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Comprehensive Stormwater Management Plan (CSMP)

Prepared for the Redevelopment of the Rice Creek Commons (formerly Twin Cities Army Ammunition Plant) Project.

Prepared for:

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Table of Contents

Table of Contents (Cont.)

FIGURES

TABLES

APPENDICES

Executive Summary

INTRODUCTION

Ramsey County (County) and the City of Arden Hills (City) working together, under a Joint Powers Agreement, to provide this Comprehensive Stormwater Management Plan (CSMP) to Rice Creek Watershed District (RCWD) for the Rice Creek Commons (formerly Twin Cities Army Ammunition Plant) redevelopment Project (**Figure 2-2**).

<u>Report Purpose</u>: The goal of this CSMP is to communicate how the development, recently renamed Rice Creek Commons, will meet RCWD Rule C requirements using a regional stormwater approach. This CSMP presents the approach for meeting the Water Quality Treatment and Peak Stormwater Runoff Control requirements. The RCWD Rules adopted at the time of printing were effective on December 1, 2014.

Existing conditions were modeled, per requirements in Rule C, and compared against the proposed conditions at outfalls. **Figure 6-2** displays tributary areas by outfall in 2012. The proposed conditions outfall are shown in **Figure 6-3**. The proposed conditions are presented in two stages; completion of the public infrastructure improvements, and the fully developed conditions using landuse assumptions in the Master Plan (**Figure 3-1**) and construction of a regional stormwater system (**Figure 4-5**). The pollutant removal efficiency of the proposed regional ponding system was evaluated at outfalls for the proposed conditions plus an interim condition considered to be the worst case scenario.

<u>Rule C.6</u>: Some outlot purchase agreements will include the requirement of designing and constructing an infiltration device or a stormwater pond that is consistent with this CSMP (Table E-1), specifically Outlots A, J, and K. The remaining outlots in Areas 1 and 2 in **Figure 5-2** will be exempt from RCWD Rule C.6(d)(2) due to MPCA concerns relative to shallow (Unit 1) groundwater is impacted by solvent releases.

The proposed ponding system will reduce pollutant loads from stormwater before discharging to the Resource of Concern (ROC) from the proposed site conditions by more than 50%, meeting RCWD standards. Each outfall under proposed conditions was evaluated for each Resource of Concern (**Figure 6-3**) and tabulated in water quality technical memorandum (P8) provided in Appendix A. Bulleted below are the total TP % reductions summarized by scenario by ROC.

- Rice Creek TP reduced by %
  - public infrastructure improvements (interim scenario 1): 65% total
  - worst case (interim scenario 2): 55% total
  - fully developed conditions (scenario 3): 64% total

- Round Lake TP reduced by %
  - public infrastructure improvements (interim scenario 1): 53% total
  - fully developed conditions (scenario 3): 60% total

This CSMP assumes that before stormwater discharges from the land being developed to the regional system, some method of pre-treatment or grit removal must be installed and maintained by the developer (e.g., flow through device, vegetated swale, vegetated filter strip, SAFL Baffle, off-line deep sump catch basins, The Preserver™, etc.).

Rule C.7: Stormwater pond design details are included in the Stormwater Pond Data Summary Tables included in the Appendix of the HydroCAD Technical Memorandum.

The Site, under proposed fully developed conditions, has discharge rate control measures proposed to meet RCWD's peak stormwater runoff control requirements through a combination of onsite infiltration and wet detention ponds.

Rule C.8: As permits are prepared to construct stormwater ponds and outlet designs are finalized, bounce and inudatiaon periods will be documented by applicants.

Rule C.9: Likewise, as permits are prepared, the design criteria will be followed by applicants.

Rule C.10: It is anticipated that the Site will be developed on an outlot by outlot basis. Preliminary outlots have been identified on the concept preliminary plat (**Figure 5-2**). The regional stormwater system will be preserved through easements or public ownership. Outlot C, the Natural Resources Corridor, will remain in Ramsey County ownership initially and be covered by easements for drainage/utilities, and and covenants for the wetland mitigation. Eventually the stormwater system within the Natural Resources Corridor, will be owned by the City as they will be responsible for ongoing maintenance.

A drainage and utility easement will also cover an approximate 80-ft wide area along the west edge of Outlots I, J, and K to fully meet stormwater water quality requirements.

Table E-1: Stormwater Requirements for Future Development Outlots

Outlot	Subbasin(s) (per Figure 6-1)	Rate Control (per Rule C.7)	Infiltration Required (per Rule C.6)
Spine Road	24, 25, 26	* Per CSMP (interim conditions)	
Outlot C	3, 8, 10, 11, 12, 13, 14, 16, 17		
Outlot H	4, 5, 6, 7		
Rice Creek Commons Old Hwy 8 Extension Road	27	*	✓ per table 5-1 of CSMP
Outlot A	22	*	✓ per table 5-1 of CSMP
Outlot B	16, 17, 19	* Pond P-14, per CSMP	
Outlot D	15	*	
Outlot E	1, 3, 8, 9	*	
Outlot F	1, 3	* Pond P-1, per CSMP	
Outlot G	2, 7	* Pond P-3, per CSMP	
Outlot I	18, 5	*	
Outlot J	18	*	✓ per table 5-1 of CSMP
Outlot K	18	*	✓ per table 5-1 of CSMP
Outlot L	20	*	
County Road H/I-35W Interchange	27, 28, 29, 31	✓ +	✓ +

✓ Development plans submitted in the future are required to meet Rice Creek Watershed District Rules for this stormwater parameter.

* CSMP submitted compares peak flow rates (existing compared to fully developed conditions) entering the Rice Creek Commons ROC (Rice Creek/Long Lake and Round Lake) in aggregate. The modeling completed sums flows from multiple subwatersheds which drain to the same location (e.g. Rice Creek).

+ The CSMP is based on 30% design, and these proposed ponds did not provide sufficient water quality treatment volume to meet RCWD rules, nor were infiltration BMPs incorporated in the stormwater management design, as required per this CSMP.

This CSMP will provide developers with technical details to complete site design to comply with RCWD Rule C using the regional system to be constructed by Ramsey County and maintained by the City of Arden Hills. Developers that choose to exceed the impervious limits designed to for that outlot, as summarized in Table E-2 and **Figure ES-1**, will be required to address any additional stormwater requirements within that outlot at the developers expense. Any such stormwater management facilities will also be maintained by the owner of the outlot.

Table E-2: Maximum Impervious Surface by Outlot

Outlot ID	Total Outlot Area (acres)	Maximum Impervious Area (acres)	Additional breakdowns
Outlot A	40.1	34.0	
Old Highway 8 extension Road	4.8	4.8	
Spine Road	24.0	24.0	
Outlot B (Creek)	45.9	18.1	15.2 acres in residential
Trail Dedication	1.1	0.7	0.4 acres residential, remaining in trails
Outlot C (NRC)	47.6	5.2	2.1 acres in civic, remaining in recreational and trails, realigned Creek
Outlot D (Town)	58.8	28.6	16.9 acres in residential, 9.7 acres in mixed use, 1.2 acres in commercial, remaining in recreational
Outlot E (Hill)	73.3	27.0	23.9 acres in residential
Outlot F (Flex Business East)	28.7	23.5	
Outlot G (Flex Business South)	31.7	21.6	
Outlot H (NRC)	3.5	0.4	0.4 acres in trails
Outlot I (Flex Business North)	18.2	15.4	
Outlot J (Corporate)	20.0	17.0	
Outlot K (Retail)	20.0	16.5	16.4 acres in retail, remaining in recreational
Outlot L (Creek Meander)	2.7	0.2	0.2 acres in trails, realigned creek

1.0 CSMP Goals and Intended Use

1.1 GOALS

As allowed for under RCWD Rule C.5 (f), this CSMP has been prepared as an alternative means to meet the requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control) for redevelopment of the Site, which will be done in various stages. Upon RCWD Board approval of this CSMP, it is agreed that the water quality treatment volumes and peak runoff rate controls standards for the 427 acre Rice Creek Commons site and the 7.1 acres of MnDOT right-of-way adjacent to the site (subwatersheds 28 & 29) will be met in aggregate for each ROC drainage area given the conditions documented herein.

The development of this CSMP is intended to streamline regulatory permit approvals saving the RCWD and developer time and money as development is proposed. This alone should make the land more attractive and valuable. The County and the City have made a considerable investment in the Site by undertaking cleanup of the site, preparing development planning documents, providing public notice and gathering public input, building public utilities (sewer, water, storm, etc.), constructing ponds and mitigation wetlands. The Site has a Master Plan so that the Site is developed in a responsible way that creates open green space, centralized stormwater management features that creates community around protection of our natural resources and provides a forum for continued education of water management and sustainable development.

By planning for development of Rice Creek Commons using a “campus” approach, the regulatory requirements can be “leveled” so that future applicants within different geographic regions of the project area aren’t faced with more challenges in meeting the requirments. Regional treatment also allows for more efficient treatment and maintenance, and helps ensure that the entire site meets RCWD requirements, from first to last development.

The JDA will use this plan to review development plans for conformance with the proposed impervious surface areas by outlot, assumptions documented in this CSMP and various land uses identified in the Master Plan. Permits will still be required from the RCWD for individual development projects to confirm compliance with this CSMP and to meet other applicable RCWD rules. More information on responsiblites are provided in Section 6.0.

1.2 DESIGN PRIORITIES

Given the overlap and complexity of these various requirements, design priorities were established to meet as many of these requirements within the Natural Resources Corridor as possible, with the following priorities in this order:

1. Accommodate all wetland replacement for public infrastructure impacts (Spine/Old Highway 8 extension Roads and utilities, stormwater ponds, associated site grading, maintenance access, County Road I/Old Highway 8 extension Road access)
2. Accommodate all required stormwater rate control and infiltration for Spine/Old Highway 8 extension Roads
3. Accommodate stormwater rate control for Rice Creek Commons development

4. Provide maintenance access to stormwater features in form of a recreational, multi-use trail
5. Provide wetland mitigation for site development to the extent feasible
6. Provide infiltration for site development (residential, retail, and commercial parcels) to the extent feasible
7. Accommodate other passive recreation opportunities where feasible

1.3 RICE CREEK WATERSHED PERMIT PHASING PLAN

Some phases of redevelopment are County projects with more predictable schedules, while other phases are dependent on developer interest on an unknown schedule. All the projects have regulatory requirements to meet.

1.3.1 RCWD Permits Issued in 2013

The redevelopment site work activities commenced after issuance of the RCWD permit 13-0023 (April 30, 2013) to Bolander for demolition and remediation activities. Activities that will be completed under RCWD permit 13-0023, include:

- the removal of railroad track, fencing, bituminous pavement, concrete sidewalk, underground storm sewer, underground sanitary sewer, underground steam, underground condensate, underground watermain, and buildings is over 95% complete. It will be completed by October 15, 2015.
- Soil remediation and cleanup activities to bring the site to within MPCA residential SRV's is approximately 75% complete. It will be completed by October 15, 2015.
- Stabilization to meet the NPDES construction stormwater permit requirements is ongoing, and is addressed as certain areas are completed. It will be 100% complete by October 15, 2015.

This work is considered a Public Infrastructure Improvement.

1.3.2 RCWD Permit Applications Planned for 2015-2016

Nearby highway and bridge improvements are needed whether Rice Creek Commons is redeveloped or not. Various periphery highway and bridge improvement projects are outlined in the Ramsey County Public Works Department Transportation Improvement Plan (such as Interstate I-35W, Highway 10, CSAH 96, County Road H and County Road I.) Ramsey County plans to apply for separate permit applications and approvals for the following public infrastructure projects. The timing is subject to change due to funding, coordination, securing permits and approvals for projects:

- Summer 2015
  - Comprehensive Stormwater Management Plan (CSMP)
  - Creek Meander Permit (Rules D, E, F, G)
  - CSAH 96/I-35W interchange (Ramsey County/SEH)
- Fall 2015
  - Rice Creek Commons Spine Road (CSAH 96 to County Road H), regional stormwater/wetland, and generalsite Grading for portion south of Rice Creek (Rules C, D, E, F, G)
- Spring 2016
  - County Road H/I-35W Interchange (Rules C, D, E, F)

- Undetermined
  - County Road I/I-35W roundabout (including Old Highway 8 extension Road between County Road I and northern most edge of the parcel north of Rice Creek)
  - Rice Creek Commons Old Highway 8 extension Road (within the portion north of Rice Creek parcel). The timing is dependent on when the parcels are sold/developed north of Rice Creek.

1.3.3 RCWD Permit Applications Planned for 2015 and Beyond

Dependent on developer interest, there may be permit applications for portions of the 427-acre site. The location, size and type of development applications (mixed residential, commercial, and light industrial) are unknown, but all development will be consistent with the Master Plan (**Figure 3-1**). Developers will need to prepare the necessary documents to document deviations from this CSMP as well as additional document required to obtain a RCWD permit (e.g., an erosion and sediment control plan may be required to be developed given Rule D requirements). Some development applications may request an extended stormwater management permit for phased development in accordance with Rule C.13. This CSMP will be available to developers as they prepare the necessary applications. Developers will be required to comply with RCWD Board Approved CSMP for each respective project proposed.

1.4 DEVELOPER SUBMITTAL SEQUENCING

Future developers will be responsible to first submit a proposal to the JDA. The submittal would document which outlot (or portion of an outlot) will be developed. The application must document that the land use proposed is consistent with the Master Plan used in developing this CSMP (**Figure 3-1**). If the Land Use is different, the developer must demonstrate how the proposed use will meet the impervious assumptions for that outlot in the CSMP.

If development is within CSMP requirements, the developer application must include:

- Name the outlot(s) or portion of an outlot requested (per **Figure 5-2**)
- Document the total area requested broken down by roof area, pervious and impervious areas,
- Preliminarily communicate the method of proposed grit removal (e.g., flow through device, vegetated swale, vegetated filter strip, SAFL Baffle, off-line deep sump catch basins, The Preserver™, etc.) before stormwater discharges from the land being developed to the regional system,
- Explicitly name the stormwater pond(s) the site is tributary (P-X per **Figure 4-5**), and,
- The applicant must submit existing and proposed topography and describe the infrastructure proposed to convey stormwater.

If the development exceeds the CSMP maximum impervious, the developer application must demonstrate how the additional runoff will be treated to meet RCWD rules. Developers that choose to exceed the impervious limits designed to for that outlot, as summarized in Table E-2, will be required to address any additional stormwater requirements within that outlot at the developers expense. Any such stormwater management facilities will also be maintained by the owner/developer of the outlot.

1.5 JOINT DEVELOPMENT AUTHORITY

Ramsey County (County) and the City of Arden Hills (City) formed a partnership to redevelop the 427 acres. The Joint Powers Agreement (JPA) defines what portions of the redevelopment project are the responsibility of the County, the City, jointly the County and the City, and the developer responsibilities. The JPA calls for the establishment of a Joint Development Authority (JDA) or "governing body." The JDA Board consists of two members from the Ramsey County Board of Commissioners, two members from the City Council, and one appointed resident from Arden Hills who serves a two-year appointment as the JDA Chair. The main duties of the JDA Board are to implement the Rice Creek Commons Master Plan and oversee Rice Creek Commons redevelopment process and activities.

1.5.1 JDA Use of the CSMP

After the RCWD Board approves this CSMP, the JDA Board may need to adjust the requirements for a Development Site. During the Rice Creek Commons redevelopment process, the JDA Board may need to adjust the requirements for a Development Site. The JDA Board will follow the amendment process defined in the JPA. JDA approved requirements related to meeting RCWD's Water Quality Treatment (Rule C.6) and Peak Stormwater Runoff Control (Rule C.7) will be incorporated into the development agreements for each Development Site.

The County and JDA Board will make the CSMP available to interested Developers to promote conformance with RCWD Board Approved CSMP for each respective project.

1.5.2 JDA Responsibilites Administering the CSMP

Three outlots (A, J, K) include the requirement of designing and constructing an infiltration device or a stormwater pond that is consistent with this CSMP (Table 1-1).

Stormwater pond design details are included in the Stormwater Pond Data Summary Tables 6-1 through 6-5, included as part of Appendix A: HydroCAD Technical Memorandum. These tables summarize for each pond, the:

- Tributary subwatershed area,
- Outlet elevation (normal stormwater pond elevation),
- Emergency overflow elevation,
- Dead pool storage (the volume that remains in the ponds "dead storage" for settling until the next storm arrives)
- HydroCAD model predicted high water level (HWL), live storage volume, and peak discharge rate for the following design rainfall events (NOAA Atlas 14)
    - 100-year 24-hour
    - 10-year 24-hour
    - 2-year 24-hour
- Stormwater control structures (e.g., orifice, weir, culvert)
- Stormwater conveyance details (e.g., overland flow channel, pipe details)

The JDA will provide developers with technical details to complete their respective site designs to comply with the assumption used to develop this CSMP.

Table 1-1: Stormwater Requirements for Future Developerment Outlots

Outlot	Subbasin(s) (per Figure 6-1)	Rate Control (per Rule C.7)	Infiltration Required (per Rule C.6)
Spine Road	24, 25, 26	* Per CSMP (interim conditions)	
Outlot C	3, 8, 10, 11, 12, 13, 14, 16, 17		
Outlot H	4, 5, 6, 7		
Rice Creek Commons Old Hwy 8 Extension Road	27	*	✓ per table 5-1 of CSMP
Outlot A	22	*	✓ per table 5-1 of CSMP
Outlot B	16, 17, 19	* P-14, per CSMP	
Outlot D	15	*	
Outlot E	1, 3, 8, 9	*	
Outlot F	1, 3	* P-1, per CSMP	
Outlot G	2, 7	* P-3, per CSMP	
Outlot I	18, 5	*	
Outlot J	18	*	✓ per table 5-1 of CSMP
Outlot K	18	*	✓ per table 5-1 of CSMP
Outlot L	20	*	
County Road H/I-35W Interchange	27, 28, 29, 31	✓+	✓+

✓ Development plans submitted in the future are required to meet Rice Creek Watershed District Rules for this stormwater parameter.

* CSMP submitted compares peak flow rates (existing compared to fully developed conditions) entering the Rice Creek Commons ROC (Rice Creek/Long Lake and Round Lake) in aggregate. The modeling completed sums flows from multiple subwatersheds which drain to the same location (e.g. Rice Creek).

+ The CSMP is based on 30% design, and these proposed ponds did not provide sufficient water quality treatment volume to meet RCWD rules, nor were infiltration BMPs incorporated in the stormwater management design, as required per this CSMP.

The HydroCAD model will be maintained by the County's consultant once per a five-year cycle until fully developed conditions is achiveved to reflect the as-built conditions at Rice Creek Commons.

1.6 DEVELOPER DEVIATIONS FROM CSMP

Future developers may want to deviate from the CSMP. The responsibility is on the developer to prepare an application that documents what is different from the CSMP (e.g., X more square feet of impervious surface than documented in Table 6-2) and how that difference will be mitigated (e.g., stormwater cistern used to water landscaped areas).

Developers that choose to exceed the impervious limits designed to for that outlot, as summarized in Table E-2, will be required to address any additional stormwater requirements within that outlot at the developers expense. Any such stormwater management facilities will also be maintained by the owner/developer of the outlot.

2.0 Site Location

2.1 PROJECT LOCATION

The project site is located in Ramsey County, Minnesota predominately within the limits of the City of Arden Hills. The site is located within portions of Sections 9 and 16, Township 30 North, Range 23 West of the 5th Principal Meridian, (the Site). The Site is bounded by U.S. Interstate Highway 35W on the west, Minnesota State Aid Highway (CSAH) 96 to the south and U.S. Highway 10 to the southwest (**Figure 2-1**). The Arden Hills Army Training Site (AHATS) bounds the Site to the east. The redevelopment Site is comprised of approximately 427 acres of the western portion of the former TCAAP facility.

2.2 DRAINAGE AREAS AND RESOURCES OF CONCERN

Rice Creek divides the Site into two sections. The portion south of Rice Creek, and the portion north of Rice Creek (**Figure 2-2**). This project is located within Lower Rice Creek subwatershed area. Some of the Site drains to Rice Creek, and the remainder of the Site drains south to Round Lake.

3.0 Background Information

Portions of the Site will be developed by Ramsey County, the City of Arden Hills, and yet to be determined developers. Ramsey County hired the Port Authority to consult and help broker commercial developer interest in the Site. The following sections help put into context the behind-the-scenes planning accomplished leading up to this submittal by giving a brief overview of the Joint Development Authority (JDA), a brief status update on various planning steps underway, and the role of the Energy Resilience Advisory Board in Rice Creek Commons redevelopment. This section will also give a brief overview of the contamination and remediation activites on the Site at the time of printing. As well as the federal, state and local water resource regulations that need to be met on the Rice Creek Commons.

3.1 OTHER CONTROLLING DOCUMENTS AND GUIDELINES

A number of documents and guidelines have been or will be in place to guide the JPA decision making, including this CSMP.

3.1.1 Rice Creek Commons Master Plan & Alternative Urban Areawide Review

The City of Arden Hills prepared the Master Plan and the Alternative Urban Areawide Review (AUAR). The Arden Hills City Council approved the Master Plan Land Use Map on June 30, 2014 (**Figure 3-1**), after several months of development, work session meetings and public comments. Changes to the Master Plan over time can be expected, based on market demands and adjustments as development occurs.

The Master Plan Land Use Map (**Figure 3-1**) shows the Natural Resources Corridor. The site also has a number of delineated wetlands (**Figure 3-2**). It is a goal of the Master Plan to meet the majority of the wetland mitigation and stormwater management requirements within the Natural Resources Corridor.

An AUAR is a form of environmental documentation through Minnesota State Rules that evaluates one or more development scenarios for an entire geographical area rather than a specific project. Development scenarios are established based upon the comprehensive plan, zoning ordinances, developers' plans, and other relevant information. The City of Arden Hills approved the Final AUAR and Mitigation Plan for the Rice Creek Commons on July 28, 2014 (https://mn-ardenhills.civicplus.com/DocumentCenter/View/971).

3.1.2 Regulations and Policies

The Arden Hills City Council is working on the Regulations and Policies for the Rice Creek Commons. The City of Arden Hills maintains a website with background and additional information (http://www.cityofardenhills.org/)

3.1.3 Energy Resilience Advisory Board

An appointed five member Energy Resilience Advisory Board (ERAB) is working with consultants to develop the Rice Creek Commons Energy Integration and Resiliency Framework (“EIRF”), which will become a companion document to the Master Plan and policy actions that the JDA, the County, and the City can consider to support that energy future. The visioning and development of guiding principles for Rice Creek Commons is underway at the time of this printing.

3.2 SITE HISTORY OVERVIEW

The Site was used for the production and storage of small arms ammunition from the 1940s to the mid-1990s. Prior to development in the 1940s, the Site was used for agricultural purposes. Many investigation and cleanup activities have been focused on the Site in the past. There are a number of maps available of the surficial geology and hydrogeology at Rice Creek Commons (**Figures 3-3, 3-4, 3-5** and **3-6**).

There were several redevelopment attempts between 2002 and 2011. One attempt, by Ryan Companies, completed a number of soil borings on the Site (**Figure 3-7**).

Ramsey County is cleaning up the surface of the Site to residential soil reference value (SRV) to allow unrestricted land use however, future property use is anticipated to be mixed residential, retail, non-retail commercial (i.e., office, light industrial) and park (i.e., recreational) (per the Master Plan.) Within the redevelopment Site (427 acres), the Army will continue to own, operate and monitor groundwater remediation systems in the surficial groundwater (Unit 1, shown in **Figure 3-8**) and in the deep groundwater (Unit 3, shown in **Figure 3-9**). Ramsey County maintains a website with background and additional information (http://ricecreekcommons.com/)

3.3 RAMSEY COUNTY PURCHASE AND CLEAN UP OVERVIEW

The redevelopment Site is comprised of approximately 427 acres of the western portion of the former TCAAP facility. Ramsey County has closed on the initial purchase and transfer of title for 397 acres of previously remediated property. The remaining 30 acres of property, which has residual soil contamination, is being leased from the federal government while Ramsey County remediates the soil. Ramsey County entered into a demolition and remediation contract with Carl Bolander and Sons in April 2013 to clean up the State’s largest Superfund site. Once the cleanup is complete, the County will close on the final 30 acres and take title of the leased property. Ramsey County is completing additional subsurface investigations throughout the Site and implementing MPCA-approved response actions as necessary.

3.4 ARMY GROUNDWATER REMEDIATION SYSTEM OVERVIEW

The federal government retains responsibility for certain environmental liabilities under the Offer to Purchase, and federal environmental laws require the U.S. government to promise, for certain contaminated property it sells, that “any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.” Under advisement by the MPCA, redevelopment of the Site must proceed in a manner such that infiltration does not alter the groundwater flow regime in areas that are known to be affected by historical solvent releases. The following sections 3.4.1 and 3.4.2 define the remaining known areas.

3.4.1 TCAAP Hillside Sand Groundwater Plume

The TCAAP Groundwater Recovery System (TGRS) will continue to treat contaminated groundwater from Unit 3 (the Quaternary aged Hillside Sand Formation, which is one of the hydrogeologic units beneath Rice Creek Commons). The TGRS treats groundwater, from

Unit 3 (**Figures 3-5** and **3-6**), through a system of deep pumping stations and an on-site treatment facility that air strips the contaminants from the water, and then recharges the treated groundwater back into the Unit 3 groundwater table (**Figure 3-9**). This system will remain in place with oversight from the Minnesota Pollution Control Agency (MPCA) and the U.S. Environmental Protection Agency (EPA) for approximately the next 50 years. In the area of the Rice Creek Commons redevelopment project, Unit 2 is an aquitard which is located above Unit 3 and hydraulicly separates the surficial groundwater (Unit 1) from deep groundwater (Unit 3).

3.4.2 Rice Creek Commons Surficial Groundwater Plumes

The Site has surficial (Unit 1) contaminated groundwater associated with the Installation Repair Program (IRP) Sites I and K and Building 102. The Site K and Building 102 plumes are located in the north end of the portion south of Rice Creek, while the Site I plume is located north of CSAH 96 in the southeast portion of the portion south of Rice Creek (**Figure 3-8**). This figure shows a snapshot of the Unit 1 groundwater plumes supported by monitoring data presented in the Fiscal Year 2012 Annual Performance Report (FY 2012 APR). There are variaitons in the size, shape and orientation of the plumes, as documented in subsequent APRs. The Unit 1 layer is comprised of generally heterogenous and discontiguous materials. In the location of the Site K plume, Unit 1 geology can be described as having discontinuous stratigraphy (both vertically and horizontally). This makes predicting the groundwater flows using a model difficult because of heterogenousity. The Unit 1 layer is at the ground surface, extends south of Rice Creek (**Figure 3-4**) and tapers out until the Unit 2 (aquitard) is exposed at the surface. To the best of our knowledge a groundwater model does not exist for Unit 1.

3.4.2.1 Site I Surficial Groundwater Plume

According to the FY 2013 APR, the Site I has a shallow groundwater plume and has not achieved the ROD clean up levels to close the site. There are three selected remedies in the Record of Decision (ROD Amendment #2, 2009): groundwater monitoring, additional characterization, and land use controls. The annual sampling, from monitoring well 01U667, is required into the future until the cleanup goals are met. According to Conestoga-Rovers & Assoiciates (CRA) report dated May 1994 (available on Ramsey Co ftp), Unit 1 is the uppermost unit at Site I comprised of discontinuous layers of fine graned sand, silt and clay (generally fill material from previous construction activities) with pockets and layers of organic deposits (peat). Unit 1 is less than 40 feet thick at Site I. Surficial groundwater is perched within Unit 1, which is underlain with Unit 2 (an aquitard, separating Unit 1 from the deeper aquifer).

3.4.2.2 Site K Surficial Groundwater Plume

According to the FY 2103 APR, the Site K shallow groundwater plume has not achieved the ROD clean up levels to close the site. Eight remedy components are being implemented at Site K. The plume is being treated using a groundwater extraction trench and air stripper, and monitored using monitoring wells, piezometers and sentinel wells. When the system operates as designed the treated water discharges to the storm sewer that, in turn, discharges to Rice Creek. This system will remain in place with oversight from the MPCA and the EPA into the future. According to CRA report dated May 1994, Unit 1 (the Fridley Formation) is the uppermost unit at Site K comprised of fine to medium graned sand with minor constituents of silt. Unit 1 is less than 2.2 to 46.8 feet thick at Site K. Surficial groundwater is perched within Unit 1, which is underlain with Unit 2 (an aquitard, separating Unit 1 from the deeper aquifer). Groundwater at Site K flows west-northwest toward Rice Creek.

3.4.2.3 Building 102 Surficial Groundwater Plume

According to the FY 2103 APR, the Building 102 shallow groundwater plume has not achieved the ROD clean up levels to close the site. The plume is being treated using Natural Attenuation (abiotic degradation), and monitored to evaluate attainment and to verify that groundwater reaching Rice Creek does not exceed state surface water standards. This system will remain in place with oversight from the MPCA and the EPA into the future. Building 102 is close to building 103, which is a considered a part of Site K.

3.5 NO ASSOCIATION DETERMINATION

Due to the potential concern relative to surficial (Unit 1) contaminated groundwater, Ramsey County is seeking explicit MPCA approval relative to implementation of stormwater best management practices (BMPs) to ensure infiltration does not alter the groundwater flow regime in areas affected by historical solvent releases. Ramsey County is seeking protection of a No Association Determination under the Minnesota Enviornmental Response and Liability Act (MERLA) for the proposed actions related to plans for stormwater infiltration, as well as concurrence from the U.S. EPA and the U.S. Army with those plans.

Ramsey County submitted a Proposed Actions Letter/Request for No Association Determination request for activites under the demolition and remediation contract, described in Section 3.3, and was granted a No Association Determination on April 13, 2013. At the time of this printing, the MPCA is considering Ramsey County's additional Proposed Actions Letter/Request for No Association Determination requests for the following proposed actions:

- Redevelopment of the Site through mass grading and installation of municipal utility infrastructure, including all proposed public roadways, underground utilities (i.e., water mains, sewers, electric power, communications lines), as well as stormwater best management BMP systems, mitigated wetlands, Rice Creek channel modifications, and other infrastructure improvements.
- The proposed stormwater system will include surface water retention and surface water conveyances, though infiltration will be the preferred method for managing stormwater on-Site. Areas of the Site where increases in stormwater infiltration (above what was considered existing conditions) are not considered appropriate are defined on **Figure 5-2**. **Figure 3-8** shows areas of the Site where shallow (i.e., Unit 1) groundwater is currently impacted by solvent releases.
- Ramsey County met with MPCA on March 18, 2015 at Ramsey County Public Works. The MPCA requested Ramsey County document the predicted infiltration contributing to the surficial (Unit 1) aquifers in the vicinity of the Installation Repair Program (IRP) Site K before the start of the redevelopment project (circa 2012) and at the end of the redevelopment project (circa, TBD). During this meeting, MPCA discussed Ramsey County's written request made on September 16, 2014 for the MPCA to issue an assurance letter called a No Association Determination to fully develop the Site. A No Association Determination would give Ramsey County assurances that the Site could be developed, as presented in the CSMP, and Ramsey County would not be associated with known contamination for Superfund liability purposes. Ramsey County is preparing a technical document thatoutlines the measures prescribed in the comprehensive stormwater management planning process to limit impacts on the

remaining impacted surficial groundwater after the current demolition and remediation efforts are completed.

- Site sampling, excavation, segregation, grading, movement, stockpiling, permitting and means necessary for appropriate disposal of soils and media to accommodate the above-referenced improvements.
- Dewatering, sampling, permitting and means necessary for appropriate disposal of waters to accommodate the above-referenced improvements.

3.6 REGULATORY REQUIREMENT OVERVIEW

There are a number of federal, state and local water resource regulations that need to be met on the Rice Creek Commons. Given the complexity and potential conflicts between these regulations, we have been meeting with the respective agencies to confirm requirements. The four key agencies and their respective approvals required are listed below:

MnDOT has jurisdiction over wetland and drainage within MnDOT right-of-way, including the interchange areas of County Road H and County Road I. Wetland and drainage permits will be required from MnDOT for modifications to these interchanges that impact wetlands and surface water runoff.

MN DNR has jurisdiction over Rice Creek (within the top of banks of the Rice Creek channel) including any changes to the creek alignment, new crossings and floodplain impacts. A public waters permit and floodplain review will be required for the creek realignment, crossing and floodplain impacts adjacent to Rice Creek.

US Army Corps of Engineers (USACE) has jurisdiction over waters of the US which includes certain wetlands and streams. A Clean Water Act Section 404 permit will be required for wetland and creek impacts.

Rice Creek Watershed District (RCWD) has jurisdiction over Rice Creek Commons storm water runoff, erosion control, floodplains, wetlands, and creek crossings. RCWD approval is required in each of these areas by way of a Comprehensive Stormwater Management Plan (CSMP) and issuance of RCWD Permits. As allowed for under RCWD Rule C.5 (f), this CSMP has been prepared as an alternative means to meet the requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control) for redevelopment of the Site, which will be done in various stages.

4.0 Rice Creek Commons Redevelopment

4.1 PREDEVELOPMENT CONDITIONS

The predevelopment conditions for the site are agreed to be 2012, before redevelopment activities, such as demolition, commenced. The Site had open space, buildings, roads, utilities, no engineered infiltration devices, and groundwater remediation systems operating. Using LiDAR data and information available on the soils, land use, and storm sewers, the predevelopment conditions subwatersheds were delineated (**Figures 4-1** and **4-2**). The southern portion of the Site drains to Round Lake, while the remainder drains to Rice Creek. **Appendix A** includes a technical memorandum summarizing the modeling completed for the Site under predevelopment conditions. Wenck evaluated the Site stormwater runoff for 2-, 10-, and 100-year 24 hour design rainfall events (2.82, 4.22, and 7.31 inches, respectively). Precipitation depths were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 and distributed with a nested curve.

Due to the remediation at Rice Creek Commons, there is a considerable amount of data available on the groundwater levels in Unit 1. **Figure 4-3** is a historical map showing the surficial (Unit 1) groundwater levels in 1987. There are no groundwater level lines shown on the map in areas where the surficial (Unit 1) groundwater wasn't observed. Hydrogeologic factors such as heterogeneity of Unit 1, The historical map doesn't have depth to groundwater labeled. **Figure 4-4** shows the groundwater piezometric contours using 2012 groundwater conditions. The groundwater levels were evaluated using available surficial (Unit 1) groundwater monitoring wells (20 wells), and based on the water level data available between 1987 and 2013, 2012 was determined to represent the seasonably high groundwater condition.

There are 14.4 acres of wetland on the site (**Figure 3-2**). The RCWD, United States Army Corps of Engineers (USACE), and Minnesota Department of Transportation (MnDOT) have different jurisdiction and mitigation requirements for the wetlands impacted. Mitigation is needed on site to satisfy RCWD and Corps requirements for the Site infrastructure impact to wetlands (construction of the Spine and Old Highway 8 extension Roads, Natural Resources Corridor grading), as shown in **Figure 4-5**. This amount does not include the creek realignment, however that work is expected to be self-mitigating. Wetland sequencing will be defined in the County's permit applications submitted to RCWD.

4.2 CONCEPT GRADING PLAN

The current plan shows the site grading for Rice Creek Commons public infrastructure improvements and the layout of the Natural Resources Corridor (**Figure 4-5**), a blend of stormwater ponds and mitigation wetlands. **Figure 4-6** is a flow diagram showing the connections between tributary subwatersheds, stormwater ponds and wetlands. The proposed grading plan accomplishes the following priorities for fully developed conditions:

1. Provide all wetland replacement for the public infrastructure impacts
2. Accommodate all required stormwater rate control and infiltration for Spine/Old Highway 8 extension Roads
3. Accommodate stormwater rate control for all Rice Creek Commons development

4. Provide maintenance access to stormwater features in form of a recreational, multi-use trail
5. *
6. *
7. Provide some space for passive recreation opportunities along the easterly portion of the site

* Depending on further coordination with the USACE and RCWD, there is room in the Natural Resources Corridor to accommodate most of priority #5 and priority #6 (Section 1.2 of this CSMP). If a permit from the USACE cannot be obtained for wetland impacts of future development, the proposed grading plan would not provide wetland replacement (priority #5) for future site development within the Natural Resources Corridor, requiring individual developments that impact wetlands to address mitigation needs separately as a part of their planning and design activities. In that case, additional infiltration best management practices (BMPs) may be incorporated into the Natural Resources Corridor (priority #6) rather than additional wetland mitigation.

4.3 PROPOSED CONDITIONS

The proposed conditions are presented in two stages; completion of the public infrastructure improvements (interim conditions), and the fully developed conditions using landuse assumptions in the Master Plan. **Appendix A** includes technical memorandums summarizing the modeling completed for the Site.

4.3.1 Interim Conditions (Public Infrastructure Improvements) (Interim Scenario 1)

The first phase of site development includes the construction of public infrastructure improvements including Spine Road, I-35W improvements, alterations to County Road H and realignment of Rice Creek (**Figure 4-5**). During this interim construction phase, a contractor, selected by Ramsey County will construct all wetlands and ponds except P-1, P-3, and P-14. The interim conditions reflect the first stage of site development which includes the construction of public infrastructure improvements. **Appendix A** includes technical memorandums summarizing the modeling completed for the Site under interim conditions (Interim Scenario 1). The same rainfall and snowmelt events were evaluated for interim conditions, as were evaluated for existing conditions.

4.3.2 Worst Case Interim Conditions (Interim Scenario 2)

The pollutant removal efficiency of the proposed regional ponding system was evaluated for the worst case scenario. This Interium Scenario 2 assumes the public infrastructure improvements are completed, stormwater pond (P-14) is built, Rice Creek Commons develops east of Spine Road (landuse per **Figure 3-1**) and there is no development or infiltration device in subwatershed SB-18 (**Figure 4-7**). **Appendix A** includes a water quality technical memorandum summarizing the modeling completed for the Site under interim conditions (Interim Scenario 2). The same rainfall and snowmelt events were evaluated for interim conditions, as were evaluated for existing conditions.

4.3.3 Proposed Conditions (Fully Developed)

Using the grading plan and assumption that existing topography will remain relatively unchanged and information available on the soils, fully developed conditions land use, and storm sewers, the fully developed conditions subwatersheds were delineated (**Figures 3-1 and 4-7**). The comparison between existing and fully developed site drainage divide is shown on **Figure 5-1**. **Appendix A** includes technical memorandums summarizing the modeling completed for the Site under proposed conditions (fully developed). The same rainfall and snowmelt events were evaluated for fully developed conditions, as were evaluated for existing conditions.

5.0 CSMP Meets RCWD Rule C Requirements

5.1 RCWD RULE C OVERVIEW

The Rice Creek Commons to be redeveloped is located within two Resource of Concern (ROC) Drainage Areas (see **Figure 2-2**). The northern part of the site (278 acres) drains to Rice Creek which flows into Long Lake located approximately 1.3 miles downstream. The southern part of the site (208 acres) drains directly into Round Lake. General drainage patterns will be maintained under the proposed, fully developed conditions and stormwater runoff within each ROC drainage area will be managed to meet RCWD's Rule C requirements as described below (as adopted at the time of printing).

As allowed for under RCWD Rule C.5 (f), this Comprehensive Stormwater Management Plan (CSMP) has been prepared as an alternative means to meet the requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control) for redevelopment of the Site, which will be done in various stages. The water quality treatment volume and peak runoff rate controls standards will be met in aggregate for each ROC drainage area. As agreed to with RCWD staff, existing impervious surface area is based on 2012 conditions prior to the start of site demolition and remediation activities. Proposed impervious surface areas are based on the proposed infrastructure improvements and various land uses identified in the Master Plan.

Best management practices (BMPs) used to meet the standards will be constructed and functional prior to, or concurrent with the construction of impervious surfaces associated with each development project. Once approved by RCWD, this CSMP will apply to future development of the site. Permits will be required for individual development projects to confirm compliance with this CSMP and to meet other applicable RCWD rules.

Initial stages of redevelopment include site demolition and remediation activities that commenced in April of 2013. The next phase is construction of public infrastructure improvements including the main access road serving the development, utilities, rough site grading, regional stormwater ponds, and mitigation wetlands. The majority of the stormwater ponds and wetland mitigation areas are located within the Natural Resources Corridor that runs through the center portion of the site.

Upon completion of the public infrastructure improvement work, private development will take place over time and in various stages which will include construction of additional stormwater management facilities. Individual stormwater management plans must conform to this CSMP as well as any ordinances that may apply within the redevelopment area.

In accordance with RCWD stormwater management policy, better site design techniques shall be considered to reduce impervious surfaces and maximize water quality and flood control benefits. Two such techniques, preserving/dedicating natural areas and using a treatment train approach for runoff management, have been incorporated into this CSMP. Developers will be required to evaluate and apply better site design techniques, wherever possible, as part of the design process for future development of the site. A better site design guidance document and checklist is available on the RCWD website.

5.2 WATER QUALITY TREATMENT – RULE C.6

RCWD’s water quality treatment requirements will be met through a combination of onsite infiltration and wet detention ponds, as described below. Due to soil constraints (Type C and D soils with low permeability), ongoing groundwater treatment activities (described in Section 3.4), MPCA’s advisement to not alter the groundwater flow regime in areas that are known to be affected by historical solvent releases, and other factors such as subsurface vapor treatment and shallow Unit 1 groundwater; the use of onsite infiltration is limited and determined to not be feasible over the majority of the site. **Figure 5-1** shows locations of potential infiltration practices based on review of existing soil borings. Copies of the soil boring logs for the project site are provided in **Appendix B**. Infiltration is deemed feasible and required in the area north of Rice Creek and an area on the west side of the Spine Road alignment as shown in **Figure 5-1**. Both of these areas drain to Rice Creek. In all other areas, including areas draining south to Round Lake, water quality treatment will be provided through wet detention ponds.

Available soil borings (circa 2007) were reviewed along the Spine Road cooridor, the best soils for infiltration practices are located in areas affected by historical solvent releases, thus infiltration is deemed infeasible and not required. The **Appendix A** HydroCAD Technical Memorandum Section 3.3 and Figure 3 display the conclusions of the infiltration potential analysis based on the 2007 borings. The runoff from Spine Road is collected by stormsewer and directed to stormwater ponds (P-2, P-6 and P-13). Additional soil borings were drilled to obtain geotechnical recommendations to advance the Spine Road corridor design during summer 2015. The preliminary soil borings logs available at the time of printing were reviewed and the best soils for infiltration practices were located in areas where infiltration BMPs were infeasible. **Figure 5-3** display the conclusions of the infiltration potential analysis based on the 2015 preliminary borings. Many of the borings show clay soils, which are not favorable for infiltration BMPs. The borings with feasible soils were located in the headwaters portions of the delineations where there isn’t a large enough subwatershed tributary to feed an infiltration BMP (SR-211), in areas of high groundwater (SR-214, SR-215, SR-216, SR-217) and in areas where stormwater reintroduction is not allowed due to historical solvent releases. These additional soil borings, when finalized, will be submitted with the public infrastructure improvements permit application to RCWD.

5.2.1 Stormwater BMP Strategy to meet Rules

5.2.1.1 Infiltration

Rule C.6 requires that where feasible, infiltration be provided for stormwater runoff from new and/or reconstructed impervious surfaces. Proposed impervious surface area is based on the proposed public infrastructure improvements and various land uses identified in the Master Plan.

Water quality treatment volume required for phosphorus removal is calculated as follows:

$$\begin{array}{c}\text{Required}\\ \text{Water Quality}\\ \text{Treatment}\\ \text{Volume}\\ \text{(ac-ft)}\end{array} = \begin{array}{c}\text{Area of New or}\\ \text{Reconstructed}\\ \text{Impervious}\\ \text{Surface (acres)}\end{array} \times 1.1\ \text{(in)} \div \begin{array}{c}\text{Total Phosphorus}\\ \text{Removal Factor}\end{array} \div \begin{array}{c}12\\ \text{(in/ft)}\end{array}$$

Where the Total Phosphorus Removal Factor = 1.0 for Infiltration BMPs

As noted above, onsite infiltration was deemed feasible and is required in the area north of Rice Creek and the northwest corner of the portion south of Rice Creek, as shown in **Figure 5-1**. The proposed new/reconstructed impervious surface area and the required water quality treatment volumes (infiltration volume) based on the above equation are provided in **Table 5-1** below:

Table 5-1: Infiltration Requirements

	Area North of Rice Creek (Figure 5-1: Area 4)	Area West of Spine Road (Figure 5-1: Area 3)
Impervious Surface (acre)	40.9	36.3
Infiltration Volume (acre-ft)	3.7	3.3

One large regional infiltration facility could be constructed in each drainage area to meet the above volume requirements. In lieu of providing large regional facilities, smaller infiltration systems could be constructed as individual parcels develop. In this case, a rate of 4,000 cubic feet of infiltration volume per acre of impervious surface area created would be used to determine infiltration requirements on a parcel-by-parcel basis.

Infiltration systems that capture, store and infiltrate stormwater runoff into the underlying permeable soils include both ground surface depressions such as infiltration basins and underground facilities such as an infiltration trench. Typical construction details for each of these practices are provided in the Minnesota Stormwater Manual (excerpts included in **Appendix C**). Drawdown must be within 48 hours after the storm event for surface systems and 72 hours for subsurface systems. A minimum of three feet of separation must be provided from the bottom of the infiltration system to the seasonally high groundwater table or bedrock. The infiltration systems will be equipped with a bypass or overflow device to redirect stormwater runoff from larger rainfall events (greater than 1.1 inches) to the downstream conveyance systems. The bypass or overflow for the infiltration device in the northwest corner of the portion south of Rice Creek will be directed to the wet detention Pond (P-13), where additional water quality benefits will be provided along with rate control.

Total suspended solids (TSS) will be removed to the maximum extent practicable from stormwater runoff from new and reconstructed impervious surfaces and from stormwater draining to infiltration areas. This will be accomplished through the use of sump catch basins and manholes, grit chambers, sand filters, or similar BMPs.

The proposed wet detention ponds described below will provide additional volume reduction and water quality benefits through infiltration, evaporation, and plant uptake between storm events creating additional storage volume in the pond as water levels drop below the outlet elevation.

5.2.1.2 Wet Detention Ponds

Stormwater ponds used for water quality treatment in meeting Rule C.6 need to be properly sized consistent with Nationwide Urban Runoff Program (NURP) criteria. This includes providing a permanent wet pool with dead storage at least equal to the runoff volume from a 2.5-inch rainfall over the pond tributary area under full development. The permanent pool volume is the most important design parameter influencing pollutant removal efficiency. It provides storage and treatment of runoff during and between storm events. The amount of dead storage calculated for each pond is shown in the Pond Data Summary Tables provided in HydroCAD Technical Memorandum (**Appendix A**).

The proposed fully developed dead storage volume provided for each ponding system is summarized in **Table 5-2**.

Table 5-2: Dead Storage

Pond/Ponding System	Dead Storage Provided (ac-ft)
P-1, P-2, P-3, P-5, P-6	14.4
P-7, P-8, P-9, P-10, P-11, P-12, P-13	15.6
P-4	0.6
P-14	4.5
Total	35.1

Individual ponds P-4 and P-14 meet RCWD's dead storage requirements. Although some of the individual ponds may not meet the dead storage requirements, the ponding system with multiple ponds in series provides a treatment train approach that enhances overall pollutant removal capabilities.

5.2.1.3 P8 Water Quality Modeling

To ensure that the average annual total phosphorus removal efficiency for the ponding systems in series is at least 50% (TP Removal Factor), the P8 Water Quality Model was utilized to estimate the overall phosphorus removal efficiency under fully developed conditions. For fully developed conditions, each outfall is numbered as shown in **Figure 6-3**. The tributary areas to each outfall are shaded in a similar color. A description of the modeling effort is summarized in a Technical Memorandum provided in **Appendix A**. Based on the P8 modeling results, the total phosphorus removal efficiencies for the two proposed ponding systems are as follows:

Table 5-3: TP Load Reductions to Rice Creek (Scenario 3: Fully Developed Conditions

Discharge Point	Watershed Inflow Load (lbs./year)	Total Outflow (lbs./year)	% Reduction
Outfall #5	279	99.9	64%
Outfall #10	18.8	7.1	62%
CRH-1**	7.1	3.8	46%
CRH-3**	5.4	4.2	22%
Thumb Infiltration	13.6	0.4	97%
Total	323.9	115.4	64%

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for CRH-3 = TP load from CRH-2 + TP load from CRH-3).
** Ponds CRH-1 and CHR-3 are 30% designed, see text above.

Table 5-4: TP Load Reductions to Round Lake (Scenario 2: Fully Developed Conditions)

Discharge Point	Total TP Inflow Load* (lbs./year)	Total Outflow Load (lbs./year)	% Reduction
Outfall #2	168.8	66.3	61%
Outfall #1	12.4	6.1	51%
Total	181.2	72.4	60%

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for Outfall #1 = TP load from Pond 4 + TP load from Wetland 1)

The 2012 outfalls are numbered as shown in **Figure 6-2**. TP loads were evaluated for interim development conditions. The results from these models are presented in **Appendix A**.

The P8 modeling confirms that the wet detention ponding networks provide water quality treatment of site stormwater runoff sufficient to meet RCWD rules. Improved wet pond designs have been observed to achieve higher pollutant removal efficiencies by adding in features such as wetland benches, flow barriers that divide the pond into two or more segments, forebays, and floating wetlands and / or aerators. The BMPs modeled in P8 are simple ponds and infiltration devices without explicitly modeling the additional pollutant removals associated with these enhanced designs. The least effective BMP provides over 50% TP removal. Each ponds, shown on **Figure 4-5**, will be installed with an aquatic bench. Future private designers should not be expected to install BMPs that are more effective than required in the CSMP, unless impervious surfaces proposed are greater than assumed in this CSMP.

Pond outlets will be designed to provide skimming/retention of oils and floatable debris for at least the 1-year 24-hour design rainfall event (2.45 inches). Velocities through each skimming device will be limited to 0.5 feet per second.

The ponds will also be designed with an aquatic bench extending below the normal water level a minimum width of 10 feet and one foot deep for safety purposes, provide suitable habitat for rooted aquatic plants, and improve access for maintenance.

5.2.2 Additional BMPs for Consideration of Future Development

Additional onsite volume abstraction/reduction will be encouraged as part of future development. The following may be considered, if feasible::

- Capture and reuse of stormwater for irrigation - Operating plans for stormwater reuse including calculations and documentation will be provided by developers and submitted with individual permit applications.
- Planting of new trees - Tree planting plans will be provided by developers and submitted with individual permit applications. Tree canopy areas provide variable rainfall interception that can be estimated using a variety of methods.
- Soil amendments - Project specifications that incorporate soil amendments or conditioners, where applicable, to restore soil function and increase infiltration capacity will be consistent with RCWD Soil Amendment Guidelines.

- Native plants - Use native plants wherever possible to enhance stormwater abstraction and uptake capabilities.
- Wetland buffers - Maintain vegetative buffers along edges of wetlands to slow runoff and filter out nutrients and suspended solids.
- Grass channels - Use grass channels and swales wherever possible to convey stormwater runoff.

5.3 PEAK STORMWATER RUNOFF CONTROL – RULE C.7

With the exception of small direct tributary areas to Rice Creek and infiltration volumes described above, all stormwater runoff from developed areas of the site will be routed through stormwater ponds where both water quality and rate control will be provided.

The HydroCAD computer model was used to model existing and proposed conditions to determine peak discharges and water levels for the 2-year, 10-year, and 100-year, 24-hour design rainfall events using NOAA Atlas 14 precipitation values. Analysis of the 10-day snowmelt event was not required as all stormwater ponds have a defined outlet at an elevation below the 100-year high water level. A description of the modeling effort, calculations, technical analysis, and supporting information is summarized in a Technical Memorandum provided in **Appendix A**.

5.3.1 Allowable Peak Discharge Rates

Since the project site is located within the Flood Management Zone of the lower Rice Creek Watershed, proposed discharge rates will be limited to 80% of existing peak discharge rates. Based on modeling of existing conditions, the allowable peak rates for the proposed redevelopment (80% of existing/Flood Management Zone) is as follows:

Table 5-5: Allowable Peak Rates

Drainage Area	2-Year	10-Year	100-Year
Rice Creek (cfs)	252	483	975
Round Lake (cfs)	127	254	525

5.3.2 Proposed Peak Discharge Rates

Stormwater runoff from redeveloped areas within both drainage areas will be routed through onsite regional ponds to meet the above peak stormwater runoff control requirements for the 2-year, 10-year and 100-year 24-hour design rainfall events (80% of existing).

Based on modeling of proposed conditions, the following peak rates have been determined:

Table 5-6: Proposed Peak Rates

	2-Year	10-Year	100-Year
Interim Rice Creek (cfs)	104	232	607
fully developed conditions Rice Creek (cfs)	237	414	853
Interim Round Lake (cfs)	51	124	349
fully developed conditions Round Lake (cfs)	54	117	326

Overall, peak rates will be reduced and there should be no adverse downstream impacts. Peak discharge rates, water elevations, and storage volumes for each of the proposed ponding areas are summarized in the Pond Data Summary Table provided in HydroCAD Technical Memorandum (**Appendix A**).

Wet detention ponds that are not constructed initially as part of the public infrastructure improvement construction phase (Ponds P-1, P-3 and P-14) will be constructed later as part of future development phases. These ponding areas will be dedicated and space reserved for future use by way of outlots and/or easements and located in the general area shown on the site plan. Ponds will be constructed to provide the dead storage volume and flood storage consistent with what was modeled and included as part of the overall stormwater analysis presented in this CSMP.

5.3.3 Outlet Control Structures

Each pond will be designed with a multi-stage outlet control structure to manage stormwater discharges for each of the design events. The outlet structure will also be designed to provide skimming/retention of oils and floatable debris for at least the 1-year 24-hour design rainfall event (2.45 inches).

Each pond will be equipped with a stabilized emergency overflow spillway to convey flows greater than the 100-year 24-hour design rainfall event (7.31 inches). Emergency overflow routes shall also be provided for added protection against flooding and local erosion.

Stormwater conveyance systems such as storm sewers and drainage channels will be designed and constructed by commercial developers to route stormwater runoff to various ponding areas serving the development.

5.3.4 Low Floor and Low Entry Freeboard Requirements

The storage volumes and discharge rates established for each pond must be maintained to prevent flooding of property and meet peak flows. The lowest floor elevation of future buildings and structures adjacent to ponds and connecting drainage channels must be at or above the 100-year high water level and the lowest opening elevation must be at least two feet above the 100-year high water level. These building elevations should be indicated on site grading plans to ensure adequate freeboard is provided. Pond emergency overflow elevations must be at least one foot below the lowest opening elevation.

6.0 Stormwater BMPs

6.1 CONSTRUCTION OF PONDS

The stormwater ponds (P-2, P-4, P-5, P-6, P-7, P-8, P-9, P-10, P-11, P-12, P-13, CRH-1, CRH-2, and CRH-3) will be constructed by the contractor(s) selected by the County (**Figure 4-5**). The County's contractor will construct storm sewer conveyance from P-5 to P-3, along with a temporary connection to the outfall to provide conveyance until P-3 is constructed. Stormwater ponds P-1, P-3 and P-14 will be constructed by respective developers. The engineering design for stormwater ponds located in MnDOT right-of-way (CRH-1, CRH-2, and CRH-3) was preliminary (30%). The proposed ponds submitted did not provide sufficient water quality treatment volume to meet RCWD rules, nor were infiltration BMPs incorporated in the stormwater management design, as required per this CSMP.

