summary Report	ph Sı	mm	ary R	eport	_			Hvdraffow Hvdronranhs hv Intelicolva v0 1	Hydrograph Report	
Hyd No	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	Hydrattow Hydrographs by Intellisolve v9.1 Hyd. No. 1 Dervionue to Ressin R	
~ N	SCS Runoff SCS Runoff	2.305	പറ	735 730	12,144 9,531				Pervious to Basin B Imp to Basin B	= SCS Runoff = 25 yrs	Peak Time
т	Combine	3.921	ŝ	730	21,675	1, 2			Combined to Basin B	= 5 min = 0.810 ac	Curve
4	Reservoir	0.266	5	925	21,664	т	83.77	12,644	Basin B Routing	e = 0.0%	Hydra
£	SCS Runoff	1.893	5	735	9,994	ł			Pervious to Basin C	= USER = 6.53 in	Distri
9 1	SCS Runoff	11.42	ი ი	730	67,171 101	.			Impervious to Basin C		Shap
- °	Combine SCS Durant	13.31	un u	730	77,165	5, 6			Combined to Basin C		
ο σ		0.0/4	n v	067	4,013 3.631				Felv to Basin A	Cuttposter (ArtearCut) = [(U.o.Cut x ou) + (U.14U X / /)] / U.o.Cut	
° 10		1.491	n n	730	8,244	8,9			Combined to Basin A		
5	Reservoir	0.432	5	770	8,239	10	83.66	2,845	Basin A Routing	Dominue to Basin B	
12	Reservoir	8.383	S	750	77,163	7	76.82	27,608	Basin C Routing	Q (cfs) Q (cfs	
13	SCS Runoff	1.679	S	735	8,824	ł			EXISTING STABILITY POINT A	3.00	ŀ
14	SCS Runoff	0.650	5	735	3,416	ł		-	EXISTING STABILITY POINT B		
15	SCS Runoff	3.196	5	735	16,795	1			EXISTING STABILITY POINT C		
										2.00	
										3	
											-
											1
										0 120 240 360 480 600 720 840 960	1080
										Hyd No. 1	
20	2021-01-15 ASHBEL Stability Analysis.gpw	HBEL Stat	ility Anal	ysis.gpw	Return Period:	eriod: 25 Year	Bar	Wednesday	Wednesday, Jan 20, 2021		

Time (min)

Hvdrograph Report

37

Peak discharge= 2.305 cfsTime to peak= 735 minHyd. volume= 12,144 cuftCurve number $= 79^*$ Tiydre number= 0 ftTindratic length= 0 ftTindratic length= 10.00 minDistribution= 795Shape factor= 285

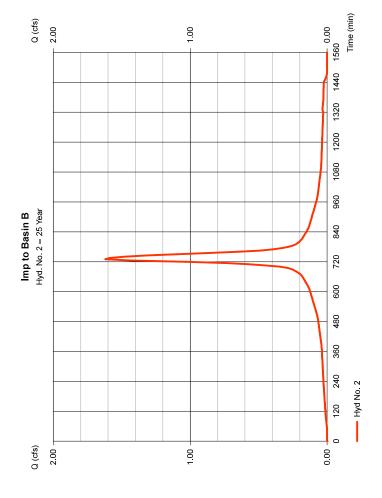
Q (cfs) 3.00

2.00

1.00

38

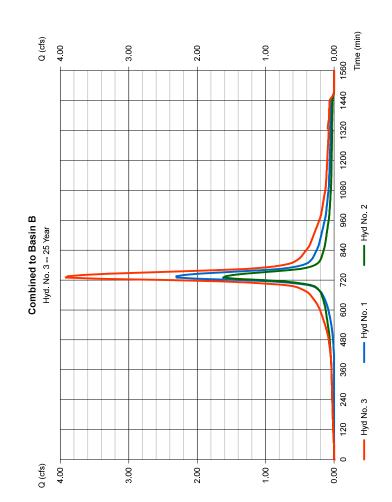
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 2			
Imp to Basin B			
Hydrograph type	= SCS Runoff	Peak discharge	= 1.620 cfs
Storm frequency	= 25 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	
Drainage area	= 0.420 ac	Curve number	П
Basin Slope	= 0.0 %	Hydraulic length	П
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	11
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

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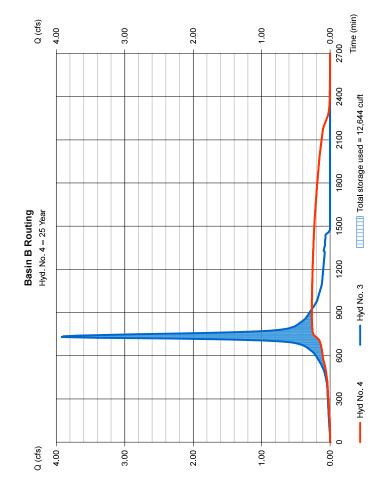
Hydraftow Hydrographs by Intelsolve v9.1 Wednesday, Jan 20, 2021 **Hydr. No. 3** Combined to Basin B Hydrograph type = Combine Storm frequency = 25 yrs Time interval = 5 min Inflow hyds. = 1, 2 Contrib. drain. area = 1,230 ac



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Hydrograph Report	ort		4-1
Hydraflow Hydrographs by Intelisolve v9.1	9.1		Wednesday, Jan 20, 2021
Hyd. No. 4			
Basin B Routing			
Hydrograph type = Res Storm frequency = 25. Time interval = 5 n Inflow hyd. No. = 3 - 1 Reservoir name = Bas	 Reservoir 25 yrs 5 min 3 - Combined to Basin B Basin B 	Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage	= 0.266 cfs = 925 min = 21,664 cuft = 83.77 ft = 12,644 cuft

Storage Indication method used.



Hydrograph Report

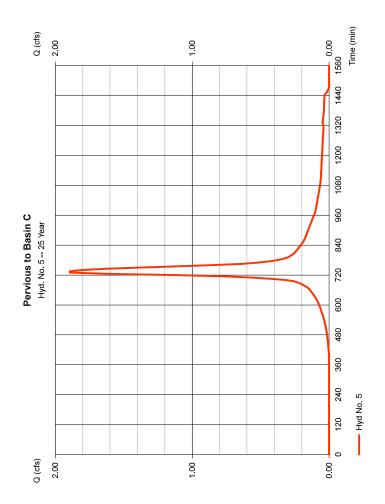
4

Hydraflow Hydrographs by Intelisolve v9 1

Hyd. No. 5

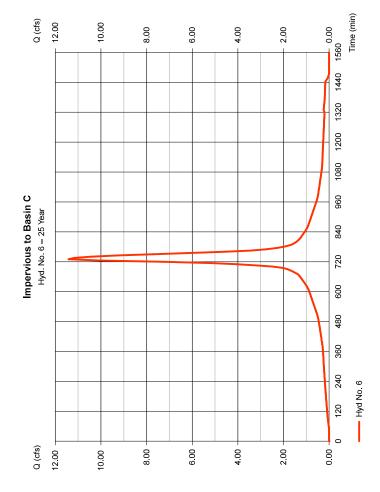
Pervious to Basin C	U		
Hydrograph type Storm frequency Time interval Drainage area Basin Slope To method Total precip. Storm duration	= SCS Runoff = 25 yrs = 5 min = 0.650 ac = 0.0% = 0.0% = 6.53 in = 24 hrs	Peak discharge Time to peak Hyd. volume Curve number Hydraulic length Time of conc. (Tc) Distribution Shape factor	= 1.893 cfs = 735 min = 9,994 cuft = 80* = 0 ft = 10.00 min = 7ype III

* Composite (Area/CN) = [(0.430 x 39) + (0.220 x 80)] / 0.650



42

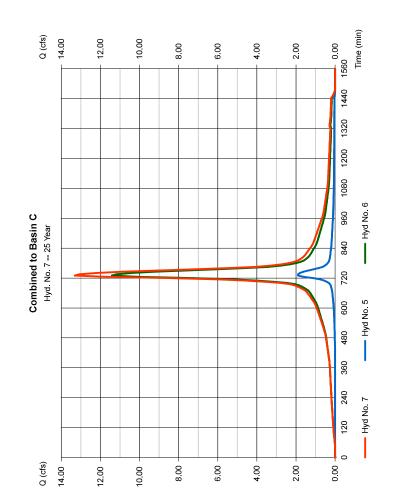
Hydraftow Hydrographs by Intelsolve v9.1 Wednesday. Jan 20. 2021 Hydr. No. 6 Impervious to Basin C Hydrograph type = SCS Runoff Storm frequency = 25 yrs Time interval = 5 min Drainage area = 2.960 ac Basin Stope = 0.0 % Time of conc. (Tc) = 10.00 min Time of conc. (Tc) = 10.00 min Distribution = 24 hrs Storm duration = 24 hrs Storm duration = 24 hrs



Hydrograph Report

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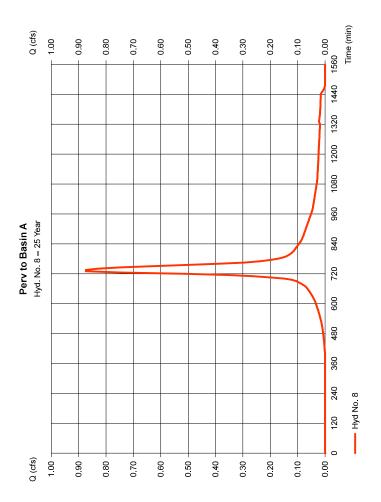
Hydraftow Hydrographs by Intelsoke v9.1 Wednesday, Jan 20. 2021 **Hydr. No. 7** Combined to Basin C Hydrograph type = Combine Storm frequency = 25 yrs Time interval = 5 min Inflow hyds. = 5, 6 Contrib. drain. area = 3.610 ac



