

# STORMWATER MANAGEMENT FACILITIES

## REPORT FOR



Technology Drive  
O'Fallon, MO 63368

### Owner:

Granite Hotels, LLC

Contact Person: Gary Zimmer

3203 Missouri Ave  
Granite City, IL 62040

### Continuing Authority:

Granite Hotels, LLC



**PREMIER CIVIL  
ENGINEERING**

308 TCW COURT  
LAKE SAINT LOUIS MO 63367

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BUILDING DEPARTMENT



# STORMWATER MANAGEMENT FACILITIES REPORT

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## OVERVIEW

### INTRODUCTION

Granite Hotels, LLC is proposing to construct a 12,200 sf 3 story building at the northwest corner of Technology Drive and Highway K in the City of O'Fallon, MO. The site is 2.00 acres and will consist of the building, parking and associated infrastructure improvements as required to make this a complete and useable site. The site is currently an open field that has not been used for agriculture. The Sleep Inn Hotel will be developed and the existing open area will remain for the remainder of the property that is owned by Delmar Gardens. A detention basin will be built to the north of this site to mitigate stormwater for this development.

### Features

With all new developments, stormwater volume issues are a concern. Granite Hotels, LLC is addressing these issues with an above ground stormwater detention system. The Post-Construction permanent BMP chosen for this site will consist of providing Channel Protection Volume to ensure a reduction in stormwater runoff and by providing a hydrograph that requires almost 48 hours to drain the basin the basin will act as a water quality BMP. Silt fence will be used as a temporary BMP during construction to reduce silt leaving the site and inlet protection fabric drops will surround inlets to reduce off-site contamination due to erosion. As a private BMP, Sleep Inn Hotels, LLC will be responsible for regular maintenance and inspection. Proper maintenance will ensure that the stormwater from the site will have minimal impact on the surrounding properties as well as reduce downstream sediment issues while the site is under construction.

By providing a large basin, the stormwater quality and quantity will provide the City public awareness of the responsibility of stormwater quality and quantity. Per the Vermont Stormwater Management Manual the key to providing channel protection for water quality is providing a 24 hour extended detention of the post-developed 1-year, 24 hour rainfall event in warm water fish habitats that are located downstream. The downstream creek located north of the site is a tributary to Schote Creek. Schote Creek ties into Dardenne Creek at approximately the location of Sports Park Drive and Highway K.

## EXECUTIVE SUMMARY

### EXISTING CONDITIONS OF ENTIRE SITE:

Grass Areas = 2.00 Acres

### POST DEVELOPED CONDITIONS:

Post developed conditions have been modeled using the proposed Sleep Inn improvements and the existing site to remain as grass with a C factor of 0.74 for the grass areas and pavement and building with a C factor of 0.98.

### POST DEVELOPED CONDITIONS:

Grass and landscaped areas = 1.43 ac.

Building and pavement areas at 100% impervious = 0.57 ac.

### CALCULATION OF ALLOWABLE DISCHARGE

	1 Year (cfs)	2 Year (cfs)	25 Year (cfs)	100 Year (cfs)
Pre Developed Runoff (Hydrograph No. 1)	1.614	2.712	8.641	12.15
Post Developed Runoff (Hydrograph No. 2)	4.611	6.134	12.88	16.45
Site Runoff Routed Through Basin (Hydrograph 3)	1.497	2.603	8.232	12.06
Reduction in Runoff from Pre Developed to Post Developed	<b>0.117</b>	<b>0.109</b>	<b>0.409</b>	<b>0.09</b>

### PEAK FLOW RATES FROM SITE TO BASIN

	Peak flow rate in cfs			
	<u>1yr</u>	<u>2 yr</u>	<u>25 yr</u>	<u>100yr</u>
Peak runoff to basin	4.611	6.134	12.88	16.45

### TABLE OF VOLUME DETAINED BY STORM EVENT

	1 Year 24 Hour Storm	2 Year 24 Hour Storm	25 Year 24 Hour Storm	100 Year 24 Hour Storm
VOLUME (CU. FT.)	4,251	5,369	9,662	11,335
HIGH WATER ELEVATION	560.05	560.38	561.48	561.83

Top of Basin Elevation = 632.20

WEIR FORMULA FOR DETENTION BASIN			
Q TO WEIR (Q) =	17.19	CFS	
WEIR (C) =	3.33		(MAY VARY DEPENDING ON WEIR. 3.0 IS FOR A MANHOLE RISER OR GRATE INLET)
LENGTH OF WEIR (L)	20.8	FT	2 GRATE INLET = 15.0' + RECTANGULAR OPENING
WEIR FORMULA:	$h = [q/(c*l)]^{2/3}$		
	h =	0.39	FT
HIGHWATER IN BASIN	WEIR ELEVATION + h		
WEIR ELEVATION =	561.80	ft.	
HW IN BASIN =	562.19		
TOP OF POND =	563.20		
	denotes input cell		

## EVALUATION OF PROPOSED CONDITIONS

Per the direction of the city of O'Fallon, the pre development runoff shall not increase from the existing conditions. Therefore, flow paths based on time of concentration have been provided to ensure that we are meeting the pre-development runoff objective. Due to the sensitive nature of the development due to downstream erosion issues the basin has been designed with a pre-treatment system by providing ADS Flexstorm filters.



## DEVELOPMENT USE

This development will construct a standalone Sleep Inn hotel that will be 3 stories in height. Construction of site components associated with the hotel

## DISTURBED AREA

The total on and offsite area disturbed by construction of this development is 2.46 acres.

Project Name:	Sleep Inn	
<b>COMPUTATIONS FOR WQ<sub>V</sub>:</b>		
<u>Drainage Area</u>	<u>Impervious Area</u>	<u>Percent Impervious</u>
2.00 Ac.	1.43 Ac.	71.5 %
The following computational procedure follows the methodology detailed in Appendix D.10 of the Maryland Stormwater Design Manual.		
1. Determine R <sub>v</sub> (Volumetric Runoff Coefficient)		
$Q_a = (P)(R_v)$		
Where:		
P = Water quality storm event depth 1.14 "		
$R_v = 0.05 + (0.009)(\% \text{ impervious area})$		
$R_v = 0.05 + (0.009)(71.5)$		
$R_v = 0.69$		
2. Determine WQ <sub>V</sub> (Water Quality Volume)		
$P = 1.14 \text{ " ( Rainfall )}$		
$WQ_V = \frac{(P)(R_v)(\text{Ac.})}{12 \text{ "}}$		
$WQ_V = \frac{(1.14 \text{ "})(0.69)(2.00 \text{ Ac.})}{12 \text{ "}} = 0.1318 \text{ Ac. Ft.} = 5739.7 \text{ Cu. Ft.}$		

### PROVIDED WATER QUALITY VOLUME

The 1 year 24 hour storm provides 4,251 cu. ft. of volume. Therefore, as part of the extended detention the dry detention basin meets its purpose for 60% TSS. The additional 40% TSS removal will be by the Flex Storm Inlet Filters. The TSS Removal based on test is 95% efficient. The Flex Storm Product will be a sufficient long term pre-treatment system. Should one of these fail, the additional water quality by the basin will meet the requirements.

## MAINTENANCE AND OPERATION PLAN

The owner has recorded a "Maintenance Agreement" between themselves and the City of O'Fallon. This agreement states that the owner agrees to maintain the stormwater management facilities located on this property and sets forth penalties that may occur if this maintenance is not performed. The contact information for the responsible party is as follows:

Gary Zimmer – Granite Hotels, LLC

The responsible party will maintain all private stormwater facilities in good working order. Minimum maintenance of the private facilities shall include routine inspection, maintenance and removal of sediment, debris, oil and foreign material from the storm sewers, inlets and manholes; and routine inspection, maintenance and cleaning of the outlet structure. An Inspection Checklist is also attached and should be used for regular maintenance and record keeping for reporting purposes. The party responsible for maintenance must evaluate the plan for effectiveness at least annually, and revise as necessary.

### Reporting Requirements

To ensure the maintenance of privately owned stormwater management facilities, the City of O'Fallon requires an Annual BMP Maintenance Report to be submitted to the City for these facilities. The Annual Report should provide documentation that maintenance was performed in accordance with the Stormwater Management Facilities Report submitted for your development and approved by the City of O'Fallon for the above referenced project. The Annual Report typically consists of a completed inspection checklist and/or maintenance log, narrative description of corrective action measures taken, photographs, and any other documentation appropriate for demonstrating compliance with the BMP Maintenance Agreement and your Facilities Report.

The annual BMP Maintenance Report should be submitted to the City of O'Fallon before December 31<sup>st</sup> of each year. A City of O'Fallon inspector will also periodically inspect the BMP to determine if it is being maintained properly. The Annual Report should be sent to:

Attn: Engineering Department  
City of O'Fallon, MO  
Contact: Michelle Grimmenger

## **Operation and Maintenance Procedures:**

1. Immediately after the dry detention basin is established, the plants on the vegetated shelf and perimeter of the basin should be watered twice weekly if necessary until the plants become established (commonly six weeks).
2. No portion of the dry detention basin should be fertilized after the initial fertilization that is required to establish the plants on the vegetated shelf.
3. Stable groundcover should be maintained in the drainage area to reduce the sediment load to the dry detention basin.
- 4.. If the embankment meets the criteria, it shall be inspected as required by a dam safety expert.

**Any deficiencies found during inspection of the dry detention pond best management practice shall be corrected, repair or replaced immediately.**

### **I. Monthly or after every 1-inch rainfall, whichever comes first:**

- a. Remove trash and debris from dry detention basin.
- b. Clear trash and debris from catch basin riser grates, bottom of catch basin, and check outlet pipe for obstructions and clogging. Check and clear orifice(s) of any obstructions.
- c. Check pond side slopes and contributing areas and repair eroded areas before next rainfall.
- d. Check pond inlet and outlet pipes, grass swales and inlet/outlet dissipaters.
- e. Replace rip rap that is choked with sediment.
- f. Check forebay for sedimentation. Remove sediment to restore original forebay design depth when 1-foot dedicated sediment storage area has reached its capacity and is full.

### **II. Annually**

- a. Check pond depth and forebay at various locations. Remove sediment to restore original pond design depth when 1-foot dedicated sediment storage area has reached its capacity and is full.
- b. Check the condition of the dam and wall for leaks and seepage, transverse or longitudinal cracks, sinkholes, woody vegetation, signs of rodent infestation differential settling or other such problems.
- c. Check the operation of all devices and equipment for proper operation.

The tables on the next two pages contain potential problems and remedial actions to be taken.



