PRELIMINARY GRADING PLAN

PRE-CONSTRUCTION MEETING: *(Prior to any clearing, grubbing, trenching, grading, or any land disturbances.)*

(CULTURAL RESOURCES)

CULT#GR-1 - ARCHAEOLOGICAL MONITORING - PRECONSTRUCTION MEETING

INTENT: In order to comply with the County of San Diego Guidelines for Significance - Cultural Resources, an Archaeological Monitoring Program shall be implemented. **DESCRIPTION OF REQUIREMENT:** The County approved Project Archaeologist and Luiseño Native American Monitor shall attend the pre-construction meeting with the contractors to explain and coordinate the requirements of the archaeological monitoring program. The Project Archaeologist and Luiseño Native American Monitor shall monitor the original cutting of previously undisturbed deposits in all areas identified for development including off-site improvements. The Project Archaeologist and Luiseño Native American monitor shall also evaluate fill soils to determine that they are clean of cultural resources. The archaeological monitoring program shall comply with the County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements for Cultural Resources. **DOCUMENTATION:** The applicant shall have the contracted Project Archeologist and Luiseño Native American attend the preconstruction meeting to explain the monitoring requirements. **TIMING:** Prior to any clearing, grubbing, trenching, grading, or any land disturbances this condition shall be completed. **MONITORING:** The *[DPW, PDCI]* shall confirm the attendance of the approved Project Archaeologist.

(HAZARDOUS MATERIALS)

HAZ #1-LEAD SURVEY [PDS, FEE X 2]

INTENT: In order to avoid hazards associated with lead based paint (LBP) and lead containing materials (LCM) to mitigate below levels of significance as established in the County of San Diego Hazardous Materials and Existing Contamination Guidelines for Determining Significance, the structure(s) identified on the approved plan set for demolition or remodel shall be surveyed for the presence of LBP/LCM because the structures were built prior to 1980. **DESCRIPTION OF REQUIREMENT:** A facility survey shall be performed to determine the presence or absence of LBP/LCM in the structure(s) identified for demolition or remodel on the approved plan set. The survey shall be completed by a California Department of Health Services (DHS) certified lead inspector/risk assessor to determine the presence or absence of LBP and LCM located in the structure. The following conditions only apply if LBP and LCM are present:

a. All LBP and LCM shall be managed in accordance with applicable regulations including, at a minimum, the hazardous waste disposal requirements (Title 22 California Code of Regulations [CCR] Division 4.5), the worker health and safety requirements (Title 8 California Code of Regulations Section 1532.1), and the State Lead Accreditation, Certification, and Work Practice Requirements (Title 17 CCR Division 1, Chapter 8).

b. All LBP and LCM scheduled for demolition or disturbed during remodeling must comply with applicable regulations for demolition methods and dust suppression.

DOCUMENTATION: The applicant shall submit a letter or report prepared by a California DHS certified lead inspector/risk assessor to the [*DEH HAZ MAT, APCD*], which certifies that there was no LBP/LCM present, or all lead containing materials have been remediated pursuant to applicable regulations. **TIMING:** Prior to grading, applicant shall comply with this condition. **MONITORING:** The [*DEH HAZ MAT, APCD*] shall review the report and any additional evidence for compliance with this condition. The [*PDS, PPD*] shall review the completed and stamped report and any additional evidence for compliance with this condition.

HAZ #2-ASBESTOS SURVEY [PDS, FEE X 2]

INTENT: In order to avoid hazards associated with Asbestos Containing Materials (ACMs) and to mitigate below levels of significance as established by the County of San Diego Hazardous Materials and Existing Contamination Guidelines for Determining Significance, the structure(s) identified on the approved plan set for demolition or remodel shall be surveyed for the presence of ACMs because the structures were built prior to 1980. **DESCRIPTION OF REQUIREMENT:** A facility survey shall be performed to determine the presence or absence of ACMs in the structure(s) identified for demolition or remodel on the approved plan set. Suspect materials that will be disturbed by the demolition or renovation activities shall be sampled and analyzed for asbestos content, or assumed to be asbestos containing. The survey shall be conducted by a person certified by Cal/OSHA pursuant to regulations implementing subdivision (b) of Section 9021.5 of the Labor Code, and shall have taken and passed an EPA-approved Building Inspector Course. If ACMs are found present, they shall be handled and remediated in compliance with the San Diego County Air Pollution Control District Rule 361.145 - Standard for Demolition and Renovation. **DOCUMENTATION:** The applicant shall submit to the [*DEH HAZ MAT, APCD*] a signed, stamped statement from the person certified to complete the facility survey indicating that the survey has been completed and that either regulated asbestos is present or absent. If regulated asbestos is present, the letter shall describe the procedures taken to remediate the hazard and certify that they have been remediated pursuant to code sections referenced above. **TIMING:** Prior to grading, the applicant shall comply with this condition. **MONITORING:** The [*DEH HAZ MAT, APCD*] shall review the report and any additional evidence for compliance with this condition. The [*PDS, PPD*] shall review the completed and stamped report and any additional evidence for compliance with this condition.

HAZ #3-STRUCTURE REMOVAL [PDS, FEE]

INTENT: In order to comply with the proposed project design for PDS2015-TM-5602, the structure(s) identified on the approved plan set shall be remodeled or demolished. **DESCRIPTION OF REQUIREMENT:** The structure(s) shown on the approved plan set shall be remodeled or demolished. A Demolition Permit shall be obtained from *[PDS, BD]*. Compliance with conditions HAZ #1 and HAZ #2, to determine the presence or absence of Lead Containing Materials and Asbestos Containing Materials, shall be completed before the County can issue a Demolition Permit. **DOCUMENTATION:** The applicant shall submit to the [*PDS, PPD*] a signed stamped statement from a registered professional; Engineer, Surveyor, Contractor, which states, that the structures have been removed or demolished. The letter report shall also include before and after pictures of the area and structure. **TIMING:** Prior to grading, the applicant shall comply with this condition. **MONITORING:** The [*PDS, PPD*] shall review the statement and, photos, and any additional evidence for compliance with this condition.

DURING CONTRUCTION: *(The following actions shall occur throughout the duration of the grading construction).*

(CULTURAL RESOURCES)

CULT#GR-2 - ARCHAEOLOGICAL MONITORING - DURING CONSTRUCTION

INTENT: In order to comply with the County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements for Cultural Resources, a Cultural Resource Grading Monitoring Program shall be implemented. **DESCRIPTION OF REQUIREMENT:** The Project Archaeologist and Luiseño Native American Monitor shall monitor the original cutting of previously undisturbed deposits in all areas identified for development including off-site improvements. The archaeological monitoring program shall comply with the following requirements during earth-disturbing activities:

a. Monitoring. During the original cutting of previously undisturbed deposits, the Project Archaeologist and Luiseño Native American Monitor shall be onsite as determined necessary by the Project Archaeologist. Inspections will vary based on the rate of excavation, the materials excavated, and the presence and abundance of artifacts and features. The frequency and location of inspections will be determined by the Project Archaeologist in consultation with the Luiseño Native American Monitor. Monitoring of the cutting of previously disturbed deposits will be determined by the Project Archaeologist in consultation with the Luiseño Native American Monitor.

b. Inadvertent Discoveries. In the event that previously unidentified potentially significant cultural resources are discovered:

1. The Project Archaeologist or the Luiseño Native American monitor shall have the authority to divert or temporarily halt ground disturbance operations in the area of discovery to allow evaluation of potentially significant cultural resources.
2. At the time of discovery, the Project Archaeologist shall contact the PDS Staff Archaeologist.
3. The Project Archaeologist, in consultation with the PDS Staff Archaeologist and the Luiseño Native American Monitor, shall determine the significance of the discovered resources.
4. Construction activities will be allowed to resume in the affected area only after the PDS Staff Archaeologist has concurred with the evaluation.

b. Inadvertent Discoveries. In the event that previously unidentified potentially

5. Isolates and clearly non-significant deposits shall be minimally documented in the field. Should the isolates and/or non-significant deposits not be collected by the Project Archaeologist, then the Luiseño Native American monitor may collect the cultural material for transfer to a Tribal Curation facility or repatriation program.
6. If cultural resources are determined to be significant, a Research Design and Data Recovery Program (Program) shall be prepared by the Project Archaeologist in consultation with the Luiseño Native American Monitor. The County Archaeologist shall review and approve the Program, which shall be carried out using professional archaeological methods. The Program shall include (1) reasonable efforts to preserve (avoidance) "unique" cultural resources or Sacred Sites; (2) the capping of identified Sacred Sites or unique cultural resources and placement of development over the cap, if avoidance is infeasible; and (3) data recovery for non-unique cultural resources. The preferred option is preservation (avoidance).

c. Human Remains. If any human remains are discovered:

1. The Property Owner or their representative shall contact the County Coroner and the PDS Staff Archaeologist.
2. Upon identification of human remains, no further disturbance shall occur in the area of the find until the forensic anthropologist appointed by the San Diego County Medical Examiner's Office has made the necessary findings as to origin. Treatment of human remains for evaluation should be decided upon through consultation between the Luiseño Native American monitor and forensic anthropologist. If the human remains are to be taken offsite for evaluation, they shall be accompanied by the Luiseño Native American monitor.
3. If the remains are determined to be of Native American origin, the NAHC shall immediately contact the Most Likely Descendant (MLD).
4. The immediate vicinity where the Native American human remains are located is not to be damaged or disturbed by further development activity until consultation with the MLD regarding their recommendations as required by Public Resources Code Section 5097.98 has been conducted.
5. The MLD may with the permission of the landowner, or their authorized representative, inspect the site of the discovery of the Native American human remains and may recommend to the owner or the person responsible for the excavation work means for treatment or disposition, with appropriate dignity, of the human remains and any associated grave goods. The descendants shall complete their inspection and make recommendations or preferences for treatment within 48 hours of being granted access to the site.
6. Public Resources Code §5097.98, CEQA §15064.5 and Health & Safety Code §7050.5 shall be followed in the event that human remains are discovered.

d. Fill Soils. The Project Archaeologist and Luiseño Native American monitor shall evaluate fill soils to determine that they are clean of cultural resources.

e. Disagreements. The County Archaeologist shall make a determination for any disagreements between the Project Archaeologist and the Luiseño Native American monitor related to archaeological monitoring.

DOCUMENTATION: The applicant shall implement the Archaeological Monitoring Program pursuant to this condition. **TIMING:** The following actions shall occur throughout the duration of the earth disturbing activities. **MONITORING:** The *[DPW, PDCI]* shall make sure that the Project Archeologist is on-site performing the monitoring duties of this condition. The *[DPW, PDCI]* shall contact the *[PDS, PPD]* if the Project Archeologist or applicant fails to comply with this condition.

(PALEONTOLOGICAL RESOURCES)

PALEO#GR-1 PALEONTOLOGICAL MONITORING

INTENT: In order to comply with Mitigation Monitoring and Reporting Program pursuant to PDS2015-TM-5602, a Paleontological Monitoring Program shall be implemented. **DESCRIPTION OF REQUIREMENT:** This project site has marginal levels of sensitive Paleontological resources. All grading activities are subject to the County of San Diego Grading Ordinance Section 87.430, if any significant resources (Fossils) are encountered during grading activities.

a. The grading contractor is responsible to monitor for paleontological resources during all grading activities. If any fossils are found greater than 12 inches in any dimension, stop all grading activities and contact PDS before continuing grading operations.

b. If any paleontological resources are discovered and salvaged, the monitoring, recovery, and subsequent work determined necessary shall be completed by or under the supervision of a Qualified Paleontologist pursuant to the San Diego County Guidelines for Determining Significance for Paleontological Resources.

TIMING: The following actions shall occur throughout the duration of the grading construction. **MONITORING:** The [*DPW, PDCI*] shall make sure that the grading contractor is on-site performing the Monitoring duties of this condition. The [*DPW, PDCI*] shall contact PDS if the grading contractor or applicant fails to comply with this condition.

(NOISE)

GP#1, TEMPORARY CONSTRUCTION NOISE: [DPW, PDCI].

INTENT: In order to minimize temporary construction noise for grading operations associated with the project subdivision and to comply with the County Noise Ordinance Section 36.408 and 36.409. **DESCRIPTION OF REQUIREMENT:** The project shall comply with the following temporary construction noise control measures:

a. Turn off equipment when not in use.

b. Equipment used in construction should be maintained in proper operating condition, and all loads should be properly secured, to prevent rattling and banging.

c. Use equipment with effective mufflers

d. Minimize the use of back up alarm.

e. Equipment staging areas should be placed at locations away from noise sensitive receivers.

f. Operations and activities shall comply with the County Noise Ordinance.

g. Any construction equipment work operating for a long period of time along a sensitive occupied property shall incorporate noise reducing measures such as reduction of construction equipment activities. For example, equipment would be reduced to operate 45 minutes, 30 minutes, 15 minutes out of the hour and/or any duration that demonstrates Noise Ordinance compliance.

DOCUMENTATION: The applicant shall comply with the temporary construction noise measures of this condition. **TIMING:** The following actions shall occur throughout the duration of the grading construction. **MONITORING:** The [*DPW, PDCI*] shall make sure that the grading contractor complies with the construction noise control measures of this condition. The [*DPW, PDCI*] shall contact the [*PDS, PCC*] if the applicant fails to comply with this condition.

ROUGH GRADING: *(Prior to rough grading approval and issuance of any building permit).*

(CULTURAL RESOURCES)

CULT#GR-3 - ARCHAEOLOGICAL MONITORING - ROUGH GRADING

INTENT: In order to comply with the County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements for Cultural Resources, an Archaeological Monitoring Program shall be implemented. **DESCRIPTION OF REQUIREMENT:** The Project Archaeologist shall prepare one of the following reports upon completion of the earth-disturbing activities that require monitoring:

a. **No Archaeological Resources Encountered.** If no archaeological resources are encountered during earth-disturbing activities, then submit a final Negative Monitoring Report substantiating that earth-disturbing activities are completed and no cultural resources were encountered. Archaeological monitoring logs showing the date and time that the monitor was on site and any comments from the Native American Monitor must be included in the Negative Monitoring Report.

b. **Archaeological Resources Encountered.** If archaeological resources were encountered during the earth disturbing activities, the Project Archaeologist shall provide an Archaeological Monitoring Report stating that the field monitoring activities have been completed, and that resources have been encountered. The report shall detail all cultural artifacts and deposits discovered during monitoring and the anticipated time schedule for completion of the curation and/or repatriation phase of the monitoring.

DOCUMENTATION: The applicant shall submit the Archaeological Monitoring Report to *[PDS, PPD]* for review and approval. Once approved, a final copy of the report shall be submitted to the South Coastal Information Center and any culturally-affiliated Tribe who requests a copy. **TIMING:** Upon completion of all earth-disturbing activities, and prior to Rough Grading Final Inspection (Grading Ordinance SEC 87.421.a.2), the report shall be completed. **MONITORING:** *[PDS, PPD]* shall review the report or field monitoring memo for compliance with the project MMRP, and inform *[DPW, PDCI]* that the requirement is completed.

(PALEONTOLOGICAL RESOURCES)

PALEO#GR-2 PALEONTOLOGICAL MONITORING

INTENT: In order to comply with the adopted Mitigation Monitoring and Reporting Program (MMRP) pursuant to PDS2015-TM-5602, and the County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements for Paleontological Resources, a Paleontological Monitoring Program shall be implemented. **DESCRIPTION OF REQUIREMENT:** One of the following letters shall be performed upon completion of the grading activities that require monitoring:

a. If no paleontological resources were discovered, submit a "No Fossils Found" letter from the grading contractor to PDS stating that the monitoring has been completed and that no fossils were discovered, and including the names and signatures from the fossil monitors. The letter shall be in the format of Attachment E of the County of San Diego Guidelines for Determining Significance for Paleontological Resources.

b. If paleontological resources were encountered during grading, a letter shall be prepared stating that the field grading monitoring activities have been completed, and that resources have been encountered. The letter shall detail the anticipated time schedule for completion of the curation phase of the monitoring.

DOCUMENTATION: The applicant shall submit the letter report to PDS for review and approval. **TIMING:** Upon completion of all grading activities, and prior to Rough Grading Final Inspection (Grading Ordinance SEC 87.421.a.2), the letter report shall be completed. **MONITORING:** PDS shall review the final negative letter report or field monitoring memo for compliance with the project MMRP, and inform *[DPW, PDCI]* that the requirement is completed.

FINAL GRADING RELEASE: *(Prior to any occupancy, final grading release, or use of the premises in reliance of this permit).*

(CULTURAL RESOURCES)

CULT#GR-4 - ARCHAEOLOGICAL MONITORING - FINAL GRADING

INTENT: In order to comply with the County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements for Cultural Resources, an Archaeological Monitoring Program shall be implemented. **DESCRIPTION OF REQUIREMENT:** The Project Archaeologist shall prepare a final report that documents the results, analysis, and conclusions of all phases of the Archaeological Monitoring Program if cultural resources were encountered during earth-disturbing activities. The report shall include the following, if applicable:

a. Department of Parks and Recreation Primary and Archaeological Site forms.

b. Daily Monitoring Logs

c. Evidence that all cultural materials have been curated and/or repatriated as follows:

(1) Evidence that all prehistoric materials collected during the archaeological monitoring program have been submitted to a San Diego curation facility or a culturally affiliated Native American Tribal curation facility that meets federal standards per 36 CFR Part 79, and, therefore, would be professionally curated and made available to other archaeologists/researchers for further study. The collections and associated records, including title, shall be transferred to the San Diego curation facility or culturally affiliated Native American Tribal curation facility and shall be accompanied by payment of the fees necessary for permanent curation. Evidence shall be in the form of a letter from the curation facility stating that the prehistoric archaeological materials have been received and that all fees have been paid.

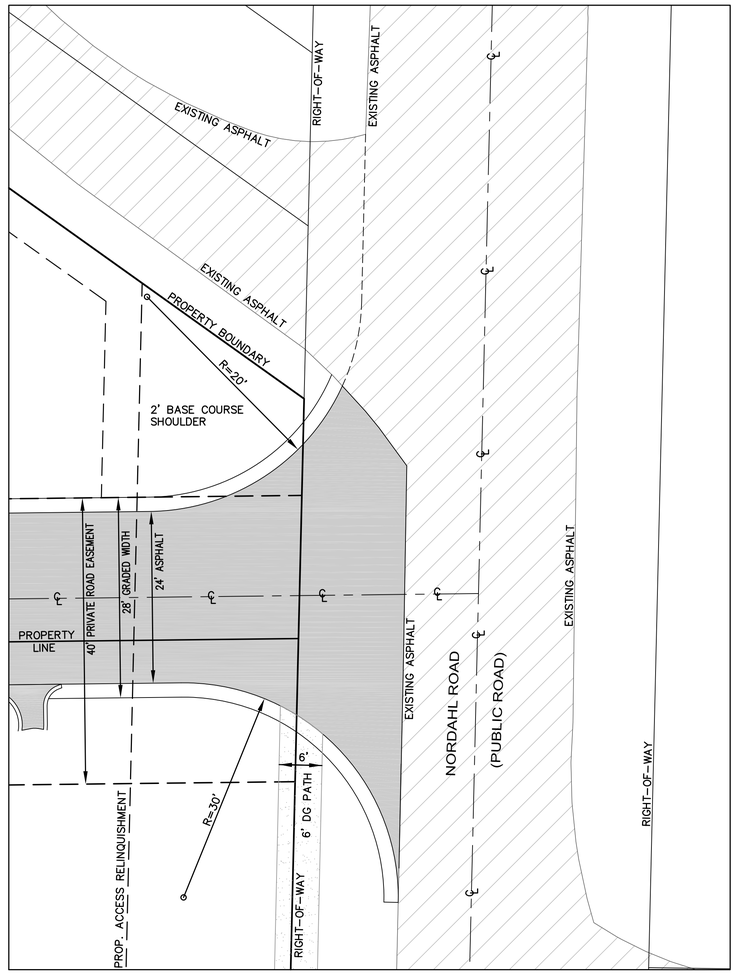
or

Evidence that all prehistoric materials collected during the grading monitoring program have been repatriated to a Native American group of appropriate tribal affinity and shall be accompanied by payment of the fees necessary, if required. Evidence shall be in the form of a letter from the Native American tribe to whom the cultural resources have been repatriated identifying that the archaeological materials have been received.

(2) Historic materials shall be curated at a San Diego curation facility and shall not be curated at a Tribal curation facility or repatriated. The collections and associated records, including title, shall be transferred to the San Diego curation facility and shall be accompanied by payment of the fees necessary for permanent curation. Evidence shall be in the form of a letter from the curation facility stating that the historic materials have been received and that all fees have been paid.

d. If no cultural resources are discovered, a Negative Monitoring Report must be submitted stating that the archaeological monitoring activities have been completed. Grading Monitoring Logs must be submitted with the negative monitoring report.

DOCUMENTATION: The applicant's archaeologist shall prepare the final report and submit it to *[PDS, PPD]* for approval. Once approved, a final copy of the report shall be submitted to the South Coastal Information Center (SCIC) and any culturally-affiliated Tribe who requests a copy. **TIMING:** Prior to any occupancy, final grading release, or use of the premises in reliance of this permit, the final report shall be prepared. **MONITORING:** *[PDS, PPD]* shall review the final report for compliance with this condition and the report format guidelines. Upon acceptance of the report, *[PDS, PPD]* shall inform *[PDS, LDR]* and *[DPW, PDCI]*, that the requirement is complete and the bond amount can be relinquished. If the monitoring was bonded separately, then *[PDS, PPD]* shall inform *[PDS or DPW FISCAL]* to release the bond back to the applicant.



PRIVATE ROAD INTERSECTION EXHIBIT

LEE C. WHITTINGTON R.C.E. 82332 EXP 3-31-20 DATE

SWEETWATER ENGINEERING LLC
Civil Engineering, Land Development Services
4476 Saratoga Av, San Diego, CA 92107
Ph:(619) 381-7080 Sweetwater-engineering.com

REGISTERED PROFESSIONAL ENGINEER
LEE C. WHITTINGTON
No. C 82332
CIVIL
STATE OF CALIFORNIA

SECTION 2

SWEETWATER ENGINEERING

Preliminary Drainage Study

Nordahl Tentative Map
(TM 5602)

RECORD ID: PDS2015-TM-5602
ENV. LOG NO.: PDS2015-ER-15-08-008
APN: 226-290-01

Prepared for:
Marie Diaz
Tellier Family Trust
4364 Bonita Road #483
Bonita, CA 91902
619-972-7839

01/17/2018

Prepared By:
Lee C. Whittington, RCE 82332
Sweetwater Engineering
8070 Rancho Fanita Drive
Santee, CA 92071
619-381-7080
619-368-7605

Table of Contents

SECTION 1

Introduction:
This Preliminary Drainage Study was prepared for the Nordahl Tentative Map (PDS2015-TM-5602) a 15-lot project (see the reduced Tentative Map and Preliminary Grading Plan in the following pages). The site encompasses approximately 3.80 acres and is located west of Nordahl Road in an unincorporated area just west of Escondido, CA. See Vicinity Map.

Pre-developed Condition:

The Pre-developed property has one existing residential house and a long-paved driveway located along the southern side of the property. The Pre-developed condition the stormwater runoff is directed to two discharge locations. Discharge point 1 is located at the Southwest corner of the property where an existing brow ditch directs runoff offsite. Discharge point 2 is located at the Southeast corner of the property where runoff is directed along the roadside dich of Nordahl Road which continues to flow in the Southeast direction along Nordahl Rd. Basin A is the drainage area that flows to Discharge point 1, it is comprised of type C soils and moderate to steep slopes and mostly pervious natural terrain with a small impervious area from the existing building on the site and the adjacent single family homes to the north. Basin B is the drainage area of the site that contributes runoff to Discharge point 2, it is comprised type C & D soils and has moderate to steep slopes and mostly pervious natural terrain with some impervious area from the existing house and asphalt driveway located on site.

Proposed Condition:

In the Post-developed condition, the existing house and driveway will be removed and replaced with 15 single family residential lots and a private drive. The drainage basins remain essentially the same with only minor changes to the top of the basin areas due to the proposed grading. The minor variations in basin sizes are due to directing drainage down lot lines instead of diagonally across the top of hill area, in order to prevent cross lot drainage. Runoff for the most part will be directed to the private drive and directed to the Bioretention ponds via. AC dikes along the road. The curve number is assumed to be medium density residential 7.3 DU/Ac. (see Table 3-1 in Section 4).

Methodology:
The pre and post-developed basins were developed from existing and proposed contour elevations. The Rational Method was utilized to determine the peak flows for the 2-year, 10-year and 100-year rainfall events. The RickRatHydro softwater was utilized to convert the rational method results into SCS Hydrograph data tables. The data was input into the Autocad Hydroflow Hydrographs Extension Software to develop hydrograph charts and to rout the outflow through the detention pond in order to size the pond for flood control. It should be noted that the ponds sections utilized in these calculations assumed that the pond areas and volumes utilized for Water Quality where not available for flood control. So, total pond areas and volumes equal flood control plus water quality areas and volumes.

Conclusion / Summary:

Due to the proposed improvements, the drainage patterns, flow velocity and flow rates will have a slight increase from those which occur in the Pre-developed condition. The increased flow rates will be retained and released below pre-developed flowrates via the use of Bio-retention ponds. Which will also double as treatment for water quality.

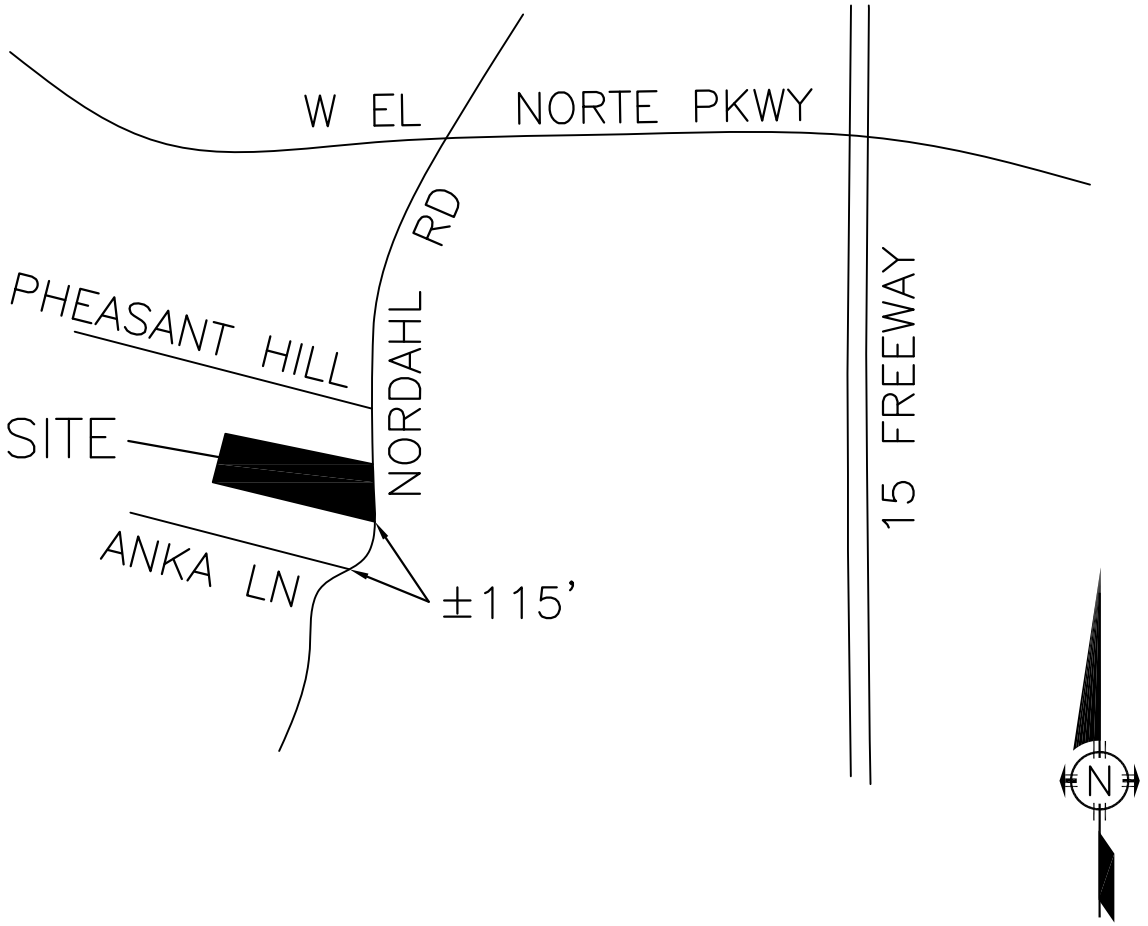
DECLARATION OF RESPONSIBLE CHARGE

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT. THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN DIEGO AND THE HELIX WATER DISTRICT ARE CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

01/17/2018

LEE C. WHITTINGTON, RCE 82332 DATE



VICINITY MAP

NO SCALE

THOMAS BRO. MAP PG. 1109-E7

NORDAHL ROAD

PRE-DEVELOPMENT DRAINAGE MAP

BASIN BOUNDARY

BASIN "A"
AREA = 2.334 AC.

BASIN "B"
AREA = 2.394 AC.

DISCHARGE POINT 1

DISCHARGE POINT 2

BASIN BOUNDARY

BASIN BOUNDARY

T1 = 8.1 min
L = 100'

T2 = 8.7 min
L = 100'

T1 = 8.1 min
L = 100'

T2 = 1.9 min
L = 358'

T1 = 3.1 min
L = 645'

SOILS TYPE "C"

SOILS TYPE "D"

780

770

760

790

780

770

790

780

760

750

0 60 120

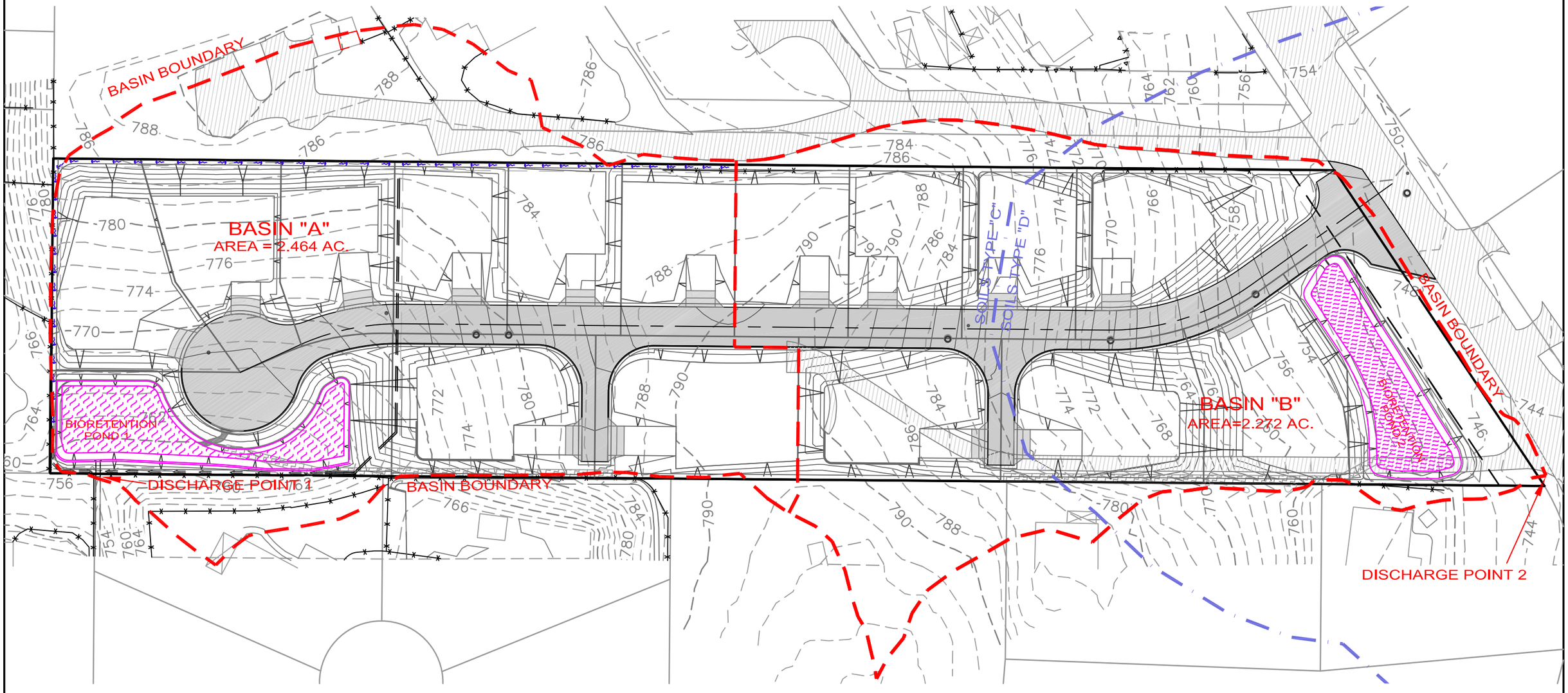
SCALE: 1" = 60'

SWEETWATER ENGINEERING
Civil Engineering, Land Development Services
8070 Rancho Fanita, Santee, CA 92071
PH: (970) 471-5792 or (619) 368-7605

C:\Civil 3D Projects\14006-Nordahl\DWG\14006-Nordal Drainage.dwg, 3/24/2015 1:11:46 PM

NORDAHL ROAD

POST-DEVELOPMENT DRAINAGE MAP



0 60 120

SCALE: 1" = 60'

SWEETWATER ENGINEERING
Civil Engineering, Land Development Services
4476 Saratoga Av, San Diego, CA 92107
PH: (970) 471-5792 Sweetwater-engineering.com

SECTION 2

SWEETWATER ENGINEERING

PROJECT NAME: **Nordahl Rd.**

BASIN NO. **Basin "A" Pre-Development**

Total Basin Area "A" = **2.334** Ac.

Soils Type: **"C"**

Runoff Coefficient C = **0.37**

Impervious Area = 0.264

Impervious area% = 11.31%

C = 0.90(imp area%) + Cp (1- imp area%)

Cp = Natural C = 0.30

Rainfall Event	2 year	10 year	100 year
6 Hour Precipitation:	1.5	2.2	3.4
24 Hour Precipitation:	2.5	3.8	6.3
P6/P24 % =	60.00%	57.89%	53.97%
Adjusted P6:	1.5	2.2	3.4

2 yr Intensity I = **2.39** in/hr

10 yr Intensity I = **3.51** in/hr

100 yr Intensity I = **5.42** in/hr

I = 7.44 P6 Tc^-0.645

Initial Time of Concentration Ti = 8.7 Min. From Table 3-2 see attached

Oveland Travel Time = 0.036 hrs = 2.18 Min. T1 =(11.9 L^3/ΔE)^0.385

Were L = 408 ft = 0.08 Miles

ΔE = 30

Time of Concentration T 10.88 Min.