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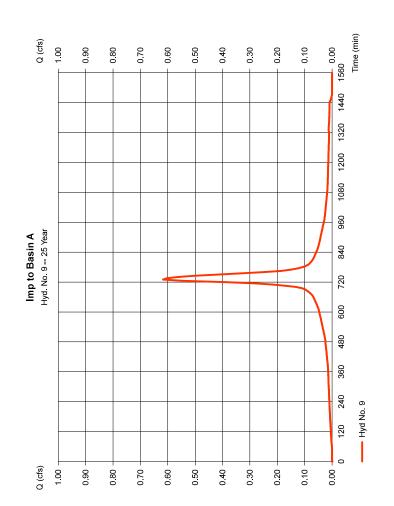
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 8			
Perv to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	п
Storm frequency	= 25 yrs	Time to peak	= 735 min
Time interval	= 5 min	Hyd. volume	= 4,613 cuft
Drainage area	= 0.300 ac	Curve number	= 80*
Basin Slope	= 0.0%	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	Ϊ
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.200 x 39) + (0.100 x 80)] / 0.300

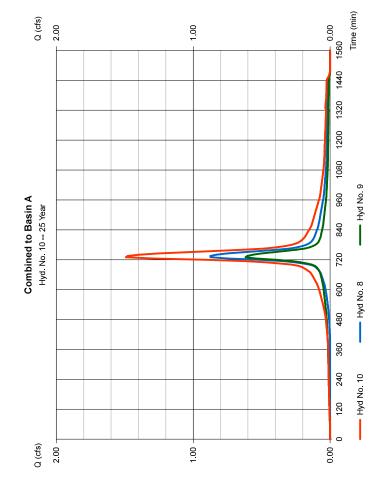


Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 9			
Imp to Basin A			
Hydrograph type	= SCS Runoff	Peak discharge	= 0.617 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 5 min	Hyd. volume	= 3,631 cuft
Drainage area	= 0.160 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydraflow Hydrographs by Intelisolve v9.1	ntelisolve v9.1	We	Wednesday, Jan 20, 2021
Hyd. No. 10			
Combined to Basin A	Ar		
Hydrograph type Storm frequency Time interval Inflow hyds.	= Combine = 25 yrs = 5 min = 8, 9	Peak discharge = 1.491 cfs Time to peak = 730 min Hyd. volume = 8,244 cuf Contrib. drain. area = 0.460 ac	1.491 cfs 730 min 8,244 cuft 0.460 ac

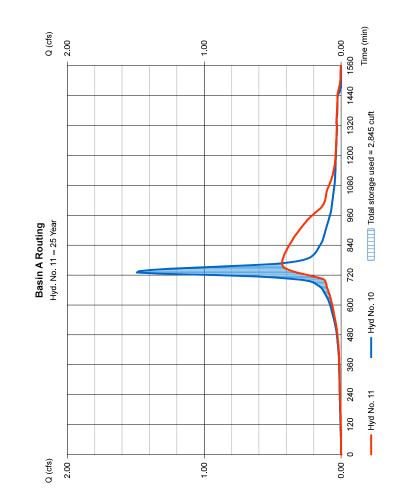


Hydrograph Report

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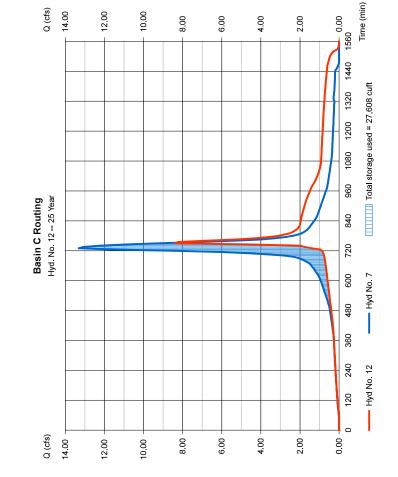
Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 11 Basin A Routing			
Hydrograph type Storm frequency Time interval Inflow hyd. No. Reservoir name	 Reservoir 25 yrs 5 min 10 - Combined to Basin A Basin A 	Peak discharge Time to peak Hyd. volume Max. Elevation Max. Storage	 = 0.432 cfs = 770 min = 8,239 cuft = 83.66 ft = 2,845 cuft

Storage Indication method used.



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 12			
Basin C Routing			
Hydrograph type	= Reservoir	Peak discharge	= 8.383 cfs
Storm frequency	= 25 yrs	Time to peak	= 750 min
Time interval	= 5 min	Hyd. volume	= 77,163 cuft
Inflow hyd. No.	= 7 - Combined to Basin C	Max. Elevation	= 76.82 ft
Reservoir name	= Basin C	Max. Storage	= 27,608 cuft
Storage Indication method used.	used.		



49

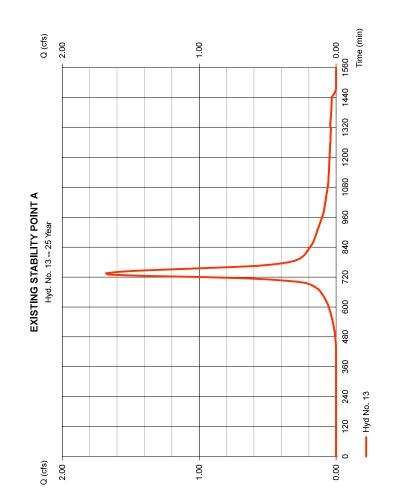
Hydraftow Hydrographs by Intelisolve v9.1

Hyd. No. 13

EXISTING STABILITY POINT A

Storm frequency25 yrsTime to peakTime interval= 5 minHyd. volumeDrainage area= 0.620 acCurve numberBasin Slope= 0.0 %Hydraulic lengthTo the thod= USERTime of conc. (Tc)Total precip.= 6.53 inDistributionStorm duration= 24 hrsShape factor	Hydrograph type	= SCS Runoff Peak discharge	ge	- 11
= 5 min = 0.620 ac = 0.0% = 0.0% = 6.53 in = 24 hs	torm frequency)	
= 0.620 ac = 0.0 % = USER = 0.53 in = 24 hrs	ime interval			
= 0.0% = USER = 6.53 in = 24 hrs	rrainage area	U	ы Б	
= USER = 6.53 in = 24 hrs	asin Slope		igth	
= 6.53 in = 24 hrs	c method		() Lo	
= 24 hrs	otal precip.			
	torm duration			

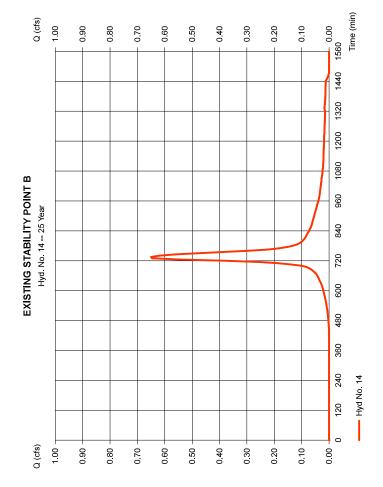
= 1.679 cfs = 735 min = 8,824 cuft = 77 = 0 ft = 10.00 min = 779pe III = 285



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Hydraflow Hydrographs by Intelisolve v9.1	Intelisolve v9.1		Wednesday, Jan 20, 2021
Hyd. No. 14			
EXISTING STABILITY POINT B	LITY POINT B		
Hydrograph type	= SCS Runoff	Peak discharge	п
Storm frequency	= 25 yrs	Time to peak	П
Time interval	= 5 min	Hyd. volume	= 3,416 cuft
Drainage area	= 0.240 ac	Curve number	п
Basin Slope	= 0.0 %	Hydraulic length	п
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	п
Storm duration	= 24 hrs	Shape factor	= 285



5

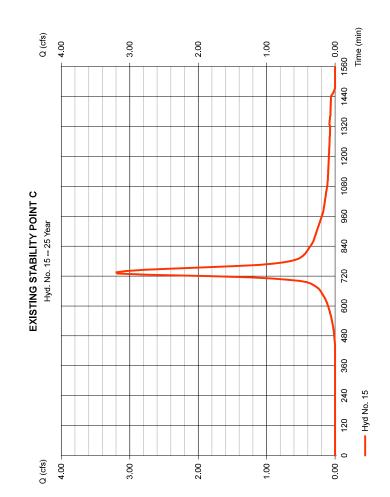
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 15

EXISTING STABILITY POINT C

П	П	П	П	П	П	П	П
Peak discharge	Time to peak	Hyd. volume	Curve number	Hydraulic length	Time of conc. (Tc)	Distribution	Shape factor
= SCS Runoff	= 25 yrs	= 5 min	= 1.180 ac	= 0.0 %	= USER	= 6.53 in	= 24 hrs
Hydrograph type	Storm frequency	Time interval	Drainage area	Basin Slope	Tc method	Total precip.	Storm duration

= 3.196 cfs = 735 min = 16,795 cuft = 77 = 10.00 min = Type III = 285



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10. STORMWATER COLLECTION CALCULATION (PIPE SIZING)



Stormwater Collection System Calculations Project: Greenwich Park Computed By: KSOOK

NOTES:

1) Design method used is Rational Method

2) Refer to Weighted Runoff Coefficient table for calculation of incremental areas and C values