BMP Element	Potential Problems	Remedial Action
Entire BMP	Trash/debris is present	Remove the trash/debris
Perimeter of the dry detention basin	Areas of bare soil and/or erosive gullies are present	Re-grade the soil if necessary to remove the gullies and then plant ground cover. Provide lime and fertilizer if necessary. Water if necessary until ground cover is reestablished.
Perimeter of the dry detention basin	Vegetation is too short or too long.	Maintain vegetation per BMP landscape plan.
Pipe Inlet	Pipe is clogged	Unclog the pipe and dispose of the material properly.
Pipe Inlet	Pipe is cracked or damaged	Repair or replace.
Forebay	Sediment has accumulated to a depth of equal to or greater than one foot which is the original design depth for sediment storage	Search for source of the sediment and remedy the problem. Remove the sediment and dispose of it properly at an off-site location.
Forebay	Erosion has occurred.	Provide additional erosion protection such as reinforced turf matting or additional riprap if needed to prevent future erosion problems.
Forebay	Weeds are present.	Remove the weeds. If a pesticide is used, wipe it on the plants rather than spraying it.
Vegetated Shelf	Pruning is needed to maintain plant health.	Prune according to best professional practices.
Vegetated Shelf	Plants are dead, dying, or diseased.	Determine the source of the problem. Is it soils, disease, etc.? Remedy the problem and replace the plants. If a soil test indicates it is necessary, provide a one-time fertilizer application to establish plants.
Vegetated Shelf	Weeds are present.	Remove the weeds. If a pesticide is used, wipe it on the plants rather than spraying it.

BMP Element	Potential Problems	Remedial Action
Main Treatment Area (Main Pond)	Sediment has accumulated to a depth equal to or greater than the original design sediment storage depth of one foot.	Search for the source of the sediment and remedy the problem. Remove the sediment to the original design bottom elevation of the pond and dispose of it properly at an off-site location.
Main Treatment Area (Main Pond)	Algal growth covers 50% or more of the water surface area.	Consult a professional to remove and control the algal growth.
Main Treatment Area (Main Pond)	Cattails, phragmites, or other invasive plants cover 50% or more of the basin surface.	Wipe an insecticide on the plants rather than spraying them.
Embankment	Shrubs have started to grow on the embankment.	Remove the shrubs immediately.
Embankment	A tree has started to grow on the embankment	Remove the tree immediately unless removing it adversely affects the integrity of the embankment. If so, contact a qualified professional concerning the tree removal and embankment repair.
BMP Element	Potential Problems	Remedial Action
Embankment	Evidence of muskrat or beaver activity is present	Consult a professional to trap and remove the muskrats
Embankment	An annual inspection by a qualified professional shows that the embankment needs repair.	Make all needed repairs immediately.
Outlet Device	The outlet device is	Clean out the outlet device.
Outlet Device	The outlet device is damaged.	Repair or replace the outlet device.
Outlet	Erosion at the outlet.	Repair the eroded area as necessary.

**Pond#:** \_\_\_\_\_ **Pond Name:** \_\_\_\_\_

### **Fence/Gate/Lock/Guardrail**

Fence / Gate / Lock in good condition? (YES/NO/N.A.)

Is there any fence damage? (YES/NO)

\_\_\_\_\_ LF of damaged fence

#of posts damaged

\_\_\_\_\_ # of corner/pull posts damaged

What type of fence/guardrail was damaged? (4' rail, guardrail)

Top Rail? (YES/NO)

### **Signs**

No swimming, skating and no trespassing signage in place, (YES/NO)

### **Trash/Debris**

Excessive trash/debris in pond? (YES/NO)

### **Pond Sediment**

Sediment in bottom of the detention/retention pond is above invert pipe elevation? (YES/NO/N.A.)

Is water ponding in the infiltration pond? (YES/NO/N.A.)

### **Erosion**

Is there any noticeable erosion along the pond berm or at the inlet/outlet/dispersal trench/ emergency overflow? (YES/NO)

### **Tree Growth/Dangerous Trees**

Are there any noticeable dangerous trees within the fenced pond perimeter? (YES/NO)

Are there any noticeable dangerous trees outside of the pond fence, but still within P.C. property limits? (YES/NO)

Are there any trees that are growing in a location or manner that may adversely impact the facility? (YES/NO)

### **Catch Basins/Control Structures**

Is there any evidence of pollutants such as oil/ gasoline/ or other pollutants within the catch basin/control structure?(YES/NO/N.A.)

Is the control device securely fastened to the structure? (YES/NO/N.A.) Is

the orifice(s) in the control structure clear of debris? (YES/NO/N.A.)

Is the ladder in the catch basin/control structure securely attached? (YES/NO/N.A.)

Is locking lid(s) fastened down with the appropriate number of tamper proof bolts?(YES/NO/N.A.) Is

the catch basin lid(s) located below grade?(YES/NO/N.A.)

Is the structure(s) damaged in any way?(YES/NO/N.A.)

Was excessive material found in the structure?(YES/NO/N.A.)

Is Trash Rack Clean and free of debris?





## **FLEXSTORM OPERATION & MAINTENANCE PLAN**

### **Installation Instructions:**

1. Remove the grate from the casting or concrete drainage structure.
2. Clean the ledge (lip) of the casting frame or drainage structure to ensure it is free of stone and dirt.
3. Drop in the FLEXSTORM Inlet Filter through the clear opening and be sure the suspension hangers rest firmly on the inside ledge (lip) of the casting.
4. Replace the grate and confirm it is elevated no more than 1/8", which is the thickness of the steel hangers.

### **Frequency of Inspections:**

1. Construction site inspection should occur following each ½" or more rain event.
2. Post Construction inspections should occur three times per year (every four months) in areas with year round rainfall and three times per year (every three months) in areas with rainy seasons before and after snowfall season.
3. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than three times per year.

### **Maintenance Guidelines:**

1. Empty the sediment bag if more than half filled with sediment and debris, or as directed by the Engineer.
2. Remove the grate, engage the lifting bars or handles with the FLEXSTORM Removal Tool, and lift from the drainage structure.
3. Dispose of the sediment or debris as directed by the Engineer or Maintenance Contract in accordance with EPA guidelines.
4. As an alternative, an industrial vacuum may be used to collect the accumulated sediment.
5. Remove any caked on silt from the sediment bag and reverse flush the bag with medium spray for optimal filtration.
6. Replace the bag if torn or punctured to ½" diameter or greater

on the lower half of the bag.

7. Post Construction PC Bags maint: At 50% saturation, the average 2' x 2' Adsorb-it lined PC filter will retain approximately 75 oz (4.2 lbs) of oil and should be serviced. It can be centrifuged or passed through a wringer to recover the oils, and the fabric reused with 85% to 90% efficacy. It may also be recycled for its fuel value through waste to energy incineration.

8. MyCelx Skimmer Pouches: The skimmers start yellow in color and will gradually turn brown as they become saturated, indicating time for replacement. Each MyCelx skimmer pouch will absorb approximately 89 oz (5 lbs) of oil before requiring replacement.

9. Dispose of all oil contaminated products in accordance with EPA guidelines.

#### **Sediment Bag Replacement:**

1. Remove the bag by loosening or cutting off the clamping band.
2. Take the new sediment bag, which is equipped with a stainless steel worm drive clamping band, and use a screw driver to tighten the bag around the frame channel.
3. Ensure the bag is secure and that there is no slack around the perimeter of the band.





## **APPENDIX “A”**

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# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



## Legend

Hyd. Origin	Description
1 SCS Runoff	EXISTING
2 SCS Runoff	PROPOSED
3 Reservoir	BASIN ROUTE

# Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	1.614	2.712	-----	-----	-----	8.641	-----	12.15	EXISTING
2	SCS Runoff	-----	4.611	6.134	-----	-----	-----	12.88	-----	16.45	PROPOSED
3	Reservoir	2	1.497	2.603	-----	-----	-----	8.232	-----	12.06	BASIN ROUTE

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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
1	SCS Runoff	1.614	2	722	4,554	-----	-----	-----	EXISTING
2	SCS Runoff	4.611	2	720	12,057	-----	-----	-----	PROPOSED
3	Reservoir	1.497	2	732	12,054	2	560.05	4,251	BASIN ROUTE
DETENTION CALCULATIONS SLEEP INN.gpw								Return Period: 1 Year	Thursday, 06 / 4 / 2015



# Hydrograph Report

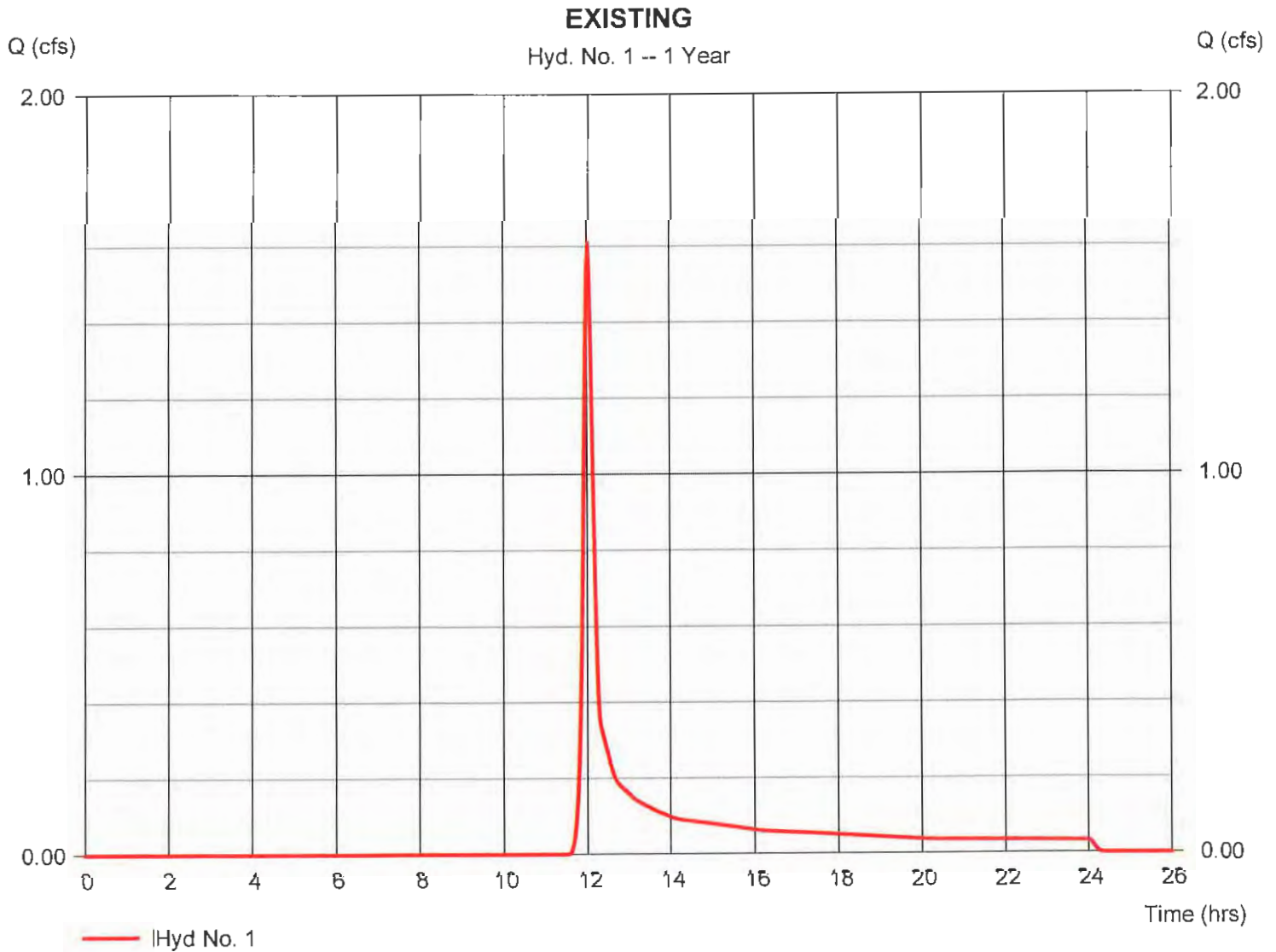
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 06 / 4 / 2015