The planned phasing is that all but stormwater ponds (P-1, P-3 and P-14) will be constructed as part of the public infrastructure improvements (Interim Scenario 1) staged outlets and general site grading to create wetland hydrology.

6.2 VOLUME REDUCTION PRACTICES

The volume reduction BMPs (e.g., infiltration practices) on the portion area and the northwest corner of the portion south of Rice Creek will be designed and constructed by the respective developer following the Minnesota Stormwater Manual guidance (**Appendix C**) and the RCWD Permit requirements. In Areas 3 and 4 (**Figure 5-1**) soil infiltration rates will be evaluated to determine if the native soils at the bottom of the proposed infiltration device infiltrate more than 8.3 inches per hour. The soils shall be amended to slow the infiltration rate below 8.3 inches per hour or as allowed by a local unit of government with a current MS4 permit. The respective developer will be the entity responsible for long-term operations and maintenance of volume reduction practices. Respective developers shall submit an infiltration management plan as part of the RCWD permit applicaiton.

6.3 RESPONSIBLE PARTY FOR STORMWATER MANAGEMENT FEATURES

Ramsey County is the entity responsible for short-term (through 5-year establishment and approval period) operations and maintenance of the wetland mitigation (Wi, W-1, W-2, W-3, W-4, and W-5).

MnDOT is the entity responsible for long-term operations and maintenance of the stormwater management and drainage facilities receiving stormwater from MnDOT right-of-way. Preliminarily these consisit of stormwater ponds; P-15, CRH-1, CRH-2, and CRH-3.

The City of Arden Hills is the entity responsible for long-term operations and maintenance of the stormwater management and drainage facilities receiving stormwater from public and private spaces within the Site. Most of these stormwater ponds are located within the Natural Resources Corridor (P-4, P-5, P-6, P-7, P-8, P-9, P-10, P-11, P-12, and P-13). Regional ponds owned by public entities that are used to meet rate control requirements do not need a maintenance agreement with the RCWD.

Some ponds (P-1, P-3 and P-14) will be constructed by the developer but will be maintained by the city once constructed and stabilized to the City'ss satisfaction. The individual Developers are not known at this time.

The infiltration BMPs in Areas 3 and 4 will be responsibility of the Developer. The Developer will need to record a Stormwater Operation and Maintenance Agreement (see RCWD website for template) with RCWD. Submittals must include an exhibit and/or legal description that identify the BMPs. The Agreement must be submitted to the RCWD for review and approval prior to submitting it to the County Recorder's office.

Table 6.1 summarizes responsible entity for the long-term operations and maintenance of the stormwater management and drainage facilities. Pretreatment features to provide grit removal will be constructed by developers and maintained by developers per each outlot.

Table 6-1: Pond Responsibilites

Feature	Constructed by	Long-Term O&M Responsibility
P-1	Developer	City of Arden Hills
P-2	Ramsey County's Contractor	City of Arden Hills
P-3	Developer	City of Arden Hills
P-4	Ramsey County's Contractor	City of Arden Hills
P-5		
P-6		
P-7		
P-8		
P-9		
P-10		
P-11		
P-12		
P-13		
P-14	Developer	City of Arden Hills
P-15	Ramsey County's Contractor	MnDOT
Infiltration BMP outlot A	Developer	Developer
CRH-1	Ramsey County's Contractor	MnDOT
CRH-2	Ramsey County's Contractor	MnDOT
CRH-3	Ramsey County's Contractor	MnDOT
Infiltration BMP outlot J	Developer	Developer
Infiltration BMP outlot K	Developer	Developer
Pretreatment BMP, grit removal	Developer	Developer

6.4 MAINTENANCE GUIDELINES FOR STORMWATER FEATURES

6.4.1 Ponds

Stormwater management and drainage facilities shall be maintained as necessary to ensure the stormwater system functions as it was originally designed, including:

- Removing accumulated sediment from low areas
- Regularly inspecting pipes, structures, and embankments for structural integrity
- Removing trash, debris, or other obstructions from site
- Clearing tributary areas of invasive or nuisance/undesirable vegetation
- Addressing any erosion issues, including restoring slope protection and riprap

Site access routes shall be well maintained and clear of obstruction. Detailed guidelines for maintenance is provided in the Minnesota Stormwater Manual. Stormwater ponds will not function properly unless a pre-treatment device is properly sized, installed and maintained as necessary to ensure the device functions as it was originally designed.

6.4.2 Infiltration BMPs

The Minnesota Stormwater Manual presents a multitude of options of infiltration BMPs for stormwater runoff. These devices will be selected, designed and installed after the CSMP is adopted. The Minnesota Stormwater Manual presents a variety of design guidelines, as well as operation and maintenance considerations for BMPs. Appendix C contains an example of the information available. Some infiltration BMPs include:

- Bioinfiltraiton/rain garden
- Infiltration basin
- Infiltration trench
- Permeable pavement
- Tree trench/tree box
- Underground infiltration

Some BMPs are easier to maintain than others. Infiltration BMPs will not function properly unless a pre-treatment device is properly sized, installed and maintained as necessary to ensure the device functions as it was originally designed. Infiltration BMPs must be maintained as necessary to ensure the device functions as it was originally designed.

6.4.3 Pre-Treatment (Grit Removal)

The Minnesota Stormwater Manual presents a multitude of options to pre-treat stormwater runoff prior to discharging it into stormwater BMP. Some pre-treatment systems include:

- Flow through device
- Swirl Chambers
- Trench Forebays
- Level Spreaders
- Vegetated filter strips
- Forebays
- Vegetated swales
- SAFL baffle

- off-line deep sump catch basins
- Proprietary Products

Detailed guidelines for maintenance is provided in the Minnesota Stormwater Manual.

6.5 EASEMENTS FOR PONDS

Preliminary outlots have been identified on the concept preliminary plat (**Figure 5-2)**. At this time the drainage and utility easements are not defined, due to the concept nature of the stage the project is in. It is one of the objectives of the plat development process to define the drainage and utility easement corridors. It is anticipated, as the platting documents for submission are produced, these corridors will be addressed and illustrated as well as other outlots or easements that may need to account for ponds, water features, stormwater retention/detention features as well as sites for significant utility structures such as substations, lift stations, etc. that may be dedicated to the public or privately owned based how it will be managed and maintained.

Some of the areas designated for MnDOT right-of-way may be right of way dedications in the plat and may not be considered tracts or outlots in the final version. Right-of-way or easements may also be needed in the portion north of Rice Creek area's westerly road if this is to become public or have public utilities.

The public infrastructure improvement grading shows the location of trails. All ponds located in the Natural Resources Corridor (NRC) are accessable by trails for long-term operations and maintenance. **Table 6.1** summarizes who is responsible for construction and long-term operations and maintenance for each stormwater pond as drainage and utility easement corridors are identified.

If a develpment project submits a RCWD permit application that has an impervious acreage less than or equal to the values by outlot in **Table 6.2**, the requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control) will be considered satisified.

Table 6-2: Impervious Summary by Outlot

Outlot ID	Area (acres)	Impervious Area (acres)	Additional breakdowns
Outlot A	40.1	34.0	
Old Highway 8 extension Road	4.8	4.8	
Spine Road	24.0	24.0	
Outlot B (Creek)	45.9	18.1	15.2 acres in residential
Trail Dedication	1.1	0.7	0.4 acres residential, remaining in trails
Outlot C (NRC)	47.6	5.2	2.1 acres in civic, remaining in recreational and trails, realigned Creek
Outlot D (Town)	58.8	28.6	16.9 acres in residential, 9.7 acres in mixed use, 1.2 acres in commercial, remaining in recreational
Outlot E (Hill)	73.3	27.0	23.9 acres in residential
Outlot F (Flex Business East)	28.7	23.5	
Outlot G (Flex Business South)	31.7	21.6	
Outlot H (NRC)	3.5	0.4	0.4 acres in trails
Outlot I (Flex Business North)	18.2	15.4	
Outlot J (Corporate)	20.0	17.0	
Outlot K (Retail)	20.0	16.5	16.4 acres in retail, remaining in recreational
Outlot L (Creek Meander)	2.7	0.2	0.2 acres in trails, realigned creek

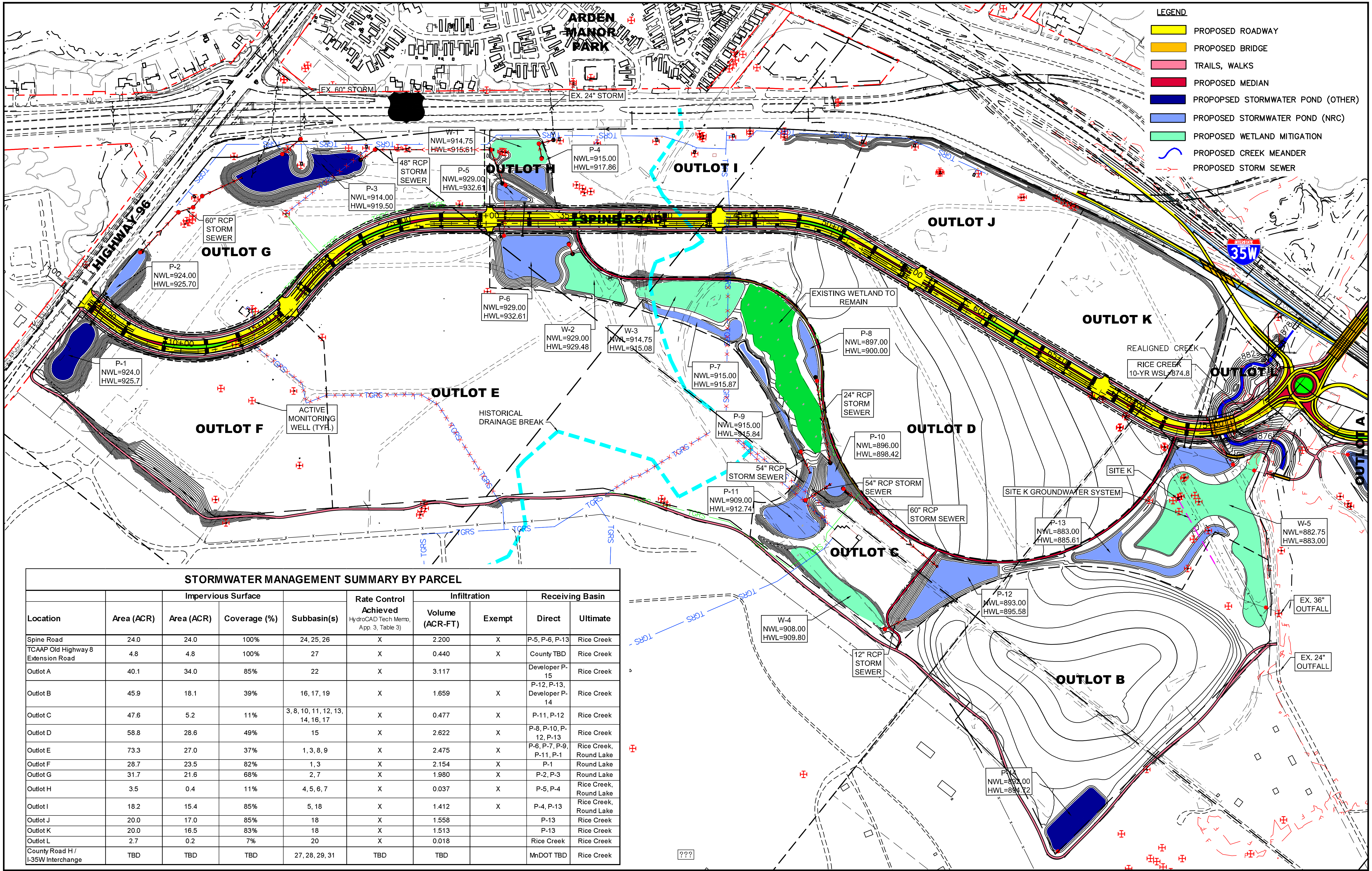
The surface area at normal water elevation for ponds/wetlands is not considered part of the impervious areas by outlot in **Table 6.2**.

6.6 RECORD DRAWINGS FOR PONDS

As required by the City of Arden Hills, upon completion of construction, the responsible party shall retain a duly licensed Professional Engineer in the State of Minnesota to certify that the as-built plans are consistent with design.

The County will require the Contractor to submit as-built drawings of the stormwater ponds, outlet control structures and stormwater system. The as-built drawings are submitted to the City of Arden Hills and the RCWD. At the end of the correction period/warranty period in the construction contract, the County will transfer responsibility of operation and maintenance of the stormwater ponds, outlet control structures and stormwater system to the City of Arden Hills.

Figures



LEGEND

🟨	PROPOSED ROADWAY
🟧	PROPOSED BRIDGE
▨	TRAILS, WALKS
🟥	PROPOSED MEDIAN
🟦	PROPSPOSED STORMWATER POND (OTHER)
🟦	PROPOSED STORMWATER POND (NRC)
🟩	PROPOSED WETLAND MITIGATION
⌒	PROPOSED CREEK MEANDER
-->-	PROPOSED STORM SEWER

STORMWATER MANAGEMENT SUMMARY BY PARCEL

		Impervious Surface			Rate Control Achieved	Infiltration		Receiving Basin	
Location	Area (ACR)	Area (ACR)	Coverage (%)	Subbasin(s)	HydroCAD Tech Memo, App. 3, Table 3)	Volume (ACR-FT)	Exempt	Direct	Ultimate
Spine Road	24.0	24.0	100%	24, 25, 26	X	2.200	X	P-5, P-6, P-13	Rice Creek
TCAAP Old Highway 8 Extension Road	4.8	4.8	100%	27	X	0.440	X	County TBD	Rice Creek
Outlot A	40.1	34.0	85%	22	X	3.117		Developer P-15	Rice Creek
Outlot B	45.9	18.1	39%	16, 17, 19	X	1.659	X	P-12, P-13, Developer P-14	Rice Creek
Outlot C	47.6	5.2	11%	3, 8, 10, 11, 12, 13, 14, 16, 17	X	0.477	X	P-11, P-12	Rice Creek
Outlot D	58.8	28.6	49%	15	X	2.622	X	P-8, P-10, P-12, P-13	Rice Creek
Outlot E	73.3	27.0	37%	1, 3, 8, 9	X	2.475	X	P-6, P-7, P-9, P-11, P-1	Rice Creek, Round Lake
Outlot F	28.7	23.5	82%	1, 3	X	2.154	X	P-1	Round Lake
Outlot G	31.7	21.6	68%	2, 7	X	1.980	X	P-2, P-3	Round Lake
Outlot H	3.5	0.4	11%	4, 5, 6, 7	X	0.037	X	P-5, P-4	Rice Creek, Round Lake
Outlot I	18.2	15.4	85%	5, 18	X	1.412	X	P-4, P-13	Rice Creek, Round Lake
Outlot J	20.0	17.0	85%	18	X	1.558		P-13	Rice Creek
Outlot K	20.0	16.5	83%	18	X	1.513		P-13	Rice Creek
Outlot L	2.7	0.2	7%	20	X	0.018		Rice Creek	Rice Creek
County Road H / I-35W Interchange	TBD	TBD	TBD	27, 28, 29, 31	TBD	TBD		MnDOT TBD	Rice Creek

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RAMSEY COUNTY

ARDEN HILLS

TCAAP Site Redevelopment
Infrastructure

COMPREHENSIVE STORMWATER
MANAGEMENT PLAN

MANAGEMENT SUMMAR□ □□ PARCEL
FIGURE ES-□

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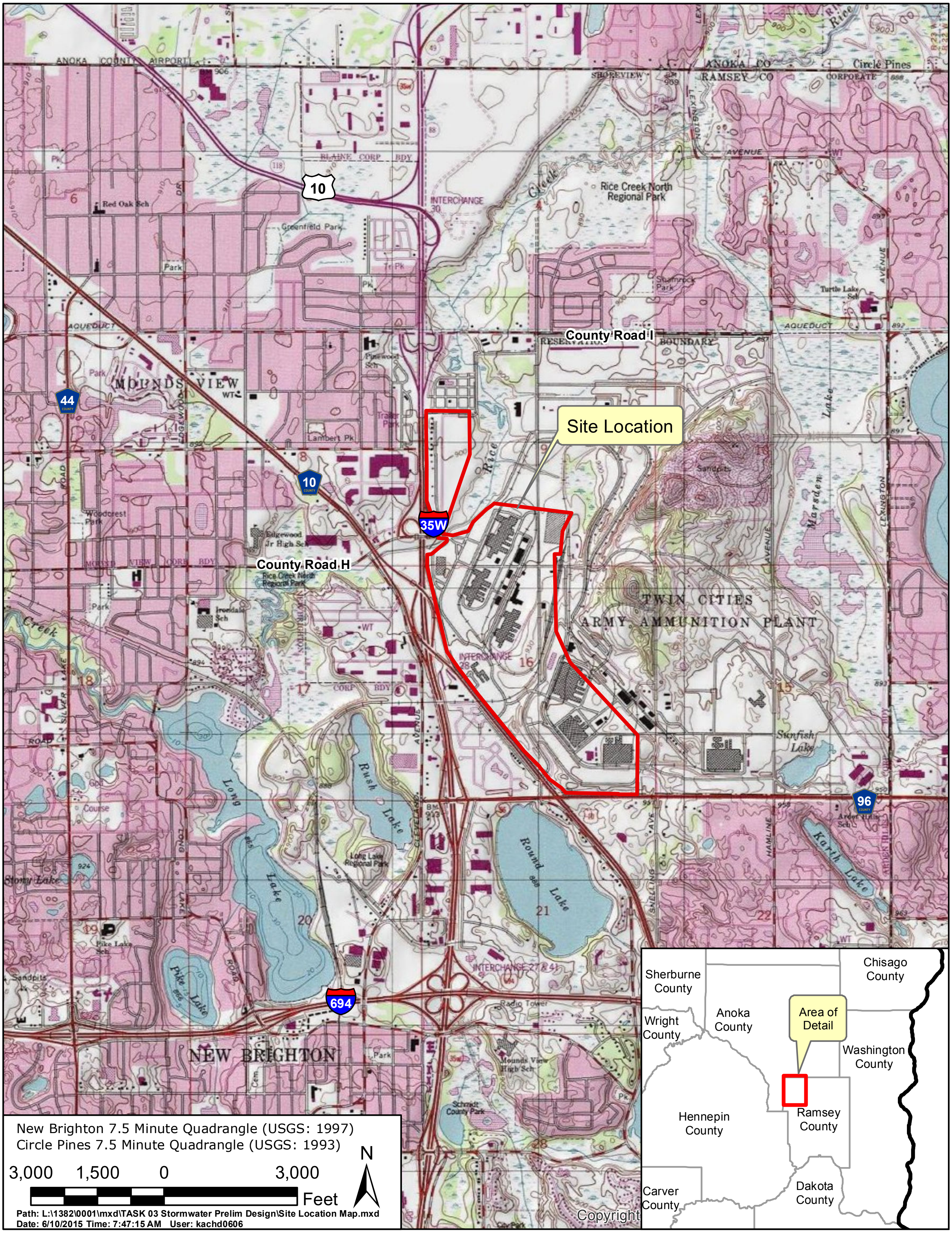

New Brighton 7.5 Minute Quadrangle (USGS: 1997)
Circle Pines 7.5 Minute Quadrangle (USGS: 1993)

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RAMSEY COUNTY	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	JUN 2015
Site Location Map		Figure 2-1

2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Site Detail Map

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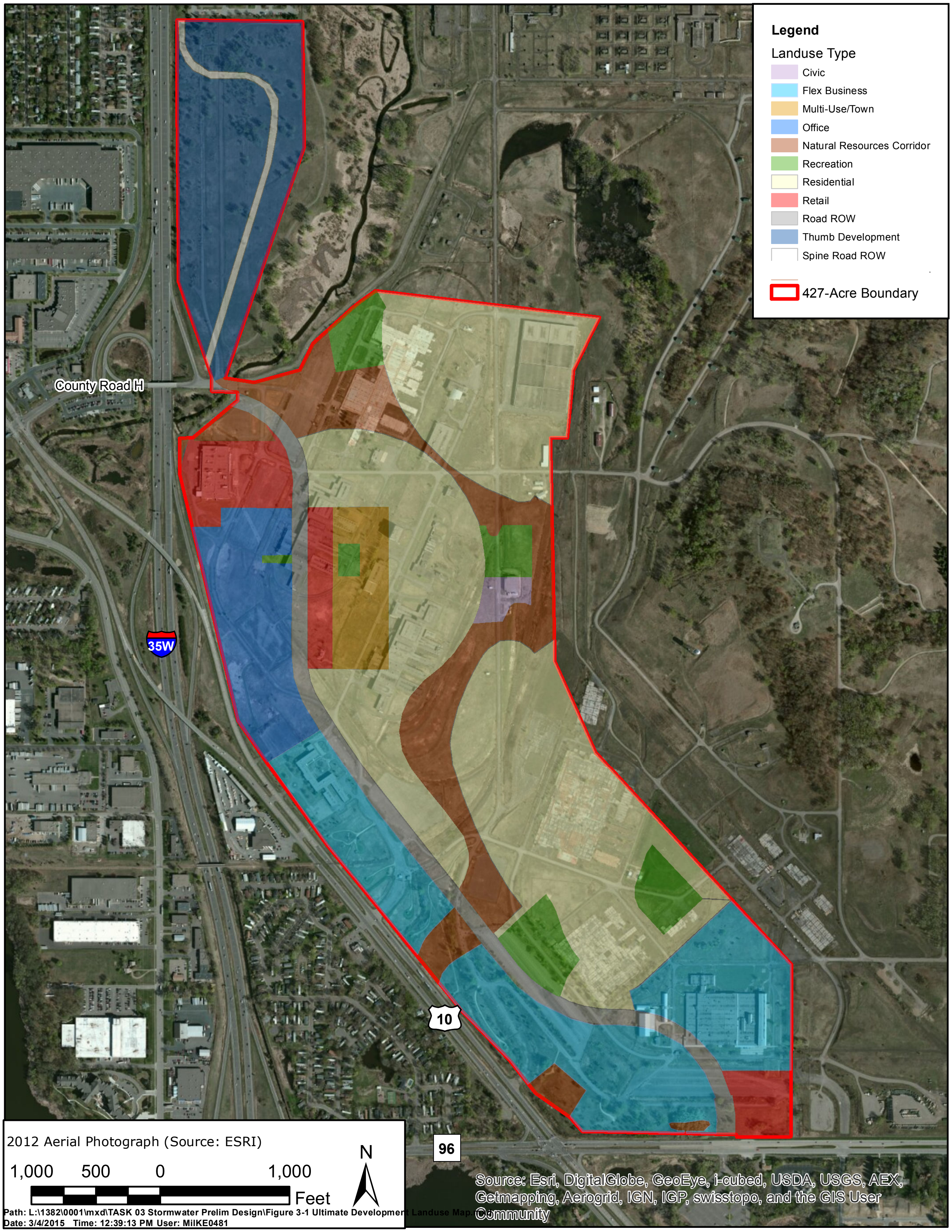
Figure 2-2



RAMSEY COUNTY

(FINAL AUAR) Fully Developed Conditions: Landuse Map

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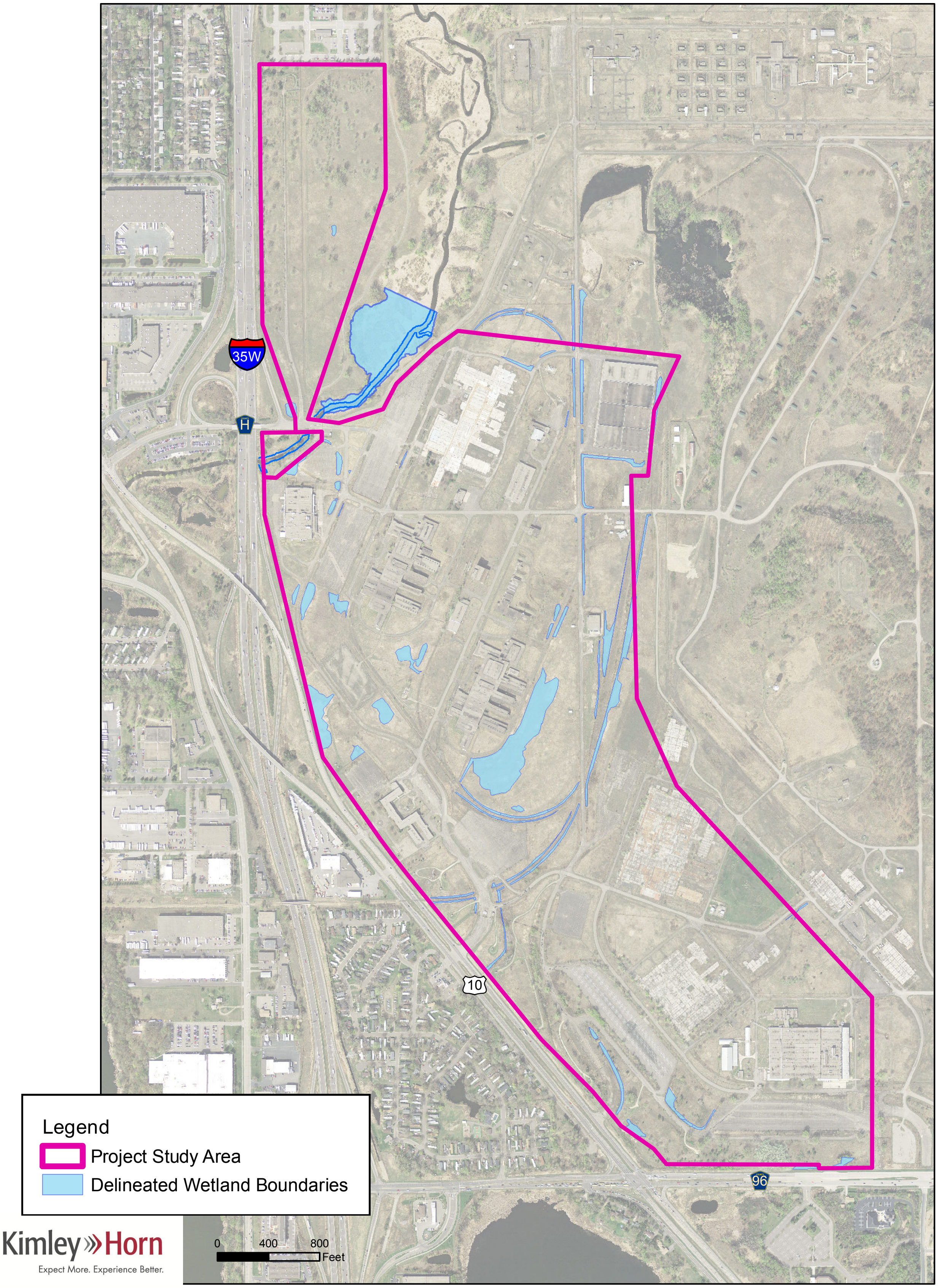
JUNE 2015

Figure 3-1



Map Source: Kimley Horn

RAMSEY COUNTY

Pre-Development (2012): Wetlands Map (Kimley-Horn)

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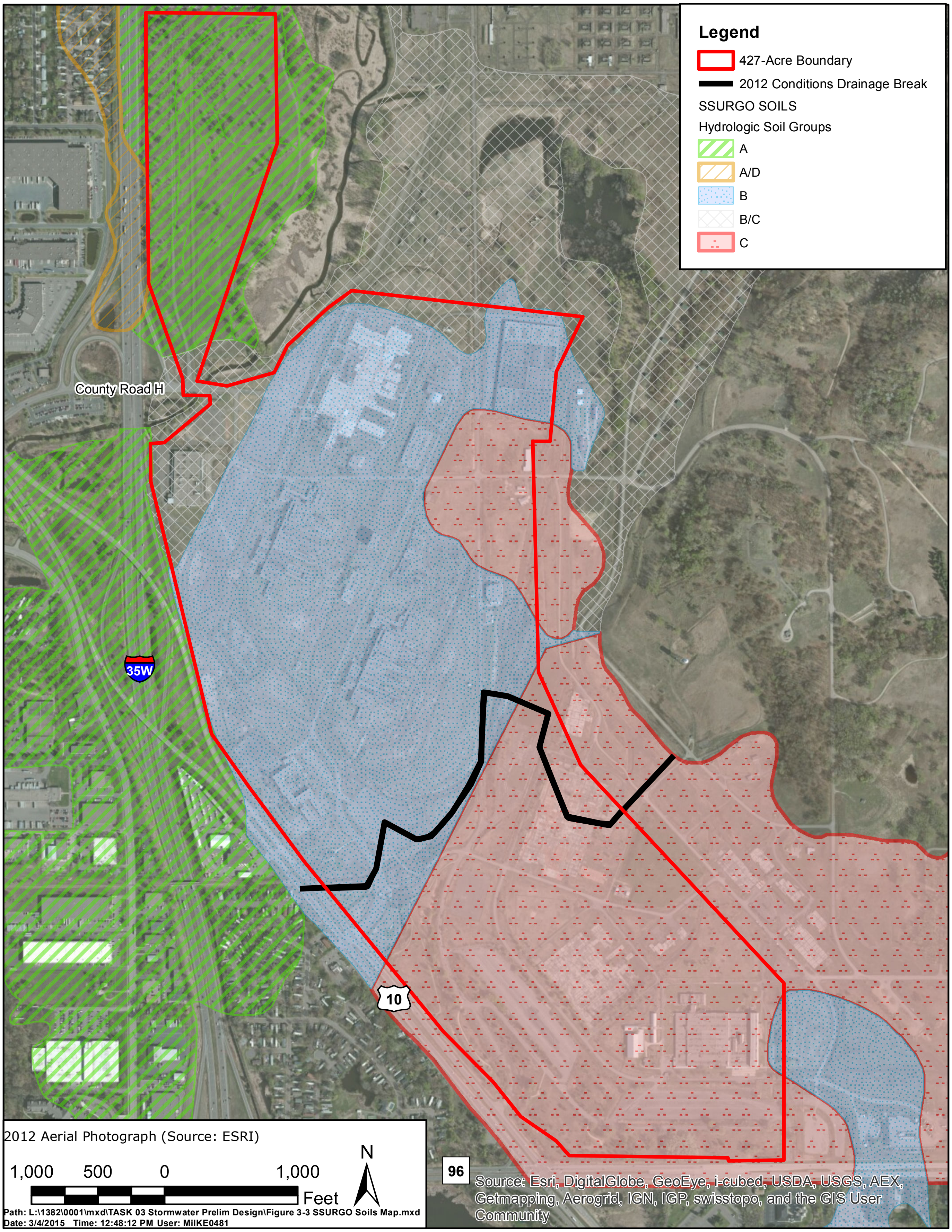
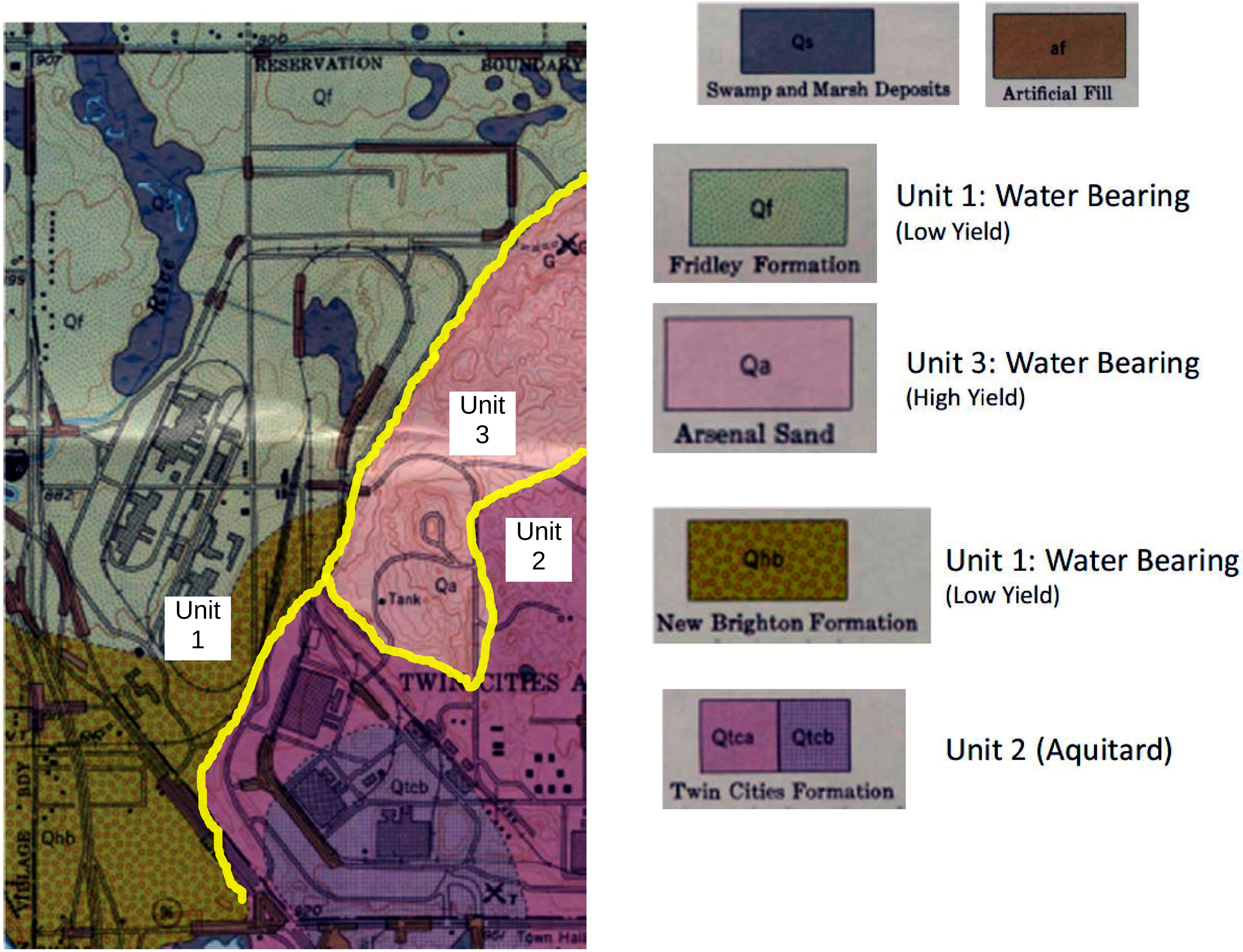
Figure 3-2



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

RAMSEY COUNTY	WENCK ASSOCIATES	JUNE 2015
SSURGO Soils Map	Responsive partner. Exceptional outcomes.	Figure 3-3



Source: Stone, John E., "Geologic Map Series 2. Surficial Geology of the New Brighton Quadrangle, MN GM-2 (1966.)

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Surficial Geology Map

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Figure 3-4

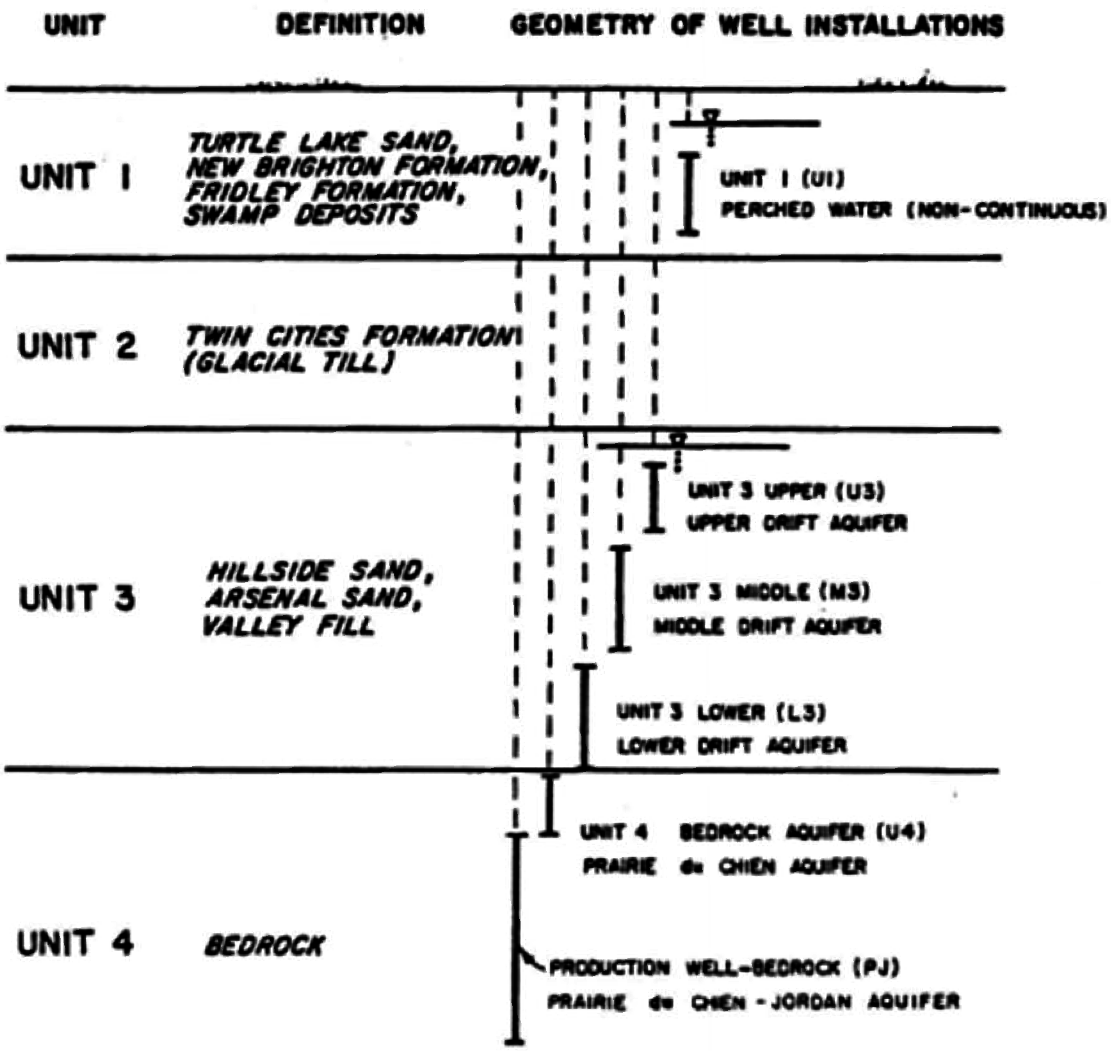

FIGURE 2.15 Illustration Showing Four Hydrologic Units at TCAAP (Source: Ref. 5207)

Source: Wenck, "Five-year review report of the final remedy for the New Brighton/Arden Hills Superfund Site" Figure 2-15, August 2009

RAMSEY COUNTY

TCAAP Four Hydrologic Units

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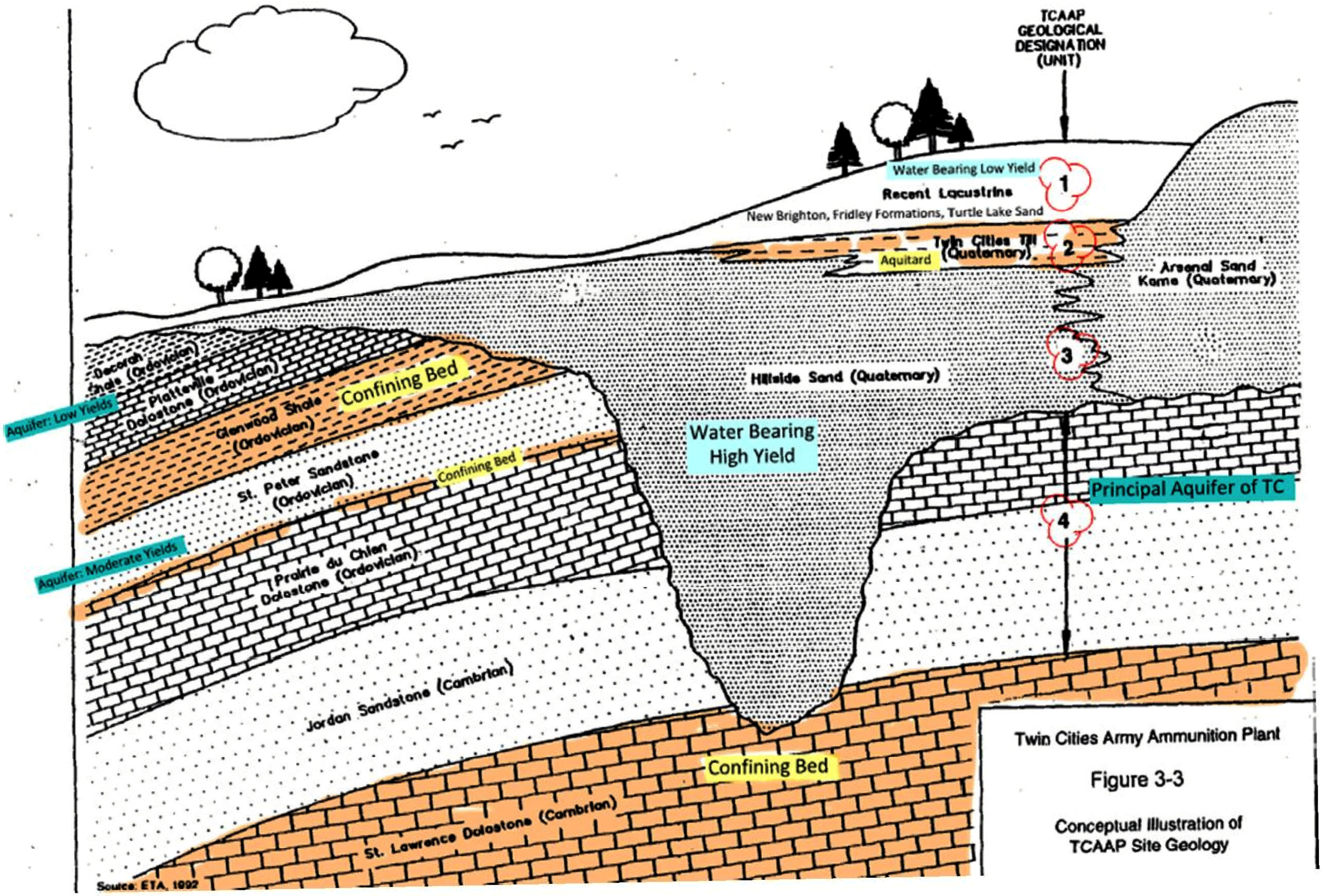
JUNE 2015

Figure 3-5



Source: Wenck, "Five-year review report of the final remedy for the New Brighton/Arden Hills Superfund Site" Figure 3-3, August 2009

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TCAAP Concept Site Geology

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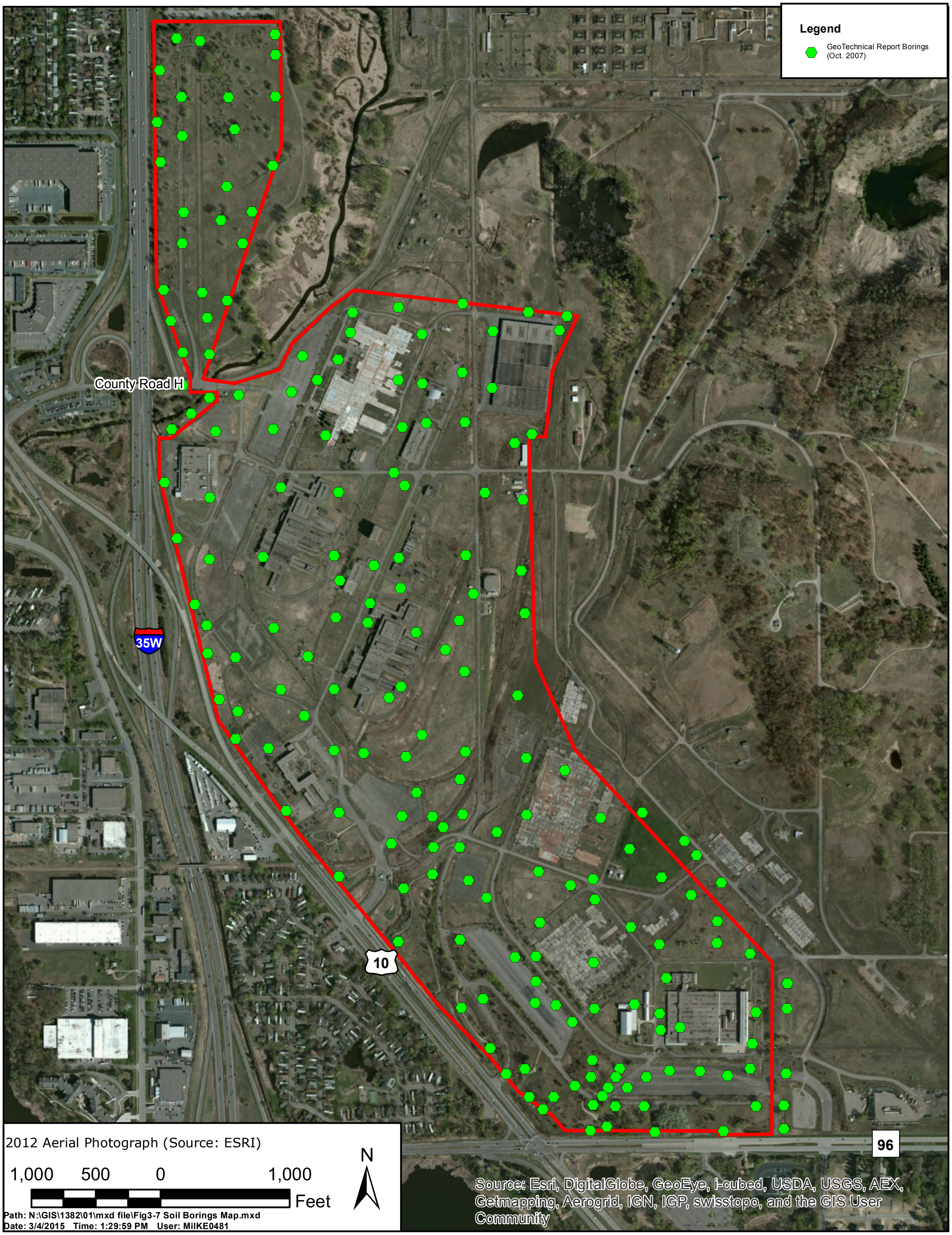
Figure 3-6



2012 Aerial Photograph (Source: ESRI)

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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Soil Borings Map (Oct. 3, 2007)

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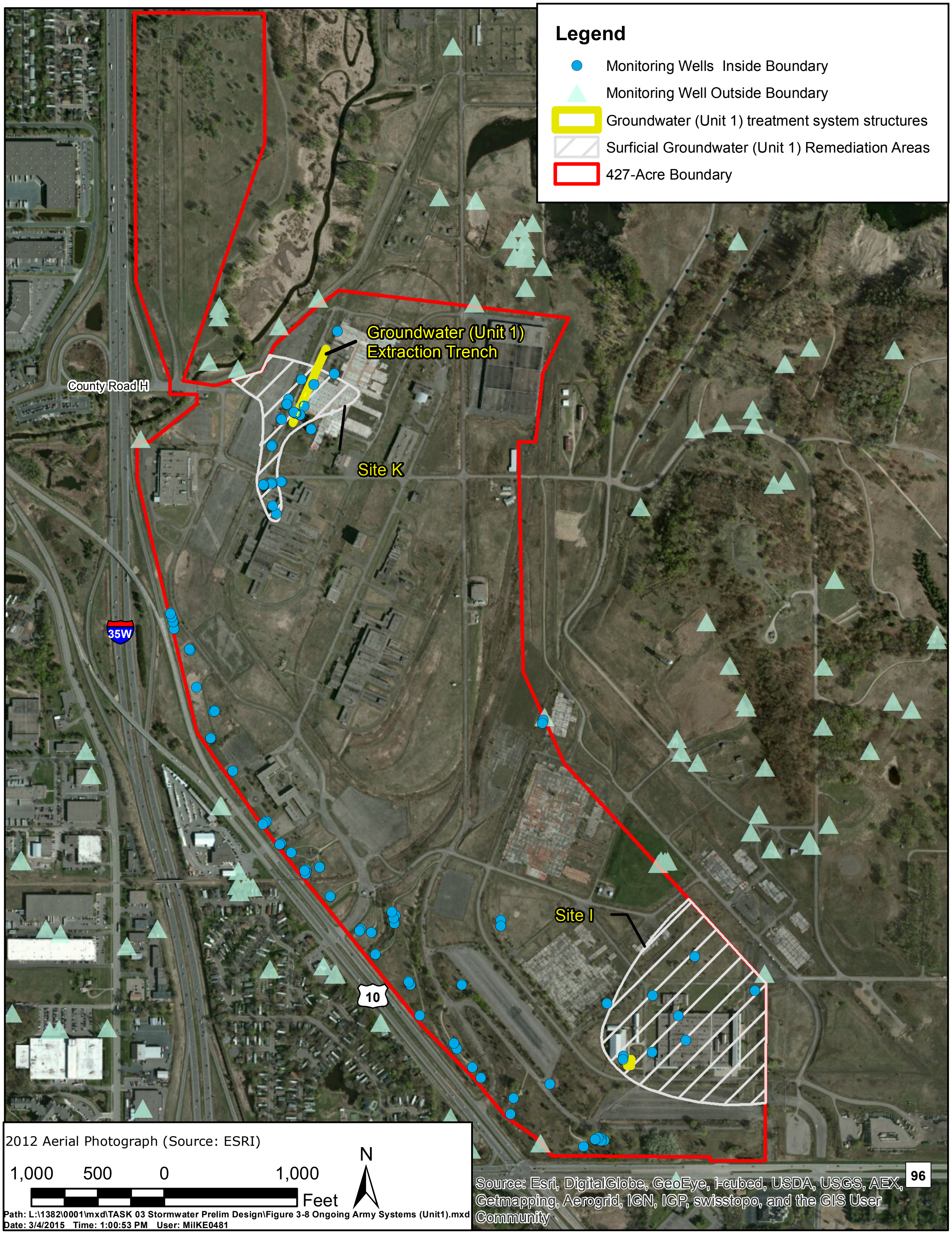
Figure 3-7



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Ongoing Army Systems (Unit 1)

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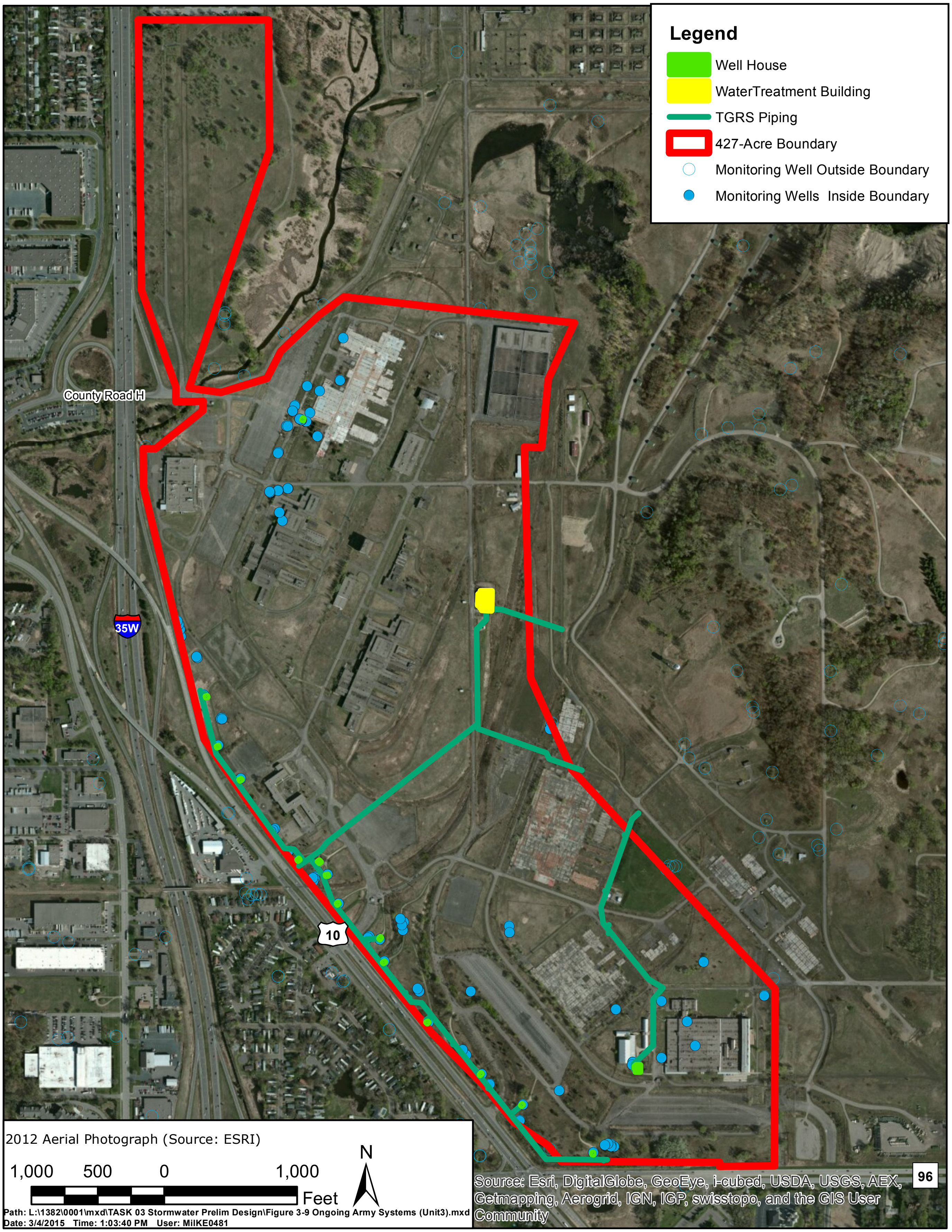
Figure 3-8



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Ongoing Army Systems (Unit 3)