PIPE S	SECTION	SUBCATCHMENT AREA	INC	REMENTAL	CUMULATIVE		TIME OF CENTRA		Ι	PEAK R	UNOFF	PIP	PING INP	UT	P	IPING DAT	ГA
FROM	ТО	Area (Acres)	"C"	A x C Ac	A x C (acres)	Tc to Inlet (min)	Tc in Pipe (min.)	Final Tc (min)	(In/Hr)	Q to Inlet (CFS)	Q cum. for Pipe (CFS)	Dia. (In)	Length (Ft)	Man. "n"	Slope (ft/ft)	Pipe Capacity (cfs)	Pipe Velocity (fps)
209	MH207	0.14	0.28	0.04	0.04	10.00	0.28	10.00	6.80	0.27	0.27	15	74.0	0.011	0.0050	5.40	4.40
307	HW306	0.15	0.93	0.14	0.14	10.00	0.05	10.00	6.80	0.95	0.95	15	18.0	0.011	0.0098	7.55	6.16
113	112	0.32	0.85	0.27	0.27	10.00	0.11	10.00	6.80	1.84	1.84	15	42.0	0.011	0.0100	7.63	6.22
112	111	0.19	0.89	0.17	0.44	10.00	0.51	10.11	6.80	1.16	2.99	15	232.0	0.011	0.0150	9.35	7.62
111	110	0.72	0.88	0.63	1.07	10.00	0.25	10.62	6.68	4.21	7.15	15	129.0	0.011	0.0190	10.52	8.58
110	MH109	0.75	0.84	0.63	1.70	10.00	0.18	10.87	6.68	4.21	11.36	18	76.0	0.011	0.0100	12.41	7.03
MH109	MH108	0.00	0.00	0.00	1.70	10.00	0.10	11.05	6.56	0.00	11.15	18	43.0	0.011	0.0100	12.41	7.03
MH107	HW106	0.00	0.00	0.00	2.19	10.00	0.06	11.40	6.56	0.00	14.37	24	21.0	0.011	0.0050	18.90	6.02
MH207	HW206	0.00	0.00	0.00	0.04	10.00	0.16	10.28	6.80	0.00	0.27	15	58.0	0.011	0.0100	7.63	6.22

Location: Texas Rd & Greenwood Rd, Marlboro, NJ Design Storm: 25 YR

Job #: 2841-99-001

Checked By: SRC Date: 1/18/2021 **11.INLET AREA SUMMARY**



Inlet Area Summary and Average Coefficient (C) Calculations

Project: Greenwich Park	Computed By: KSOOK
Job #: 2841-99-001	Checked By: SRC
Location: Texas Rd & Greenwood Rd, Marlboro NJ	Date: 1/18/2021

Drainage Area	-		•		Average		Total Area
	Area (sf)	(C) Used	Space/Woods	ent (C)	Coefficient	(SF)	(acres)
			Area for Soil	Used	(C) Used		
			Group B (SF)				
209	4258	0.95	1860	0.35	0.77	6118	0.14
114	33166	0.95	3545	0.35	0.89	36711	0.84
110	26707	0.95	6095	0.35	0.84	32802	0.75
111	27383	0.95	3833	0.35	0.88	31216	0.72
112	7467	0.95	873	0.35	0.89	8340	0.19
113	11858	0.95	2271	0.35	0.85	14129	0.32
307	6465	0.95	249	0.35	0.93	6714	0.15
Totals	117305		18726			136031	3.1

12. NJGRS Spreadsheets

New Jersey Groundwar		Annual Groundwater Red		alysis	(based on GS	R-32)			Project Name:	Ashbel Ass	ociates, L	LC
Recharge Spreadshee Version 2.0		Select Township \downarrow	Average Annual P (in)	Climatic Factor		Description: 120 Unit F					sidential l	₋ayout
November 2	2003	MONMOUTH CO., MARLBORO TWP	44.9	1.44					Analysis Date:	08/01/20		
		Pre-Developed Cond	itions						Post-Develope	d Conditions		
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)		Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	2.71	Woods	Atsion	0.0	-		1	0.04	Open space	Atsion	0.0	-
2	7.55	Woods	Elkton	0.0	-		2	2.67	Woods	Atsion	0.0	-
3	5.82	Woods	Klej	13.7	290,144		3	7.55	Woods	Elkton	0.0	-
4	18.54	Woods	Manahawkin	0.0	-		4	5.82	Woods	Klej	13.7	290,144
5	0						5	12.56	Woods	Manahawkin	0.0	-
6	0						6	3.7	Impervious areas	Manahawkin	0.0	-
7	0						7	2.28	Open space	Manahawkin	0.0	-
8	0						8	0				
9	0						9	0				
10	0						10	0				
11	0						11	0				
12	0						12	0				
13	0						13	0				
14	0						14	0				
15	0						15	0				
Total =	34.6			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)		Total =	34.6			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				2.3	290,144		Annual	Recharg	ge Requirements Calculat	ion↓	2.3	290,144
Procedure	to fill the	Pre-Development and Post-Development Conc	litions Tables			% of Pre-	Developed /	Annual Re	charge to Preserve =	100%	Total Impervious Area (sq.ft)	161,172
For each land	segment, fir	st enter the area, then select TR-55 Land Cover, then select :	Soil. Start from the to	p of the table		Post-D	evelopme	ent Ann	ual Recharge Deficit=	0	(cubic feet)	
and proceed d	ownward. Do	on't leave blank rows (with A=0) in between your segment ent	ries. Rows with A=0 w	ill not be		Recha	arge Effici	iency Pa	rameters Calculations (ar	ea averages)		
displayed or us	sed in calcul	ations. For impervious areas outside of standard lots select "	Impervious Areas" as	the Land Cover.		RWC=	1.48	(in)	DRWC=	1.48	(in)	
Soil type for in	npervious ar	eas are only required if an infiltration facility will be built withir	these areas.			ERWC =	0.41	(in)	EDRWC=	0.41	(in)	

13. RIP-RAP CALCULATIONS



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

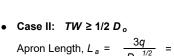
Rip Rap Pad # 1

Design Storm Flow for 25 Year, Q 0.43 c Vertical Dimension of Outlet Pipe, Do 15 ir	
	fs
	ı
Horizontal Dimension of Outlet Pipe, W_o	ı
Tailwater Depth, TW ¹	

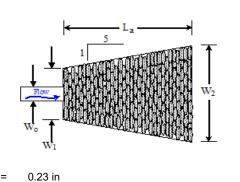
Apron Dimension Calculations:

Unit Dicharge, $q = Q/D_o = 0.35$ cfs per foot

• Case I: $TW < 1/2 D_o$ Apron Length, $L_a = \frac{1.8q}{D_o^{-1/2}} + 7D_o = 9.31 \text{ ft}$ or $L_a = 10 \text{ ft}$ Width, $W_1 = 3W_o = 3.75 \text{ ft}$ or $W_1 = 4 \text{ ft}$ Width, $W_2 = 3W_o + L_a = 13.06 \text{ ft}$ or $W_2 = 14 \text{ ft}$



Apron Length, $L_a = \frac{3q}{D_o^{1/2}}$	- =
Width, $W_1 = 3W_0 =$ Width, $W_2 = 3W_0 + 0.4L_a$	=
	-



 W_2

Rip Rap Stone Size Calculations

Median Stone, d_{50} =	0.02 <i>q</i> ^{1.3}
	Τ\Λ/

₅₀ = 6 in

W,

Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

Rip Rap Pad # 2

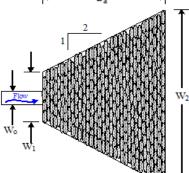
Design Parameters:		
Design Storm Flow for 25 Year, Q	0.95	cfs
Vertical Dimension of Outlet Pipe, <i>D</i> _o	15	in
Horizontal Dimension of Outlet Pipe, W_o	15	in
Tailwater Depth, <i>TW</i> ¹	1.11	ft

Apron Dimension Calculations:

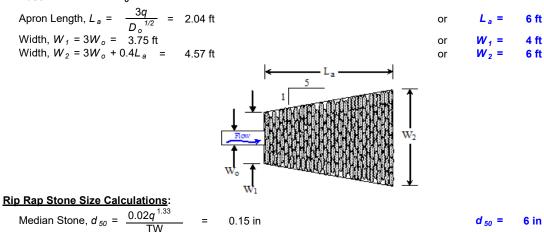
Unit Dicharge, $q = Q/D_o = 0.76$ cfs per foot

• Case I: TW < 1/2 D_o

Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o = L_a =$ Width, $W_1 = 3W_o =$ Width, $W_2 = 3W_o + L_a =$ $W_1 =$ $W_2 =$



• Case II: $TW \ge 1/2 D_o$



Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



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Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

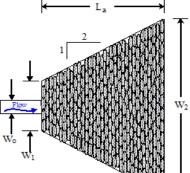
Rip Rap Pad # 3

0.27	cfs
15	in
15	in
0.41	ft
	15 15

Apron Dimension Calculations:

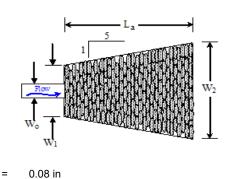
Unit Dicharge, $q = Q/D_o = 0.22$ cfs per foot

• Case I: $TW < 1/2 D_o$ Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o = 9.1 \text{ ft}$ or $L_a = 10 \text{ ft}$ Width, $W_1 = 3W_o = 3.75 \text{ ft}$ or $W_1 = 4 \text{ ft}$ Width, $W_2 = 3W_o + L_a = 12.85 \text{ ft}$ or $W_2 = 13 \text{ ft}$



Case II: *TW* ≥ 1/2 *D*_o

Apron Length, $L_a = \frac{3q}{D_a^{1/2}}$	<u>-</u> =
Width, $W_1 = 3W_o =$ Width, $W_2 = 3W_o + 0.4L_a$	=