## Hyd. No. 1

### EXISTING

Hydrograph type	= SCS Runoff	Peak discharge	= 1.614 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 4,554 cuft
Drainage area	= 2.000 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.20 min
Total precip.	= 2.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 1

EXISTING

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 9.95</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 9.95</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 432.00	0.00	0.00	
Watercourse slope (%)	= 4.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=3.23	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 2.23</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 2.23</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>12.20 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

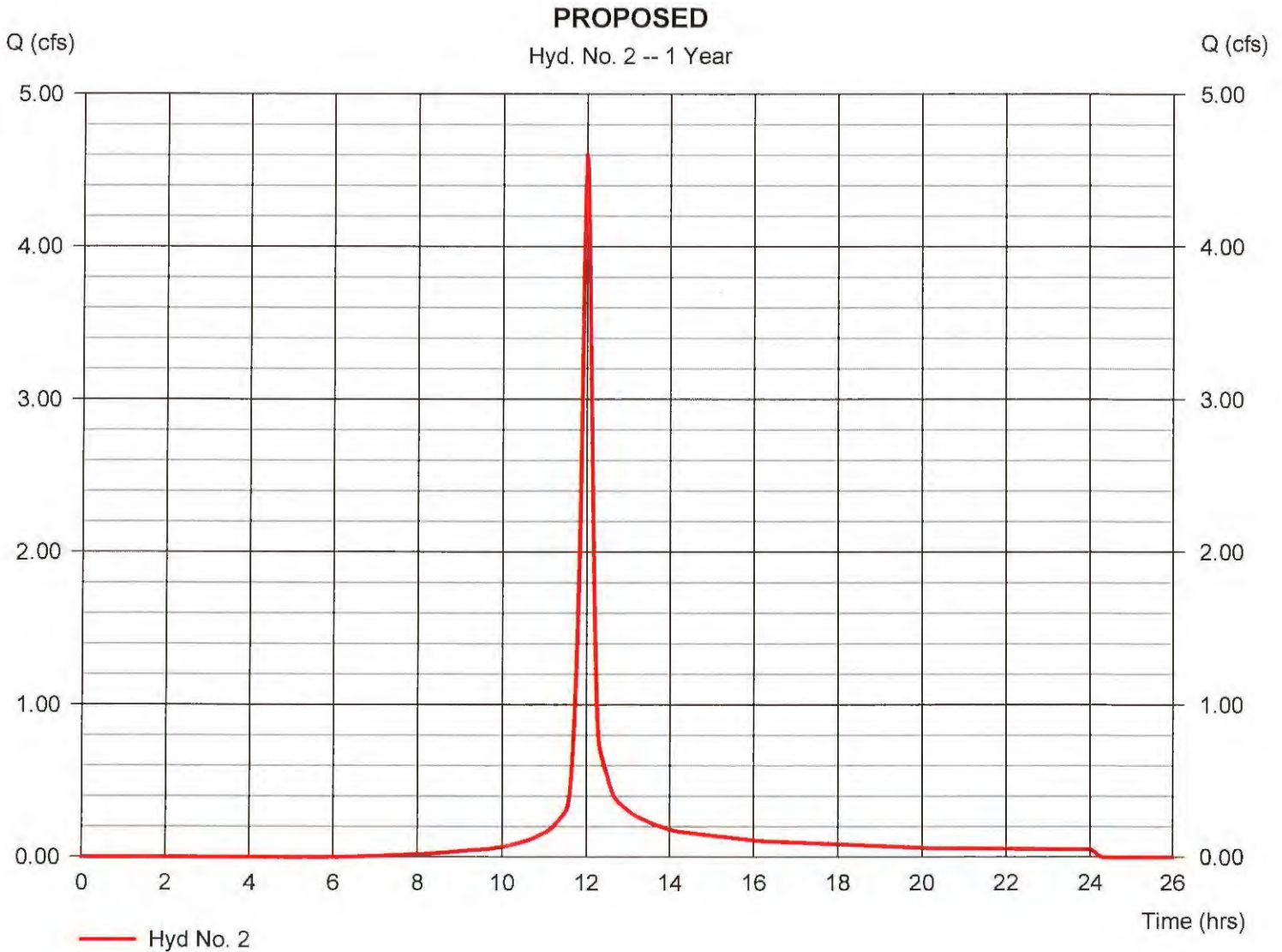
Thursday, 06 / 4 / 2015

## Hyd. No. 2

### PROPOSED

Hydrograph type	= SCS Runoff	Peak discharge	= 4.611 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 12,057 cuft
Drainage area	= 2.000 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.30 min
Total precip.	= 2.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.430 x 98) + (0.570 x 74)] / 2.000



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 2

PROPOSED

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 78.0	22.0	0.0	
Two-year 24-hr precip. (in)	= 3.10	3.10	0.00	
Land slope (%)	= 1.50	5.00	0.00	
<b>Travel Time (min)</b>	<b>= 9.16</b>	<b>+</b>	<b>0.25</b>	<b>+</b>
			<b>0.00</b>	<b>= 9.41</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 54.00	0.00	0.00	
Watercourse slope (%)	= 2.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	=2.87	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.31</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 0.31</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 1.23	1.76	0.00	
Wetted perimeter (ft)	= 2.77	2.66	0.00	
Channel slope (%)	= 0.50	1.00	0.00	
Manning's n-value	= 0.013	0.013	0.015	
Velocity (ft/s)	=4.70	8.69	0.00	
Flow length (ft)	{0}437.0	20.0	0.0	
<b>Travel Time (min)</b>	<b>= 1.55</b>	<b>+</b>	<b>0.04</b>	<b>+</b>
			<b>0.00</b>	<b>= 1.59</b>
<b>Total Travel Time, Tc .....</b>				<b>11.30 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

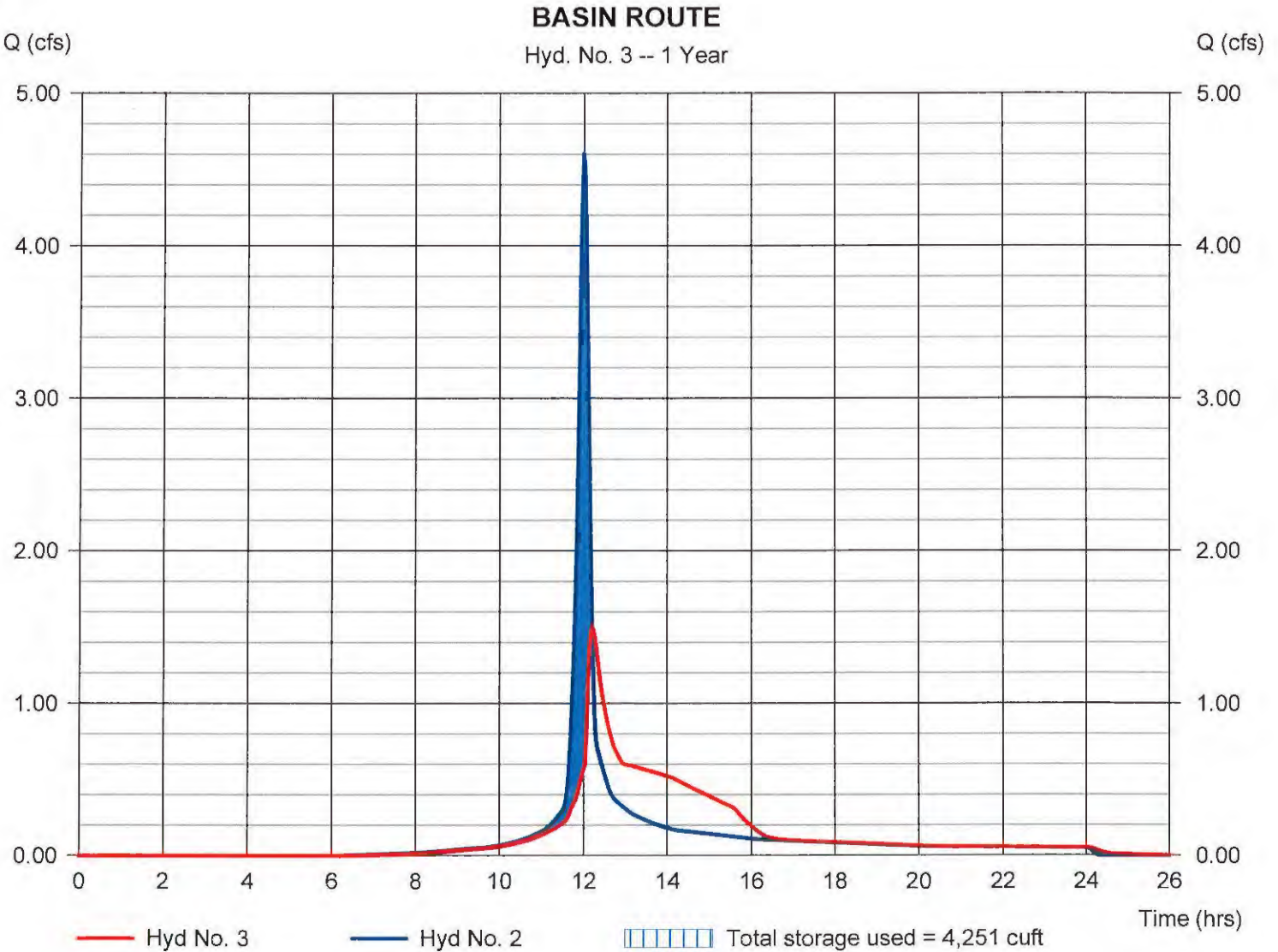
Thursday, 06 / 4 / 2015

## Hyd. No. 3

### BASIN ROUTE

Hydrograph type	= Reservoir	Peak discharge	= 1.497 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 12,054 cuft
Inflow hyd. No.	= 2 - PROPOSED	Max. Elevation	= 560.05 ft
Reservoir name	= DETENTION BASIN	Max. Storage	= 4,251 cuft

Storage Indication method used.