Runoff Flowrate Q = C I A

Q 2yr = **2.20** CFS

Q 10yr = **3.03** CFS

Q 100yr = **4.54** CFS

RUN DATE 1/13/2018
HYDROGRAPH FILE NAME Text1 Basin A, 2yr Pre-Developed Hydrograph Results
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 1.5 INCHES
BASIN AREA 2.334 ACRES
RUNOFF COEFFICIENT 0.37
PEAK DISCHARGE 2.2 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.1
TIME (MIN) = 22	DISCHARGE (CFS) = 0.1
TIME (MIN) = 33	DISCHARGE (CFS) = 0.1
TIME (MIN) = 44	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 66	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 88	DISCHARGE (CFS) = 0.1
TIME (MIN) = 99	DISCHARGE (CFS) = 0.1
TIME (MIN) = 110	DISCHARGE (CFS) = 0.1
TIME (MIN) = 121	DISCHARGE (CFS) = 0.1
TIME (MIN) = 132	DISCHARGE (CFS) = 0.1
TIME (MIN) = 143	DISCHARGE (CFS) = 0.1
TIME (MIN) = 154	DISCHARGE (CFS) = 0.1
TIME (MIN) = 165	DISCHARGE (CFS) = 0.2
TIME (MIN) = 176	DISCHARGE (CFS) = 0.2
TIME (MIN) = 187	DISCHARGE (CFS) = 0.2
TIME (MIN) = 198	DISCHARGE (CFS) = 0.2
TIME (MIN) = 209	DISCHARGE (CFS) = 0.2
TIME (MIN) = 220	DISCHARGE (CFS) = 0.3
TIME (MIN) = 231	DISCHARGE (CFS) = 0.4
TIME (MIN) = 242	DISCHARGE (CFS) = 0.4
TIME (MIN) = 253	DISCHARGE (CFS) = 2.2
TIME (MIN) = 264	DISCHARGE (CFS) = 0.3
TIME (MIN) = 275	DISCHARGE (CFS) = 0.2
TIME (MIN) = 286	DISCHARGE (CFS) = 0.2
TIME (MIN) = 297	DISCHARGE (CFS) = 0.1
TIME (MIN) = 308	DISCHARGE (CFS) = 0.1
TIME (MIN) = 319	DISCHARGE (CFS) = 0.1
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 341	DISCHARGE (CFS) = 0.1
TIME (MIN) = 352	DISCHARGE (CFS) = 0.1
TIME (MIN) = 363	DISCHARGE (CFS) = 0.1
TIME (MIN) = 374	DISCHARGE (CFS) = 0

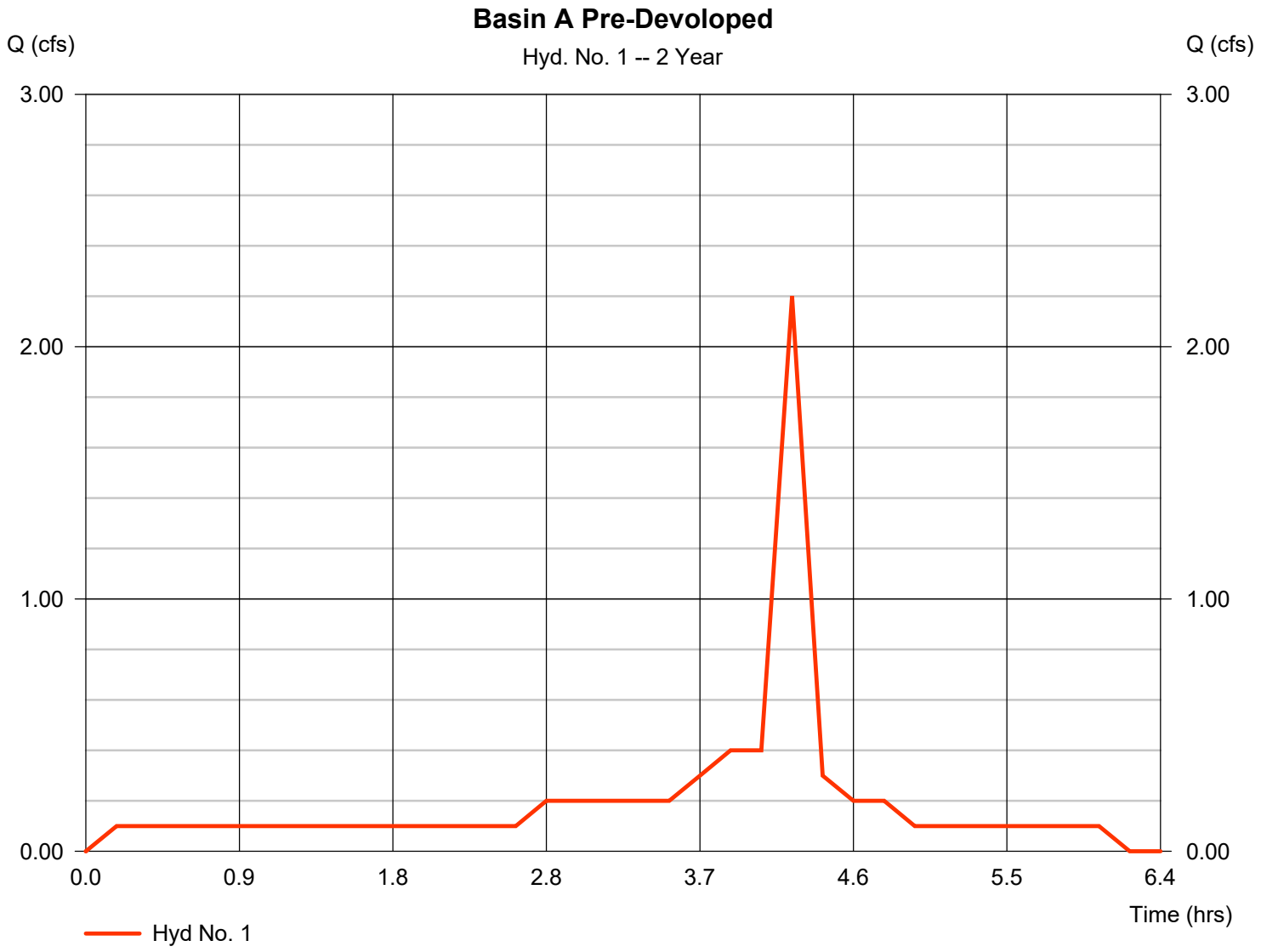
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin A Pre-Devoloped

Hydrograph type	= Manual	Peak discharge	= 2.200 cfs
Storm frequency	= 2 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 4,686 cuft



RUN DATE 1/17/2018
HYDROGRAPH FILE NAME Text1 Basin A, 10yr Pre-Developed Hydrograph Results
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 2.2 INCHES
BASIN AREA 2.334 ACRES
RUNOFF COEFFICIENT 0.37
PEAK DISCHARGE 3.03 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.1
TIME (MIN) = 22	DISCHARGE (CFS) = 0.1
TIME (MIN) = 33	DISCHARGE (CFS) = 0.1
TIME (MIN) = 44	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 66	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 88	DISCHARGE (CFS) = 0.1
TIME (MIN) = 99	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 121	DISCHARGE (CFS) = 0.2
TIME (MIN) = 132	DISCHARGE (CFS) = 0.2
TIME (MIN) = 143	DISCHARGE (CFS) = 0.2
TIME (MIN) = 154	DISCHARGE (CFS) = 0.2
TIME (MIN) = 165	DISCHARGE (CFS) = 0.2
TIME (MIN) = 176	DISCHARGE (CFS) = 0.2
TIME (MIN) = 187	DISCHARGE (CFS) = 0.3
TIME (MIN) = 198	DISCHARGE (CFS) = 0.3
TIME (MIN) = 209	DISCHARGE (CFS) = 0.4
TIME (MIN) = 220	DISCHARGE (CFS) = 0.4
TIME (MIN) = 231	DISCHARGE (CFS) = 0.6
TIME (MIN) = 242	DISCHARGE (CFS) = 0.8
TIME (MIN) = 253	DISCHARGE (CFS) = 3.03
TIME (MIN) = 264	DISCHARGE (CFS) = 0.5
TIME (MIN) = 275	DISCHARGE (CFS) = 0.3
TIME (MIN) = 286	DISCHARGE (CFS) = 0.3
TIME (MIN) = 297	DISCHARGE (CFS) = 0.2
TIME (MIN) = 308	DISCHARGE (CFS) = 0.2
TIME (MIN) = 319	DISCHARGE (CFS) = 0.2
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 341	DISCHARGE (CFS) = 0.1
TIME (MIN) = 352	DISCHARGE (CFS) = 0.1
TIME (MIN) = 363	DISCHARGE (CFS) = 0.1
TIME (MIN) = 374	DISCHARGE (CFS) = 0

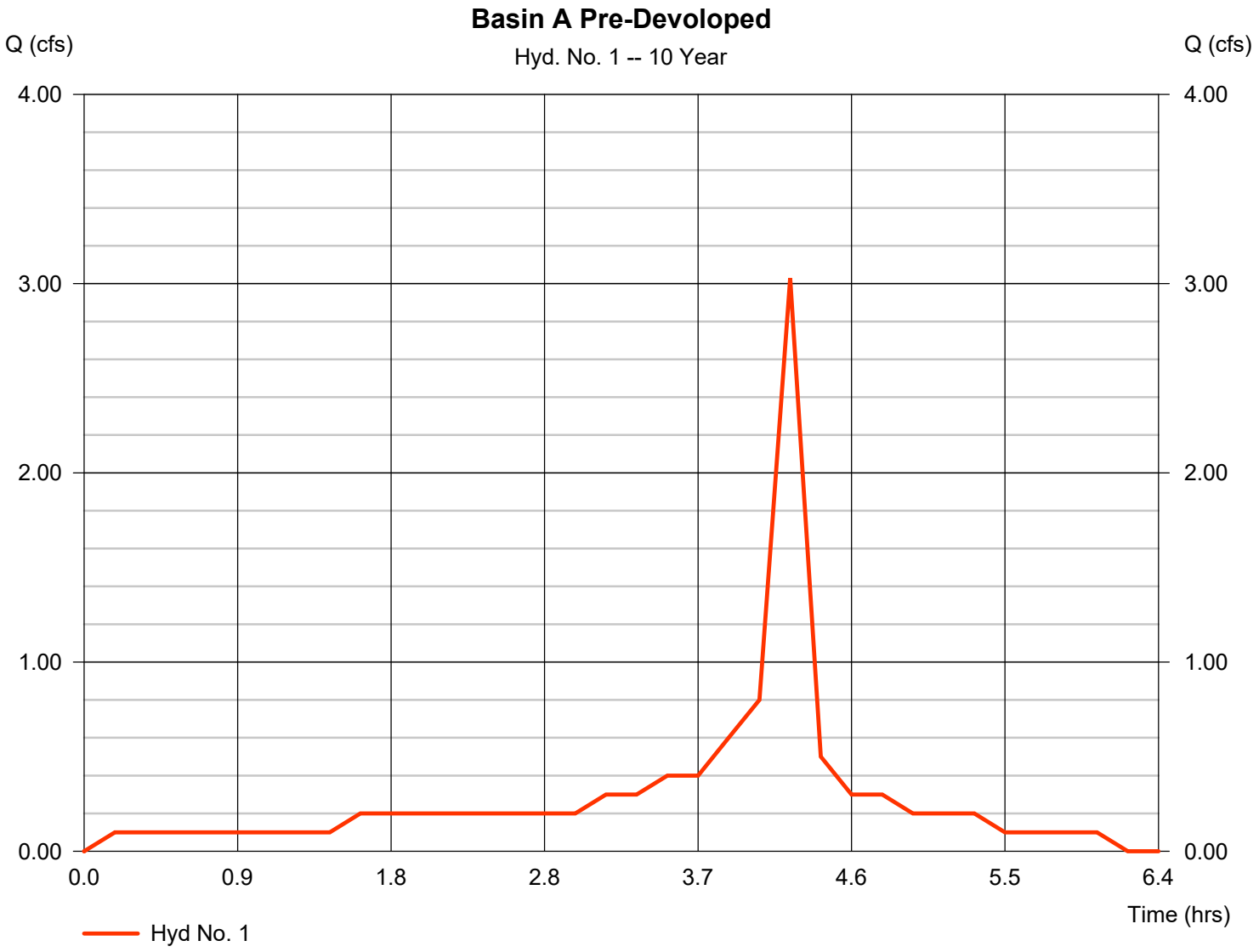
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin A Pre-Devoloped

Hydrograph type	= Manual	Peak discharge	= 3.030 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 6,818 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin A, 100yr Pre-Developed Hydrograph Results
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 2.2 INCHES
BASIN AREA 2.334 ACRES
RUNOFF COEFFICIENT 0.37
PEAK DISCHARGE 4.54 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.1
TIME (MIN) = 22	DISCHARGE (CFS) = 0.1
TIME (MIN) = 33	DISCHARGE (CFS) = 0.1
TIME (MIN) = 44	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 66	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 88	DISCHARGE (CFS) = 0.1
TIME (MIN) = 99	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 121	DISCHARGE (CFS) = 0.2
TIME (MIN) = 132	DISCHARGE (CFS) = 0.2
TIME (MIN) = 143	DISCHARGE (CFS) = 0.2
TIME (MIN) = 154	DISCHARGE (CFS) = 0.2
TIME (MIN) = 165	DISCHARGE (CFS) = 0.2
TIME (MIN) = 176	DISCHARGE (CFS) = 0.2
TIME (MIN) = 187	DISCHARGE (CFS) = 0.3
TIME (MIN) = 198	DISCHARGE (CFS) = 0.3
TIME (MIN) = 209	DISCHARGE (CFS) = 0.4
TIME (MIN) = 220	DISCHARGE (CFS) = 0.4
TIME (MIN) = 231	DISCHARGE (CFS) = 0.6
TIME (MIN) = 242	DISCHARGE (CFS) = -0.7
TIME (MIN) = 253	DISCHARGE (CFS) = 4.54
TIME (MIN) = 264	DISCHARGE (CFS) = 0.5
TIME (MIN) = 275	DISCHARGE (CFS) = 0.3
TIME (MIN) = 286	DISCHARGE (CFS) = 0.3
TIME (MIN) = 297	DISCHARGE (CFS) = 0.2
TIME (MIN) = 308	DISCHARGE (CFS) = 0.2
TIME (MIN) = 319	DISCHARGE (CFS) = 0.2
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 341	DISCHARGE (CFS) = 0.1
TIME (MIN) = 352	DISCHARGE (CFS) = 0.1
TIME (MIN) = 363	DISCHARGE (CFS) = 0.1
TIME (MIN) = 374	DISCHARGE (CFS) = 0

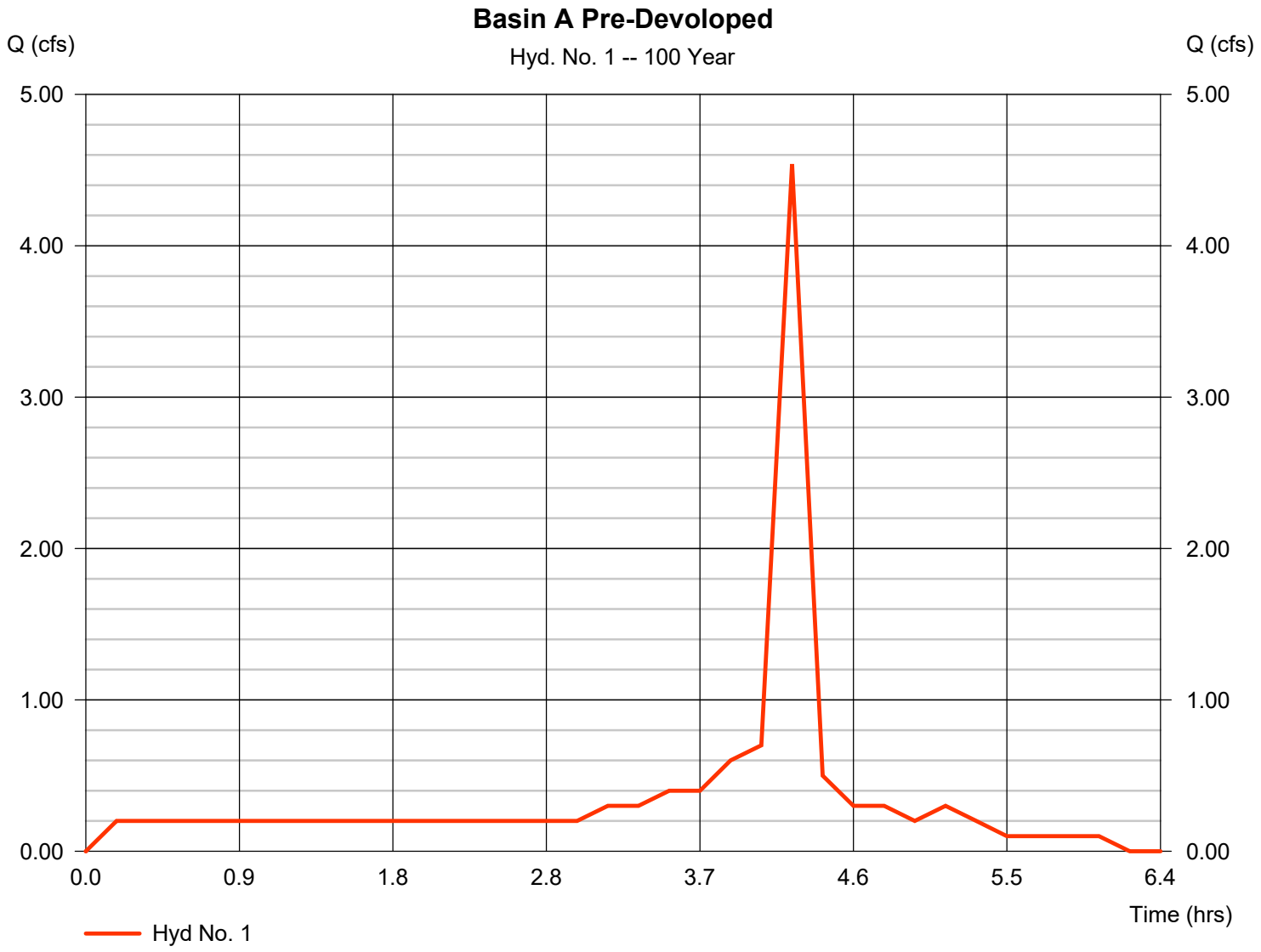
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin A Pre-Devoloped

Hydrograph type	= Manual	Peak discharge	= 4.540 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 8,342 cuft



SWEETWATER ENGINEERING

PROJECT NAME: **Nordahl Rd.**
BASIN NO. **Basin "A" Post-Development**

Total Basin Area "A" = **2.464** Ac.

Soils Type: **"C"**

Runoff Coefficient C = **0.54** Cp = MDR 7.3 - C = 0.54

Impervious area% = 40.00%

Rainfall Event	2 year	10 year	100 year
6 Hour Precipitation:	1.5	2.2	3.4
24 Hour Precipitation:	2.5	3.8	6.3
P6/P24 % =	60.00%	57.89%	53.97%
Adjusted P6:	1.5	2.2	3.4

2 yr Intensity I = **2.53** in/hr I = 7.44 P6 Tc^-0.645
10 yr Intensity I = **3.71** in/hr
100 yr Intensity I = **5.73** in/hr

Initial Time of Concentration Ti = 5.16 Min. From Table 3-2 see attached
where L = 77.0'

Oveland Travel Time = 0.037 hrs = 2.22 Min. T1 =(11.9 L^3/ΔE)^0.385
Were L = 409 ft = 0.08 Miles
ΔE = 29

Time of Concentration 7.38 Min. * Tc is less than 10 Min.
Use min 10 Min. use minimum Tc of 10 min.

Runoff Flowrate Q = C I A

Q 2yr = **3.36** CFS

Q 10yr = **4.93** CFS

Q 100yr = **7.62** CFS

RUN DATE 1/14/2018 Basin A, 2yr Post-Developed Hydrograph Results
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 10 MIN.
6 HOUR RAINFALL 1.5 INCHES
BASIN AREA 2.464 ACRES
RUNOFF COEFFICIENT 0.54
PEAK DISCHARGE 3.36 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0.1
TIME (MIN) = 20	DISCHARGE (CFS) = 0.1
TIME (MIN) = 30	DISCHARGE (CFS) = 0.1
TIME (MIN) = 40	DISCHARGE (CFS) = 0.1
TIME (MIN) = 50	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 80	DISCHARGE (CFS) = 0.1
TIME (MIN) = 90	DISCHARGE (CFS) = 0.2
TIME (MIN) = 100	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 120	DISCHARGE (CFS) = 0.2
TIME (MIN) = 130	DISCHARGE (CFS) = 0.2
TIME (MIN) = 140	DISCHARGE (CFS) = 0.2
TIME (MIN) = 150	DISCHARGE (CFS) = 0.2
TIME (MIN) = 160	DISCHARGE (CFS) = 0.2
TIME (MIN) = 170	DISCHARGE (CFS) = 0.2
TIME (MIN) = 180	DISCHARGE (CFS) = 0.3
TIME (MIN) = 190	DISCHARGE (CFS) = 0.3
TIME (MIN) = 200	DISCHARGE (CFS) = 0.3
TIME (MIN) = 210	DISCHARGE (CFS) = 0.4
TIME (MIN) = 220	DISCHARGE (CFS) = 0.5
TIME (MIN) = 230	DISCHARGE (CFS) = 0.7
TIME (MIN) = 240	DISCHARGE (CFS) = 0.9
TIME (MIN) = 250	DISCHARGE (CFS) = 3.36
TIME (MIN) = 260	DISCHARGE (CFS) = 0.5
TIME (MIN) = 270	DISCHARGE (CFS) = 0.4
TIME (MIN) = 280	DISCHARGE (CFS) = 0.3
TIME (MIN) = 290	DISCHARGE (CFS) = 0.2
TIME (MIN) = 300	DISCHARGE (CFS) = 0.2
TIME (MIN) = 310	DISCHARGE (CFS) = 0.2
TIME (MIN) = 320	DISCHARGE (CFS) = 0.2
TIME (MIN) = 330	DISCHARGE (CFS) = 0.2
TIME (MIN) = 340	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 370	DISCHARGE (CFS) = 0

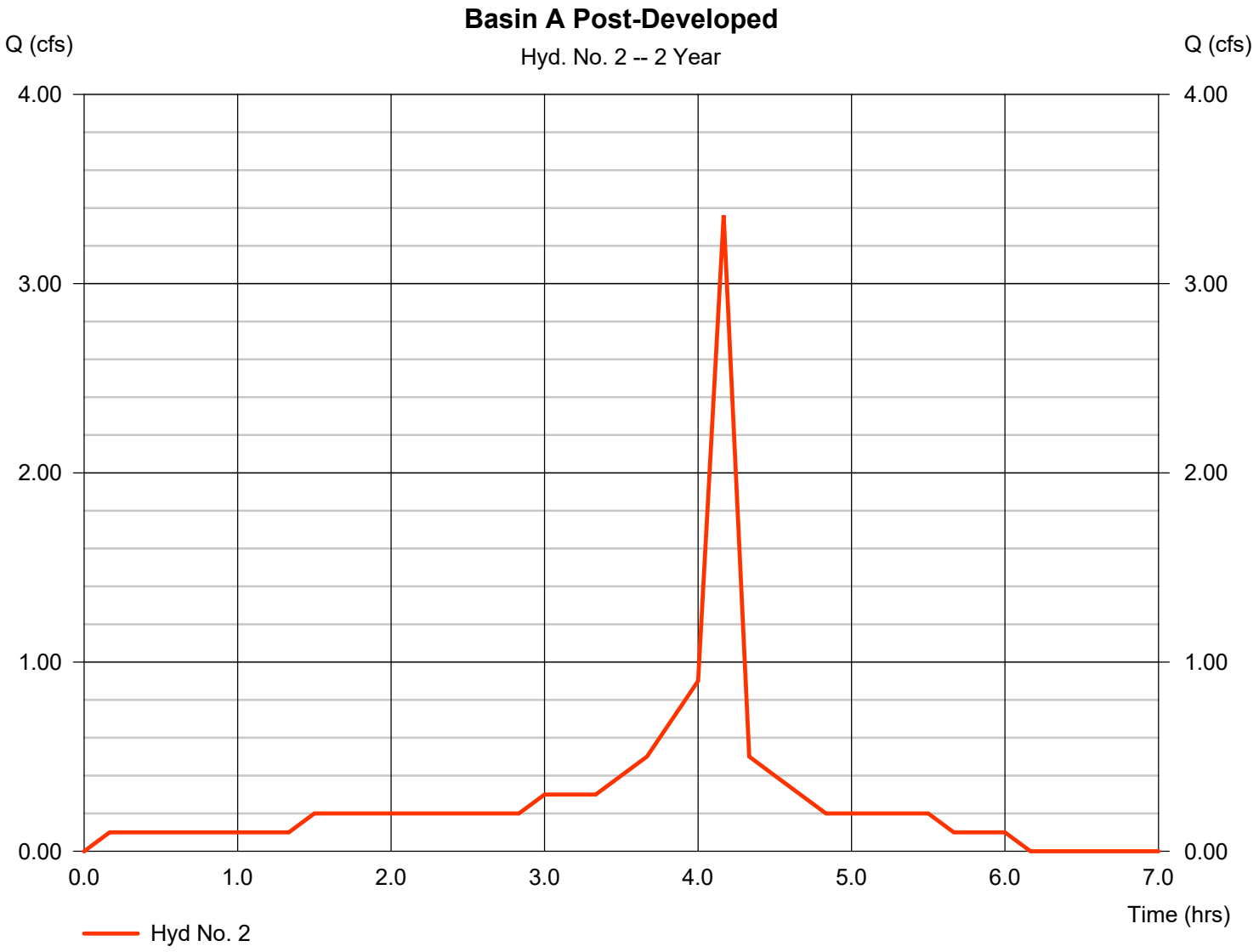
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin A Post-Developed

Hydrograph type	= Manual	Peak discharge	= 3.360 cfs
Storm frequency	= 2 yrs	Time to peak	= 4.17 hrs
Time interval	= 10 min	Hyd. volume	= 7,116 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin A, 10yr Post-Developed Hydrograph Results
TIME OF CONCENTRATION 10 MIN.
6 HOUR RAINFALL 2.2 INCHES
BASIN AREA 2.464 ACRES
RUNOFF COEFFICIENT 0.54
PEAK DISCHARGE 4.93 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0.2
TIME (MIN) = 20	DISCHARGE (CFS) = 0.2
TIME (MIN) = 30	DISCHARGE (CFS) = 0.2
TIME (MIN) = 40	DISCHARGE (CFS) = 0.2
TIME (MIN) = 50	DISCHARGE (CFS) = 0.2
TIME (MIN) = 60	DISCHARGE (CFS) = 0.2
TIME (MIN) = 70	DISCHARGE (CFS) = 0.2
TIME (MIN) = 80	DISCHARGE (CFS) = 0.2
TIME (MIN) = 90	DISCHARGE (CFS) = 0.2
TIME (MIN) = 100	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 120	DISCHARGE (CFS) = 0.3
TIME (MIN) = 130	DISCHARGE (CFS) = 0.3
TIME (MIN) = 140	DISCHARGE (CFS) = 0.3
TIME (MIN) = 150	DISCHARGE (CFS) = 0.3
TIME (MIN) = 160	DISCHARGE (CFS) = 0.3
TIME (MIN) = 170	DISCHARGE (CFS) = 0.4
TIME (MIN) = 180	DISCHARGE (CFS) = 0.4
TIME (MIN) = 190	DISCHARGE (CFS) = 0.4
TIME (MIN) = 200	DISCHARGE (CFS) = 0.5
TIME (MIN) = 210	DISCHARGE (CFS) = 0.6
TIME (MIN) = 220	DISCHARGE (CFS) = 0.7
TIME (MIN) = 230	DISCHARGE (CFS) = 1
TIME (MIN) = 240	DISCHARGE (CFS) = 1.4
TIME (MIN) = 250	DISCHARGE (CFS) = 4.93
TIME (MIN) = 260	DISCHARGE (CFS) = 0.8
TIME (MIN) = 270	DISCHARGE (CFS) = 0.5
TIME (MIN) = 280	DISCHARGE (CFS) = 0.4
TIME (MIN) = 290	DISCHARGE (CFS) = 0.3
TIME (MIN) = 300	DISCHARGE (CFS) = 0.3
TIME (MIN) = 310	DISCHARGE (CFS) = 0.3
TIME (MIN) = 320	DISCHARGE (CFS) = 0.2
TIME (MIN) = 330	DISCHARGE (CFS) = 0.2
TIME (MIN) = 340	DISCHARGE (CFS) = 0.2
TIME (MIN) = 350	DISCHARGE (CFS) = 0.2
TIME (MIN) = 360	DISCHARGE (CFS) = 0.2
TIME (MIN) = 370	DISCHARGE (CFS) = 0

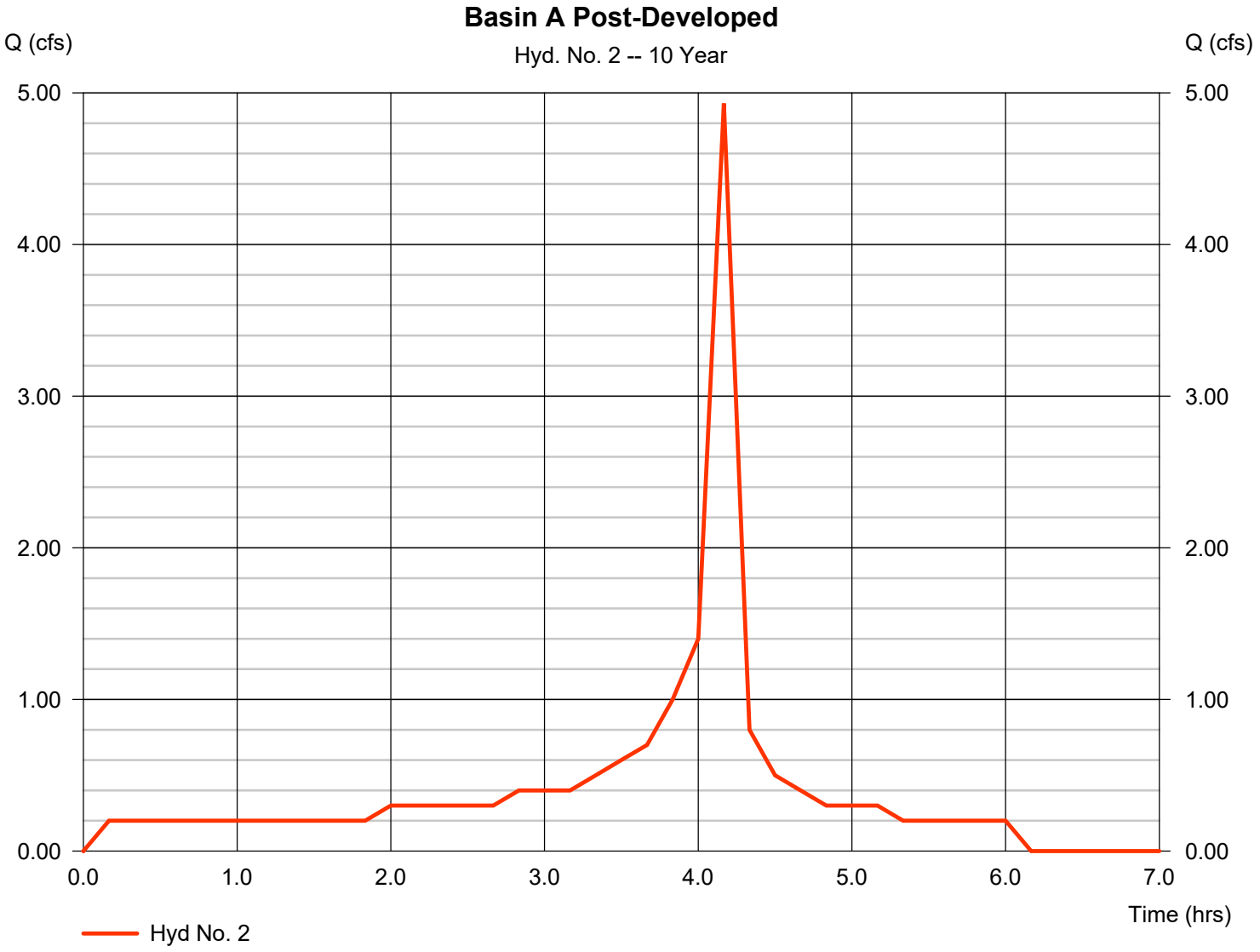
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin A Post-Developed

Hydrograph type	= Manual	Peak discharge	= 4.930 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.17 hrs
Time interval	= 10 min	Hyd. volume	= 10,578 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin A, 100yr Post-Developed Hydrograph Results
TIME OF CONCENTRATION 10 MIN.
6 HOUR RAINFALL 3.4 INCHES
BASIN AREA 2.464 ACRES
RUNOFF COEFFICIENT 0.54
PEAK DISCHARGE 7.62 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0.3
TIME (MIN) = 20	DISCHARGE (CFS) = 0.3
TIME (MIN) = 30	DISCHARGE (CFS) = 0.3
TIME (MIN) = 40	DISCHARGE (CFS) = 0.3
TIME (MIN) = 50	DISCHARGE (CFS) = 0.3
TIME (MIN) = 60	DISCHARGE (CFS) = 0.3
TIME (MIN) = 70	DISCHARGE (CFS) = 0.3
TIME (MIN) = 80	DISCHARGE (CFS) = 0.3
TIME (MIN) = 90	DISCHARGE (CFS) = 0.4
TIME (MIN) = 100	DISCHARGE (CFS) = 0.4
TIME (MIN) = 110	DISCHARGE (CFS) = 0.4
TIME (MIN) = 120	DISCHARGE (CFS) = 0.4
TIME (MIN) = 130	DISCHARGE (CFS) = 0.4
TIME (MIN) = 140	DISCHARGE (CFS) = 0.4
TIME (MIN) = 150	DISCHARGE (CFS) = 0.5
TIME (MIN) = 160	DISCHARGE (CFS) = 0.5
TIME (MIN) = 170	DISCHARGE (CFS) = 0.6
TIME (MIN) = 180	DISCHARGE (CFS) = 0.6
TIME (MIN) = 190	DISCHARGE (CFS) = 0.7
TIME (MIN) = 200	DISCHARGE (CFS) = 0.7
TIME (MIN) = 210	DISCHARGE (CFS) = 0.9
TIME (MIN) = 220	DISCHARGE (CFS) = 1
TIME (MIN) = 230	DISCHARGE (CFS) = 1.5
TIME (MIN) = 240	DISCHARGE (CFS) = 2.1
TIME (MIN) = 250	DISCHARGE (CFS) = 7.62
TIME (MIN) = 260	DISCHARGE (CFS) = 1.2
TIME (MIN) = 270	DISCHARGE (CFS) = 0.8
TIME (MIN) = 280	DISCHARGE (CFS) = 0.6
TIME (MIN) = 290	DISCHARGE (CFS) = 0.5
TIME (MIN) = 300	DISCHARGE (CFS) = 0.5
TIME (MIN) = 310	DISCHARGE (CFS) = 0.4
TIME (MIN) = 320	DISCHARGE (CFS) = 0.4
TIME (MIN) = 330	DISCHARGE (CFS) = 0.3
TIME (MIN) = 340	DISCHARGE (CFS) = 0.3
TIME (MIN) = 350	DISCHARGE (CFS) = 0.3
TIME (MIN) = 360	DISCHARGE (CFS) = 0.3
TIME (MIN) = 370	DISCHARGE (CFS) = 0