Rip Rap Stone Size Calculations

Median Stone, $d_{50} = \frac{0.02q^{1.33}}{TM}$

₅₀ = 6 in

W 2

Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

Rip Rap Pad # 4

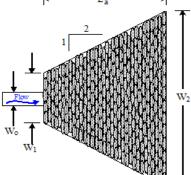
Design Parameters:		
Design Storm Flow for 25 Year, Q	0.27	cfs
Vertical Dimension of Outlet Pipe, <i>D</i> _o	15	in
Horizontal Dimension of Outlet Pipe, W_o	15	in
Tailwater Depth, <i>TW</i> ¹	0.99	ft

Apron Dimension Calculations:

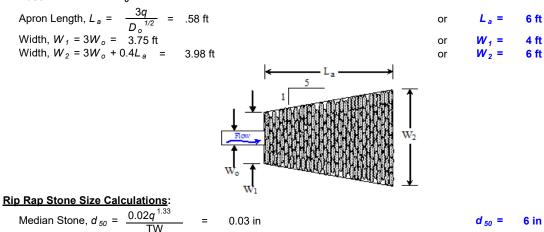
Unit Dicharge, $q = Q/D_o = 0.22$ cfs per foot

• Case I: TW < 1/2 D_o

Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o = L_a =$ Width, $W_1 = 3W_o =$ Width, $W_2 = 3W_o + L_a =$ W



• Case II: $TW \ge 1/2 D_o$



Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

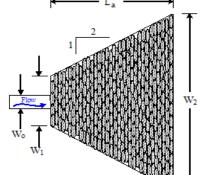
Rip Rap Pad # 5

7 cfs	÷
	S
<mark>5</mark> in	1
<mark>5</mark> in	1
<mark>5</mark> ft	
	5 in

Apron Dimension Calculations:

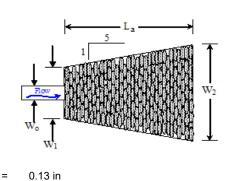
Unit Dicharge, $q = Q/D_o = 0.22$ cfs per foot

• Case I: $TW < 1/2 D_o$ Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o = 9.1 \text{ ft}$ or $L_a = 10 \text{ ft}$ Width, $W_1 = 3W_o = 3.75 \text{ ft}$ or $W_1 = 4 \text{ ft}$ Width, $W_2 = 3W_o + L_a = 12.85 \text{ ft}$ or $W_2 = 13 \text{ ft}$



Case II: TW ≥ 1/2 D_o

Apron Length, $L_a = \frac{3q}{D_o^{-1}}$	/2 =
Width, $W_1 = 3W_o =$ Width, $W_2 = 3W_o + 0.4L_a$	=



Rip Rap Stone Size Calculations

Median Stone, $d_{50} = \frac{0.02q^{1.33}}{TW}$

₅₀ = 6 in

W,

Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

Rip Rap Pad # 6

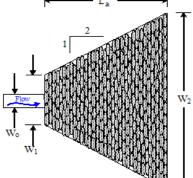
Design Parameters:		
Design Storm Flow for 25 Year, Q	14.37	cfs
Vertical Dimension of Outlet Pipe, D _o	24	in
Horizontal Dimension of Outlet Pipe, W_o	24	in
Tailwater Depth, <i>TW</i> ¹	3.06	ft

Apron Dimension Calculations:

Unit Dicharge, $q = Q/D_o = 7.19$ cfs per foot

• Case I: TW < 1/2 D_o

Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o =$	L _a =
Width, $W_1 = 3W_o =$	W , =
Width, $W_2 = 3W_o + L_a =$	W ₂ =



• Case II: $TW \ge 1/2 D_o$

1.08 in

Rip Rap Stone Size Calculations

Median Stone, $d_{50} = \frac{0.02q^{1.33}}{TM}$

50 = 6 in

16 ft

6 ft

13 ft

Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.

=

- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{1.} Tailwater depth shall be the 2-year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use TW = 0.2D_o.

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

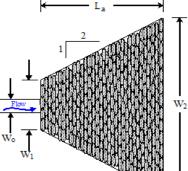
Rip Rap Pad # 7

Design Parameters:		
Design Storm Flow for 25 Year, Q	8.38	cfs
Vertical Dimension of Outlet Pipe, D _o	18	in
Horizontal Dimension of Outlet Pipe, W_o	18	in
Tailwater Depth, <i>TW</i> ¹	0.30	ft

Apron Dimension Calculations:

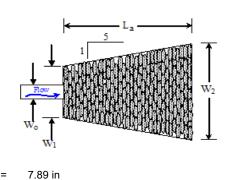
Unit Dicharge, $q = Q/D_o = 5.59$ cfs per foot

• Case I: $TW < 1/2 D_o$ Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o = 18.71 \text{ ft}$ or $L_a = 19 \text{ ft}$ Width, $W_1 = 3W_o = 4.5 \text{ ft}$ or $W_1 = 5 \text{ ft}$ Width, $W_2 = 3W_o + L_a = 23.21 \text{ ft}$ or $W_2 = 24 \text{ ft}$



• Case II: $TW \ge 1/2 D_o$

Apron Length, $L_a = \frac{3q}{D_a}$	
Width, $W_1 = 3W_o =$ Width, $W_2 = 3W_o + 0.4L_a$	



Rip Rap Stone Size Calculations

Median Stone,	d =	0.02 <i>q</i> ^{1.33}
moulan otono,	a 50	TW

l₅₀ = 8 in

W 2

Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.



Date:	1/20/2021
Project:	Hyde Park
Project No:	2841-99-001

Calculated By: KS Checked By: SRC

Conduit Outlet Protection Calculations

Rip Rap Pad # <u>8</u>

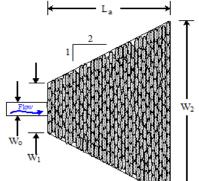
Design Storm Flow for 25 Year, Q	32 cfs
	8 in
Horizontal Dimension of Outlet Pipe, W_o	8 in
	2 <mark>5</mark> ft

Apron Dimension Calculations:

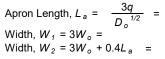
Unit Dicharge, $q = Q/D_o = 1.23$ cfs per foot

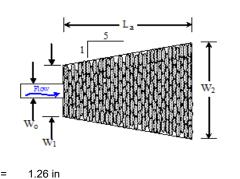
• Case I: TW < 1/2 D 。

Apron Length, $L_a = \frac{1.8q}{D_a^{1/2}} +$	7D _o =	7.38 ft	or	L _a =	8 ft
Width, $W_1 = 3W_o = 2$. ft Width, $W_2 = 3W_o + L_a =$	9.38 ft			W ₁ = W ₂ =	



• Case II: $TW \ge 1/2 D_o$





Rip Rap Stone Size Calculations

Median Stone, d_{50} =	0.02q
	T\A

₅₀ = 6 in

W 2

Notes:

- 1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
- 2. The side slopes shall be 2:1 or flatter.
- 3. The bottom grade shall be 0.0% (level).
- 4. There shall be no overfall at the end of the apron or at the end of the culvert.
- 5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d₅₀. The largest stone size in the mixture shall be 1.5 times the d₅₀ size. The rip-rap shall be reasonably well graded.
- 6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
- 7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
- 8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

^{1.} Tailwater depth shall be the 2-year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use TW = 0.2D_o.

^{2.} For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_{o}$.

14. CLASS IV DAM CALCULATIONS



Class IV Dam Calculations

Project: Ashbel Associates, LLC

Job #: 2841-99-001

Calculated by: SMM Checked By: SRC

Location: Greenwood Road & Texas Road, Marlboro, NJ

Date: 1/20/2021	
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Basin	Basin Bottom Elevation	Outlet Elevation	Emergency Spillway Elevation	Outlet Pipe Elevation	Dam Height (ft)	100-yr Elevation	100-yr Inflow (cfs)	100-yr Plug Elev.	150% 100-yr Plug (cfs)	150% 100 [.] yr Elevation	TOB Elev.	Freeboard (ft.)
Α	81.50	81.40	83.90	80.92	2.98	83.86	2.17	83.88	N/A	-	84.90	1.00
В	81.00	80.90	84.50	79.10	5.40	84.27	5.74	84.36	8.61	84.52	85.52	1.02
С	72.00	71.90	76.99	71.47	5.52	76.99	18.53	77.12	27.80	77.35	78.35	1.36

15. JELLYFISH MTD DETAIL AND NJDEP CERTIFICATION

GENERAL NOTES:

- ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED. 2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR
- INFORMATIONAL PURPOSES ONLY. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
- DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
- NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR PROJECT BID DATE OR AS DIRECTED BY THE ENGINEER OF RECORD

- JELLYFISH STRUCTURE & DESIGN NOTES: 1. 762 MM Ø (30") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
- 2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12) MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
- CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS. STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND

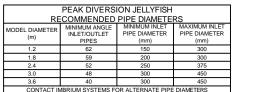
GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.

- ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478 ASTM C-443 AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS. AND ANY OTHER SITE OR LOCAL STANDARDS.
- CONCETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
- IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
- STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
- CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
- IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS. BY OTHERS, THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
- D. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

- PEAK DIVERSION JELLYFISH DESIGN NOTES: 1. STRUCTURE SHALL MEET AASHTO HS-20 OR PER APPROVING JURISDICTION REQUIREMENTS; WHICHEVER IS MORE STRINGENT, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
- STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD
- INLET HGL NOT TO EXCEED 6" BELOW THE TOP OF THE M.A.W. DURING THE PEAK DESIGN STORM, OR 10-YEAR STORM (WHICHEVER IS GREATER).
- INLET PIPE INVERT ELEVATION VARIES FROM 1" TO 6" MAXIMUM ABOVE THE OUTLET PIPE INVERT
- OUTLET PIPE INVERT IS EQUAL TO THE CARTRIDGE DECK ELEVATION.
- THE OUTLET PIPE DIAMETER FOR NEW INSTALLATIONS IS TO BE ONE PIPE SIZE LARGER
- THAN THE INLET PIPE AT EQUAL OR GREATER SLOPE. THE DIFFERENCE IN THE INLET AND OUTLET PIPE ELEVATIONS FOR RETROFIT INSTALLATIONS TO EXISTING STORM DRAIN PIPES SHALL BE EQUAL TO THE SLOPE OVER THE DIAMETER OF THE MANHOLE; NOT THE EXCEED 6" IN VERTICAL DIFFERENTIAL BETWEEN INLET AND OUTLET PIPES.