## Pond No. 1 - DETENTION BASIN

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 557.20 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	557.20	01	0	0
0.80	558.00	978	392	392
1.80	559.00	1,823	1,400	1,792
2.80	560.00	2,759	2,291	4,083
3.80	561.00	4,009	3,384	7,467
4.80	562.00	5,287	4,648	12,114
5.80	563.00	6,722	6,005	18,119
6.00	563.20	8,137	1,486	19,605

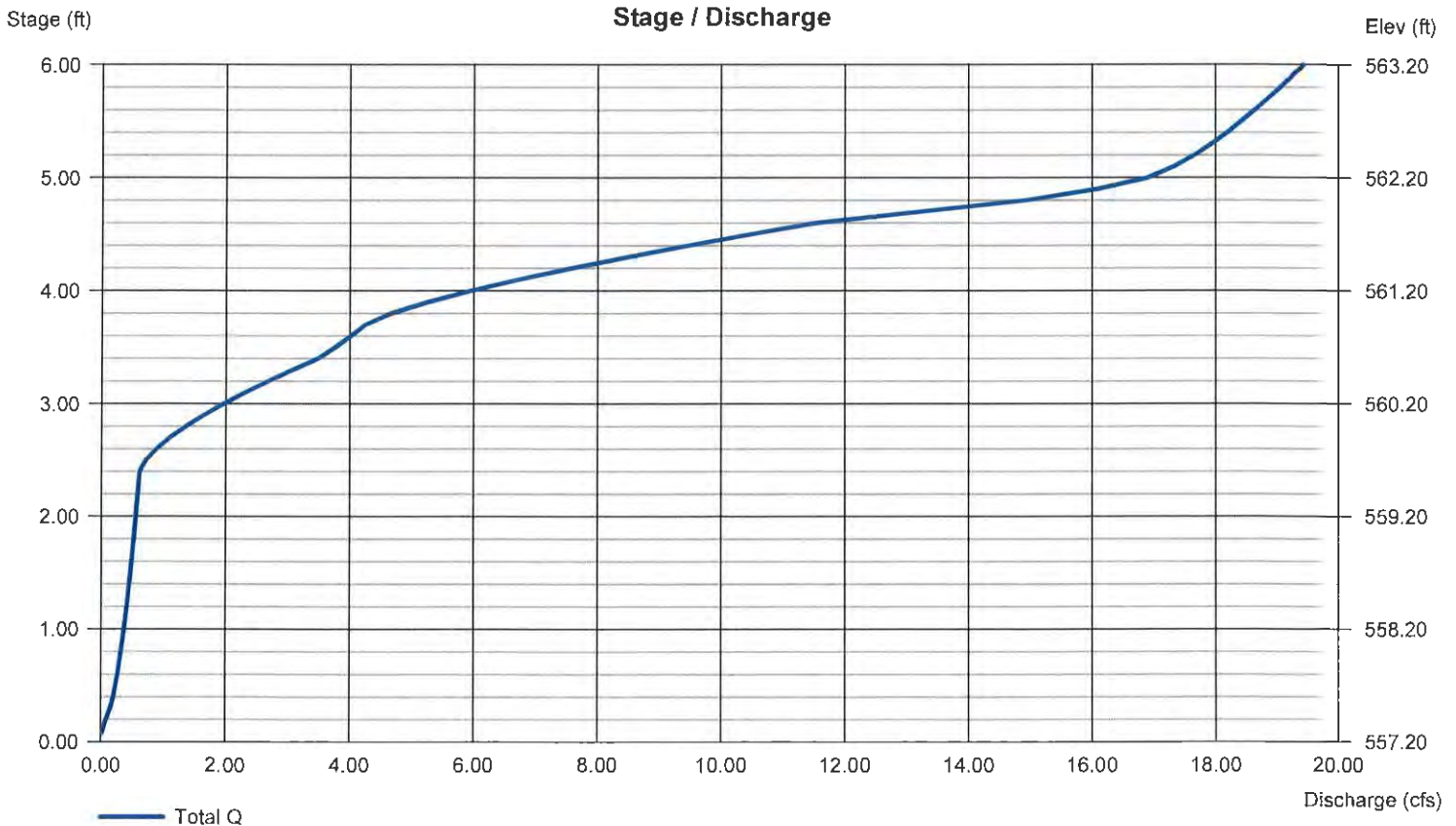
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	4.00	12.00	0.00
Span (in)	= 18.00	4.00	10.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 557.20	557.20	559.60	0.00
Length (ft)	= 20.00	0.50	0.50	0.00
Slope (%)	= 1.00	0.01	0.01	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	2.00	Inactive	Inactive
Crest El. (ft)	= 561.80	560.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	Cipti	---
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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





# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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
1	SCS Runoff	2.712	2	722	7,279	-----	-----	-----	EXISTING
2	SCS Runoff	6.134	2	720	16,206	-----	-----	-----	PROPOSED
3	Reservoir	2.603	2	730	16,203	2	560.38	5,369	BASIN ROUTE

# Hydrograph Report

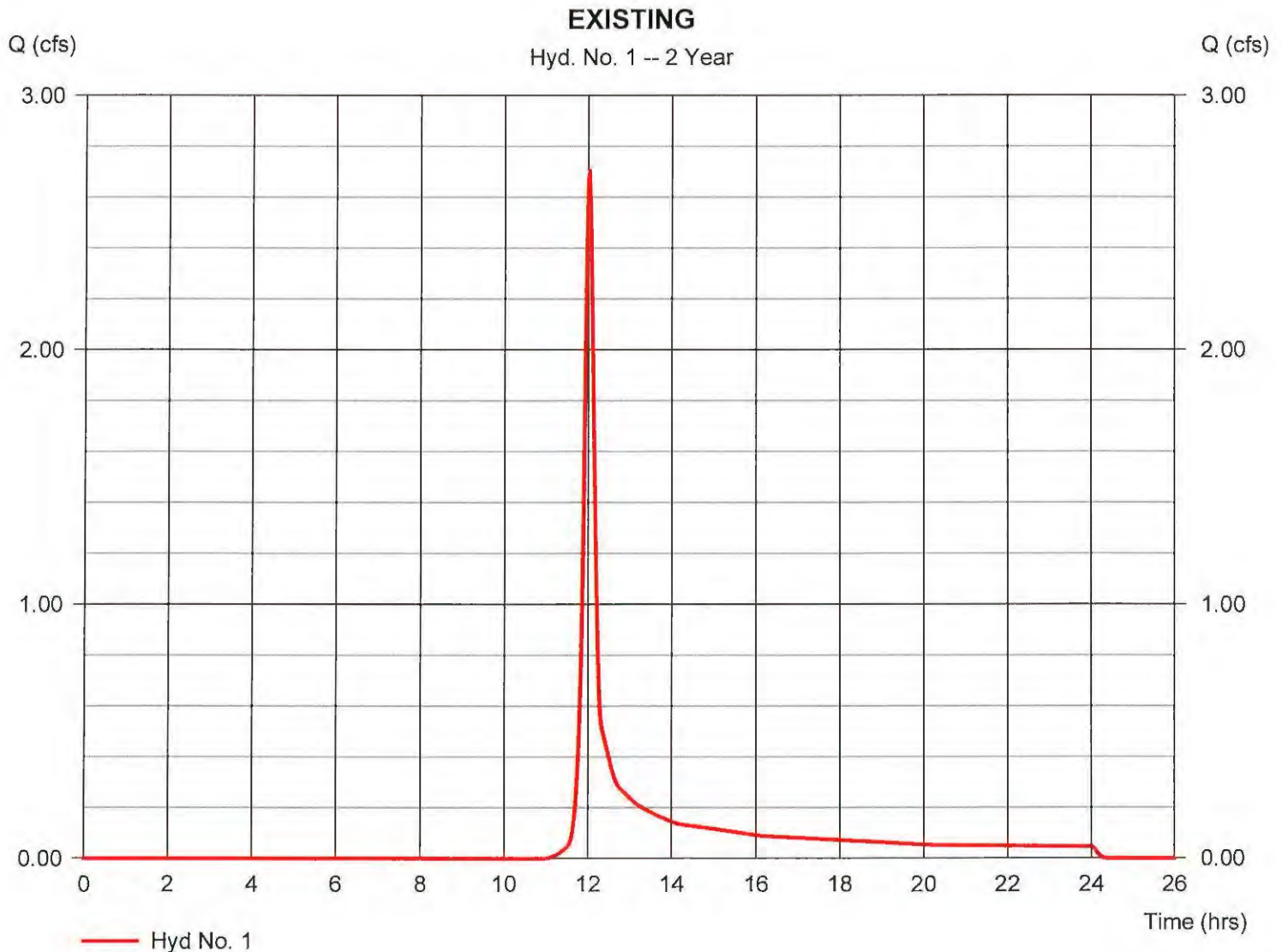
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 06 / 4 / 2015

## Hyd. No. 1

### EXISTING

Hydrograph type	= SCS Runoff	Peak discharge	= 2.712 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 7,279 cuft
Drainage area	= 2.000 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.20 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