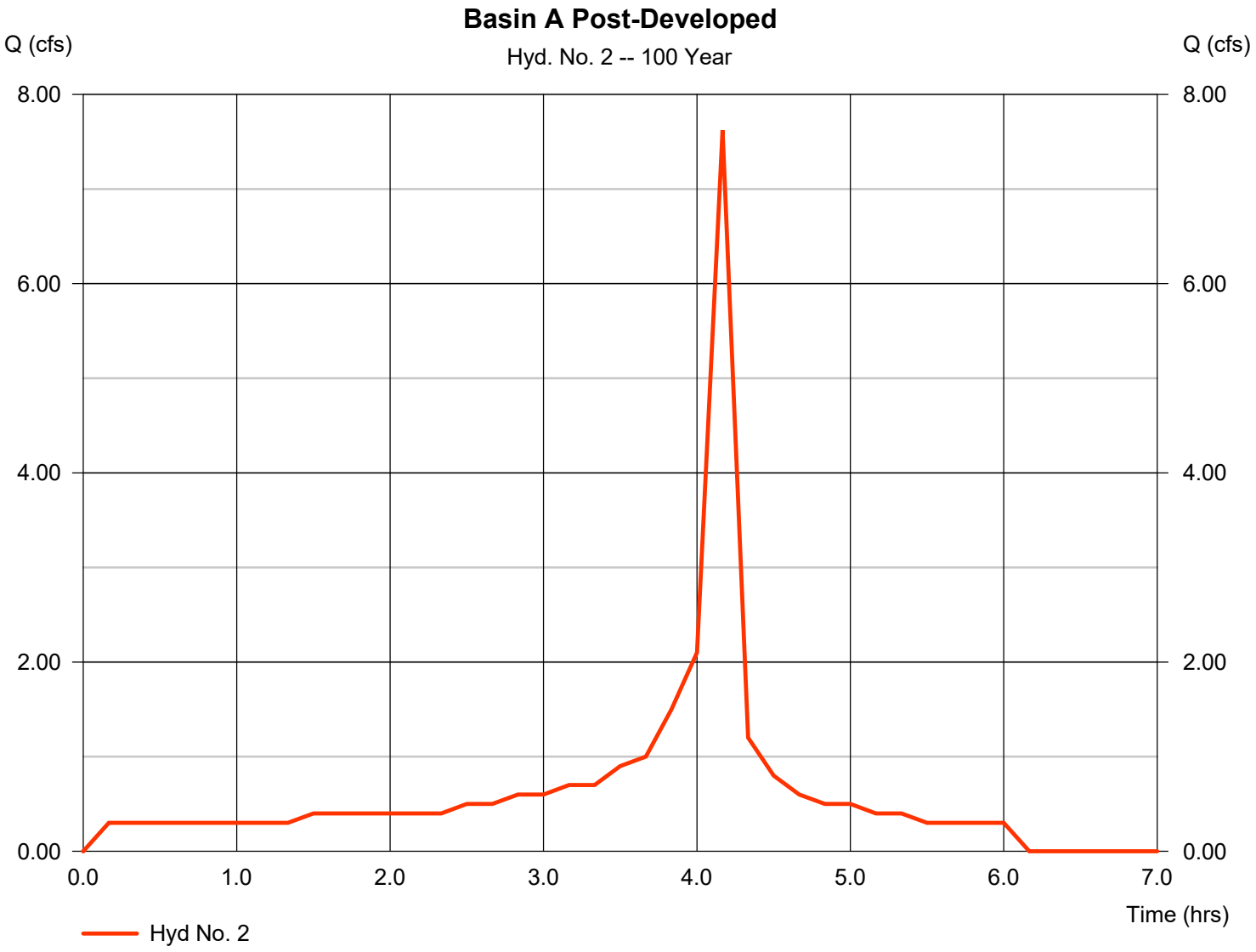
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin A Post-Developed

Hydrograph type	= Manual	Peak discharge	= 7.620 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.17 hrs
Time interval	= 10 min	Hyd. volume	= 16,272 cuft



SECTION 3

Bioretention Pond 1 (Basin "A") Total Storage Volumes (Including Water Quality)

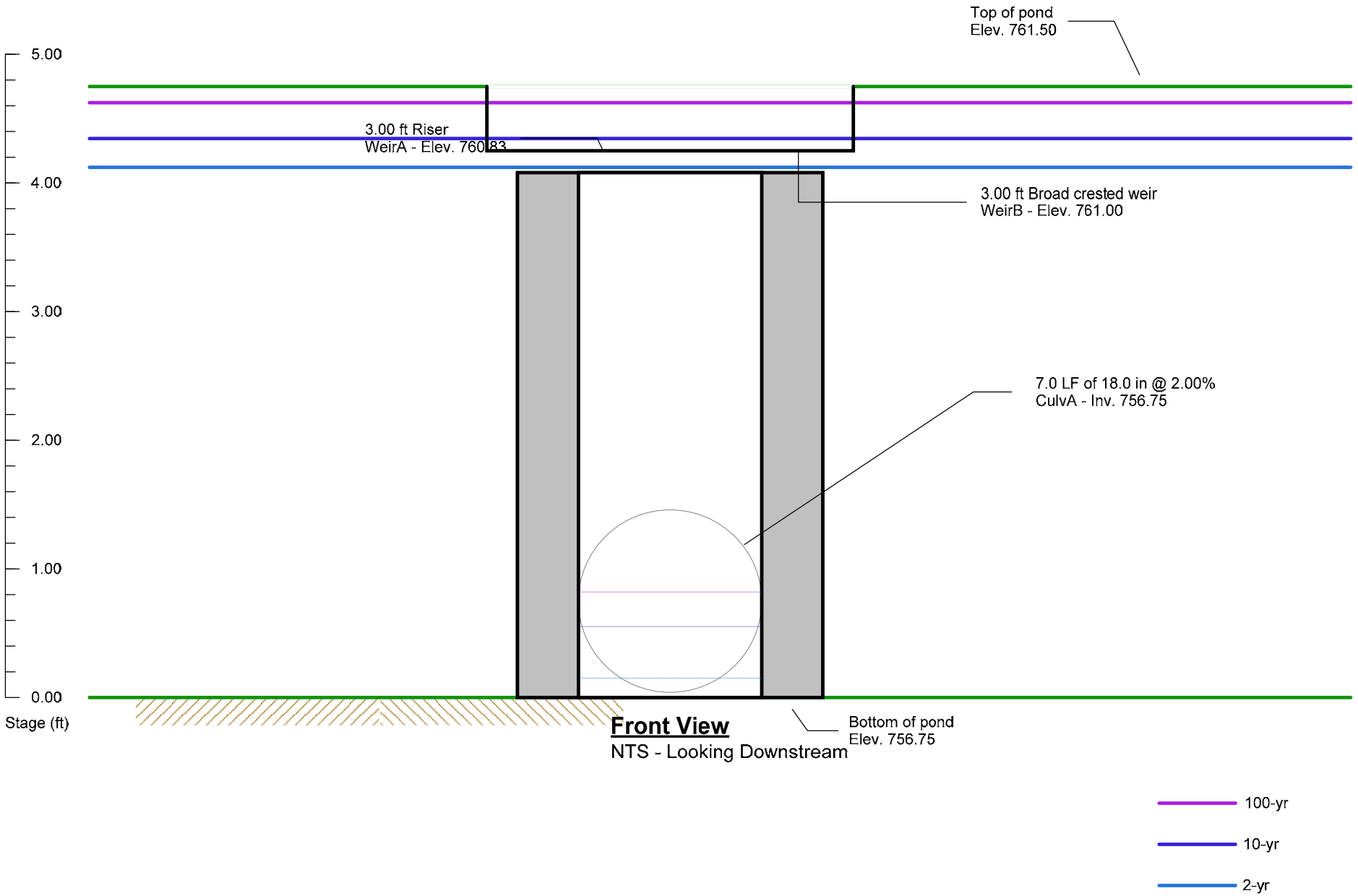
Pond Layer	Bottom El (Ft)	Bottom Area (CF)	Thickness (in)	Top El (Ft)	Top Area	Side Slopes	Porossity	Incrimental Volume	Accumulative Volume
6" of 3/4" Gravel Below Subdrain Inv	756.75	4228.56	6	757.25	4228.56	Vert	0.40	845.71	845.71
3/4" Gravel Above Subdrain Inv	757.25	4228.56	8	757.92	4228.56	Vert	0.40	1127.62	1973.33
Pea Gravel	757.92	4228.56	4	758.25	4228.56	Vert	0.40	563.81	2537.14
Engineered Soil	758.25	4228.56	18	759.75	4228.56	Vert	0.10	634.28	3171.42
Mulch	759.75	4228.56	3	760.00	4228.56	Vert	0.40	422.86	3594.28
Top of Mulch to Top fo Riser	760.00	4228.56	10	760.83	5417.06	3:01	1.00	4019.01	7613.28
Freeboard	760.83	5417.06	8	761.50	5942.74	3:01	1.00	3786.60	11399.88

Bioretention Pond 1 (Basin "A") Total Storage Volumes (Without Water Quality) - Volumes Used for 100 yr Detention Routing Calculations

Pond Layer	Bottom El (Ft)	Bottom Area (CF)	Thickness (in)	Top El (Ft)	Top Area	Side Slopes	Porossity	Incrimental Volume	Accumulative Volume
6" of 3/4" Gravel Below Subdrain Inv	756.75	3427.56	6	757.25	3427.56	Vert	0.40	685.51	685.51
3/4" Gravel Above Subdrain Inv	757.25	3427.56	8	757.92	3427.56	Vert	0.40	914.02	1599.53
Pea Gravel	757.92	3427.56	4	758.25	3427.56	Vert	0.40	457.01	2056.54
Engineered Soil	758.25	3427.56	18	759.75	3427.56	Vert	0.10	514.13	2570.67
Mulch	759.75	3427.56	3	760.00	3427.56	Vert	0.40	342.76	2913.43
Top of Mulch to Top of Riser	760.00	3427.56	10	760.83	5417.06	3:01	1.00	3685.26	6598.68
Freeboard (12")	760.83	5417.06	8	761.50	5942.74	3:01	1.00	3786.60	10385.28

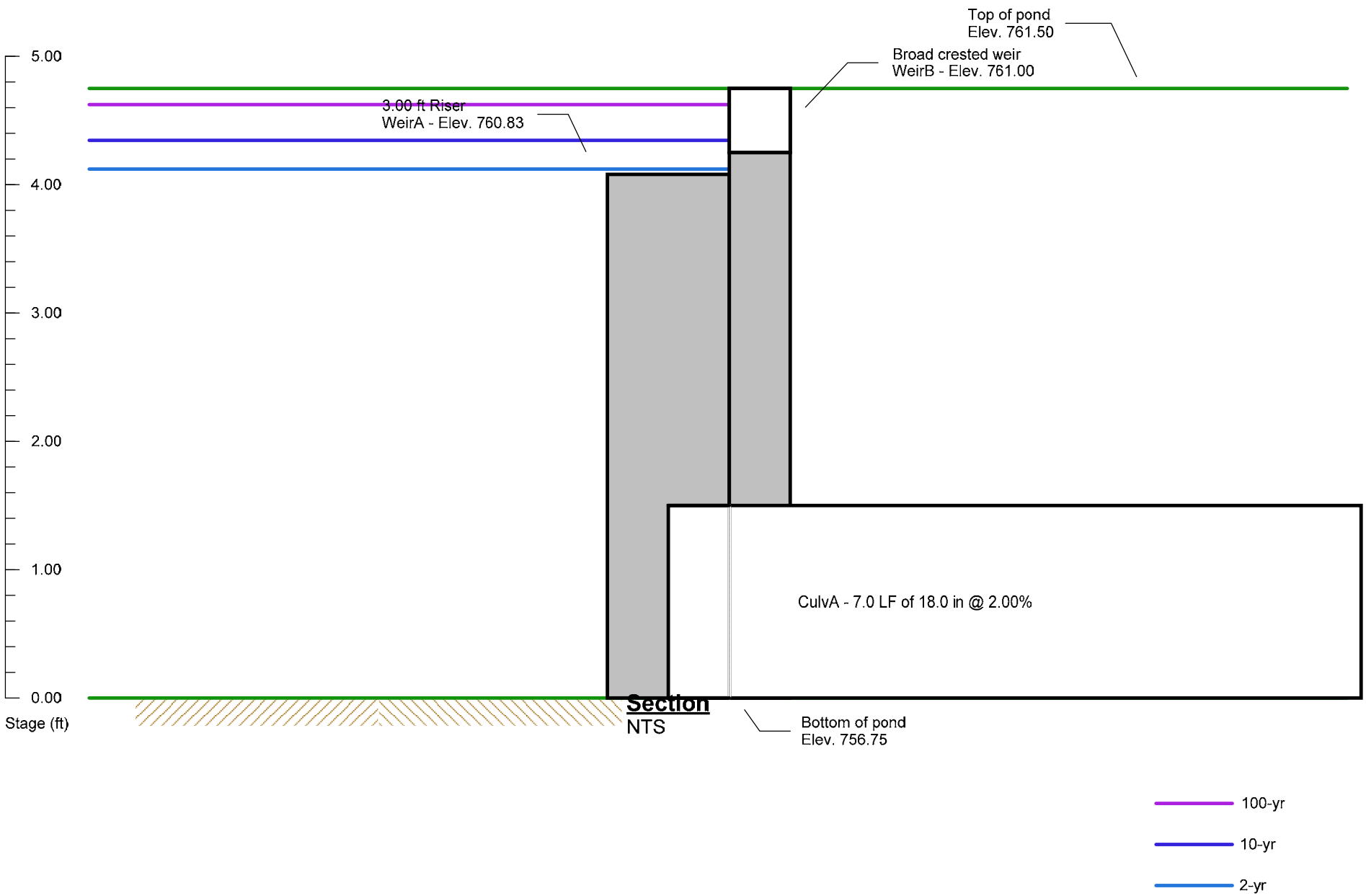
* Required Min Water Quality Area is 801 (sf) so removing that area from the full bottom of pond area (4228.56 sf) leaves 3427.56 (sf) of storage area available for Detention and Hydromodification

Pond No. 1 - Basin A - Pond



Inflow hydrograph = 2. Manual - Basin A Post-Developed

Pond No. 1 - Basin A - Pond



Inflow hydrograph = 2. Manual - Basin A Post-Developed

Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	26.0877	10.7000	0.8283	--------
3	0.0000	0.0000	0.0000	--------
5	41.1990	10.7000	0.8283	--------
10	52.7183	10.7000	0.8283	--------
25	65.7239	10.7000	0.8283	--------
50	76.8716	10.7000	0.8283	--------
100	86.7806	10.7000	0.8283	--------

File name: Autocad Hydraflow IDF file for Church.IDF

Intensity = B / (Tc + 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	2.67	2.12	1.77	1.53	1.35	1.21	1.10	1.01	0.93	0.87	0.81	0.77
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	4.21	3.35	2.80	2.42	2.13	1.91	1.74	1.59	1.47	1.37	1.29	1.21
10	5.39	4.28	3.58	3.09	2.73	2.45	2.22	2.04	1.89	1.76	1.65	1.55
25	6.72	5.34	4.46	3.85	3.40	3.05	2.77	2.54	2.35	2.19	2.05	1.93
50	7.86	6.25	5.22	4.51	3.98	3.57	3.24	2.97	2.75	2.56	2.40	2.26
100	8.87	7.05	5.90	5.09	4.49	4.03	3.66	3.36	3.11	2.89	2.71	2.55

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.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	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
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	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydrograph Return Period Recap

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	Manual	------	-------	2.200	-------	-------	3.030	-------	-------	4.540	Basin A Pre-Devoloped
2	Manual	------	-------	3.360	-------	-------	4.930	-------	-------	7.620	Basin A Post-Developed
3	Reservoir	2	-------	0.107	-------	-------	1.596	-------	-------	4.017	Pond A Routing Results

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	Manual	2.200	11	253	4,686	------	------	------	Basin A Pre-Devoloped
2	Manual	3.360	10	250	7,116	------	------	------	Basin A Post-Developed
3	Reservoir	0.107	10	340	515	2	760.87	6,833	Pond A Routing Results

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin A Pre-Devoloped

Hydrograph type	= Manual	Peak discharge	= 2.200 cfs
Storm frequency	= 2 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 4,686 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
11	0.100	242	0.400
22	0.100	253	2.200
33	0.100	264	0.300
44	0.100	275	0.200
55	0.100	286	0.200
66	0.100	297	0.100
77	0.100	308	0.100
88	0.100	319	0.100
99	0.100	330	0.100
110	0.100	341	0.100
121	0.100	352	0.100
132	0.100	363	0.100
143	0.100		
154	0.100	*...End*	
165	0.200		
176	0.200		
187	0.200		
198	0.200		
209	0.200		
220	0.300		
231	0.400		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin A Post-Developed

Hydrograph type	= Manual	Peak discharge	= 3.360 cfs
Storm frequency	= 2 yrs	Time to peak	= 250 min
Time interval	= 10 min	Hyd. volume	= 7,116 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
10	0.100	220	0.500
20	0.100	230	0.700
30	0.100	240	0.900
40	0.100	250	3.360
50	0.100	260	0.500
60	0.100	270	0.400
70	0.100	280	0.300
80	0.100	290	0.200
90	0.200	300	0.200
100	0.200	310	0.200
110	0.200	320	0.200
120	0.200	330	0.200
130	0.200	340	0.100
140	0.200	350	0.100
150	0.200	360	0.100
160	0.200		
170	0.200	*...End*	
180	0.300		
190	0.300		
200	0.300		
210	0.400		

<<

Hydrograph Report

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 0.107 cfs
Storm frequency	= 2 yrs	Time to peak	= 340 min
Time interval	= 10 min	Hyd. volume	= 515 cuft
Inflow hyd. No.	= 2 - Basin A Post-Deve	Reservoir name	= Basin A - Pond
Max. Elevation	= 760.87 ft	Max. Storage	= 6,833 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
310	0.200	760.84	0.015	-----	-----	-----	0.015	-----	-----	-----	-----	0.015
320	0.200	760.85	0.060	-----	-----	-----	0.060	-----	-----	-----	-----	0.060
330	0.200	760.87	0.094	-----	-----	-----	0.094	-----	-----	-----	-----	0.094
340	0.100	760.87 <<	0.107	-----	-----	-----	0.107	-----	-----	-----	-----	0.107
<<												
350	0.100	760.87	0.106	-----	-----	-----	0.105	-----	-----	-----	-----	0.105
360	0.100	760.87	0.104	-----	-----	-----	0.104	-----	-----	-----	-----	0.104
370	0.000	760.87	0.091	-----	-----	-----	0.091	-----	-----	-----	-----	0.091
380	0.000	760.86	0.069	-----	-----	-----	0.069	-----	-----	-----	-----	0.069
390	0.000	760.85	0.053	-----	-----	-----	0.052	-----	-----	-----	-----	0.052
400	0.000	760.85	0.040	-----	-----	-----	0.040	-----	-----	-----	-----	0.040
410	0.000	760.84	0.030	-----	-----	-----	0.030	-----	-----	-----	-----	0.030
420	0.000	760.84	0.023	-----	-----	-----	0.023	-----	-----	-----	-----	0.023
430	0.000	760.84	0.017	-----	-----	-----	0.017	-----	-----	-----	-----	0.017
440	0.000	760.84	0.013	-----	-----	-----	0.013	-----	-----	-----	-----	0.013
450	0.000	760.83	0.010	-----	-----	-----	0.010	-----	-----	-----	-----	0.010
460	0.000	760.83	0.008	-----	-----	-----	0.008	-----	-----	-----	-----	0.008
470	0.000	760.83	0.006	-----	-----	-----	0.006	-----	-----	-----	-----	0.006
480	0.000	760.83	0.004	-----	-----	-----	0.004	-----	-----	-----	-----	0.004
490	0.000	760.83	0.003	-----	-----	-----	0.003	-----	-----	-----	-----	0.003
500	0.000	760.83	0.003	-----	-----	-----	0.003	-----	-----	-----	-----	0.003

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
510	0.000	760.83	0.002	-----	-----	-----	0.002	-----	-----	-----	-----	0.002
520	0.000	760.83	0.001	-----	-----	-----	0.001	-----	-----	-----	-----	0.001
530	0.000	760.83	0.001	-----	-----	-----	0.001	-----	-----	-----	-----	0.001

...End

Hydrograph Report

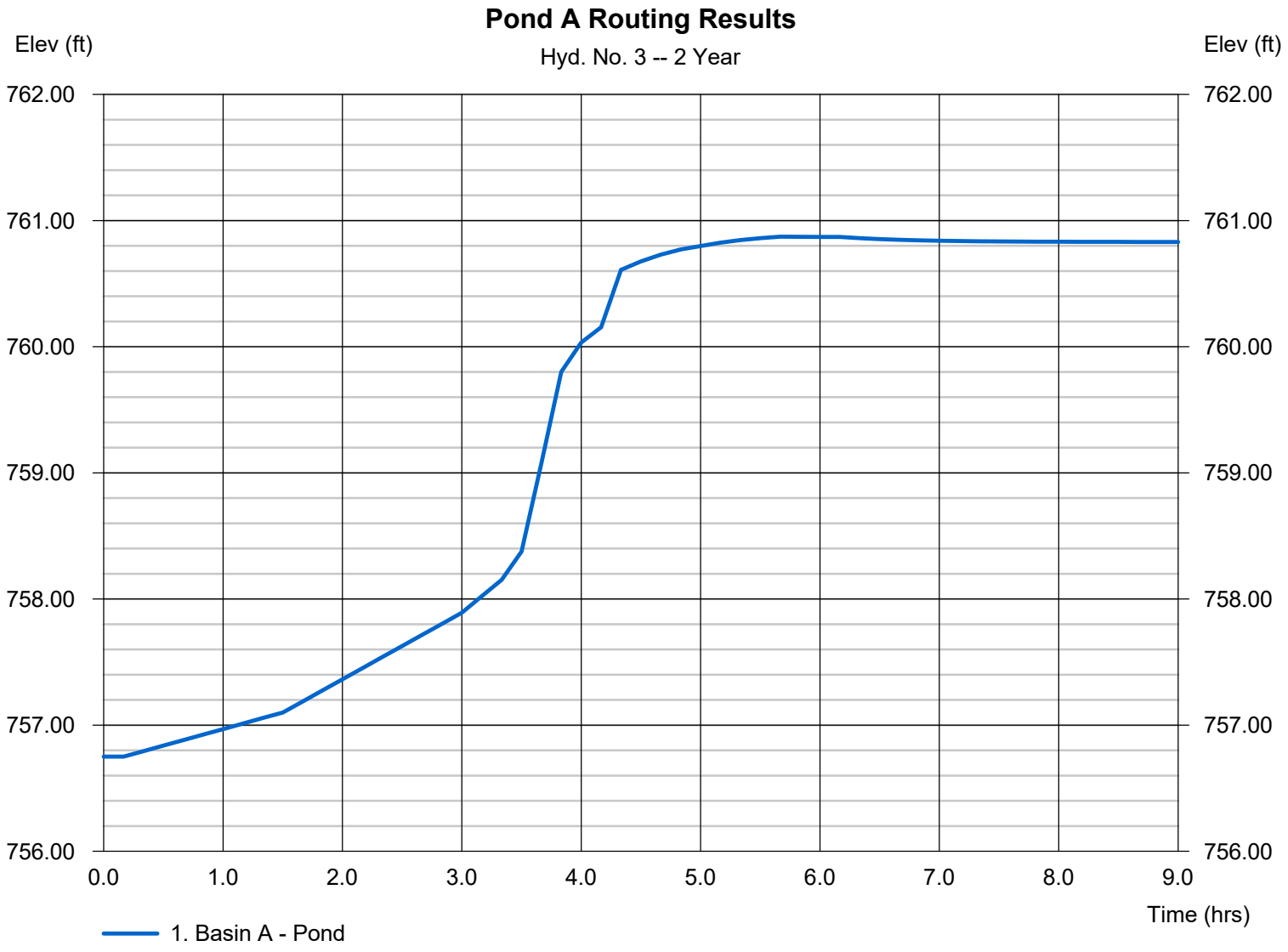
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 0.107 cfs
Storm frequency	= 2 yrs	Time to peak	= 5.67 hrs
Time interval	= 10 min	Hyd. volume	= 515 cuft
Inflow hyd. No.	= 2 - Basin A Post-Developed	Max. Elevation	= 760.87 ft
Reservoir name	= Basin A - Pond	Max. Storage	= 6,833 cuft

Storage Indication method used.



Hydrograph Report

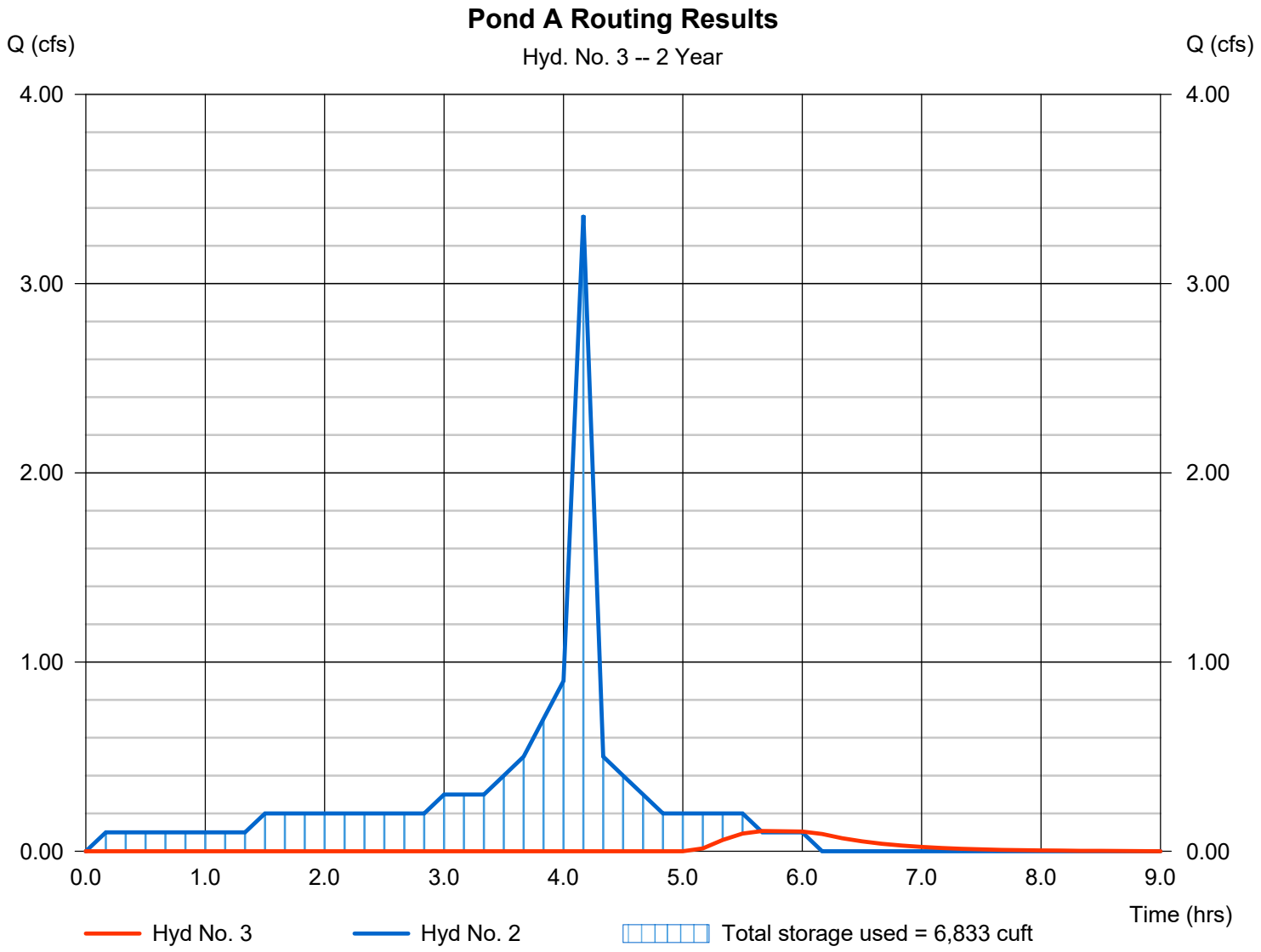
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond A Routing Results

Hydrograph type	=	Reservoir	Peak discharge	=	0.107 cfs
Storm frequency	=	2 yrs	Time to peak	=	5.67 hrs
Time interval	=	10 min	Hyd. volume	=	515 cuft
Inflow hyd. No.	=	2 - Basin A Post-Developed	Max. Elevation	=	760.87 ft
Reservoir name	=	Basin A - Pond	Max. Storage	=	6,833 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	Manual	3.030	11	253	6,818	------	------	------	Basin A Pre-Devoloped
2	Manual	4.930	10	250	10,578	------	------	------	Basin A Post-Developed
3	Reservoir	1.596	10	260	3,977	2	761.14	8,097	Pond A Routing Results

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin A Pre-Devoloped

Hydrograph type	= Manual	Peak discharge	= 3.030 cfs
Storm frequency	= 10 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 6,818 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
11	0.100	242	0.800
22	0.100	253	3.030
33	0.100	264	0.500
44	0.100	275	0.300
55	0.100	286	0.300
66	0.100	297	0.200
77	0.100	308	0.200
88	0.100	319	0.200
99	0.200	330	0.100
110	0.200	341	0.100
121	0.200	352	0.100
132	0.200	363	0.100
143	0.200		
154	0.200	*...End*	
165	0.200		
176	0.200		
187	0.300		
198	0.300		
209	0.400		
220	0.400		
231	0.600		

<<

Hydrograph Report

Hyd. No. 2

Basin A Post-Developed

Hydrograph type	= Manual	Peak discharge	= 4.930 cfs
Storm frequency	= 10 yrs	Time to peak	= 250 min
Time interval	= 10 min	Hyd. volume	= 10,578 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
10	0.200	220	0.700
20	0.200	230	1.000
30	0.200	240	1.400
40	0.200	250	4.930
50	0.200	260	0.800
60	0.200	270	0.500
70	0.200	280	0.400
80	0.200	290	0.300
90	0.200	300	0.300
100	0.200	310	0.300
110	0.200	320	0.200
120	0.300	330	0.200
130	0.300	340	0.200
140	0.300	350	0.200
150	0.300	360	0.200
160	0.300		
170	0.400	*...End*	
180	0.400		
190	0.400		
200	0.500		
210	0.600		

<<

Hydrograph Report

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 1.596 cfs
Storm frequency	= 10 yrs	Time to peak	= 260 min
Time interval	= 10 min	Hyd. volume	= 3,977 cuft
Inflow hyd. No.	= 2 - Basin A Post-Developed	Reservoir name	= Basin A - Pond
Max. Elevation	= 761.14 ft	Max. Storage	= 8,097 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
250	4.930 <<	760.88	0.137	-----	-----	-----	0.137	-----	-----	-----	-----	0.137
260	0.800	761.10 <<	1.390	-----	-----	-----	1.365	0.231	-----	-----	-----	1.596
270	0.500	761.03	0.918	-----	-----	-----	0.893	0.042	-----	-----	-----	0.935
280	0.400	760.99	0.680	-----	-----	-----	0.661	0.018	-----	-----	-----	0.679
290	0.300	760.97	0.518	-----	-----	-----	0.504	0.001	-----	-----	-----	0.505
300	0.300	760.95	0.430	-----	-----	-----	0.419	-----	-----	-----	-----	0.419
310	0.300	760.94	0.380	-----	-----	-----	0.371	-----	-----	-----	-----	0.371
320	0.200	760.93	0.329	-----	-----	-----	0.323	-----	-----	-----	-----	0.323
330	0.200	760.92	0.278	-----	-----	-----	0.273	-----	-----	-----	-----	0.273
340	0.200	760.91	0.247	-----	-----	-----	0.244	-----	-----	-----	-----	0.244
350	0.200	760.91	0.229	-----	-----	-----	0.226	-----	-----	-----	-----	0.226
360	0.200	760.91	0.218	-----	-----	-----	0.216	-----	-----	-----	-----	0.216
370	0.000	760.90	0.171	-----	-----	-----	0.171	-----	-----	-----	-----	0.171
380	0.000	760.88	0.130	-----	-----	-----	0.130	-----	-----	-----	-----	0.130
390	0.000	760.87	0.098	-----	-----	-----	0.098	-----	-----	-----	-----	0.098
400	0.000	760.86	0.075	-----	-----	-----	0.075	-----	-----	-----	-----	0.075
410	0.000	760.85	0.057	-----	-----	-----	0.057	-----	-----	-----	-----	0.057
420	0.000	760.85	0.043	-----	-----	-----	0.043	-----	-----	-----	-----	0.043
430	0.000	760.84	0.033	-----	-----	-----	0.033	-----	-----	-----	-----	0.033
440	0.000	760.84	0.025	-----	-----	-----	0.025	-----	-----	-----	-----	0.025

Continues on next page...