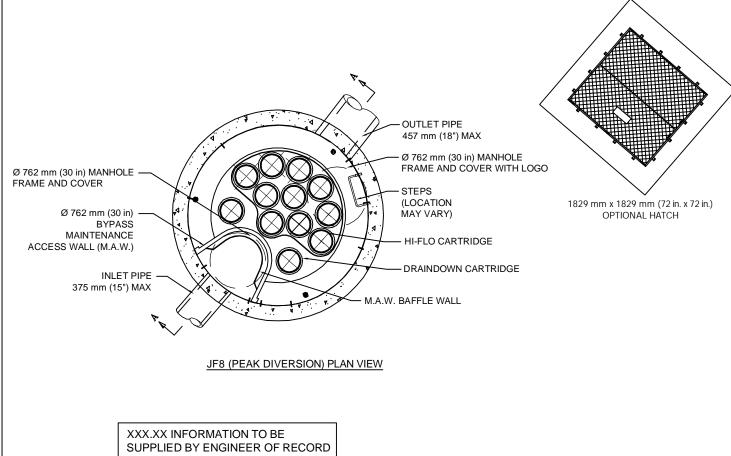
INSTALLATION NOTES

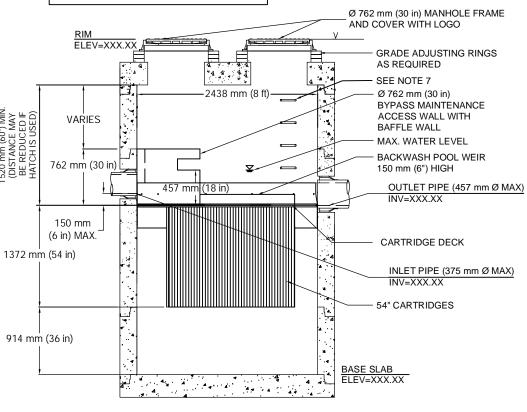
- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY
- AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT) CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM
- CONSTRUCTION-RELATED EROSION RUNOFF. CARTRIDGE INSTALLATION. BY IMBRIUM. SHALL OCCUR ONLY AFTER SITE HAS BEEN
- STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.



FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD EVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON VAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT ERE NOTED ON BYPASS STRUCTURE

DRAWING NOT TO BE USED FOR CONSTRUCTION





JELLYFISH CROSS SECTION A-A

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ΠΞΓ	JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE	5 ITLE IS SHOWN. #2438 mm (96') MANHOLE JELTTISH PEAK IFEATMENT CAPACITY IS 35.5 L/S (1:95 CF-S), AND MAXIMUM BTPASS CAPACITY IS 141.5 L/S (5:00 CFS). IF THE SITE CONDITIONS EXCEED TOTAL CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED. TREATMENT FLOW RATE IS BASED ON 457 MM (18") OF HEAD PRESSURE.	CARTRIDGE SELECTION	CARTRIDGE DEPTH	OUTLET INVERT TO STRUCTURE BASE SLAB	FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	MAX. CARTS HIGH-FLO/DRAINDOWN	MAX. BYPASS (L/s)	MAX. SEDIMENT CAPACITY (kg)	MAX. TREATMENT (L/s)	MAX. TREATMENT AND BYPASS (L/s) (TOTAL CAPACITY)					USINIS		JF8 PEAK DIVERSION	Scale = 1:50 hindeminesterms.com intelembriumsysterms.com
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State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION Bureau of Nonpoint Pollution Control Division of Water Quality 401-02B Post Office Box 420 Trenton, New Jersey 08625-0420 609-633-7021 Fax: 609-777-0432 http://www.state.nj.us/dep/dwg/bnpc home.htm

Joel Garbon Product Manager 7564 Standish Place Suite 112 Rockville, MD 20855

CHRIS CHRISTIE

Governor

KIM GUADAGNO

Lt. Governor

Re: Final Certification Jellyfish[®] Filter by Imbrium Systems

Expiration Date: December 1, 2016 TSS Removal Rate: 80%

Dear Mr. Garbon:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Imbrium Systems. has requested a Final Certification for the Jellyfish[®] Filter.

This project falls under the "Transition for Manufactured Treatment Devices July 15, 2011". The Jellyfish Filter by Imbrium Systems qualified for Category C. Manufactured Treatment Devices Seeking Final Certifications - In Process which are MTDs that have commenced field testing on or before August 1, 2011.

NJDEP received the required information from signed statement sby the NJCAT Technical Director and the manufacturer listing the indicating that the requirements of the 2009 NJDEP Field Testing Protocols have been met or exceeded. NJDEP also received a signed statement from the third party testing entity, University of Florida, indicating that the testing requirements have been met or exceeded. The NJCAT letter also includes a recommended certification TSS removal rate and the required maintenance plan.

The NJDEP certifies the use of the Jellyfish Filter by Imbrium Systems at TSS removal rate of 80%, subject to the following conditions:

- 1. The Jellyfish Filter is designed according to the NJ Water Quality Design Storm in N.J.A.C. 7:8-5.5.
- 2. The peak inflow of the water quality design storm is limited to the following:

BOB MARTIN Commissioner

May 14, 2012

For each hi-flow cartridge, the maximum inflow is 1.48 gpm and a maximum inflow drainage area is 0.012 impervious acres, for each inch of cartridge length.

For each draindown cartridge, the maximum inflow 0.74 gpm and the maximum inflow drainage area is 0.006 impervious acres for each inch of cartridge length.

Example: For a 54-inch hi-flo cartridge length, the maximum inflow is 80 gpm and the maximum inflow drainage area is 0.65 impervious acres.

Maximum treatment flow rates for typical Jellyfish Filter models are provided in Table 1.

Maximum treatment flow rates and maximum inflow drainage areas for various cartridge lengths are provided in Table 2.

- 3. The bottom of the Jellyfish tentacles is a minimum of 2 feet above the bottom of the vault. The sedimentation area in the vault shall be a minimum of 4 ft^2 per cartridge.
- 4. The Jellyfish Filter is certified as an off-line system only.
- 5. The Jellyfish Filter cannot be used in series with a settling chamber (such as a hydrodynamic separator) or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
- 6. The maintenance plan for sites using this device shall incorporate, at a minimum, the maintenance requirements for the Jellyfish Filter shown in Appendix A below.

In addition to the attached, any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8, must include a detailed maintenance plan. The detailed maintenance plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance of the New Jersey Stormwater Best Management Manual.

NJDEP anticipates proposing further adjustments to this process through the readoption of the Stormwater Management Rules. Additional information regarding the implementation of the Stormwater Management Rules, N.J.A.C. 7:8, are available at www.njstormwater.org. If you have any questions regarding the above information, please contact Ms. Sandra Blick of my office at (609) 633-7021.

Sincerely,

Ed Frankel, P.P., Section Chief ' Bureau of Nonpoint Pollution Control

C: Chron File Richard Magee, NJCAT Mark Pedersen, DLUR Elizabeth Dragon, BNPC

Table 1Maximum Treatment Flow Rates forStandard (54" Cartridge Length) Jellyfish[®] Filter Models

Manhole Diameter (ft)	Model No.	Hi-Flo Cartridges (54" Length)	Draindown Cartridges (54" Length)	Maximum Treatment Flow Rate (gpm / cfs)
Catch Basin		varies	varies	varies
4	JF4-2-1	2	1	200 / 0.45
6	JF6-3-1	3	1	. 280 / 0.62
	JF6-4-1	4	1	360 / 0.80
	JF6-5-1	5	1	440 / 0.98
· · · ·	JF6-6-1	6	1	520 / 1.16
8	JF8-6-2	6	2	560 / 1.25
	JF8-7-2	7	2	640 / 1.43
	JF8-8-2	8	2	720 / 1.60
	JF8-9-2	9	2	800 / 1.78
	JF8-10-2	10	2	880 / 1.96
10 ¹	JF10-11-3	11	3	1000 / 2.23
	JF10-12-3	12	3	1080 / 2.41
	JF10-13-3	13	3	1160 / 2.58
	JF10-14-3	14	3	1240 / 2.76
	JF10-15-3	15	3	1320 / 2.94
	JF10-16-3	16	3	1400 / 3.12
12 ²	JF12-17-4	17	4	1520 / 3.39
·····	JF12-18-4	18	4	1600 / 3.57
	JF12-19-4	19	4	1680 / 3.74
	JF12-20-4	20	4	1760 / 3.92
	JF12-21-4	21	4	1840 / 4.10
	JF12-22-4	22	4	1920 / 4.28
	JF12-23-4	23	4	2000 / 4.46
	JF12-24-4	24	4	2080 / 4.63
Vault		varies	varies	varies

¹ The MTFR for a 10-ft diameter unit occurs with Model JF10-16-3. Since this leaves 4 unoccupied cartridge receptacles in the 10-ft diameter deck, the design engineer has the option to add up to 4 additional cartridges to increase the sediment capacity of the system, however may not increase the MTFR above that of the JF10-16-3.

² The MTFR for a 12-ft diameter unit occurs with Model JF12-24-4. Since this leaves 4 unoccupied cartridge receptacles in the 12-ft diameter deck, the design engineer has the option to add up to 4 additional cartridges to increase the sediment capacity of the system, however may not increase the MTFR above that of the JF12-24-4.