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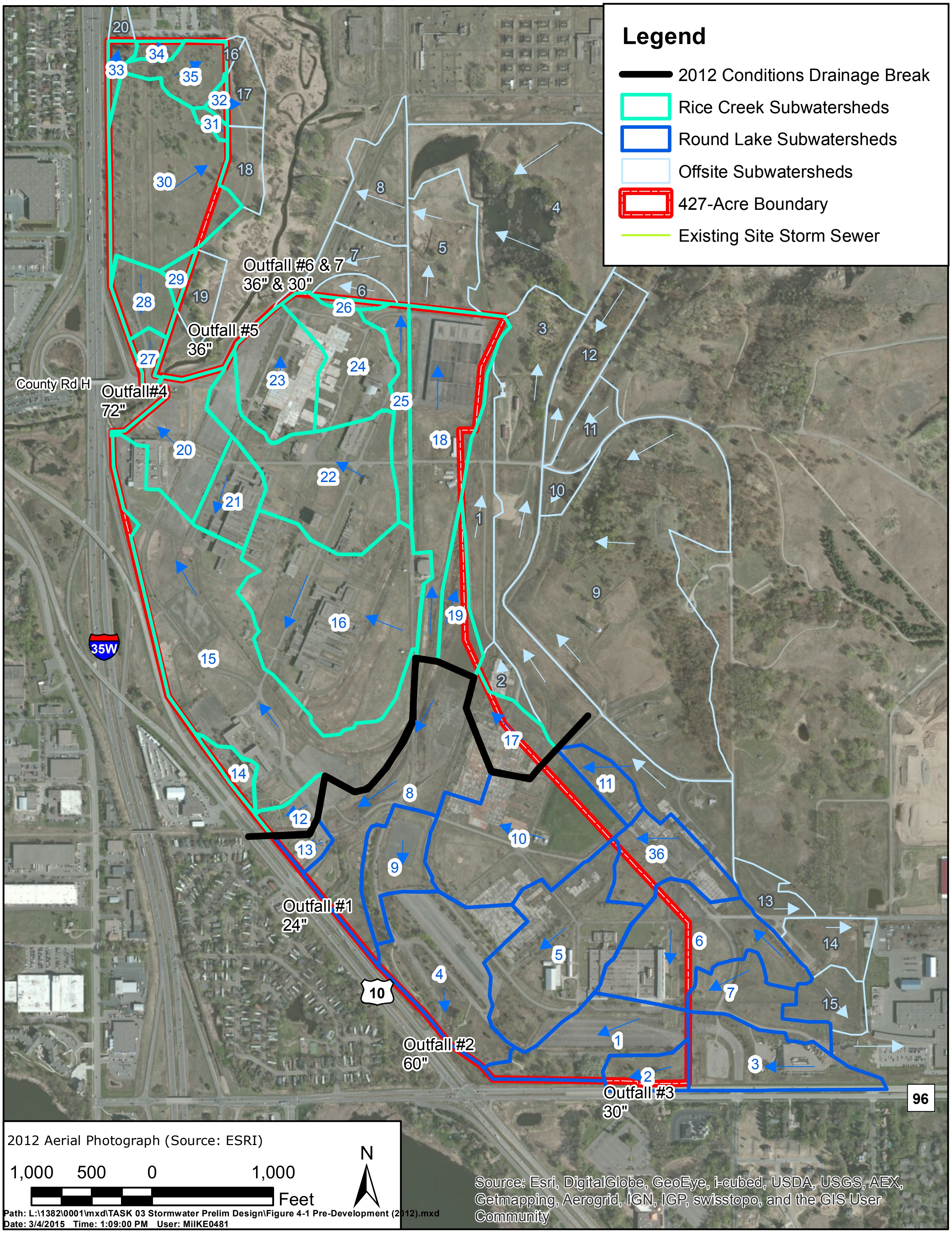
Figure 3-9



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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RAMSEY COUNTY

Pre-Development (2012): Subwatershed Map

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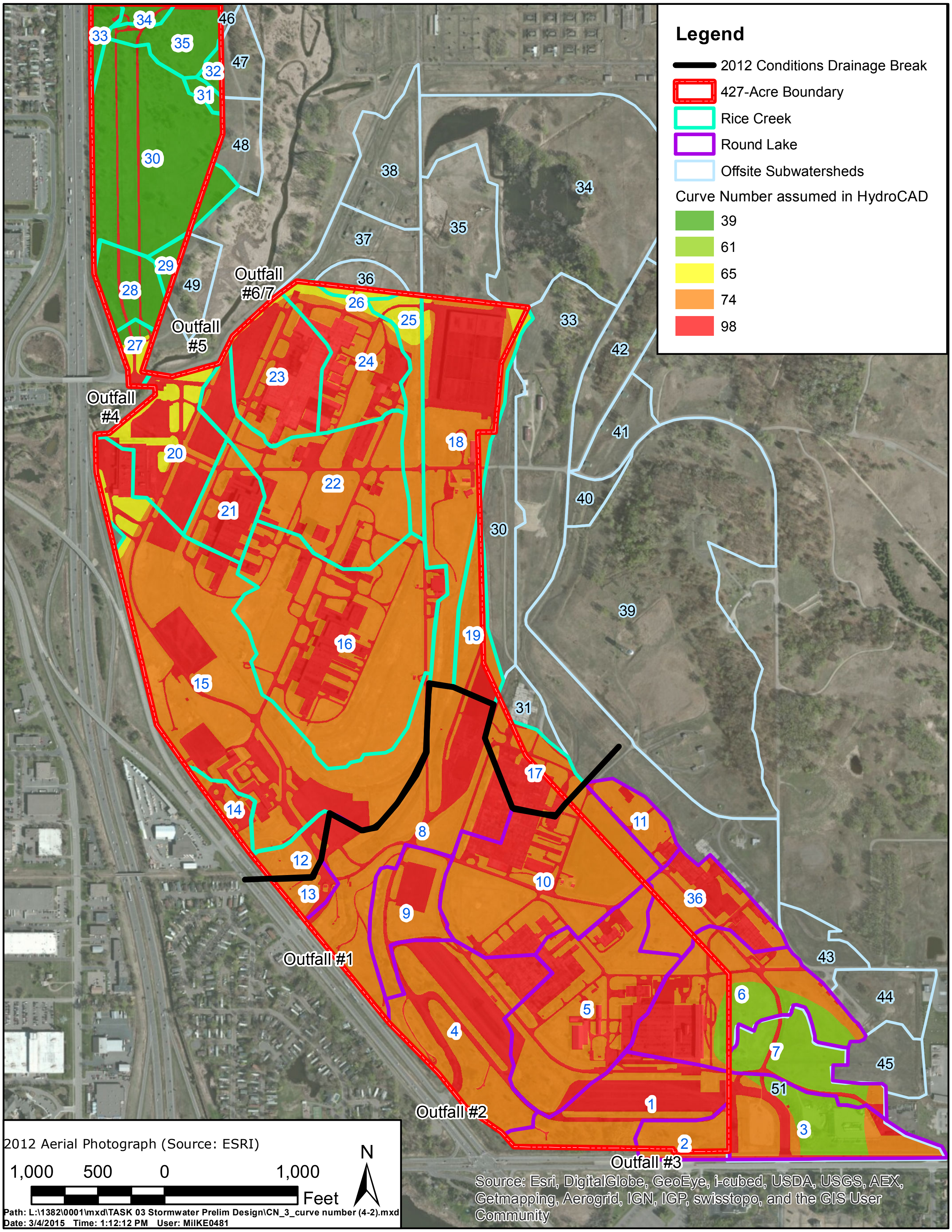
Figure 4-1



2012 Aerial Photograph (Source: ESRI)

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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

RAMSEY COUNTY

Pre-Development (2012): Subwatershed Map with Curve Number

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Figure 4-2

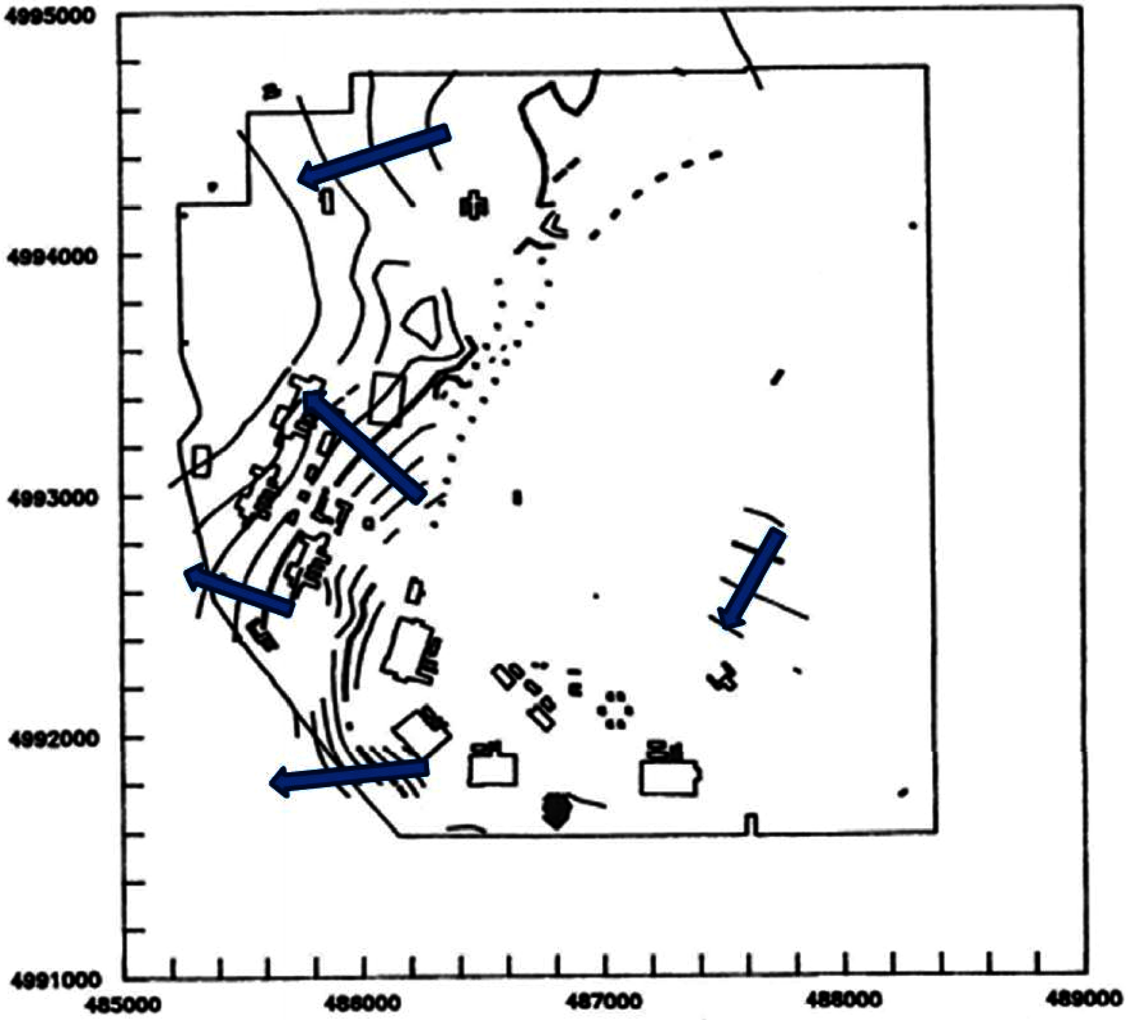

FIGURE 2.16 Water-Level Elevations for Hydrologic Unit 1 at TCAAP, February 17, 1987 (Source: USATHAMA database)

Source: Wenck, "Five-year review report of the final remedy for the New Brighton/Arden Hills Superfund Site" Figure 2-16, August 2009

Path: L:\1382\0001\mxd\TASK 03 Stormwater Prelim Design\Fig4-3 Pre-Development (1987) Groundwater Gradient Map.mxd
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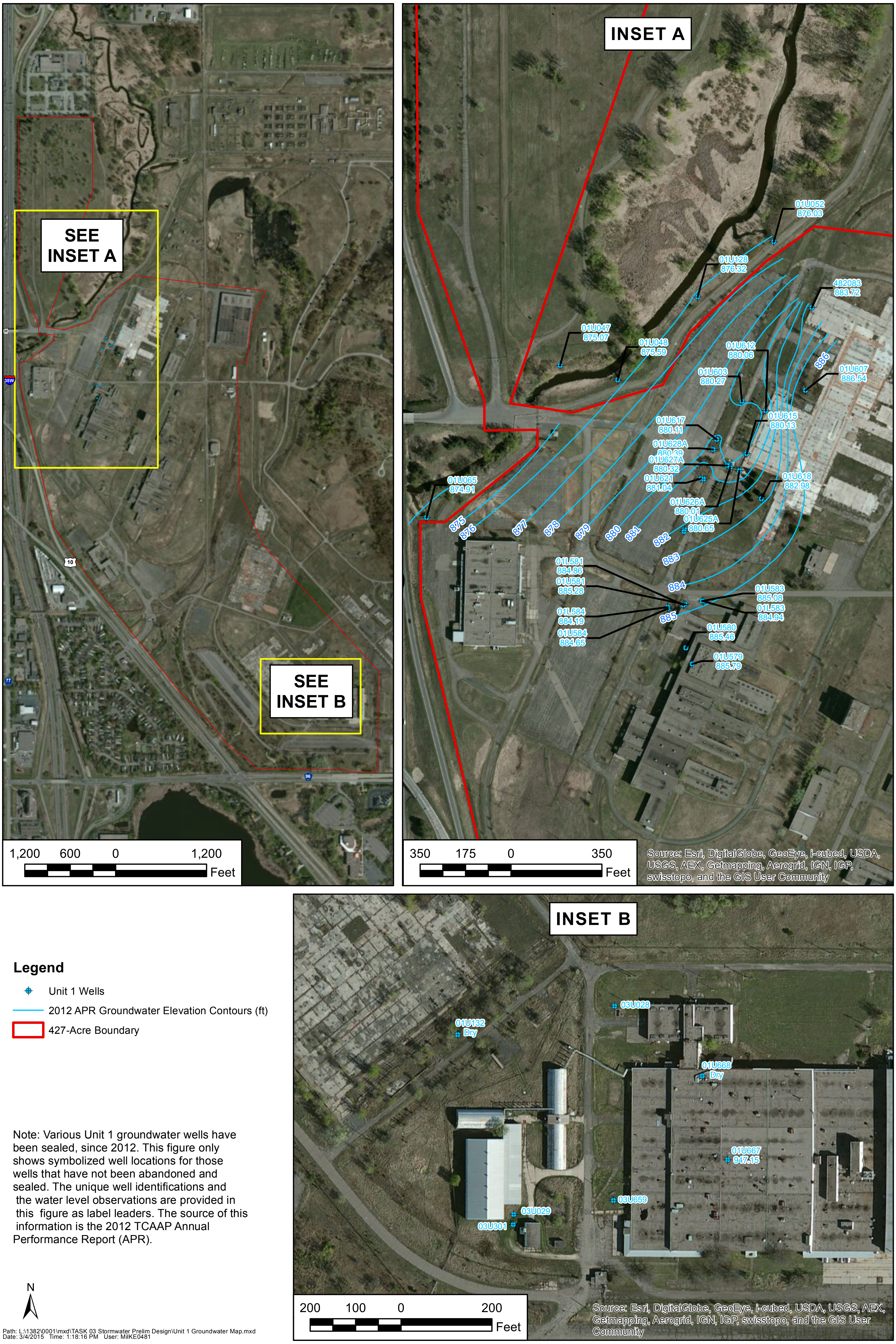
Pre-Development (1987): Groundwater Gradient Map (Unit 1)		Figure 4-3



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ⌖ Unit 1 Wells
- — 2012 APR Groundwater Elevation Contours (ft)
- 🟥 427-Acre Boundary

Note: Various Unit 1 groundwater wells have been sealed, since 2012. This figure only shows symbolized well locations for those wells that have not been abandoned and sealed. The unique well identifications and the water level observations are provided in this figure as label leaders. The source of this information is the 2012 TCAAP Annual Performance Report (APR).

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2012 Groundwater Elevation Map (Unit 1)

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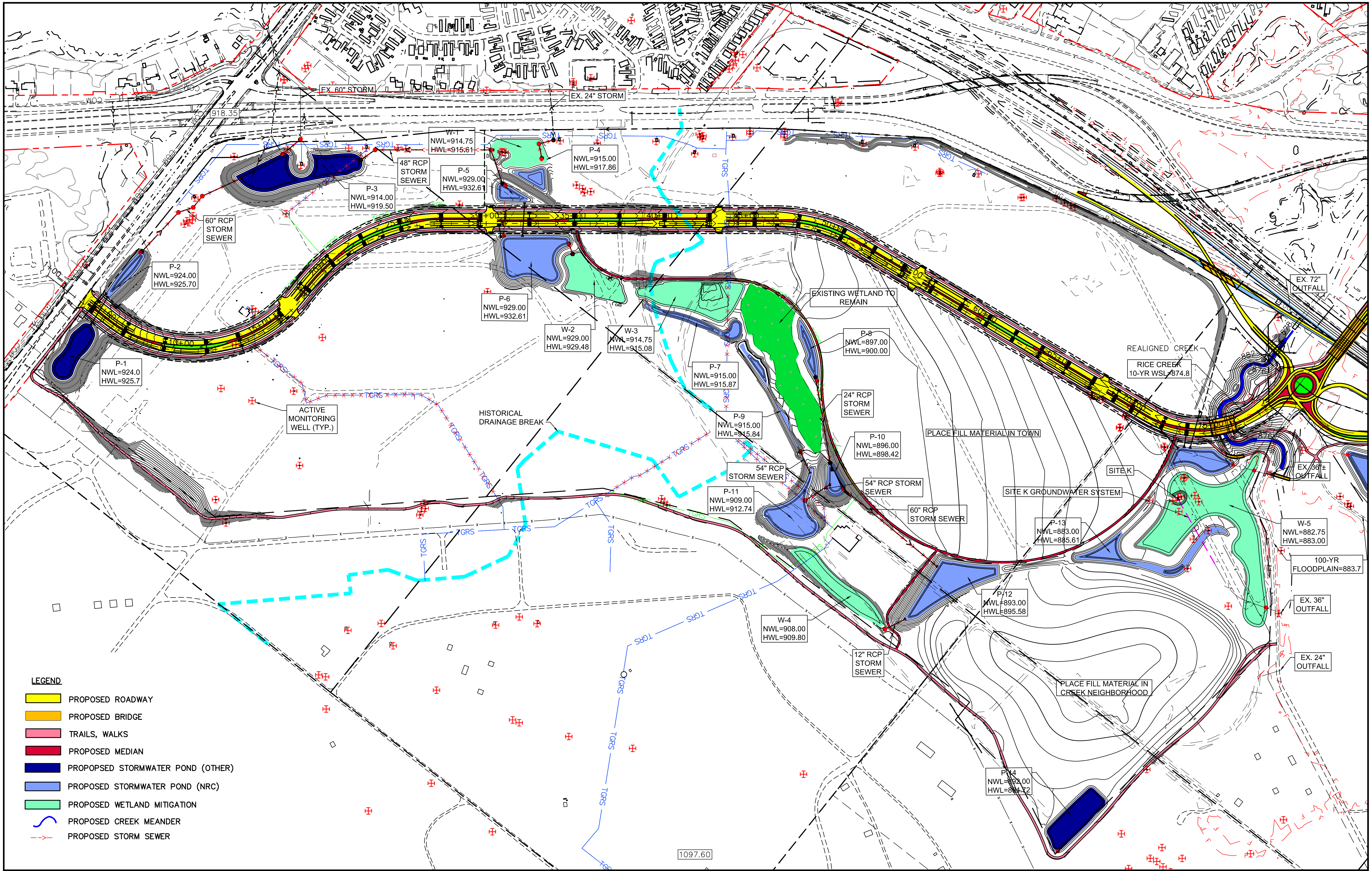
Figure 4-4



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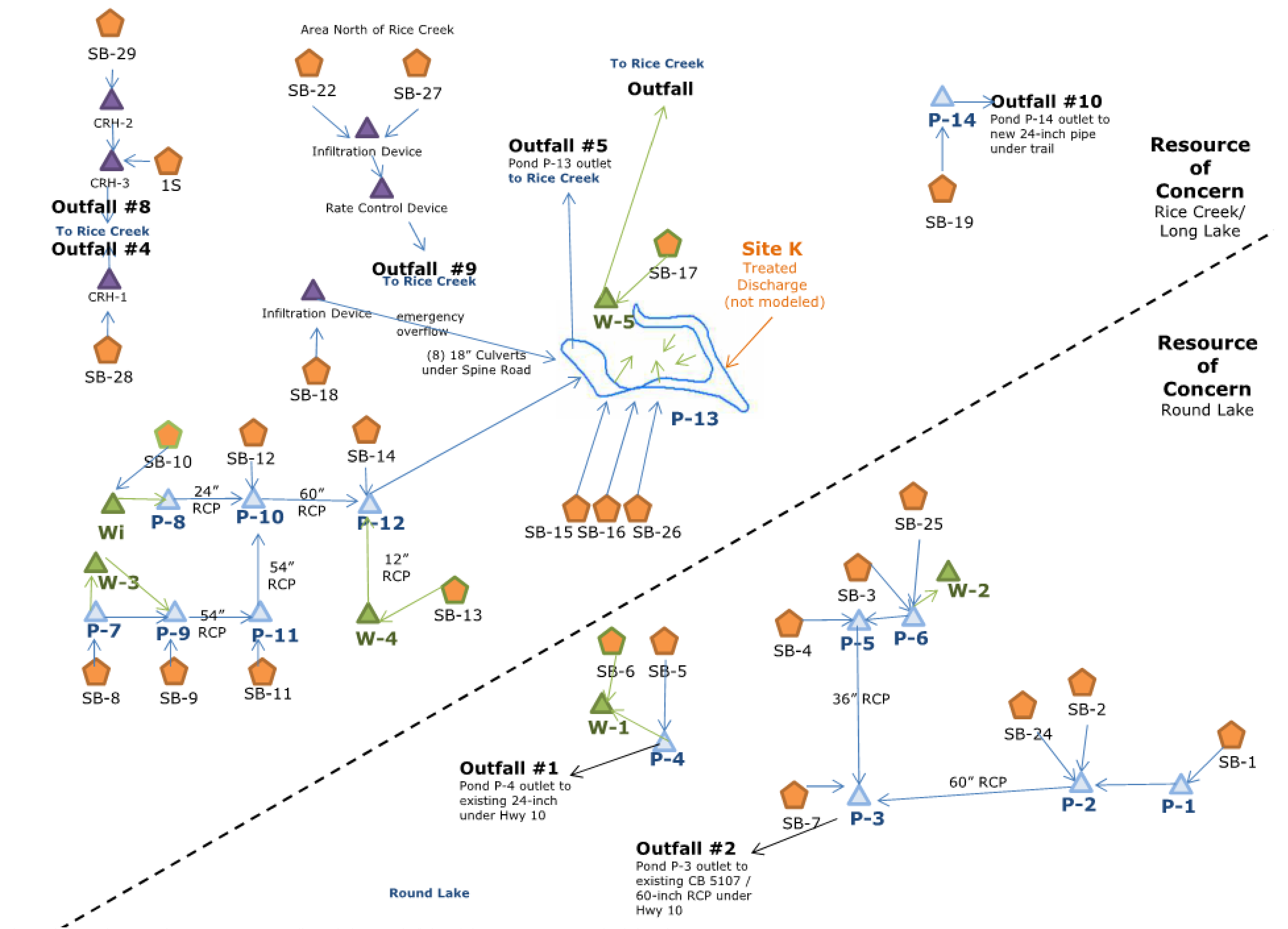
RAMSEY COUNTY

ARDEN HILLS

TCAAP Site Redevelopment Infrastructure

COMPREHENSIVE STORMWATER MANAGEMENT PLAN

SITE GRADING AND STORM DRAINAGE IMPROVEMENTS
FIGURE 4-5



T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater Prelim Design\CSMP_Final\Figures\Figure 4-6 Stormwater Pond and Flow Diagram_31 JUL 2015.ppt

RAMSEY COUNTY

Stormwater Pond and Wetland Flow Diagram

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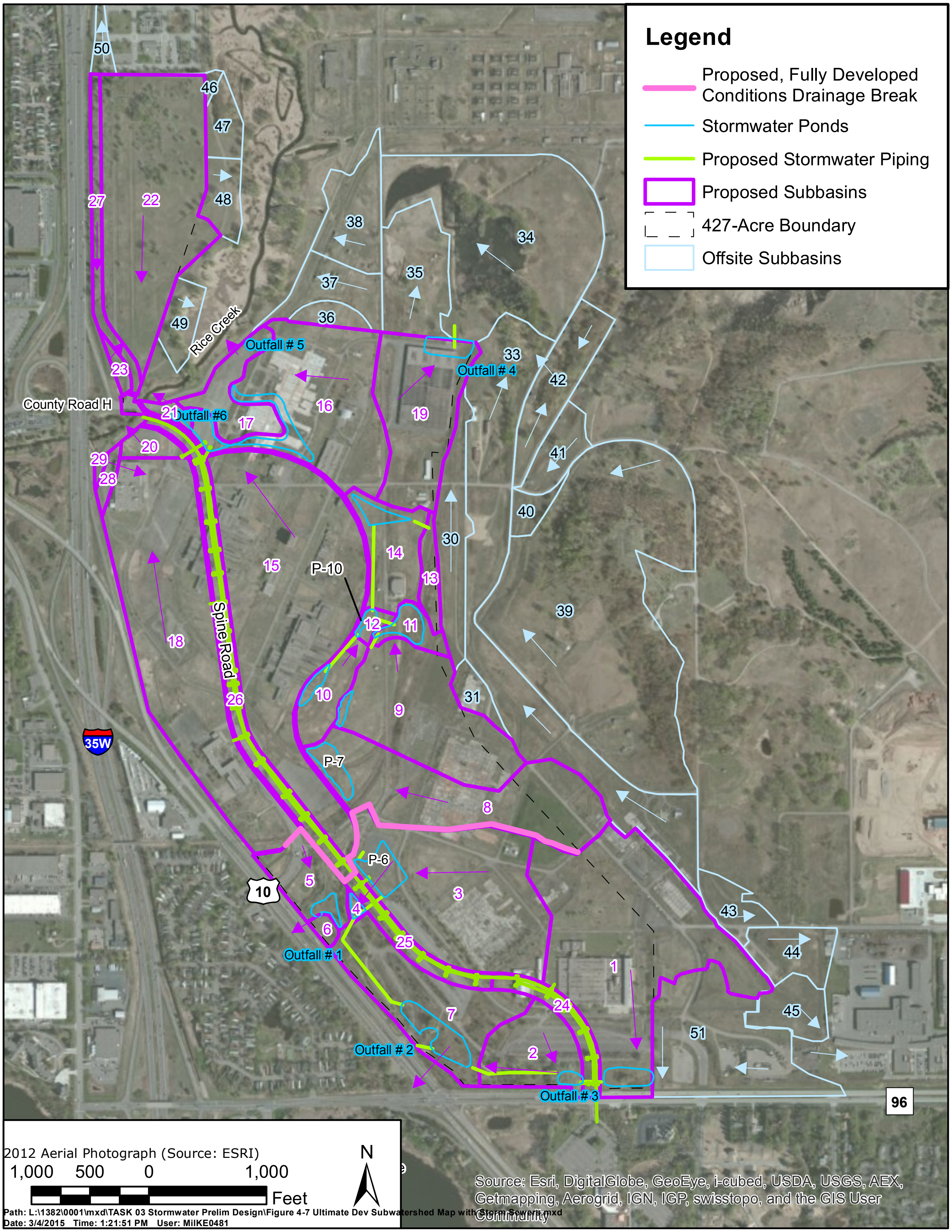
JULY 2015

Figure 4-6



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RAMSEY COUNTY

Fully Developed Conditions: Subwatershed Map & Storm Sewers

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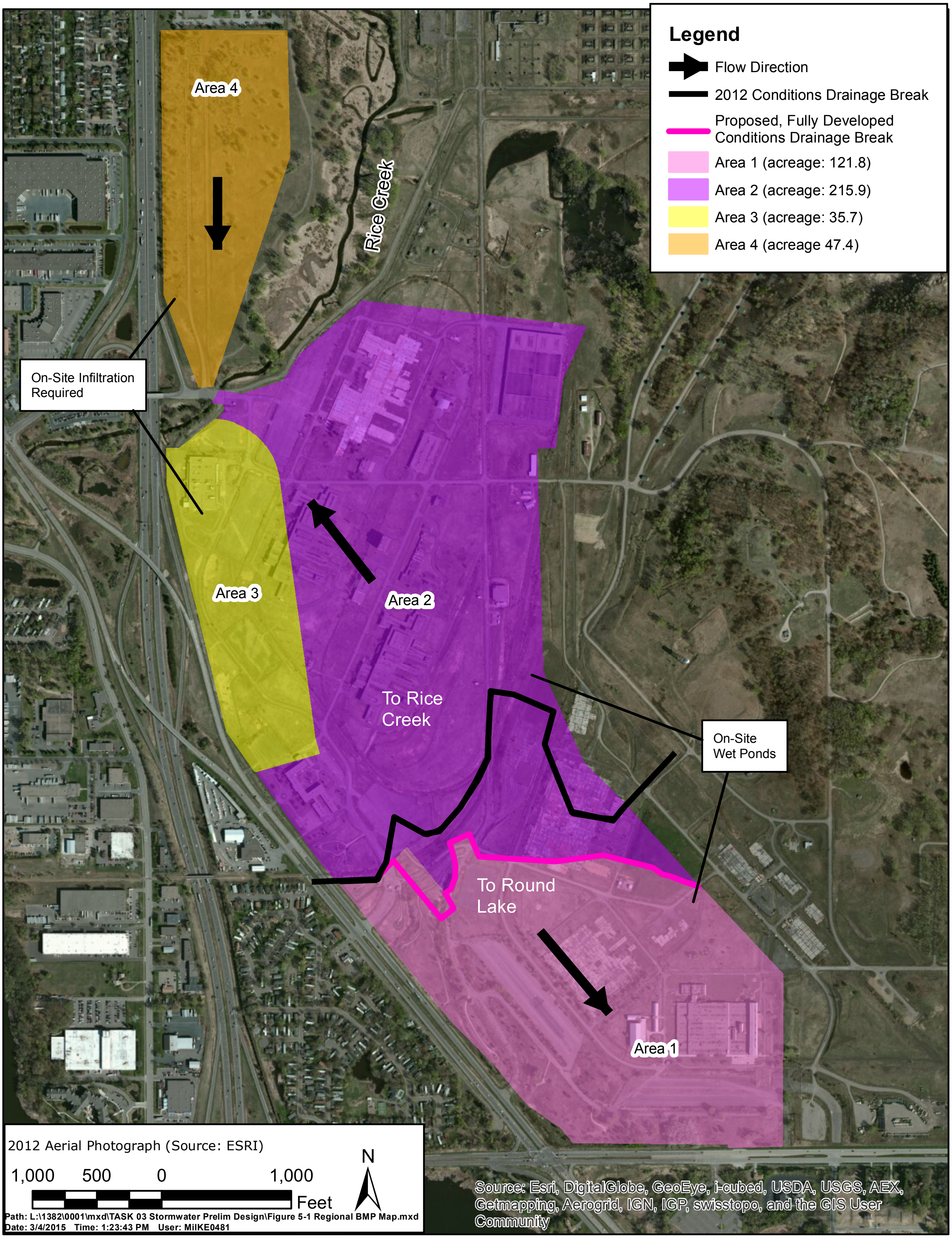
Figure 4-7



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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RAMSEY COUNTY

Regional BMP Map

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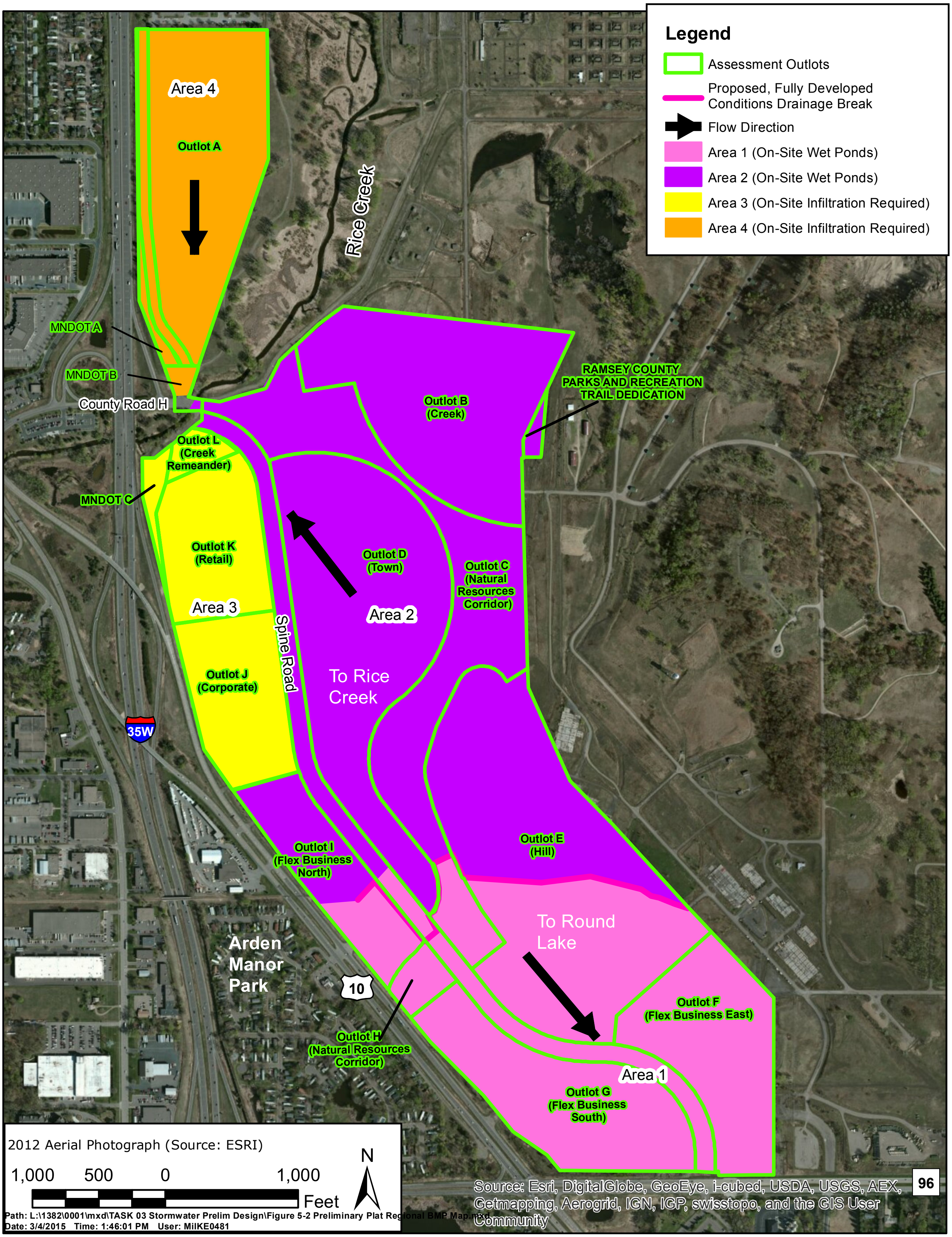
Figure 5-1



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Path: L:\1382\0001\mxd\TASK 03 Stormwater Prelim Design\Figure 5-2 Preliminary Plat Regional BMP Map.mxd
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RAMSEY COUNTY

Preliminary Plat with Regional BMP Map

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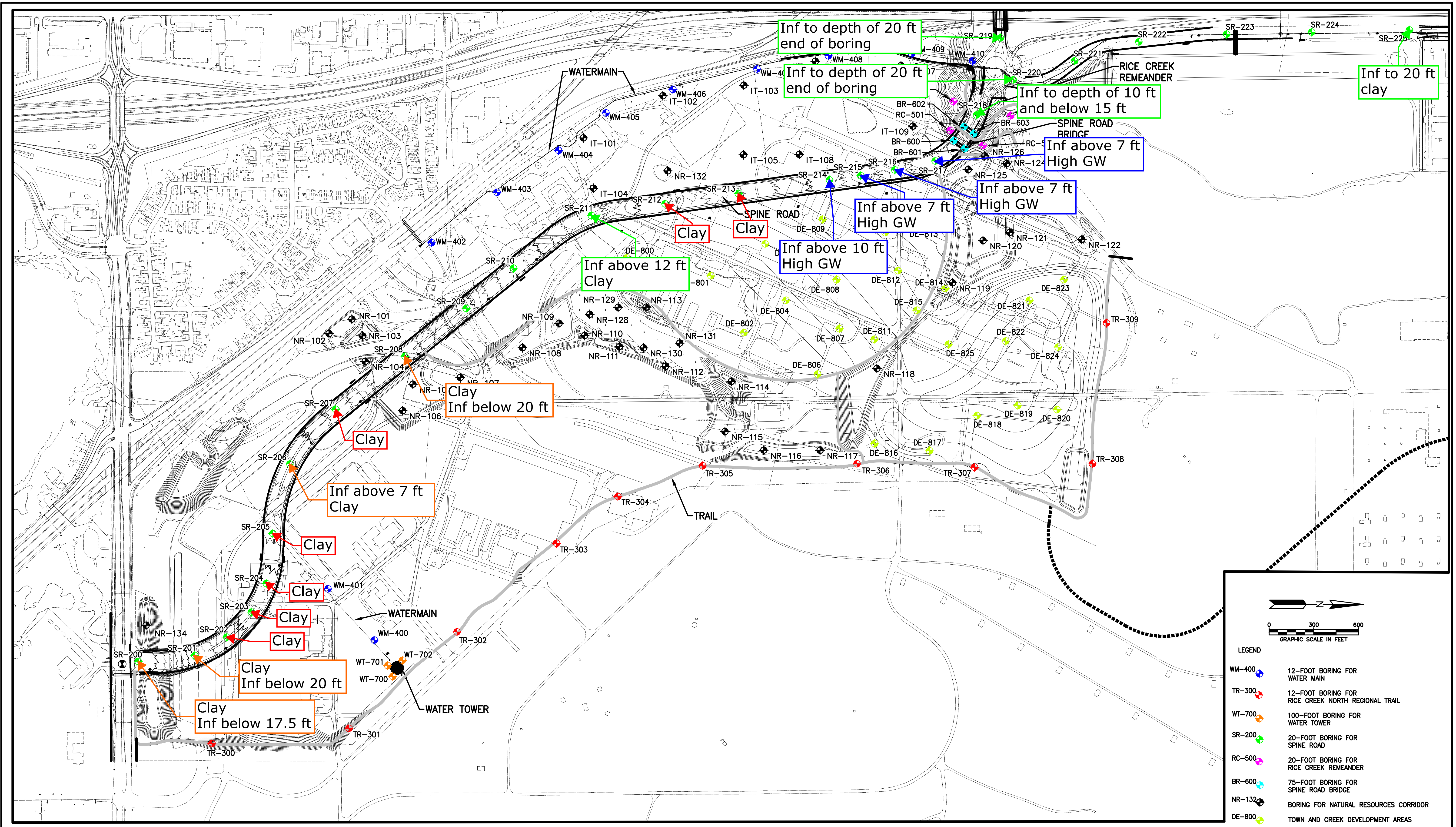
JUNE 2015

Figure 5-2



LEGEND

WM-400	12-FOOT BORING FOR WATER MAIN
TR-300	12-FOOT BORING FOR RICE CREEK NORTH REGIONAL TRAIL
WT-700	100-FOOT BORING FOR WATER TOWER
SR-200	20-FOOT BORING FOR SPINE ROAD
RC-500	20-FOOT BORING FOR RICE CREEK REMEANDER
BR-600	75-FOOT BORING FOR SPINE ROAD BRIDGE
NR-132	BORING FOR NATURAL RESOURCES CORRIDOR
DE-800	TOWN AND CREEK DEVELOPMENT AREAS

0	ISSUED FOR bid	JVB	TR	03/19/15
REV	REVISION DESCRIPTION	DWN	APP	REV DATE

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MAPLE PLAIN, MINNESOTA
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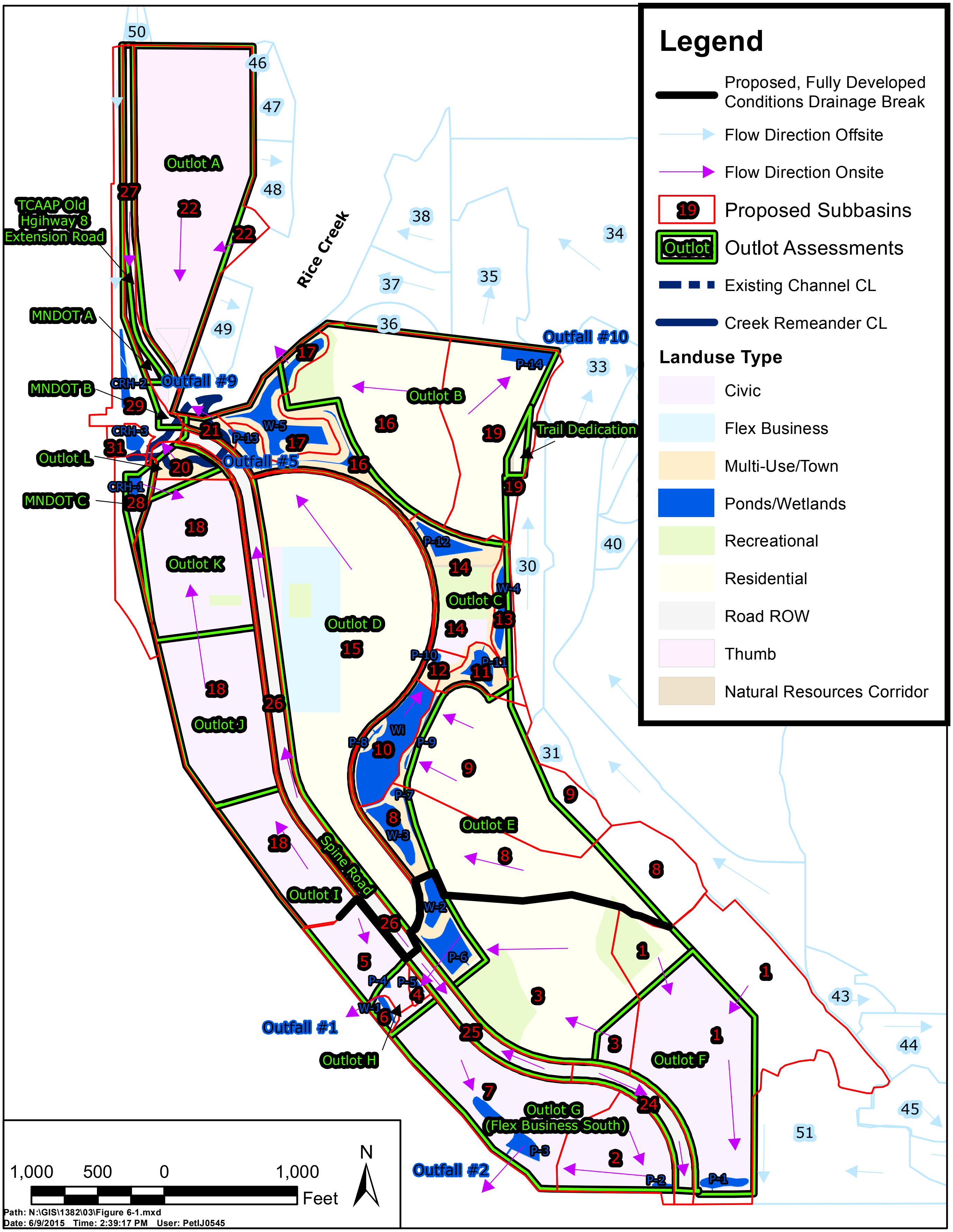
F 762-479-4242

PROJECT TITLE
REQUEST FOR DRILLING QUOTE

SHEET TITLE
Preliminary (June 2015) Soil Borings along Spine Road

DWN BY	CHK'D	APP'D	DWG DATE	MARCH 2014
JVB	JW	TR	SCALE	AS NOTED

PROJECT NO.	SHEET NO.	REV NO.
1382-0001	Figure 5-3	0



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RAMSEY COUNTY

Prelim. Plat (Outlots) Fully Developed Conditions Subwatersheds

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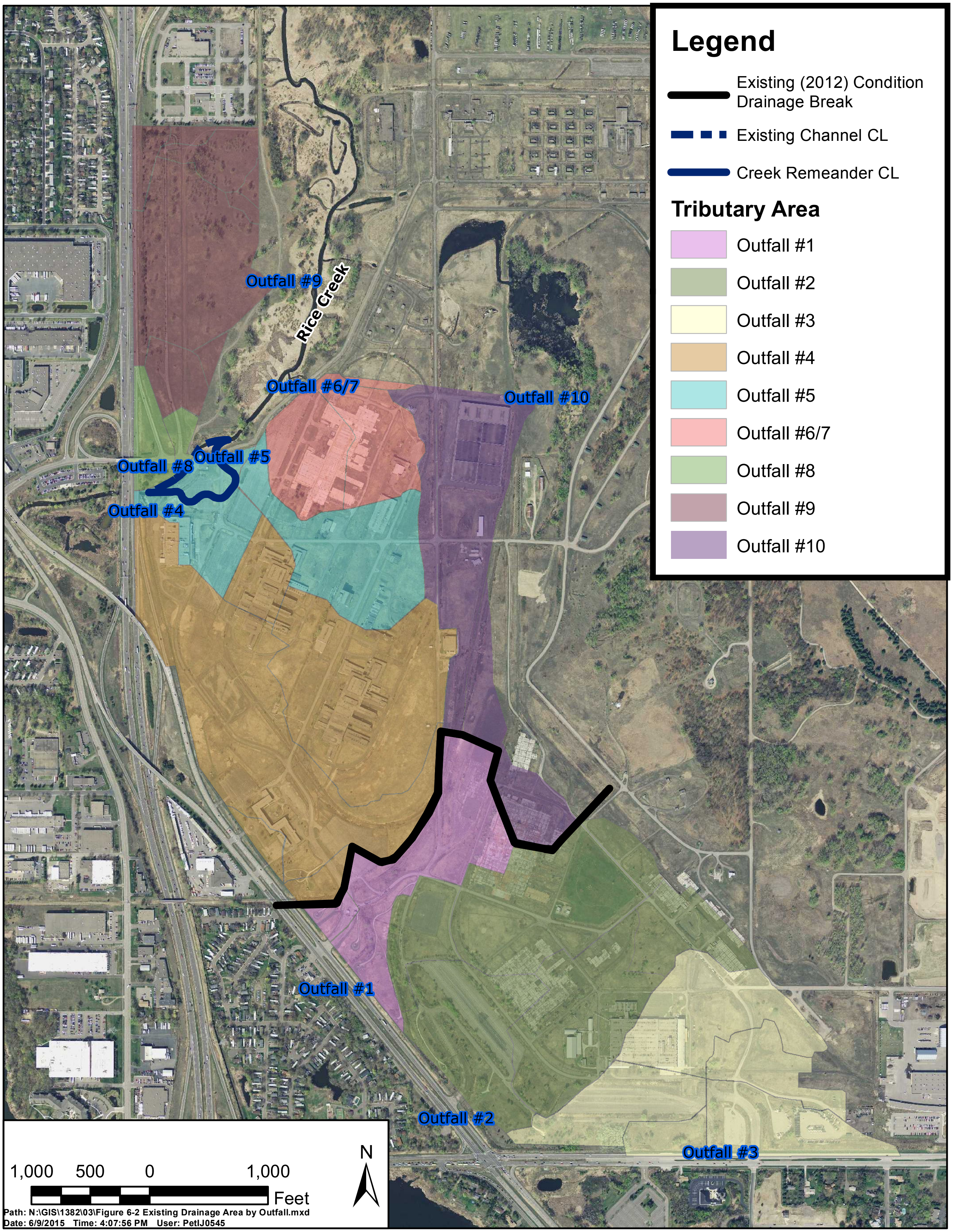
Responsive partner. Exceptional outcomes.

JUNE 2015

Figure 6-1



Path: N:\GIS\1382\03\Figure 6-2 Existing Drainage Area by Outfall.mxd
Date: 6/9/2015 Time: 4:07:56 PM User: PetlJ0545

RAMSEY COUNTY

Pre-development (2012): Drainage Areas by Outfalls

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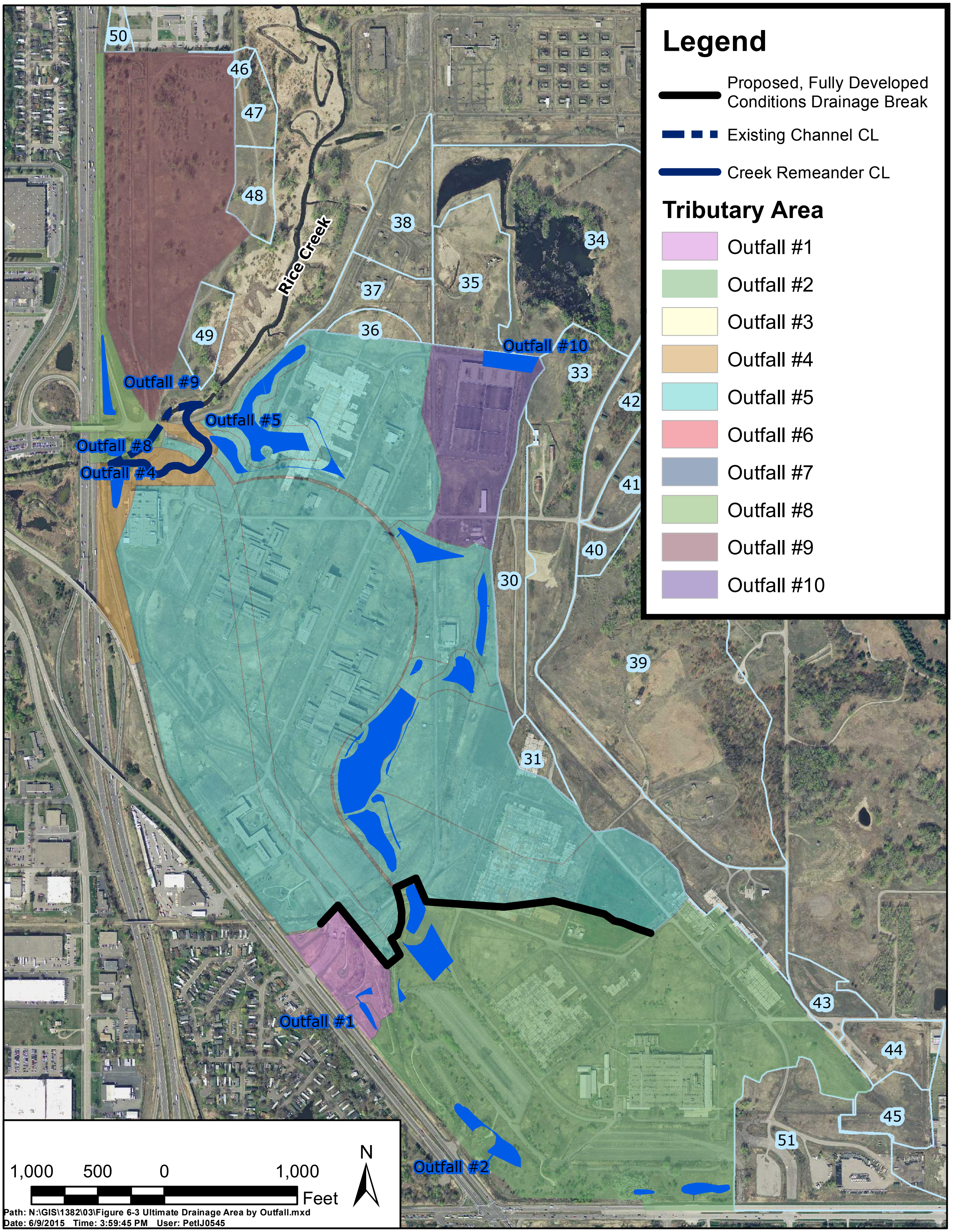
Figure 6-2



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Fully Developed Conditions: Drainage Areas by Outfalls

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Figure 6-3

Appendix A

Technical Memorandums:
- Hydrology and Hydraulics Modeling (HydroCAD)
- Water Quality Modeling (P8)

Technical Memo

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To: Beth Kunkel, Kimley-Horn

From: Pamela Massaro, PE, Wenck Associates, Inc.
Adam Marsh, EIT, Wenck Associates, Inc.

Date: August 31, 2015

Subject: HydroCAD Stormwater Modeling
Summary of Changes made August 30, 2015

After discussing the stormwater modeling completed using the HydroCAD model as presented in the Comprehensive Stormwater Management Plan (CSMP) with Rice Creek Watershed District (RCWD) representative Kate MacDonald on Friday August 28, 2015, Ramsey County's consultants (Kimley Horn, Wenck Associates Inc.) revised the interim and fully developed conditions site condition HydroCAD model to address:

- Warning messages, and
- Sub-catchment 51 flows to Outfall 3.

This technical memorandum summarizes the changes made to the *Interim* and *Full Buildout* HydroCAD models transmitted by email to RCWD representative Kate MacDonald.

Changes to Model

In both the *Interim* and *Full Buildout* HydroCAD models, the following changes were made:

- Reaches were removed from the model.
- Model calculation mode was switched from Muskingum-Cunge to Dynamic Storage-Indication in order to capture backwater effects between stormwater ponds.
- Wetland W-3 was disconnected from Pond P-7 to add stability to the model. Excluding this connection makes the model more conservative by reducing the storage volume available during storm events. In actuality, P-7 will feed W-3 via a small pipe located at P-7's and W-3's respective normal water levels.
    - W-3 spill crest - 916 ft
    - P-7 100-yr peak water surface elevation - 915.93 ft.
- The lag time of Offsite Subbain 51 was adjusted to reflect proposed development at the MN Army National Guard Arden Hills Army Training Site (AHATS) readiness center site, the land upon which Offsite Subbasin 51 is located.
- Where appropriate, links were added to sum the peak discharge from one or more ponds that discharge together.

Model Results

The above changes resulted in discharge rates shown in the table below:

Peak Discharge Rate (cfs) of 100-yr, 24-yr Storm Event

Outfall	Existing Conditions (cfs)	80 % of Existing Conditions (cfs)	Interim Condition		Full Buildout Condition	
			Previous (cfs)	Revised (cfs)	Previous (cfs)	Revised (cfs)
Round Lake Outfall #1	135	108	11	11	16	16
Round Lake Outfall #2	438	350	272	277	261	268
Round Lake Outfall #3	83	67	94	70	94	70
Rice Creek	1219	975	682	678	867	862

Model Warnings

The revised *Interim* condition model contains three warnings. None of these warnings threaten the validity of model results.

First Warning: Pond 17P Exceeded Pond P-5/P-6 by 0.17’ @ 36.12 hours (0.20 cfs 0.727 af). The 12-inch RCP pipe with a slope of 0.0437 ft/ft and a 300 ft length between ponds P-5/P-6 limit the flow rates and pond levels take more time to equalize after a precipitation event. This warning is not a concern because it indicates that P17 (wetland W-2) returns to pre-storm conditions less quickly than P-5/P-6. P-5/P-6 is connected to W-2 by a 12-inch pipe intended to maintain the hydrology of W-2 during periods of dry weather. Some storm water is released to W-2 during storm events (peak discharge of 3.09 cfs) and that stormwater is slowly released to W-3 (peak discharge of 1.02 cfs). Because W-2 releases water so slowly, P-5/P-6 returns to pre-storm conditions more rapidly than W-2, thus triggering the HydroCAD warning at simulation hour 36.12, more than a full day after peak storm intensity.

Second Warning: Pond 7P Qout>Qin may require Finer Routing or smaller dt. This is a common warning message that results from using the Dynamic Storage-Indication solution technique. As stated in the HydroCAD User Help Guide this warning message is sometime caused by normal routing conditions. An inspection of the hydrograph and output data from the HydroCAD model indicates that, in this case, no modeling issue exists (i.e. caused by normal routing conditions). There are no oscillations or flow abnormalities in the pond P-7 influent or effluent hydrographs. Nor does the pond summary data indicate that an error exists in the model results for P-7. In an effort to eliminate this warning, the Finer Routing setting was increased from 1 to 2 but this had no effect on model results. The time step used is 0.01 hours, the smallest time increment allowed by HydroCAD.

Third Warning: Pond 10P outlet Device #1 rise exceeded. Pond P-10 outlet device #1 (the primary outlet) is designed to be submerged. Once the outlet device #1 rise is exceeded, HydroCAD treats the outlet as an orifice of the modeled dimensions. This is how outlet device #1 was designed to operate.