Pond A Routing Results

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
450	0.000	760.84	0.019	-----	-----	-----	0.019	-----	-----	-----	-----	0.019

...End

Hydrograph Report

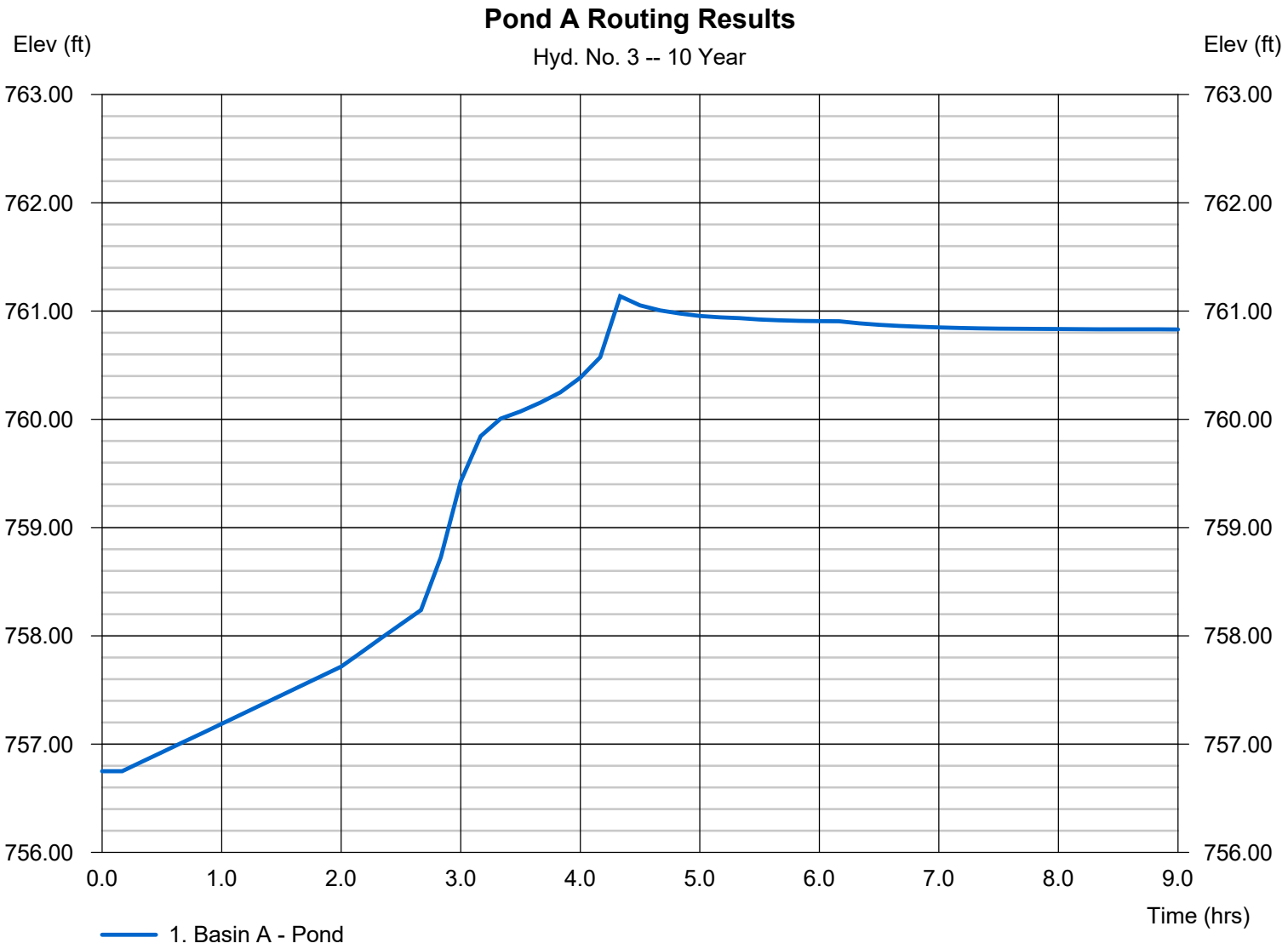
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 1.596 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.33 hrs
Time interval	= 10 min	Hyd. volume	= 3,977 cuft
Inflow hyd. No.	= 2 - Basin A Post-Developed	Max. Elevation	= 761.14 ft
Reservoir name	= Basin A - Pond	Max. Storage	= 8,097 cuft

Storage Indication method used.



Hydrograph Report

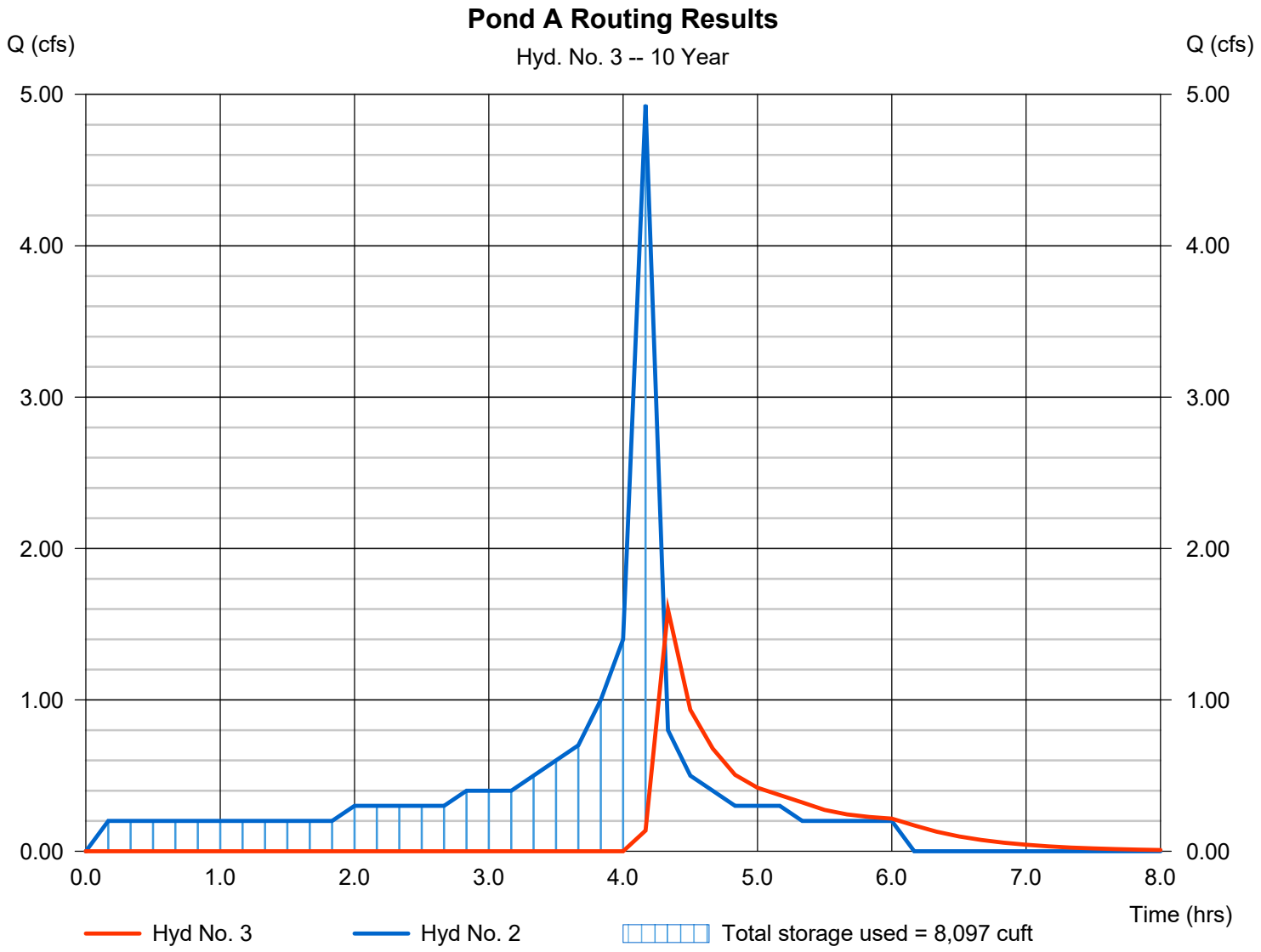
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 1.596 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.33 hrs
Time interval	= 10 min	Hyd. volume	= 3,977 cuft
Inflow hyd. No.	= 2 - Basin A Post-Developed	Max. Elevation	= 761.14 ft
Reservoir name	= Basin A - Pond	Max. Storage	= 8,097 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	Manual	4.540	11	253	8,342	------	------	------	Basin A Pre-Devoloped
2	Manual	7.620	10	250	16,272	------	------	------	Basin A Post-Developed
3	Reservoir	4.017	10	260	9,671	2	761.50	9,673	Pond A Routing Results

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin A Pre-Devoloped

Hydrograph type	= Manual	Peak discharge	= 4.540 cfs
Storm frequency	= 100 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 8,342 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
11	0.200	242	0.700
22	0.200	253	4.540
33	0.200	264	0.500
44	0.200	275	0.300
55	0.200	286	0.300
66	0.200	297	0.200
77	0.200	308	0.300
88	0.200	319	0.200
99	0.200	330	0.100
110	0.200	341	0.100
121	0.200	352	0.100
132	0.200	363	0.100
143	0.200		
154	0.200	*...End*	
165	0.200		
176	0.200		
187	0.300		
198	0.300		
209	0.400		
220	0.400		
231	0.600		

<<

Hydrograph Report

Hyd. No. 2

Basin A Post-Developed

Hydrograph type	= Manual	Peak discharge	= 7.620 cfs
Storm frequency	= 100 yrs	Time to peak	= 250 min
Time interval	= 10 min	Hyd. volume	= 16,272 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
10	0.300	220	1.000
20	0.300	230	1.500
30	0.300	240	2.100
40	0.300	250	7.620
50	0.300	260	1.200
60	0.300	270	0.800
70	0.300	280	0.600
80	0.300	290	0.500
90	0.400	300	0.500
100	0.400	310	0.400
110	0.400	320	0.400
120	0.400	330	0.300
130	0.400	340	0.300
140	0.400	350	0.300
150	0.500	360	0.300
160	0.500		
170	0.600	*...End*	
180	0.600		
190	0.700		
200	0.700		
210	0.900		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 4.017 cfs
Storm frequency	= 100 yrs	Time to peak	= 260 min
Time interval	= 10 min	Hyd. volume	= 9,671 cuft
Inflow hyd. No.	= 2 - Basin A Post-Developed	Reservoir name	= Basin A - Pond
Max. Elevation	= 761.50 ft	Max. Storage	= 9,673 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
240	2.100	760.99	0.668	-----	-----	-----	0.649	0.017	-----	-----	-----	0.666
250	7.620 <<	761.29	2.072	-----	-----	-----	2.062	1.250	-----	-----	-----	3.312
260	1.200	761.37 <<	2.266	-----	-----	-----	2.230	1.787	-----	-----	-----	4.017
270	0.800	761.15	1.813	-----	-----	-----	1.795	0.450	-----	-----	-----	2.245
280	0.600	761.05	1.028	-----	-----	-----	1.003	0.084	-----	-----	-----	1.087
290	0.500	761.01	0.763	-----	-----	-----	0.742	0.026	-----	-----	-----	0.768
300	0.500	760.98	0.631	-----	-----	-----	0.614	0.013	-----	-----	-----	0.626
310	0.400	760.97	0.544	-----	-----	-----	0.529	0.004	-----	-----	-----	0.533
320	0.400	760.96	0.483	-----	-----	-----	0.469	-----	-----	-----	-----	0.469
330	0.300	760.95	0.433	-----	-----	-----	0.421	-----	-----	-----	-----	0.421
340	0.300	760.94	0.382	-----	-----	-----	0.373	-----	-----	-----	-----	0.373
350	0.300	760.93	0.351	-----	-----	-----	0.344	-----	-----	-----	-----	0.344
360	0.300	760.93	0.333	-----	-----	-----	0.326	-----	-----	-----	-----	0.326
370	0.000	760.91	0.259	-----	-----	-----	0.255	-----	-----	-----	-----	0.255
380	0.000	760.89	0.161	-----	-----	-----	0.161	-----	-----	-----	-----	0.161
390	0.000	760.88	0.122	-----	-----	-----	0.122	-----	-----	-----	-----	0.122
400	0.000	760.87	0.093	-----	-----	-----	0.093	-----	-----	-----	-----	0.093
410	0.000	760.86	0.070	-----	-----	-----	0.070	-----	-----	-----	-----	0.070
420	0.000	760.85	0.053	-----	-----	-----	0.053	-----	-----	-----	-----	0.053
430	0.000	760.85	0.041	-----	-----	-----	0.040	-----	-----	-----	-----	0.040

<<

...End

Hydrograph Report

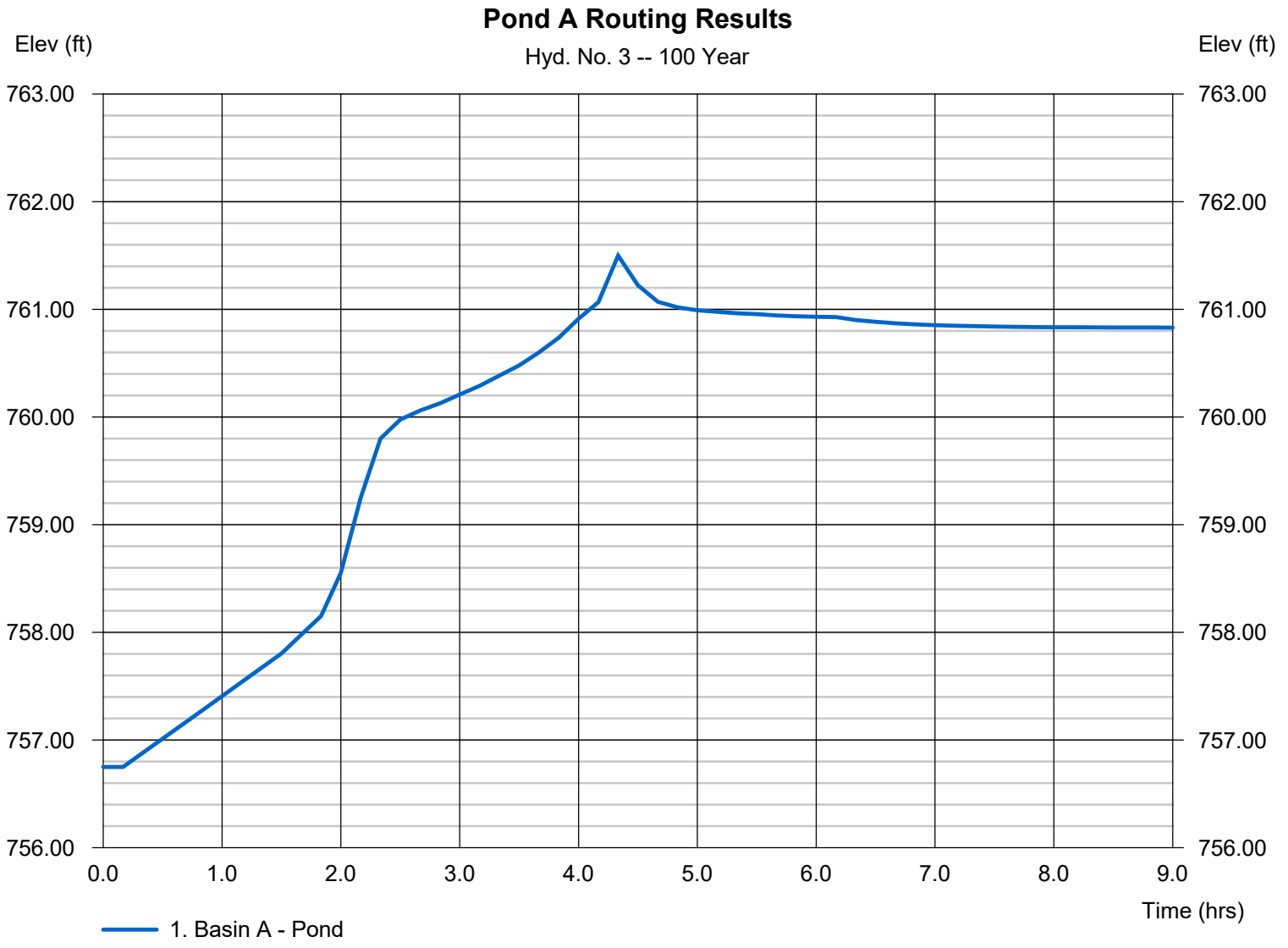
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond A Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 4.017 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.33 hrs
Time interval	= 10 min	Hyd. volume	= 9,671 cuft
Inflow hyd. No.	= 2 - Basin A Post-Developed	Max. Elevation	= 761.50 ft
Reservoir name	= Basin A - Pond	Max. Storage	= 9,673 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

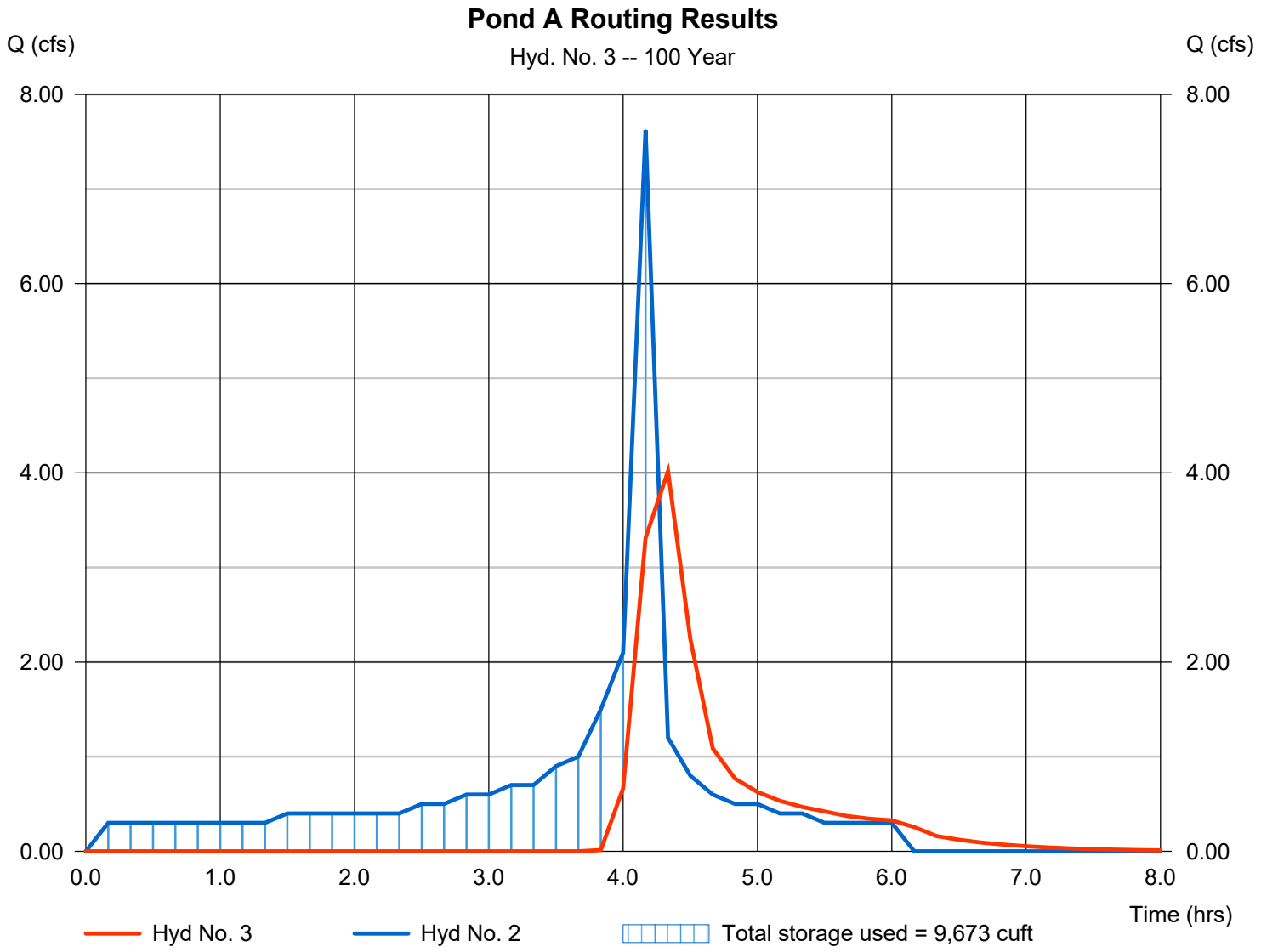
Hyd. No. 3

Pond A Routing Results

Hydrograph type	=	Reservoir	Peak discharge	=	4.017 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.33 hrs
Time interval	=	10 min	Hyd. volume	=	9,671 cuft
Inflow hyd. No.	=	2 - Basin A Post-Developed	Max. Elevation	=	761.50 ft
Reservoir name	=	Basin A - Pond	Max. Storage	=	9,673 cuft

Storage Indication method used.

Peak Discharge of 4.017 is less than the Pre-Developed Q100 Peak Discharge of 4.54 cfs, so pond and outflow features are sized correctly



SECTION 4

SWEETWATER ENGINEERING

PROJECT NAME: **Nordahl Rd.**

BASIN NO. **Basin "B" Pre-Development**

Total Basin Area "A" = **2.394** Ac.

Soils Type: **"C" =** 1.117 Ac. Soils Type: **"D" =** 1.277 Ac.

Runoff Coefficient C = **0.37** C = 0.90(imp area%) + Cp (1- imp area%)

Impervious Area = 0.151 Cp = Natural C = 0.30

Impervious area% = 6.31% Cp = Natural D = 0.35

Avg = 0.33

Rainfall Event	2 year	10 year	100 year
6 Hour Precipitation:	1.5	2.2	3.4
24 Hour Precipitation:	2.5	3.8	6.3
P6/P24 % =	60.00%	57.89%	53.97%
Adjusted P6:	1.5	2.2	3.4

2 yr Intensity I = **2.28** in/hr I = 7.44 P6 Tc^-0.645

10 yr Intensity I = **3.34** in/hr

100 yr Intensity I = **5.16** in/hr

Initial Time of Concentration Ti = 8.7 Min. From Table 3-2 see attached

Oveland Travel Time = 0.051 hrs = 3.07 Min. T1 =(11.9 L^3/ΔE)^0.385

Were L = 645 ft = 0.12 Miles

ΔE = 49

Time of Concentration TC= 11.77 Min.

Runoff Flowrate Q = C I A

Q 2yr = **1.99** CFS

Q 10yr = **2.92** CFS

Q 100yr = **4.52** CFS

RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin B, 2yr Pre-Developed Hydrograph Results
TIME OF CONCENTRATION 12 MIN.
6 HOUR RAINFALL 1.5 INCHES
BASIN AREA 2.394 ACRES
RUNOFF COEFFICIENT 0.37
PEAK DISCHARGE 1.99 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 12	DISCHARGE (CFS) = 0.1
TIME (MIN) = 24	DISCHARGE (CFS) = 0.1
TIME (MIN) = 36	DISCHARGE (CFS) = 0.1
TIME (MIN) = 48	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 72	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 96	DISCHARGE (CFS) = 0.1
TIME (MIN) = 108	DISCHARGE (CFS) = 0.1
TIME (MIN) = 120	DISCHARGE (CFS) = 0.1
TIME (MIN) = 132	DISCHARGE (CFS) = 0.1
TIME (MIN) = 144	DISCHARGE (CFS) = 0.1
TIME (MIN) = 156	DISCHARGE (CFS) = 0.1
TIME (MIN) = 168	DISCHARGE (CFS) = 0.2
TIME (MIN) = 180	DISCHARGE (CFS) = 0.2
TIME (MIN) = 192	DISCHARGE (CFS) = 0.2
TIME (MIN) = 204	DISCHARGE (CFS) = 0.2
TIME (MIN) = 216	DISCHARGE (CFS) = 0.3
TIME (MIN) = 228	DISCHARGE (CFS) = 0.4
TIME (MIN) = 240	DISCHARGE (CFS) = 0.6
TIME (MIN) = 252	DISCHARGE (CFS) = 1.99
TIME (MIN) = 264	DISCHARGE (CFS) = 0.3
TIME (MIN) = 276	DISCHARGE (CFS) = 0.2
TIME (MIN) = 288	DISCHARGE (CFS) = 0.2
TIME (MIN) = 300	DISCHARGE (CFS) = 0.1
TIME (MIN) = 312	DISCHARGE (CFS) = 0.1
TIME (MIN) = 324	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 348	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 372	DISCHARGE (CFS) = 0

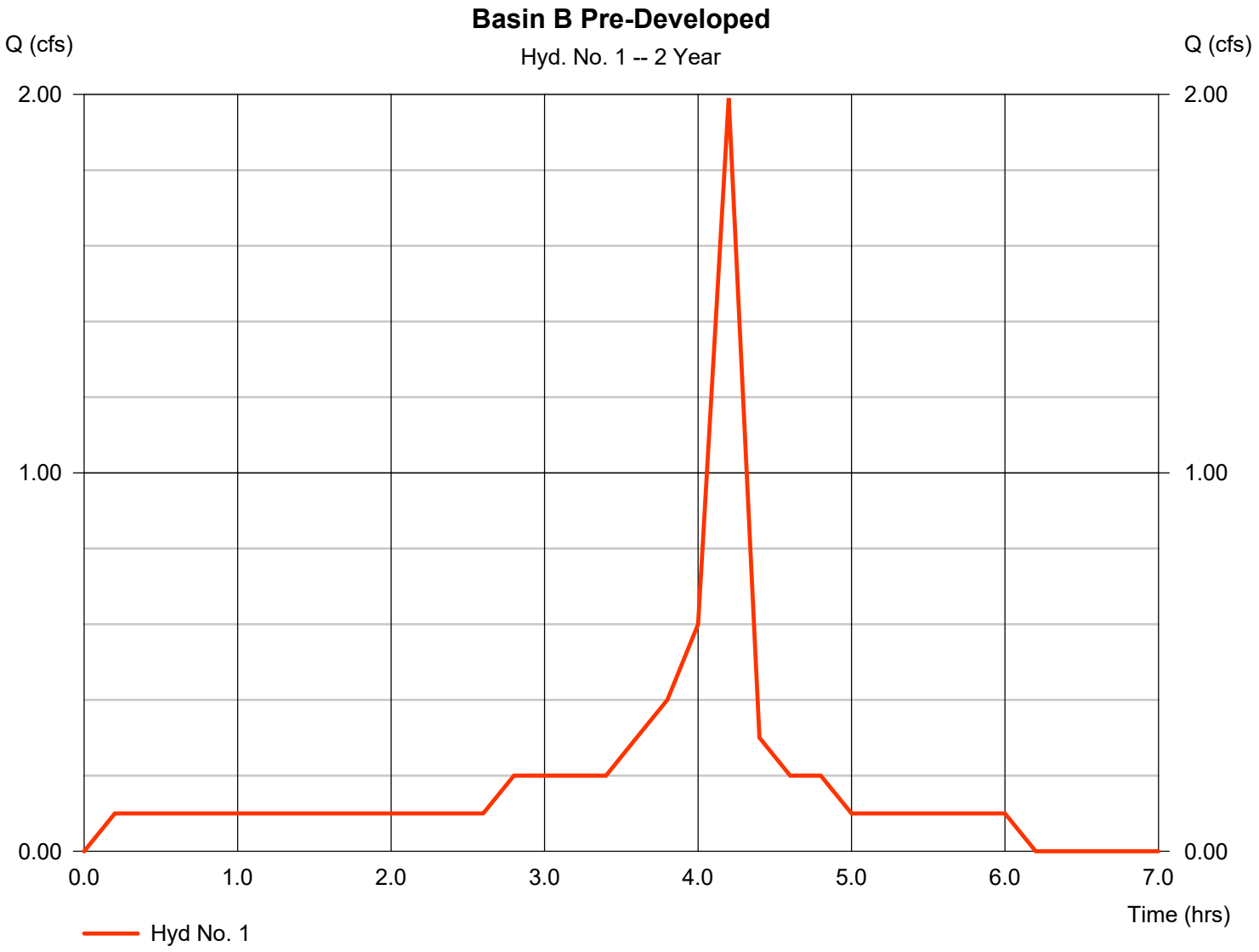
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	= Manual	Peak discharge	= 1.990 cfs
Storm frequency	= 2 yrs	Time to peak	= 4.20 hrs
Time interval	= 12 min	Hyd. volume	= 4,817 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin B, 10yr Pre-Developed Hydrograph Results
TIME OF CONCENTRATION 12 MIN.
6 HOUR RAINFALL 2.2 INCHES
BASIN AREA 2.394 ACRES
RUNOFF COEFFICIENT 0.37
PEAK DISCHARGE 2.92 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 12	DISCHARGE (CFS) = 0.1
TIME (MIN) = 24	DISCHARGE (CFS) = 0.1
TIME (MIN) = 36	DISCHARGE (CFS) = 0.1
TIME (MIN) = 48	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 72	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 96	DISCHARGE (CFS) = 0.2
TIME (MIN) = 108	DISCHARGE (CFS) = 0.2
TIME (MIN) = 120	DISCHARGE (CFS) = 0.2
TIME (MIN) = 132	DISCHARGE (CFS) = 0.2
TIME (MIN) = 144	DISCHARGE (CFS) = 0.2
TIME (MIN) = 156	DISCHARGE (CFS) = 0.2
TIME (MIN) = 168	DISCHARGE (CFS) = 0.2
TIME (MIN) = 180	DISCHARGE (CFS) = 0.3
TIME (MIN) = 192	DISCHARGE (CFS) = 0.3
TIME (MIN) = 204	DISCHARGE (CFS) = 0.3
TIME (MIN) = 216	DISCHARGE (CFS) = 0.4
TIME (MIN) = 228	DISCHARGE (CFS) = 0.6
TIME (MIN) = 240	DISCHARGE (CFS) = 0.8
TIME (MIN) = 252	DISCHARGE (CFS) = 2.92
TIME (MIN) = 264	DISCHARGE (CFS) = 0.5
TIME (MIN) = 276	DISCHARGE (CFS) = 0.3
TIME (MIN) = 288	DISCHARGE (CFS) = 0.2
TIME (MIN) = 300	DISCHARGE (CFS) = 0.2
TIME (MIN) = 312	DISCHARGE (CFS) = 0.2
TIME (MIN) = 324	DISCHARGE (CFS) = 0.2
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 348	DISCHARGE (CFS) = 0.1
TIME (MIN) = 360	DISCHARGE (CFS) = 0.1
TIME (MIN) = 372	DISCHARGE (CFS) = 0

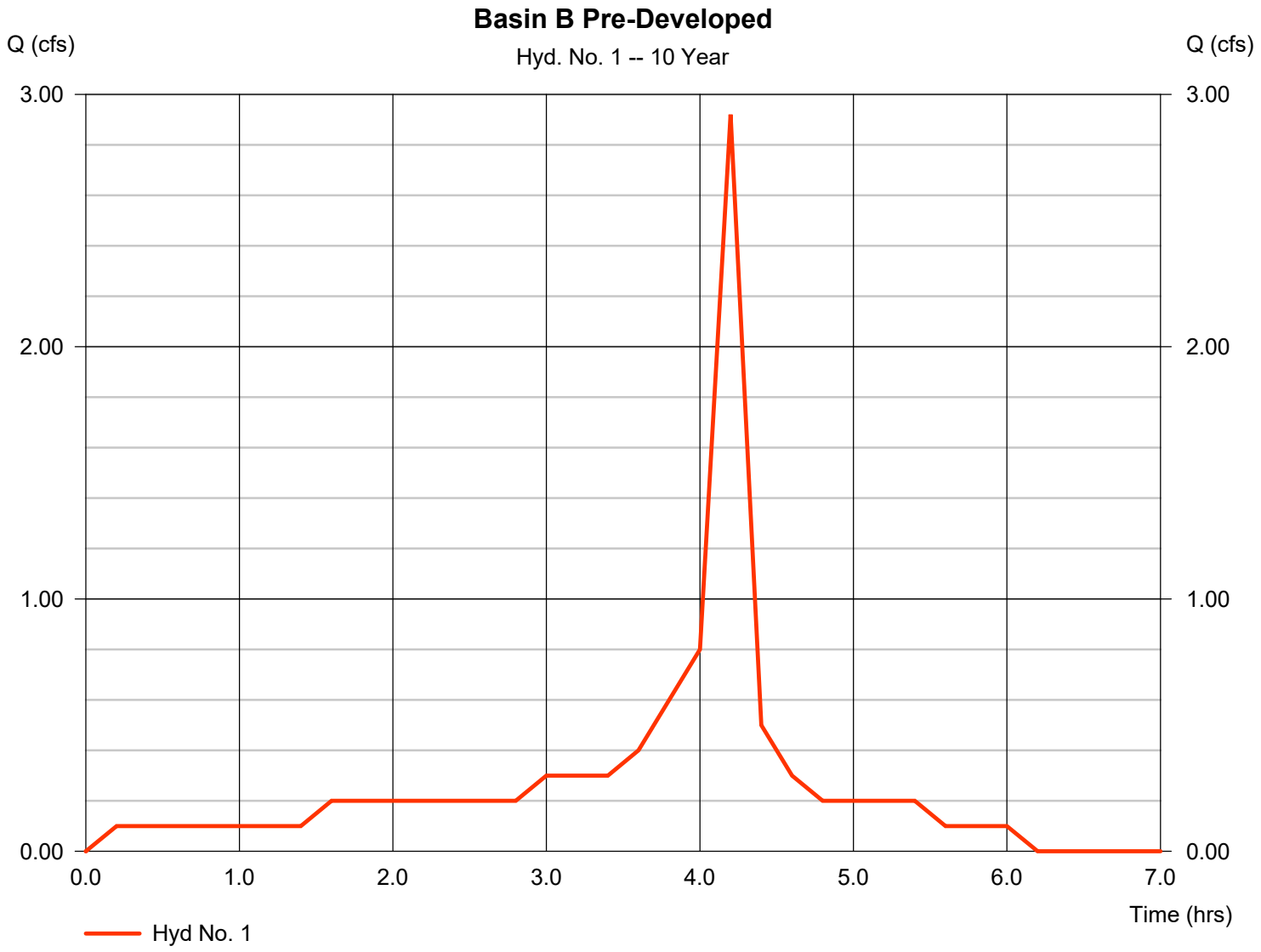
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	= Manual	Peak discharge	= 2.920 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.20 hrs
Time interval	= 12 min	Hyd. volume	= 6,926 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin B, 100yr Pre-Developed Hydrograph Results
TIME OF CONCENTRATION 12 MIN.
6 HOUR RAINFALL 3.4 INCHES
BASIN AREA 2.394 ACRES
RUNOFF COEFFICIENT 0.37
PEAK DISCHARGE 4.52 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 12	DISCHARGE (CFS) = 0.2
TIME (MIN) = 24	DISCHARGE (CFS) = 0.2
TIME (MIN) = 36	DISCHARGE (CFS) = 0.2
TIME (MIN) = 48	DISCHARGE (CFS) = 0.2
TIME (MIN) = 60	DISCHARGE (CFS) = 0.2
TIME (MIN) = 72	DISCHARGE (CFS) = 0.2
TIME (MIN) = 84	DISCHARGE (CFS) = 0.2
TIME (MIN) = 96	DISCHARGE (CFS) = 0.2
TIME (MIN) = 108	DISCHARGE (CFS) = 0.3
TIME (MIN) = 120	DISCHARGE (CFS) = 0.3
TIME (MIN) = 132	DISCHARGE (CFS) = 0.3
TIME (MIN) = 144	DISCHARGE (CFS) = 0.3
TIME (MIN) = 156	DISCHARGE (CFS) = 0.3
TIME (MIN) = 168	DISCHARGE (CFS) = 0.4
TIME (MIN) = 180	DISCHARGE (CFS) = 0.4
TIME (MIN) = 192	DISCHARGE (CFS) = 0.4
TIME (MIN) = 204	DISCHARGE (CFS) = 0.5
TIME (MIN) = 216	DISCHARGE (CFS) = 0.6
TIME (MIN) = 228	DISCHARGE (CFS) = 0.9
TIME (MIN) = 240	DISCHARGE (CFS) = 1.2
TIME (MIN) = 252	DISCHARGE (CFS) = 4.52
TIME (MIN) = 264	DISCHARGE (CFS) = 0.7
TIME (MIN) = 276	DISCHARGE (CFS) = 0.5
TIME (MIN) = 288	DISCHARGE (CFS) = 0.4
TIME (MIN) = 300	DISCHARGE (CFS) = 0.3
TIME (MIN) = 312	DISCHARGE (CFS) = 0.3
TIME (MIN) = 324	DISCHARGE (CFS) = 0.2
TIME (MIN) = 336	DISCHARGE (CFS) = 0.2
TIME (MIN) = 348	DISCHARGE (CFS) = 0.2
TIME (MIN) = 360	DISCHARGE (CFS) = 0.2
TIME (MIN) = 372	DISCHARGE (CFS) = 0

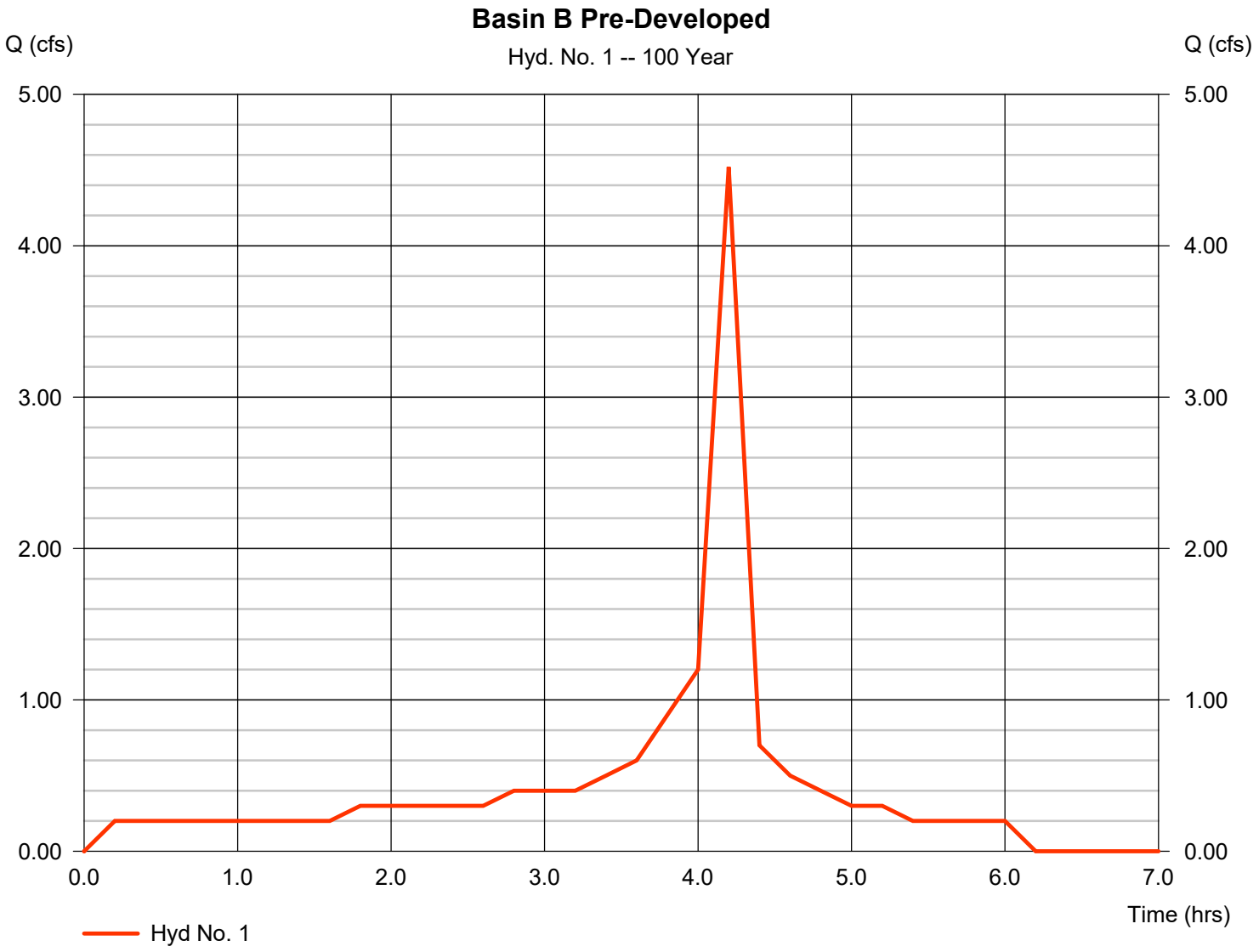
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	= Manual	Peak discharge	= 4.520 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.20 hrs
Time interval	= 12 min	Hyd. volume	= 10,814 cuft



SWEETWATER ENGINEERING

PROJECT NAME: **Nordahl Rd.**

BASIN NO. **Basin "B" Post-Development**

Total Basin Area "A" = **2.272** Ac.