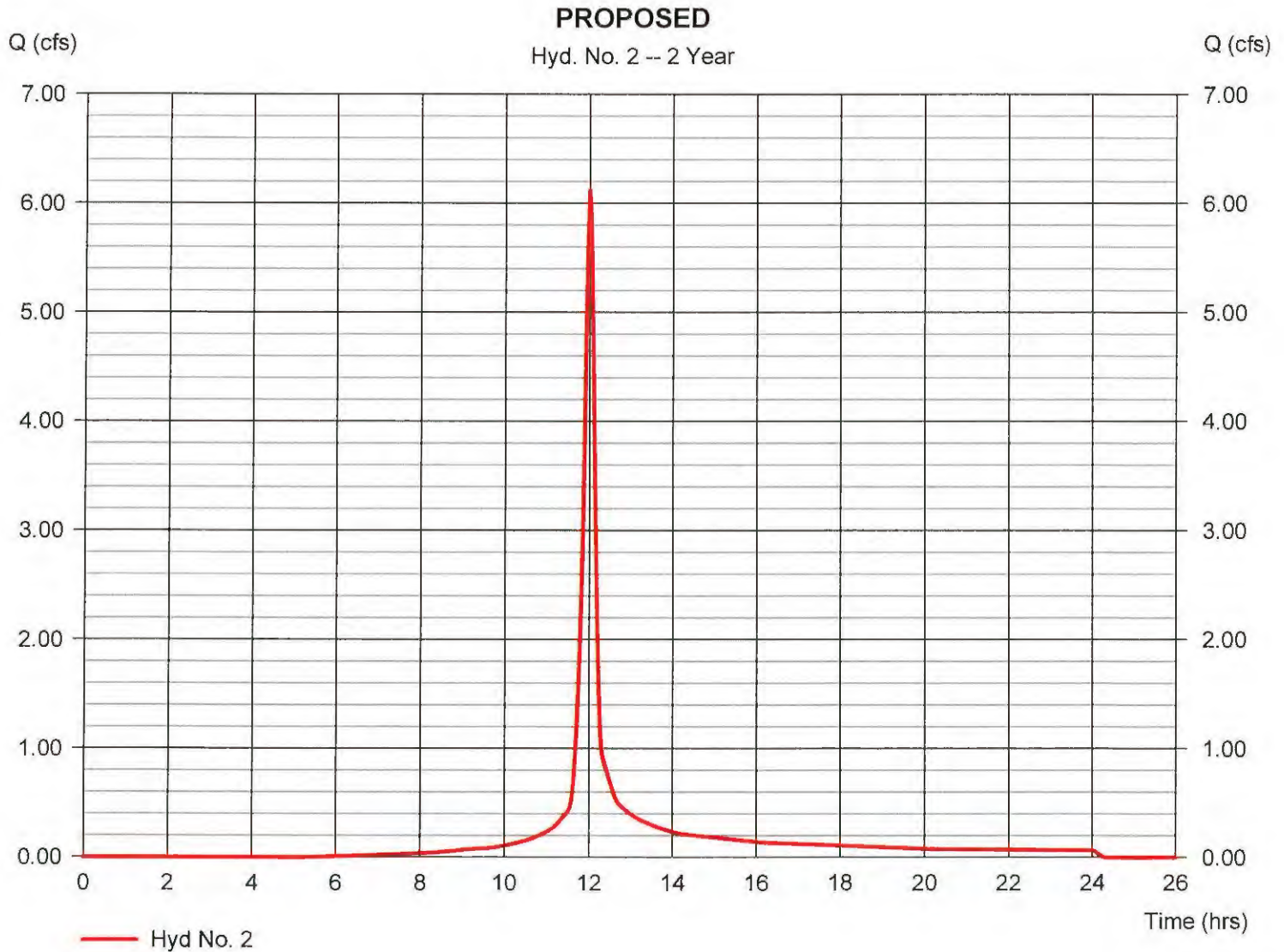
Thursday, 06 / 4 / 2015

## Hyd. No. 2

### PROPOSED

Hydrograph type	= SCS Runoff	Peak discharge	= 6.134 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 16,206 cuft
Drainage area	= 2.000 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.30 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.430 x 98) + (0.570 x 74)] / 2.000



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

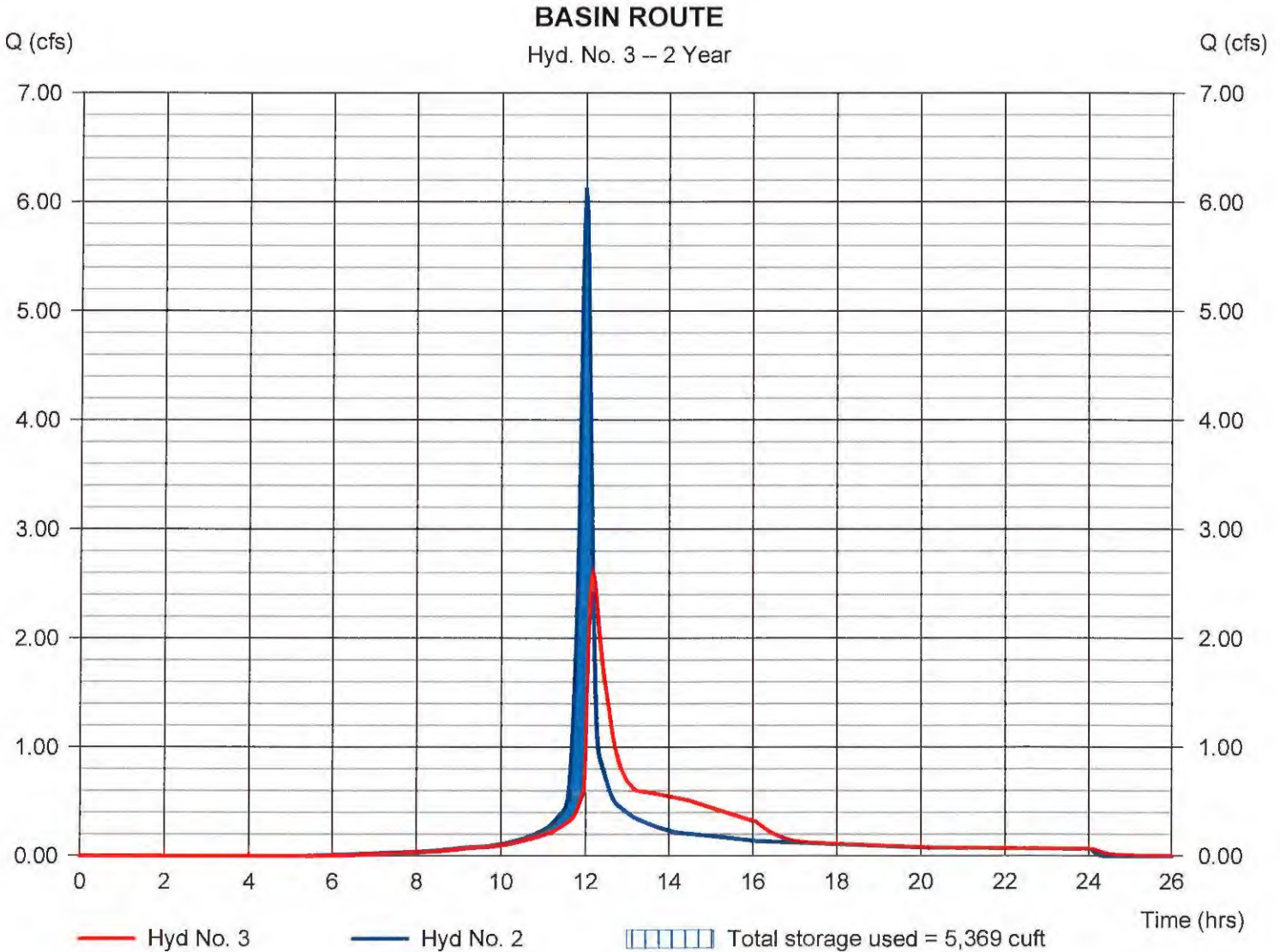
Thursday, 06 / 4 / 2015

## Hyd. No. 3

### BASIN ROUTE

Hydrograph type	= Reservoir	Peak discharge	= 2.603 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 16,203 cuft
Inflow hyd. No.	= 2 - PROPOSED	Max. Elevation	= 560.38 ft
Reservoir name	= DETENTION BASIN	Max. Storage	= 5,369 cuft

Storage Indication method used.



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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
1	SCS Runoff	8.641	2	720	22,404	-----	-----	-----	EXISTING
2	SCS Runoff	12.88	2	720	35,430	-----	-----	-----	PROPOSED
3	Reservoir	8.232	2	728	35,427	2	561.48	9,662	BASIN ROUTE
DETENTION CALCULATIONS SLEEP INN.gpw								Return Period: 25 Year	Thursday, 06 / 4 / 2015



# Hydrograph Report

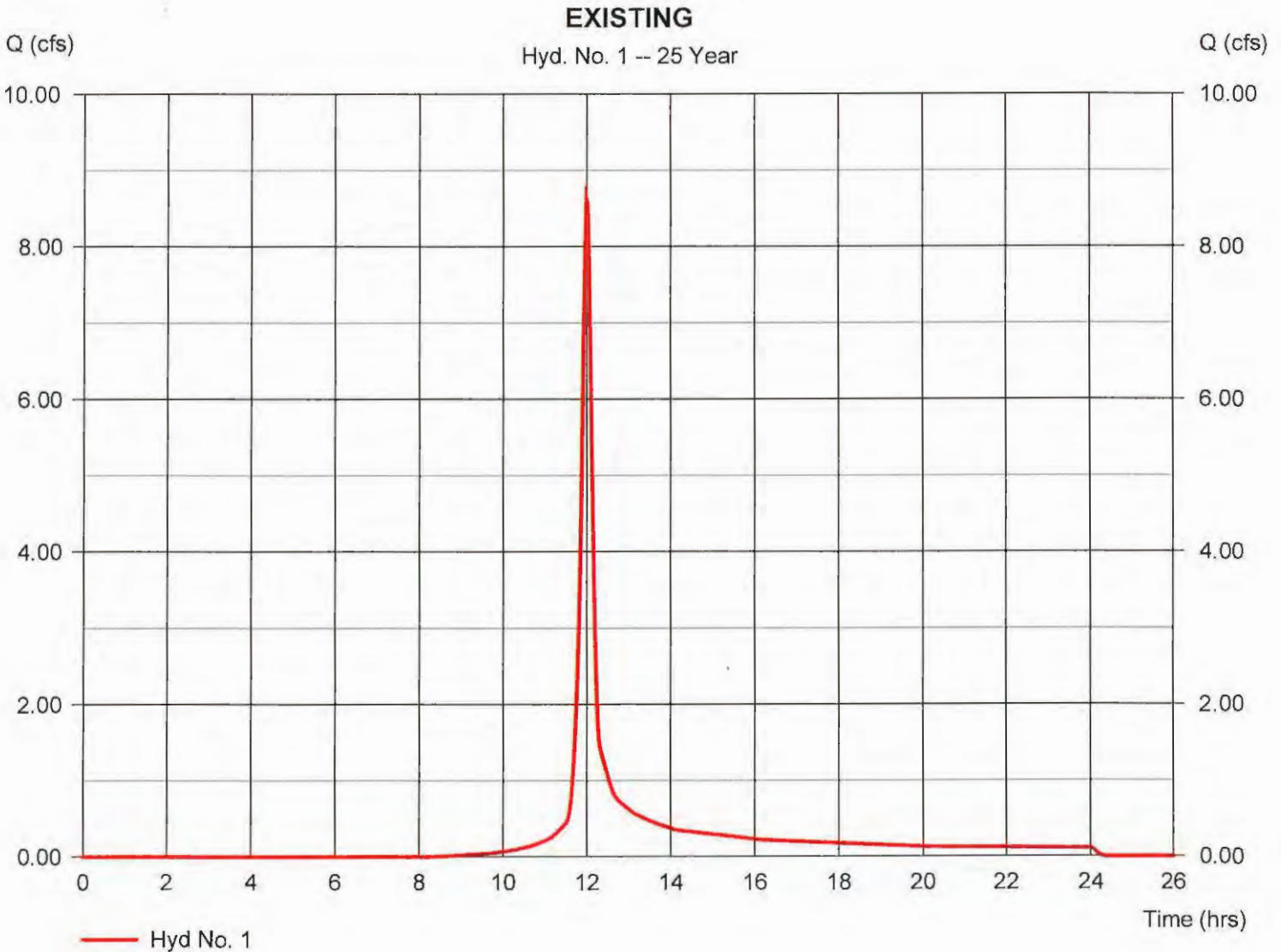
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 06 / 4 / 2015