The revised *Full Buildout* condition model contains two warnings. None of these warnings threaten the validity of model results.

First Warning: Pond 7P Qout>Qin may require Finer Routing or smaller dt. As stated in the HydroCAD User Help Guide this warning message is sometime caused by normal routing conditions. An inspection of the hydrograph and output data from the HydroCAD model indicates that, in this case, no modeling issue exists (i.e. caused by normal routing conditions). There are no oscillations or flow abnormalities in the pond P-7 influent or effluent hydrographs. Nor does the pond summary data indicate that an error exists in the model results for P-7. In an effort to eliminate this warning, the Finer Routing setting was increased from 1 to 2 but this had no effect on model results. The time step used is 0.01 hours, the smallest time increment allowed by HydroCAD.

Second Warning: Pond 10P outlet Device #1 rise exceeded. Pond P-10 outlet device #1 (the primary outlet) is designed to be submerged. Once the outlet device #1 rise is exceeded, HydroCAD treats the outlet as an orifice of the modeled dimensions. This is how outlet device #1 was designed to operate.

Technical Memo

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To: Beth Kunkel, Kimley-Horn

From: Pamela Massaro, PE, Wenck Associates, Inc.
Adam Marsh, EIT, Wenck Associates, Inc.

Date: July 30, 2015

Subject: HydroCAD Stormwater Modeling

Introduction

The purpose of this technical memorandum is to summarize the stormwater modeling completed using the HydroCAD model as presented in the Comprehensive Stormwater Management Plan (CSMP) submitted to the Rice Creek Watershed District (RCWD) for the portion of the former Twin Cities Army Ammunition Plant (TCAAP) Site being redeveloped by Ramsey County (County), the City of Arden Hills (City), the County's consultants (Kimley Horn, Wenck Associates Inc.), and future Developers. The Site, under 2012 existing conditions, provides few stormwater control structures to reduce discharge rate and just grassy swales as best management practices (BMPs) to improve water quality treatment before stormwater leaves the Site.

The Rice Creek Commons Site, under fully developed conditions, will meet RCWD's water quality treatment requirements through a combination of onsite infiltration and wet detention ponds. Water quality results are summarized in a separate *P8 Water Quality Modeling* technical memorandum. This technical memorandum details stormwater volume and discharge rate control measures proposed to meet RCWD's peak stormwater runoff control requirements.

Many figures referenced in this technical memorandum are from the CSMP document.

1.0 Existing Site Conditions

1.1 Project Location

The 427-acre Rice Creek Commons Site, known as the former Twin Cities Army Ammunitions Plant (TCAAP), is located in the Ramsey County, Minnesota in the cities of Arden Hills and New Brighton. It is bounded by U.S. Interstate Highway 35 (I-35W) on the west, County State Aid Highway 96 (CSAH 96) to the south and U.S. Highway 10 (Hwy 10) to the southwest (**CSMP Figure 2-1**).

Rice Creek passes through the site near County Road H. Two-thirds of the site drain to Rice Creek and the remaining portion drains south to Round Lake. **CSMP Figure 2-2** shows the dividing line for areas draining to Rice Creek and Round Lake.

1.2 Existing Condition Subwatersheds

Wenck delineated 37 subwatersheds using topography (LiDAR data: Block F: 11-13-11 to 11-17-11, reflight 3-25-12) and information available on the US Army storm sewer network (**Figure 1**). Overland flow direction and drainage swales were identified using the available one foot contours. The existing conditions model explicitly represents 503.4 acres, which includes some off-site drainage.

There are nine subwatersheds (27-35 and County Rd H) that drain from the portion north of Rice Creek directly to Rice Creek. Stormwater exits at various, non-descript locations and discharges directly or ultimately to Rice Creek.

There are nine subwatersheds (12, 14-16 and 20-24), south of Rice Creek, that drain stormwater north discharging directly into Rice Creek by way of a ditch on the western site boundary or through various storm sewers.

There are five subwatersheds (17-19 and 25-26), south of Rice Creek, comprising the northeastern edge of the portion south of Rice Creek, where stormwater flows northeast to a wetland area, which eventually discharges to Rice Creek.

The southern third of the site drains to Round Lake by one of three outfalls (**CSMP Figure 4-7**). There are two subwatersheds (8, 13) that contribute runoff to Outfall #1, a 24-inch culvert passing beneath Hwy 10. There are eight subwatersheds (1, 4-6, 9-11, and 36) that contribute runoff to Outfall #2, a 60-inch culvert passing beneath Hwy 10. There are three subwatersheds (2, 3 and 7) that contribute runoff to Outfall #3, a 30-inch culvert which connects to the new storm sewer installed for CSAH 96.

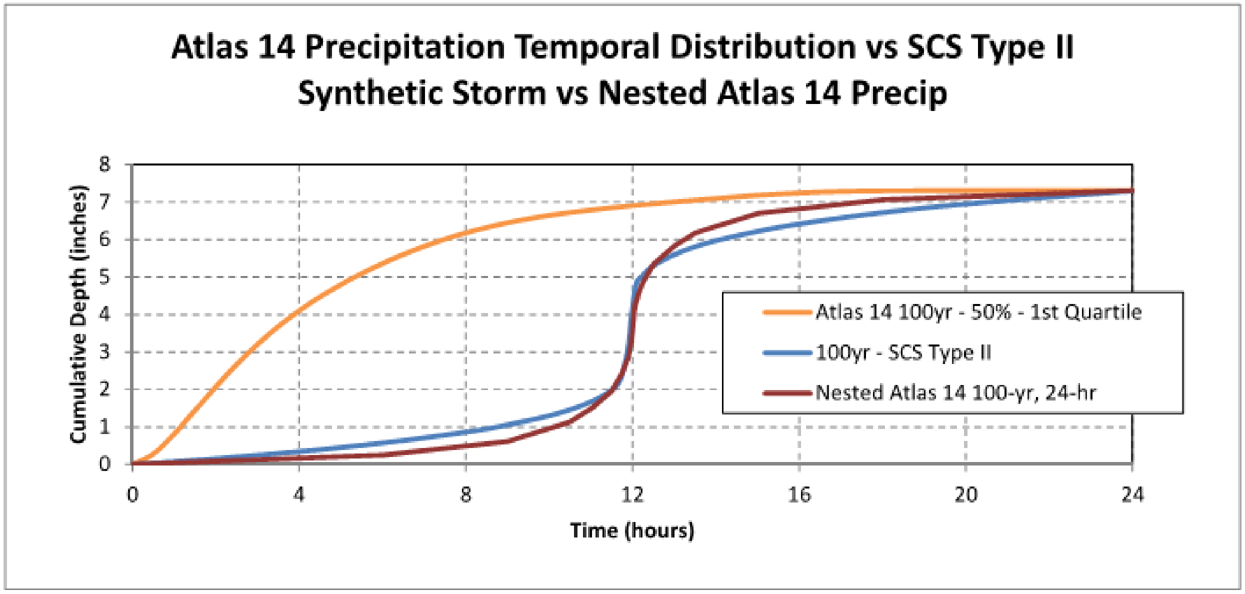
1.3 Subwatershed Runoff

Wenck evaluated stormwater runoff for 2-, 10-, and 100-year 24-hour design rainfall events. Precipitation depths were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. The 24-hour nested Atlas 14 rainfall depths used are:

▲ 2-Year Event	2.82 inches
▲ 10-Year Event	4.22 inches
▲ 100-Year Event	7.31 inches

The Atlas 14 nested curve is a hyetograph that encompasses short duration and long duration storms in one distribution (a conservative but effective approach for design). The Soil Conservation Service (SCS) Type II distribution is a nested curve developed using the Technical Paper (TP-40) data set. No areal reduction factor (a factor used to account for special variations in rainfall intensity) is applied based on individual subwatershed size. The rainfall distributions for the 100-year 24-hour design rainfall event are illustrated in **Figure 2**.

Figure 2 – Temporal nested Atlas 14 storm precipitation distribution compared to a SCS Type II distribution for the 100-yr, 24-hr rainstorms



The existing and proposed stormwater management calculations are based on the National Resources Conservation Service (NRCS) methodology using curve numbers (CN), time of concentration (T_c) and a design storm event approach. These variables and the other requisite NRCS inputs are used to complete calculations and to build a model in HydroCAD, a computer-aided design system for modeling the hydrology and hydraulics of stormwater runoff. The SCS Unit Hydrograph method is used to generate the subwatershed runoff hydrographs. A rainfall temporal distribution curve along with the drainage basin area, basin time of concentration, and drainage basin composite CN are required input parameters.

To reflect the 2012 site conditions the existing condition model does not have any stormwater ponds or basins.

1.3.1 Existing Condition Soils

The SCS classifies soils into four Hydrologic Soil Groups based on the soil's potential for runoff. The four Hydrologic Soil Groups (HSG) are A, B, C, and D. Type A soils generally have the least runoff potential and Type D soils have the greatest. Details for these classifications can be found in SCS TR-55 (SCS 1986). Soil data from the NRCS SSURGO database data is incomplete (**CSMP Figure 3-3**), with the bottom two-thirds of the site classified merely as "Urban". The geologic map of surficial geology (**CSMP Figure 3-4**) provides additional information about the site's geology. The portion south of Rice Creek has had the same land use for decades, the soil condition is poor and the soil is classified as Type C. The Type C soil classification is refined using geotechnical investigation information. Open spaces (including lawns, parks, and grasslands) are assigned a CN of 74 according to RCWD rules.

1.3.2 Existing Condition Land Cover

The 2012 aerial photograph provides sufficient land use data for the existing conditions. Roads and buildings are digitized and assigned a CN of 98 in compliance with RCWD rules. The portion of the site north of Rice Creek has Type A soils and is predominately open space, with some access trails.

1.3.3 Existing Condition Curve Number

Wenck determined curve numbers by intersecting the HSG map information with land cover data using GIS (**CSMP Figure 4-2**). Intersecting subwatershed area with curve number attribute information provided the composite curve number for each subwatershed (**Table 1**).

1.3.4 Existing Condition Time of Concentration

Time of concentration is the time it takes runoff to travel from the most distant point in the watershed to its outlet. The time of concentration is determined by a basin's geometry and flow types, which impact flow velocities. Runoff is assumed to travel as sheet flow, shallow concentrated flow, or channel flow. Time of concentration is estimated as the sum of travel times of these flows. The basin lag time is calculated for each subwatershed using **Equation 1**.

Equation 1 – Time of concentration

$$t_c = t_{sheet\ flow} + t_{shallow\ concentrated\ flow} + t_{channel\ flow}$$

where

$$t_{sheet\ flow} = 0.007 * \frac{(flow\ length * n)^{0.8}}{precipitation\ depth^{0.5}\ slope^{0.4}}$$

$$t_{shallow\ concentrated\ flow} = \frac{flow\ length}{C * slope^{0.5}}$$

where $C=16.1345$ for unpaved surfaces or
$C=20.3282$ for paved surfaces

$$t_{channel\ flow} = \frac{flow\ length}{\{\ [1.49 * (cross\ sectional\ area \div wetted\ perimeter)^{2/3} * slope^{0.5}] \div n\ \}}$$

Wenck calculates the time of concentration using existing topography, and surface channels. No storm sewer is included in the model for two reasons. First, available information about storm sewer layout and dimensions is insufficient to allow accurate representation in a model. Second, the United States Army ceased operations at TCAAP in 2002 and fitness of the storm sewer system in 2012 is unknown. Runoff travels as sheet flow for a maximum of 100 feet, at which point it transitions to shallow concentrated flow. Shallow concentrated flow then continues until intercepted by a surface channel or the receiving water body.

Table 1 - Input parameters for the Existing Condition HydroCAD Model

Subwatershed	T_c	Area	Composite CN
	min	*Acres*	*-*
1	16.3	15.3	87
2	12.2	4.9	77
3	32.8	15.5	75
4	11.3	24.0	85
5	44.5	27.2	83
6	46.4	22.5	79
7	27	9.8	66
8	9.5	28.7	83
9	12.7	9.3	82
10	37.7	30.0	81
11	32.9	4.4	80
12	14	3.3	80
13	36.2	2.3	82
14	8.94	2.5	84
15	28	61.3	82
16	26.3	44.8	81
17	11.5	8.0	88
18	15.8	28.4	83
19	7.3	6.4	78
20	17.1	15.9	85
21	10.8	7.2	90
22	19.6	26.6	82
23	9.42	13.8	92
24	19	13.9	85
25	22.6	6.7	75
26	38.2	0.8	66
27	13	2.0	66
28	23.8	5.8	44
29	26.9	1.3	39
30	26.8	31.6	42
31	30.2	0.9	39
32	27.6	0.9	39
33	19.9	3.2	48
34	12.1	1.2	49
35	16.7	6.2	43
36	61.5	11.2	84
County Road H	29.3	5.9	80
Total	-	503.4	-

2.0 Interim and Fully Developed Site Conditions

Wenck evaluated stormwater runoff for interim and fully developed conditions site conditions.

2.1 Interim Conditions (Interim Scenario 1)

The first phase of site development includes the construction of public infrastructure including Spine Road, I-35W improvements, alterations to County Road H and realignment of Rice Creek (**CSMP Figure 4-5)**. During this interim construction phase (Interim Scenario 1), a contractor, selected by Ramsey County will construct all wetlands and ponds except P-1, P-3, and P-14. Interim Scenario 1 reflects the first stage of site development which includes the construction of public infrastructure, described in the CSMP. The Water Quality Model evaluates Interim Scenario 1 and Interim Scenario 2. Interim Scenario 2 is not modeled explicitly in HydroCAD.

2.2 Fully Developed Conditions

The fully developed conditions site plan is only conceptual in nature, at this time, leaving final design for various parts of the Site to developers. Private developers will construct ponds P-1, P-3 and P-14. Fully developed conditions reflect proposed grading plans for initial site development (**CSMP Figure 4-5)** and master land use plan (**CSMP Figure 3-1)**.

2.3 Watershed Delineation

For the Interim Scenario 1 and fully developed conditions, Wenck reviewed proposed grading plans and delineated the Site into 30 subwatersheds (**CSMP Figure 4-7**), four subwatersheds in the portion north of Rice Creek and 26 in the portion south of Rice Creek.

There are four subwatersheds (22, 27, 29, and 1S) north of Rice Creek that drain to Rice Creek.

There are 13 subwatersheds (8-18, 26, and 28) south of Rice Creek that drain stormwater runoff to the north. The runoff is routed through a series of stormwater ponds in the Natural Resource Corridor and ultimately discharges to Rice Creek.

Two subwatersheds (20 and 21) encompass the relocated Rice Creek meander and its bank area. These subwatersheds are not included in the model because precipitation falling in these subwatersheds falls directly into Rice Creek.

There is one subwatershed (19), south of Rice Creek, comprising the northeastern edge of the site, where stormwater flows to a stormwater pond (P-14). The pond discharges beneath the trail and drains northeast to an existing wetland area, which eventually discharges to Rice Creek.

The southern third of site drains to Round Lake by one of three outfalls. There are two subwatersheds (5 and 6) that contribute runoff to Outfall #1, a 24-inch culvert passing beneath Hwy 10. There are seven subwatersheds (1-4, 7, 24 and 25) contributing runoff to Outfall #2, a 60-inch culvert passing beneath Hwy 10. Stormwater originating in offsite subwatershed 51 is diverted before entering the Rice Creek Commons property and discharges to Round Lake through an existing storm sewer. Fully developed conditions assume that the stormwater ponds P-1 and P-2 are not connected to the storm sewer catchbasin (CB 5004) which is routes runoff through a 15-inch pipe under CSAH 96. The stormwater ponds P-1 and P-2 are assumed to be connected to stormwater pond P-3 by a 60-inch pipe.

In the Interim Scenario 1 and fully developed condition HydroCAD models, 142.2 acres drain to Round Lake and 332.8 acres drain to Rice Creek. The Interim Scenario 1 and fully developed conditions total tributary area is 500.2 acres, 3.2 acres less than the existing tributary area. Two factors account for the change in total tributary area. First, the remeander of Rice Creek, causes subwatersheds 20 and 21 to include Rice Creek and its banks in the Interim Scenario 1 and fully developed conditions. For this reason, subwatersheds 20 and 21 (3.9 acres) are excluded from the Interim Scenario 1 and fully developed conditions model. Second, in the Interim Scenario 1 and fully developed conditions, 0.7 acres of additional tributary area are added due to expansion of I-35W and County Road H.

2.4 Stormwater Control Structures

To provide stormwater control in Interim Scenario 1, a contractor selected by Ramsey County will construct 14 stormwater ponds. During subsequent development, private developers will construct three additional ponds to provide further rate control (**CSMP Figure 4-6**). For water quality control, the required treatment volume is captures and treated in wet ponds or infiltration basins. For a detailed analysis of water quality controls, see the CSMP Appendix A: P8 Water Quality Modeling Technical Memorandum.

The Interim Scenario 1 and fully developed conditions grading plans include five newly created wetlands (W-1, W-2, W-3, W-4 and W-5) and preservation of one existing wetland (Wi). Wetlands are modeled to receive controlled inputs of water from the dead pool of adjacent stormwater ponds.

Through an iterative process, Wenck sized National Urban Runoff Program compliant stormwater control structures in collaboration with Kimley-Horn and Associates, Inc. Kimley-Horn provided a proposed grading plan indicating the approximate size and location of stormwater control structures, which Wenck translated into HydroCAD and P8 models. Based on model results, Wenck recommended alterations to stormwater control structure size and location. Kimley-Horn then revised the proposed grading plan to address stormwater control and water quality concerns identified by Wenck. After several iterations, Wenck and Kimley-Horn reached a proposed grading plan that satisfies RCWD discharge rate and water quality requirements. Kimley-Horn is preparing a RCWD permit application for Interim Scenario 1.

2.5 Routing

Each subwatershed's runoff is routed individually and directed to a pond and stormwater control structure, or drain directly to the receiving waterbody (**CSMP Figure 4-7**). Wenck did not consider storm sewers, other than what is considered public infrastructure. Developers will design and construct storm sewers conforming to the grading and stormwater control structures presented here.

2.6 Land Cover

Interim Scenario 1 and fully developed conditions plan drawings obtained from Kimley-Horn provided land cover data for the fully developed conditions condition (**CSMP Figure 3-1**). In accordance with SCS TR-55, the following land use designations were used:

- Residential areas – 38% impervious
- Commercial areas – 85% impervious
- Recreational areas – 30% impervious
- Open spaces – 2% impervious
- Pavement – 100% impervious

2.7 Curve Number

The Interim Scenario 1 and fully developed conditions curve numbers were assigned by intersecting the HSG map information with land cover data using GIS tools. Intersecting the area of each subwatershed with curve number attribute information provided the curve numbers for each subwatershed (**Table 2 and Table 3**). Wenck assigned separate areas and curve numbers for the pervious and impervious fraction of each subwatershed.

For both conditions, Wenck adjusted the CN of Type A and Type B soils upwards from 39 to 49 and from 61 to 74, respectively. This shift accounts for the effects of compaction and soil stratification that decrease the infiltration rate of Type A and B soils.

2.8 Time of Concentration

Because storm sewer design on Outlots is the responsibility of developers, time of concentration was calculated considering sheet flow and shallow concentrated flow only. Wenck calculated the time of concentration using fully developed conditions condition topography and stormwater control structures. Runoff travels as sheet flow for a maximum of 100 feet, at which point it transitions to shallow concentrated flow. Shallow flow calculations assume that runoff travels entirely over roads, parking lots, businesses and other paved surfaces. These are the most likely flow paths for unrouted flow in the fully developed conditions condition. Shallow concentrated flow then continues until intercepted by a stormwater control structure, or the receiving waterbody.

Table 2 - Input parameter for Interim Scenario 1 condition HydroCAD model

Subwatershed	Tc	Pervious		Impervious	
		Area	CN	Area	CN
1	53.1	52.1	74	0.0	-
2	16.6	11.0	74	0.4	100
3	15.3	34.7	74	2.9	-
4	5.9	0.3	74	0.3	100
5	59.3	7.4	74	0.5	100
6	20.3	0.9	74	0.1	100
7	5.7	21.6	74	0.0	-
8	47.1	27.9	74	1.6	100
9	30	25.8	74	0.0	100
10	7.3	6.1	74	0.3	100
11	11.7	2.1	74	1.2	100
12	9.5	1.1	74	0.3	100
13	9.4	2.2	74	0.8	100
14	4.3	8.6	74	1.6	-
15	31.3	58.5	74	0.0	-
16	12.1	30.6	74	1.9	100
17	4.3	3.9	74	3.7	100
18	33.5	52.8	74	0.0	-
19	24.7	21.2	74	0.0	-
20	0	2.7	74	0.0	-
21	0	1.2	74	0.0	-
22	41	41.9	74	0.0	-
23	No subwatershed assigned the number 23				
24	7.5	0.1	74	4.9	98
25	10.7	0.2	74	4.9	98
26	25.4	0.2	74	14.1	98
27	27.6	0.0	74	5.5	98
28	14.6	3.7	74	3.3	98
29	19.1	6.4	74	3.9	-
51	17.7	20.2	65**	5.0	98
1S		1.1	74	0.5	98
Total	-	442.5^	-	57.6^	-

*Surface of ponds and wetlands assigned a CN of 100. All other impervious area assigned a CN of 98.

**Subwatersheds 20 and 21 are located directly over top of Rice Creek and are excluded from the model because precipitation falling in these subwatersheds falls directly into relocated Rice Creek.

^Excludes area of subwatershed 20 and 21.

Table 3 – Input parameter for fully developed conditions HydroCAD model

Subwatershed	T_c	Pervious Area	Pervious CN	Impervious Area	Impervious CN*
	min	*acres*	*-*	*acres*	*-*
1	53.1	27.0	74	25.2	98
2	16.6	1.8	74	9.6	98
3	15.3	22.1	74	15.6	98
4	5.9	0.5	74	0.1	100
5	59.3	2.3	74	5.5	98
6	20.3	0.8	74	0.2	100
7	5.7	3.3	74	18.3	98
8	47.1	20.7	74	8.9	98
9	30	17.2	74	8.6	98
10	7.3	5.9	74	0.5	98
11	11.7	2.2	74	1.1	100
12	9.5	0.8	74	0.5	98
13	9.4	2.1	74	0.9	100
14	4.3	5.9	74	4.4	98
15	31.3	30.3	74	28.2	98
16	12.1	21.6	74	10.9	98
17	4.3	3.9	74	3.7	100
18	33.5	8.2	74	44.7	98
19	24.7	12.7	74	8.5	98
20**	0	2.5	74	0.3	98
21**	0	1.2	74	0.0	98
22	41	7.5	49	34.5	98
23	No subwatershed assigned the number 23				
24	7.5	0.1	74	4.9	98
25	10.7	0.2	74	4.8	98
26	25.4	0.2	74	14.1	98
27	27.6	0.0	49	5.5	98
28	1.6	3.7	74	3.3	98
29	35.1	6.4	74	3.9	98
51	17.7	20.2	65	5.0	98
1S	25.5	1.1	74	0.5	98
Total:		228.5^	73	271.7^	98

*Surface of ponds and wetlands assigned a CN of 100. All other impervious area assigned a CN of 98.

**Subwatersheds 20 and 21 are located directly over top of Rice Creek and are excluded from the model because precipitation falling in these subwatersheds falls directly into relocated Rice Creek.

^Excludes area of subwatershed 20 and 21.

3.0 HydroCAD Model Results

The existing and proposed stormwater management calculations are based on NRCS methodology using CN, T_c, and a nested Atlas 14 24-hour rainfall distribution. The 24-hour nested Atlas 14 rainfall depths used are:

▲ 2-Year Event	2.82 inches
▲ 10-Year Event	4.22 inches
▲ 100-Year Event	7.31 inches

These, and other NRCS inputs, were combined in HydroCAD, a stormwater hydraulic and hydrology modeling software, to perform design calculations. Wenck used the Storage-Indication routing method, which routes flow according to storage capacity and neglects travel time, as the pond routing method. Reach routing utilized the Muskingum-Cunge channel flow routing method because this method accounts for both reach storage capacity and travel time through the reach. Analysis of the 10-day snowmelt event was not required as all proposed stormwater ponds have a defined outlet at an elevation below the 100-year high water level.

3.1 Existing vs. Proposed Runoff

Wenck evaluated the peak discharge rate of the existing and fully developed site conditions for the 2-, 10-, and 100-year 24-hour design rainfall events. Rice Creek Watershed District Rule C.7 requires that Interim Scenario 1 and fully developed conditions model predicted peak discharge rates not exceed 80% of existing peak discharge.

3.1.1 Summary for Resource of Concern (Round Lake)

Under existing conditions, stormwater is discharged to Round Lake by way of three culverts. The proposed peak discharge rates under Interim Scenario 1 and fully developed conditions at each location have been significantly reduced for all three design storms (**Table 4**). The proposed stormwater management plan eliminates discharges through Outfall #3 (**CSMP Figure 4-7**) for both the Interim Scenario 1 and fully developed conditions. Runoff originating in offsite subwatershed 51 is redirected to the south before entering Rice Creek Commons property and discharges to Round Lake by way of an existing storm sewer. The Interim Scenario 1 and fully developed conditions grading plan redirects stormwater from 29.8 acres, which drain to Round Lake under existing conditions, to the Rice Creek. This 15.2% reduction in Round Lake tributary and the construction of stormwater retention ponds accounts for the peak discharge rate reduction.

Under Interim Scenario 1 and fully developed conditions, the combined peak discharge rate to Round Lake will be reduced by >80% for all three storm events (**Table 4**).

Table 4 – Peak discharge rates to Round Lake for existing and proposed conditions

Outfall #1 to Round Lake	Drainage Area (acres)	Discharge (cfs)		
		2-yr	10-yr	100-yr
Existing	23.3	34	67	135
80% of Existing	-	27	54	108
Interim Scenario 1	8.8	2	3	11
Fully Developed Conditions	8.8	4	6	16
Outfall #2 to Round Lake	**Drainage Area (acres)**	**Discharge (cfs)**		
		2-yr	**10-yr**	**100-yr**
Existing	143.8	112	217	438
80% of Existing	-	90	174	350
Interim Scenario 1	133.4	37	94	272
Fully Developed Conditions	133.4	47	98	261
Outfall #3 to Round Lake	**Drainage Area (acres)**	**Discharge (cfs)**		
		2-yr	**10-yr**	**100-yr**
Existing	30.2	13	33	83
80% of Existing	-	10	26	67
Interim Scenario 1	0.0	0	0	0
Fully Developed Conditions	0.0	0	0	0
Offsite Subbasin 51 to Round Lake	**Drainage Area (acres)**	**Discharge (cfs)**		
		2-yr	**10-yr**	**100-yr**
Existing	25.3	0	0	0
80% of Existing	-	0	0	0
Interim Scenario 1	25.3	16	37	94
Fully Developed Conditions	25.3	16	37	94
Total in Aggregate to Round Lake	**Drainage Area (acres)**	**Discharge (cfs)**		
		2-yr	**10-yr**	**100-yr**
Existing	197.3	159	317	656
80% of Existing	-	127	254	525
Interim Scenario 1	167.5	55	134	377
Fully Developed Conditions	167.5	67	141	371

3.1.2 Summary for Resource of Concern (Rice Creek)

Under existing conditions, runoff south of Rice Creek reaches Rice Creek by storm sewer outfalls or overland flow discharging to Rice Creek (**CSMP Figure 4-1**). Stormwater from the north of Rice Creek discharges to Rice Creek by way of an overland flow at numerous uncontrolled locations.

Under existing and proposed conditions, Rice Creek Commons stormwater from the north and south of Rice Creek discharges to the Rice Creek within a single 1,500 foot section of stream. The travel time from the most upstream to most downstream outfalls is minimal (approximately two minutes) causing discharge from separate locations to compound one another. As a result, the aggregate peak discharge to Rice Creek determines the impact to this resource of concern.

The proposed stormwater control structures (**CSMP Figure 4-5**) reduce peak discharge to Rice Creek by >80% for both the Interim Scenario 1 and fully developed conditions condition (**Table 5**). Compared to existing conditions, the Interim Scenario 1 and fully developed conditions, respectively, reduce peak discharge by 66.0% and 22.8% for the 2-yr storm event; 59.3% and 29.3% for the 10-yr storm; and 44.0% and 28.9% for the 100-yr storm event.

Table 7 - Total peak discharge to Rice Creek for existing and fully developed conditions (in aggregate)

Total Peak Discharge to Rice Creek	Drainage Area (acres)	Discharge (cfs)		
		2-yr	10-yr	100-yr
Existing	288.7	315	604	1219
80% of Existing	-	252	483	975
Interim Scenario 1	317.5	107	246	682
Fully developed conditions	317.5	243	427	867

Full supporting calculations for the existing, interim, and fully developed conditions condition HydroCAD Models are included in **Appendix A, B** and **C**, respectively.

3.2 Pond Outlet Control Structures

All pond designs include a multi-stage outlet control structure (OCS) to manage stormwater for each of the design events. Detailed summaries of tributary areas to each stormwater pond, outlet information, normal water elevations, emergency overflow elevations, dead pool storage, and high water levels, live storage and peak discharge rates for each design storm event (2-yr, 10-yr and 100-yr) are included in **Section 6.0**.

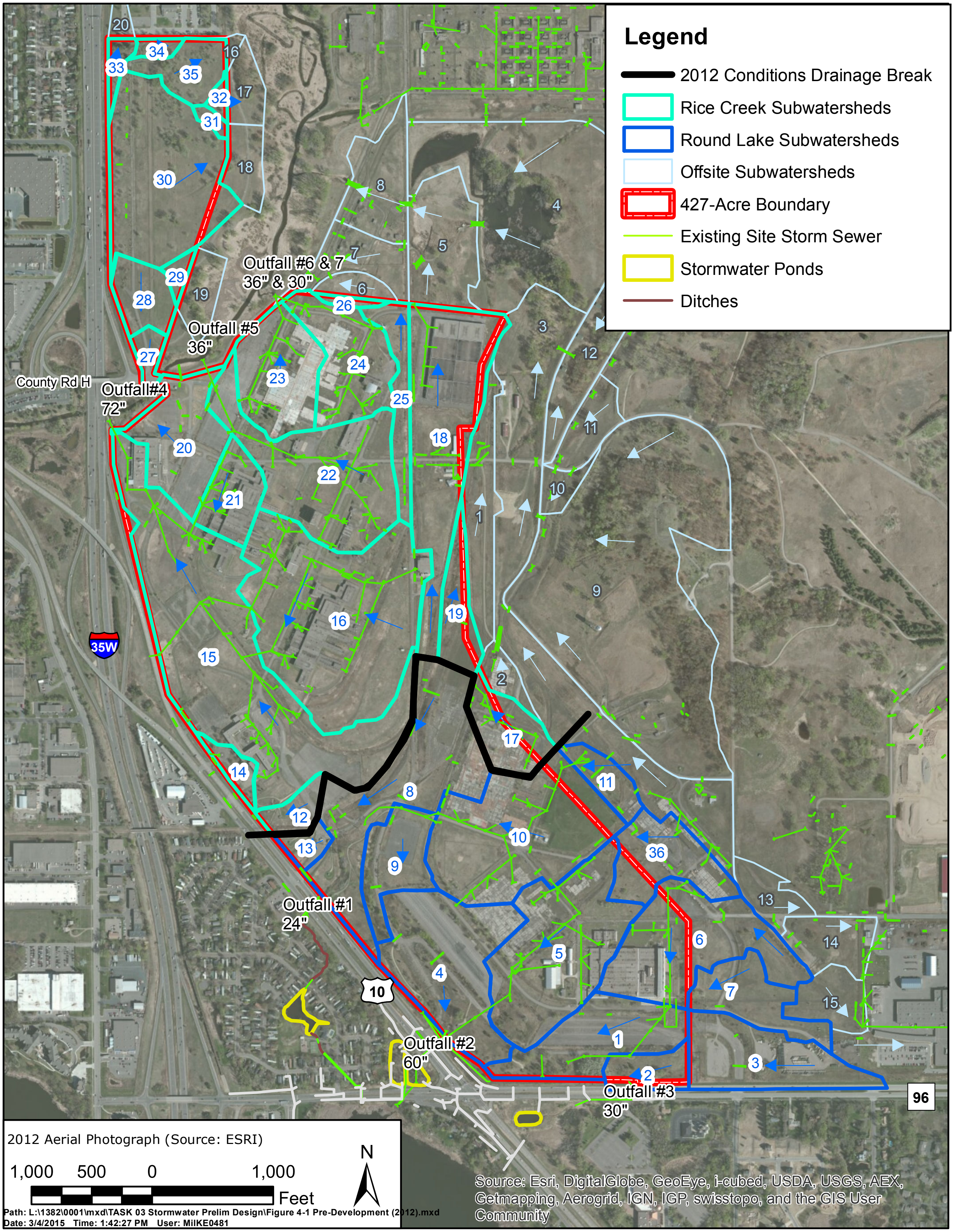
3.3 Infiltration Potential

Wenck reviewed the soil borings within the Site (**CSMP Figure 3-7**) and classified the soils in each boring log based on infiltration potential. If a boring had clay soils then it was considered no infiltration potential and labeled on **Figure 3** as a red dot. If there was a seam of sand or silt at depth, then the boring was classified as "infiltration potential at target seam" and labeled with an orange square on the Figure. If a particular soil boring showed favorable soils for infiltration, then it was labeled with a green star. If the soils showed potential at depth or at the surface, then it was labeled with a brown triangle and a yellow pentagon. **Figure 3** also shows the approximate location of the stormwater ponds (P-1 through P-14) in blue, the preliminary Outlots from the concept preliminary plat in purple, and areas excluded due to the potential concern relative to surficial (Unit 1) contaminated groundwater shown in red with diagonal lines. On an Outlot by Outlot basis, the infiltration is deemed feasible based on the majority of borings within an Outlot. Infiltration will be required in the portion north of Rice Creek and an area on the west side of the Spine Road alignment as shown in **CSMP Figure 5-1**.

4.0 Summary and Conclusions

Based on the HydroCAD modeling results presented herein, the RCWD peak runoff rate control standards will be met in aggregate for each Resource of Concern drainage area. Under Interim Scenario 1 and fully developed conditions, the total tributary area discharging to Round Lake decreases 15.2% to 167.4 acres and the total tributary area discharging to Rice Creek increases 8.7% to 332.8 acres when compared to existing conditions.

5. Figures



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Path: L:\1382\0001\mxd\TASK 03 Stormwater Prelim Design\Figure 4-1 Pre-Development (2012).mxd
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RAMSEY COUNTY

Pre-Development (2012): Subwatershed Map with Storm Sewers

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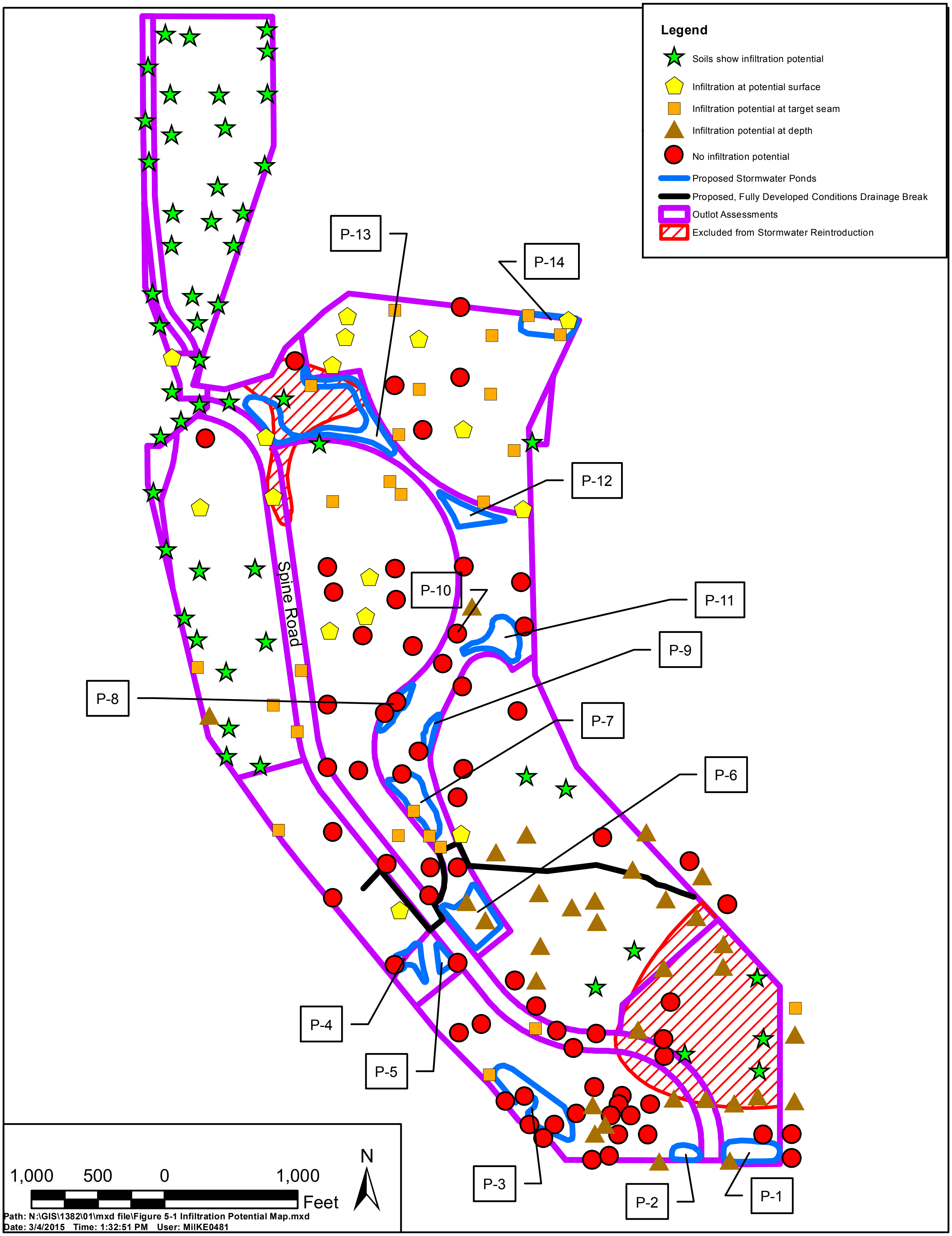
Figure 1



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Infiltration Potential Map

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Figure 3

6. Summary Tables

Stormwater Pond Data Summary Tables

HydroCAD Tech Memo
Section 6.0 Table 6-1, Pond Outlets

Stormwater Control Structure	Outlet structure	Pipe Size	Length (ft)	Slope	Max Velocity
			ft	*ft/ft*	*ft/sec*
P-1/P-2	6" horizontal orifice w/invert @ 924 ft Sharp crested box w/40' perimeter at 924.4 ft	60" RCP	2150	0.0050	10.7
P-3	12" horizontal orifice w/invent @ 914 ft Sharp crested rectangular weir w/invert at 915 ft and crest length = 7 ft Sharp crested rectangular weir w/invert at 918.25 ft and crest length = 10 ft	60" RCP	100	0.0085	13.9
P-4	6" horizontal orifice w/invent @ 915 ft 9" Diamater horizontal oriface w/invert @ 915 ft		Connection to W-1		
	24" RCP culvert w/inlet @ 915.95 ft	24" RCP	50	0.0050	5.8
P-5/P-6	12" horizontal orifice w/invert @ 930 ft 9" vertical oriface w/invert @ 930 ft 7 ft sharp crested weir @930.5 ft 10 ft sharp crested weir @ 931.5 ft dropping into a 48" pipe	48" RCP	830	0.0070	10.8
P-7	12" RCP W/invert at 915		Connection to W-3		
	75' broad crested weir @ 915 ft		Overland Flow to P-7 from P-9		
P-8	24" RCP w/invert at 897 ft	24" RCP	380	0.0028	3.9
P-9	80' broad crested weir @ 915 ft		Overland Flow to P-9 from P-11		
P-10	2.5 ft sharp crested rectangular baffel weir w/invert @ 896 ft dumping into 30" pipe	30" RCP	750	0.0037	6.8
	50 ft broad crested rectangular weir w/invert @ 897.4 ft	Overland flow from broad crested wier to handle >10-yr stroms			
P-11	12" horizontal oriface w/invert @ 909 ft		Connection to W-4		
	12" horizontal orifice w/invert at 909 ft	two 24" RCP	200	0.0050	10.0
	Two 24" RCPs w/invert at @ 910 ft 60 ft broad crested rectangular weir w/invert @ 912 ft	Overland flow from broad crested wier to handle >10-yr stroms			
P-12	two 12" horizontal orifice w/invert at 893 ft four 44"x27" RCP arch culverts w/ invert at 893.5 ft	Overland flow via channel to P-13 from P-12			
P-13	five 12" RCP pipes w/invert at 883 ft		Connection to W-5		
	55 ft broad crested weir		Channel flow to Rice Creek		
P-14	12" horizontal orifice w/invert at 892 ft 18" Round RCP culvert w/invert at 893 ft	18" RCP is sufficient, specific reach not defined in model			
CRH-1	Infiltration	-	15 acres of infiltration ar		0.8 in/hr
	two 24" RCP pipes w/invert @ 877 ft	two 24" RCP	155	0.0065	2.5
CRH-2	Infiltration	-	.2 acres of infiltration are		0.8 in/hr
	two 24" RCP pipes w/invert @ 881.5 ft	two 24" RCP	155	0.0065	2.5
CRH-3	Infiltration	-	15 acres of infiltration ar		0.8 in/hr
	two 24" RCP pipes w/invert @ 878 ft	two 24" RCP	155	0.0065	2.5
W-1	6" horizontal orifice w/invert @ 914.75 ft	12" RCP	100	0.0010	1.6
W-2	12" RCP w/invert @ 929.1 ft	12" RCP	300	0.0437	2.6
W-3	12" RCP w/invert @ 914.75 ft	12" RCP	50	0.0380	2.5
W-4	12" RCP w/invert @ 908 ft	12" RCP	170	0.0020	2.0
W-5	Two 6 ft sharp crested rectangular baffel weir w/invert @ 882.75 ft	12" RCP	100	0.0050	3.7

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HydroCAD Tech Memo
Section 6.0 Table 6-2, Interim Pond Geometery

Basin ID	Tributary Area				Basin Info		
	Tributary	Direct	Previously Ponded	Total	Outlet Elev/ NWL	Emergency Overflow	Dead Storage
		(acres)	(acres)	(acres)	(feet)	(feet)	(ac-ft)
Round Lake							
P-1	-	-	-	-	Constructed in Later Phase		
P-2	1, 2, 24	68.3	0.0	68.3	924.0	926.0	0.7
P-3	-	-	-	-	Constructed in Later Phase		
P-4	5	7.9	0.0	7.9	915.0	918.0	0.6
P-5	4, P-6	0.6	42.7	43.3	930.0	933.0	5.1
P-6	3, 25	42.7	0.0	42.7	930.0	933.0	
W-1	6	1.0	0.0	1.0	913.0	915.0	-
W-2	P-6	0.0	42.7	42.7	929.0	930.0	-
Offsite Subbasin 51	Offsite Subbasin 51	25.2	0.0	25.2	-	-	-
Rice Creek/Long Lake							
P-7	8	29.6	0.0	29.6	915.0	916.0	1.1
P-8	10	6.4	0.0	6.4	897.0	900.0	0.5
P-9	9, P-7, W-3	25.8	29.6	55.4	915.0	918.0	0.4
P-10	12, P-8, P-11	1.4	65.1	66.4	896.0	899.0	0.7
P-11	11, P-9	3.3	**55.4**	58.7	909.0	913.0	3.6
P-12	14, P-10, W-4	10.2	69.4	79.7	893.0	896.0	5.1
P-13	15, 16, 18, 26, P-12	158.1	79.7	237.8	883.0	886.0	4.3
P-14	19	21.2	0.0	21.2	Constructed in Later Phase		
Thumb	22, 27	48.5	0.0	48.5	-	-	-
CRH-1	28	7.0	0.0	5.7	876.0	879.0	-
CRH-2	29	10.2	0.0	10.2	881.5	884.0	-
CRH-3	CRH-2, 1S	1.6	10.2	11.8	876.0	879.0	-
W-3	P7	0.0	29.6	29.6	914.8	916.0	-
W-4	13	3.0	0.0	3.0	908.0	910.0	-
W-5	17	7.6	237.8	245.4	880.0	883.0	-

NOTE: Subbasins 20-22 and 27 are not routed through onsite ponds. No subbasin assigned number 23
Outlet information in Appendix 3, Table 2

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HydroCAD Tech Memo

Section 6.0 Table 6-3, Interim Pond Discharge

Basin ID	Tributary Subbasins and Ponds	100-Year Storm			10-Year Storm			2-Year Storm		
		HWL (feet)	Live Storage (ac-ft)	Peak Outflow (cfs)	HWL (feet)	Live Storage (ac-ft)	Peak Outflow (cfs)	HWL (feet)	Live Storage (ac-ft)	Peak Outflow (cfs)
Round Lake										
P-1	-	-	-	-	-	-	-	-	-	-
P-2	1, 2, 24	925.5	0.6	146	925.0	0.4	59	924.7	0.3	25
P-3	-	-	-	272	-	-	94	-	-	37
P-4	5	917.3	0.8	8	916.2	0.4	1	915.4	0.1	1
P-5	4, P-6	931.5	5.6	113	930.5	3.2	29	929.9	1.8	10
P-6	3, 25									
W-1	6	915.3	0.4	3	915.1	0.2	2	915.0	0.1	1
W-2	P-6	929.6	0.7	1	929.5	0.6	1	929.4	0.4	0
Offsite Subbasin 51	Offsite Subbasin 51	-	-	94	-	-	37	-	-	16
Rice Creek/Long Lake										
P-7	8	915.9	0.4	77	915.8	0.4	32	915.8	0.4	14
P-8	10	899.0	0.9	12	898.1	0.4	4	897.6	0.2	1
P-9	9, P-7, W-3	915.8	0.2	148	915.4	0.1	60	915.3	0.1	25
P-10	12, P-8, P-11	898.4	0.8	127	897.6	0.5	25	896.8	0.2	5
P-11	11, P-9	912.7	5.2	136	911.4	3.2	26	910.2	1.5	7
P-12	14, P-10, W-4	895.5	4.5	118	894.1	1.9	23	893.6	0.9	6
P-13	15, 16, 18, 26, P-12	855.3	5.3	503	884.2	2.5	189	883.7	1.4	86
P-14	19	-	-	75	-	-	30	-	-	12
Thumb	22, 27	-	-	53	-	-	0	-	-	0
CRH-1	28	878.8	0.8	25	878.1	0.5	12	877.7	0.4	5
CRH-2	29	883.8	1.5	27	882.7	0.9	10	882.1	0.6	2
CRH-3	CRH-2, 1S	879.8	0.8	26	878.9	0.4	8	878.3	2.6	1
W-3	P7	915.2	0.9	1	915.1	0.6	0	915.0	0.5	0
W-4	13	909.3	1.3	4	908.9	0.9	3	908.7	0.6	2
W-5	17	-	-	-	883.1	1.6	7	882.9	0.9	3

NOTE: Subbasins 20-22 and 27 are not routed through onsite ponds. No subbasin assigned number 23

HydroCAD Tech Memo

Section 6.0 Table 6-4, Full Buildout Pond Geometery

Basin ID	Tributary Area				Basin Info		
	Tributary	Direct	Previously Ponded	Total	Outlet Elev/ NWL	Emergency Overflow	Dead Storage
		(acres)	(acres)	(acres)	(feet)	(feet)	(ac-ft)
Round Lake							
P-1	1	52.2	0.0	52.2	924.0	926.0	3.5
P-2	2, 24	16.1	52.2	68.3			
P-3	-	21.6	111.6	133.1	914.0	920.0	5.8
P-4	5	7.9	0.0	7.9	915.0	918.0	0.6
P-5	4, P-6	0.6	42.7	43.3	930.0	933.0	5.1
P-6	3, 25	42.7	0.0	42.7			
W-1	6	1.0	0.0	1.0	913.0	916.0	-
W-2	P-6	0.0	42.7	42.7	929.0	930.0	-
Offsite Subbasin 51	Offsite Subbasin 51	25.2	0.0	25.2	-	-	-
Rice Creek/Long Lake							
P-7	8	29.6	0.0	29.6	915.0	916.0	1.1
P-8	10	6.4	0.0	6.4	897.0	900.0	0.5
P-9	9, P-7, W-3	25.8	29.6	55.4	915.0	918.0	0.4
P-10	12, P-8, P-11	1.4	65.1	66.4	896.0	899.0	0.7
P-11	11, P-9	3.3	55.4	58.7	909.0	913.0	3.6
P-12	14, P-10, W-4	10.2	69.4	79.7	893.0	896.0	5.1
P-13	15, 16, 18, 26, P-12	158.1	79.7	237.8	883.0	886.0	4.3
P-14	19	21.2	0.0	21.2	892.0	895.5	4.5
Thumb	22, 27	48.5	0.0	48.5	-	-	-
CRH-1	28	7.0	0.0	7.0	876.0	879.0	-
CRH-2	29	10.2	0.0	10.2	881.5	884.0	-
CRH-3	CRH-2, 1S	1.6	10.2	11.8	876.0	879.0	-
W-3	P7	0.0	29.6	29.6	914.8	916.0	-
W-4	13	3.0	0.0	3.0	908.0	910.0	-
W-5	17	7.6	237.8	245.4	880.0	883.0	-

NOTE: Subbasins 20-22 and 27 are not routed through onsite ponds. No subbasin assigned number 23
Outlet information in Appendix 3, Table 2

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HydroCAD Tech Memo

Section 6.0 Table 6-5, Full Buildout Pond Discharge

Basin ID	Tributary Area	100-Year Storm			10-Year Storm			2-Year Storm		
	Tributary	HWL	Live Storage	Peak Outflow	HWL	Live Storage	Peak Outflow	HWL	Live Storage	Peak Outflow
		(feet)	(ac-ft)	(cfs)	(feet)	(ac-ft)	(cfs)	(feet)	(ac-ft)	(cfs)
Round Lake										
P-1	1	925.7	2.4	174	925.2	1.6	90	924.9	1.3	53
P-2	2, 24									
P-3	-	919.7	13.3	261	918.0	7.9	98	916.5	5.2	47
P-4	5	917.8	1.0	13	916.8	0.6	4	916.2	0.4	2
P-5	4, P-6	932.6	8.4	123	931.5	5.6	29	930.7	3.8	7
P-6	3, 25									
W-1	6	915.4	0.5	3	915.2	0.3	2	915.1	0.2	2
W-2	P-6	929.6	0.7	1	929.5	0.6	1	929.4	0.4	0
Offsite Subbasin 51	Offsite Subbasin 51	-	-	94	-	-	37	-	-	16
Rice Creek/Long Lake										
P-7	8	915.9	0.4	86	915.8	0.4	40	915.8	0.4	21
P-8	10	899.1	0.9	12	898.1	0.4	4	897.6	0.2	1
P-9	9, P-7, W-3	915.9	0.2	167	915.5	0.1	78	915.4	0.1	42
P-10	12, P-8, P-11	898.5	0.9	169	897.8	0.6	39	897.5	0.5	22
P-11	11, P-9	912.8	5.4	161	912.0	4.2	40	910.9	2.5	16
P-12	14, P-10, W-4	895.8	5.2	141	894.4	2.3	37	893.8	1.4	12
P-13	15, 16, 18, 26, P-12	885.7	6.3	631	884.6	3.4	295	884.1	2.2	165
P-14	19	895.2	4.9	16	893.7	2.4	7	893.0	1.3	4
Thumb	22, 27	-	-	169	-	-	94	-	-	61
CRH-1	28	878.8	0.8	25	878.1	0.5	12	877.7	0.4	5
CRH-2	29	883.8	1.5	27	882.7	0.9	10	882.1	0.6	2
CRH-3	CRH-2, 1S	879.8	0.8	26	878.9	0.4	8	878.3	2.6	1
W-3	P7	915.2	0.9	1	915.1	0.7	1	915.0	0.5	0
W-4	13	909.4	1.4	4	909.0	0.9	3	908.8	0.8	3
W-5	17	-	-	-	883.2	2.4	12	883.1	1.7	8

NOTE: Subbasins 20-22 and 27 are not routed through onsite ponds. No subbasin assigned number 23

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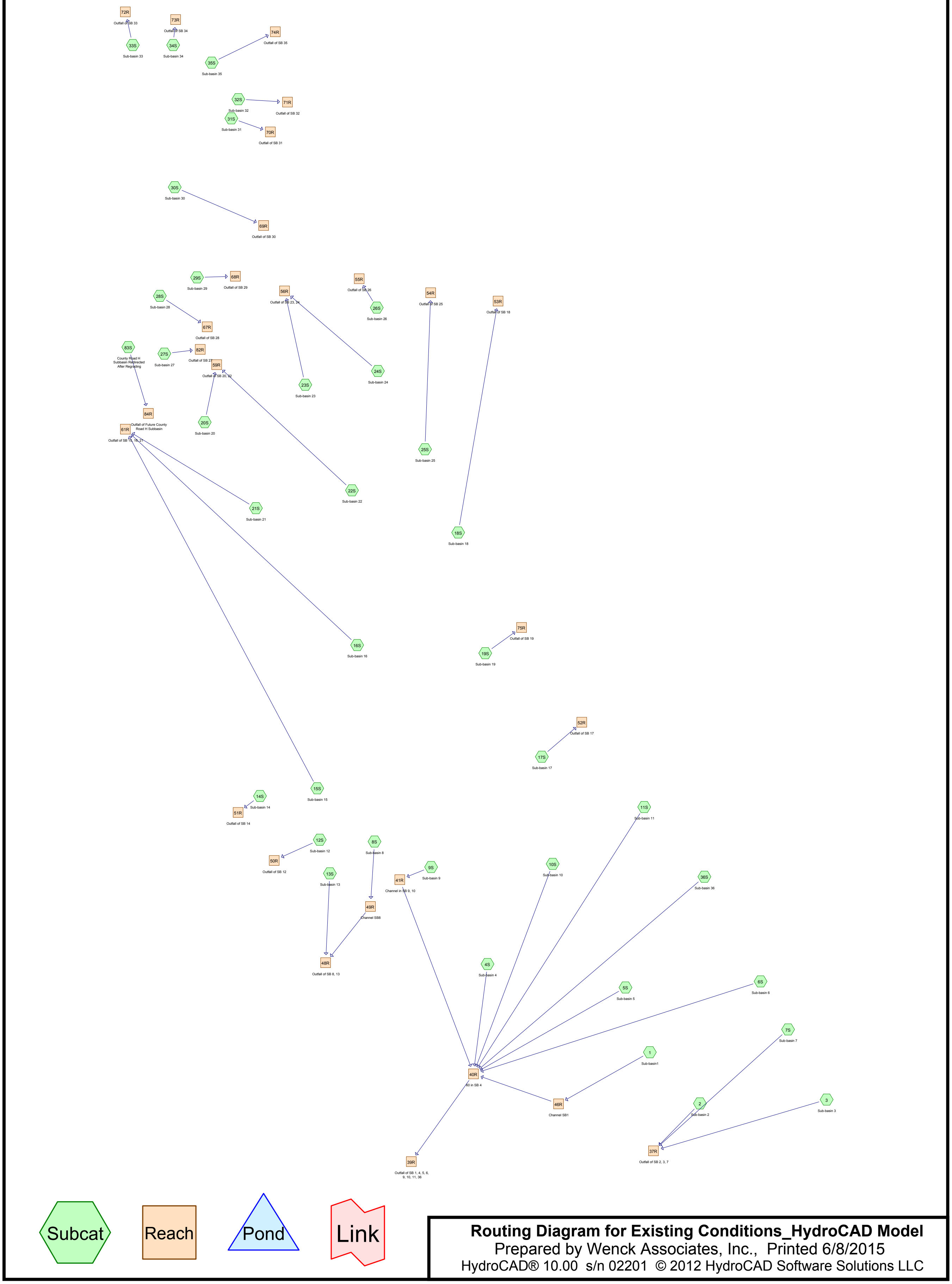
Appendix A