Soils Type: **"C" =** 0.995 Ac. Soils Type: **"D" =** 1.277 Ac.

Runoff Coefficient C = **0.56** Cp = MDR C = 0.54

Cp = MDR D = 0.57

Impervious area% = 40.00%

Rainfall Event	2 year	10 year	100 year
6 Hour Precipitation:	1.5	2.2	3.4
24 Hour Precipitation:	2.5	3.8	6.3
P6/P24 % =	60.00%	57.89%	53.97%
Adjusted P6:	1.5	2.2	3.4

2 yr Intensity I = **2.33** in/hr I = 7.44 P6 Tc^-0.645

10 yr Intensity I = **3.42** in/hr

100 yr Intensity I = **5.29** in/hr

Initial Time of Concentration Ti = 8.7 Min. From Table 3-2 see attached

Oveland Travel Time = 0.043 hrs = 2.61 Min. T1 =(11.9 L^3/ΔE)^0.385

Were L = 519 ft = 0.10 Miles

ΔE = 39

Time of Concentration TC= 11.31 Min. * Tc is less than 10 Min.

Runoff Flowrate Q = C I A

Q 2yr = **2.97** CFS

Q 10yr = **4.36** CFS

Q 100yr = **6.73** CFS

RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin B, 2yr Post-Developed Hydrograph Results
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 1.5 INCHES
BASIN AREA 2.272 ACRES
RUNOFF COEFFICIENT 0.56
PEAK DISCHARGE 2.97 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.1
TIME (MIN) = 22	DISCHARGE (CFS) = 0.1
TIME (MIN) = 33	DISCHARGE (CFS) = 0.1
TIME (MIN) = 44	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 66	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 88	DISCHARGE (CFS) = 0.1
TIME (MIN) = 99	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 121	DISCHARGE (CFS) = 0.2
TIME (MIN) = 132	DISCHARGE (CFS) = 0.2
TIME (MIN) = 143	DISCHARGE (CFS) = 0.2
TIME (MIN) = 154	DISCHARGE (CFS) = 0.2
TIME (MIN) = 165	DISCHARGE (CFS) = 0.2
TIME (MIN) = 176	DISCHARGE (CFS) = 0.2
TIME (MIN) = 187	DISCHARGE (CFS) = 0.3
TIME (MIN) = 198	DISCHARGE (CFS) = 0.3
TIME (MIN) = 209	DISCHARGE (CFS) = 0.4
TIME (MIN) = 220	DISCHARGE (CFS) = 0.4
TIME (MIN) = 231	DISCHARGE (CFS) = 0.6
TIME (MIN) = 242	DISCHARGE (CFS) = 0.9
TIME (MIN) = 253	DISCHARGE (CFS) = 2.97
TIME (MIN) = 264	DISCHARGE (CFS) = 0.5
TIME (MIN) = 275	DISCHARGE (CFS) = 0.3
TIME (MIN) = 286	DISCHARGE (CFS) = 0.3
TIME (MIN) = 297	DISCHARGE (CFS) = 0.2
TIME (MIN) = 308	DISCHARGE (CFS) = 0.2
TIME (MIN) = 319	DISCHARGE (CFS) = 0.2
TIME (MIN) = 330	DISCHARGE (CFS) = 0.1
TIME (MIN) = 341	DISCHARGE (CFS) = 0.1
TIME (MIN) = 352	DISCHARGE (CFS) = 0.1
TIME (MIN) = 363	DISCHARGE (CFS) = 0.1
TIME (MIN) = 374	DISCHARGE (CFS) = 0

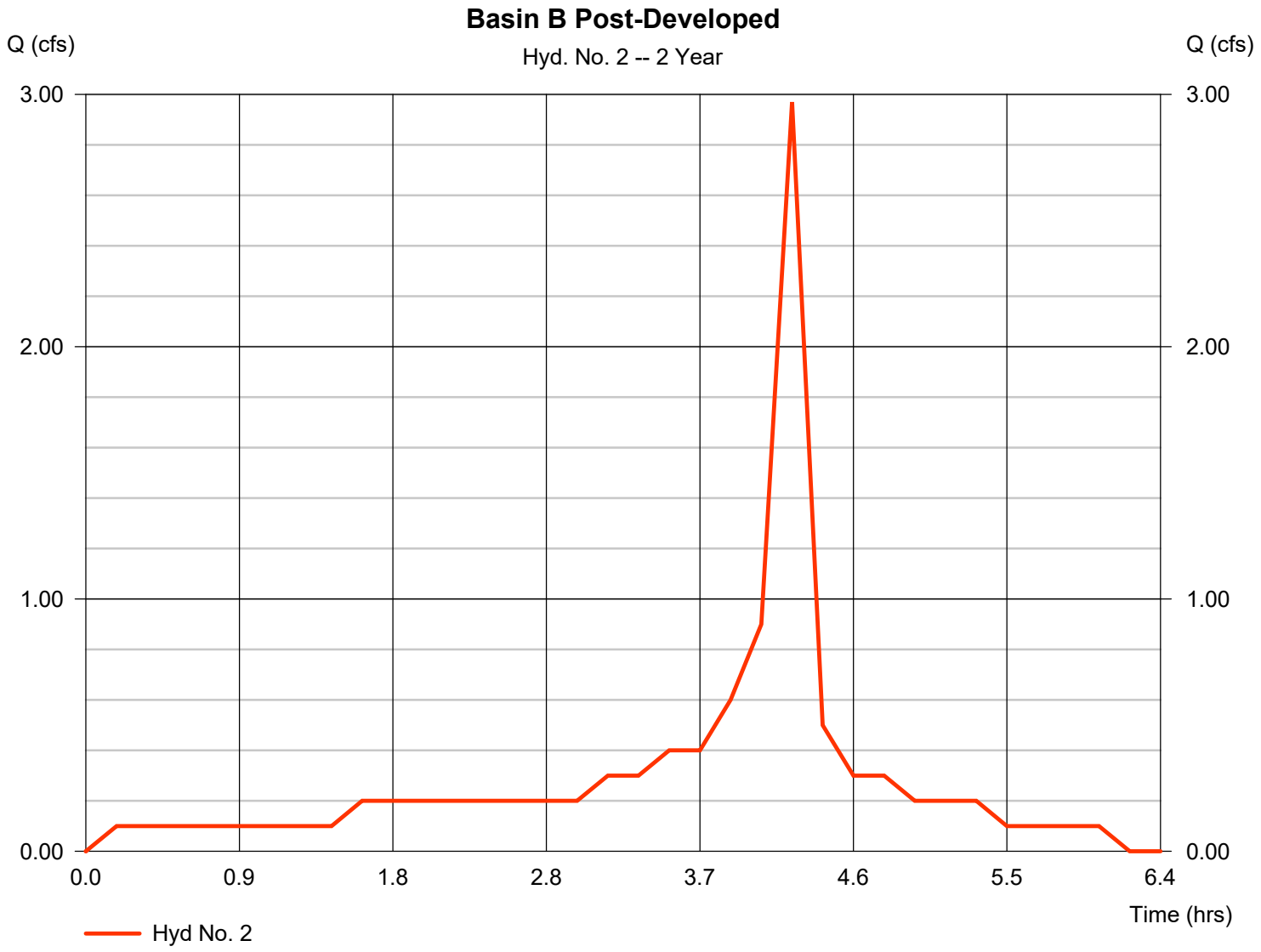
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	= Manual	Peak discharge	= 2.970 cfs
Storm frequency	= 2 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 6,844 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1 Basin B, 10yr Post-Developed Hydrograph Results
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 2.2 INCHES
BASIN AREA 2.272 ACRES
RUNOFF COEFFICIENT 0.56
PEAK DISCHARGE 4.36 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.2
TIME (MIN) = 22	DISCHARGE (CFS) = 0.2
TIME (MIN) = 33	DISCHARGE (CFS) = 0.2
TIME (MIN) = 44	DISCHARGE (CFS) = 0.2
TIME (MIN) = 55	DISCHARGE (CFS) = 0.2
TIME (MIN) = 66	DISCHARGE (CFS) = 0.2
TIME (MIN) = 77	DISCHARGE (CFS) = 0.2
TIME (MIN) = 88	DISCHARGE (CFS) = 0.2
TIME (MIN) = 99	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 121	DISCHARGE (CFS) = 0.2
TIME (MIN) = 132	DISCHARGE (CFS) = 0.3
TIME (MIN) = 143	DISCHARGE (CFS) = 0.3
TIME (MIN) = 154	DISCHARGE (CFS) = 0.3
TIME (MIN) = 165	DISCHARGE (CFS) = 0.3
TIME (MIN) = 176	DISCHARGE (CFS) = 0.3
TIME (MIN) = 187	DISCHARGE (CFS) = 0.4
TIME (MIN) = 198	DISCHARGE (CFS) = 0.4
TIME (MIN) = 209	DISCHARGE (CFS) = 0.5
TIME (MIN) = 220	DISCHARGE (CFS) = 0.6
TIME (MIN) = 231	DISCHARGE (CFS) = 0.9
TIME (MIN) = 242	DISCHARGE (CFS) = 1.3
TIME (MIN) = 253	DISCHARGE (CFS) = 4.36
TIME (MIN) = 264	DISCHARGE (CFS) = 0.7
TIME (MIN) = 275	DISCHARGE (CFS) = 0.5
TIME (MIN) = 286	DISCHARGE (CFS) = 0.4
TIME (MIN) = 297	DISCHARGE (CFS) = 0.3
TIME (MIN) = 308	DISCHARGE (CFS) = 0.3
TIME (MIN) = 319	DISCHARGE (CFS) = 0.2
TIME (MIN) = 330	DISCHARGE (CFS) = 0.2
TIME (MIN) = 341	DISCHARGE (CFS) = 0.2
TIME (MIN) = 352	DISCHARGE (CFS) = 0.2
TIME (MIN) = 363	DISCHARGE (CFS) = 0.2
TIME (MIN) = 374	DISCHARGE (CFS) = 0

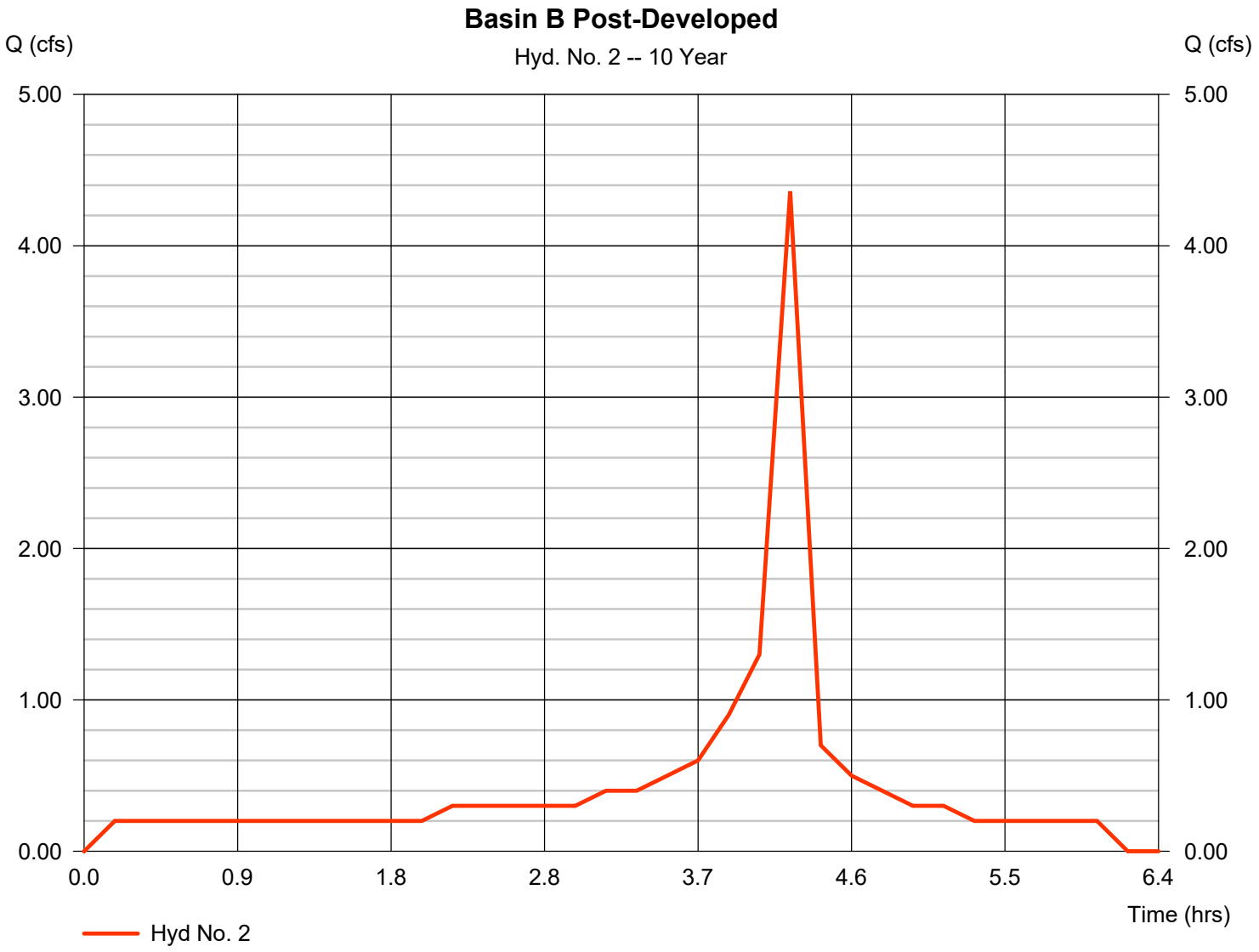
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	= Manual	Peak discharge	= 4.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 10,138 cuft



RUN DATE 1/14/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 11 MIN. Basin B, 100yr Post-Developed Hydrograph Results
6 HOUR RAINFALL 3.4 INCHES
BASIN AREA 2.272 ACRES
RUNOFF COEFFICIENT 0.56
PEAK DISCHARGE 6.73 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.3
TIME (MIN) = 22	DISCHARGE (CFS) = 0.3
TIME (MIN) = 33	DISCHARGE (CFS) = 0.3
TIME (MIN) = 44	DISCHARGE (CFS) = 0.3
TIME (MIN) = 55	DISCHARGE (CFS) = 0.3
TIME (MIN) = 66	DISCHARGE (CFS) = 0.3
TIME (MIN) = 77	DISCHARGE (CFS) = 0.3
TIME (MIN) = 88	DISCHARGE (CFS) = 0.3
TIME (MIN) = 99	DISCHARGE (CFS) = 0.3
TIME (MIN) = 110	DISCHARGE (CFS) = 0.4
TIME (MIN) = 121	DISCHARGE (CFS) = 0.4
TIME (MIN) = 132	DISCHARGE (CFS) = 0.4
TIME (MIN) = 143	DISCHARGE (CFS) = 0.4
TIME (MIN) = 154	DISCHARGE (CFS) = 0.5
TIME (MIN) = 165	DISCHARGE (CFS) = 0.5
TIME (MIN) = 176	DISCHARGE (CFS) = 0.5
TIME (MIN) = 187	DISCHARGE (CFS) = 0.6
TIME (MIN) = 198	DISCHARGE (CFS) = 0.7
TIME (MIN) = 209	DISCHARGE (CFS) = 0.8
TIME (MIN) = 220	DISCHARGE (CFS) = 0.9
TIME (MIN) = 231	DISCHARGE (CFS) = 1.4
TIME (MIN) = 242	DISCHARGE (CFS) = 2
TIME (MIN) = 253	DISCHARGE (CFS) = 6.73
TIME (MIN) = 264	DISCHARGE (CFS) = 1.1
TIME (MIN) = 275	DISCHARGE (CFS) = 0.7
TIME (MIN) = 286	DISCHARGE (CFS) = 0.6
TIME (MIN) = 297	DISCHARGE (CFS) = 0.5
TIME (MIN) = 308	DISCHARGE (CFS) = 0.4
TIME (MIN) = 319	DISCHARGE (CFS) = 0.4
TIME (MIN) = 330	DISCHARGE (CFS) = 0.3
TIME (MIN) = 341	DISCHARGE (CFS) = 0.3
TIME (MIN) = 352	DISCHARGE (CFS) = 0.3
TIME (MIN) = 363	DISCHARGE (CFS) = 0.3
TIME (MIN) = 374	DISCHARGE (CFS) = 0

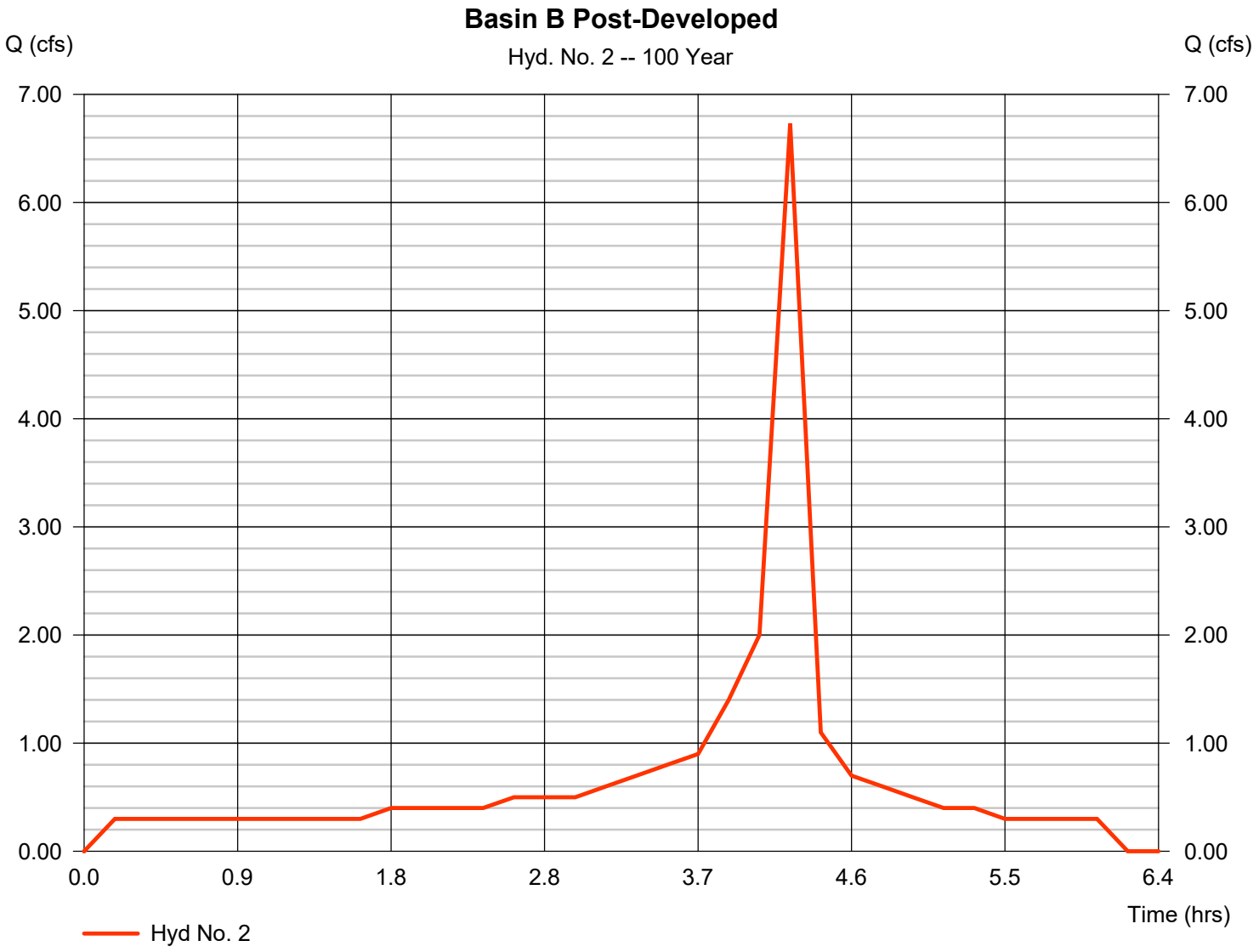
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	= Manual	Peak discharge	= 6.730 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 15,728 cuft



SECTION 5

Bioretention Pond 2 (Basin "B") Total Storage Volumes (Including Water Quality)

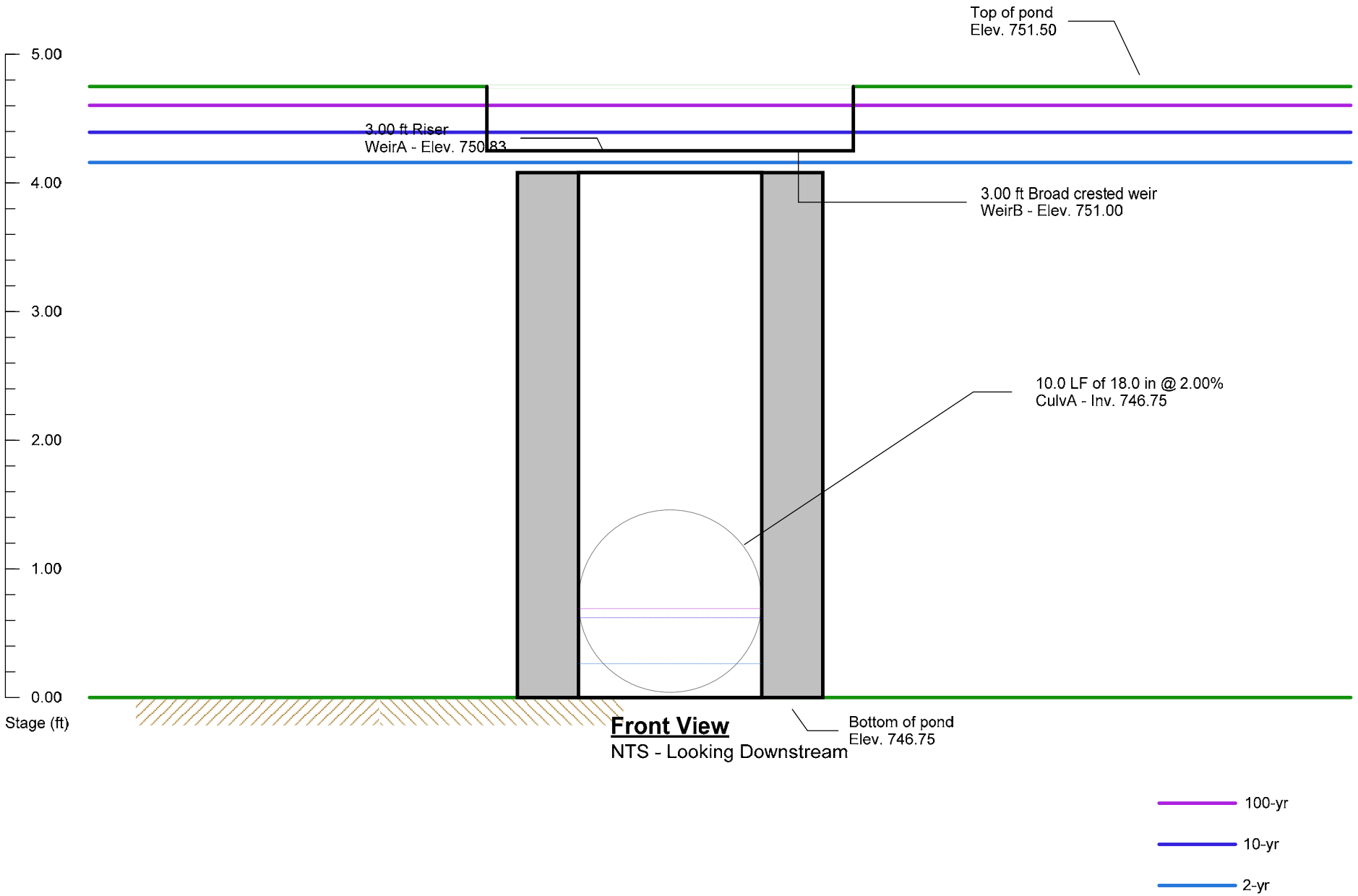
Pond Layer	Bottom El (Ft)	Bottom Area (CF)	Thickness (in)	Top El (Ft)	Top Area	Side Slopes	Porossity	Incrimental Volume	Accumulative Volume
6" of 3/4" Gravel Below Subdrain Inv	746.75	3714.87	6	747.25	3714.87	Vert	0.40	742.97	742.97
3/4" Gravel Above Subdrain Inv	747.25	3714.87	8	747.92	3714.87	Vert	0.40	990.63	1733.61
Pea Gravel	747.92	3714.87	4	748.25	3714.87	Vert	0.40	495.32	2228.92
Engineered Soil	748.25	3714.87	18	749.75	3714.87	Vert	0.10	557.23	2786.15
Mulch	749.75	3714.87	3	750.00	3714.87	Vert	0.40	371.49	3157.64
Top of Mulch to Top of Riser	750.00	3714.87	10	750.83	4567.57	3:01	1.00	3451.02	6608.66
Freeboard	750.83	4567.57	8	751.50	5284.31	3:01	1.00	3283.96	9892.62

Bioretention Pond 2 (Basin "B") Total Storage Volumes (Without Water Quality) - Volumes Used for 100 yr Detention Routing Calculations

Pond Layer	Bottom El (Ft)	Bottom Area (CF)	Thickness (in)	Top El (Ft)	Top Area	Side Slopes	Porossity	Incrimental Volume	Accumulative Volume
6" of 3/4" Gravel Below Subdrain Inv	746.75	2837.87	6	747.25	2837.87	Vert	0.40	567.57	567.57
3/4" Gravel Above Subdrain Inv	747.25	2837.87	8	747.92	2837.87	Vert	0.40	756.77	1324.34
Pea Gravel	747.92	2837.87	4	748.25	2837.87	Vert	0.40	378.38	1702.72
Engineered Soil	748.25	2837.87	18	749.75	2837.87	Vert	0.10	425.68	2128.40
Mulch	749.75	2837.87	3	750.00	2837.87	Vert	0.40	283.79	2412.19
Top of Mulch to Top of Riser	750.00	2837.87	10	750.83	4567.57	3:01	1.00	3085.60	5497.79
Freeboard (8")	750.83	4567.57	8	751.50	5284.31	3:01	1.00	3283.96	8781.75

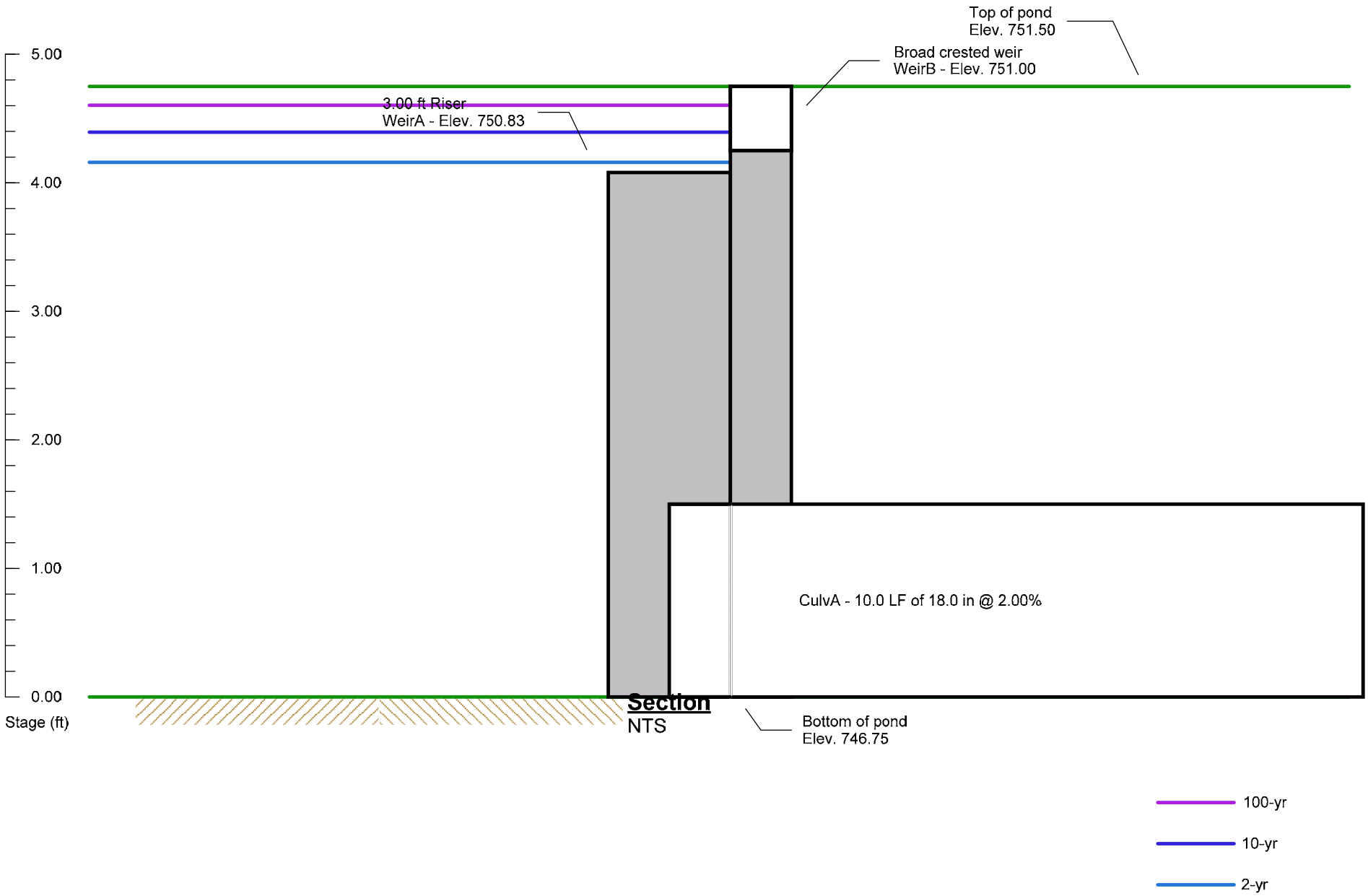
* Required Min Water Quality Area is 877 (sf) so removing that area from the full bottom of pond area (3714.87 sf) leaves 2837.87 (sf) of storage area available for Detention and Hydromodification