## Hyd. No. 1

### EXISTING

Hydrograph type	= SCS Runoff	Peak discharge	= 8.641 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 22,404 cuft
Drainage area	= 2.000 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.20 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

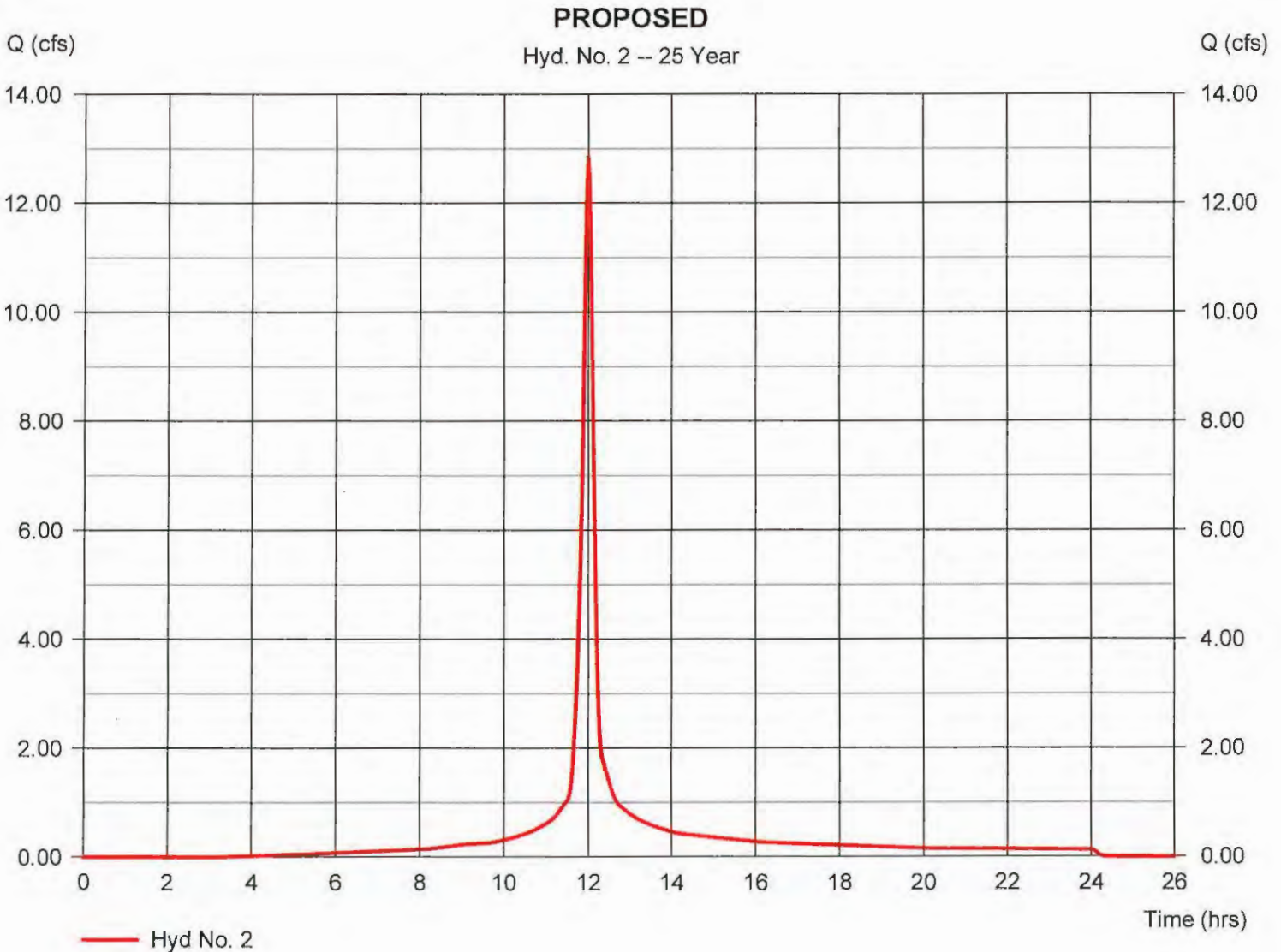
Thursday, 06 / 4 / 2015

## Hyd. No. 2

### PROPOSED

Hydrograph type	= SCS Runoff	Peak discharge	= 12.88 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 35,430 cuft
Drainage area	= 2.000 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.30 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.430 x 98) + (0.570 x 74)] / 2.000



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

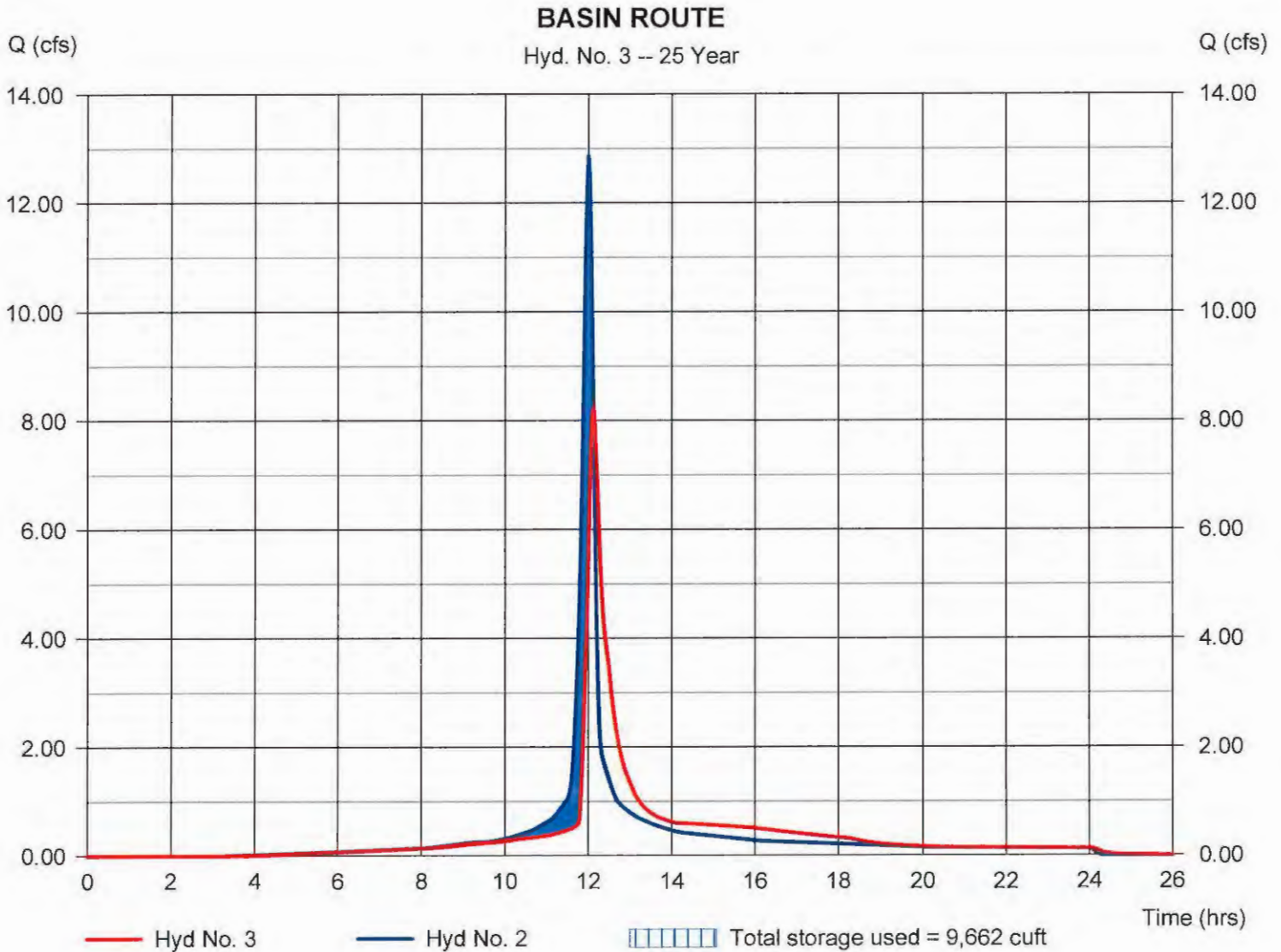
Thursday, 06 / 4 / 2015

## Hyd. No. 3

### BASIN ROUTE

Hydrograph type	= Reservoir	Peak discharge	= 8.232 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 35,427 cuft
Inflow hyd. No.	= 2 - PROPOSED	Max. Elevation	= 561.48 ft
Reservoir name	= DETENTION BASIN	Max. Storage	= 9,662 cuft

Storage Indication method used.





# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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
1	SCS Runoff	12.15	2	720	31,572	-----	-----	-----	EXISTING
2	SCS Runoff	16.45	2	720	45,936	-----	-----	-----	PROPOSED
3	Reservoir	12.06	2	726	45,934	2	561.83	11,335	BASIN ROUTE
DETENTION CALCULATIONS SLEEP INN.gpr								Return Period: 100 Year	Thursday, 06 / 4 / 2015