Existing Conditions (2012)

Hydrology and Hydraulics Modeling (HydroCAD)



Routing Diagram for Existing Conditions_HydroCAD Model
Prepared by Wenck Associates, Inc., Printed 6/8/2015
HydroCAD® 10.00 s/n 02201 © 2012 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
15.328	87	(1)
27.092	75	(2, 3, 25S)
53.741	85	(4S, 20S, 24S)
27.171	83	(5S)
28.829	78	(6S, 19S)
9.790	62	(7S)
95.827	81	(8S, 10S, 16S)
94.629	82	(9S, 13S, 15S, 22S)
4.343	76	(11S)
9.187	80	(12S, 83S)
38.195	84	(14S, 18S)
8.010	86	(17S)
7.156	90	(21S)
13.825	92	(23S)
2.861	66	(26S, 27S)
5.784	44	(28S)
3.017	39	(29S, 31S, 32S)
31.577	42	(30S)
3.237	48	(33S)
1.241	49	(34S)
6.229	43	(35S)
11.210	79	(36S)
498.279	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
498.279	Other	1, 2, 3, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18S, 19S, 20S, 21S, 22S, 23S, 24S, 25S, 26S, 27S, 28S, 29S, 30S, 31S, 32S, 33S, 34S, 35S, 36S, 83S
498.279		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	498.279	498.279		1, 2, 3, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18S, 19S, 20S, 21S, 22S, 23S, 24S, 25S, 26S, 27S, 28S, 29S, 30S, 31S, 32S, 33S, 34S, 35S, 36S, 83S
0.000	**0.000**	**0.000**	**0.000**	**498.279**	**498.279**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	40R	0.00	-23.69	718.0	0.0330	0.013	60.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment1: Sub-basin1 Runoff Area=15.328 ac 0.00% Impervious Runoff Depth=1.58"
Tc=16.3 min CN=87 Runoff=26.50 cfs 2.022 af

Subcatchment2: Sub-basin 2 Runoff Area=4.913 ac 0.00% Impervious Runoff Depth=0.85"
Tc=12.2 min CN=75 Runoff=4.67 cfs 0.346 af

Subcatchment3: Sub-basin 3 Runoff Area=15.522 ac 0.00% Impervious Runoff Depth=0.85"
Tc=32.8 min CN=75 Runoff=9.18 cfs 1.093 af

Subcatchment4S: Sub-basin 4 Runoff Area=23.961 ac 0.00% Impervious Runoff Depth=1.44"
Tc=11.3 min CN=85 Runoff=44.38 cfs 2.872 af

Subcatchment5S: Sub-basin 5 Runoff Area=27.171 ac 0.00% Impervious Runoff Depth=1.30"
Tc=40.5 min CN=83 Runoff=23.85 cfs 2.950 af

Subcatchment6S: Sub-basin 6 Runoff Area=22.467 ac 0.00% Impervious Runoff Depth=1.00"
Tc=46.4 min CN=78 Runoff=13.57 cfs 1.877 af

Subcatchment7S: Sub-basin 7 Runoff Area=9.790 ac 0.00% Impervious Runoff Depth=0.33"
Tc=27.0 min CN=62 Runoff=1.66 cfs 0.268 af

Subcatchment8S: Sub-basin 8 Runoff Area=21.017 ac 0.00% Impervious Runoff Depth=1.18"
Tc=9.5 min CN=81 Runoff=33.39 cfs 2.061 af

Subcatchment9S: Sub-basin 9 Runoff Area=9.296 ac 0.00% Impervious Runoff Depth=1.24"
Tc=12.7 min CN=82 Runoff=13.79 cfs 0.960 af

Subcatchment10S: Sub-basin 10 Runoff Area=30.014 ac 0.00% Impervious Runoff Depth=1.18"
Tc=37.7 min CN=81 Runoff=24.50 cfs 2.943 af

Subcatchment11S: Sub-basin 11 Runoff Area=4.343 ac 0.00% Impervious Runoff Depth=0.90"
Tc=32.9 min CN=76 Runoff=2.75 cfs 0.324 af

Subcatchment12S: Sub-basin 12 Runoff Area=3.310 ac 0.00% Impervious Runoff Depth=1.12"
Tc=14.0 min CN=80 Runoff=4.17 cfs 0.308 af

Subcatchment13S: Sub-basin 13 Runoff Area=2.279 ac 0.00% Impervious Runoff Depth=1.24"
Tc=36.2 min CN=82 Runoff=2.01 cfs 0.235 af

Subcatchment14S: Sub-basin 14 Runoff Area=2.518 ac 0.00% Impervious Runoff Depth=1.37"
Tc=8.9 min CN=84 Runoff=4.89 cfs 0.287 af

Subcatchment15S: Sub-basin 15 Runoff Area=56.506 ac 0.00% Impervious Runoff Depth=1.24"
Tc=28.0 min CN=82 Runoff=57.14 cfs 5.833 af

Subcatchment16S: Sub-basin 16 Runoff Area=44.796 ac 0.00% Impervious Runoff Depth=1.18"
Tc=26.3 min CN=81 Runoff=44.07 cfs 4.393 af

Subcatchment17S: Sub-basin 17 Runoff Area=8.010 ac 0.00% Impervious Runoff Depth=1.51"
Tc=11.5 min CN=86 Runoff=15.45 cfs 1.008 af

Subcatchment18S: Sub-basin 18 Runoff Area=35.677 ac 0.00% Impervious Runoff Depth=1.37"
Tc=15.8 min CN=84 Runoff=53.72 cfs 4.072 af

Subcatchment19S: Sub-basin 19 Runoff Area=6.362 ac 0.00% Impervious Runoff Depth=1.00"
Tc=7.3 min CN=78 Runoff=9.29 cfs 0.531 af

Subcatchment20S: Sub-basin 20 Runoff Area=15.897 ac 0.00% Impervious Runoff Depth=1.44"
Tc=17.1 min CN=85 Runoff=24.29 cfs 1.905 af

Subcatchment21S: Sub-basin 21 Runoff Area=7.156 ac 0.00% Impervious Runoff Depth=1.82"
Tc=10.8 min CN=90 Runoff=17.27 cfs 1.085 af

Subcatchment22S: Sub-basin 22 Runoff Area=26.548 ac 0.00% Impervious Runoff Depth=1.24"
Tc=19.6 min CN=82 Runoff=32.17 cfs 2.741 af

Subcatchment23S: Sub-basin 23 Runoff Area=13.825 ac 0.00% Impervious Runoff Depth=1.99"
Tc=9.4 min CN=92 Runoff=38.34 cfs 2.294 af

Subcatchment24S: Sub-basin 24 Runoff Area=13.883 ac 0.00% Impervious Runoff Depth=1.44"
Tc=19.0 min CN=85 Runoff=20.15 cfs 1.664 af

Subcatchment25S: Sub-basin 25 Runoff Area=6.657 ac 0.00% Impervious Runoff Depth=0.85"
Tc=22.6 min CN=75 Runoff=4.76 cfs 0.469 af

Subcatchment26S: Sub-basin 26 Runoff Area=0.823 ac 0.00% Impervious Runoff Depth=0.46"
Tc=38.2 min CN=66 Runoff=0.20 cfs 0.032 af

Subcatchment27S: Sub-basin 27 Runoff Area=2.038 ac 0.00% Impervious Runoff Depth=0.46"
Tc=13.0 min CN=66 Runoff=0.77 cfs 0.078 af

Subcatchment28S: Sub-basin 28 Runoff Area=5.784 ac 0.00% Impervious Runoff Depth=0.01"
Tc=23.9 min CN=44 Runoff=0.01 cfs 0.003 af

Subcatchment29S: Sub-basin 29 Runoff Area=1.255 ac 0.00% Impervious Runoff Depth=0.00"
Tc=26.9 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment30S: Sub-basin 30 Runoff Area=31.577 ac 0.00% Impervious Runoff Depth=0.00"
Tc=45.9 min CN=42 Runoff=0.01 cfs 0.001 af

Subcatchment31S: Sub-basin 31 Runoff Area=0.884 ac 0.00% Impervious Runoff Depth=0.00"
Tc=30.2 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment32S: Sub-basin 32 Runoff Area=0.878 ac 0.00% Impervious Runoff Depth=0.00"
Tc=27.6 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment33S: Sub-basin 33 Runoff Area=3.237 ac 0.00% Impervious Runoff Depth=0.04"
Tc=19.9 min CN=48 Runoff=0.01 cfs 0.010 af

Subcatchment 34S: Sub-basin 34 Runoff Area=1.241 ac 0.00% Impervious Runoff Depth=0.05"
Tc=12.1 min CN=49 Runoff=0.01 cfs 0.005 af

Subcatchment 35S: Sub-basin 35 Runoff Area=6.229 ac 0.00% Impervious Runoff Depth=0.00"
Tc=16.7 min CN=43 Runoff=0.00 cfs 0.001 af

Subcatchment 36S: Sub-basin 36 Runoff Area=11.210 ac 0.00% Impervious Runoff Depth=1.06"
Tc=52.2 min CN=79 Runoff=6.74 cfs 0.989 af

Subcatchment 83S: County Road H Runoff Area=5.877 ac 0.00% Impervious Runoff Depth=1.12"
Tc=19.1 min CN=80 Runoff=6.41 cfs 0.547 af

Reach 37R: Outfall of SB 2, 3, 7 Inflow=12.99 cfs 1.708 af
Outflow=12.99 cfs 1.708 af

Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36 Inflow=111.85 cfs 14.937 af
Outflow=111.85 cfs 14.937 af

Reach 40R: 60 in SB 4 Avg. Flow Depth=1.37' Max Vel=26.20 fps Inflow=111.84 cfs 14.937 af
60.0" Round Pipe n=0.013 L=718.0' S=0.0330 '/' Capacity=473.08 cfs Outflow=111.85 cfs 14.937 af

Reach 41R: Channel in SB 9, 10 Avg. Flow Depth=0.35' Max Vel=8.22 fps Inflow=13.79 cfs 0.960 af
n=0.050 L=1,660.0' S=0.0048 '/' Capacity=280.23 cfs Outflow=12.78 cfs 0.960 af

Reach 46R: Channel SB1 Avg. Flow Depth=0.61' Max Vel=5.16 fps Inflow=26.50 cfs 2.022 af
n=0.050 L=841.0' S=0.0071 '/' Capacity=296.86 cfs Outflow=26.13 cfs 2.022 af

Reach 48R: Outfall of SB 8, 13 Inflow=33.61 cfs 2.296 af
Outflow=33.61 cfs 2.296 af

Reach 49R: Channel SB8 Avg. Flow Depth=0.54' Max Vel=5.56 fps Inflow=33.39 cfs 2.061 af
n=0.050 L=521.0' S=0.0077 '/' Capacity=706.58 cfs Outflow=32.82 cfs 2.061 af

Reach 50R: Outfall of SB 12 Inflow=4.17 cfs 0.308 af
Outflow=4.17 cfs 0.308 af

Reach 51R: Outfall of SB 14 Inflow=4.89 cfs 0.287 af
Outflow=4.89 cfs 0.287 af

Reach 52R: Outfall of SB 17 Inflow=15.45 cfs 1.008 af
Outflow=15.45 cfs 1.008 af

Reach 53R: Outfall of SB 18 Inflow=53.72 cfs 4.072 af
Outflow=53.72 cfs 4.072 af

Reach 54R: Outfall of SB 25 Inflow=4.76 cfs 0.469 af
Outflow=4.76 cfs 0.469 af

Reach 55R: Outfall of SB 26 Inflow=0.20 cfs 0.032 af
Outflow=0.20 cfs 0.032 af

Reach 56R: Outfall of SB 23, 24
Inflow=51.42 cfs 3.958 af
Outflow=51.42 cfs 3.958 af

Reach 59R: Outfall of SB 20, 22
Inflow=56.04 cfs 4.646 af
Outflow=56.04 cfs 4.646 af

Reach 61R: Outfall of SB 15, 16, 21
Inflow=108.23 cfs 11.311 af
Outflow=108.23 cfs 11.311 af

Reach 67R: Outfall of SB 28
Inflow=0.01 cfs 0.003 af
Outflow=0.01 cfs 0.003 af

Reach 68R: Outfall of SB 29
Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 69R: Outfall of SB 30
Inflow=0.01 cfs 0.001 af
Outflow=0.01 cfs 0.001 af

Reach 70R: Outfall of SB 31
Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 71R: Outfall of SB 32
Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 72R: Outfall of SB 33
Inflow=0.01 cfs 0.010 af
Outflow=0.01 cfs 0.010 af

Reach 73R: Outfall of SB 34
Inflow=0.01 cfs 0.005 af
Outflow=0.01 cfs 0.005 af

Reach 74R: Outfall of SB 35
Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Reach 75R: Outfall of SB 19
Inflow=9.29 cfs 0.531 af
Outflow=9.29 cfs 0.531 af

Reach 82R: Outfall of SB 27
Inflow=0.77 cfs 0.078 af
Outflow=0.77 cfs 0.078 af

Reach 84R: Outfall of Future County Road H Subbasin
Inflow=6.41 cfs 0.547 af
Outflow=6.41 cfs 0.547 af

Total Runoff Area = 498.279 ac Runoff Volume = 46.208 af Average Runoff Depth = 1.11"
100.00% Pervious = 498.279 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1: Sub-basin1

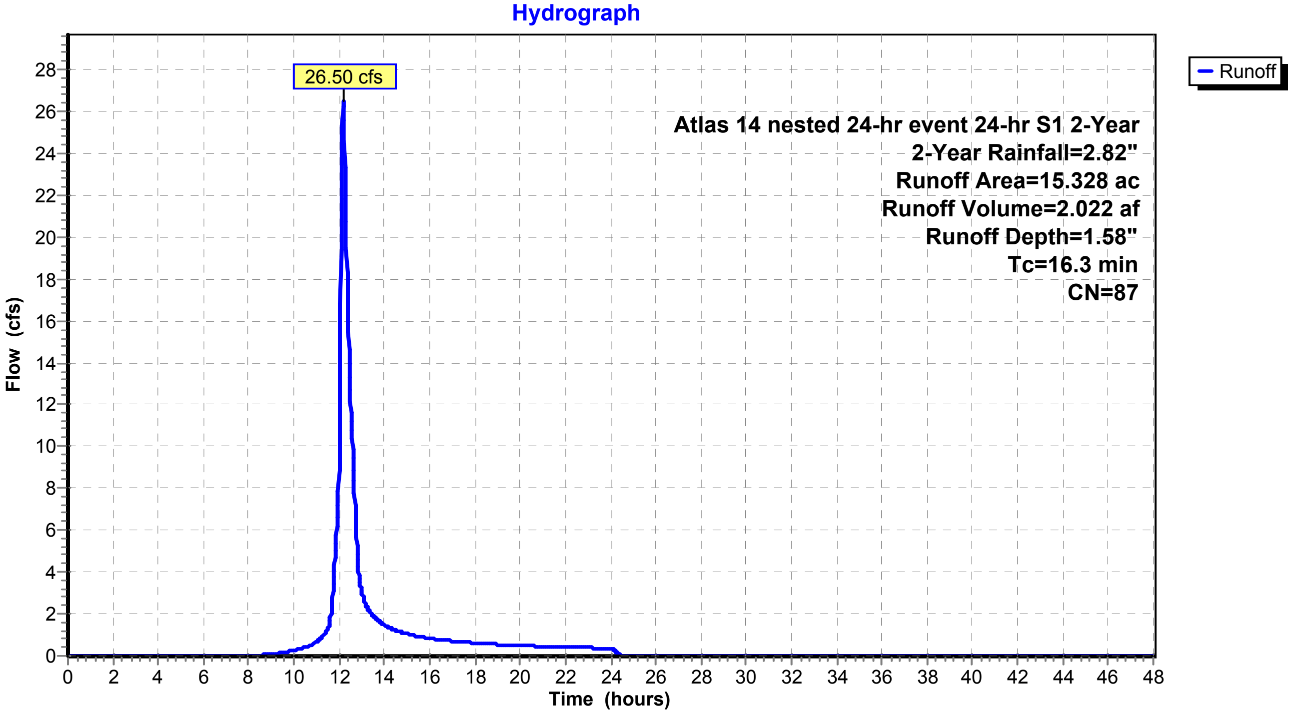
Runoff = 26.50 cfs @ 12.18 hrs, Volume= 2.022 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	15.328	87	
	15.328		100.00% Pervious Area

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

Subcatchment 1: Sub-basin1



Summary for Subcatchment 2: Sub-basin 2

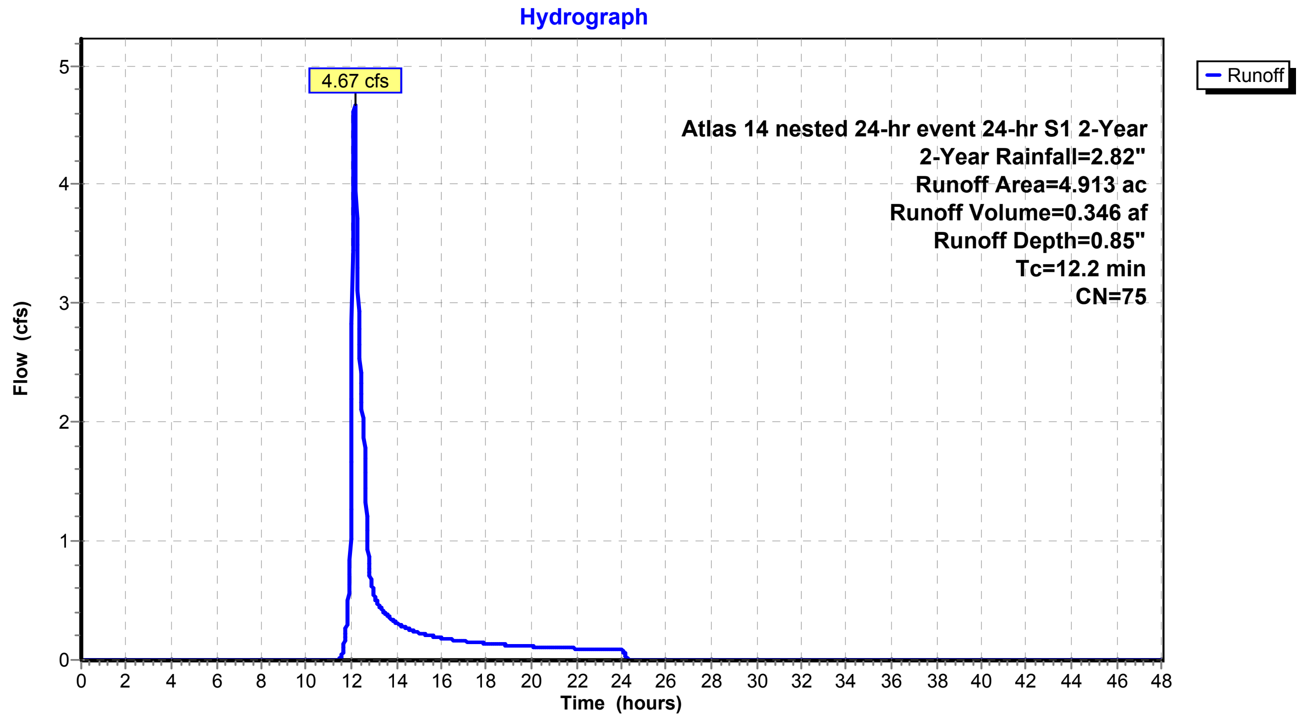
Runoff = 4.67 cfs @ 12.14 hrs, Volume= 0.346 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	4.913	75	
	4.913		100.00% Pervious Area

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

Subcatchment 2: Sub-basin 2



Summary for Subcatchment 3: Sub-basin 3

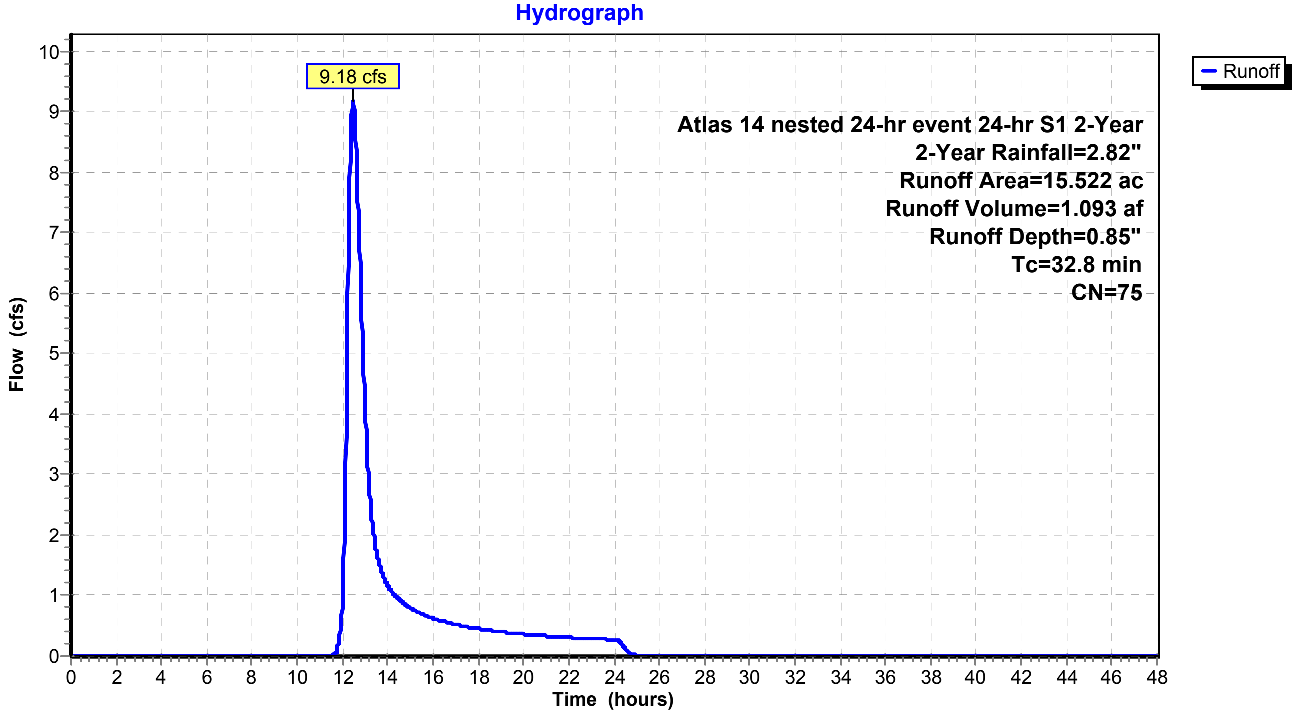
Runoff = 9.18 cfs @ 12.46 hrs, Volume= 1.093 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	15.522	75	
	15.522		100.00% Pervious Area

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

Subcatchment 3: Sub-basin 3



Summary for Subcatchment 4S: Sub-basin 4

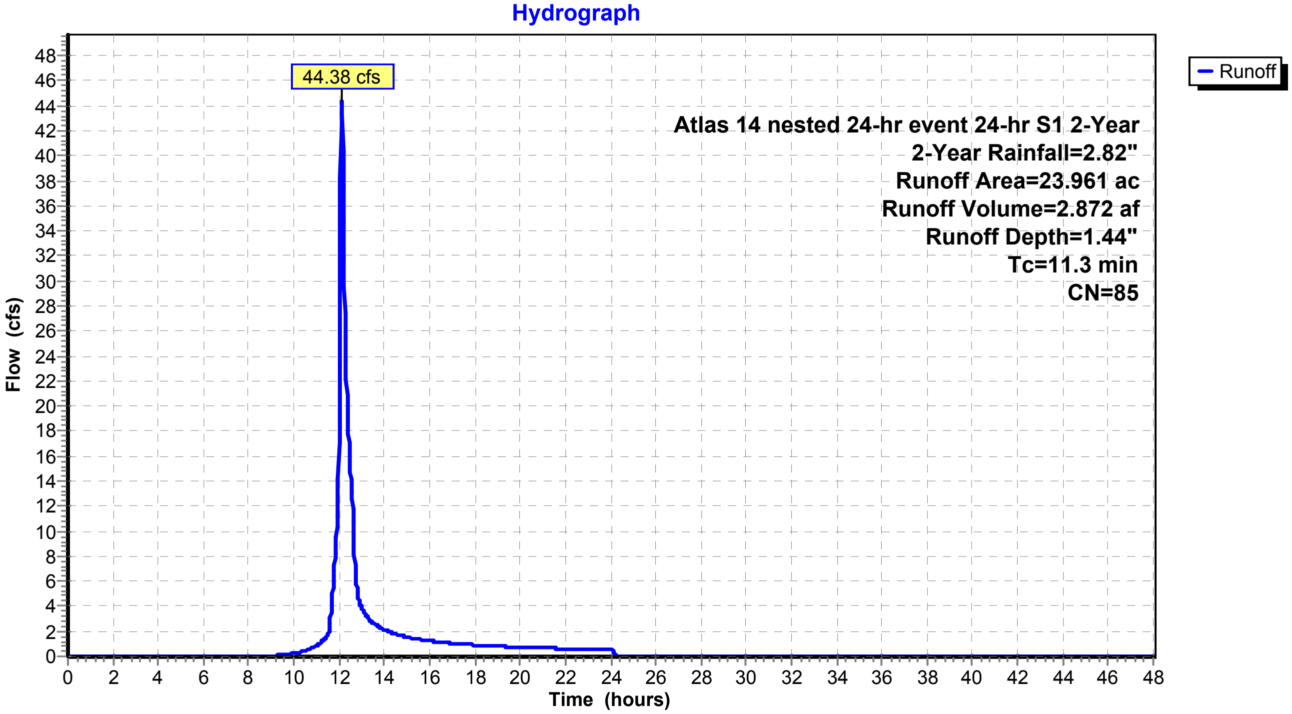
Runoff = 44.38 cfs @ 12.11 hrs, Volume= 2.872 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	23.961	85	
	23.961		100.00% Pervious Area

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

Subcatchment 4S: Sub-basin 4



Summary for Subcatchment 5S: Sub-basin 5

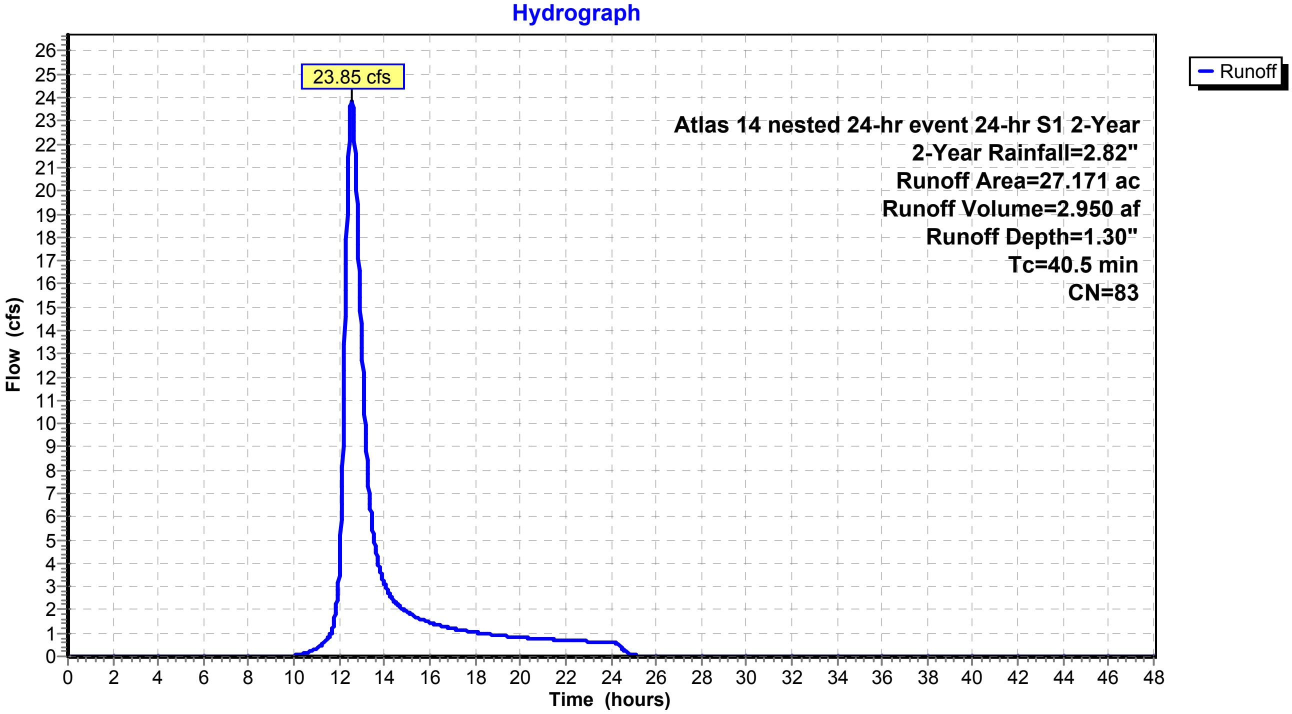
Runoff = 23.85 cfs @ 12.55 hrs, Volume= 2.950 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	27.171	83	
	27.171		100.00% Pervious Area

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

Subcatchment 5S: Sub-basin 5



Summary for Subcatchment 6S: Sub-basin 6

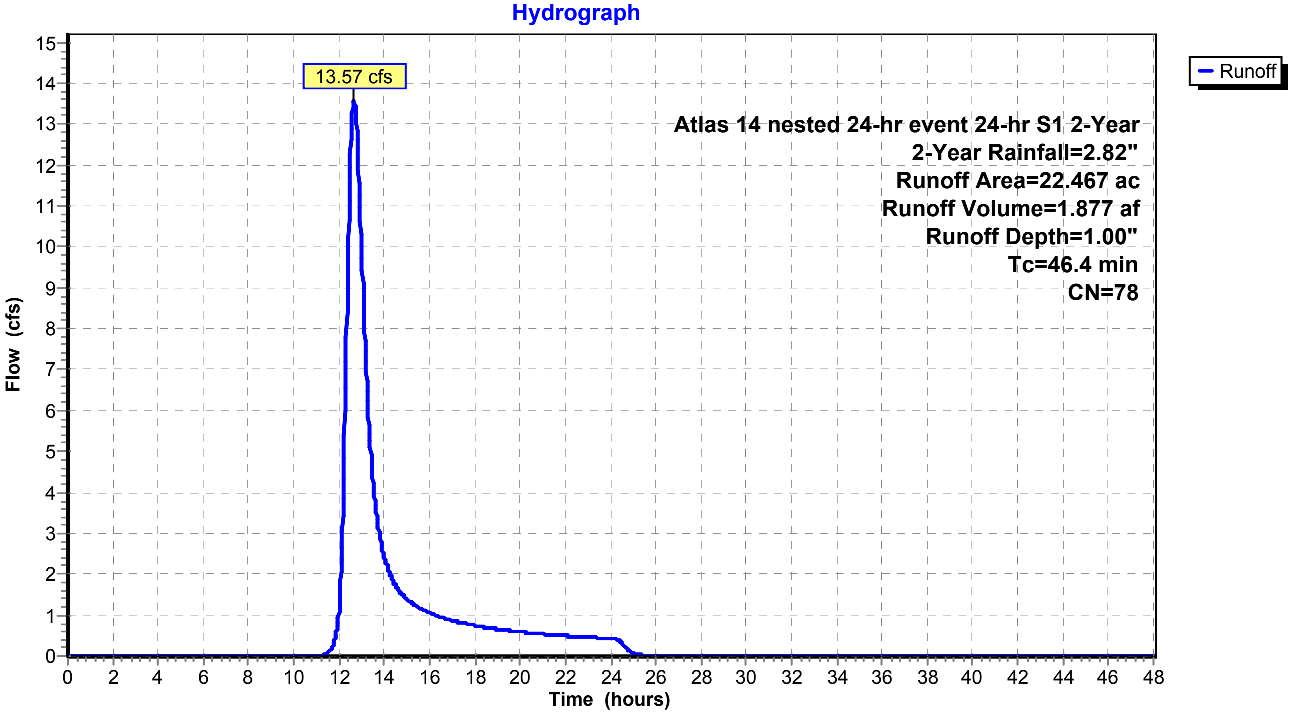
Runoff = 13.57 cfs @ 12.65 hrs, Volume= 1.877 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	22.467	78	
	22.467		100.00% Pervious Area

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

Subcatchment 6S: Sub-basin 6



Summary for Subcatchment 7S: Sub-basin 7

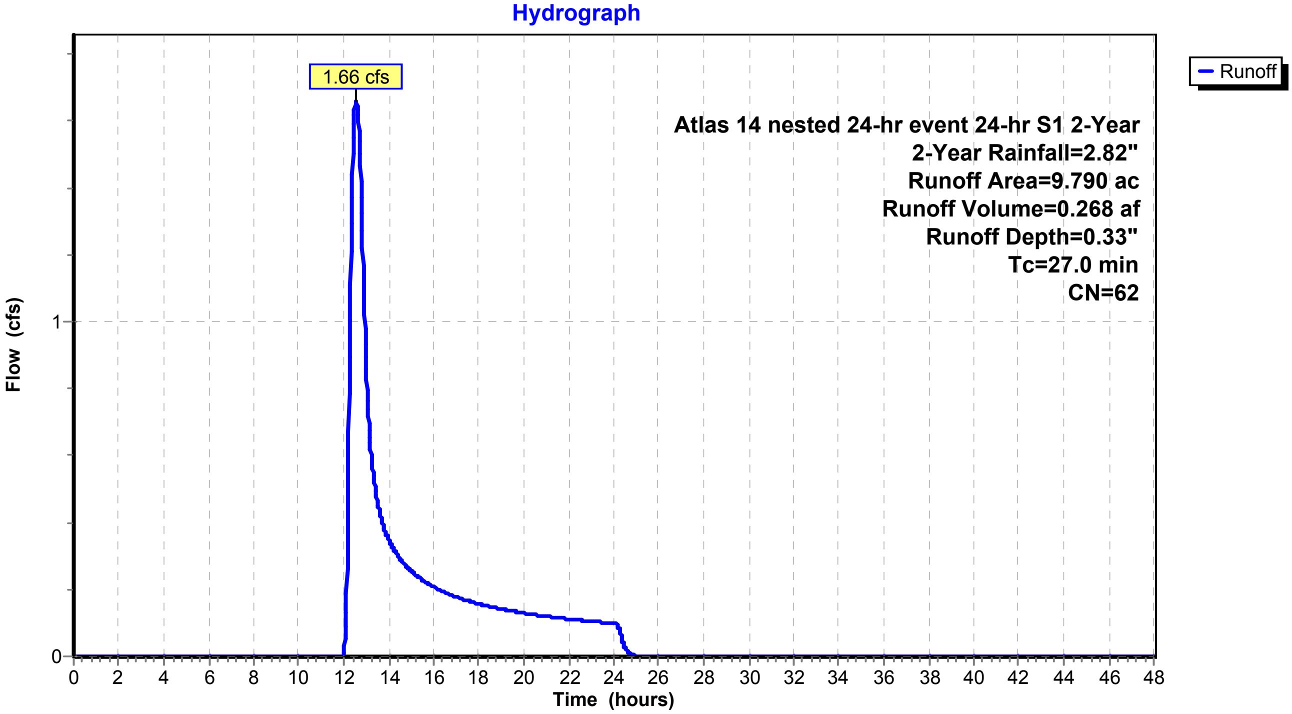
Runoff = 1.66 cfs @ 12.55 hrs, Volume= 0.268 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	9.790	62	
	9.790		100.00% Pervious Area

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

Subcatchment 7S: Sub-basin 7



Summary for Subcatchment 8S: Sub-basin 8

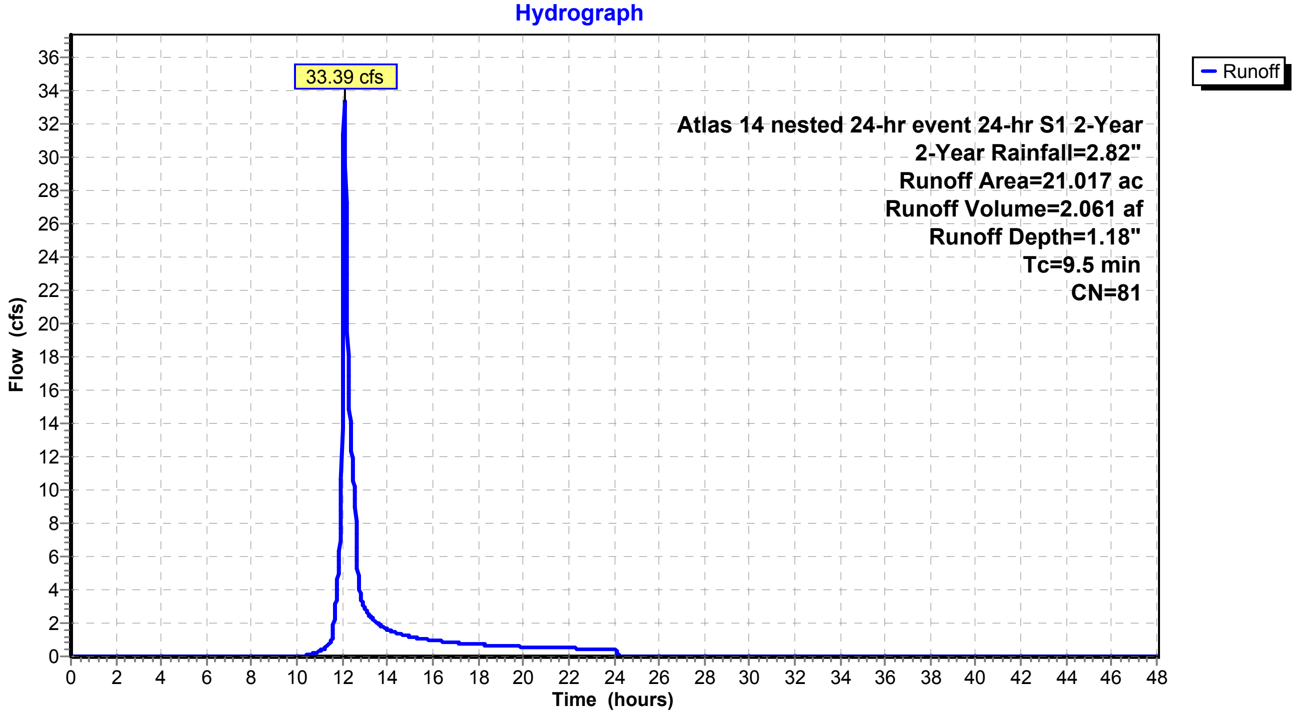
Runoff = 33.39 cfs @ 12.09 hrs, Volume= 2.061 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	21.017	81	
	21.017		100.00% Pervious Area

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

Subcatchment 8S: Sub-basin 8



Summary for Subcatchment 9S: Sub-basin 9

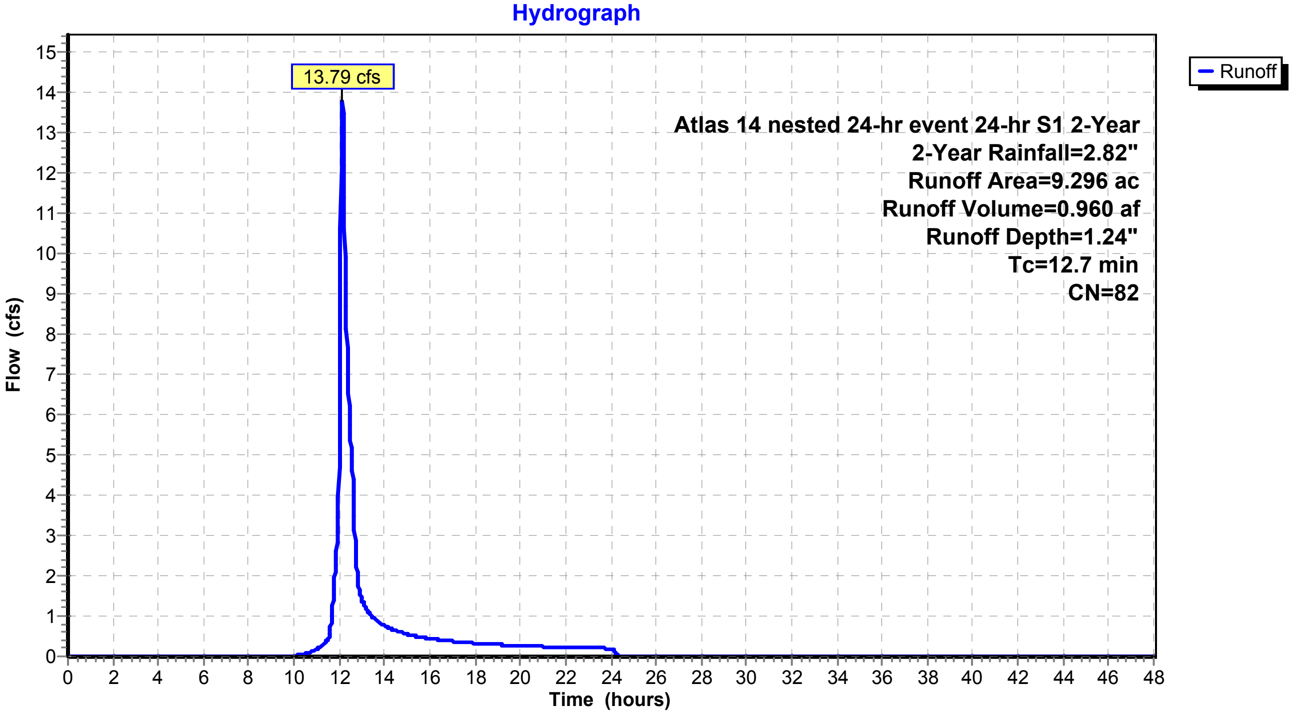
Runoff = 13.79 cfs @ 12.13 hrs, Volume= 0.960 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	9.296	82	
	9.296		100.00% Pervious Area

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

Subcatchment 9S: Sub-basin 9



Summary for Subcatchment 10S: Sub-basin 10

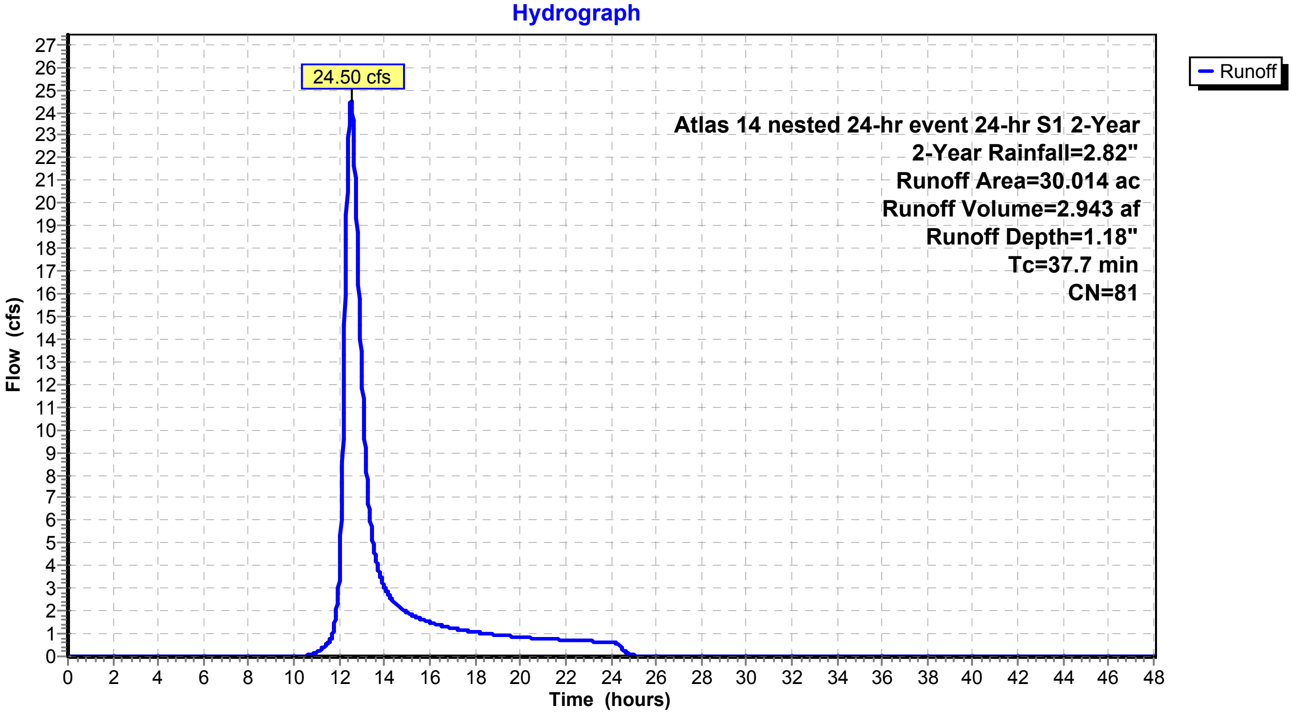
Runoff = 24.50 cfs @ 12.52 hrs, Volume= 2.943 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	30.014	81	
	30.014		100.00% Pervious Area

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

Subcatchment 10S: Sub-basin 10



Summary for Subcatchment 11S: Sub-basin 11

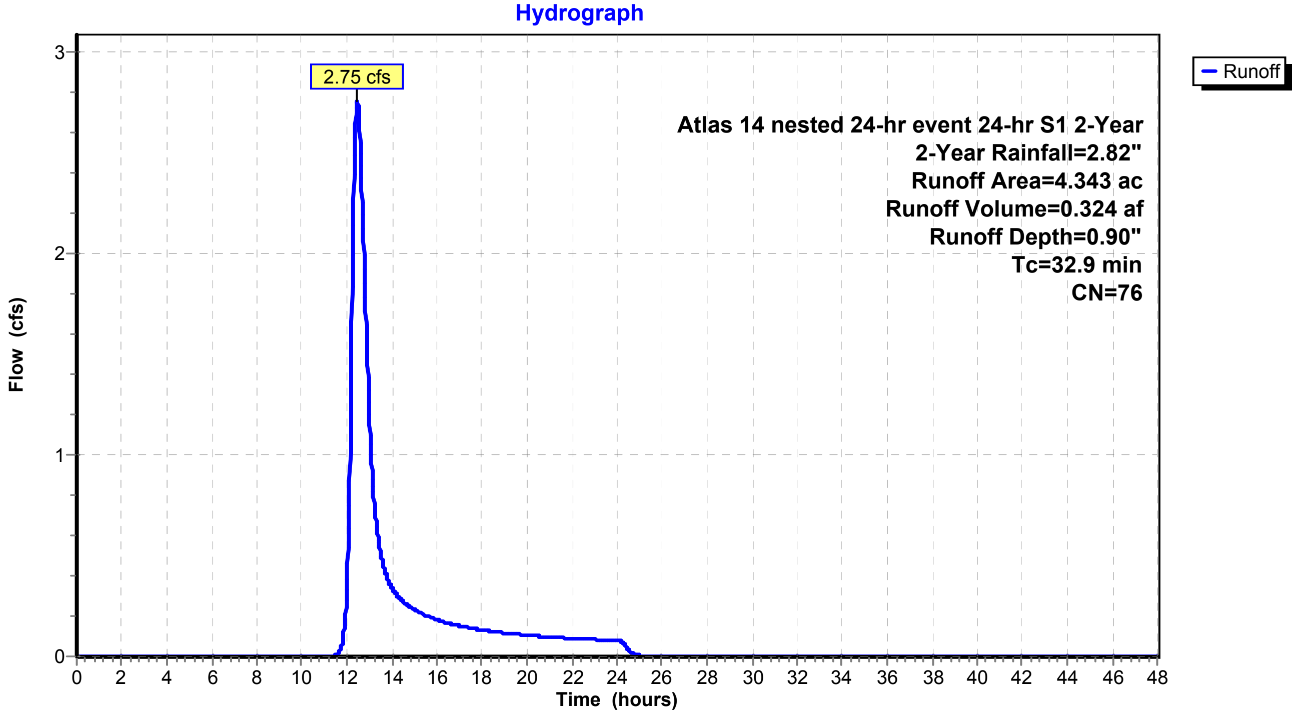
Runoff = 2.75 cfs @ 12.46 hrs, Volume= 0.324 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	4.343	76	
	4.343		100.00% Pervious Area

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

Subcatchment 11S: Sub-basin 11



Summary for Subcatchment 12S: Sub-basin 12

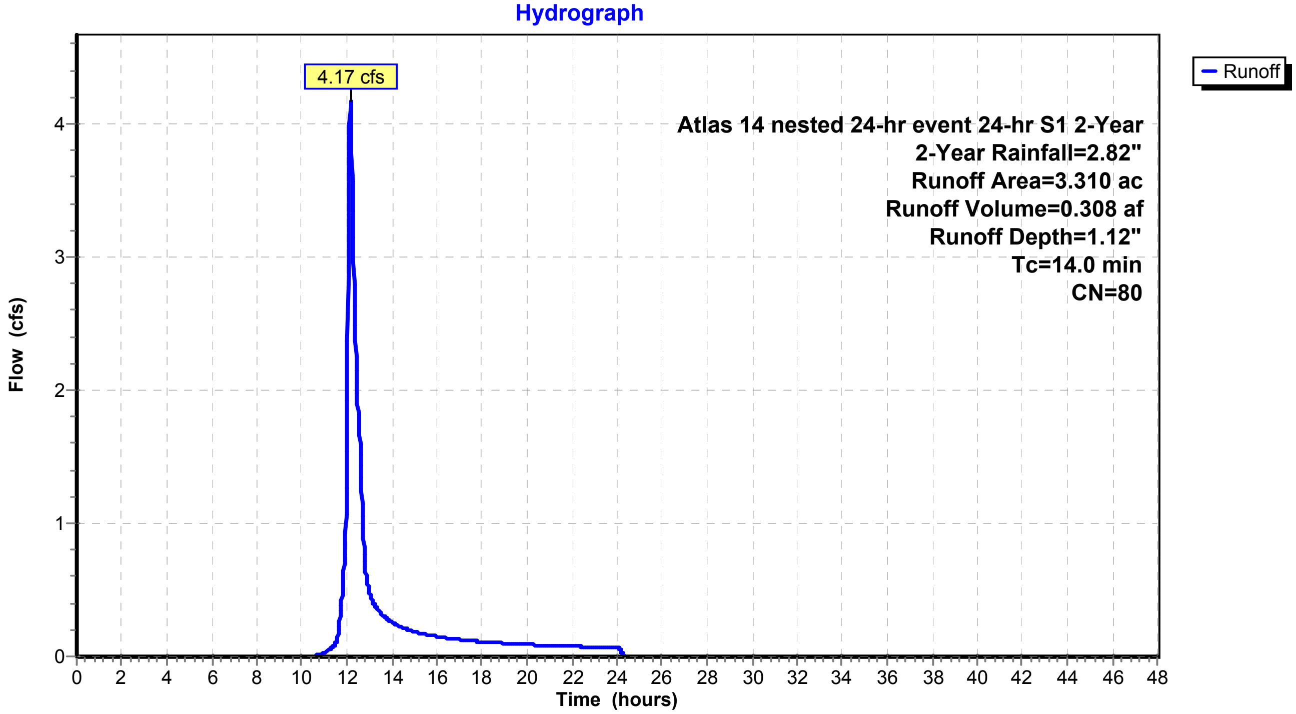
Runoff = 4.17 cfs @ 12.16 hrs, Volume= 0.308 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.310	80	
	3.310		100.00% Pervious Area

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

Subcatchment 12S: Sub-basin 12



Summary for Subcatchment 13S: Sub-basin 13

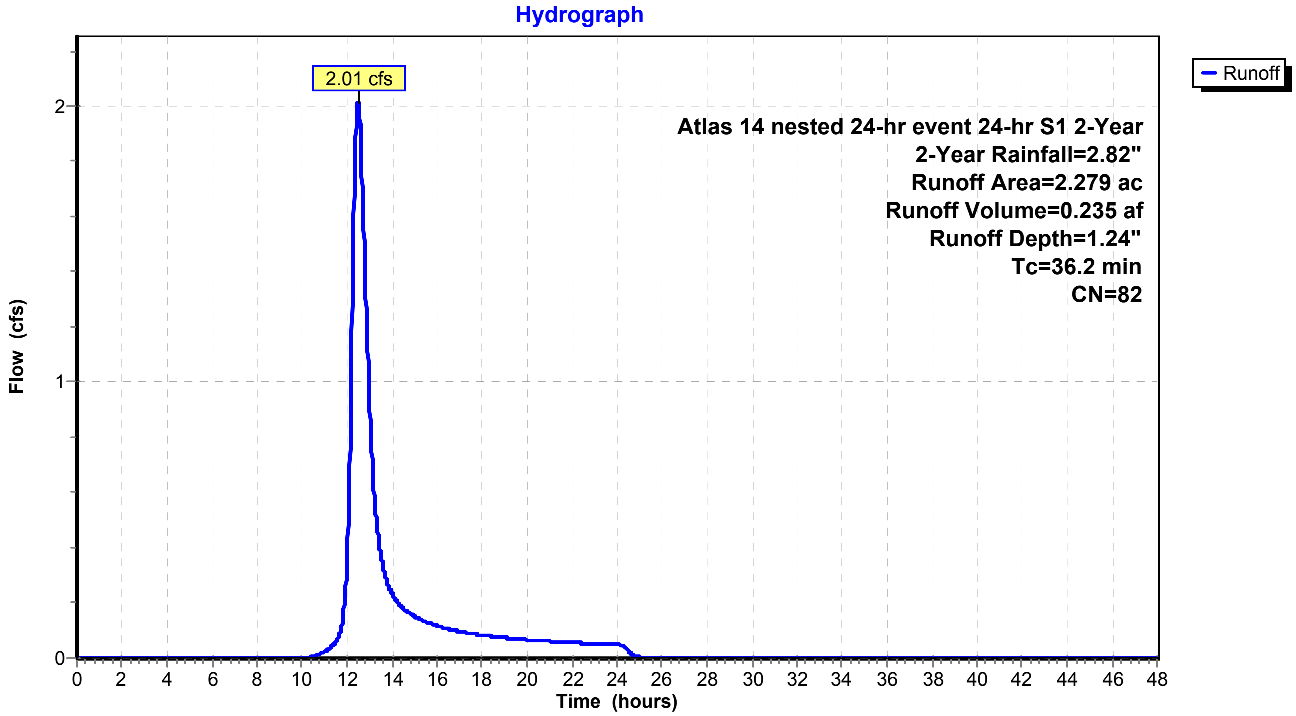
Runoff = 2.01 cfs @ 12.49 hrs, Volume= 0.235 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.279	82	
	2.279		100.00% Pervious Area