Table 2Maximum Treatment Flow Rate and
Maximum Inflow Drainage Areafor Various Jellyfish® Cartridge Lengths

Cartridge Length (inches)	Maximum Treatment Flow Rate (gpm)	Maximum Inflow Drainage Area (impervious acres)
15	Hi-Flo 22 Draindown 11	Hi-Flo 0.18 Draindown 0.09
27	Hi-Flo 40 Draindown 20	Hi-Flo 0.32 Draindown 0.16
40	Hi-Flo 60 Draindown 30	Hi-Flo 0.48 Draindown 0.24
54	Hi-Flo 80 Draindown 40	Hi-Flo 0.65 Draindown 0.32

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Appendix A

Imbrium Systems Jellyfish[®] Filter Inspection and Maintenance Information

Jellyfish[®] Filter Inspection and Maintenance

Regular inspection and maintenance are proven, cost-effective ways to maximize water resource protection for all stormwater pollution control practices, and are required to insure proper functioning of the Jellyfish Filter. Inspection of the Jellyfish Filter is easily performed from the surface, while proper maintenance requires a combination of procedures conducted from the surface and with worker entry into the structure. The Jellyfish Filter's patented technology has no moving parts, keeping the process simple.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Jellyfish Filter into service.
- A minimum of two inspections are required during the first year of operation to accurately assess the sediment and floatable pollutant accumulation, and to ensure that the automatic backwash feature is functioning properly.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections must also be performed immediately after an oil, fuel or other chemical spill.

When is maintenance service needed?

- For optimum performance, the unit must be cleaned out once the sediment depth reaches 12 inches of accumulation. Generally, the minimum cleaning frequency is once annually, although the frequency can be based on historical inspection results.
- Filter cartridges must be cleaned and re-commissioned, or replaced, every 12 months or when the automatic backwash feature no longer functions, whichever occurs first. The automatic backwash function will be disabled if the filter cartridges become saturated with sediment. This saturated condition is indicated if the backwash pool contains more than 3 inches depth of water after 12 or more hours of dry weather have elapsed since the most recent rainfall/runoff event.
- The unit must be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise the Jellyfish Filter's performance?

- If sediment accumulates beyond 12 inches in depth, filter cartridge life and sediment removal efficiency may be reduced.
- If filter cartridges become saturated with sediment, the system may not provide filtration treatment at the designed water quality flow rate, and unfiltered water may bypass the filter cartridges.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured and may cause fouling of the filter cartridges.
- If debris clogs the inlet of the system, removal efficiency of sediment, hydrocarbons, and gross pollutants may be reduced.
- If a downstream blockage occurs, a backwater condition may occur in the system and removal efficiency of sediment, hydrocarbons, and gross pollutants may be reduced.

What training is required?

The Jellyfish Filter is inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. Since some of the maintenance procedures require manned entry into the Jellyfish structure, only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

For typical inspection and maintenance activities, no specific supplemental training is required for the Jellyfish Filter. Information provided in this document or the Jellyfish Filter Owner's Manual contains sufficient guidance to maintain the system properly.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick or sampling tool
- Sediment probe
- Flashlight
- Camera
- Data log
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

How is the Jellyfish Filter inspected?

- The Jellyfish filter system can be inspected from the surface through the standard surface manhole access cover or custom doors.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick. Sediment and oil depth are measured through the maintenance access wall.
- Visual inspection for floatable pollutant accumulation such as litter and hydrocarbons is also performed by shining a flashlight into the maintenance access wall.
- Visual inspection of the backwash pool (6-inch high kidney-shaped or oval-shaped

weir) should also be performed to check for standing water in the pool. If at least 12 hours of dry weather have elapsed since the most recent rainfall/runoff event and the backwash pool contains more than 3 inches of water, this condition indicates that the filter cartridges are saturated with sediment and should be cleaned or replaced.

• Inspections also involve a visual inspection of the internal components of the system for obvious damage.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal, if necessary
- Manhole access cover lifting tool
- Oil dipstick or sampling tool
- Sediment probe
- Flashlight
- Camera
- Data log
- Safety cones and caution tape
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required
- Replacement cartridges are required if manual cleaning and re-commissioning of existing cartridges is not possible or adequate to restore proper system function.
- Jellyfish Cartridge Backflush Pipe

How is the Jellyfish Filter maintained?

- The Jellyfish Filter can be maintained through the standard surface manhole access cover. All access covers should be removed to provide additional light and ventilation. If custom doors were installed instead of frames and covers, open all doors.
- If the filter cartridges are to be manually backflushed (see procedure below), perform the manual backflush service prior to vacuum removal of sediment, floatable, and water (i.e. perform the manual backflush with the lower chamber full of water).
- Insert the oil dipstick or sampling tool into the maintenance access wall. If oil is present, pump off the oil layer into separate containment using a small pump and tubing. Some maintenance service providers may elect to use the vacuum hose if the oil amount is small.
- Maintenance cleaning of accumulated floatable litter and sediment is performed with a vacuum hose inserted through the maintenance access wall.
- Using the vacuum hose, decant the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.
- Remove the sediment from the bottom of the unit using the vacuum hose.
- For larger Jellyfish Filters, (8-ft, 10-ft, 12-ft diameter), complete sediment removal

may be facilitated by inserting a garden hose sprayer through a hole in the cartridge deck where a blank cartridge lid (no orifice in the cartridge lid) or filter cartridge has been removed. Use the garden hose sprayer to break up sediment on the bottom of vessel that is farthest from the maintenance access wall, being careful not to cut or otherwise damage the filter tentacle membranes with excessive water pressure. (Note: Use of a garden hose sprayer is recommended. Do not use a high pressure jet sprayer or power washer, as excessive water pressure may damage the filter tentacle membranes.) Rinse the loosened sediment toward the maintenance access wall for easy vacuum removal.

- To access the cartridge deck for manual cleaning or replacement of filter cartridges, descend the ladder that is built into structure's sidewall, observing all precautions for safe and proper confined space entry. Note that the cartridge deck may be slippery. Care should be taken to avoid stepping directly onto the backwash pool weir, as damage may result.
- A manual backflush of the cartridges is recommended to remove a high percentage of accumulated sediment from the filtration tentacles, restore flow capacity, and extend the service life of the cartridges. A Jellyfish Cartridge Backflush Pipe (12-inch diameter x 40-inch length aluminum pipe with flapper valve) may be purchased from Imbrium Systems that allows each cartridge to be selectively backwashed using water that is supplied from either (a) the previously decanted water stored in a vactor truck compartment; (b) clean water from a separate water truck delivered to the site; or (c) water from a nearby fire hydrant or other clean water source. <u>NOTE</u>: Manual backflushing of the cartridges is best performed with the lower chamber full of water (i.e. prior to vacuuming out the sediment, floatables, and water). This ensures that a uniform backflush pressure is applied across all of the filter media surface area.
- Manual backflush procedure: Twist the threaded cartridge lid on the cartridge receptacle counter-clockwise to remove the lid and expose the cartridge head. (NOTE: Do not step directly onto an exposed cartridge head when a cartridge lid is removed, as excessive downward force may damage the cartridge receptacle and result in injury if the cartridge head is forced through the receptacle and into the lower chamber.) Place the Jellyfish Cartridge Backflush Pipe over the cartridge receptacle such that the gasket on the bottom of the Backflush Pipe is seated on the rim of the cartridge receptacle. Fill the Backflush Pipe with water (approximately 16 gallons). Pull the cord to open the flapper valve and backflush the water through the cartridge. Refill the Pipe and backflush a second time. The full Pipe contents should drain down to the top of the open flapper valve (30 inches from the top of the Pipe) within approximately 15 seconds to remove a high percentage of accumulated sediment and restore the flow capacity of the cartridge. Remove the Pipe and re-install the lid hand-tight. For the most thorough backflushing, backflush the Draindown Cartridge(s) first, followed by the Hi-Flo Cartridges, then finish with a final single backflush on the Draindown Cartridge(s). (NOTE: The Hi-Flo Cartridges are those cartridges within the kidney-shaped 6-inch high backwash pool weir. The Draindown Cartridges are those cartridges outside the backwash pool weir. See the diagram below for reference.) When backflushing a cartridge, it is important to keep the lids in place on all other cartridges both as a safety precaution and so that water displaced from the lower chamber during backflushing is properly filtered when discharged to the top of the cartridge deck.

- **Optional manual rinsing procedure:** If manual backwashing using the Jellyfish • Cartridge Backflush Pipe is ineffective in restoring adequate cartridge flow capacity, cartridges may be removed, manually rinsed, and re-commissioned. With the threaded cartridge lid removed, slowly and carefully remove the cartridge from the receptacle using the lifting loops in the cartridge head. (NOTE: Should a snag occur, do not force the cartridge upward as this may result in damage to the tentacles. Instead, gently rotate the cartridge with a slight sideways motion to clear the snag and remove the cartridge.) Remove the cartridge from the vessel, as rinsing is best performed outside the vessel. Immediately replace the lid on the exposed receptacle/hole as a safety precaution. Using a garden hose sprayer, direct the water spray at an angle across the tentacle membrane surface, starting at the top of the tentacle and working downward. For most effective rinsing, remove each tentacle from the cartridge head plate by unscrewing the attachment nut, and perform a 360 degree rinse of each tentacle. Re-attach the rinsed tentacles to the head plate and re-commission the cleaned cartridge. If manual rinsing cannot be performed, or if inspection upon rinsing indicates damage to the tentacles, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Imbrium Systems to order replacement tentacles.
- New cartridges are lightweight (less than 20 pounds), and can be easily lowered down to a worker on the cartridge deck. Care should be taken not to bend or otherwise damage the tentacles during the handling and installation procedures.
- For maximum safety, it is recommended that each cartridge be removed and replaced one at a time, such that there is never more than one cartridge receptacle/hole exposed.
- After vacuuming out sediment, floatables, and water, re-fill the lower chamber with water where required by the local jurisdiction.