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 06 / 4 / 2015

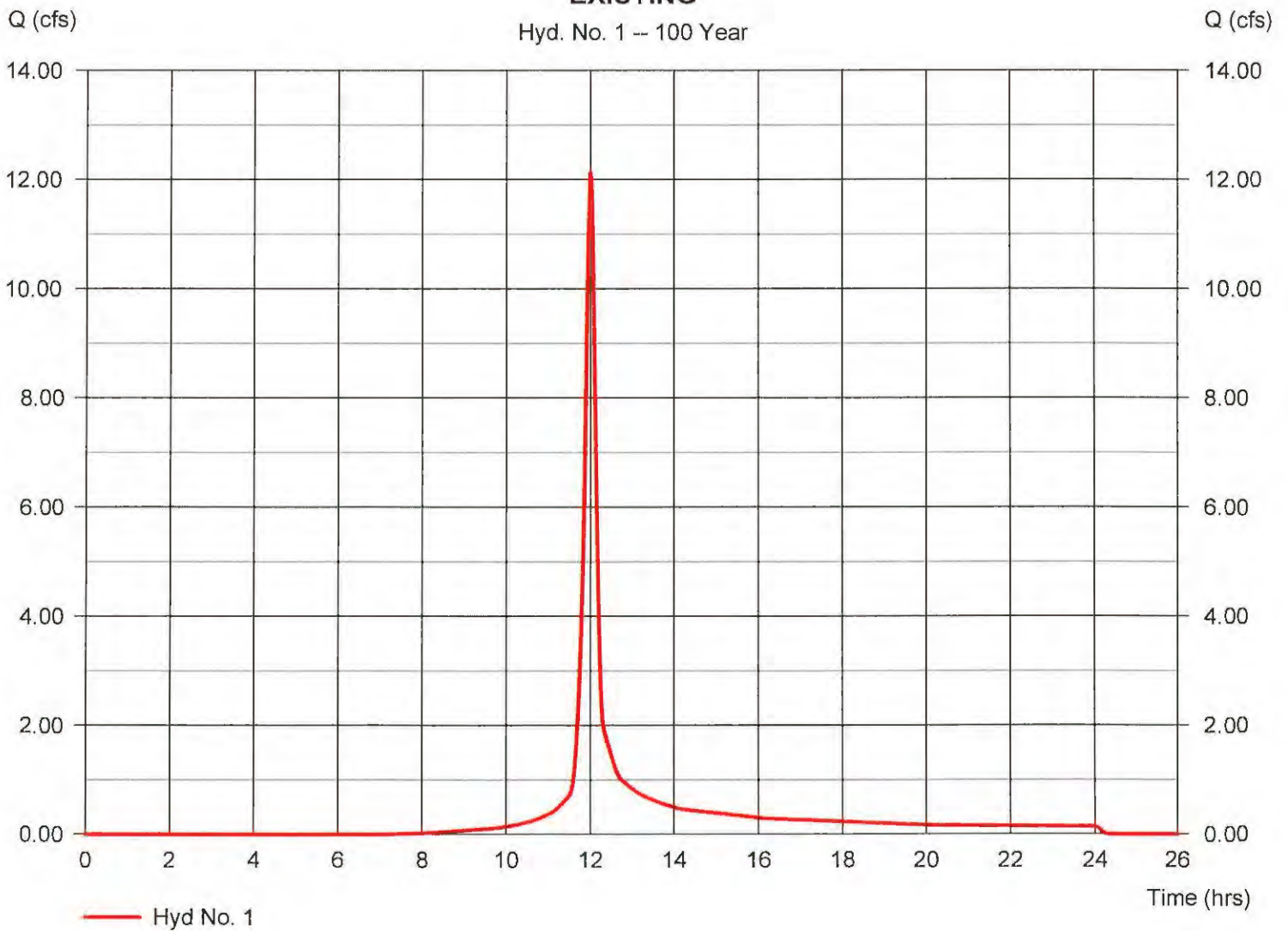
## Hyd. No. 1

### EXISTING

Hydrograph type	= SCS Runoff	Peak discharge	= 12.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 31,572 cuft
Drainage area	= 2.000 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.20 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### EXISTING

Hyd. No. 1 -- 100 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 06 / 4 / 2015

## Hyd. No. 2

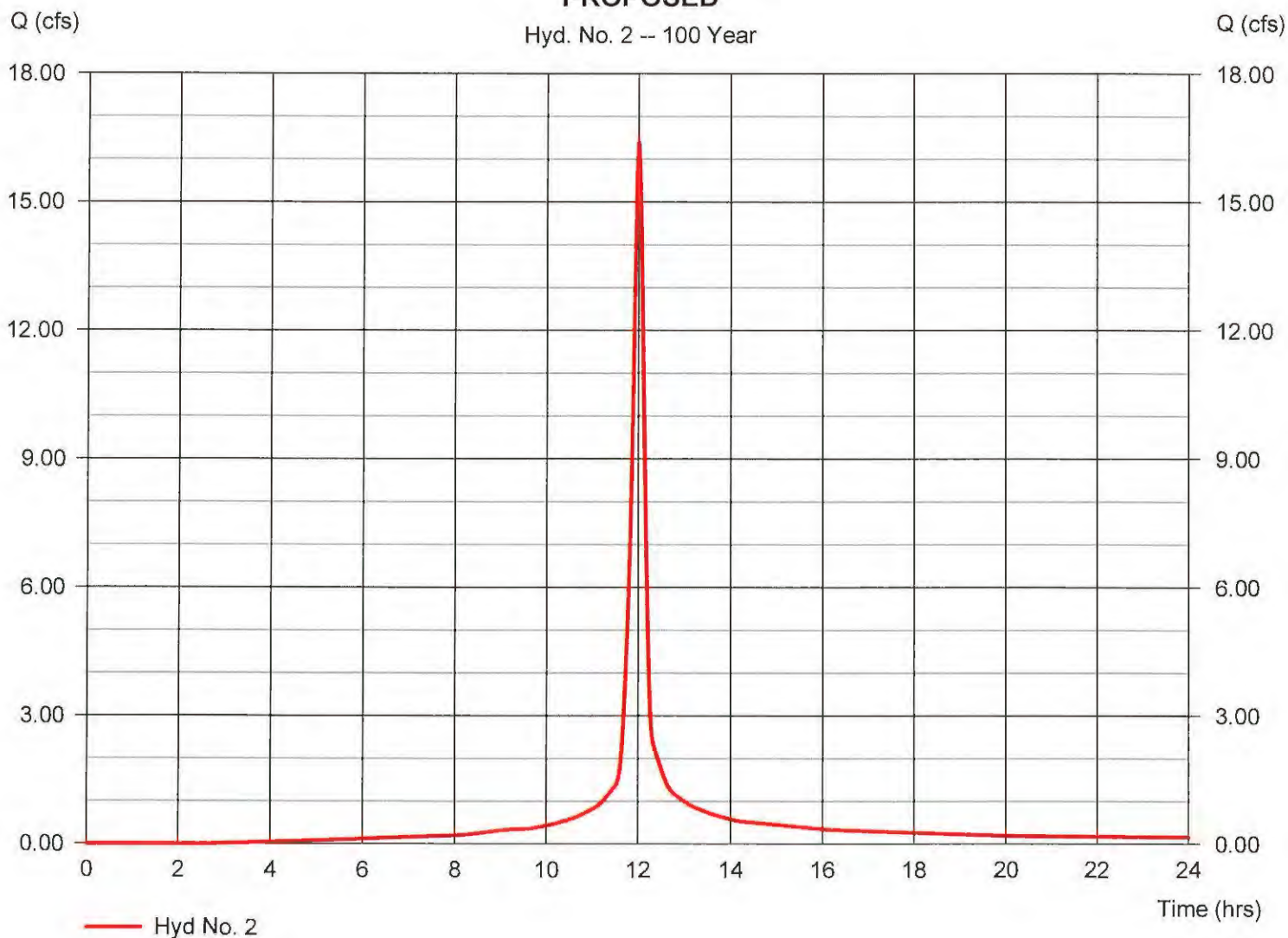
### PROPOSED

Hydrograph type	= SCS Runoff	Peak discharge	= 16.45 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 45,936 cuft
Drainage area	= 2.000 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.30 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.430 x 98) + (0.570 x 74)] / 2.000

### PROPOSED

Hyd. No. 2 -- 100 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

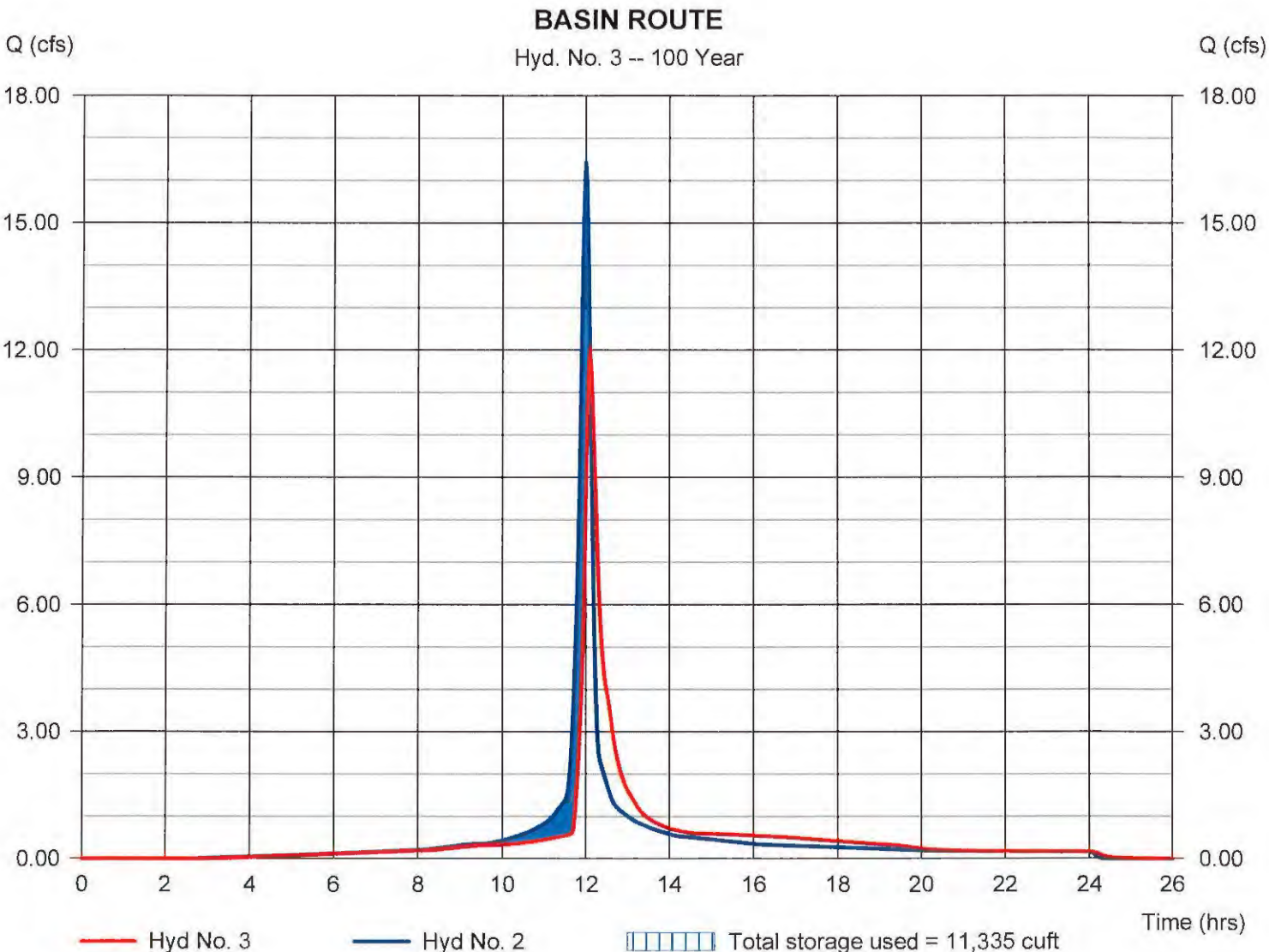
Thursday, 06 / 4 / 2015

## Hyd. No. 3

### BASIN ROUTE

Hydrograph type	= Reservoir	Peak discharge	= 12.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 45,934 cuft
Inflow hyd. No.	= 2 - PROPOSED	Max. Elevation	= 561.83 ft
Reservoir name	= DETENTION BASIN	Max. Storage	= 11,335 cuft

Storage Indication method used.



# Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 06 / 4 / 2015

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	-----
2	48.9472	10.1000	0.8124	-----
3	0.0000	0.0000	0.0000	-----
5	0.0000	0.0000	0.0000	-----
10	0.0000	0.0000	0.0000	-----
25	0.0000	0.0000	0.0000	-----
50	0.0000	0.0000	0.0000	-----
100	0.0000	0.0000	0.0000	-----

File name: SAINT LOUIS.IDF

$$\text{Intensity} = B / (T_c + D)^E$$


Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.39	4.28	3.57	3.08	2.72	2.44	2.22	2.04	1.88	1.76	1.65	1.55
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tc = time in minutes. Values may exceed 60.

AUL17 CALC SPECS AND REPORTS\3 HYDRAULIC AND DETENTION CALCS\REPORT 4.19.2013\STL PCP.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.50	3.10	0.00	3.30	4.25	5.77	6.80	7.20
SCS 6-Hr	0.00	0.00	0.00	0.00	2.60	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	2.75	4.00	0.00	6.50	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	2.80	3.90	0.00	6.00	0.00



 - AREA DRAWS TO BASIN

CALCULATIONS SHOWN BASED ON 15 YEAR, 20 MINUTE STORM  
THIS SHEET IS FOR DRAINAGE PURPOSES ONLY. DO NOT USE THIS PLAN FOR CONSTRUCTION.

PROVIDED WATER QUALITY VOLUME  
THE 1 YEAR 24 HOUR STORM PROVIDES 29,298 CU. FT. OF VOLUME. THEREFORE, AS PART OF THE EXTENDED DETENTION THE DRY DETENTION BASIN MEETS ITS PURPOSE FOR 60% TSS. THE EXISTING GRASS SWALE THAT IS THE OUTFALL FOR THE PROPOSED EXTENDED DETENTION DRY BASIN PROVIDES 40% TSS. THEREFORE THE DEVELOPMENT WILL HAVE 80% TSS REMOVAL BY TREATMENT TRAIN. THE SECOND WATER QUALITY FEATURE BY TREATMENT TRAIN REDUCES TSS BY 50%.

N/F  
DELMAR GARDENS AT PERSIMMON  
POINTE LLC 5862-0113  
RD 3-157E-9442-00-0003  
ZONED C-2 GENERAL BUSINESS

N/F  
MAR GARDENS AT  
MNICH POINTE LLC  
5862-0113  
157E-9442-00-0003  
ED C-2 GENERAL  
BUSINESS

I:\vault\pvc\civil\3D PROJECTS\2014\147401 SLEEP INN OF FALLON\COMMERCIAL\CONSTRUCTION DRAWINGS\18 POST-DEVELOPED DRAINAGE AREA MAP.dwg

SANITARY MH 9879-7  
TOP 563.21  
FLOWLINE 542.92

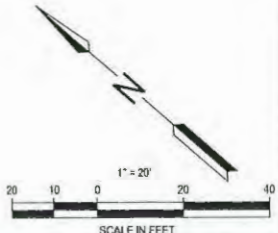
N/F  
MIDAS O'FALLON SS LLC  
6123-0375  
RD 3-157E-9579-00-0003  
ZONED C-2 GENERAL BUSINESS



NOTE:  
Underground utilities and structures have been plotted from available information and therefore, their location must be considered approximate only. It is the responsibility of the individual contractor to notify the utility companies before actual construction.



TECHNOLOGY DRIVE  
(VARIABLE WIDTH)



**SLEEP INN**  
NEW PROJECT FOR  
79 UNIT  
SLEEP INN HOTEL  
1147 TECHNOLOGY DR  
O'FALLON, MO

**SLONE ARCHITECTS**  
1200 E. WOODHURST DR.  
SUITE J-100  
SPRINGFIELD, MO 65804  
P: 417.887.4575  
F: 417.887.5080  
SLONEARCHITECTS.COM

**PREMIER CIVIL ENGINEERING**  
308 TCW Court  
Lake Saint Louis, MO 63387  
Phone: (314) 925-7457  
Missouri Certificate of Authority # E-2011000031  
Missouri Certificate of Authority # LS-2012007849

ENGINEERS AUTHENTICATION  
The undersigned hereby certifies that the design and construction of the project is in accordance with the Missouri Professional Engineering Act and the rules and regulations of the Board of Professional Engineers, Architects, and Surveyors of the State of Missouri.

Developer / Owner Information  
GRANITE HOTELS, LLC  
74 VIA PREMINENTA  
SUNRISE BEACH, MO 65079

POST-DEVELOPED DRAINAGE AREA MAP

P+Z No. 09-15.02 & 09-15.03  
APPROVED 5-7-2015

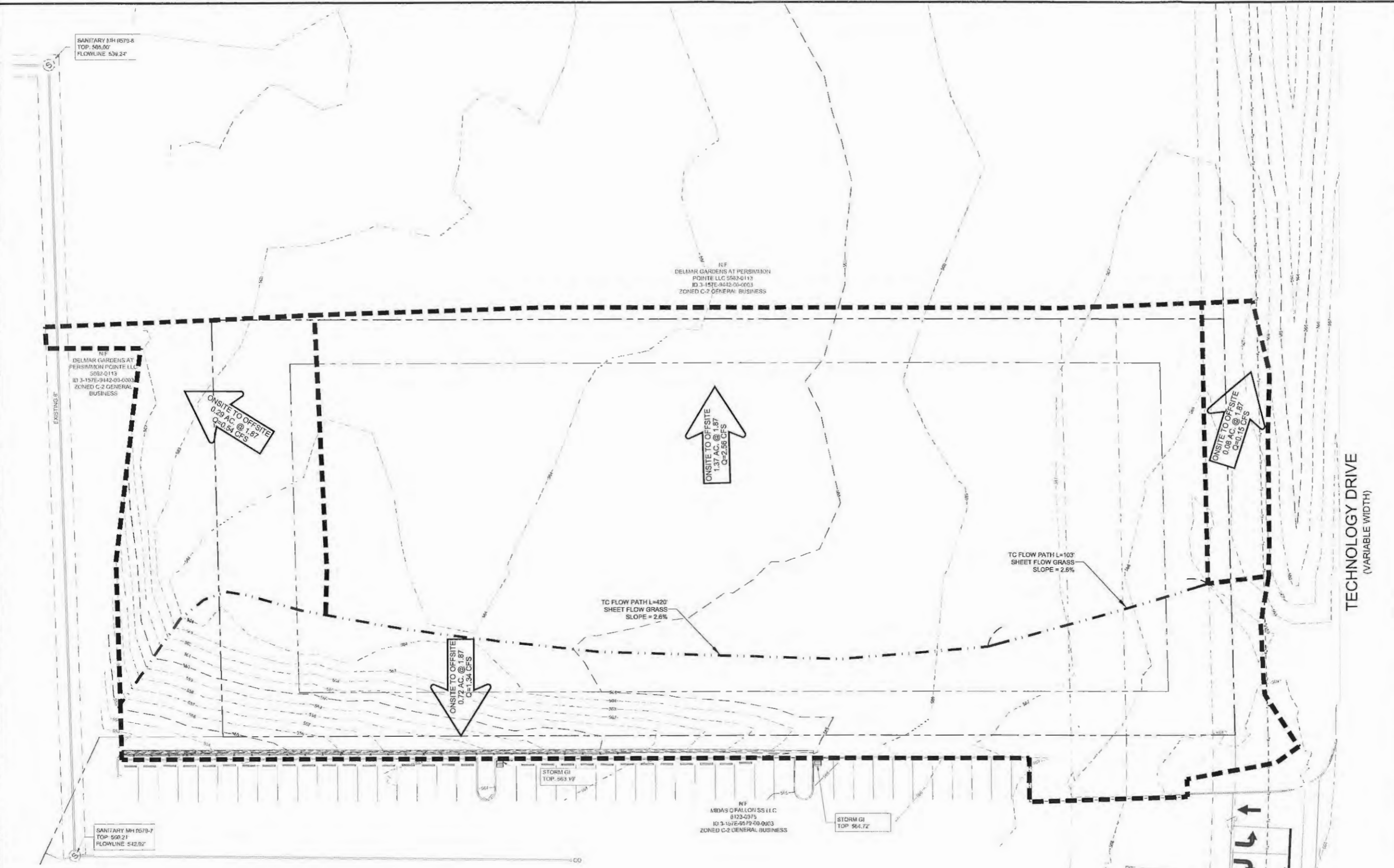
City No. 15-494

Sheet Number:  
18

PCE PROJECT NO. 147401



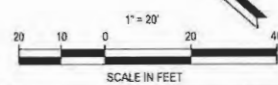
\\vaup-pc\vaup\civil\3D PROJECTS\2014\147401 SLEEP INN OF FALLON\COMMERCIAL\CONSTRUCTION DRAWINGS\17 PRE-DEVELOPED DRAINAGE AREA MAP.dwg



**1-800-DIG-RITE**  
CALL BEFORE YOU DIG!

**NOTE:**  
Underground Utilities and structures have been plotted from available information and therefore, their location must be considered approximate only. It is the responsibility of the individual contractors to notify the utility companies before actual construction.

CALCULATIONS SHOWN BASED ON 15 YEAR, 20 MINUTE STORM  
THIS SHEET IS FOR DRAINAGE PURPOSES ONLY. DO NOT USE THIS PLAN FOR CONSTRUCTION.



<p><b>SLEEP INN</b> NEW PROJECT FOR 79 UNIT SLEEP INN HOTEL 1147 TECHNOLOGY DR OFALLON, MO</p>	
<p><b>SLONE ARCHITECTS</b> ARCHITECTS &amp; ENGINEERS DESIGN 1200 E. WOODBURY DR. SUITE J-100 SPRINGFIELD, MO 65804 P: 417.887.4575 F: 417.887.5050 SLONEARCHITECTS.COM</p>	
<p><b>PREMIER CIVIL ENGINEERING</b> 308 TCW Court Lake Saint Louis, MO 63387 Phone: (314) 925-7444 Fax: (314) 925-7457 Missouri Certificate of Authority # E-2011000031 Missouri Certificate of Authority # LS-2012007846</p>	
<p><b>ENGINEERS AUTHENTICATION</b> The responsibility for professional engineering is held by the engineer or architect who is licensed in the State of Missouri. The engineer or architect who is licensed in the State of Missouri is not responsible for the design or construction of any structure or system which is not designed or constructed in accordance with the Missouri Code of Professional Engineers and Architects.</p>	
<p>STEVE MARSH P.E. ENGINEER PC0004719</p>	
<p><b>Developer / Owner Information</b> GRANITE HOTELS, LLC 74 VIA PREMINENTA SUNRISE BEACH, MO 65079</p>	
<p><b>PRE-DEVELOPED DRAINAGE AREA MAP</b></p>	
<p>P+Z No. 09-15.02 &amp; 09-15.03 APPROVED 5-7-2015</p>	
<p>City No. 15-494</p>	
<p>Sheet Number: <b>17</b> PCE PROJECT NO. 147401</p>	