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

Subcatchment 13S: Sub-basin 13



Summary for Subcatchment 14S: Sub-basin 14

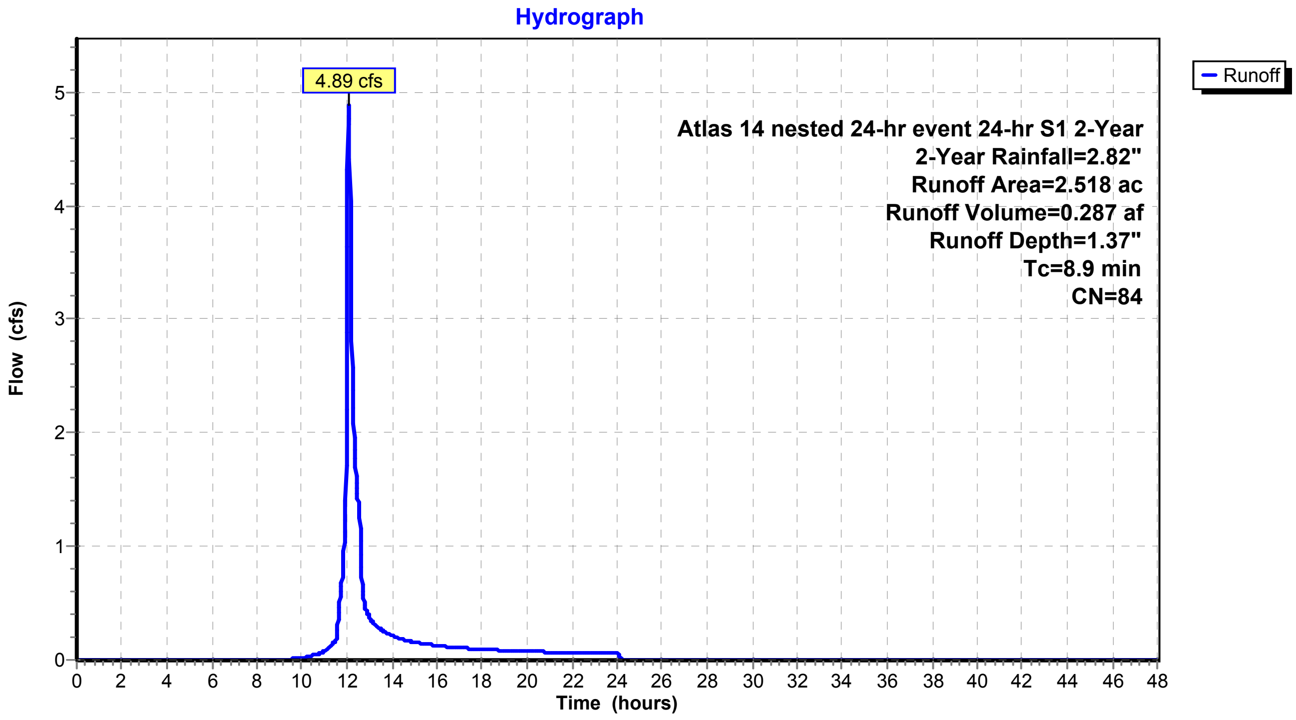
Runoff = 4.89 cfs @ 12.08 hrs, Volume= 0.287 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.518	84	
	2.518		100.00% Pervious Area

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

Subcatchment 14S: Sub-basin 14



Summary for Subcatchment 15S: Sub-basin 15

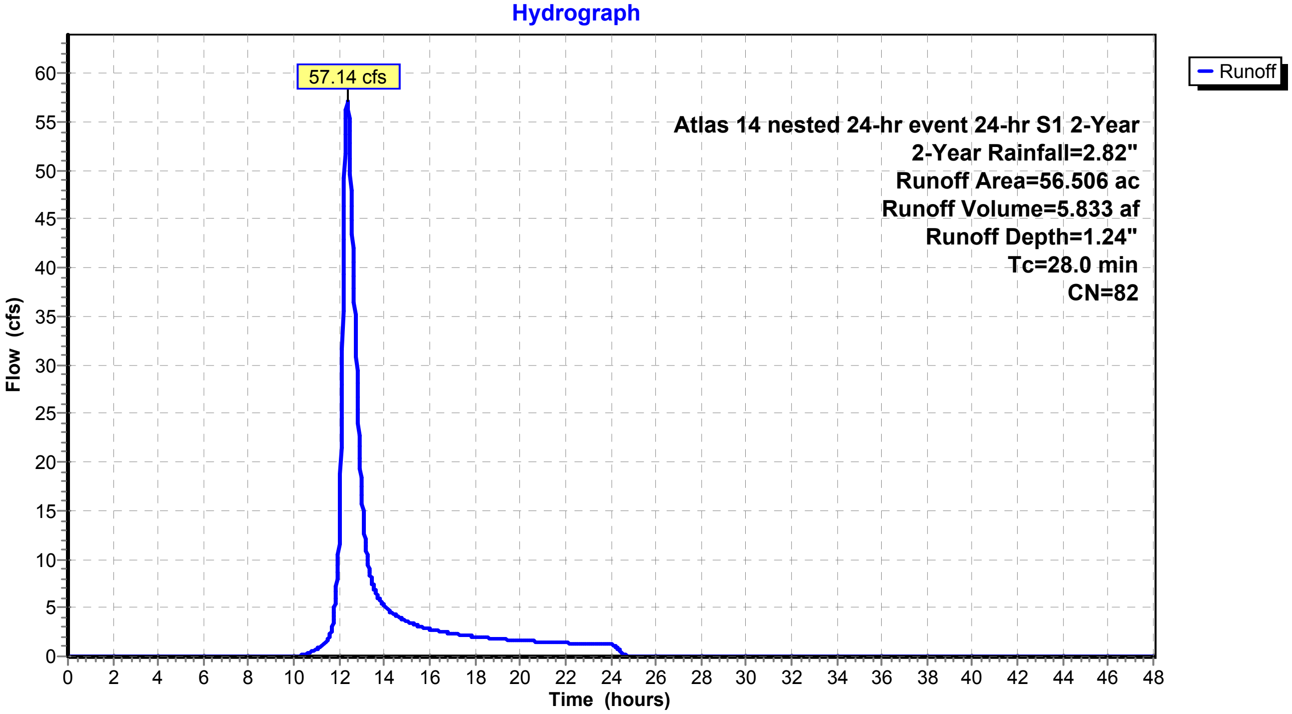
Runoff = 57.14 cfs @ 12.36 hrs, Volume= 5.833 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	56.506	82	
	56.506		100.00% Pervious Area

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

Subcatchment 15S: Sub-basin 15



Summary for Subcatchment 16S: Sub-basin 16

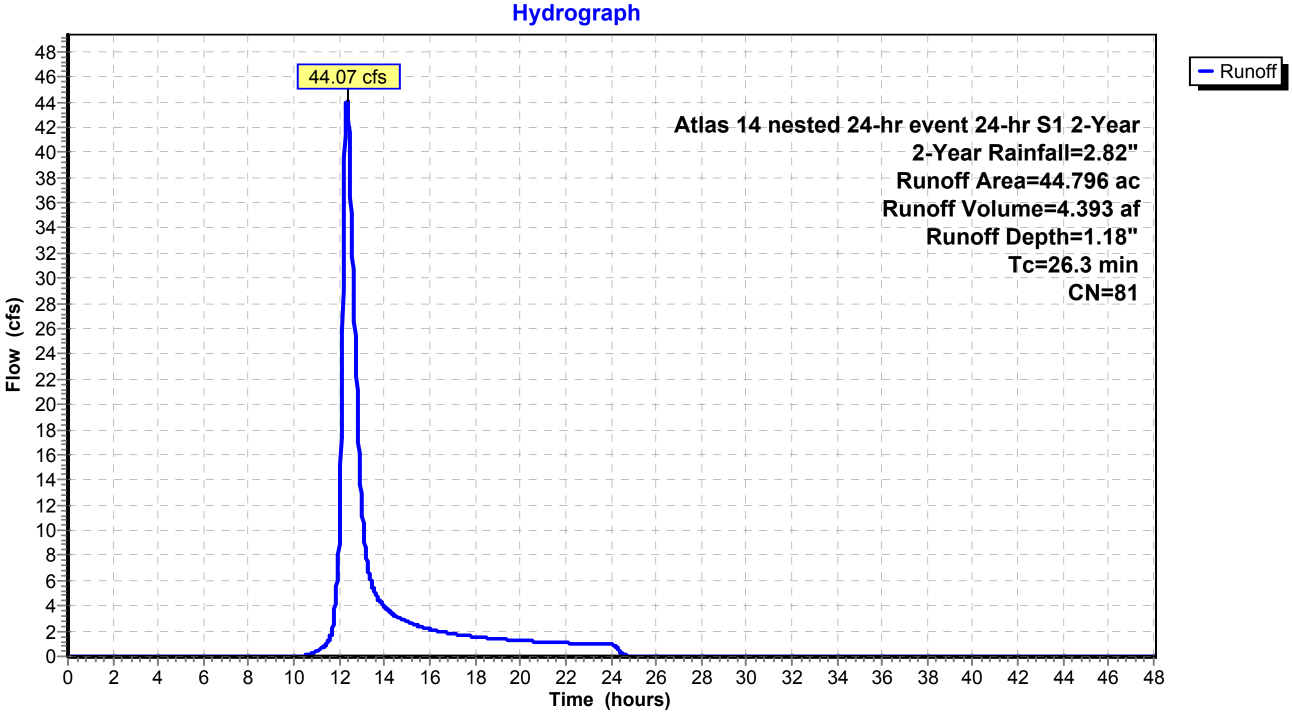
Runoff = 44.07 cfs @ 12.34 hrs, Volume= 4.393 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	44.796	81	
	44.796		100.00% Pervious Area

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

Subcatchment 16S: Sub-basin 16



Summary for Subcatchment 17S: Sub-basin 17

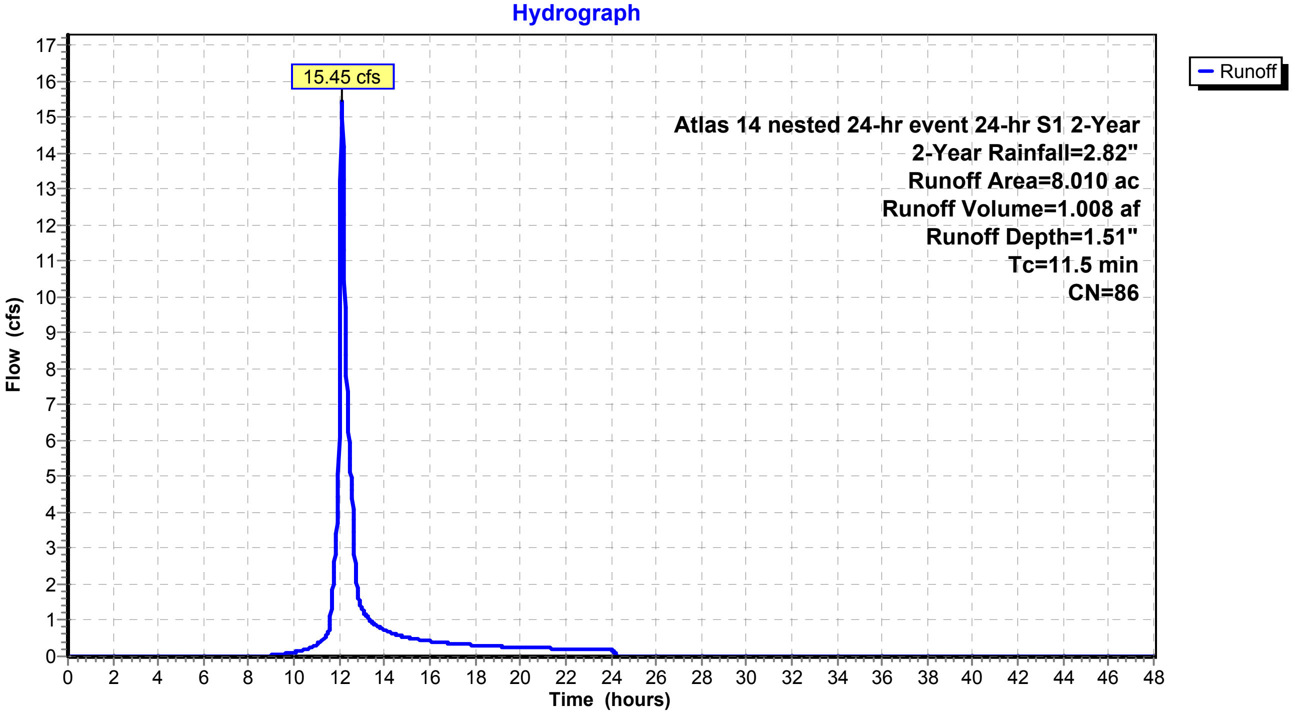
Runoff = 15.45 cfs @ 12.11 hrs, Volume= 1.008 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	8.010	86	
	8.010		100.00% Pervious Area

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

Subcatchment 17S: Sub-basin 17



Summary for Subcatchment 18S: Sub-basin 18

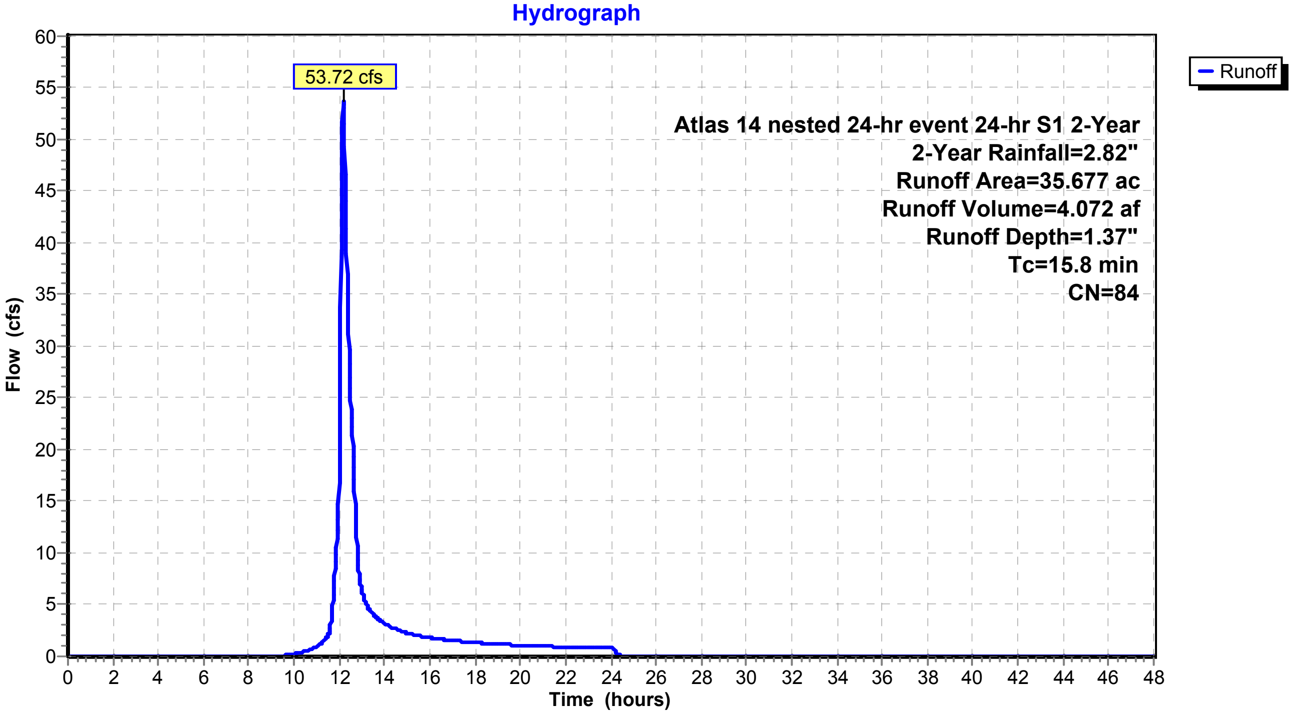
Runoff = 53.72 cfs @ 12.18 hrs, Volume= 4.072 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	35.677	84	
	35.677		100.00% Pervious Area

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

Subcatchment 18S: Sub-basin 18



Summary for Subcatchment 19S: Sub-basin 19

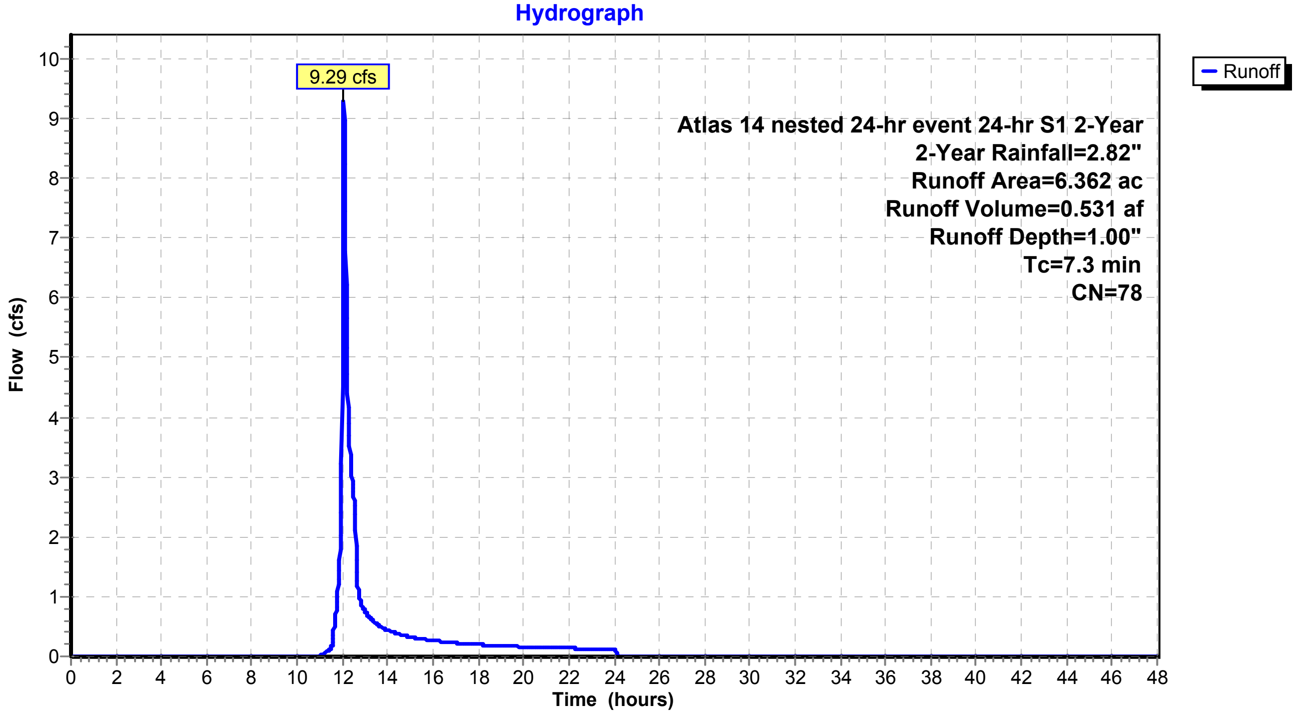
Runoff = 9.29 cfs @ 12.06 hrs, Volume= 0.531 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	6.362	78	
	6.362		100.00% Pervious Area

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

Subcatchment 19S: Sub-basin 19



Summary for Subcatchment 20S: Sub-basin 20

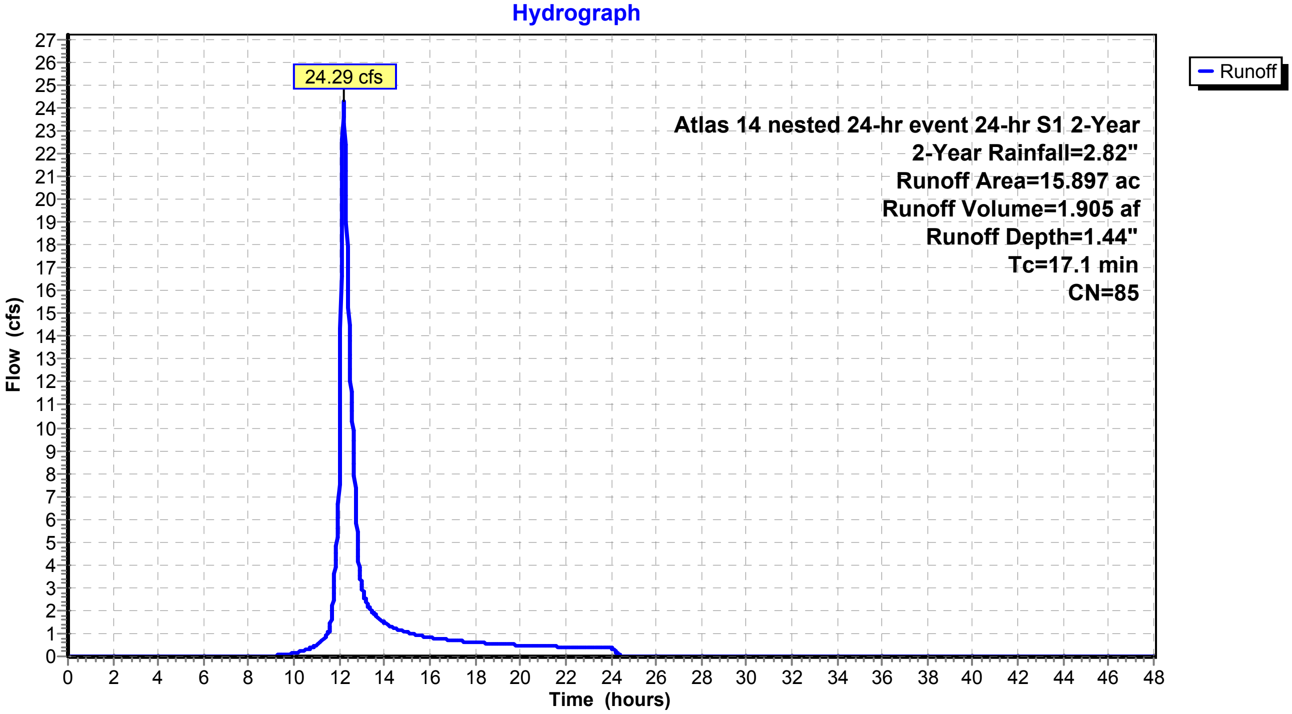
Runoff = 24.29 cfs @ 12.19 hrs, Volume= 1.905 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	15.897	85	
	15.897		100.00% Pervious Area

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

Subcatchment 20S: Sub-basin 20



Summary for Subcatchment 21S: Sub-basin 21

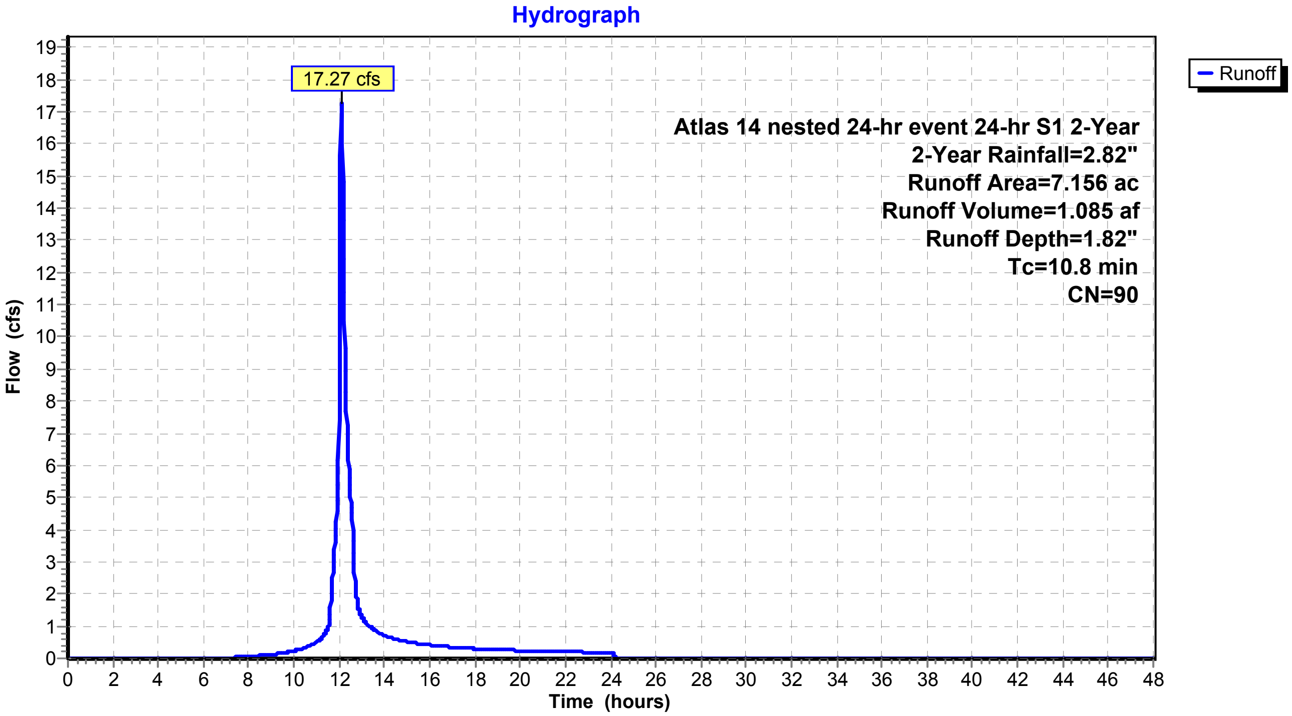
Runoff = 17.27 cfs @ 12.10 hrs, Volume= 1.085 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	7.156	90	
	7.156		100.00% Pervious Area

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

Subcatchment 21S: Sub-basin 21



Summary for Subcatchment 22S: Sub-basin 22

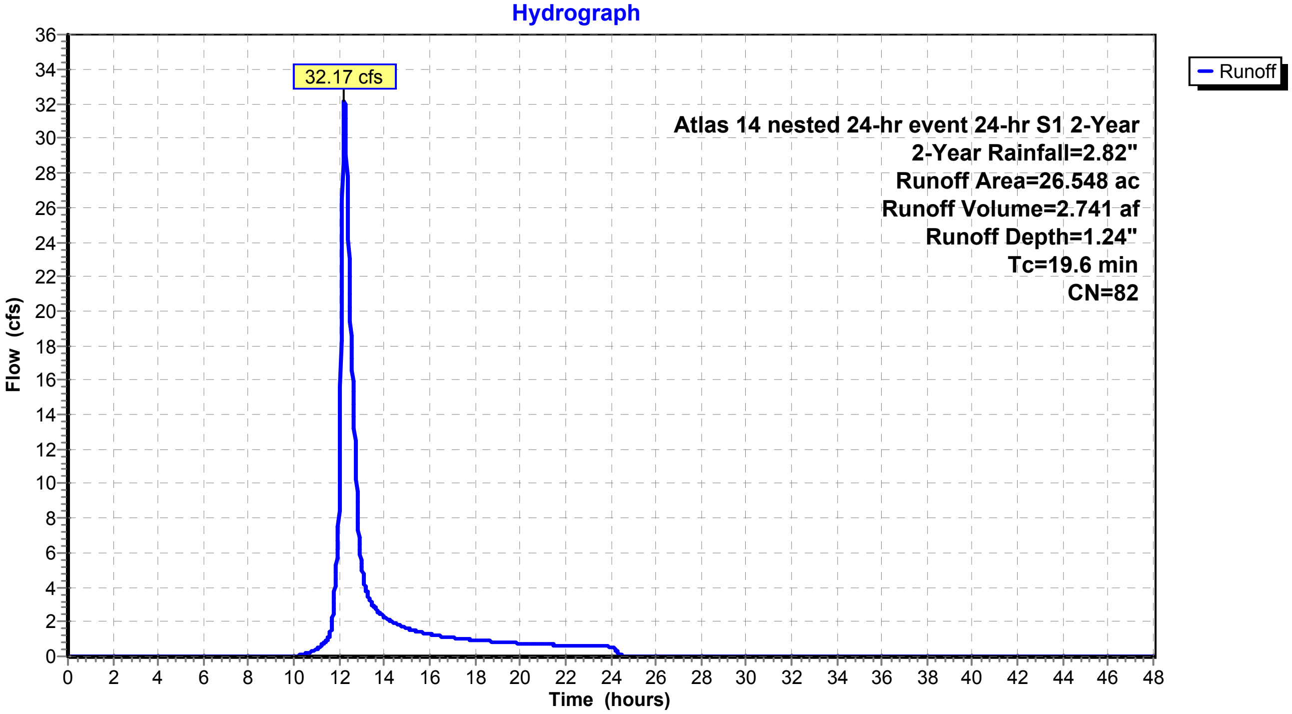
Runoff = 32.17 cfs @ 12.24 hrs, Volume= 2.741 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	26.548	82	
	26.548		100.00% Pervious Area

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

Subcatchment 22S: Sub-basin 22



Summary for Subcatchment 23S: Sub-basin 23

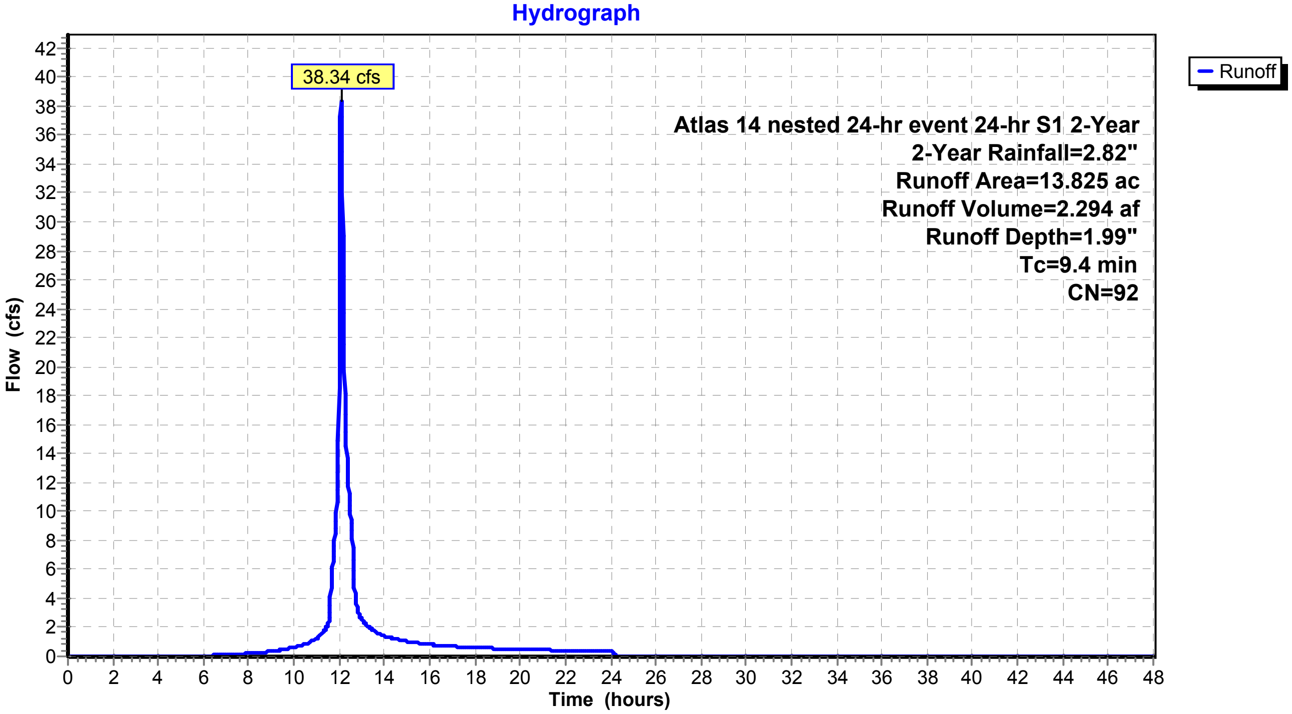
Runoff = 38.34 cfs @ 12.08 hrs, Volume= 2.294 af, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	13.825	92	
	13.825		100.00% Pervious Area

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

Subcatchment 23S: Sub-basin 23



Summary for Subcatchment 24S: Sub-basin 24

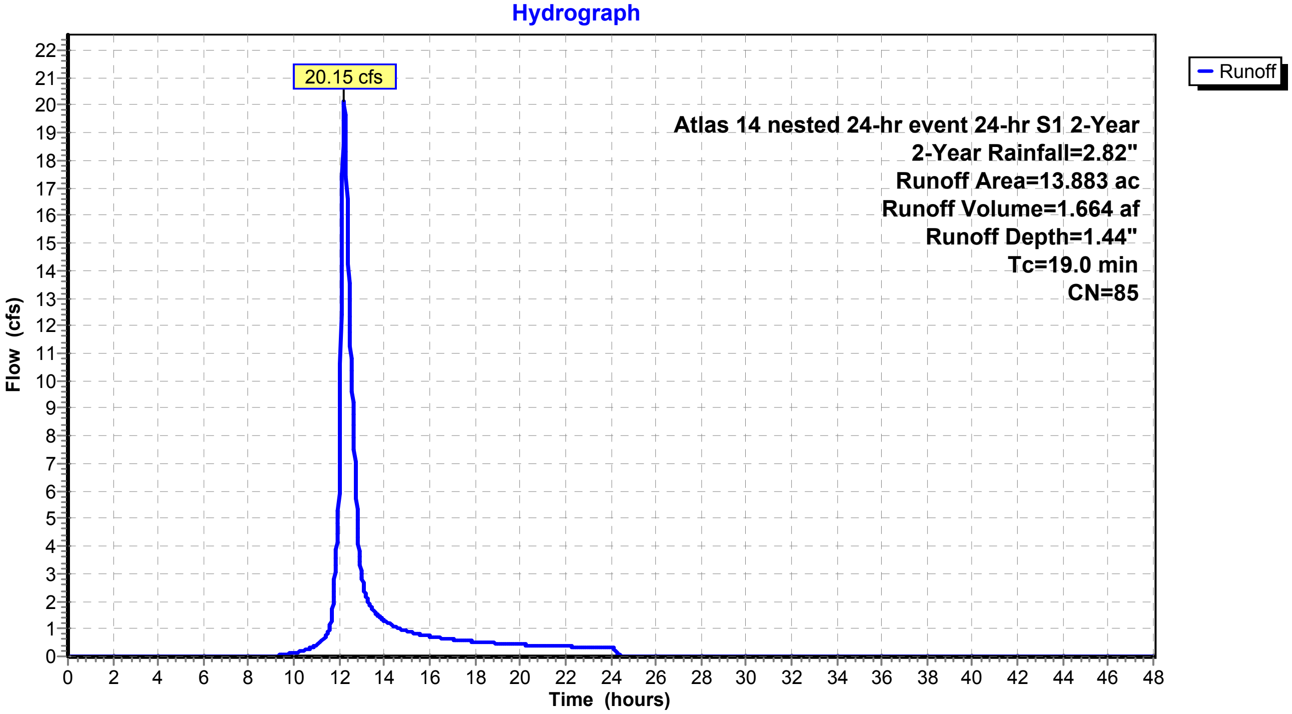
Runoff = 20.15 cfs @ 12.22 hrs, Volume= 1.664 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	13.883	85	
	13.883		100.00% Pervious Area

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

Subcatchment 24S: Sub-basin 24



Summary for Subcatchment 25S: Sub-basin 25

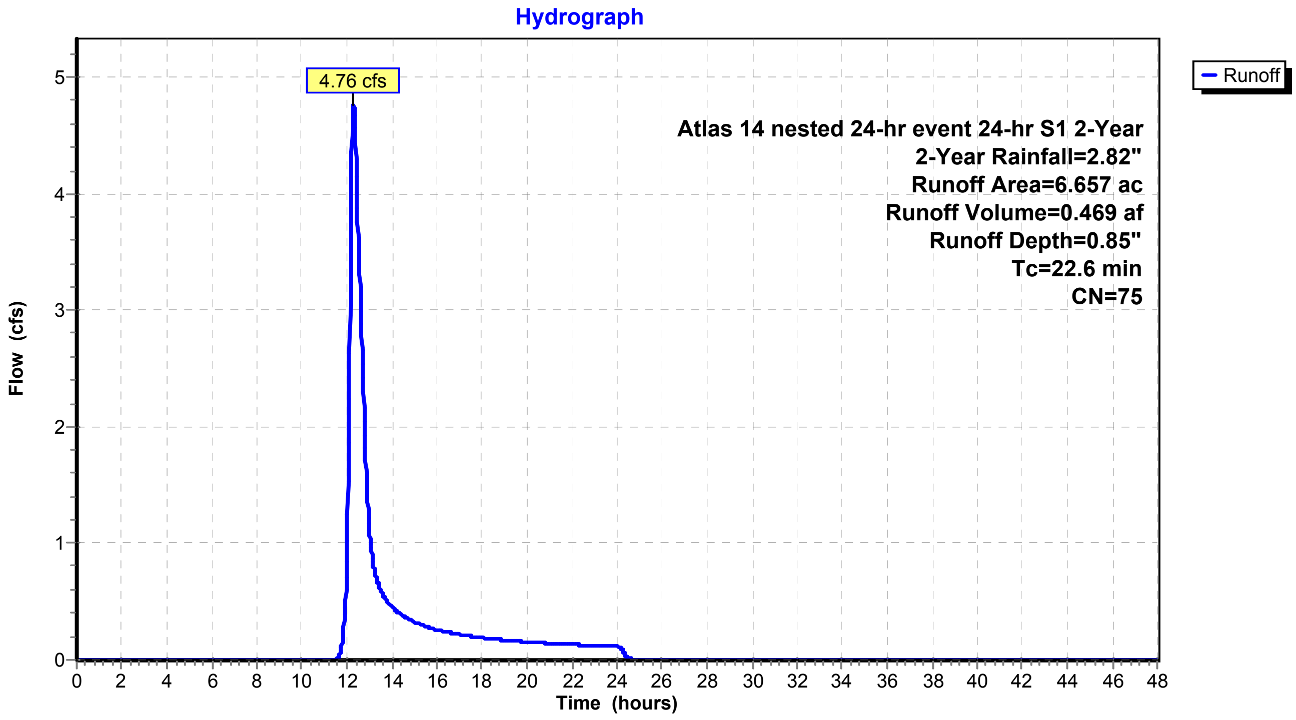
Runoff = 4.76 cfs @ 12.30 hrs, Volume= 0.469 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	6.657	75	
	6.657		100.00% Pervious Area

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

Subcatchment 25S: Sub-basin 25



Summary for Subcatchment 26S: Sub-basin 26

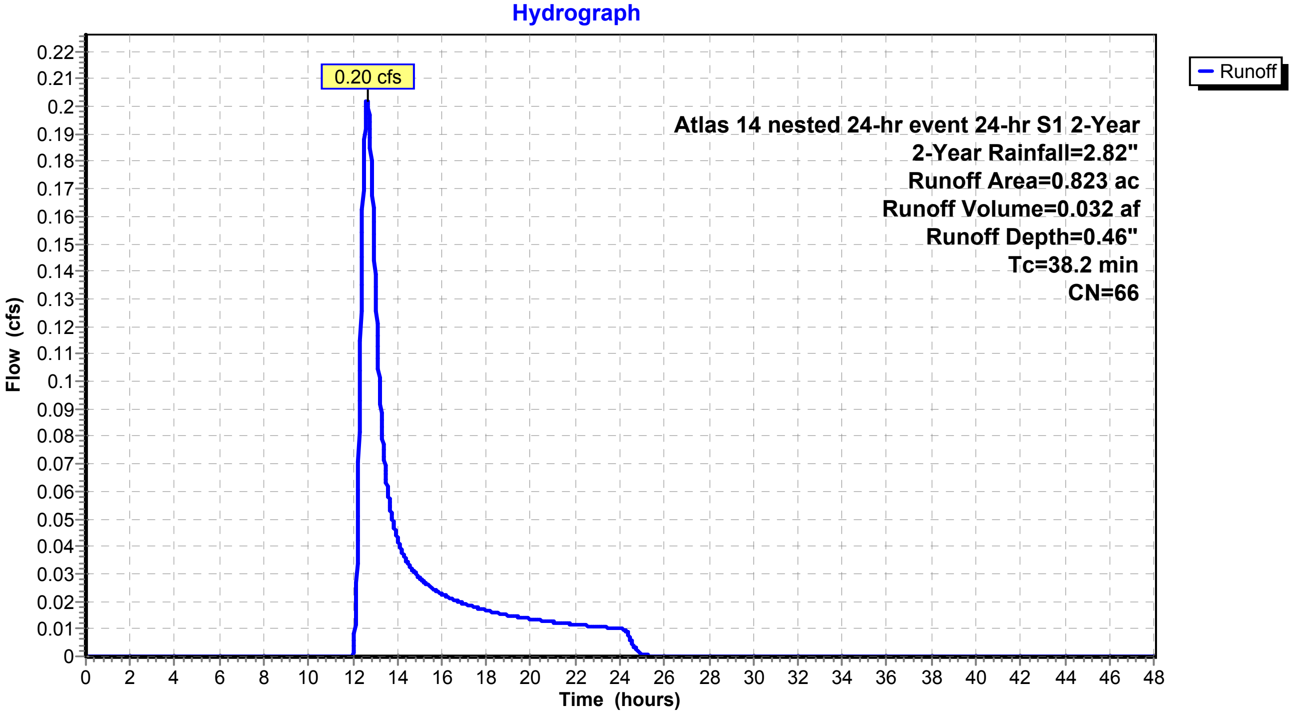
Runoff = 0.20 cfs @ 12.64 hrs, Volume= 0.032 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.823	66	
	0.823		100.00% Pervious Area

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

Subcatchment 26S: Sub-basin 26



Summary for Subcatchment 27S: Sub-basin 27

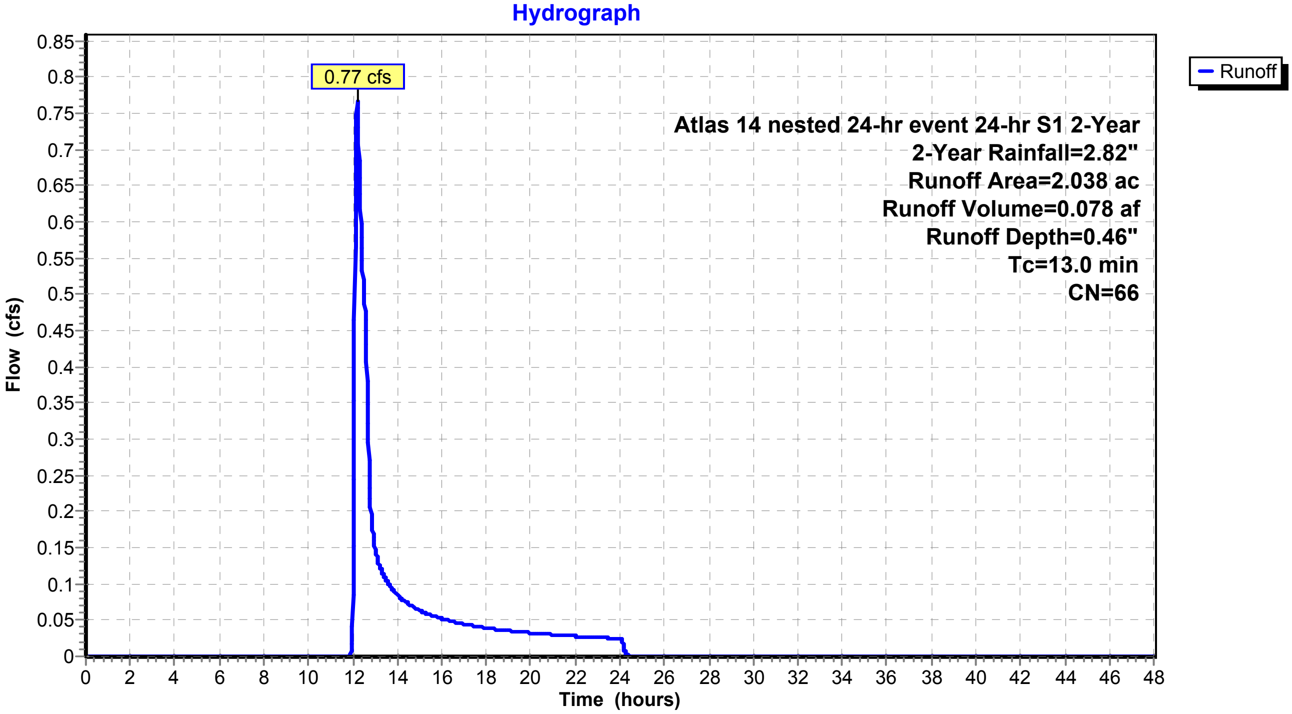
Runoff = 0.77 cfs @ 12.19 hrs, Volume= 0.078 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.038	66	
	2.038		100.00% Pervious Area

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

Subcatchment 27S: Sub-basin 27



Summary for Subcatchment 28S: Sub-basin 28

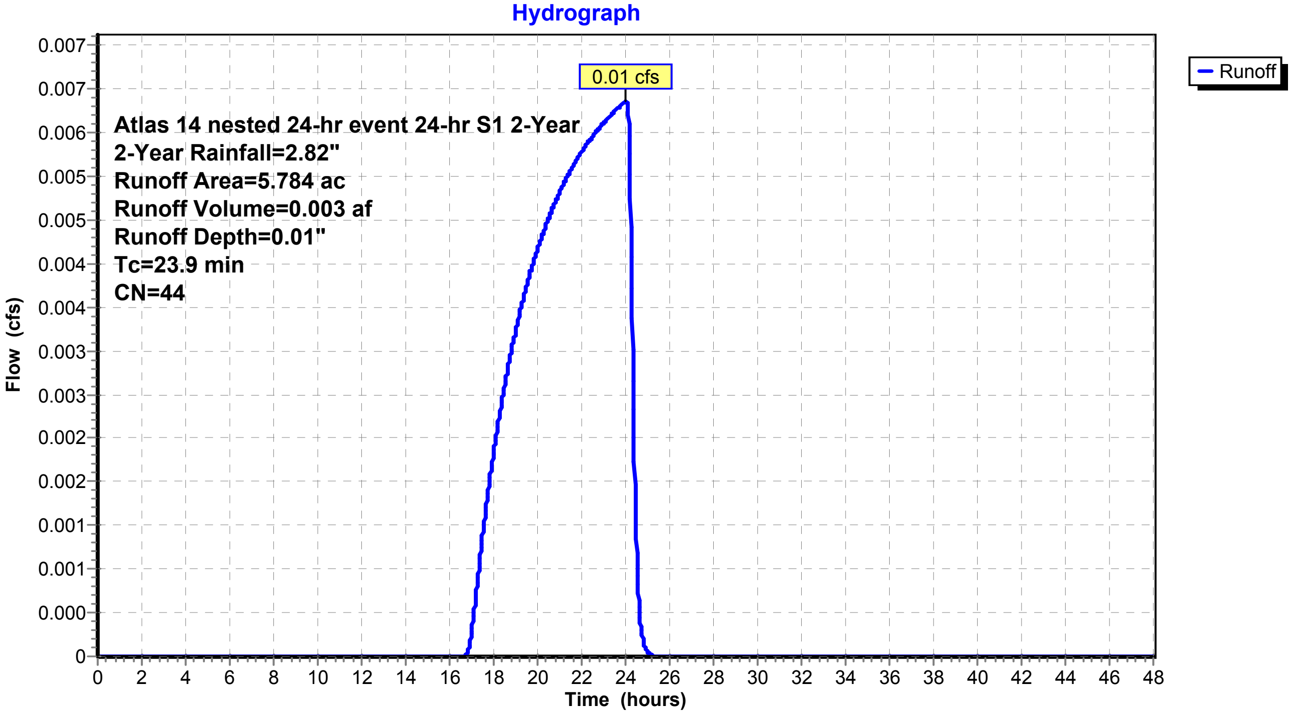
Runoff = 0.01 cfs @ 24.03 hrs, Volume= 0.003 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	5.784	44	
	5.784		100.00% Pervious Area

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

Subcatchment 28S: Sub-basin 28



Summary for Subcatchment 29S: Sub-basin 29

[45] Hint: Runoff=Zero

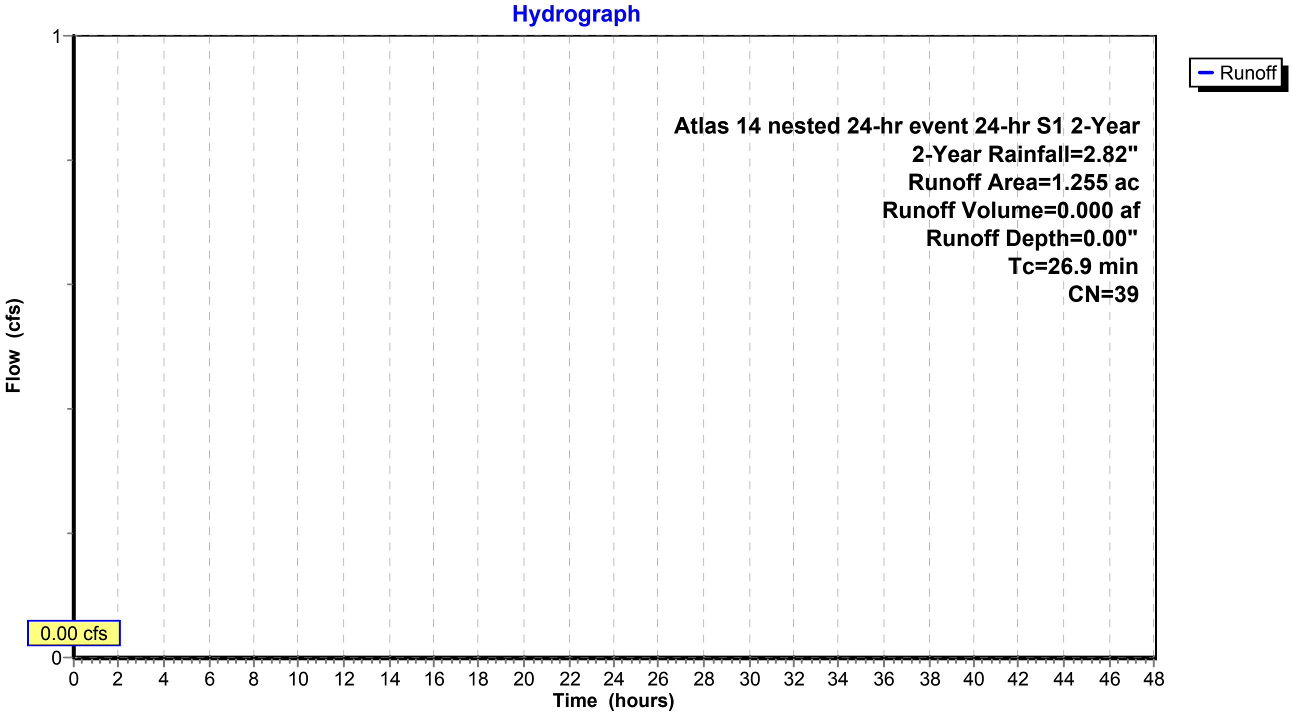
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	1.255	39	
	1.255		100.00% Pervious Area

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

Subcatchment 29S: Sub-basin 29



Summary for Subcatchment 30S: Sub-basin 30

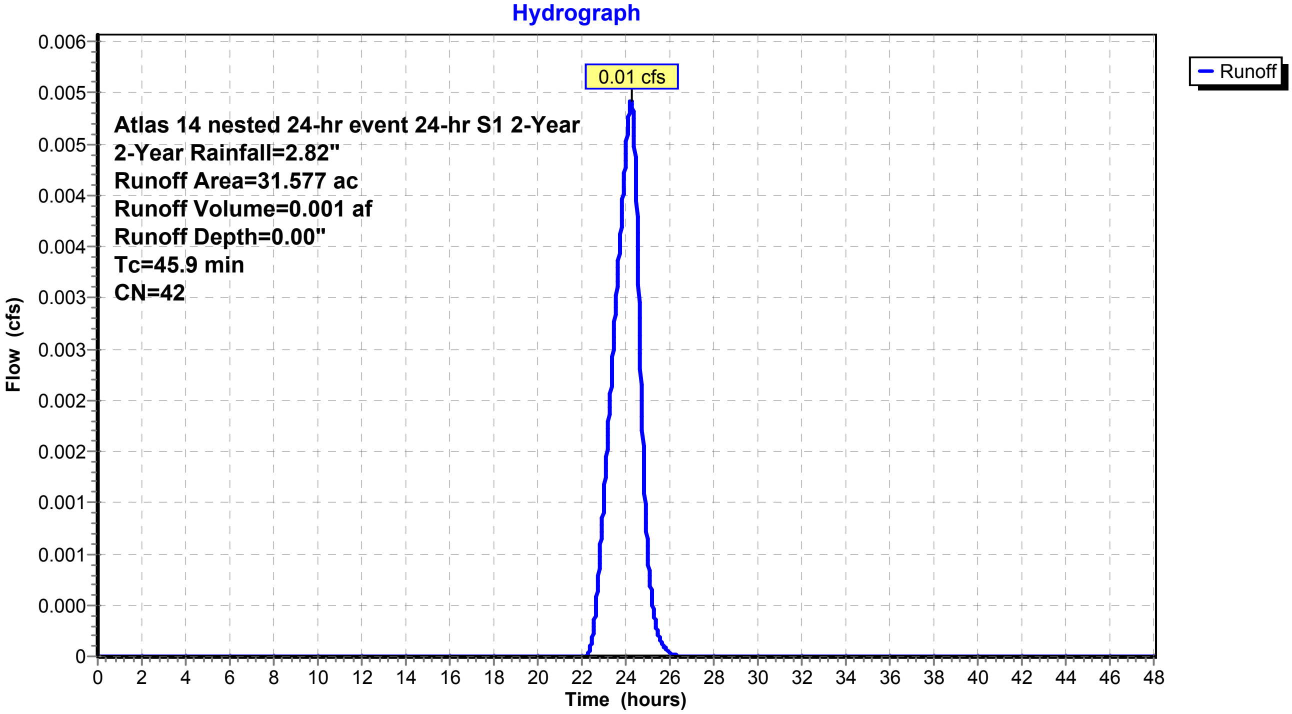
Runoff = 0.01 cfs @ 24.23 hrs, Volume= 0.001 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	31.577	42	
	31.577		100.00% Pervious Area