Pond No. 1 - Basin B - Pond



Inflow hydrograph = 2. Manual - Basin B Post-Developed

Pond No. 1 - Basin B - Pond



Inflow hydrograph = 2. Manual - Basin B Post-Developed

Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	26.0877	10.7000	0.8283	--------
3	0.0000	0.0000	0.0000	--------
5	41.1990	10.7000	0.8283	--------
10	52.7183	10.7000	0.8283	--------
25	65.7239	10.7000	0.8283	--------
50	76.8716	10.7000	0.8283	--------
100	86.7806	10.7000	0.8283	--------

File name: Autocad Hydraflow IDF file for Church.IDF

Intensity = B / (Tc + 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	2.67	2.12	1.77	1.53	1.35	1.21	1.10	1.01	0.93	0.87	0.81	0.77
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	4.21	3.35	2.80	2.42	2.13	1.91	1.74	1.59	1.47	1.37	1.29	1.21
10	5.39	4.28	3.58	3.09	2.73	2.45	2.22	2.04	1.89	1.76	1.65	1.55
25	6.72	5.34	4.46	3.85	3.40	3.05	2.77	2.54	2.35	2.19	2.05	1.93
50	7.86	6.25	5.22	4.51	3.98	3.57	3.24	2.97	2.75	2.56	2.40	2.26
100	8.87	7.05	5.90	5.09	4.49	4.03	3.66	3.36	3.11	2.89	2.71	2.55

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.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	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
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	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydrograph Return Period Recap

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	Manual	------	-------	1.990	-------	-------	2.920	-------	-------	4.520	Basin B Pre-Developed
2	Manual	------	-------	2.970	-------	-------	4.360	-------	-------	6.730	Basin B Post-Developed
3	Reservoir	2	-------	0.233	-------	-------	2.201	-------	-------	3.831	Pond B Routing Results

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	Manual	1.990	12	252	4,817	------	------	------	Basin B Pre-Developed
2	Manual	2.970	11	253	6,844	------	------	------	Basin B Post-Developed
3	Reservoir	0.233	11	297	1,345	2	750.91	5,888	Pond B Routing Results

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	= Manual	Peak discharge	= 1.990 cfs
Storm frequency	= 2 yrs	Time to peak	= 252 min
Time interval	= 12 min	Hyd. volume	= 4,817 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
12	0.100	264	0.300
24	0.100	276	0.200
36	0.100	288	0.200
48	0.100	300	0.100
60	0.100	312	0.100
72	0.100	324	0.100
84	0.100	336	0.100
96	0.100	348	0.100
108	0.100	360	0.100
120	0.100		
132	0.100	*...End*	
144	0.100		
156	0.100		
168	0.200		
180	0.200		
192	0.200		
204	0.200		
216	0.300		
228	0.400		
240	0.600		
252	1.990		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	= Manual	Peak discharge	= 2.970 cfs
Storm frequency	= 2 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 6,844 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
11	0.100	242	0.900
22	0.100	253	2.970
33	0.100	264	0.500
44	0.100	275	0.300
55	0.100	286	0.300
66	0.100	297	0.200
77	0.100	308	0.200
88	0.100	319	0.200
99	0.200	330	0.100
110	0.200	341	0.100
121	0.200	352	0.100
132	0.200	363	0.100
143	0.200		
154	0.200	*...End*	
165	0.200		
176	0.200		
187	0.300		
198	0.300		
209	0.400		
220	0.400		
231	0.600		

<<

Hydrograph Report

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 0.233 cfs
Storm frequency	= 2 yrs	Time to peak	= 297 min
Time interval	= 11 min	Hyd. volume	= 1,345 cuft
Inflow hyd. No.	= 2 - Basin B Post-Deve	Reservoir name	= Basin B - Pond
Max. Elevation	= 750.91 ft	Max. Storage	= 5,888 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
264	0.500	750.85	0.057	-----	-----	-----	0.056	-----	-----	-----	-----	0.056
275	0.300	750.89	0.159	-----	-----	-----	0.158	-----	-----	-----	-----	0.158
286	0.300	750.91	0.220	-----	-----	-----	0.217	-----	-----	-----	-----	0.217
297	0.200	750.91 <<	0.237	-----	-----	-----	0.233	-----	-----	-----	-----	0.233
<<												
308	0.200	750.91	0.220	-----	-----	-----	0.217	-----	-----	-----	-----	0.217
319	0.200	750.90	0.211	-----	-----	-----	0.209	-----	-----	-----	-----	0.209
330	0.100	750.90	0.181	-----	-----	-----	0.181	-----	-----	-----	-----	0.180
341	0.100	750.89	0.154	-----	-----	-----	0.154	-----	-----	-----	-----	0.154
352	0.100	750.88	0.138	-----	-----	-----	0.138	-----	-----	-----	-----	0.138
363	0.100	750.88	0.127	-----	-----	-----	0.127	-----	-----	-----	-----	0.127
374	0.000	750.87	0.104	-----	-----	-----	0.104	-----	-----	-----	-----	0.104
385	0.000	750.86	0.073	-----	-----	-----	0.073	-----	-----	-----	-----	0.073
396	0.000	750.85	0.051	-----	-----	-----	0.051	-----	-----	-----	-----	0.051
407	0.000	750.84	0.036	-----	-----	-----	0.036	-----	-----	-----	-----	0.036
418	0.000	750.84	0.025	-----	-----	-----	0.025	-----	-----	-----	-----	0.025
429	0.000	750.84	0.018	-----	-----	-----	0.018	-----	-----	-----	-----	0.018
440	0.000	750.83	0.013	-----	-----	-----	0.013	-----	-----	-----	-----	0.013
451	0.000	750.83	0.009	-----	-----	-----	0.009	-----	-----	-----	-----	0.009
462	0.000	750.83	0.006	-----	-----	-----	0.006	-----	-----	-----	-----	0.006
473	0.000	750.83	0.004	-----	-----	-----	0.004	-----	-----	-----	-----	0.004

Continues on next page...

Pond B Routing Results

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
484	0.000	750.83	0.003	-----	-----	-----	0.003	-----	-----	-----	-----	0.003

...End

Hydrograph Report

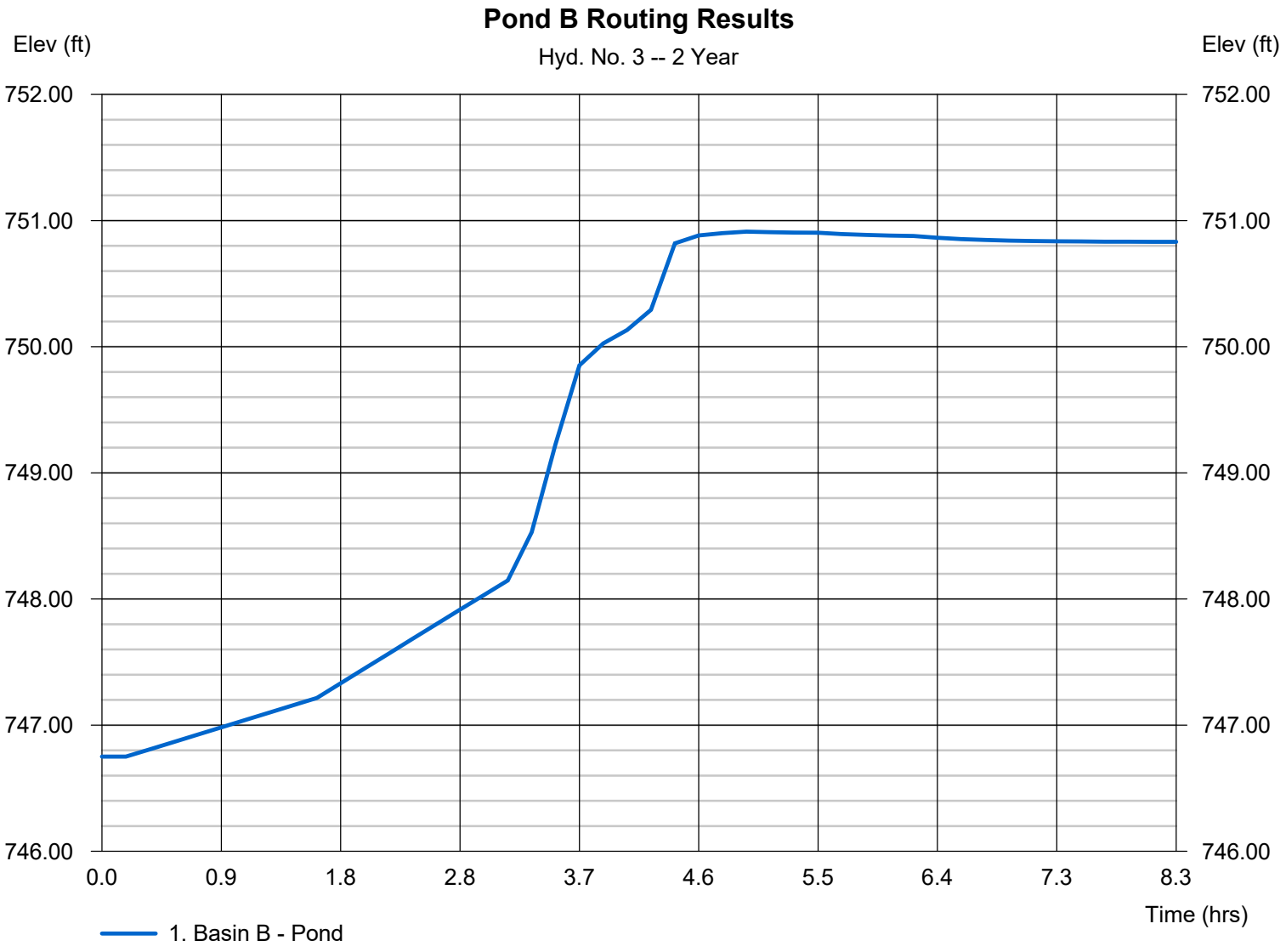
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 0.233 cfs
Storm frequency	= 2 yrs	Time to peak	= 4.95 hrs
Time interval	= 11 min	Hyd. volume	= 1,345 cuft
Inflow hyd. No.	= 2 - Basin B Post-Developed	Max. Elevation	= 750.91 ft
Reservoir name	= Basin B - Pond	Max. Storage	= 5,888 cuft

Storage Indication method used.



Hydrograph Report

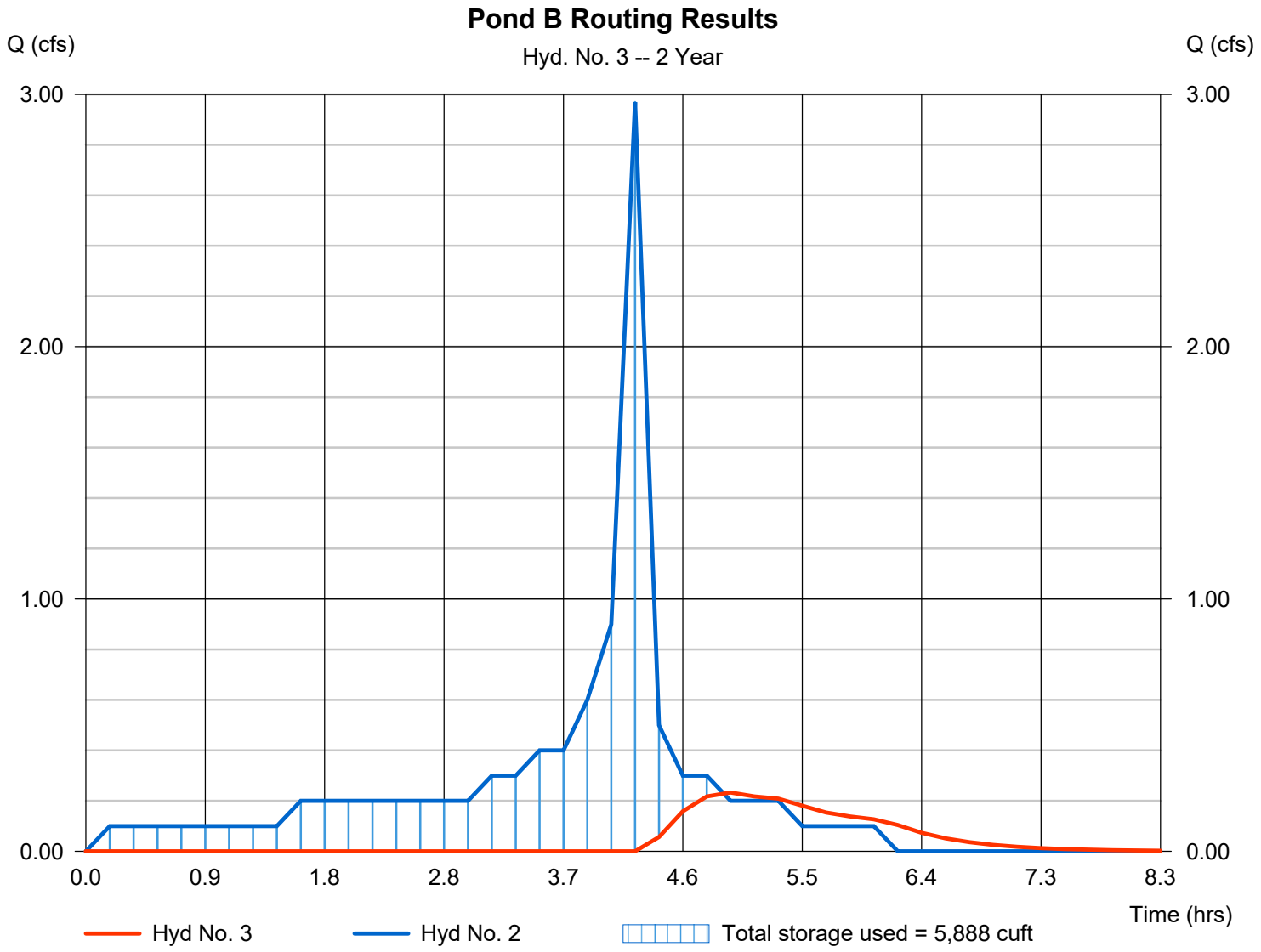
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 0.233 cfs
Storm frequency	= 2 yrs	Time to peak	= 4.95 hrs
Time interval	= 11 min	Hyd. volume	= 1,345 cuft
Inflow hyd. No.	= 2 - Basin B Post-Developed	Max. Elevation	= 750.91 ft
Reservoir name	= Basin B - Pond	Max. Storage	= 5,888 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	Manual	2.920	12	252	6,926	------	------	------	Basin B Pre-Developed
2	Manual	4.360	11	253	10,138	------	------	------	Basin B Post-Developed
3	Reservoir	2.201	11	264	4,638	2	751.25	7,038	Pond B Routing Results

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	= Manual	Peak discharge	= 2.920 cfs
Storm frequency	= 10 yrs	Time to peak	= 252 min
Time interval	= 12 min	Hyd. volume	= 6,926 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
12	0.100	264	0.500
24	0.100	276	0.300
36	0.100	288	0.200
48	0.100	300	0.200
60	0.100	312	0.200
72	0.100	324	0.200
84	0.100	336	0.100
96	0.200	348	0.100
108	0.200	360	0.100
120	0.200		
132	0.200	*...End*	
144	0.200		
156	0.200		
168	0.200		
180	0.300		
192	0.300		
204	0.300		
216	0.400		
228	0.600		
240	0.800		
252	2.920		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	= Manual	Peak discharge	= 4.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 10,138 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
11	0.200	242	1.300
22	0.200	253	4.360
33	0.200	264	0.700
44	0.200	275	0.500
55	0.200	286	0.400
66	0.200	297	0.300
77	0.200	308	0.300
88	0.200	319	0.200
99	0.200	330	0.200
110	0.200	341	0.200
121	0.200	352	0.200
132	0.300	363	0.200
143	0.300		
154	0.300	*...End*	
165	0.300		
176	0.300		
187	0.400		
198	0.400		
209	0.500		
220	0.600		
231	0.900		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 2.201 cfs
Storm frequency	= 10 yrs	Time to peak	= 264 min
Time interval	= 11 min	Hyd. volume	= 4,638 cuft
Inflow hyd. No.	= 2 - Basin B Post-Deve	Reservoir name	= Basin B - Pond
Max. Elevation	= 751.25 ft	Max. Storage	= 7,038 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
253	4.360 <<	751.00	0.741	-----	-----	-----	0.722	0.024	-----	-----	-----	0.747
264	0.700	751.14 <<	1.781	-----	-----	-----	1.766	0.435	-----	-----	-----	2.201
275	0.500	751.02	0.845	-----	-----	-----	0.826	0.035	-----	-----	-----	0.861
286	0.400	750.98	0.612	-----	-----	-----	0.593	0.011	-----	-----	-----	0.604
297	0.300	750.96	0.472	-----	-----	-----	0.455	-----	-----	-----	-----	0.455
308	0.300	750.94	0.392	-----	-----	-----	0.380	-----	-----	-----	-----	0.380
319	0.200	750.93	0.326	-----	-----	-----	0.317	-----	-----	-----	-----	0.317
330	0.200	750.92	0.266	-----	-----	-----	0.261	-----	-----	-----	-----	0.261
341	0.200	750.91	0.235	-----	-----	-----	0.231	-----	-----	-----	-----	0.231
352	0.200	750.91	0.219	-----	-----	-----	0.216	-----	-----	-----	-----	0.216
363	0.200	750.90	0.211	-----	-----	-----	0.208	-----	-----	-----	-----	0.208
374	0.000	750.89	0.163	-----	-----	-----	0.163	-----	-----	-----	-----	0.163
385	0.000	750.87	0.115	-----	-----	-----	0.114	-----	-----	-----	-----	0.114
396	0.000	750.86	0.081	-----	-----	-----	0.080	-----	-----	-----	-----	0.080
407	0.000	750.85	0.057	-----	-----	-----	0.057	-----	-----	-----	-----	0.057
418	0.000	750.85	0.040	-----	-----	-----	0.040	-----	-----	-----	-----	0.040
429	0.000	750.84	0.028	-----	-----	-----	0.028	-----	-----	-----	-----	0.028

<<

...End

Hydrograph Report

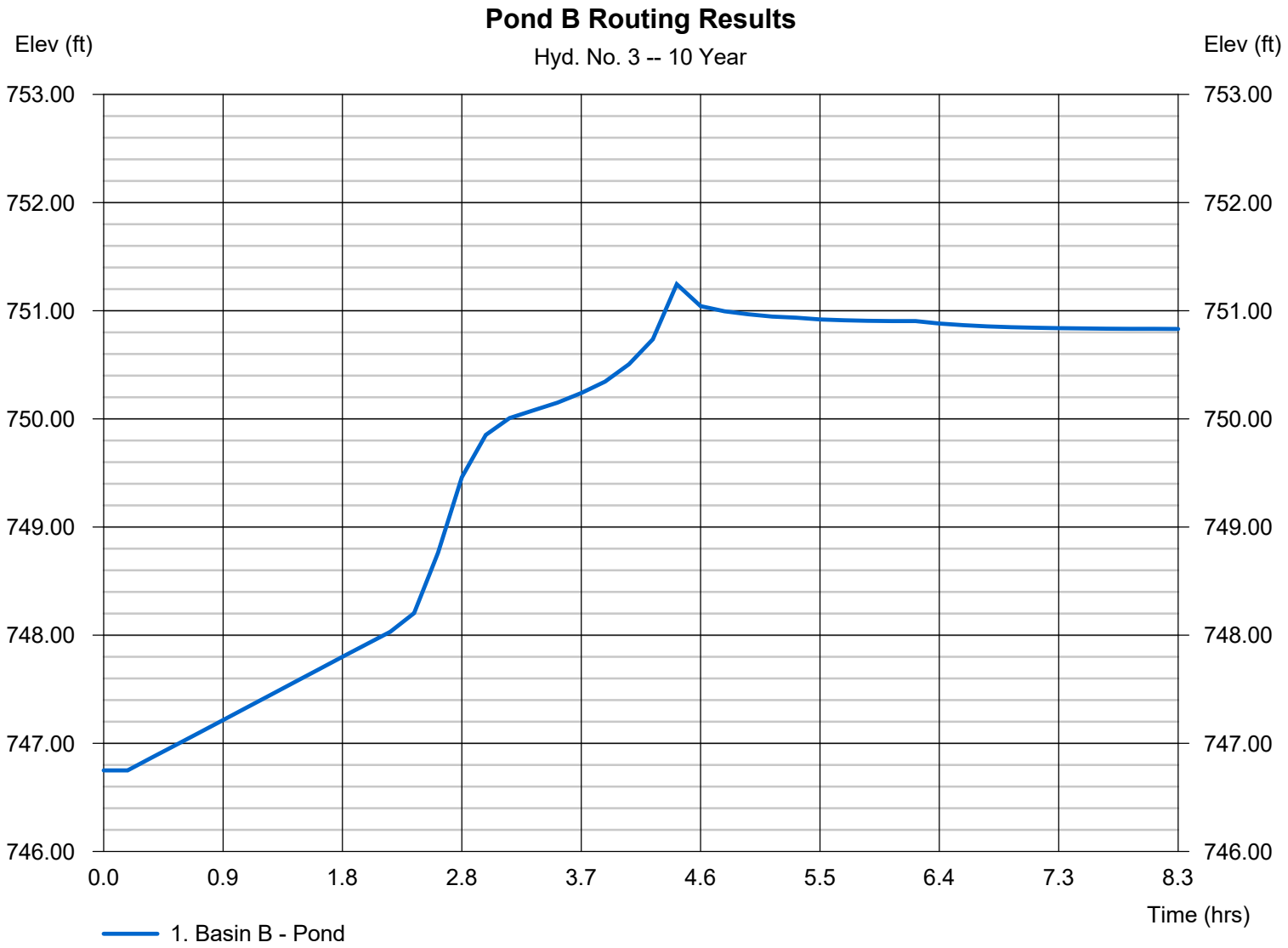
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 2.201 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.40 hrs
Time interval	= 11 min	Hyd. volume	= 4,638 cuft
Inflow hyd. No.	= 2 - Basin B Post-Developed	Max. Elevation	= 751.25 ft
Reservoir name	= Basin B - Pond	Max. Storage	= 7,038 cuft

Storage Indication method used.



Hydrograph Report

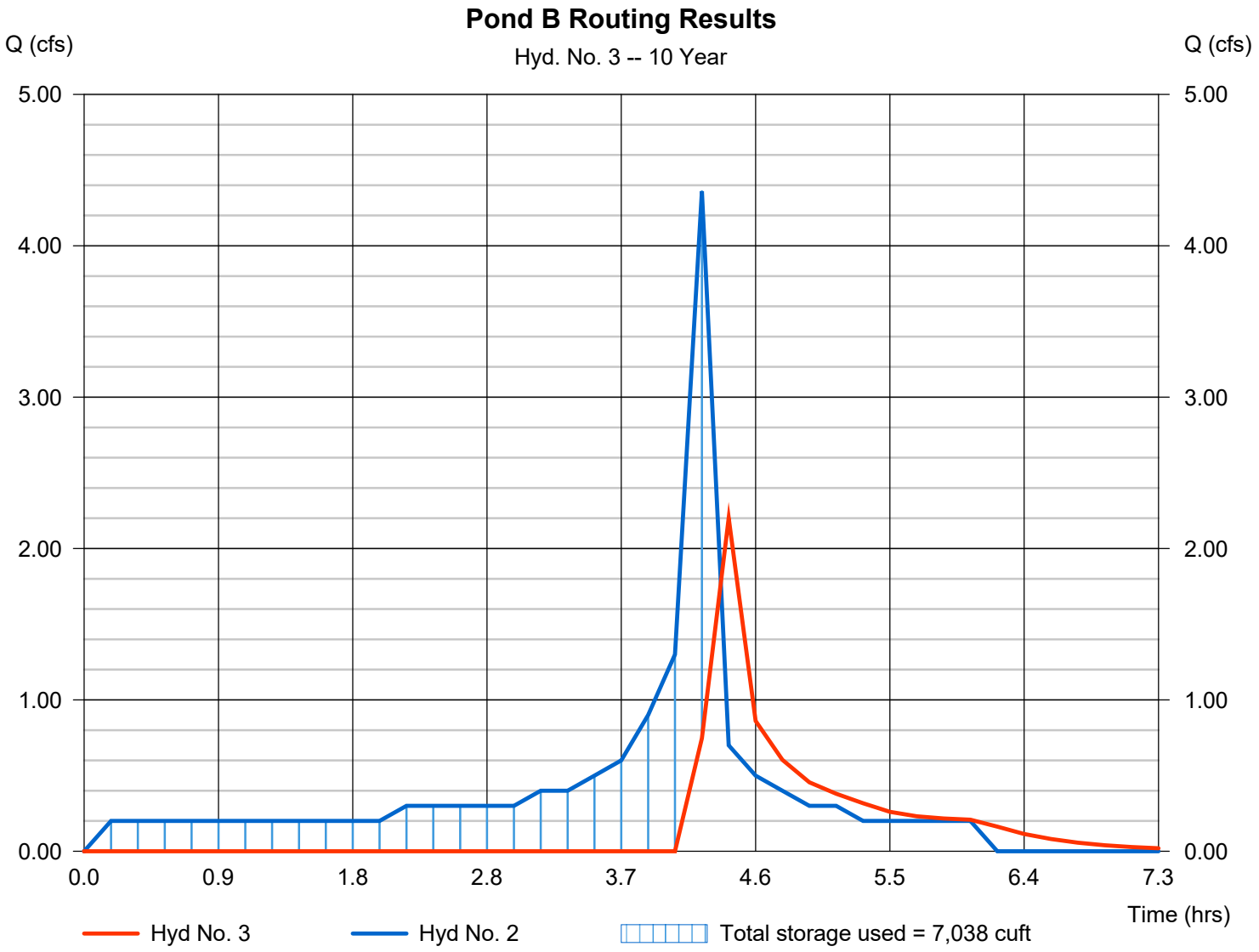
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 2.201 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.40 hrs
Time interval	= 11 min	Hyd. volume	= 4,638 cuft
Inflow hyd. No.	= 2 - Basin B Post-Developed	Max. Elevation	= 751.25 ft
Reservoir name	= Basin B - Pond	Max. Storage	= 7,038 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	Manual	4.520	12	252	10,814	------	------	------	Basin B Pre-Developed
2	Manual	6.730	11	253	15,728	------	------	------	Basin B Post-Developed
3	Reservoir	3.831	11	264	10,228	2	751.50	8,063	Pond B Routing Results

Hydrograph Report

Hyd. No. 1

Basin B Pre-Developed

Hydrograph type	= Manual	Peak discharge	= 4.520 cfs
Storm frequency	= 100 yrs	Time to peak	= 252 min
Time interval	= 12 min	Hyd. volume	= 10,814 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
12	0.200	264	0.700
24	0.200	276	0.500
36	0.200	288	0.400
48	0.200	300	0.300
60	0.200	312	0.300
72	0.200	324	0.200
84	0.200	336	0.200
96	0.200	348	0.200
108	0.300	360	0.200
120	0.300		
132	0.300	*...End*	
144	0.300		
156	0.300		
168	0.400		
180	0.400		
192	0.400		
204	0.500		
216	0.600		
228	0.900		
240	1.200		
252	4.520		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 2

Basin B Post-Developed

Hydrograph type	= Manual	Peak discharge	= 6.730 cfs
Storm frequency	= 100 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 15,728 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
11	0.300	242	2.000
22	0.300	253	6.730
33	0.300	264	1.100
44	0.300	275	0.700
55	0.300	286	0.600
66	0.300	297	0.500
77	0.300	308	0.400
88	0.300	319	0.400
99	0.300	330	0.300
110	0.400	341	0.300
121	0.400	352	0.300
132	0.400	363	0.300
143	0.400		
154	0.500	*...End*	
165	0.500		
176	0.500		
187	0.600		
198	0.700		
209	0.800		
220	0.900		
231	1.400		

<<

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 3.831 cfs
Storm frequency	= 100 yrs	Time to peak	= 264 min
Time interval	= 11 min	Hyd. volume	= 10,228 cuft
Inflow hyd. No.	= 2 - Basin B Post-Deve	Reservoir name	= Basin B - Pond
Max. Elevation	= 751.50 ft	Max. Storage	= 8,063 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
231	1.400	750.96	0.470	-----	-----	-----	0.453	-----	-----	-----	-----	0.453
242	2.000	751.07	1.186	-----	-----	-----	1.159	0.148	-----	-----	-----	1.307
253	6.730 <<	751.33	2.152	-----	-----	-----	2.128	1.454	-----	-----	-----	3.581
264	1.100	751.35 <<	2.215	-----	-----	-----	2.188	1.643	-----	-----	-----	3.831
<<												
275	0.700	751.10	1.460	-----	-----	-----	1.428	0.261	-----	-----	-----	1.689
286	0.600	751.02	0.845	-----	-----	-----	0.826	0.035	-----	-----	-----	0.861
297	0.500	750.99	0.669	-----	-----	-----	0.650	0.017	-----	-----	-----	0.666
308	0.400	750.97	0.546	-----	-----	-----	0.527	0.004	-----	-----	-----	0.531
319	0.400	750.96	0.475	-----	-----	-----	0.459	-----	-----	-----	-----	0.458
330	0.300	750.95	0.420	-----	-----	-----	0.406	-----	-----	-----	-----	0.406
341	0.300	750.94	0.366	-----	-----	-----	0.355	-----	-----	-----	-----	0.355
352	0.300	750.93	0.338	-----	-----	-----	0.328	-----	-----	-----	-----	0.328
363	0.300	750.93	0.323	-----	-----	-----	0.315	-----	-----	-----	-----	0.315
374	0.000	750.91	0.239	-----	-----	-----	0.235	-----	-----	-----	-----	0.235
385	0.000	750.88	0.142	-----	-----	-----	0.142	-----	-----	-----	-----	0.142
396	0.000	750.87	0.100	-----	-----	-----	0.100	-----	-----	-----	-----	0.100
407	0.000	750.86	0.070	-----	-----	-----	0.070	-----	-----	-----	-----	0.070
418	0.000	750.85	0.049	-----	-----	-----	0.049	-----	-----	-----	-----	0.049

...End

Hydrograph Report

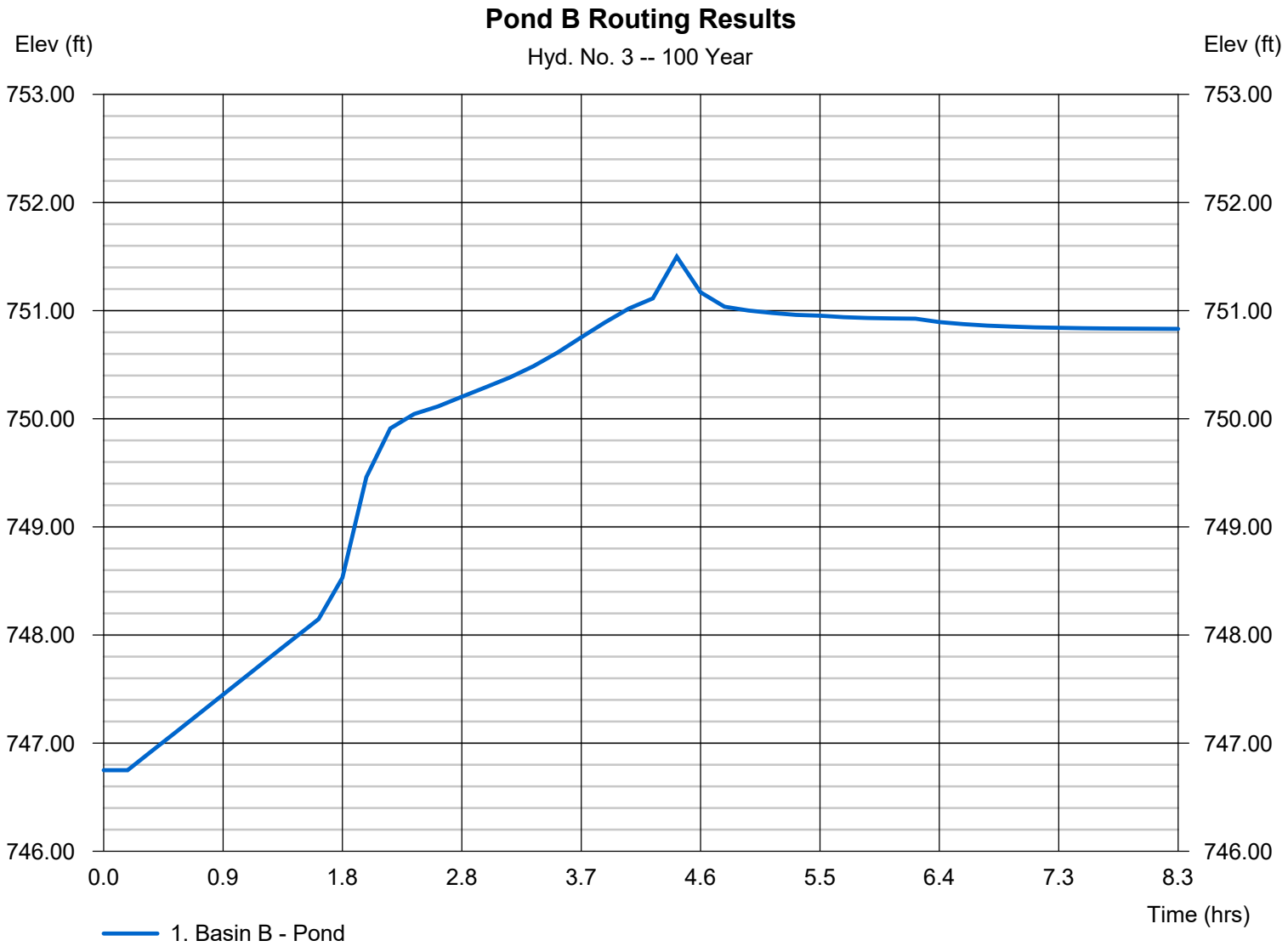
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 3.831 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.40 hrs
Time interval	= 11 min	Hyd. volume	= 10,228 cuft
Inflow hyd. No.	= 2 - Basin B Post-Developed	Max. Elevation	= 751.50 ft
Reservoir name	= Basin B - Pond	Max. Storage	= 8,063 cuft

Storage Indication method used.