What is required for proper disposal?

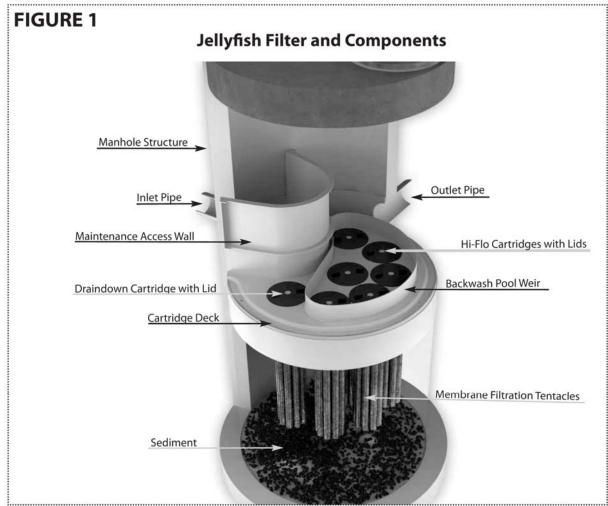
• Disposal requirements for recovered pollutants and spent filter cartridges may vary depending on local guidelines. In most areas the sediment and spent filter cartridges, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.

What about oil spills?

- Petroleum-based pollutants captured by the Jellyfish Filter (oil/chemical/fuel spills) should be removed and disposed of by a licensed waste management company.
- Although the Jellyfish Filter captures virtually all free oil, a sheen at the outlet does not mean the unit isn't working. A rainbow or sheen can be visible at oil concentrations of less than 10 mg/L (ppm).

What factors affect the costs involved with inspection/maintenance?

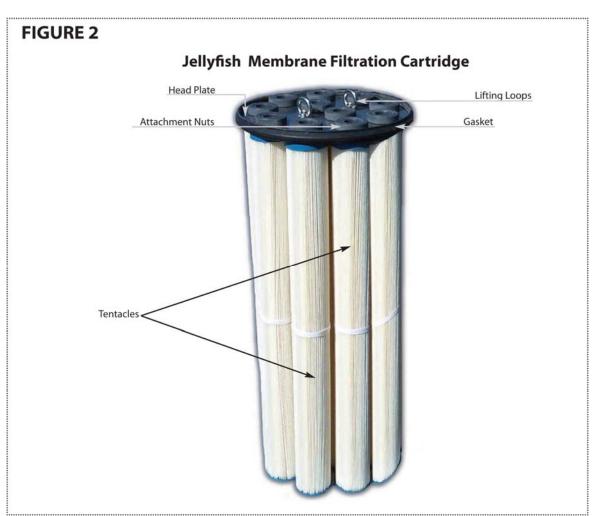
 Inspection and maintenance costs are based on unit size, cartridge count, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations. Maintenance costs are anticipated to be substantially lower in instances where dirty cartridges are manually cleaned and re-commissioned rather than replaced with new cartridges.



Below is a cut-away schematic of the Jellyfish Filter with key components identified (6-ft diameter manhole configuration is depicted).

Note: Separator Skirt Not Shown

The Jellyfish Filter has no moving parts to wear out and therefore maintenance activities are generally focused on pollutant removal and filter cartridge service.



Below is a schematic of a Jellyfish Filter membrane filtration cartridge. The extraordinarily high surface area of the membrane filtration tentacles provides superior flow and sediment capacity as well as low head loss. Tentacles can be easily removed from the head plate and replaced.



The depth of sediment and oil can be measured from the surface by using a sediment probe or dipstick tube equipped with a ball check valve and inserted through the Jellyfish Filter's maintenance access wall. The large opening in the maintenance access wall provides convenient access for inspection and vacuum removal of water and pollutants.



A maintenance worker stationed on the surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to the Jellyfish Filter's long and effective service life.

Ordering Replacement Parts

Jellyfish filter cartridges, replacement tentacles, cartridge lids, Jellyfish Cartridge Backflush Pipes (for manual backflushing), and other system components can be ordered by contacting:

Imbrium Systems Corporation 1-888-279-8826 www.imbriumsystems.com

(revised 3-28-12)

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. <u>WORK INCLUDED</u>: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

- B. REFERENCE STANDARDS
- ASTM C 891: SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
- ASTM C 478: SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS ASTM C 990: SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
- STM C 990. SPECIFICATION FOR JOINTS FOR CONCRETE MAINFOLES USING PREFORMED FLEXIBLE JOINT SEA STM D 4101: SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION
- C. <u>SHOP DRAWINGS</u>: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.
- D. <u>PRODUCT SUBSTITUTIONS</u>: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.
- E. <u>HANDLING AND STORAGE</u>: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

- A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(5), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.
- B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.
- C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENTS SHALL BE A MINIMUM IS INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE (SHALL BE 0.21 GPM/F12 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.
- D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.
- E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.
- F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.
- G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.
- H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.
- I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.
- J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.
- K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.
- L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097; CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.
- M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.
- N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

- A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.
- B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.
- C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.
- D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/TT2 (0.142 LPS/M2).
- E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.
- F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.
- G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.
- H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.
- I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

- A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
- B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).
- C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.
- D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.
- E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60° OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60° VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.
- F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

- A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.
- B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE
 - AGGREGATE BASE
 BASE SLAB
 - TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
 - BYPASS SECTION
 - CONNECT INLET AND OUTLET PIPES
 - CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
 - MAINTENANCE RISER SECTION(S) (IF REQUIRED)
 - FRAME AND ACCESS COVER
- C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.
- D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.
- E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.
- F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.
- G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.
- H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST
- I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.
- J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

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16. RUNOFF RATE REDUCTIONS



Runoff Rate Reduction Performance

Project:	Ashbel Associates, LLC
Job #:	2841-99-001
Location:	Greenwood Road & Texas Road, Marlboro, NJ
Date:	1/20/2021

Combined Flows to Study Point 1

Design Storm	Existing Runoff Rate from Disturbed Areas (CFS)	Rate	Maximum Allowable Runoff Rate (CFS)	Proposed Runoff Rate (CFS)
1 Year	0.81	0%	0.81	1.07
2 Year	4.97	50%	2.48	1.51
10 Year	10.66	25%	8.00	2.88
25 Year	14.95	0%	14.95	8.38
100 Year	23.17	20%	18.54	18.38

Stability Point A

Design Storm	Existing Runoff Rate from Disturbed Areas (CFS)	Rate	Maximum Allowable Runoff Rate (CFS)	Proposed Runoff Rate (CFS)
2 Year	0.56	0%	0.56	0.27
10 Year	1.20	0%	1.20	0.38
25 Year	1.68	0%	N/A	0.43