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

Subcatchment 30S: Sub-basin 30



Summary for Subcatchment 31S: Sub-basin 31

[45] Hint: Runoff=Zero

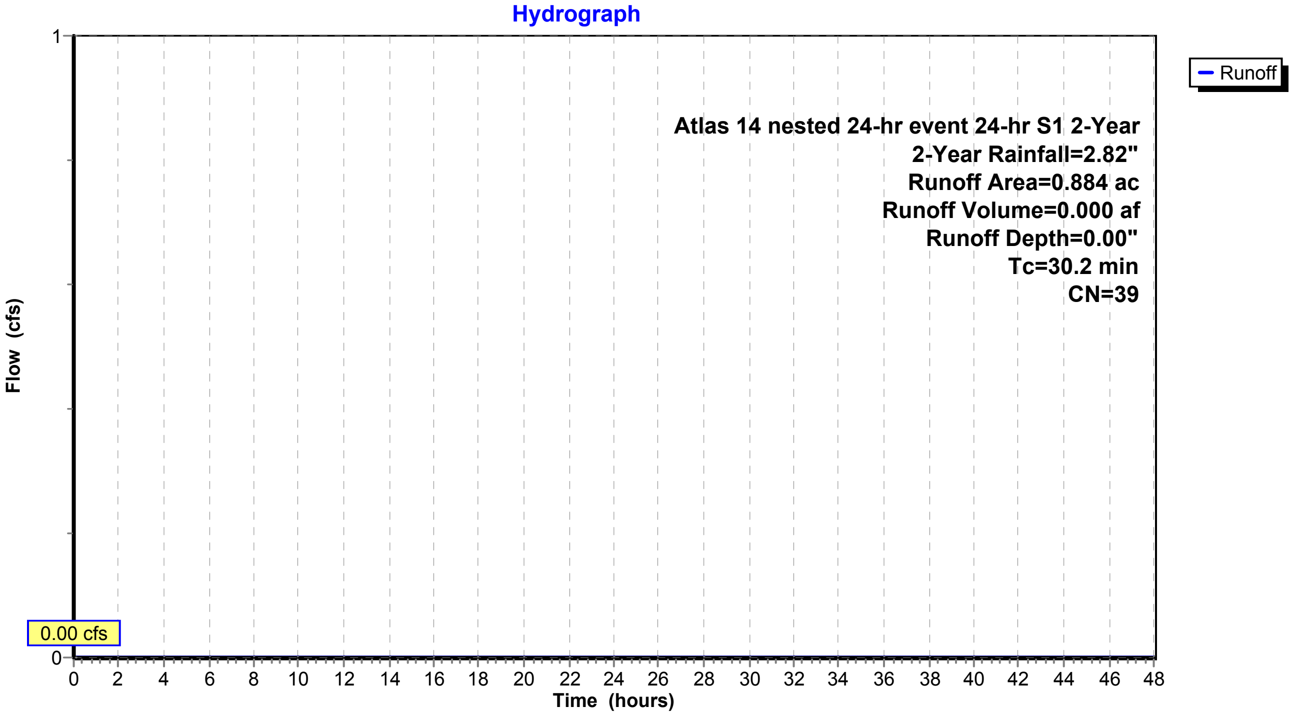
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.884	39	
	0.884		100.00% Pervious Area

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

Subcatchment 31S: Sub-basin 31



Summary for Subcatchment 32S: Sub-basin 32

[45] Hint: Runoff=Zero

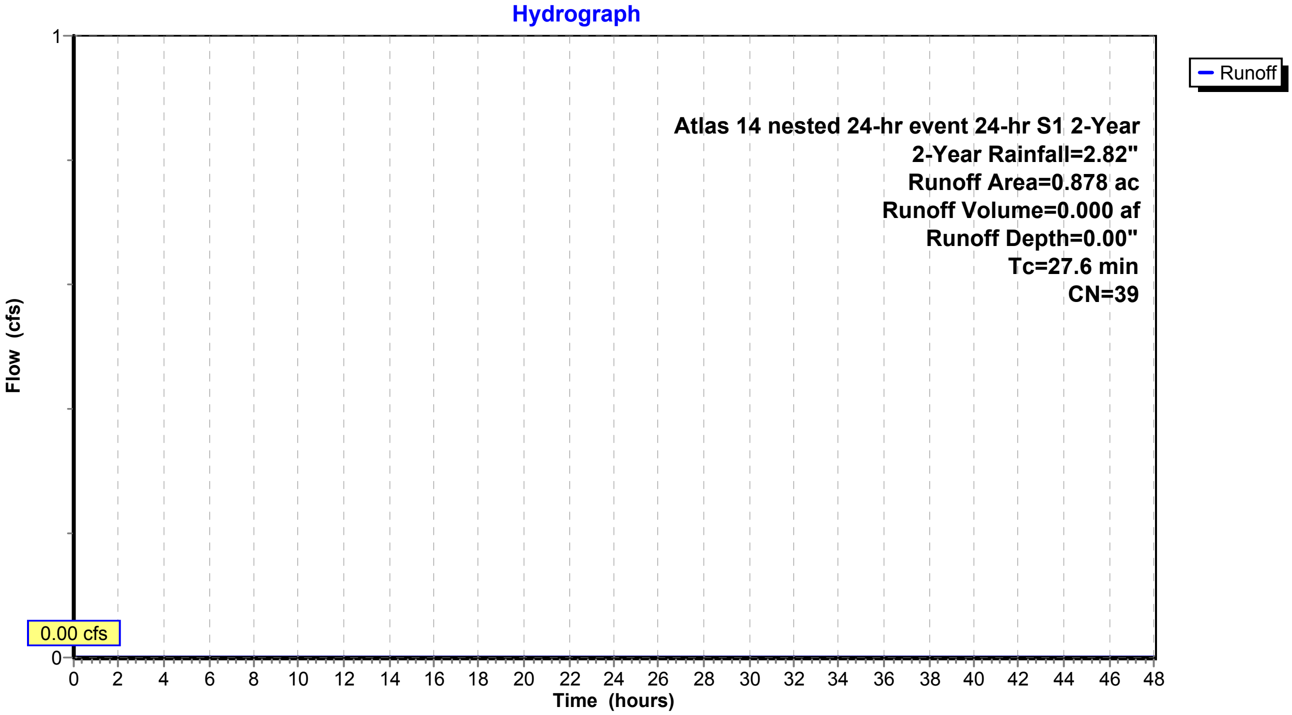
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.878	39	
	0.878		100.00% Pervious Area

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

Subcatchment 32S: Sub-basin 32



Summary for Subcatchment 33S: Sub-basin 33

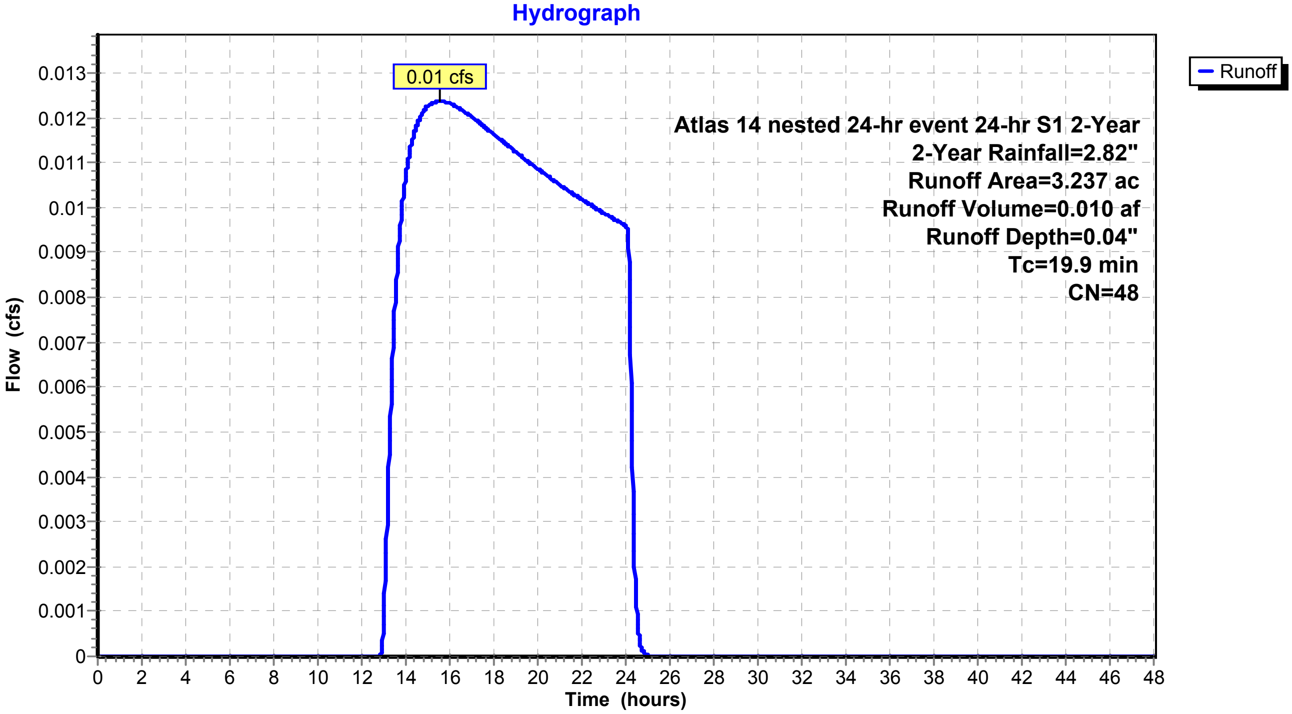
Runoff = 0.01 cfs @ 15.50 hrs, Volume= 0.010 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.237	48	
	3.237		100.00% Pervious Area

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

Subcatchment 33S: Sub-basin 33



Summary for Subcatchment 34S: Sub-basin 34

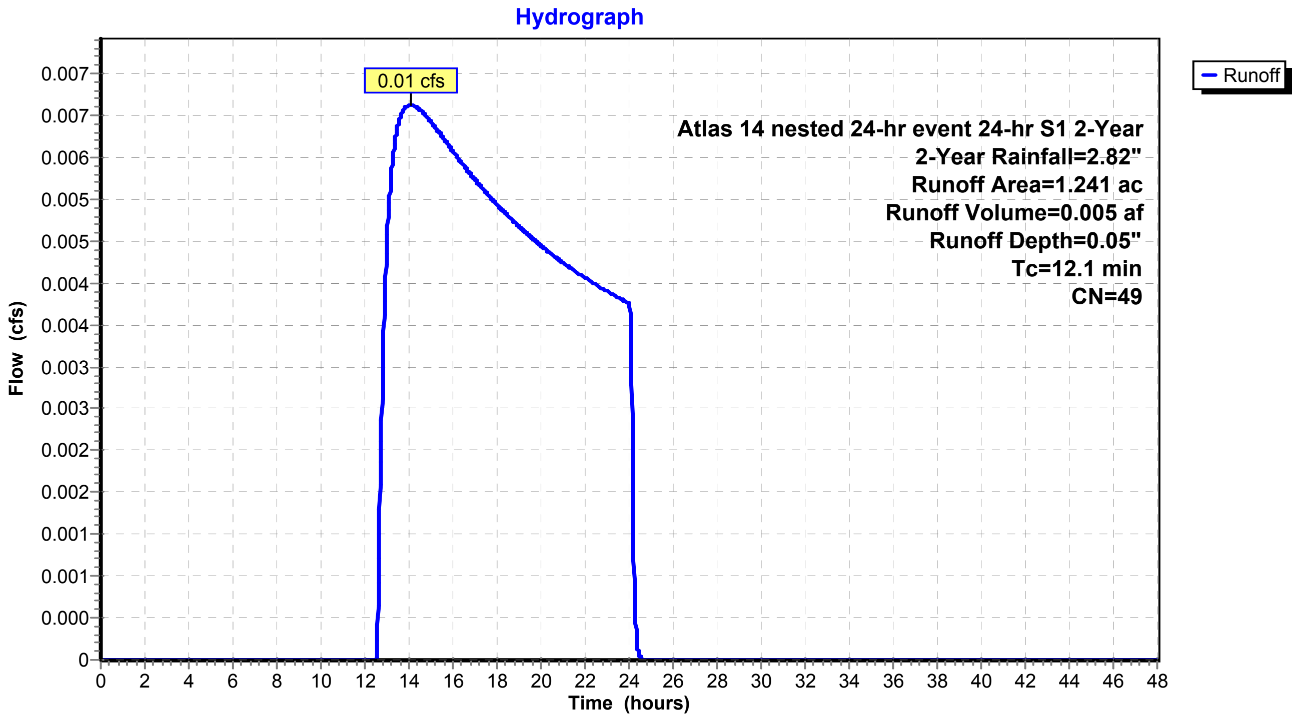
Runoff = 0.01 cfs @ 14.09 hrs, Volume= 0.005 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	1.241	49	
	1.241		100.00% Pervious Area

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

Subcatchment 34S: Sub-basin 34



Summary for Subcatchment 35S: Sub-basin 35

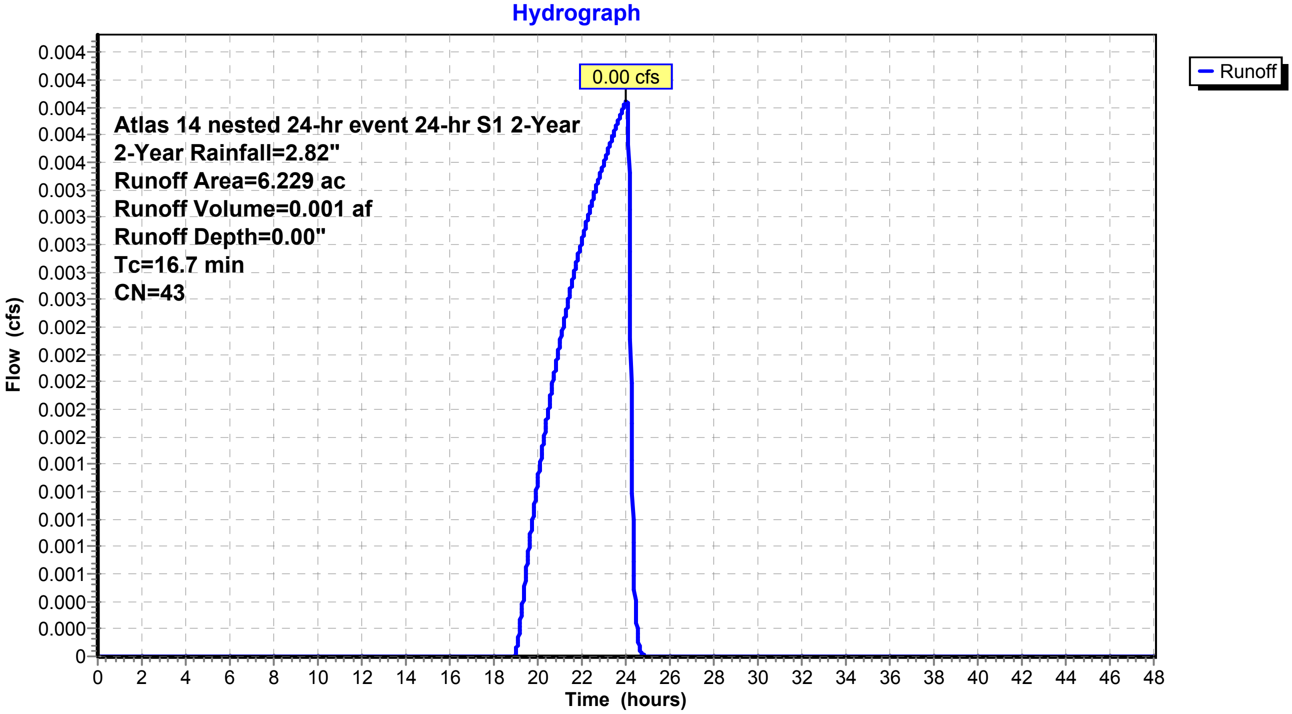
Runoff = 0.00 cfs @ 24.02 hrs, Volume= 0.001 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	6.229	43	
	6.229		100.00% Pervious Area

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

Subcatchment 35S: Sub-basin 35



Summary for Subcatchment 36S: Sub-basin 36

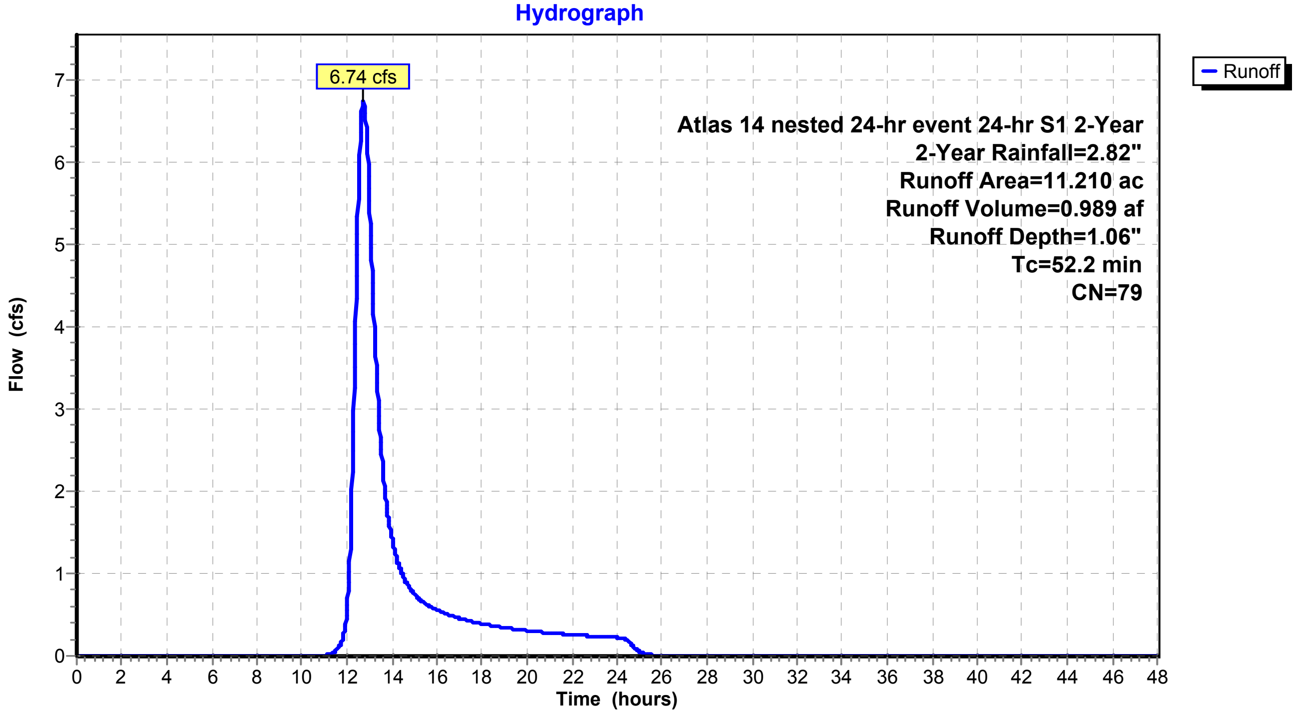
Runoff = 6.74 cfs @ 12.72 hrs, Volume= 0.989 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	11.210	79	
	11.210		100.00% Pervious Area

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

Subcatchment 36S: Sub-basin 36



Summary for Subcatchment 83S: County Road H Subbasin Redirected After Regrading

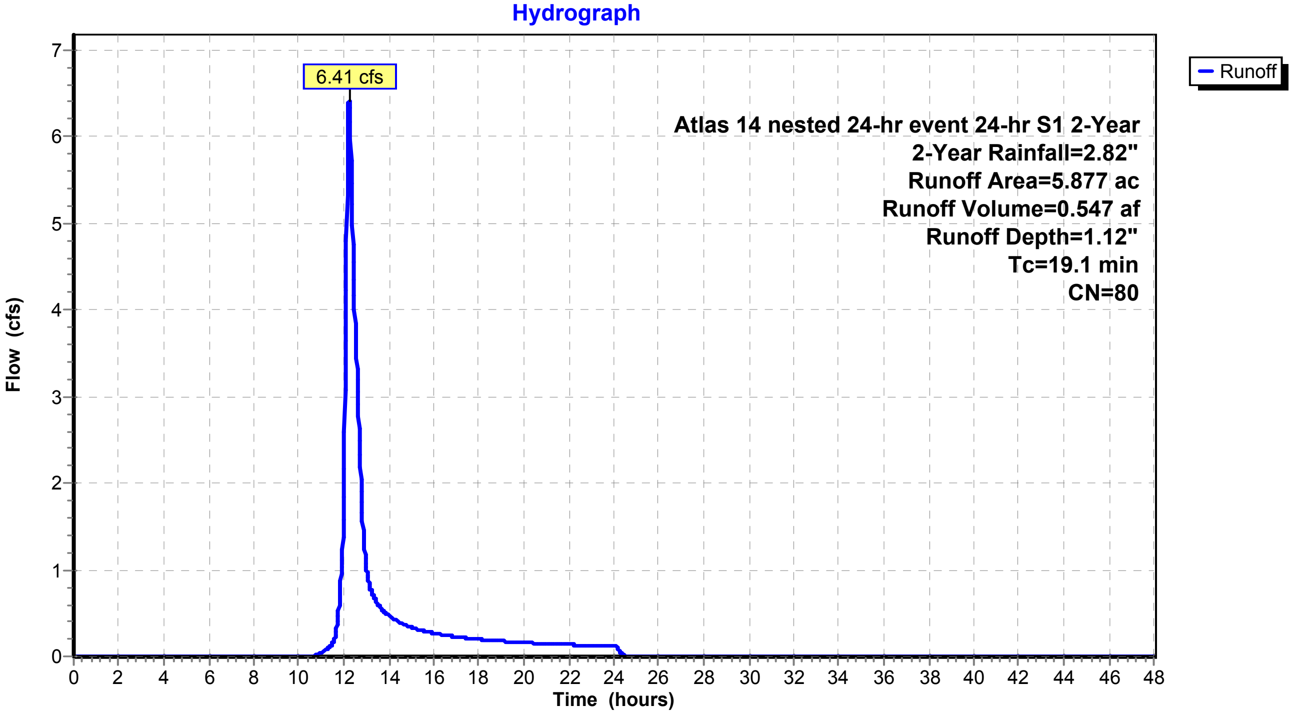
Runoff = 6.41 cfs @ 12.23 hrs, Volume= 0.547 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 2-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	5.877	80	
	5.877		100.00% Pervious Area

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

Subcatchment 83S: County Road H Subbasin Redirected After Regrading



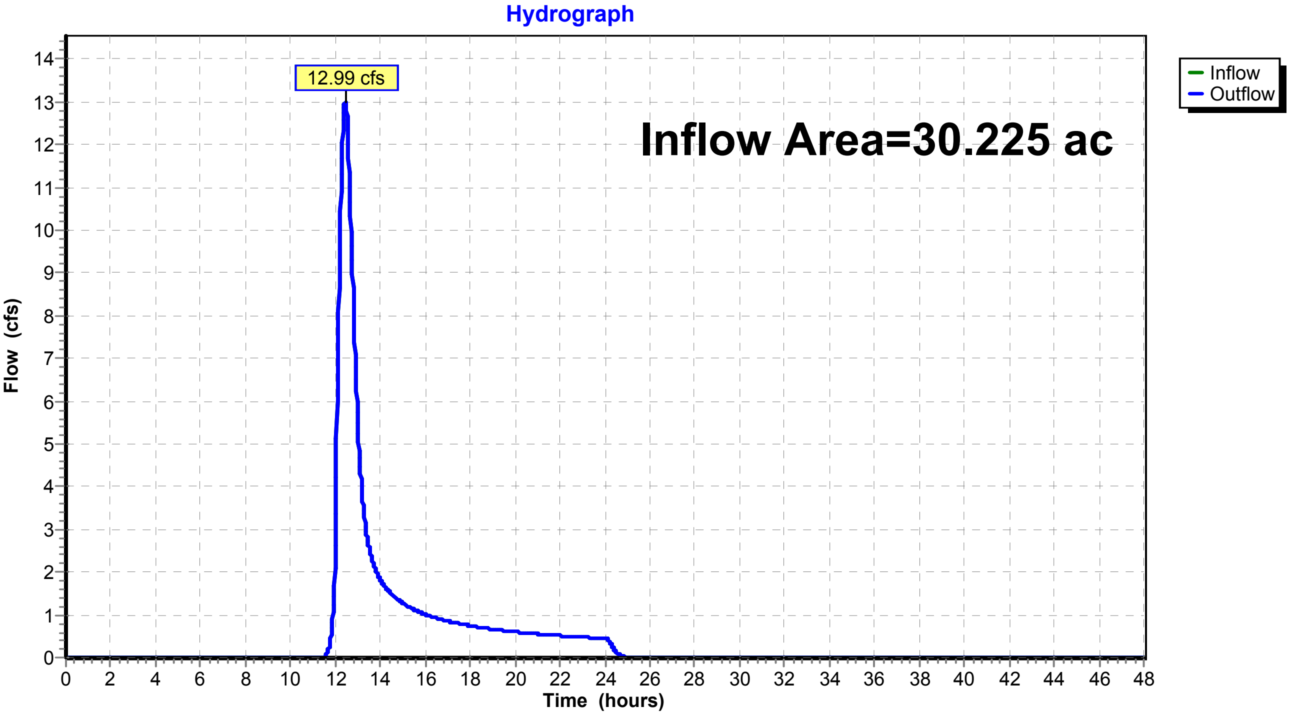
Summary for Reach 37R: Outfall of SB 2, 3, 7

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       30.225 ac,   0.00% Impervious,  Inflow Depth =   0.68"    for  2-Year event
Inflow       =      12.99 cfs @   12.44 hrs,  Volume=            1.708 af
Outflow      =      12.99 cfs @   12.44 hrs,  Volume=            1.708 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 37R: Outfall of SB 2, 3, 7



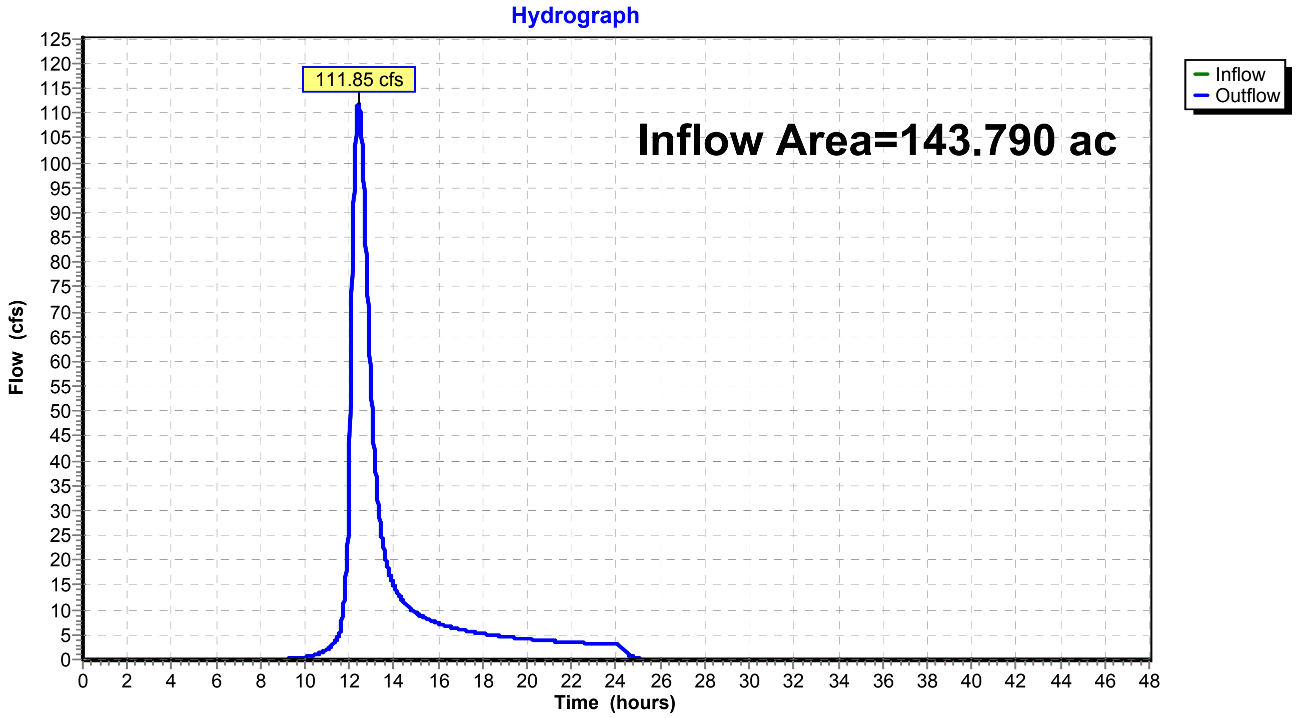
Summary for Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 143.790 ac, 0.00% Impervious, Inflow Depth = 1.25" for 2-Year event
Inflow = 111.85 cfs @ 12.41 hrs, Volume= 14.937 af
Outflow = 111.85 cfs @ 12.41 hrs, Volume= 14.937 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36



Summary for Reach 40R: 60 in SB 4

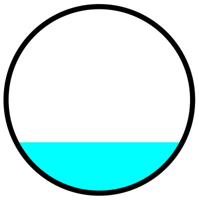
[52] Hint: Inlet/Outlet conditions not evaluated
[65] Warning: Inlet elevation not specified
[88] Warning: Qout>Qin may require Finer Routing>1

```
Inflow Area =      143.790 ac,    0.00% Impervious,  Inflow Depth =   1.25"    for  2-Year event
Inflow       =      111.84 cfs @   12.40 hrs,  Volume=          14.937 af
Outflow      =      111.85 cfs @   12.41 hrs,  Volume=          14.937 af,  Atten= 0%,  Lag= 0.4 min
```

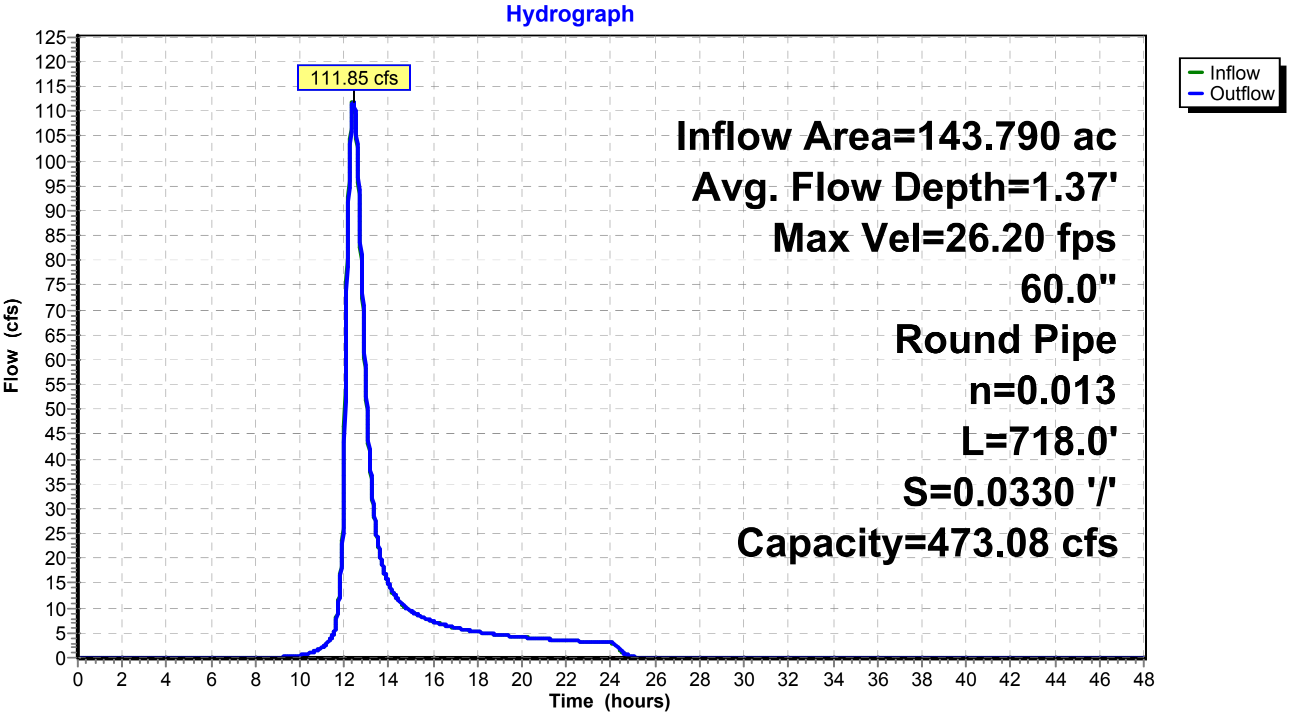
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 83.88 cfs Estimated Depth= 1.43' Velocity= 18.18 fps
m= 1.416, c= 25.74 fps, dt= 1.2 min, dx= 718.0' / 1 = 718.0', K= 0.5 min, X= 0.479
Max. Velocity= 26.20 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 25.74 fps, Avg. Travel Time= 0.5 min

Peak Storage= 3,119 cf @ 12.40 hrs
Average Depth at Peak Storage= 1.37'
Bank-Full Depth= 5.00' Flow Area= 19.6 sf, Capacity= 473.08 cfs

60.0" Round Pipe
n= 0.013
Length= 718.0'   Slope= 0.0330 '/'
Inlet Invert= 0.00', Outlet Invert= -23.69'



Reach 40R: 60 in SB 4



Summary for Reach 41R: Channel in SB 9, 10

[65] Warning: Inlet elevation not specified

```
Inflow Area =        9.296 ac,    0.00% Impervious,  Inflow Depth =   1.24"    for  2-Year event
Inflow      =       13.79 cfs @   12.13 hrs,  Volume=           0.960 af
Outflow     =       12.78 cfs @   12.39 hrs,  Volume=           0.960 af,  Atten= 7%,  Lag= 15.3 min
```

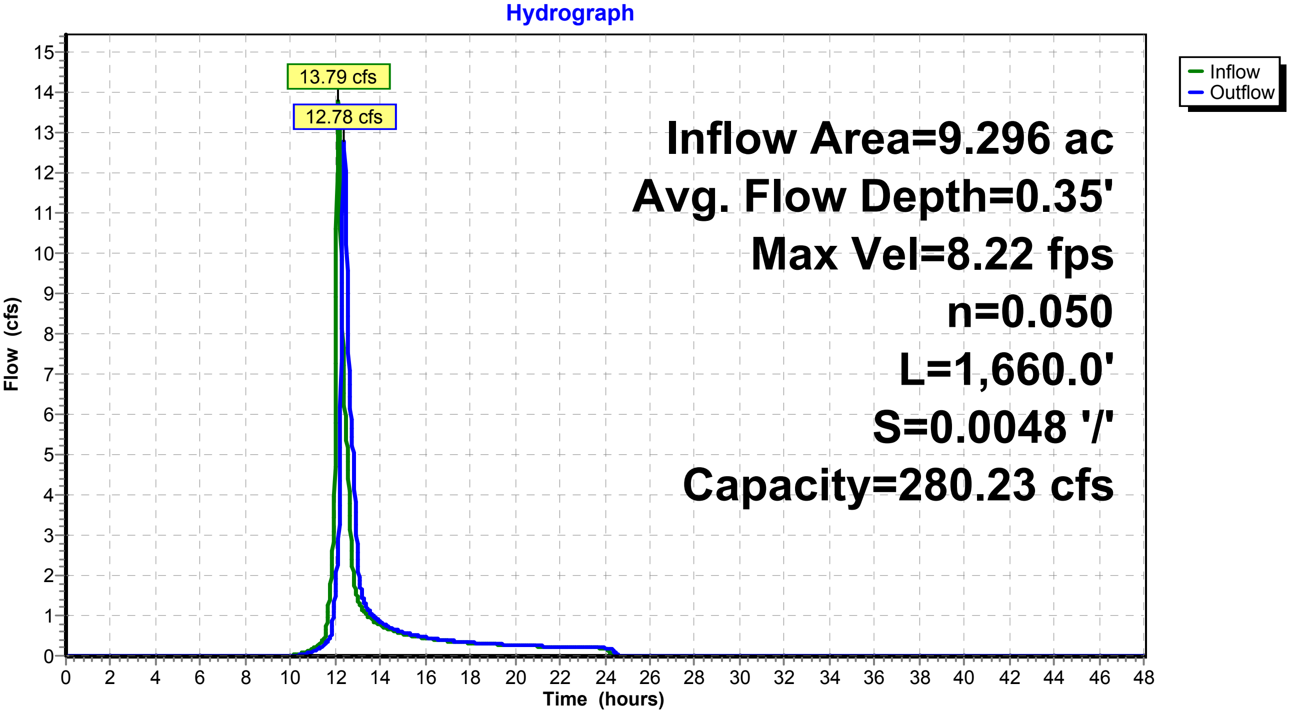
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 10.34 cfs Estimated Depth= 0.49' Velocity= 1.18 fps
m= 1.584, c= 1.88 fps, dt= 1.2 min, dx= 1,660.0' / 12 = 138.3', K= 1.2 min, X= 0.269
Max. Velocity= 8.22 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.96 fps, Avg. Travel Time= 14.1 min

Peak Storage= 10,181 cf @ 12.29 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 3.00' Flow Area= 84.0 sf, Capacity= 280.23 cfs

16.00' x 3.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/' Top Width= 40.00'
Length= 1,660.0' Slope= 0.0048 '/'
Inlet Invert= 0.00', Outlet Invert= -7.97'

‡

Reach 41R: Channel in SB 9, 10



Summary for Reach 46R: Channel SB1

[65] Warning: Inlet elevation not specified

```
Inflow Area =        15.328 ac,    0.00% Impervious,  Inflow Depth =   1.58"    for  2-Year event
Inflow      =        26.50 cfs @   12.18 hrs,  Volume=            2.022 af
Outflow     =        26.13 cfs @   12.27 hrs,  Volume=            2.022 af,  Atten= 1%,  Lag= 5.2 min
```

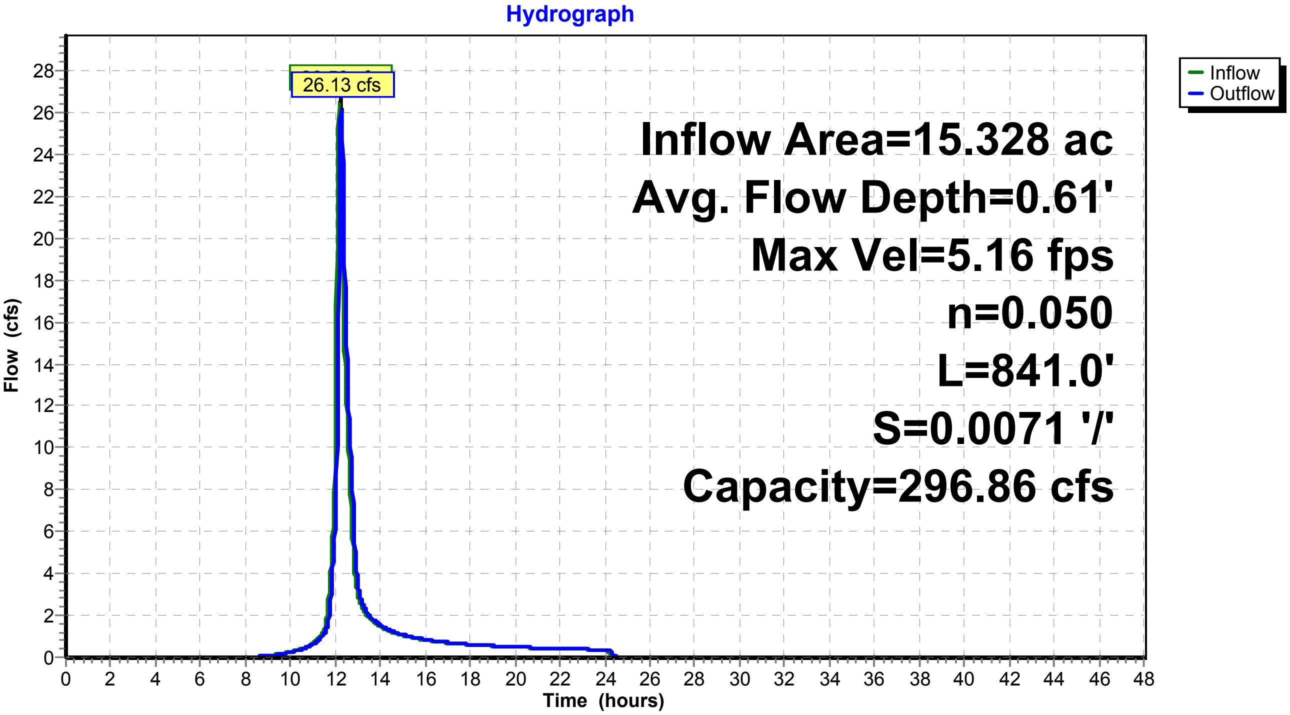
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 19.87 cfs Estimated Depth= 0.71' Velocity= 1.77 fps
m= 1.540, c= 2.73 fps, dt= 1.2 min, dx= 841.0' / 4 = 210.3', K= 1.3 min, X= 0.346
Max. Velocity= 5.16 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 2.74 fps, Avg. Travel Time= 5.1 min

Peak Storage= 7,973 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 3.00' Flow Area= 75.0 sf, Capacity= 296.86 cfs

13.00' x 3.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/' Top Width= 37.00'
Length= 841.0' Slope= 0.0071 '/'
Inlet Invert= 0.00', Outlet Invert= -5.97'


‡

Reach 46R: Channel SB1



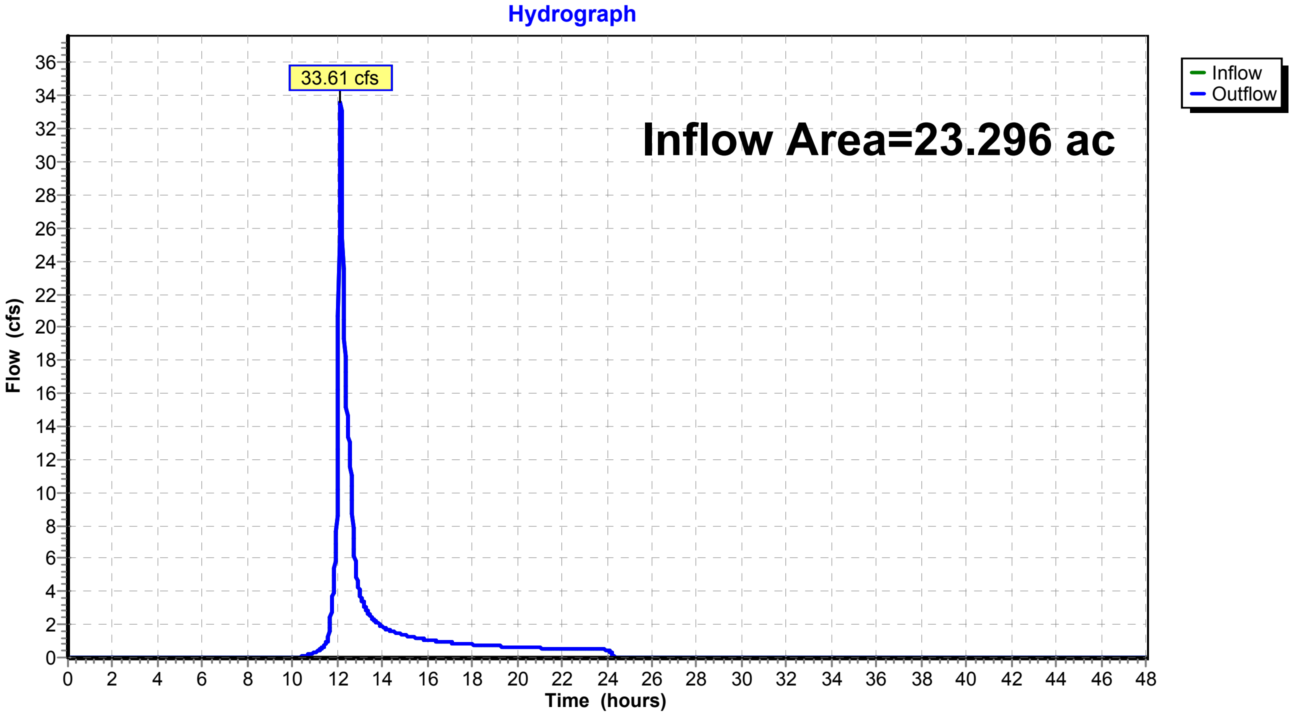
Summary for Reach 48R: Outfall of SB 8, 13

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 23.296 ac, 0.00% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 33.61 cfs @ 12.14 hrs, Volume= 2.296 af
Outflow = 33.61 cfs @ 12.14 hrs, Volume= 2.296 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 48R: Outfall of SB 8, 13



Summary for Reach 49R: Channel SB8

[65] Warning: Inlet elevation not specified

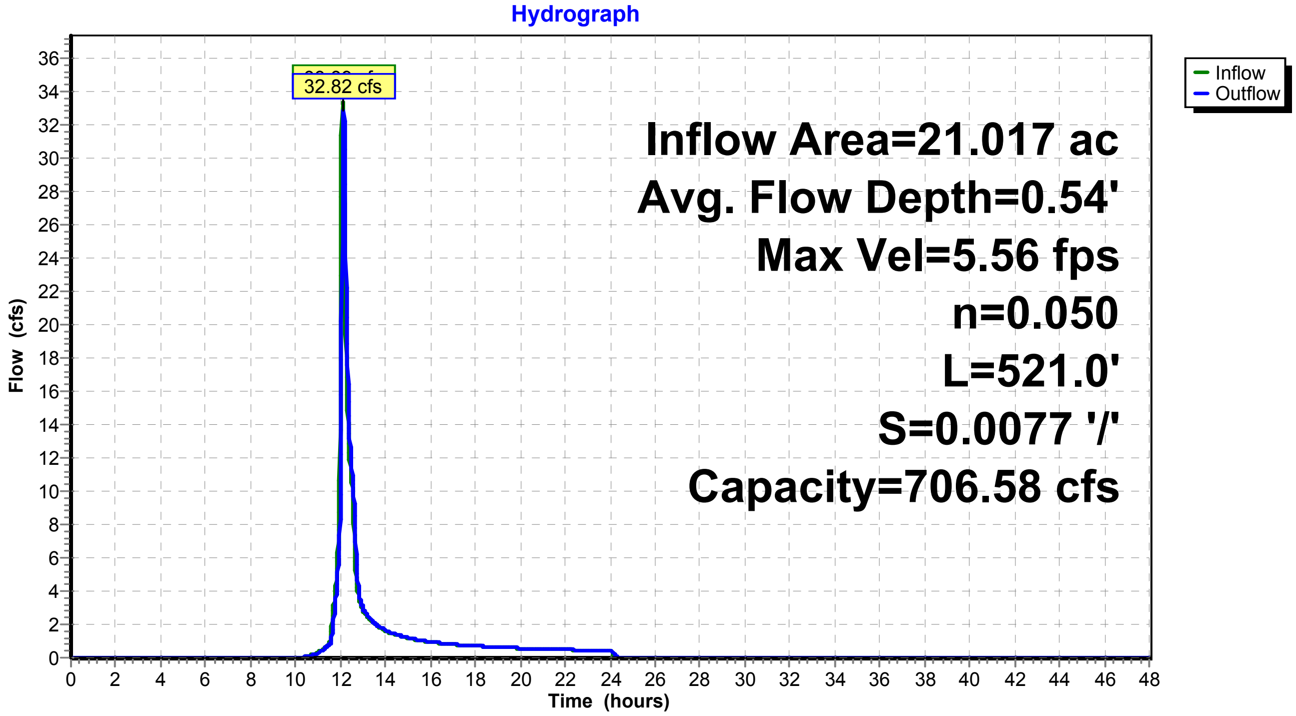
Inflow Area = 21.017 ac, 0.00% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 33.39 cfs @ 12.09 hrs, Volume= 2.061 af
Outflow = 32.82 cfs @ 12.14 hrs, Volume= 2.061 af, Atten= 2%, Lag= 3.2 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 25.04 cfs Estimated Depth= 0.65' Velocity= 1.80 fps
m= 1.577, c= 2.83 fps, dt= 1.2 min, dx= 521.0' / 3 = 173.7', K= 1.0 min, X= 0.347
Max. Velocity= 5.56 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.84 fps, Avg. Travel Time= 3.1 min

Peak Storage= 5,972 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 4.00' Flow Area= 140.0 sf, Capacity= 706.58 cfs

19.00' x 4.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/' Top Width= 51.00'
Length= 521.0' Slope= 0.0077 '/'
Inlet Invert= 0.00', Outlet Invert= -4.01'

Reach 49R: Channel SB8



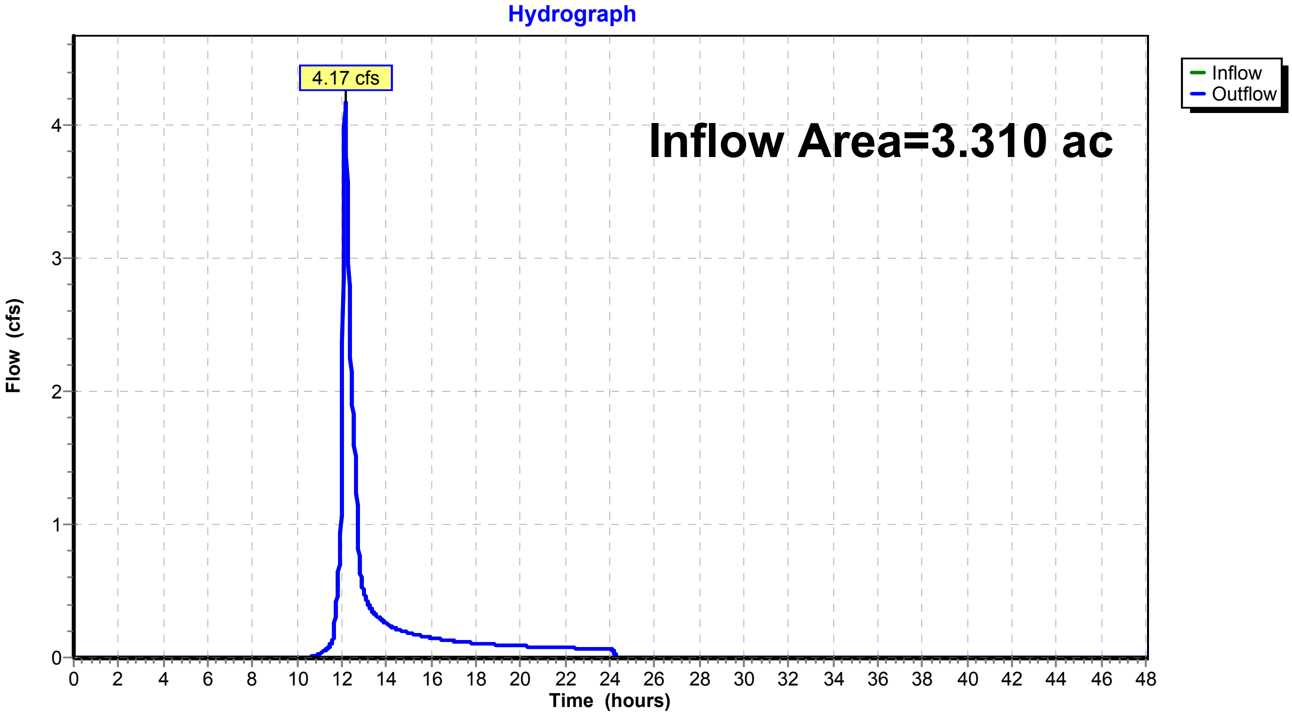
Summary for Reach 50R: Outfall of SB 12

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.310 ac, 0.00% Impervious, Inflow Depth = 1.12" for 2-Year event
Inflow = 4.17 cfs @ 12.16 hrs, Volume= 0.308 af
Outflow = 4.17 cfs @ 12.16 hrs, Volume= 0.308 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 50R: Outfall of SB 12



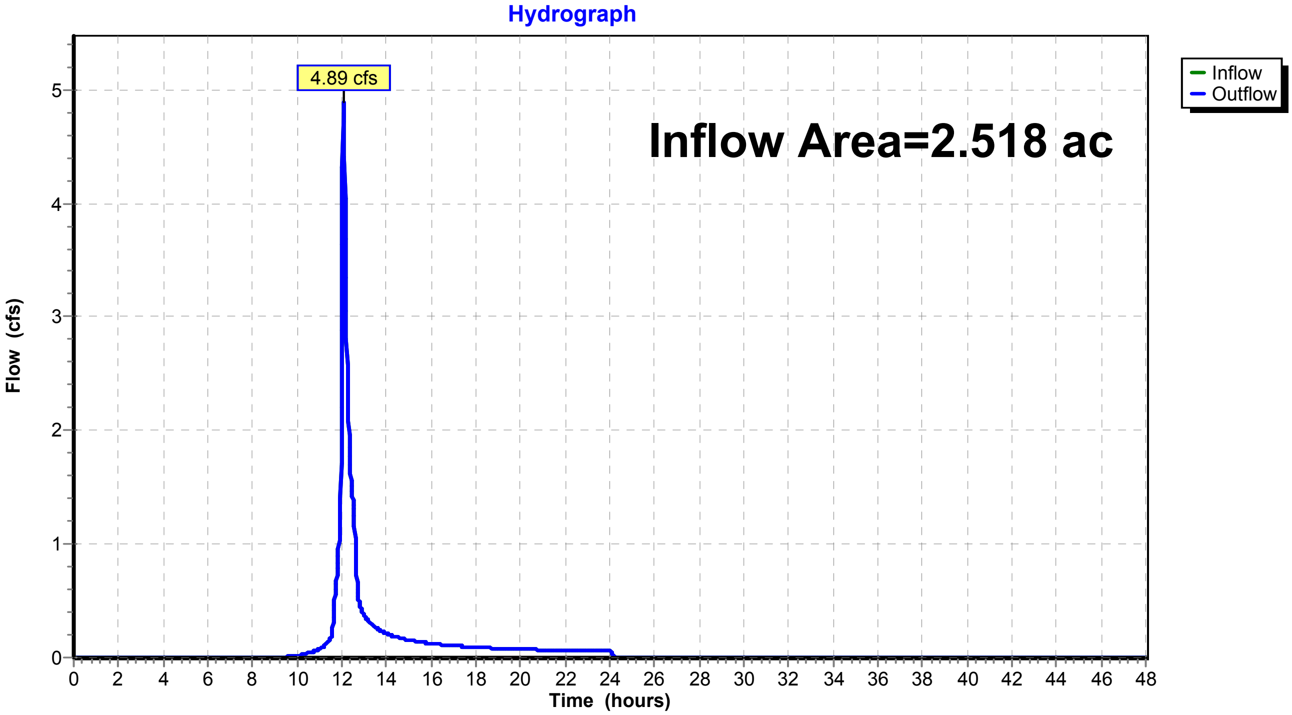
Summary for Reach 51R: Outfall of SB 14

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.518 ac, 0.00% Impervious, Inflow Depth = 1.37" for 2-Year event
Inflow = 4.89 cfs @ 12.08 hrs, Volume= 0.287 af
Outflow = 4.89 cfs @ 12.08 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 51R: Outfall of SB 14