Hydrograph Report

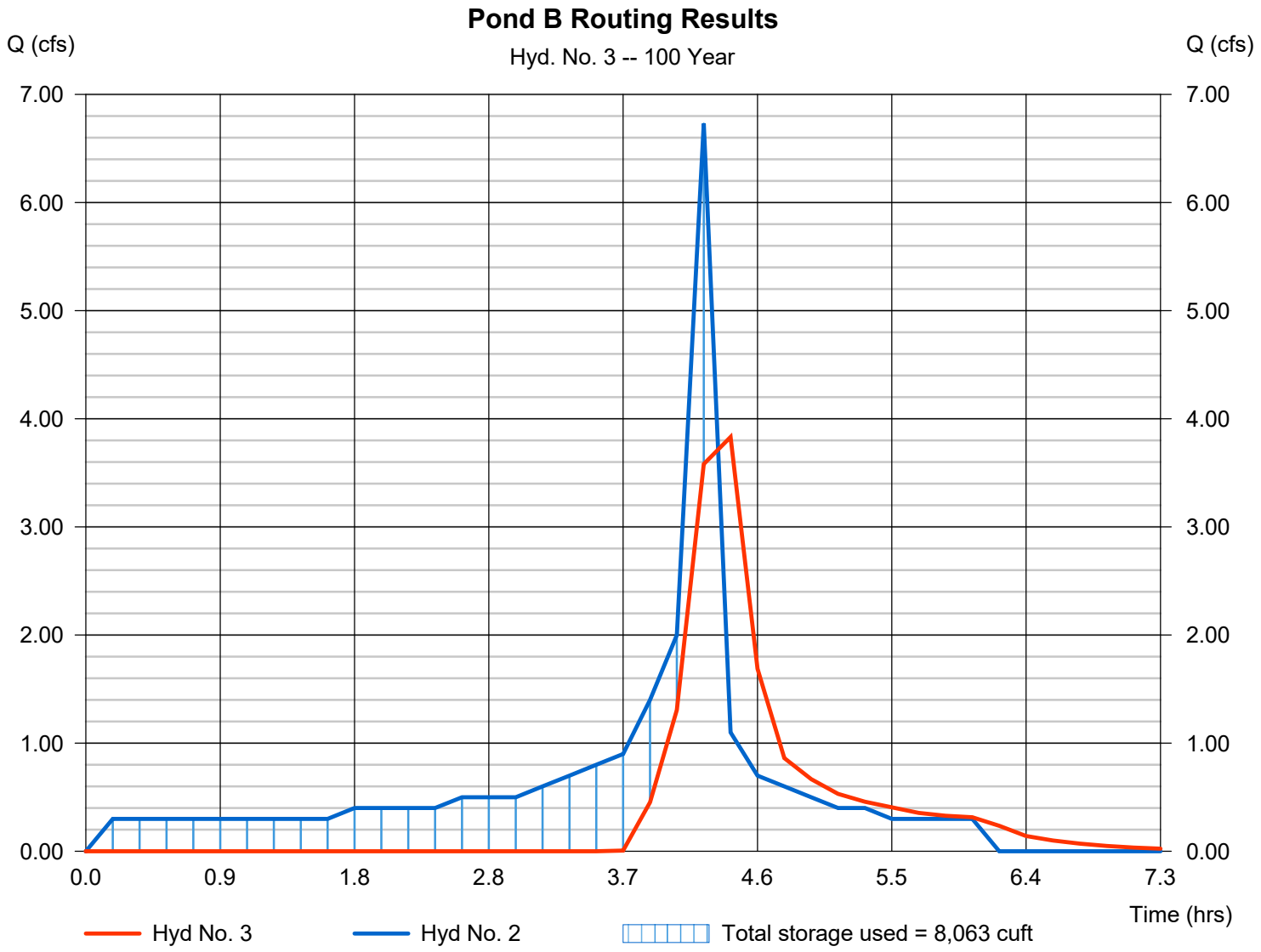
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Wednesday, 01 / 17 / 2018

Hyd. No. 3

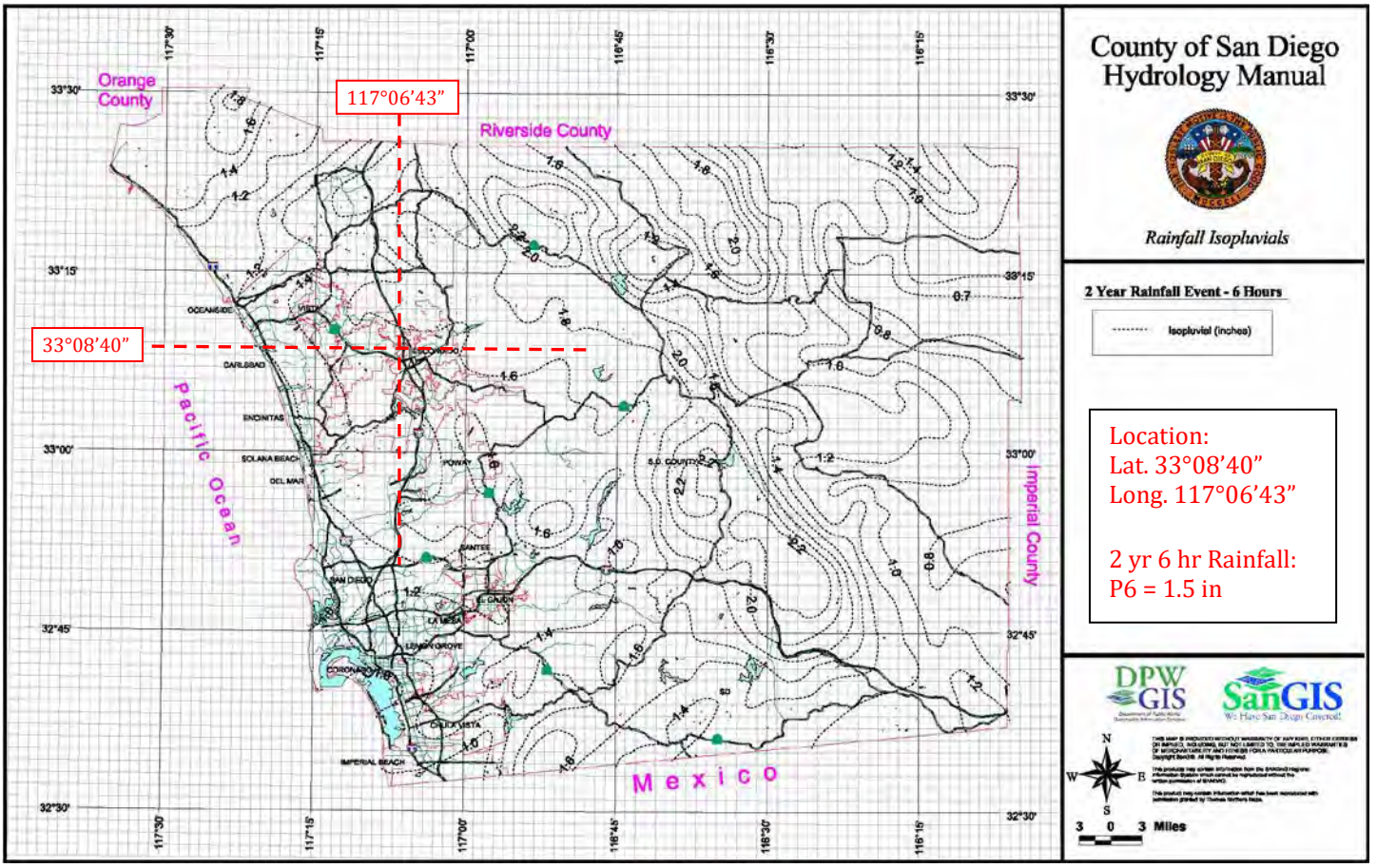
Pond B Routing Results

Hydrograph type	= Reservoir	Peak discharge	= 3.831 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.40 hrs
Time interval	= 11 min	Hyd. volume	= 10,228 cuft
Inflow hyd. No.	= 2 - Basin B Post-Developed	Max. Elevation	= 751.50 ft
Reservoir name	= Basin B - Pond	Max. Storage	= 8,063 cuft

Storage Indication method used.



SECTION **6**



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Location:
Lat. 33°08'40"
Long. 117°06'43"

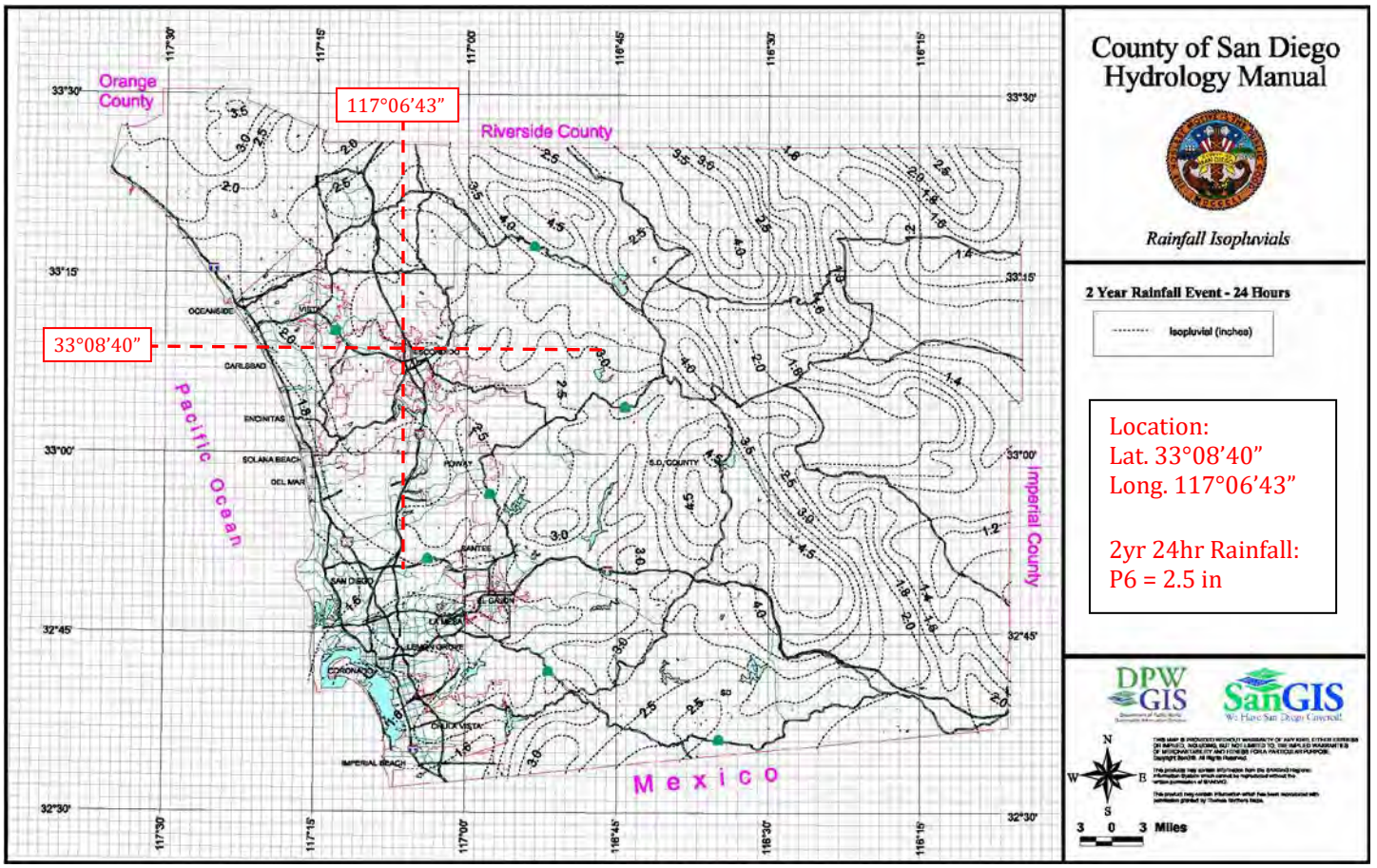
2 yr 6 hr Rainfall:
P6 = 1.5 in

DPW GIS

SanGIS
We Have San Diego Covered!

N
W
E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Location:
Lat. 33°08'40"
Long. 117°06'43"

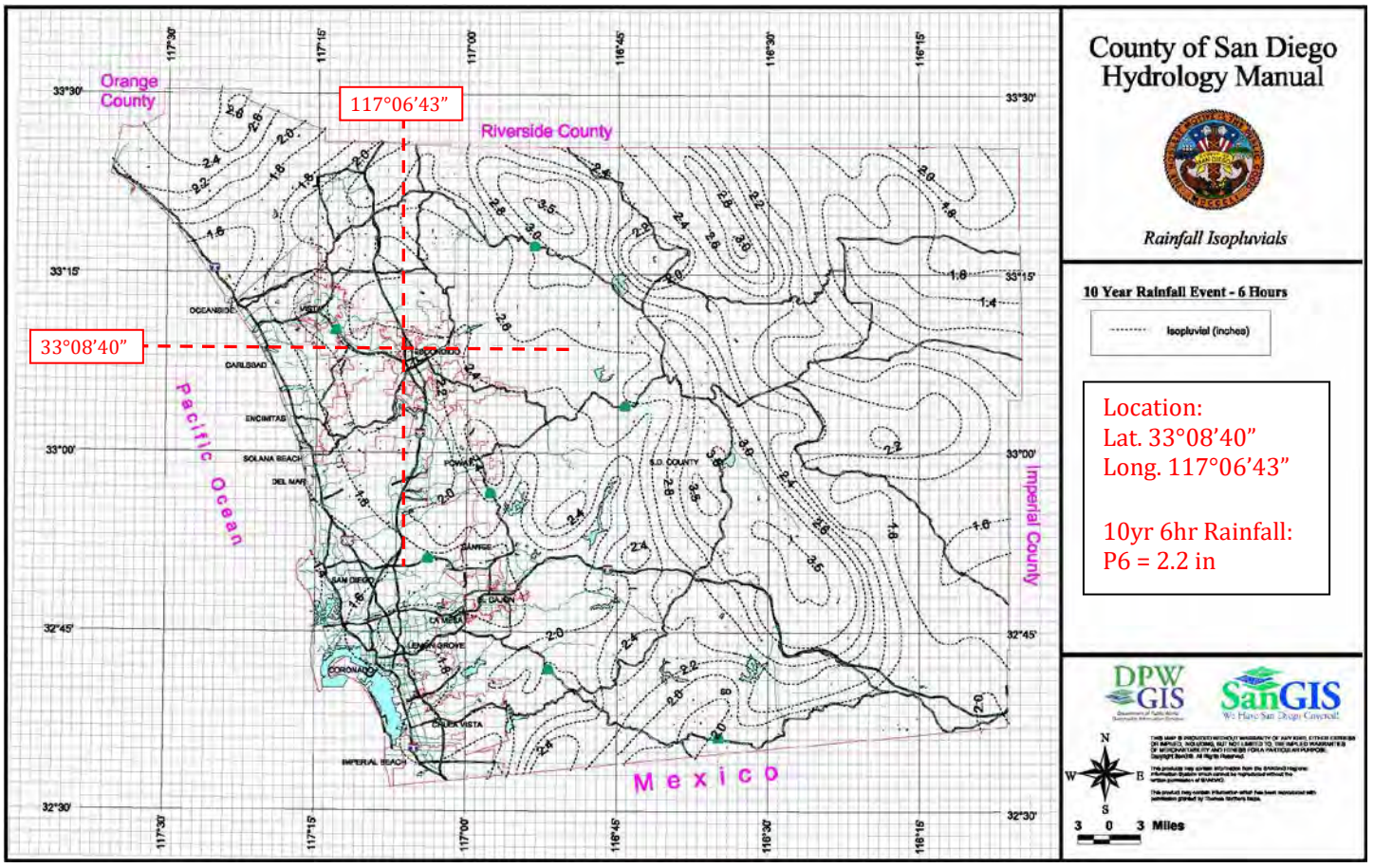
2yr 24hr Rainfall:
P6 = 2.5 in

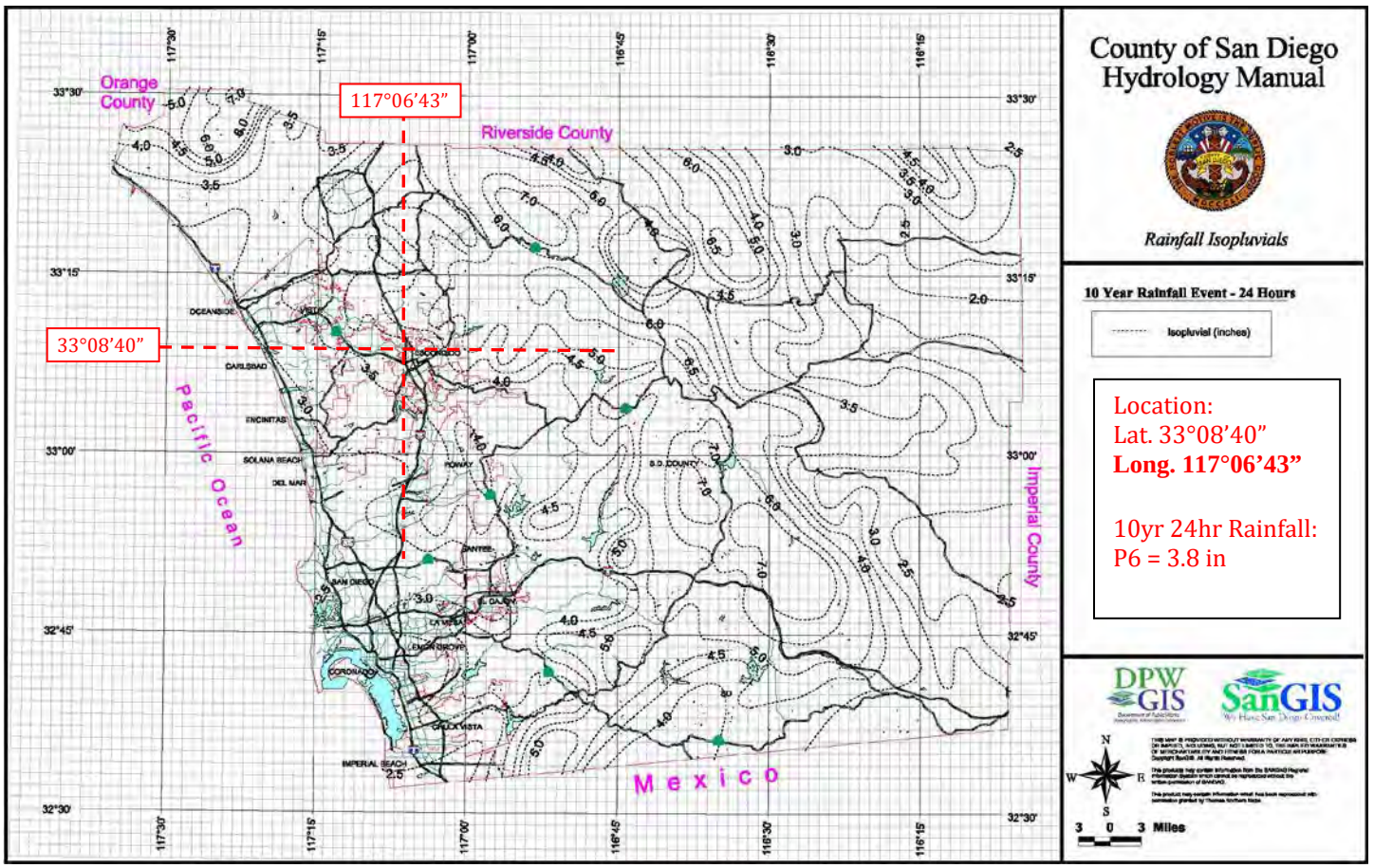
DPW GIS

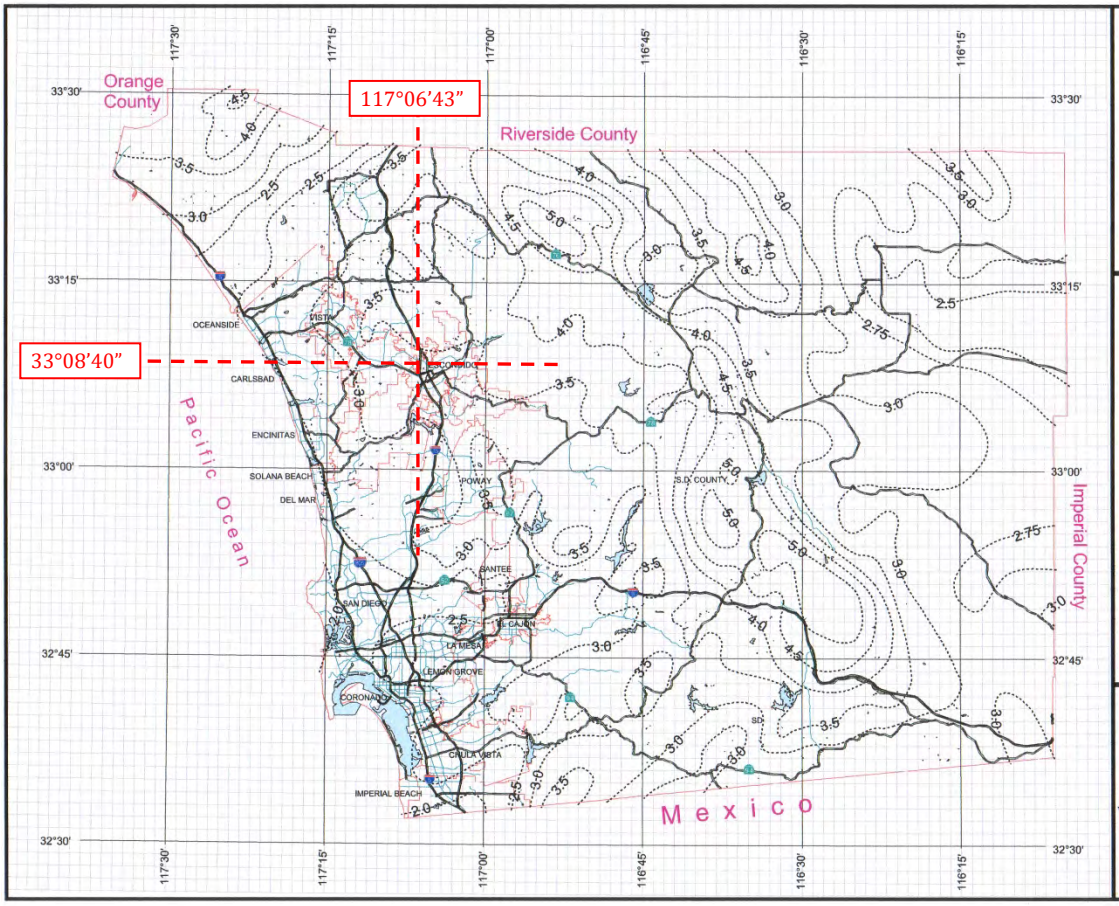
SanGIS
We Have San Diego Covered!

N
W
E
S

3 0 3 Miles


Orange County
117°06'43"
Riverside County
33°08'40"
Pacific Ocean
Imperial County
Mexico
County of San Diego Hydrology Manual
Rainfall Isopluvials
10 Year Rainfall Event - 6 Hours
Isopluvial (inches)
Location:
Lat. 33°08'40"
Long. 117°06'43"
10yr 6hr Rainfall:
P6 = 2.2 in
DPW GIS
SanGIS
3 0 3 Miles


Orange County
117°06'43"
Riverside County
33°08'40"
Pacific Ocean
Imperial County
Mexico
County of San Diego Hydrology Manual
Rainfall Isopluvials
10 Year Rainfall Event - 24 Hours
Isopluvial (inches)
Location:
Lat. 33°08'40"
Long. 117°06'43"
10yr 24hr Rainfall:
P6 = 3.8 in
DPW GIS
SanGIS
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Location:
Lat. 33°08'40"
Long. 117°06'43"

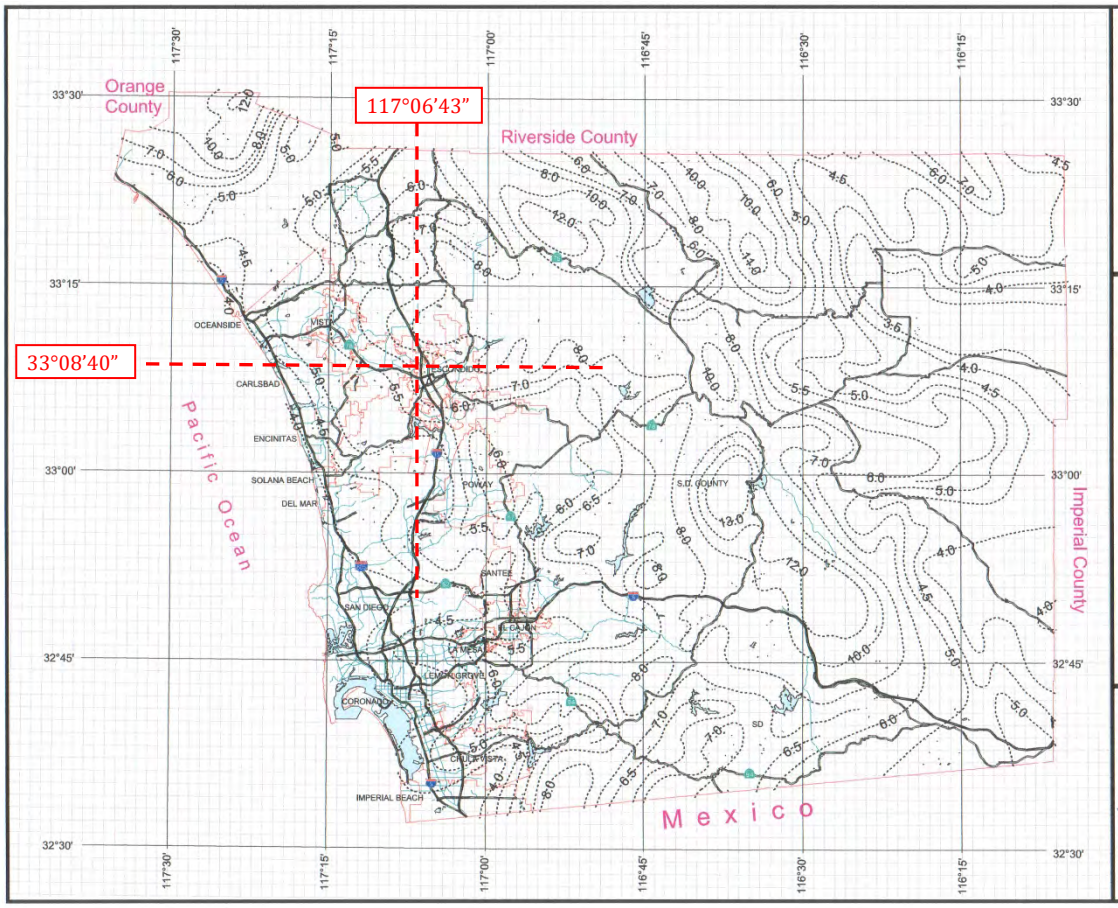
100yr 6hr Rainfall:
P6 = 3.4 in

DPW GIS — Department of Public Works Geographic Information Services

SanGIS — We Have San Diego Covered!

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Location:
Lat. 33°08'40"
Long. 117°06'43"

100 yr 24hr Rainfall:
P24 = 6.3 in

DPW GIS — Department of Public Works Geographic Information Services

SanGIS — We Have San Diego Covered!

N W E S

3 0 3 Miles

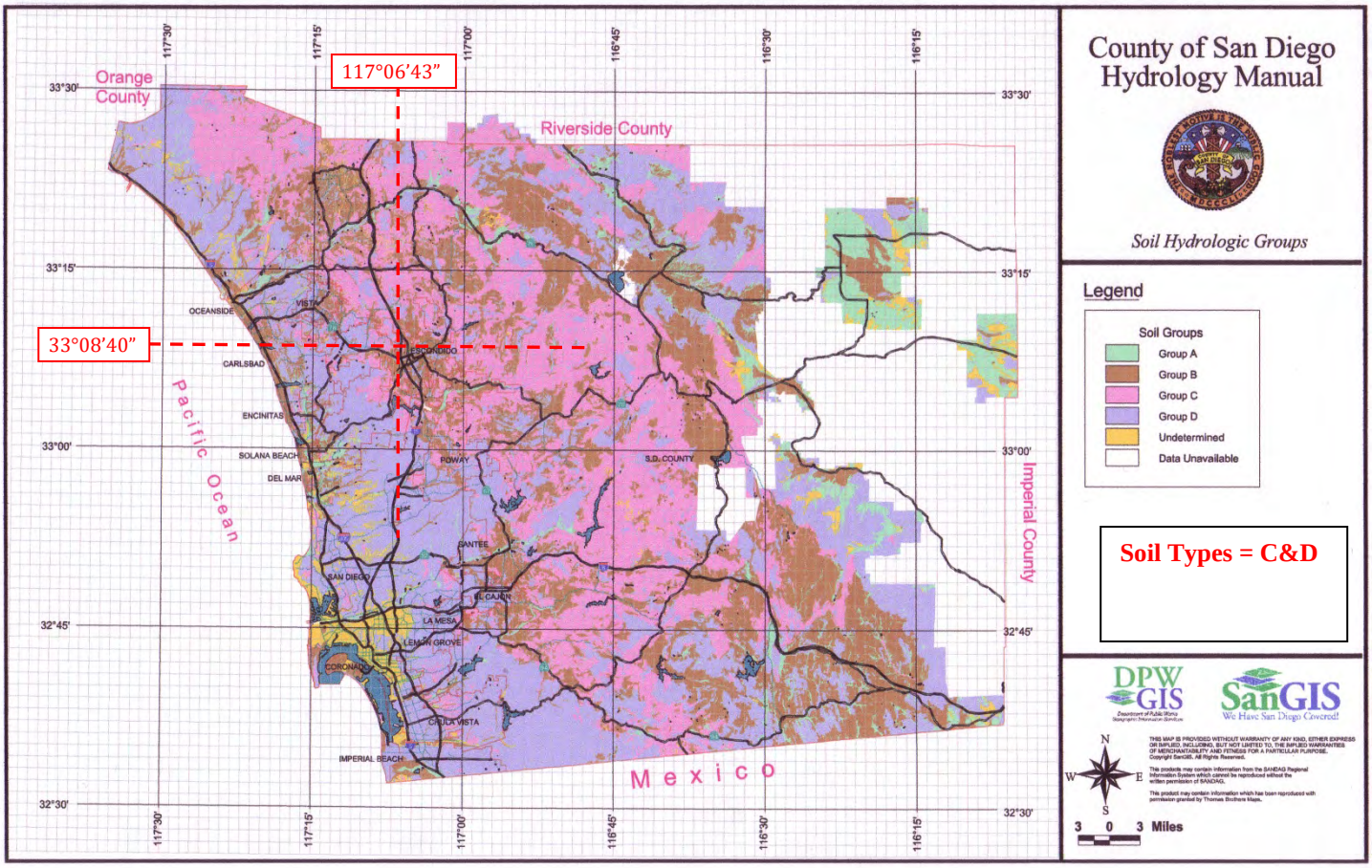


Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

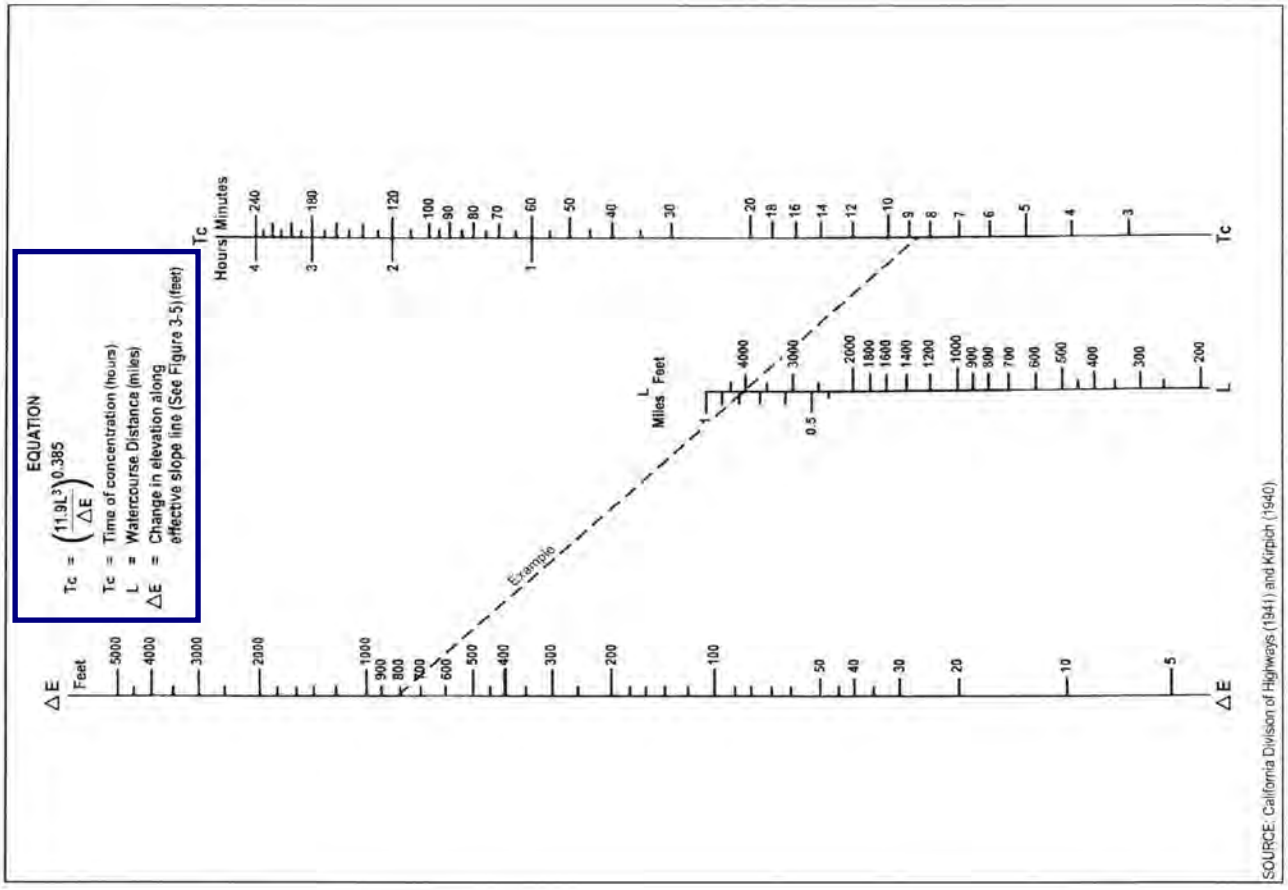
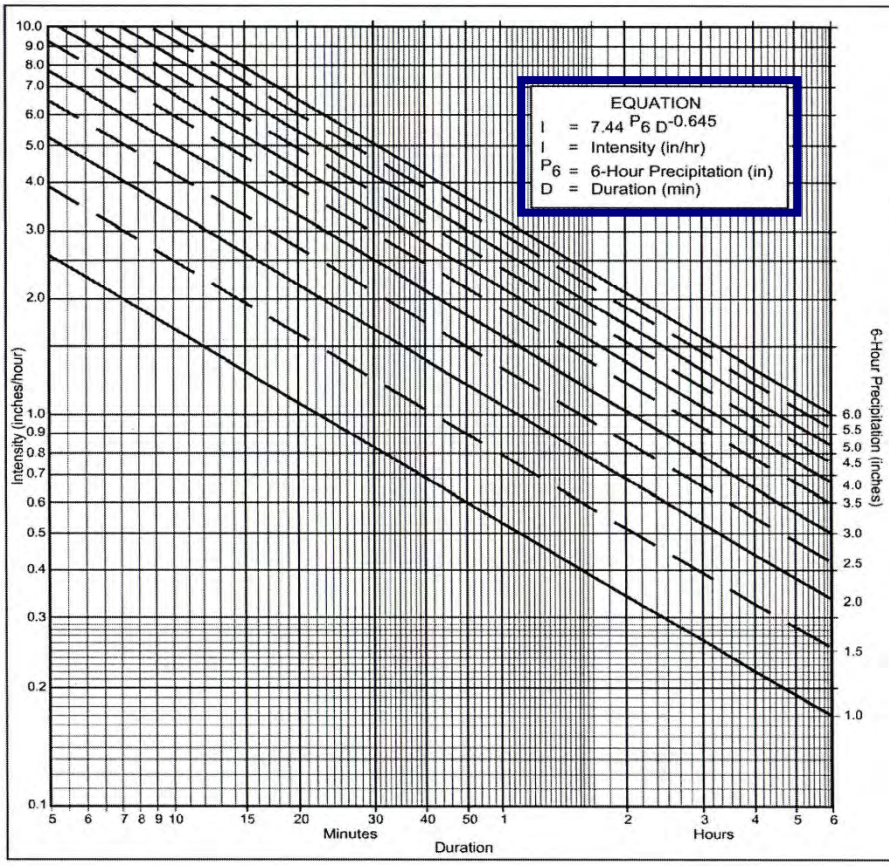


FIGURE 3-4

Nomograph for Determination of Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.8 in., P_{24} = 5.6, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.8 in.