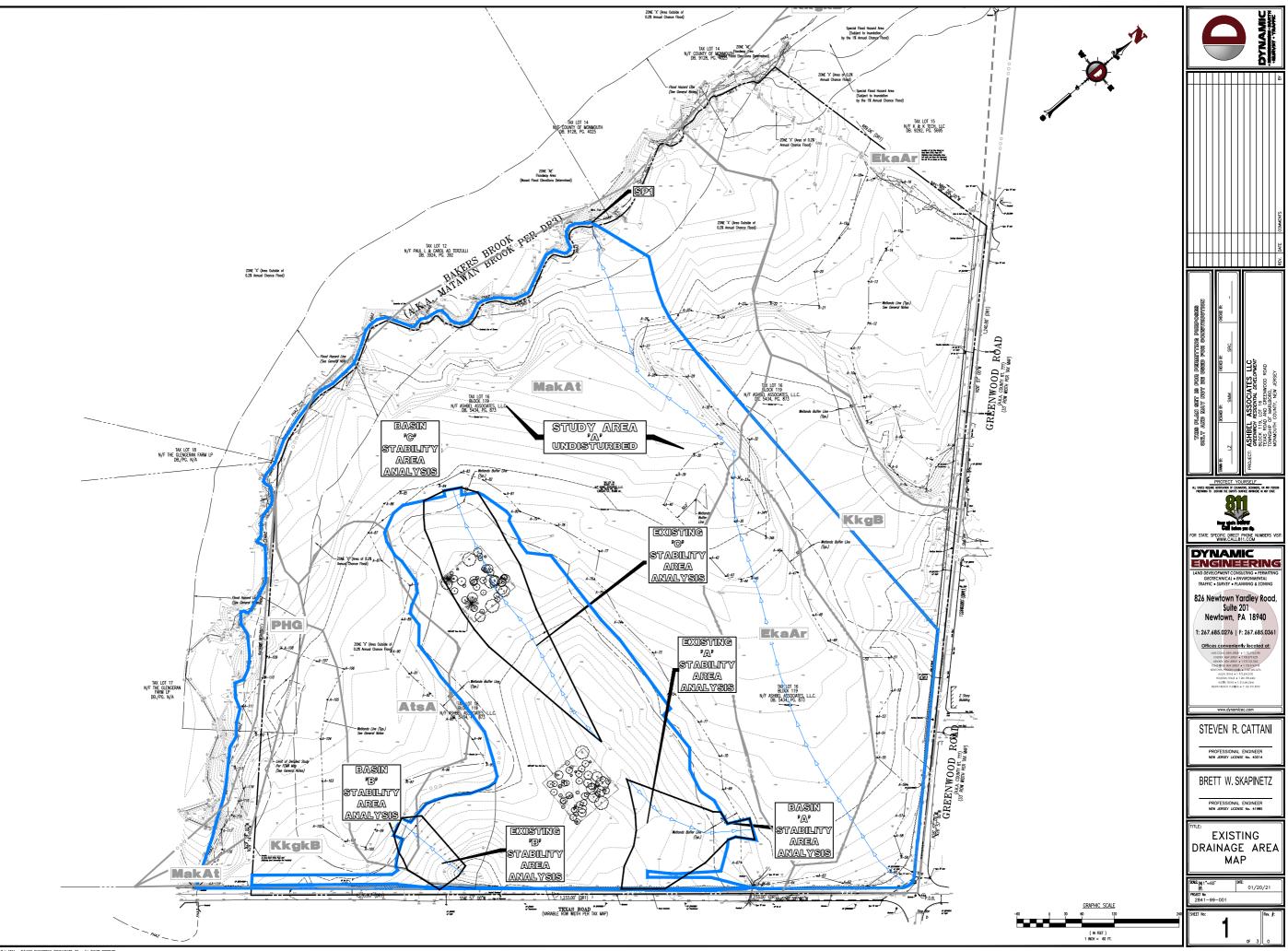
Stability Point B

Design Storm	Existing Runoff Rate from Disturbed Areas (CFS)	Rate	Maximum Allowable Runoff Rate (CFS)	Proposed Runoff Rate (CFS)
2 Year	0.15	0%	0.15	0.19
10 Year	0.29	0%	0.29	0.24
25 Year	0.41	0%	N/A	0.27

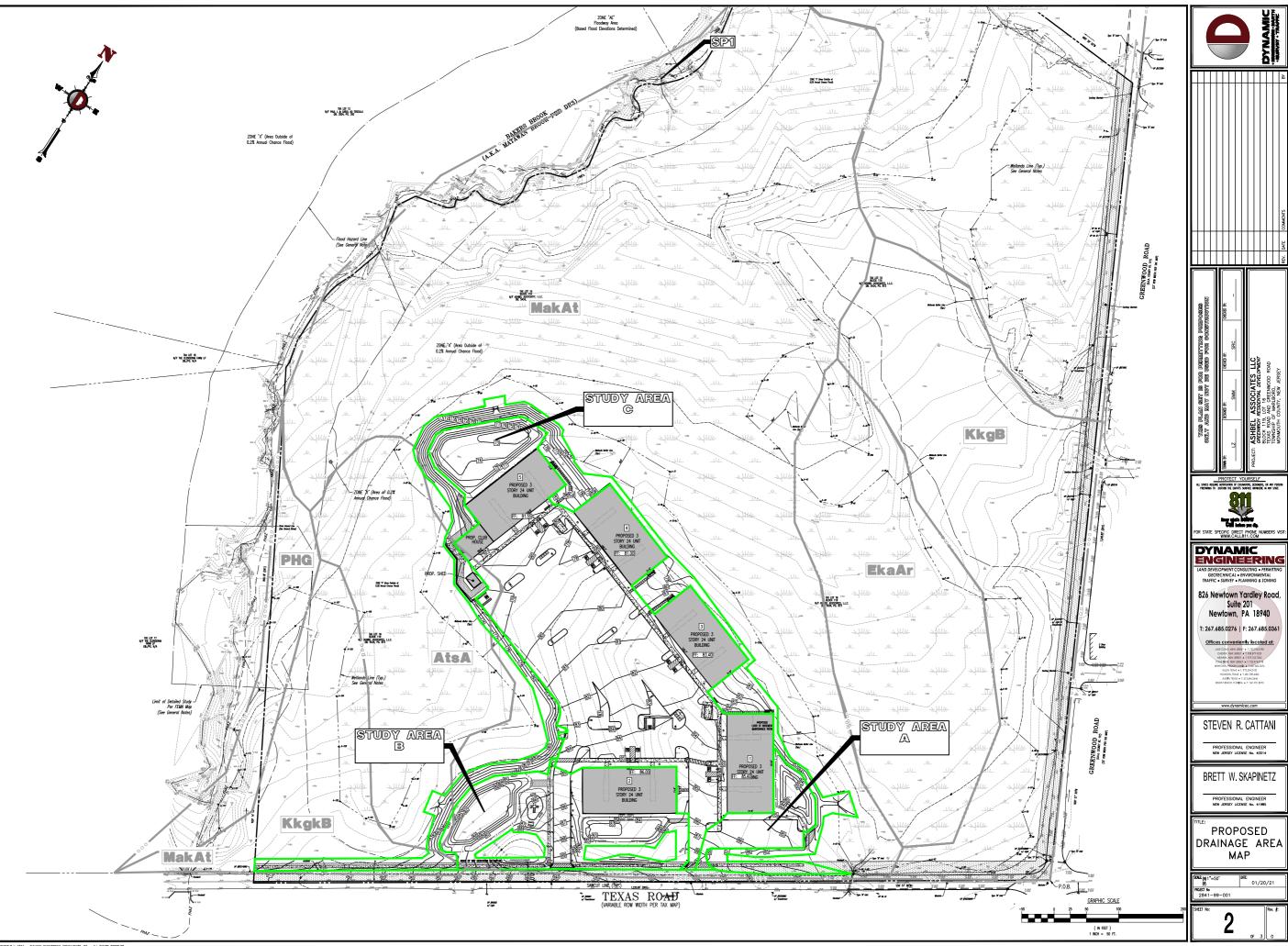
Stability Point C

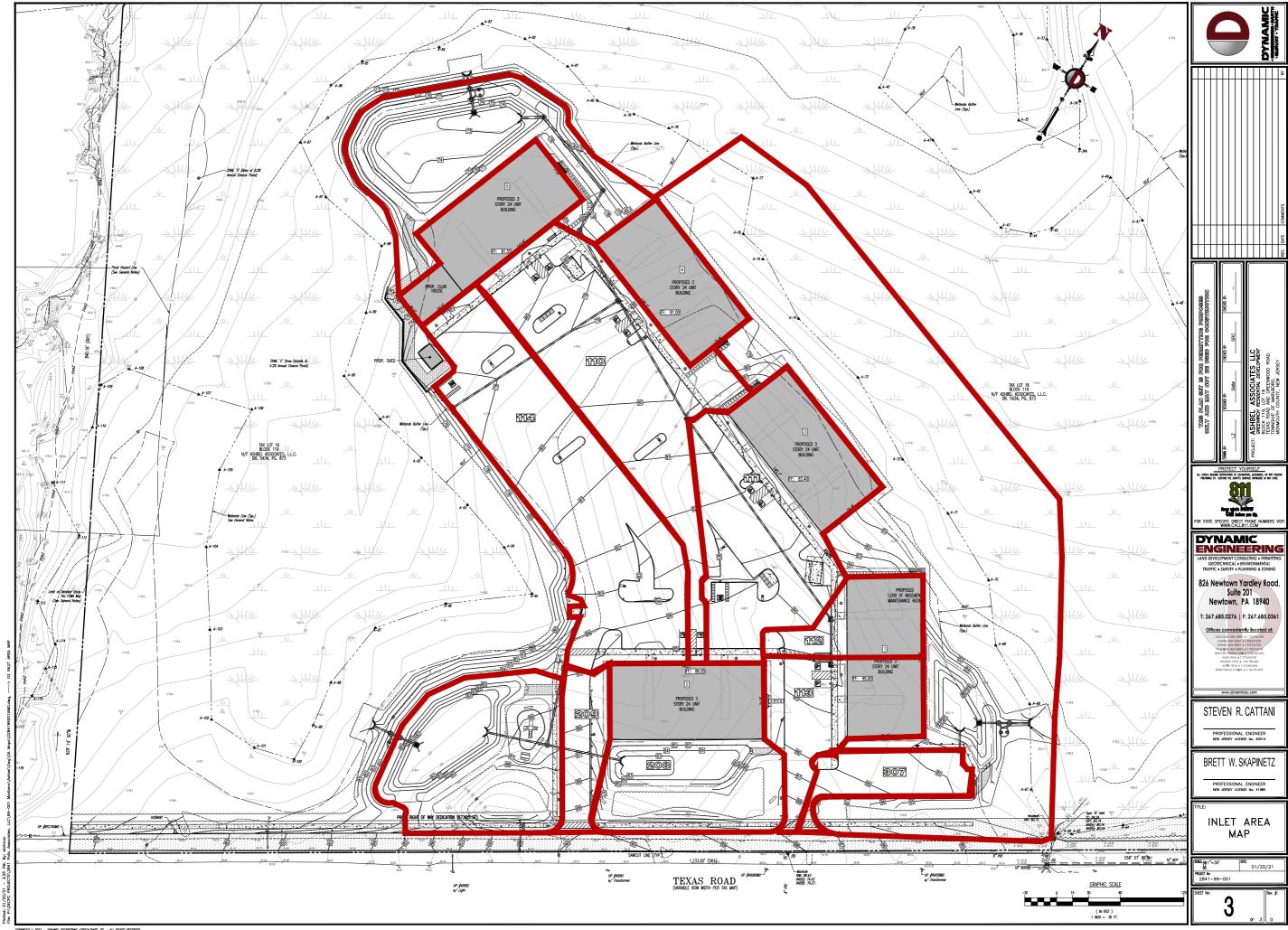
Design Storm	Existing Runoff Rate from Disturbed Areas (CFS)	Rate	Maximum Allowable Runoff Rate (CFS)	Proposed Runoff Rate (CFS)
2 Year	1.06	0%	1.06	1.06
10 Year	2.28	0%	2.28	2.28
25 Year	3.20	0%	N/A	8.38

17. DRAINAGE AREA MAPS



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