(d) t_x = *** min. *** - See Calculation Summary

(e) I = *** in./hr. *** - See Calculation Summary

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 7.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

This page was left intentionally blank.

DEBERRY ENGINEERING ASSOCIATES, INC
The Clock Tower Plaza 16466 Bernardo Center Dr. Ste 136, San Diego, CA 92128

PRELIMINARY GEOTECHNICAL INVESTIGATION

1217 Nordahl Road
Escondido, CA 92026

August 10, 2016

PREPARED FOR:

Mr. Bernardo Diaz
Redstone Capital

Office: 858.451.0713
Cell: 858.472.2783
Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

DEBERRY ENGINEERING ASSOCIATES, INC
The Clock Tower Plaza 16466 Bernardo Center Dr. Ste 136, San Diego, CA 92128

September 9, 2016

Mr. Bernardo Diaz
Redstone Capital

SUBJECT: Preliminary Geotechnical Investigation

PROJECT: 1217 Nordahl Road
APN 226 290 01
Escondido, CA 92026

Dear Mr. Diaz:
At your request, a representative of DeBerry Engineering Associates, Inc. has conducted a limited soil investigation to determine the suitability of the soil for proposed foundations for the single family residential development at the above project. The field portion of this investigation was conducted on July 27 and September 6, 2016. Prior infiltration rate tests were performed on the property at the locations identified on the preliminary grading plan for infiltration basins on May 18, 2016.

The scope of the project is outlined as follows:

1. Provide a soils report, including soil profile and soil engineering parameters. To obtain this information, soil probes, trench excavations and hand test pits into the soil have been made.

The following report is understood to be an expression of professional opinion by this engineer, which is based on his knowledge, information and belief of the conditions noted at the time of the investigation. As such, it consists of neither a guarantee nor a warranty, expressed or implied as to the condition of the property or possible defects which may not have been apparent at the time of the investigation. This report does not constitute a compliance report. This report is provided solely for the exclusive use of the above noted client. If either party becomes involved in litigation arising as a result of the contents of this report, both parties agree to mediation through the Better Business Bureau.

We appreciate this opportunity to be of Professional Service to you in this matter. If you have any questions regarding this report please contact us.

Respectfully Submitted,
DeBerry Engineering Associates

William J. DeBerry, R.C.E. #34545

Attachments

Office: 858.451.0713
Cell: 858.472.2783
Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Table of Contents

DEBERRY ENGINEERING ASSOCIATES, INC
The Clock Tower Plaza 16466 Bernardo Center Dr. Ste 136, San Diego, CA 92128

INTRODUCTION AND SCOPE OF SERVICES:

At the request of Mr. Bernardo Diaz, a representative of DeBerry Engineering Associates, Inc. has conducted a limited subsurface Geo-Technical investigation to determine the suitability of the soil for proposed single family residential development to the property located at 1217 Nordahl Road in the Escondido area of the County of San Diego, California. The property is more particularly referred to as Block 12 portions of Lots 6,7 and 9 in the Rancho los Callecitros de San Marcos Townsite Subdivision, Map 806. The field portion of this investigation was conducted on July 27 and September 6, 2016. Infiltration testing was performed on May 18, 2016. The purpose of this report is to present the results of the investigation of the Geo-Technical conditions at the subject property and their influence on the proposed single family residential construction. This report will address the findings and provide appropriate recommendations.
The scope of the project included the following:

- An inspection of the site conditions.
- A review of the pertinent Geotechnical data.
- A limited sub-surface soil investigation to determine the engineering and infiltration properties of the foundation soils.
- A report of our findings, conclusions and recommendations for foundation and private road section.

SITE DESCRIPTION AND OBSERVATIONS:

The subject site as it presently exists is a vacant mostly grassy field with a single family residential structure on the central south side and some outbuildings at the central area. There is a large outcropping of rocks surrounded by large trees near the central high area of the side. The proposed configuration of the lot as presently considered, consists of 14 single family residential lot sites with a private road in the central area to provide access to the proposed sites. The parcel is a rectangular parcel approximately 169,013 square feet. It is bounded on the north by a private road to residential properties, on the west by residential properties, the south by residential properties and a vacant field and the east by Nordahl Road. The site has a high central area with the exposed outcropping of rocks. It generally slopes downward away from the central high area at between 6 to 10%, to the west and east.

The existing vegetation is to be removed and the site is to be prepared and graded for construction of fourteen one and/or two story single family residence, associated parking and 24 foot wide street. It is anticipated that the proposed residence will be of wood frame construction founded on shallow foundations and a conventional slab-on-grade floor system. Development of the parcels will require excavation of

onsite soil and re-compaction of surface soils along with leveling of the four building sites. A 3 foot over excavation will be required on the four house pads, and a two foot over excavation will be required for the Street Section.

DESCRIPTION OF SITE GEOLOGY AND GEOLOGIC HAZARDS:

Landslide Potential and Slope Stability –

A review of the State of California Department of Conservation, Division of Mines and Geology Map indicates that the property is located in an area generally susceptible to Landslides. Slopes within this area are at or near their stability limits due to a combination of weak materials and steep slopes (many slope angles exceed 15 degrees). Although most slopes do not currently contain landslide deposits, they can be expected to fail, locally, when adversely modified. There is no history of actual landslides on this site.

Liquefaction –

Per the Multi Jurisdictional Hazard Mitigation plan for San Diego County dated March 2004, the area is in a location which is not subject to liquefaction in an earthquake

Flooding –

Per the Federal Emergency Management Agency.FEMA flood plan layers the site is located outside the boundaries of the 100-year floodplain and is in the 500-year floodplains.

Tsunamis and Seiches –

Tsunamis are large sea waves produced by submarine earthquakes or volcanic eruptions. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays and reservoirs. Based the elevation of the lot and the distance from the coastline, the site is considered to possess a low risk potential from Tsunami or Seiche activity.

Faults –

Multi Jurisdictional Hazard Mitigation plan for San Diego County dated March 2004,, there are five faults located near the planning area. They are listed below, including the most probable maximum Richter scale magnitude earthquake that each might cause:

- Rose Canyon Fault (6.2-7.0)
- La Nación (6.2-6.6) • Coronado Bank (6.0-7.7)
- San Diego Trough (6.1-7.7)
- San Clemente (6.6-7.7)

The La Nacion Fault Zone poses the greatest potential earthquake threat to the planning area. The Rose Canyon Fault is considered to be the greatest potential threat to the San Diego region as a whole, due to its proximity to areas of high population, but threatens other parts of the region more than the project site.

Geotechnical Conditions –

The Geologic Map of the Oceanside 30’x60’ quadrangle compiled by Kennedy and Tan indicates that the site is underlain by Undifferentiated Metasedimentary and Metavolcanic rock.

SUBSURFACE FINDINGS:

The soil was examined and logged in hand borings which had been excavated at the site on July 27 and in trench excavations which were excavated with a machine excavator on September 6, 2016. The borings were made generally on each end and near the center of the site to approximately 6 feet below the surface grade or until refusal. The trench excavations were made near the high portion of the site and near the south side. The soils encountered on the site consist of a light Brown, Silty fine sandy material, over a, very dense slightly decomposed rock. The trenches made with the machine excavator were carried to a depth of approximately 8 feet, utilizing both the excavator and a jack hammer to loosen the soil.

The log and location of the boring is indicated in the appendix. Bulk samples were obtained from the boring and brought into our office for evaluation.

Soil Classification

The predominant fill material in the borings consisted of silty sand (SM)

Groundwater

No groundwater was encountered during the excavations

Laboratory Tests

The Determination of Percentage of Particles Smaller than -200 Sieve test (ASTM 01140-06) aids in classification of the tested soils based on their fine material content and provides qualitative information related to engineering characteristics such as expansion potential, permeability, and shear strength. This testing indicated that the soils possess low expansion characteristics.

Infiltration Testing

The infiltration rate of the soil was testing utilizing the double ring test. The Double Ring Infiltrometer was originally developed to estimate the saturated hydraulic conductivity of low permeability materials, such as clay liners for ponds, but has seen significant use in storm water applications. The most recent revision of this method from 2009 is known as ASTM 3385-09. The testing apparatus is designed with concentric rings that form an inner ring and an annulus between the inner and outer rings. Infiltration from the annulus between the two rings is intended to saturate the soil outside of the inner ring such that infiltration from the inner ring is restricted primarily to the vertical direction. To conduct this test, both the center ring and annulus between the rings are filled with water. There is no pre-wetting of the soil in this test. However, a constant head of 1 to 6 inches is maintained for 6 hours, or until a constant flow rate is established. Both the inner flow rate and annular flow rate are recorded, but if they are different, the inner flow rate should be used. There are a variety of approaches that are used to maintain a constant head on the system, including use of a Mariotte tube, constant level float valves, or manual observation and filling. This test must be conducted at the elevation of the proposed infiltrating surface; therefore application of this test is limited in cases where the infiltration surface is a significant distance below existing grade at the time of testing.

This test is generally considered to provide a direct estimate of vertical infiltration rate for the specific point tested and is highly replicable. However, given the small diameter of the inner ring (standard diameter is 12 inches, but it can be larger), this test only measures infiltration rate in a small area. Additionally, given the small quantity of water used in this test compared to larger scale tests, this test may be biased high in cases where the long term infiltration rate is governed by groundwater mounding and the rate at which mounding dissipates (i.e., the capacity of the infiltration receptor). Finally, the added effort and cost of isolating vertical infiltration rate may not necessarily be warranted considering that BMPs typically have a lateral component of infiltration as well. Therefore, while this method has the advantages of being technical rigorous and well standardized, it should not necessarily be assumed to be the most representative test for estimating full-scale infiltration rates. Source: American Society for Testing and Materials (ASTM) International (2009).
A factor of safety of 2.5 was estimated to be applied to the infiltration data based upon the criteria in Worksheet D 5-1 in Appendix D of the Model BMP Design Manual dated June 2015.

Site Specific Seismic Parameters

Seismically related design parameters obtained from the California Building Code (CBC 2013) are presented below. These design factors are based on subsurface soil and bedrock conditions and distance of the site from known active faults.

Parameter	Value	Reference 2013 CBC
Ground Motion Ss	1.1156	Fig 1613.5(1)
Ground Motion S1	0.4320g	Fig 1613.5(2)
Site Class	c	Table 1613.5.2
Site Coefficient, Fa	1.00	Table 1613.5.3(1)
Site Coefficient, Fv	1.37	Table 1613.5.3(2)
Seismic Design Category	D	Table 1613.5.6 (1&2)

CONCLUSIONS and RECOMMENDATIONS:

Based upon this investigation the following opinions are offered:
In general, our findings indicate that the subject property is suitable for the proposed development, provided the recommendations herein are followed. The observations and testing suggest the proposed onsite storm water infiltration / percolation BMP will not result in soil piping, daylight water seepage, slope instability or ground settlement.

Engineering parameters

The following parameters are to be used for the Restrained Foundation Walls using the equivalent Fluid Method:

Allowable Soil Bearing:	2000 psf
Heel Active Pressure:	50.0 psf/ft
Passive Pressure:	300.0 psf/ft
Soil Density:	118.6 pcf
Optimum Moisture:	7.52 %
Footing/Soil Friction:	0.35
Expansion Index	35 @ 144.7 psf

For the Dynamic seismic lateral earth pressure, use a Kh soil density multipier of 0.2g and a weight multiplier of 0.2g. Response Coefficent R=2.

Passive pressure:

The passive pressure for the prevailing soil conditions may be considered to be 300 psf per foot of depth. This pressure may be increased by 113 for seismic loading. The coefficient of friction between concrete and the underlying material may be assumed to be 0.35. When combining frictional and passive resistance, friction should be reduced by 1/3. The upper 12 inches of soil should not be, considered when calculating passive pressures for exterior walls.

Active pressure:

The active soil pressure for the design of unrestrained earth retaining structures with level backfills may be assumed to be equivalent to the pressure of a fluid weighing 50 pcf. For restrained walls, an equivalent fluid pressure of 60 pcf may be assumed. An additional 15 pcf should be added to said values for a 2: 1 (2 feet horizontal : 1 feet vertical) sloping backfill behind the wall. These pressures do not included any other surcharge loads. The retaining wall backfill must be well drained and granular type material.

Preparation and grading:

Prepare and grade the site. After the remnants of existing vegetation are removed, and the site cleared of all trash and debris, surface soils in the Building area, and Street are to be excavated to a minimum depth of between 2 to 3 feet and brought to near optimum moisture and compacted to above 90 percent of maximum dry density. Surfaces exposed in the excavations should be scarified and moisture conditioned prior to re-compaction operations.

Slab on grade foundations

GENERAL: Based on our findings and engineering judgment, the proposed residences may be supported by conventional continuous and isolated spread footings. While the lot is considered to be a transition lot, we recommend that the cut areas be over-excavated approximately two feet and re-compacted to match the filled area. This will prevent the necessity of utilizing a post tensioned slab. The following recommendations are considered the minimum based on the anticipated soil conditions and are not intended to be lieu of structural considerations. All foundations should be designed by a qualified structural engineer.

DIMENSIONS: Spread footings supporting the proposed guest house should be embedded at least 15 inches below lowest adjacent finished pad grade for one-story construction. Continuous spread footings should have a minimum width of 15 inches. Isolated spread footings should have a minimum width of 24 inches.

BEARING CAPACITY: Spread footings with a minimum embedment of 15 inches and a minimum width of 15 inches in scarified and re-compacted soil may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf). This value may be increased by 700 pounds per square foot for each additional foot of embedment and 300 pounds per square foot for each additional foot of width up to a maximum of 3,000 pounds per square foot.

The bearing value may also be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

FOOTING REINFORCING: Reinforcement requirements for foundations should be provided by the structural designer. However, based on the existing soil conditions, we recommend that the minimum reinforcing for continuous footings consist of at least two No. 5 bars positioned near the bottom of the footing and two No. 5 bar positioned near the top of the footing.

LATERAL LOAD RESISTANCE: Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and soil may be considered to be 0.4. The passive resistance may be considered to be equal to an equivalent fluid weight of 350 pounds per cubic foot.

SETTLEMENT CHARACTERISTICS: The anticipated total and differential foundation settlement is expected to be up to approximately one inch or one inch in forty feet, respectively, provided the recommendations presented in this report are followed. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to shrinkage during curing or redistribution of stresses, therefore some cracks should be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

EXPANSIVE CHARACTERISTICS: The anticipated foundation soils were judged to have a low expansive potential (EI less than 50). The recommendations within this report reflect these conditions.

FOUNDATION PLAN REVIEW: The final foundation plan and accompanying details and notes should be submitted to this office for review. The intent of our review will be to verify that the plans used for construction reflect the minimum dimensioning and reinforcing criteria presented in this section and that no additional criteria are required due to changes in the foundation type or layout. It is not our intent to review structural plans, notes, details, or calculations to verify that the design engineer has correctly applied the geotechnical design values. It is the responsibility of the design engineer to properly design/specify the foundations and other structural elements based on the requirements of the structure and considering the information presented in this report.

FOUNDATION EXCAVATION OBSERVATION: All footing excavations should be observed by a representative of DeBerry Engineering Associates prior to placing of forms and reinforcing steel to determine whether the foundation recommendations presented herein are followed and that the foundation soils are as anticipated in the preparation of this report. All footing excavations should be excavated neat, level, and square. All loose or unsuitable material should be removed prior to the placement of concrete.

Interior floor slabs:

The following recommendations are considered the minimum slab requirements based on the anticipated soil conditions and are not intended to be in lieu of structural considerations.

For the slab on grade foundations, it is recommended that the soil within 5 feet of the building foot print be scarified and re-compacted to a depth of 4 feet.
The minimum floor slab thickness should be four inches (actual) and all floor slabs should be reinforced with at least No. 3 reinforcing bars placed at 18 inches on center each way. Slab reinforcement should be supported on chairs such that the reinforcing bars are positioned at mid-height in the floor slab. Slab reinforcement should be supported on chairs such that the reinforcing bars are positioned at mid-height in the floor slab. The slab reinforcement should extend into the perimeter foundations at least six inches.

UNDER-SLAB VAPOR RETARDERS: Steps should be taken to minimize the transmission of moisture vapor from the subsoil through the interior slabs where it can potentially damage the interior floor coverings. Local industry standards typically include the placement of a vapor retarder, such as plastic, in a layer of coarse sand placed directly beneath the concrete slab. Two inches of sand and two inches of sand are typically used above and below the plastic, respectively. This is the most common under-slab vapor retarder system used in San Diego County. The vapor retarder should be at least 15- mil Stegowarp® or similar material with sealed seams and should extend at least 12 inches down the sides of the interior and perimeter footings. The sand should have a sand equivalent of at least 30, and contain less than 10% passing the Number 100 sieve and less than 5% passing the Number 200 sieve. The membrane should be placed in accordance with the recommendation and consideration of ACI 302, “Guide for Concrete Floor and Slab Construction” and ASTM E1643, “Standards Practice for Installation of Water Vapor Retarder Used in Contact with Earth or Granular Fill Under Concrete Slabs.” It is the flooring contractor’s responsibility to place floor coverings in accordance with the flooring manufacturer specifications.

Exterior concrete slabs-on-grade:

Exterior concrete slabs on grade should have a minimum thickness of 4 inches and be reinforced with at least No. 3 bars placed at 18 inches ocew. Concrete driveways should be at least 5 inches thick, and should be reinforced with at least No. 4 reinforcing steel bars placed at 18 inches on center each way. Driveway slabs should be provided w ith a thickened edge at least 12 inches deep and 6 inches wide.

Concrete pavement construction should comply with the requirements set forth in Sections 201-1.1.2 and 302-6 of the Standard Specifications for Public Works Construction. The concrete materials should be a Class 560-C-3250 mix. All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

Earthwork

GENERAL: All grading should conform to the guidelines presented in the current edition of the California Building Code, the minimum requirements of the County of San Diego.

PREEXCAVATION MEETING: It is recommended that a pre-excavation meeting including the excavation contractor, the client, and a representative from DeBerry Engineering be performed, to discuss the recommendations of this report and address any issues that may affect excavation operations.

Private Road Pavement Sections :

The design included an investigation of the soil capacity of the subgrade, a determination of the Traffic Index and the determination of the pavement design. Based on our analysis, it is recommended that a pavement section consisting of 8" of compacted aggregate base under 4" of asphaltic concrete be utilized. The sub-grade and base should be compacted to 90% and approved by DeBerry Engineering Associates.

OBSERVATION OF EXCAVATION: Periodic observation by the Geotechnical Consultant, approximately one time on each day of excavation is essential during the excavation operation to confirm conditions anticipated by our investigation, to allow adjustments in design criteria to reflect actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein. It is recommended that DeBerry Engineering Associates Inc. be retained to provide continuous geotechnical engineering services during the earthwork operations. This is to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction DeBerry Engineering Associates Inc., or our consultants, will not be held responsible for earthwork of any kind performed without our observation, inspection and testing.

CLEARING AND GRUBBING: Site preparation should begin with the removal of any vegetation and other deleterious materials including demolition debris from the portions of the site that will receive settlement-sensitive improvements. This should include all significant root material. The resulting materials should be disposed of off-site in a legal dumpsite. Discing of the vegetation is not considered an appropriate means to remove the vegetation and could result in the requirement that soils contaminated with vegetation be exported from the site.

SITE PREPARATION: Site preparation should begin with the removal of topsoil that are not removed by planned excavation. Based on our subsurface explorations, the maximum removal depth is expected to be about 1 foot below existing grade. Deeper removals may be necessary in areas of the site not investigated. All areas cleaned out of unsuitable soils should be approved by the geotechnical engineer or his representative prior to replacing any of the excavated soils. The excavated materials can be replaced as properly compacted fill in accordance with the recommendations presented in the "Compaction and Method of Filling" section of this report.

PROCESSING OF FILL AREAS: Prior to placing any new fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of 48 inches, moisture-conditioned, and compacted to at least 90 percent relative compaction.

COMPACTION AND METHOD OF FILLING: All fill placed at the site should be compacted to a relative compaction of at least 90 percent of its maximum laboratory

dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts six to eight inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by the Geotechnical Consultant. Fill material should be free of rocks or lumps of soil in excess of twelve inches in maximum dimension.

Utility trench backfill within five feet of the proposed structures and beneath the driveways and concrete flatwork should be compacted to a minimum of 90 percent of its maximum dry density. The upper twelve inches of subgrade beneath paved areas should be compacted to 95 percent of its maximum dry density. This compaction should be obtained by the paving contractor just prior to placing the aggregate base material.

IMPORTED FILL: Imported fill shall be approved by our office prior to importing. Imported fill shall consist of very low expansive soil (Expansion Index 20 or less) and less than 25 percent shall pass the No. 200 U.S. standard sieve.

SURFACE DRAINAGE: The drainage around the proposed improvements should be designed to collect and direct surface water away from proposed improvements and the top of slopes toward appropriate drainage facilities. Rain gutters with downspouts that discharge runoff away from the structure into controlled drainage devices are recommended.
The ground around the proposed improvements as well as any similarly located pervious hardscape areas should be graded so that surface water flows rapidly away from the improvements without ponding. In general, we recommend that the ground adjacent to structures be sloped away at a minimum gradient of two percent. Densely vegetated areas where runoff can be impaired should have a minimum gradient of five percent for the first five feet from the structure. It is essential that new and existing drainage patterns be coordinated to produce proper drainage.

Providing and maintaining adequate site drainage and moisture protection of supporting soils is an important design consideration. Foundation recommendations resented herein assume proper site drainage will be established and maintained. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded such that surface drainage flow is directed from structures and into swales or other controlled drainage facilities.

Drainage patterns provided at the time of construction should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Over watering should be avoided. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, zones of wet or saturated soil may develop.

LIMITATIONS OF INSPECTION

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. The findings of this report are valid as of the present date. Changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes of the works of man on this or adjacent sites. In addition, changes in applicable standards may occur, whether resulting from legislation or the broadening of knowledge. Thus, the findings of this report may be invalidated wholly or in part by outside changes beyond our control. The report should not be relied upon after a period of three years. Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances by reputable Engineers practicing in this or similar localities. The values presented are based upon experience with this and other similar projects as well as information provided by previous studies. Assumptions are made that the soil conditions are as reported and are relatively constant. Should any conditions be encountered which are not in accordance with this report, this company should be contacted for additional recommendations.

This report is understood to be an expression of professional opinion by this engineer, which is based on his knowledge, information and belief of the conditions noted at the time of the investigation. As such, it consists of neither a guarantee nor a warranty, expressed or implied as to the condition of the property or possible defects which may not have been apparent at the time of the investigation.

We appreciate this opportunity to be of Professional Service to you in this matter. If you have any questions regarding this report please contact us.

Respectfully Submitted,
DeBerry Engineering Associates

William J. DeBerry, R.C.E. #34545

Attachments

APPENDIX

Testing Locations

Office: 858.451.0713
Cell: 858.472.2783
Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Date: July 27, 2016
Boring B1

6” diameter hole.

Depth In Feet	Bulk Sample	Apparent cohesion And Friction Angle	Blow Per Foot	Description	In Place	
					Dry Density Pcf	Moisture Content, % dry wt.
0 - 2				Light Brown slightly silty fine sand Dry		
	XX				118.6	7.5%
2						
4						
				4.5’ Resistant slightly decomposed rock, brown silty sand Humid		
6				End of excavation. No water no caving		
8						
10				‘		
12						
14						
16						
18						
20						

Office: 858.451.0713
Cell: 858.472.2783
Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Date: July 27, 2016
Boring B2

6” diameter hole.

Depth In Feet	Bulk Sample	Apparent cohesion And Friction Angle	Blow Per Foot	Description	In Place	
					Dry Density Pcf	Moisture Content, % dry wt.
0 - 2 2 4 6 8 10 12 14 16 18 20				Light Brown slightly silty fine sand Dry 2.5’ Resistant slightly decomposed rock, brown silty sand Humid End of excavation. No water no caving ‘		

Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Date: July 27, 2016
Boring B3

6” diameter hole.

Depth In Feet	Bulk Sample	Apparent cohesion And Friction Angle	Blow Per Foot	Description	In Place	
					Dry Density Pcf	Moisture Content, % dry wt.
0 - 2 2 4 6 8 10 12 14 16 18 20				Light Brown slightly silty fine sand Dry 4.0’ Resistant slightly decomposed rock, brown silty sand Humid End of excavation. No water no caving ‘		

Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Date: September 6, 2016
Trench T1

6" diameter hole.

Depth In Feet	Bulk Sample	Apparent cohesion And Friction Angle	Blow Per Foot	Description	In Place	
					Dry Density Pcf	Moisture Content, % dry wt.
0 - 2 2 4 6 8 10 12 14 16 18 20				Light Brown slightly silty fine sand Dry Hard resistant fine highly cemented silty sand 4.0' Resistant slightly decomposed rock, brown silty sand Humid, able to be loosened with a jack hammer. 8' End of excavation. No water no caving '		

Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Date: September 6, 2016
Trench T2

6" diameter hole.

Depth In Feet	Bulk Sample	Apparent cohesion And Friction Angle	Blow Per Foot	Description	In Place	
					Dry Density Pcf	Moisture Content, % dry wt.
0 - 2 2 4 6 8 10 12 14 16 18 20				Light Brown slightly silty fine sand Dry Hard resistant fine highly cemented silty sand 4.0' Resistant slightly decomposed rock, brown silty sand Humid, able to be loosened with a jack hammer. 8' End of excavation. No water no caving '		

Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

May 18, 2016

Bernardo Diaz

Redstone Capital

SUBJECT: Infiltration Testing Results

PROJECT: 1217 Nordahl Rpad
Escondido, CA

Dear Mr. Diaz:

At your request a representative of DeBerry Engineering Associates, Inc. has conducted infiltration testing at three locations on the above site as indicted on the preliminary grading plan. The testing was done in accordance with ASTM D 3385-09 under the control of a CA licensed Civil Engineer. The results of the testing are provided in the attachments

We appreciate this opportunity to be of Professional Service to you in this matter. If you have any questions regarding this report please contact us.

Respectfully Submitted,
DeBerry Engineering Associates

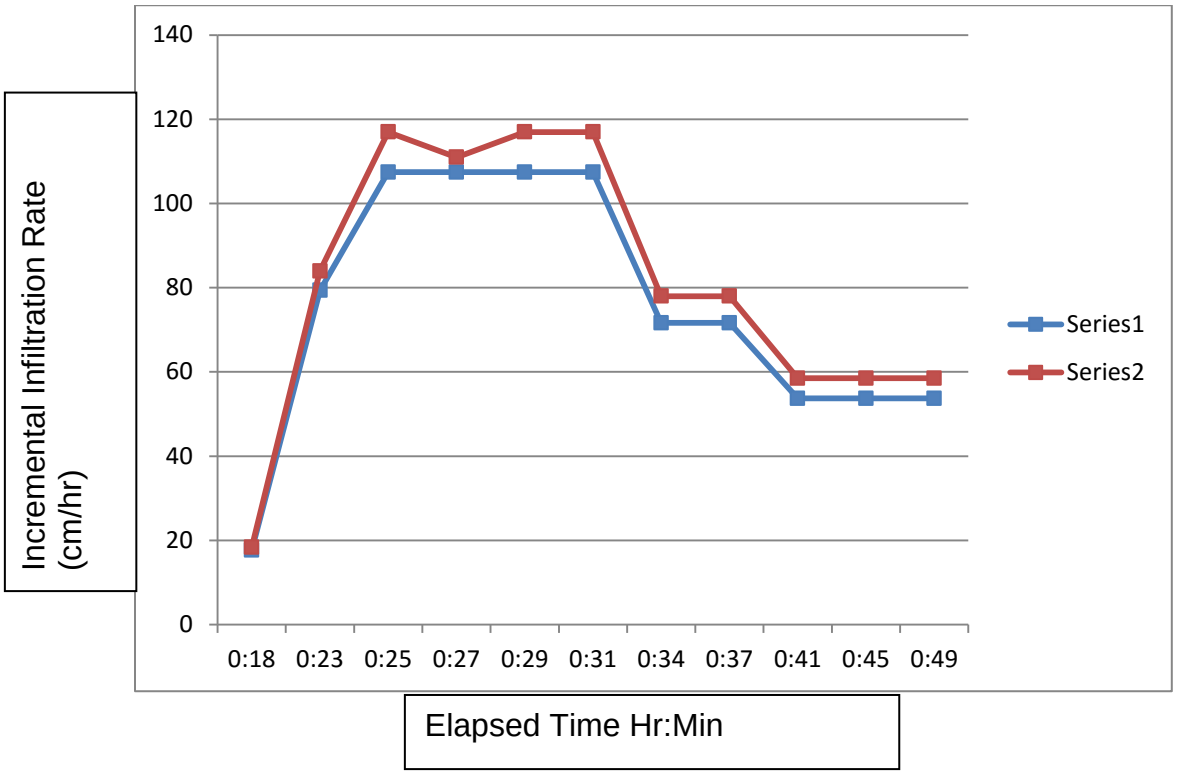
William J. DeBerry, R.C.E. #34545

Attachments

DEBERRY ENGINEERING ASSOCIATES, INC
The Clock Tower Plaza 16466 Bernardo Center Dr. Ste 136, San Diego, CA 92128

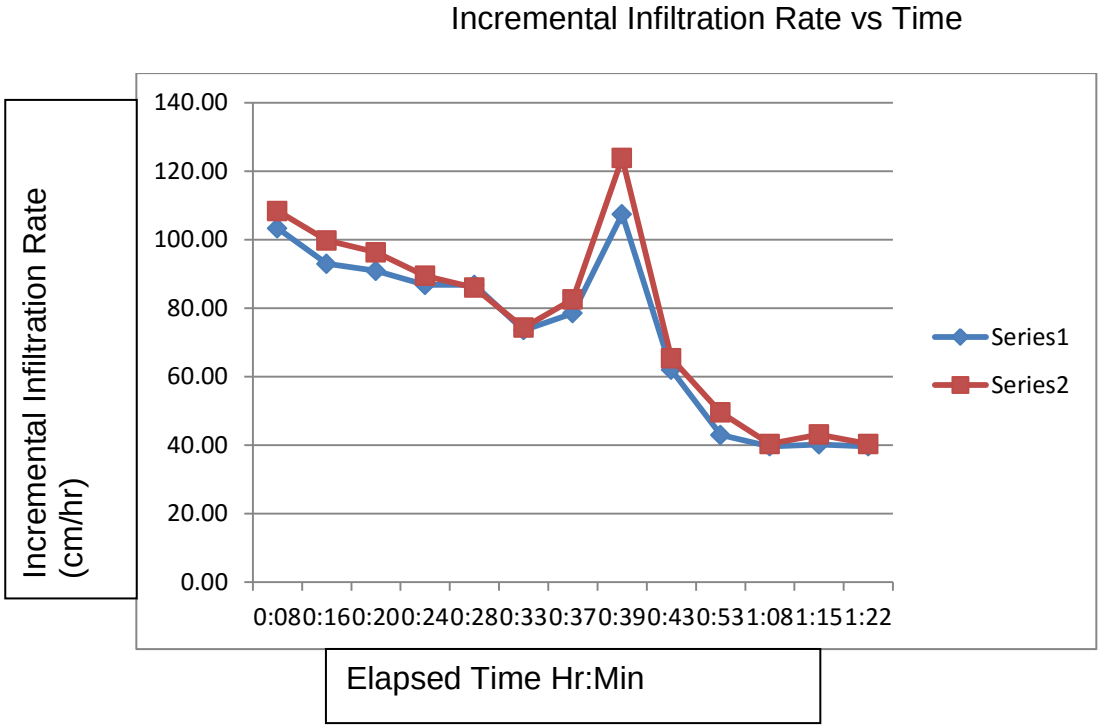
1217 Nordahl Road
Test Location 1, East Pond

Incremental Infiltration Rate vs Time



Office: 858.451.0713
Cell: 858.472.2783
Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

1217 Nordahl Road
Test Location 2, West Pond



Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

Worksheet D.5-1: Factor of Safety and Design Infiltration Rate Worksheet

Factor of Safety and Design Infiltration Rate Worksheet			Worksheet D.5-1		
Factor Category		Factor Description	Assigned Weight (w)	Factor Value[1] (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1
B	Design	Level of pretreatment/ expected sediment loads	0.5	3	1.5
		Redundancy/ resiliency	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.5
Combined Safety Factor, $S_{total} = S_A \times S_B$					2.5
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					20
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					8.0
Supporting Data					
Briefly describe infiltration test and provide reference to test forms: The test results are attached					

Note

1. Factor values are assigned per Table D.5-1 in the BMP Design Manual.

	Infiltration Rate cm/hr	
Infiltration Rate	Test 1	Test 2
	58.5	43

	Infiltration Rate in/hr		
	Test 1	Test 2	Average
	23	17	20

Email: dianed3@cox.net, wjdeberry@cox.net
www.deberryeng.com

REFERENCES

1. ACI 302, “Guide for Concrete Floor and Slab Construction.
2. California Building Code (CBC 2013).
3. City of La Mesa Zoning Map.
4. FEMA Flood Maps.
5. Geology of the San Diego Metropolitan Area, California, California Division of Mines and Geology Bulletin 200.
6. Geology of the La Mesa Quadrangle, Kennedy, M.P. and Peterson, G.L. 1975, Geology of the eastern San Diego Metropolitan Area Seismic Safety Study:
7. Geotechnical Investigation by DenMar 3923 Quarry Road dated July 8, 2015.
8. Multi Jurisdictional Hazard Mitigation plan for San Diego County dated March
9. The State of California Division of Mines and Geology Landslide Hazard Identification Map.
10. Standard Specifications for Public Works Construction.
11. Report of Preliminary Soil Investigation Residential Site 256 Palm Ave by Alpine Engineering dated February 5, 2013.
12. San Diego Model BMP Design Manual dated June 2015.