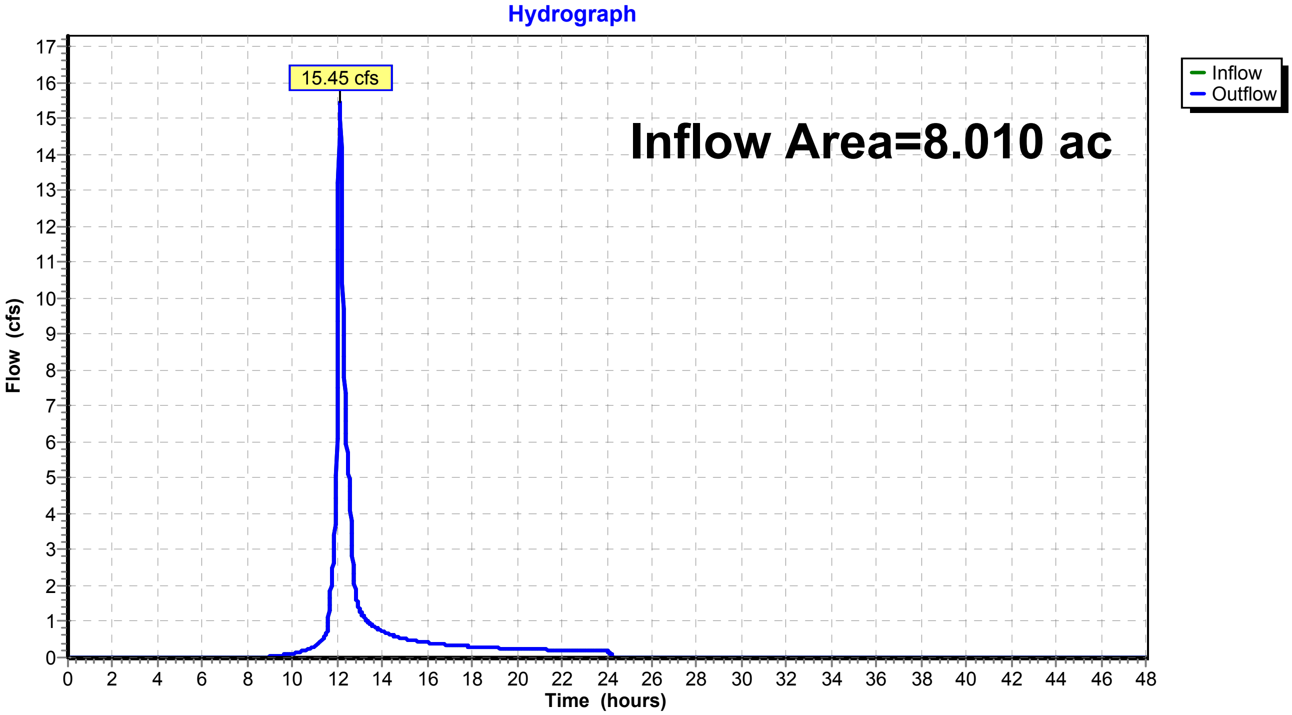
Summary for Reach 52R: Outfall of SB 17

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =         8.010 ac,    0.00% Impervious,  Inflow Depth =   1.51"    for  2-Year event
Inflow      =        15.45 cfs @   12.11 hrs,  Volume=            1.008 af
Outflow     =        15.45 cfs @   12.11 hrs,  Volume=            1.008 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 52R: Outfall of SB 17



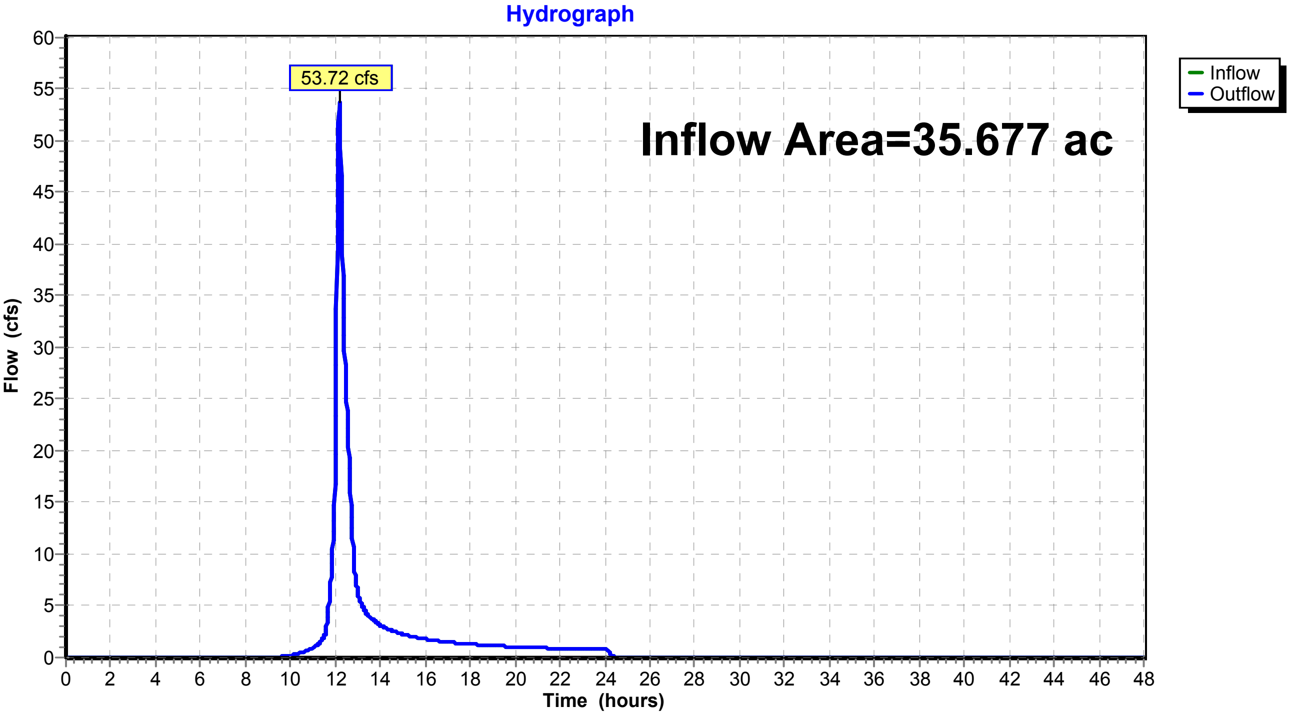
Summary for Reach 53R: Outfall of SB 18

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        35.677 ac,   0.00% Impervious,  Inflow Depth =   1.37"    for  2-Year event
Inflow      =        53.72 cfs @   12.18 hrs,  Volume=           4.072 af
Outflow     =        53.72 cfs @   12.18 hrs,  Volume=           4.072 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 53R: Outfall of SB 18



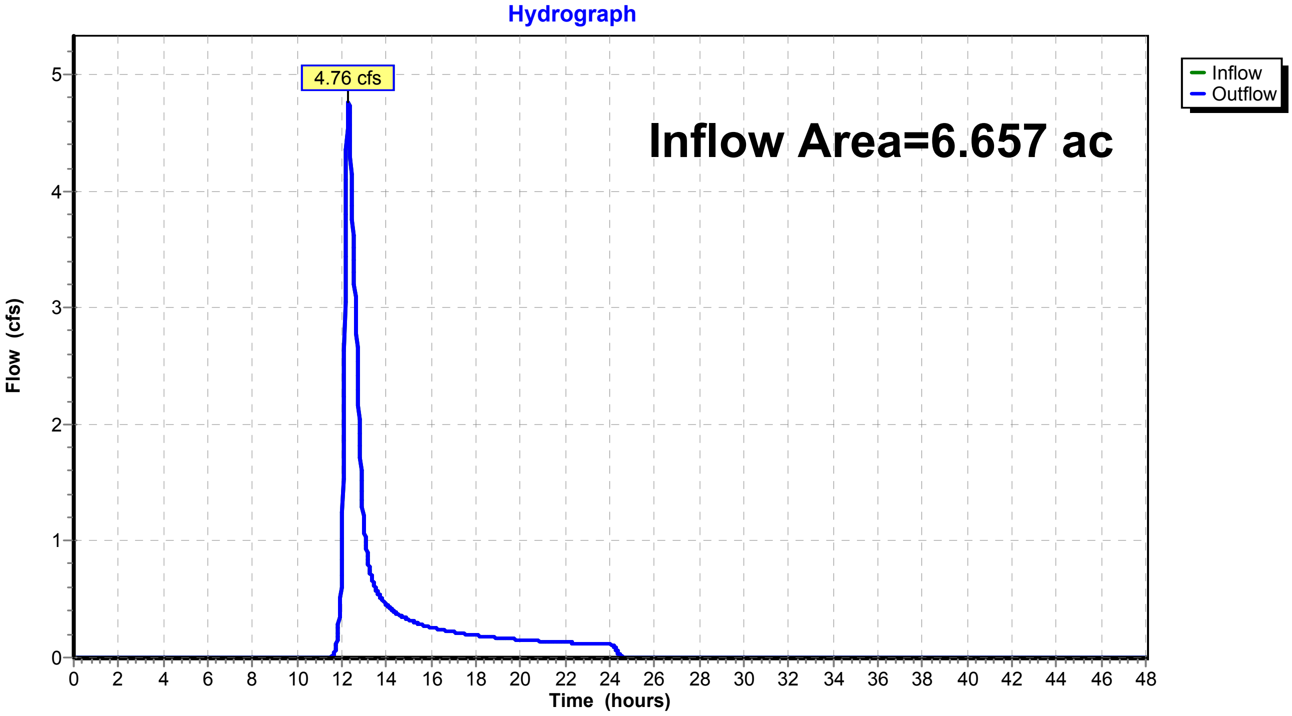
Summary for Reach 54R: Outfall of SB 25

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	6.657 ac,	0.00% Impervious, Inflow Depth = 0.85"	for 2-Year event
Inflow =	4.76 cfs @	12.30 hrs, Volume=	0.469 af
Outflow =	4.76 cfs @	12.30 hrs, Volume=	0.469 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 54R: Outfall of SB 25



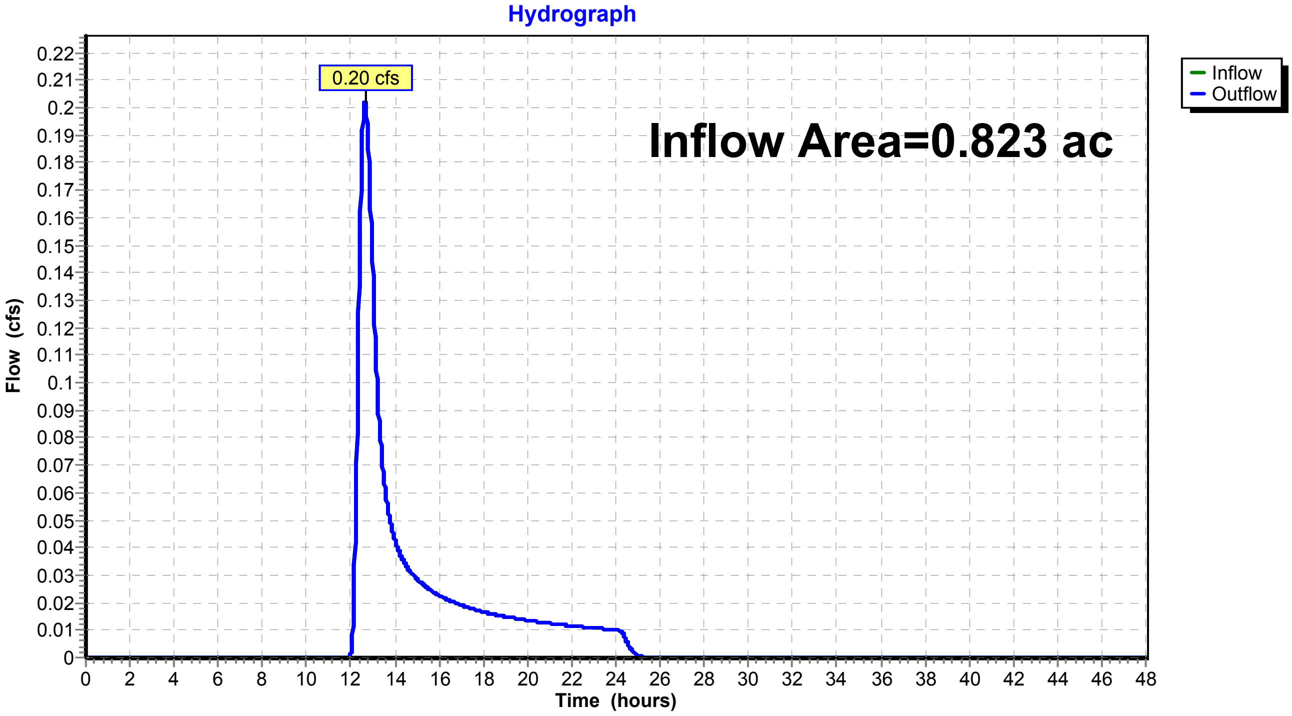
Summary for Reach 55R: Outfall of SB 26

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =         0.823 ac,    0.00% Impervious,  Inflow Depth =   0.46"    for  2-Year event
Inflow       =        0.20 cfs @   12.64 hrs,  Volume=            0.032 af
Outflow      =        0.20 cfs @   12.64 hrs,  Volume=            0.032 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 55R: Outfall of SB 26



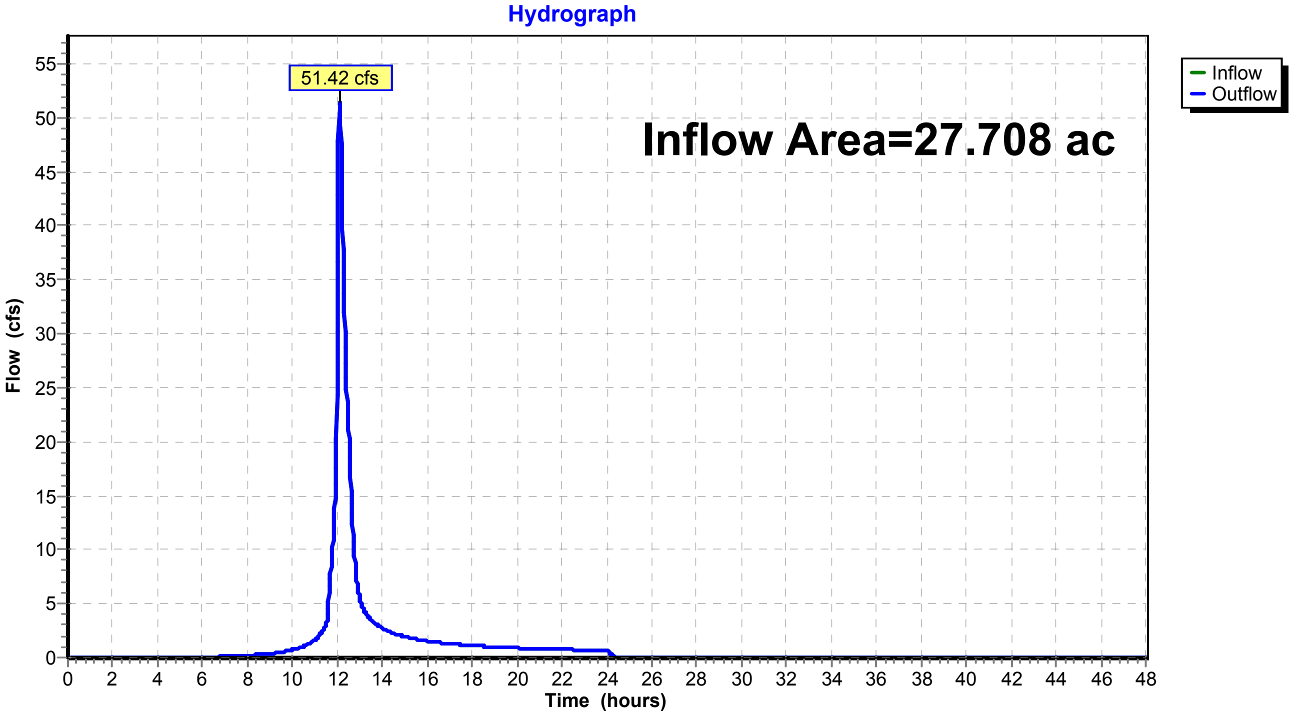
Summary for Reach 56R: Outfall of SB 23, 24

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       27.708 ac,   0.00% Impervious,  Inflow Depth =   1.71"    for  2-Year event
Inflow      =       51.42 cfs @   12.10 hrs,  Volume=          3.958 af
Outflow     =       51.42 cfs @   12.10 hrs,  Volume=          3.958 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 56R: Outfall of SB 23, 24



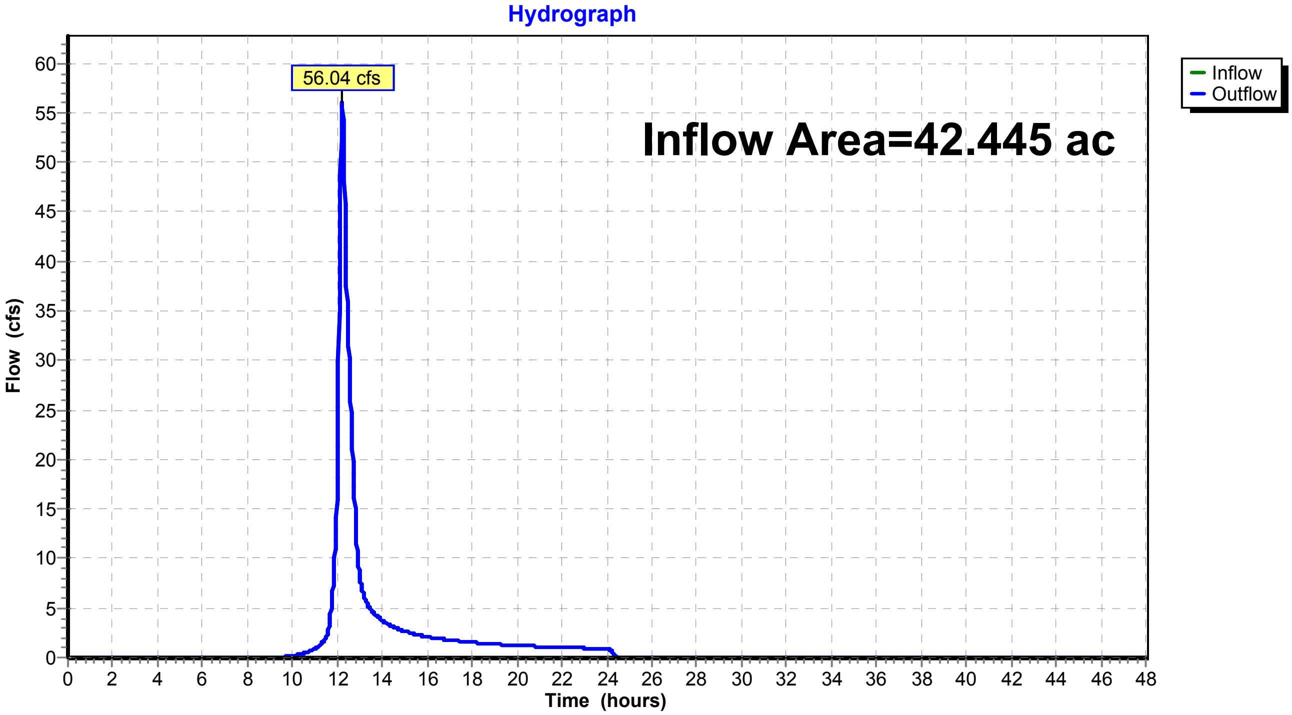
Summary for Reach 59R: Outfall of SB 20, 22

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	42.445 ac,	0.00% Impervious,	Inflow Depth =	1.31"	for 2-Year event	
Inflow =	56.04 cfs @	12.22 hrs,	Volume=	4.646 af		
Outflow =	56.04 cfs @	12.22 hrs,	Volume=	4.646 af,	Atten= 0%,	Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 59R: Outfall of SB 20, 22



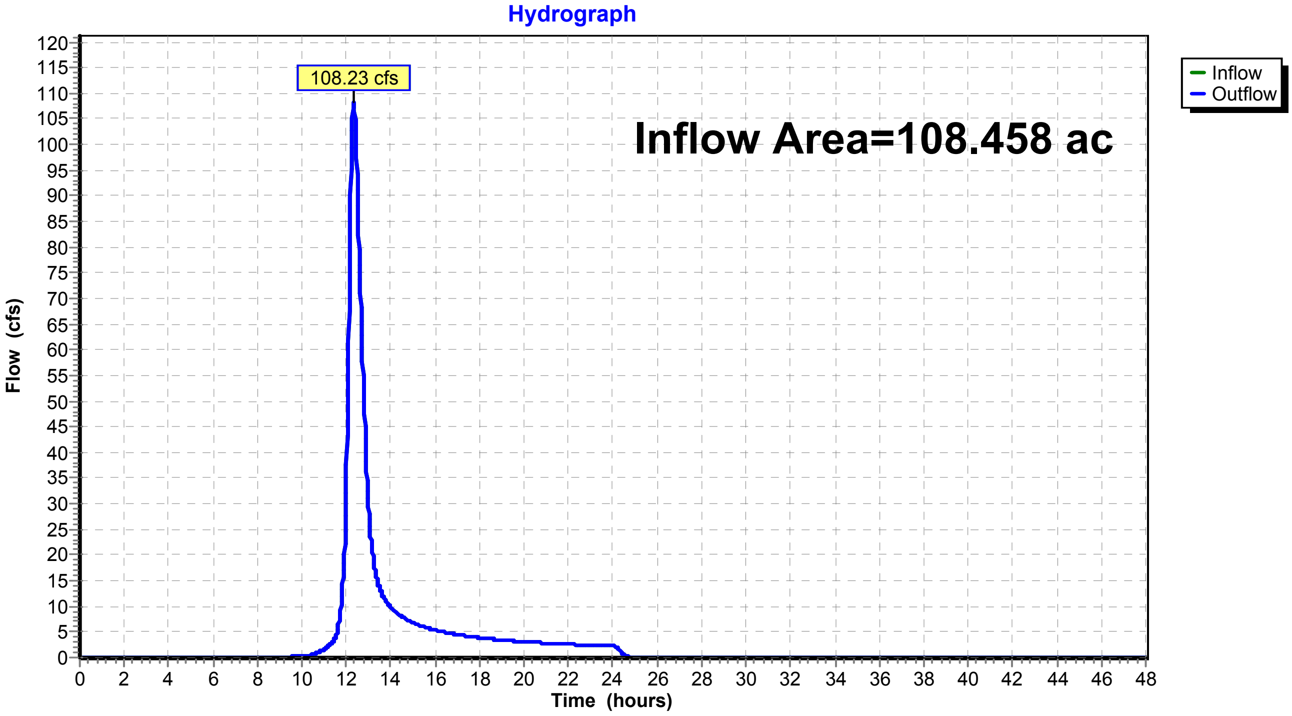
Summary for Reach 61R: Outfall of SB 15, 16, 21

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      108.458 ac,   0.00% Impervious,  Inflow Depth =   1.25"    for  2-Year event
Inflow       =     108.23 cfs @   12.34 hrs,  Volume=          11.311 af
Outflow      =     108.23 cfs @   12.34 hrs,  Volume=          11.311 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 61R: Outfall of SB 15, 16, 21



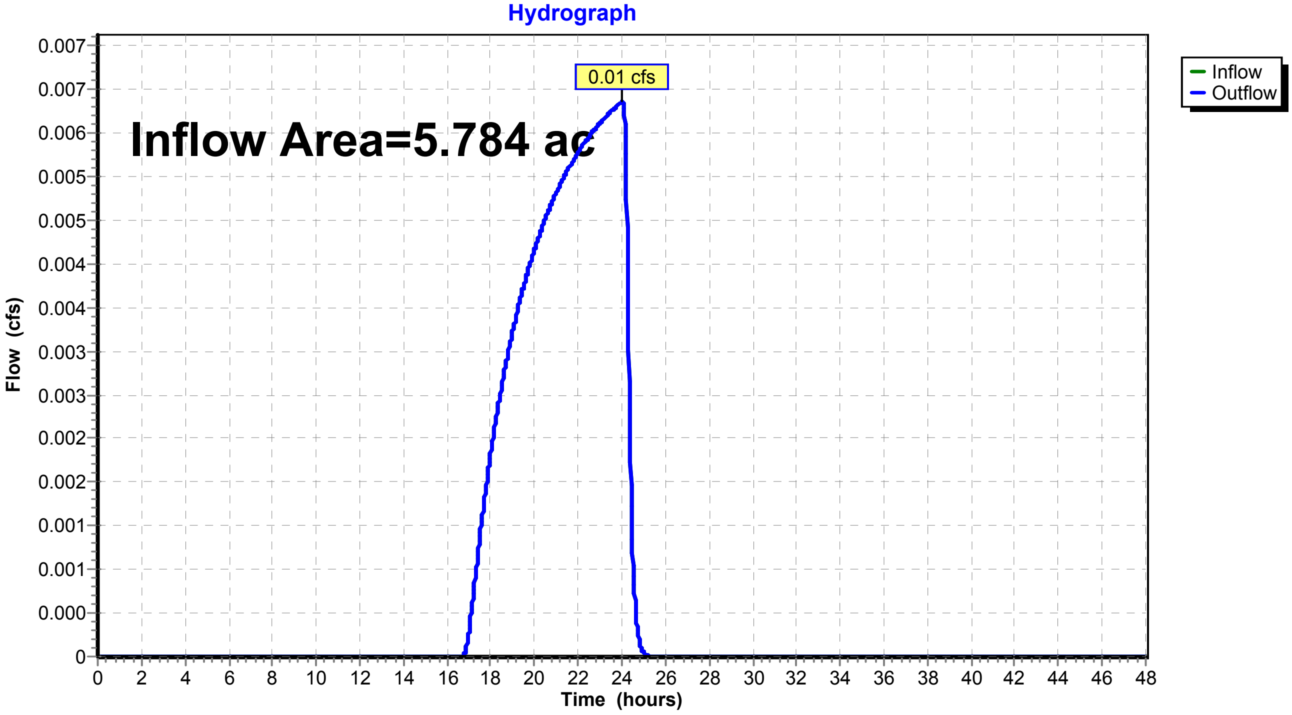
Summary for Reach 67R: Outfall of SB 28

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.784 ac, 0.00% Impervious, Inflow Depth = 0.01" for 2-Year event
Inflow = 0.01 cfs @ 24.03 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 24.03 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 67R: Outfall of SB 28



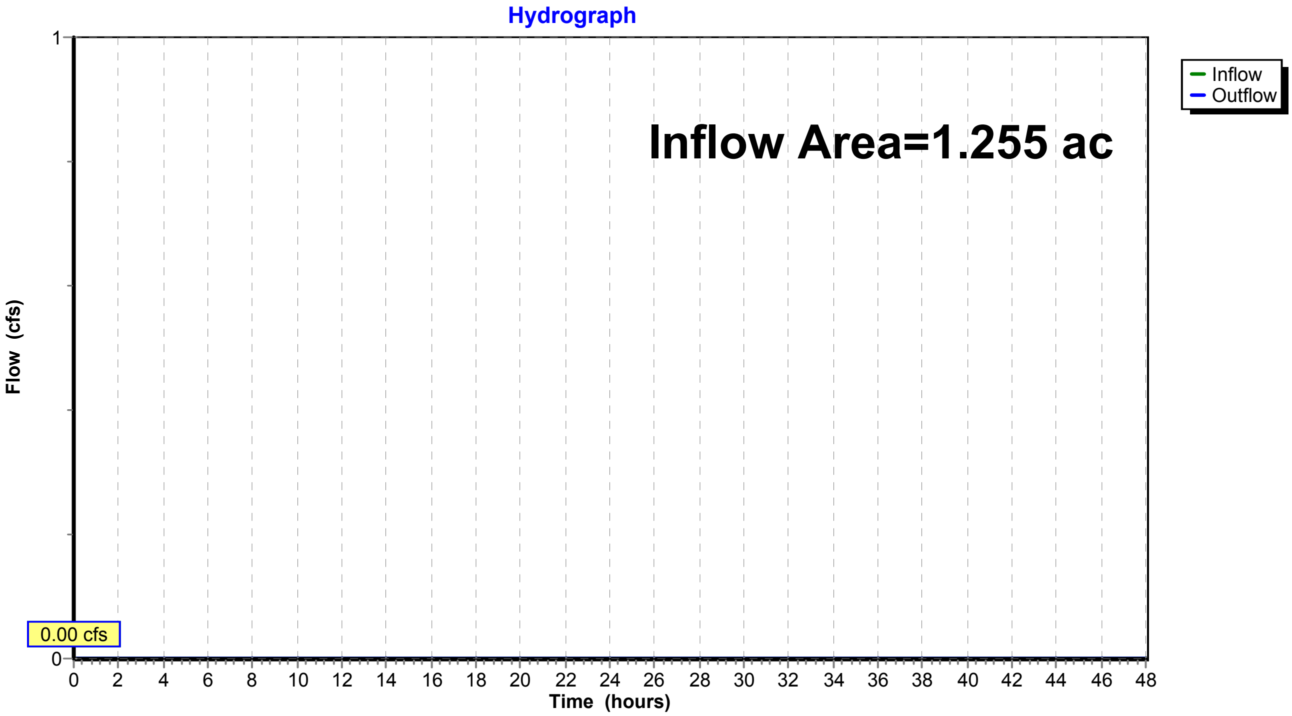
Summary for Reach 68R: Outfall of SB 29

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =         1.255 ac,    0.00% Impervious,  Inflow Depth =   0.00"    for  2-Year event
Inflow       =        0.00 cfs @     0.00 hrs,  Volume=            0.000 af
Outflow      =        0.00 cfs @     0.00 hrs,  Volume=            0.000 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 68R: Outfall of SB 29



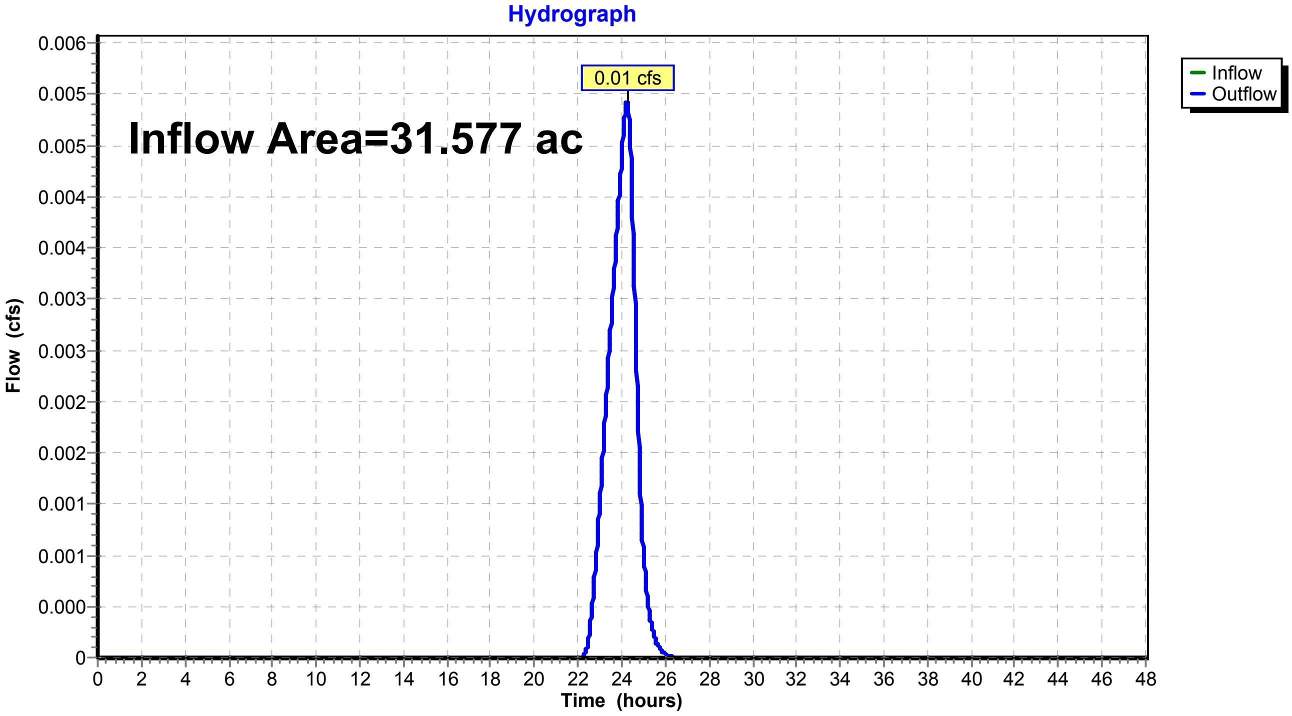
Summary for Reach 69R: Outfall of SB 30

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        31.577 ac,    0.00% Impervious,  Inflow Depth =   0.00"    for  2-Year event
Inflow      =         0.01 cfs @  24.23 hrs,  Volume=             0.001 af
Outflow     =         0.01 cfs @  24.23 hrs,  Volume=             0.001 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 69R: Outfall of SB 30



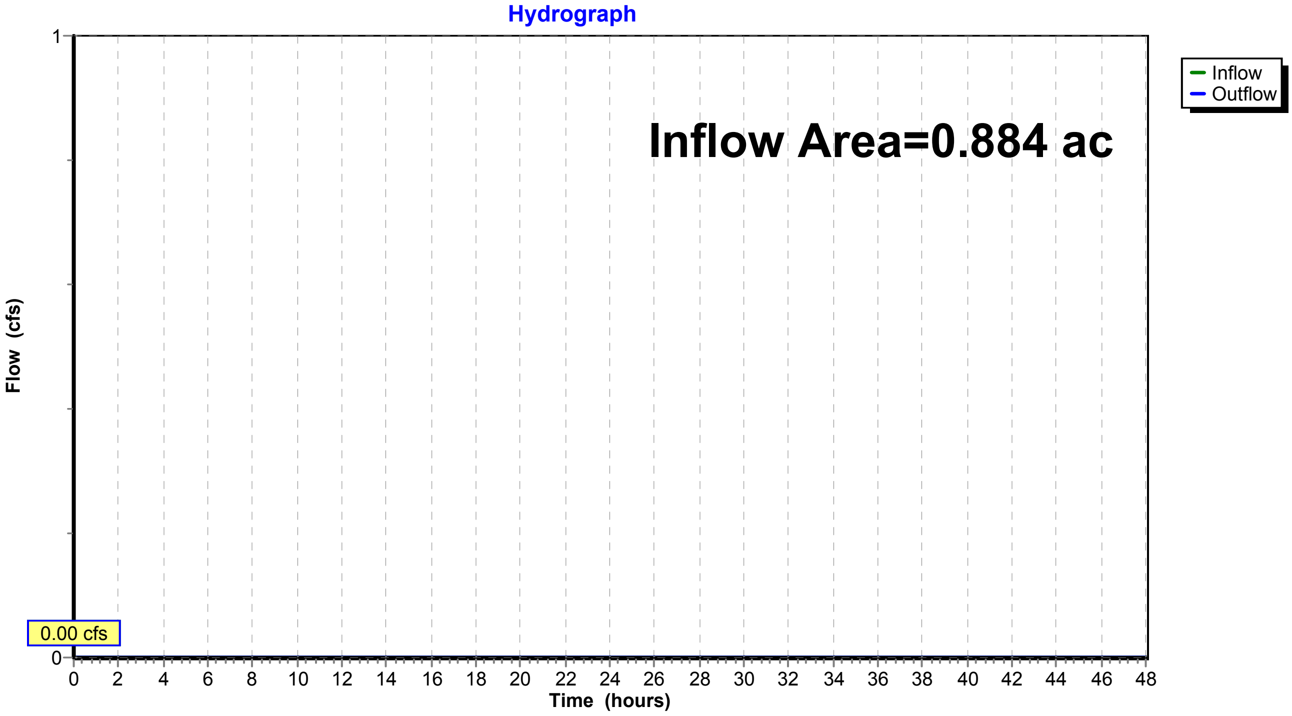
Summary for Reach 70R: Outfall of SB 31

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =         0.884 ac,   0.00% Impervious,  Inflow Depth =   0.00"    for  2-Year event
Inflow      =        0.00 cfs @    0.00 hrs,  Volume=            0.000 af
Outflow     =        0.00 cfs @    0.00 hrs,  Volume=            0.000 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 70R: Outfall of SB 31



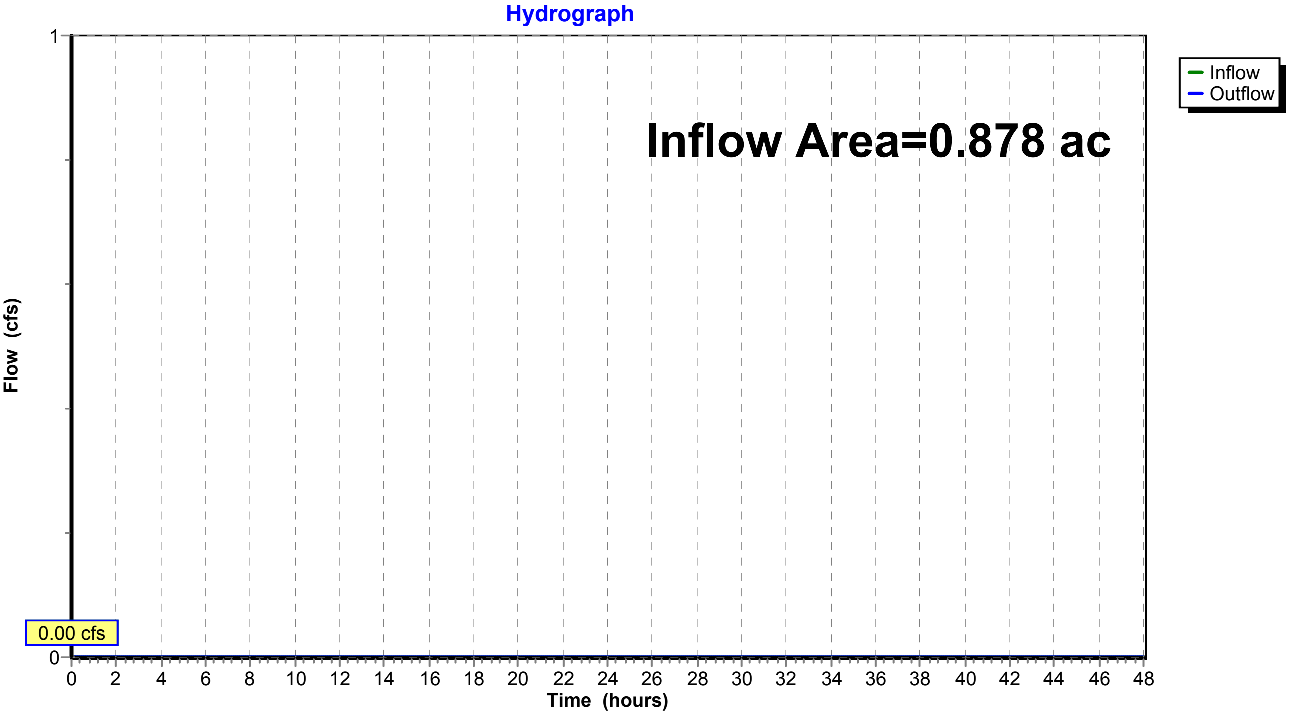
Summary for Reach 71R: Outfall of SB 32

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =         0.878 ac,    0.00% Impervious,  Inflow Depth =   0.00"    for  2-Year event
Inflow      =        0.00 cfs @    0.00 hrs,  Volume=            0.000 af
Outflow     =        0.00 cfs @    0.00 hrs,  Volume=            0.000 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 71R: Outfall of SB 32



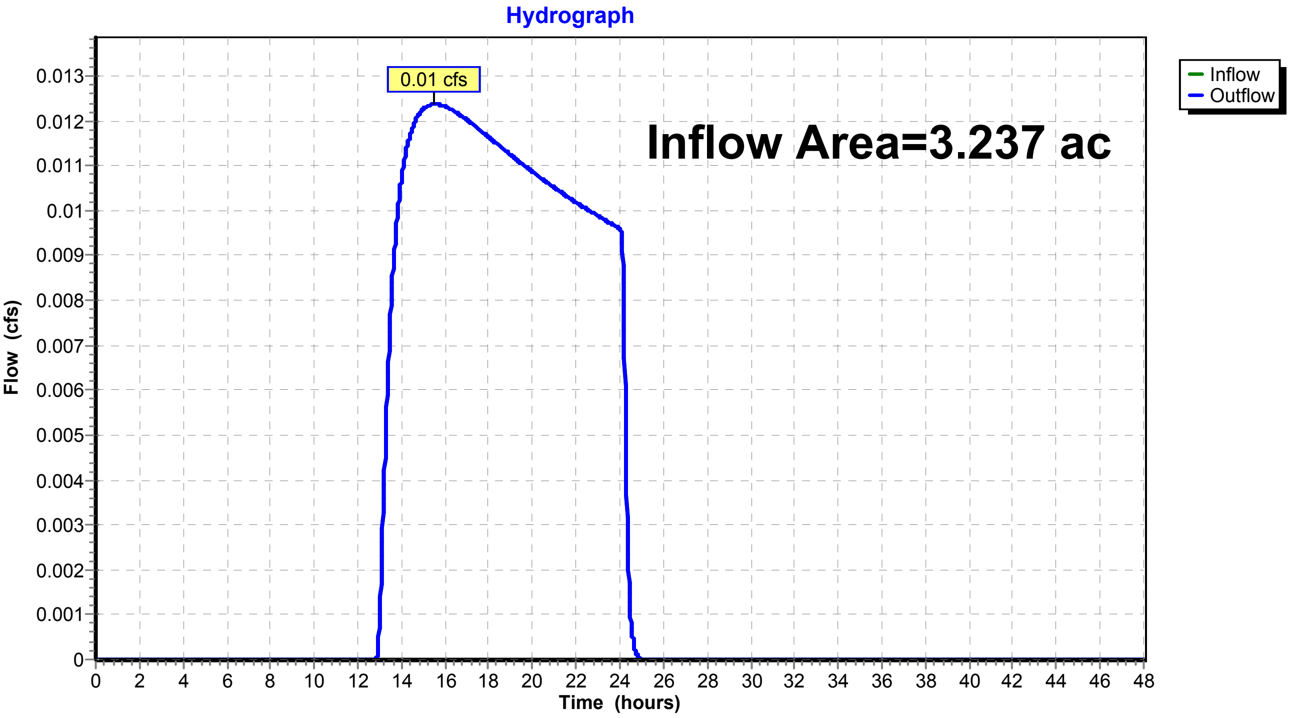
Summary for Reach 72R: Outfall of SB 33

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	3.237 ac,	0.00% Impervious, Inflow Depth = 0.04"	for 2-Year event
Inflow =	0.01 cfs @	15.50 hrs, Volume=	0.010 af
Outflow =	0.01 cfs @	15.50 hrs, Volume=	0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 72R: Outfall of SB 33



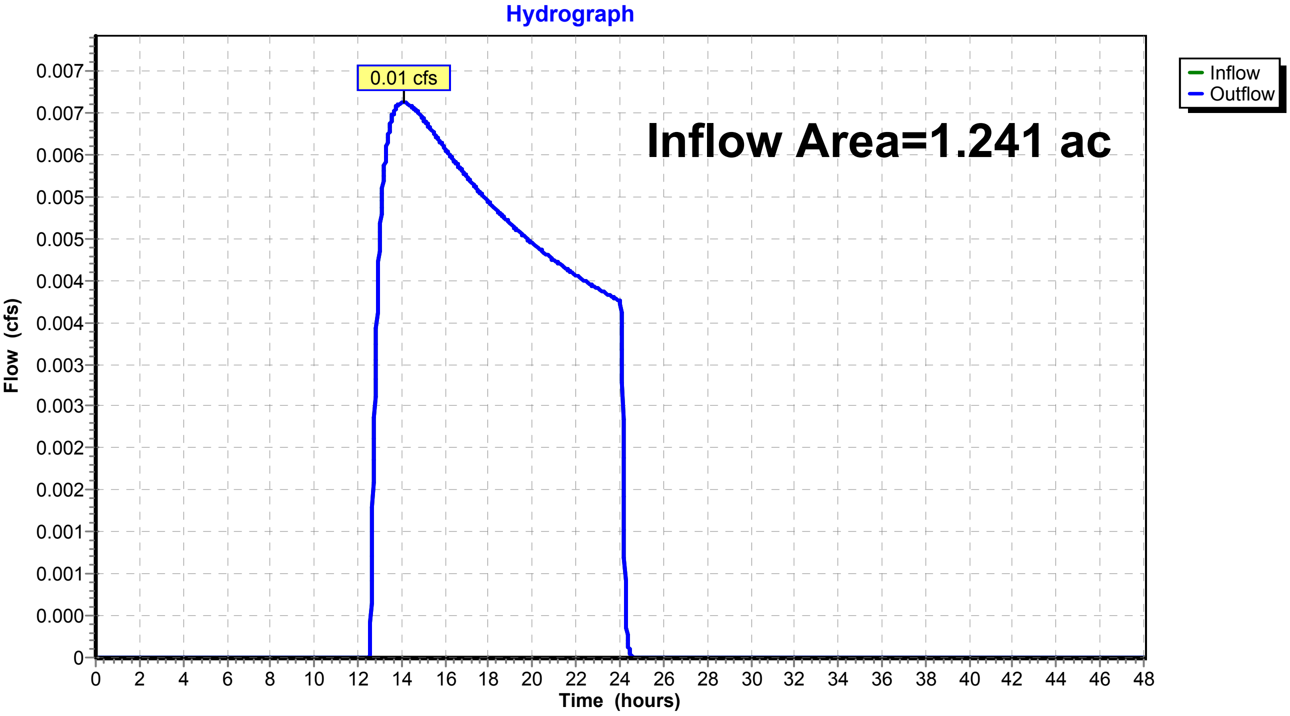
Summary for Reach 73R: Outfall of SB 34

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       1.241 ac,   0.00% Impervious,  Inflow Depth =   0.05"    for  2-Year event
Inflow       =      0.01 cfs @   14.09 hrs,  Volume=            0.005 af
Outflow      =      0.01 cfs @   14.09 hrs,  Volume=            0.005 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 73R: Outfall of SB 34

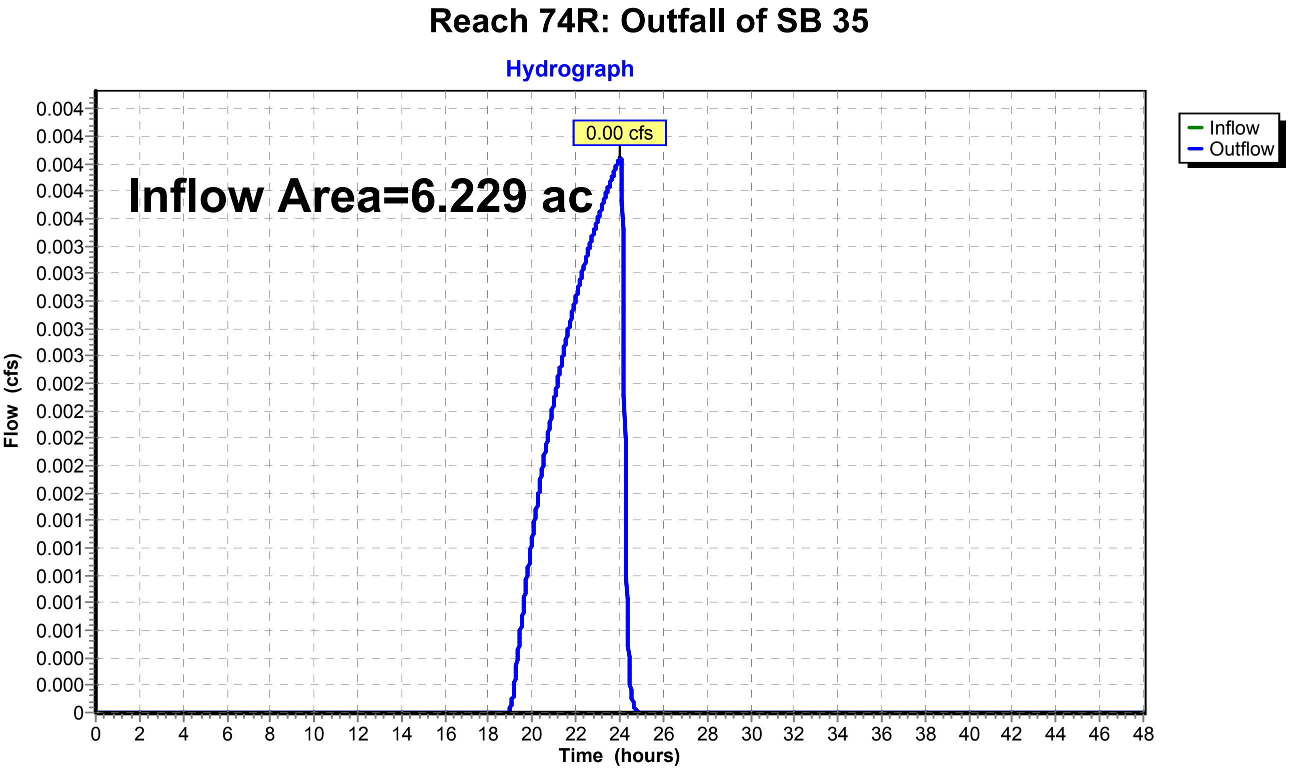


Summary for Reach 74R: Outfall of SB 35

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.229 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.02 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 24.02 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs



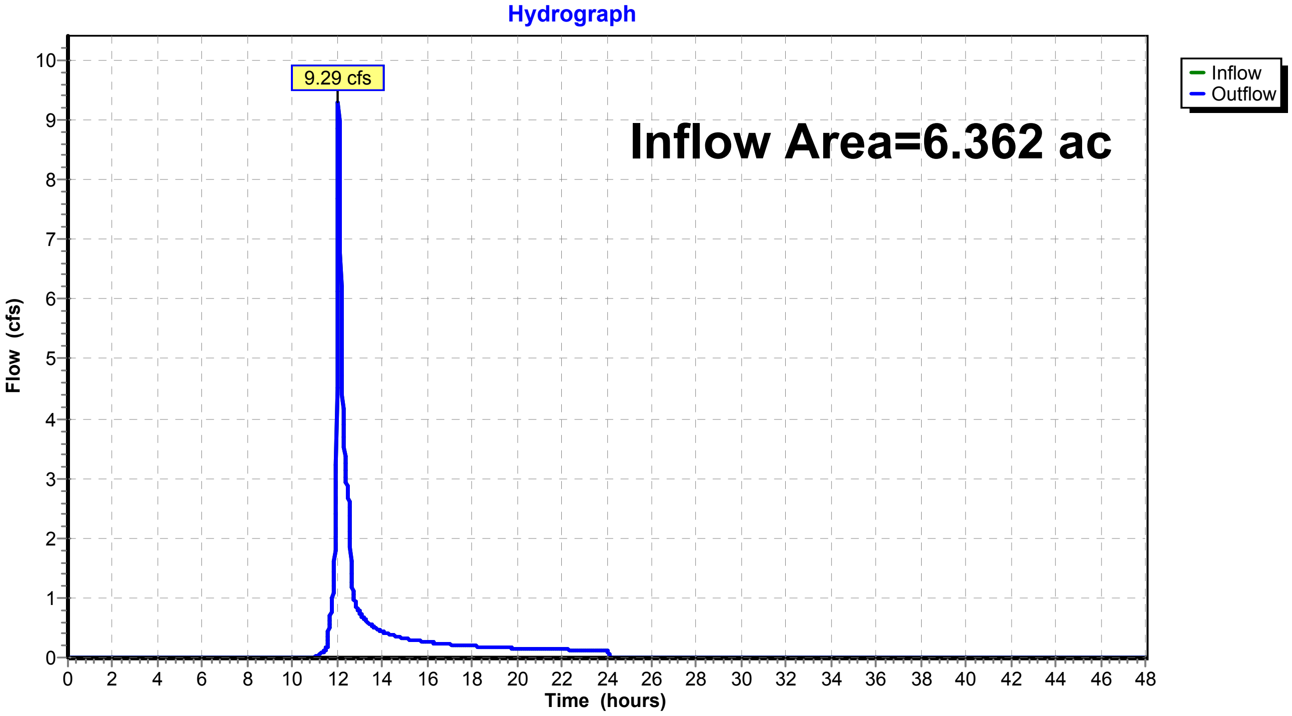
Summary for Reach 75R: Outfall of SB 19

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       6.362 ac,   0.00% Impervious,  Inflow Depth =   1.00"    for  2-Year event
Inflow      =      9.29 cfs @   12.06 hrs,  Volume=             0.531 af
Outflow     =      9.29 cfs @   12.06 hrs,  Volume=             0.531 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 75R: Outfall of SB 19



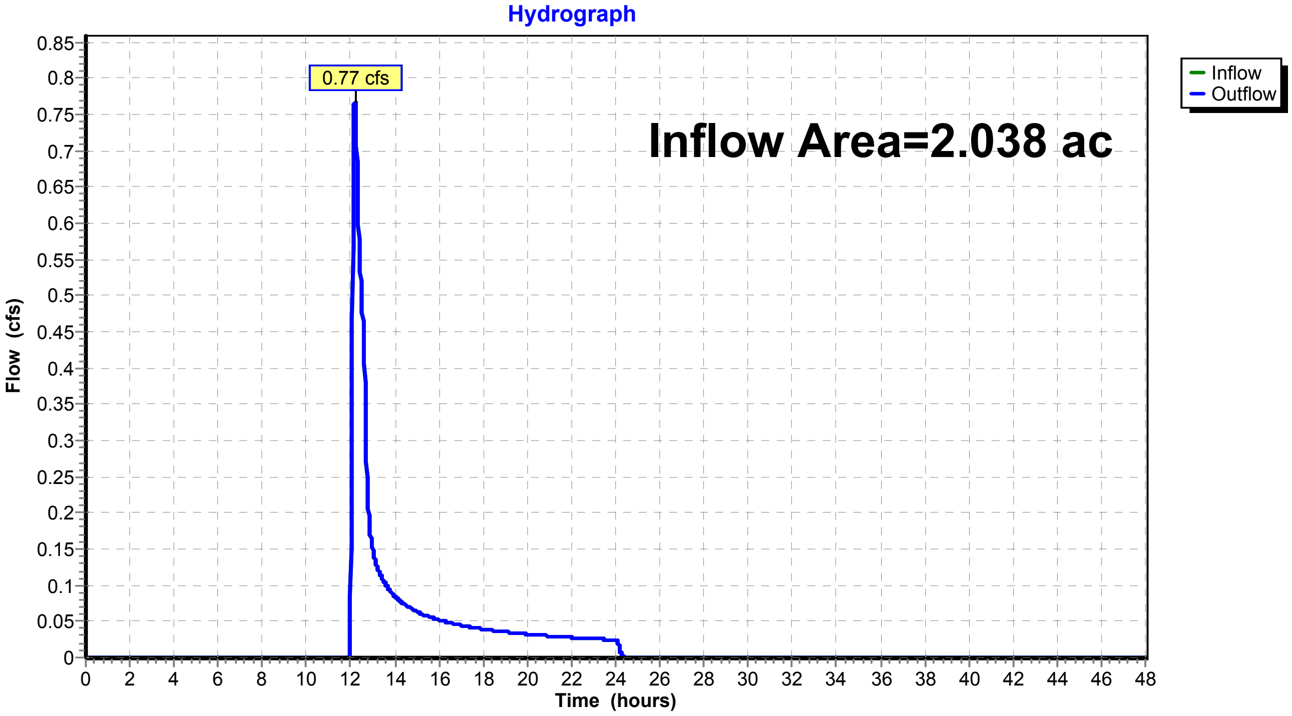
Summary for Reach 82R: Outfall of SB 27

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.038 ac, 0.00% Impervious, Inflow Depth = 0.46" for 2-Year event
Inflow = 0.77 cfs @ 12.19 hrs, Volume= 0.078 af
Outflow = 0.77 cfs @ 12.19 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 82R: Outfall of SB 27



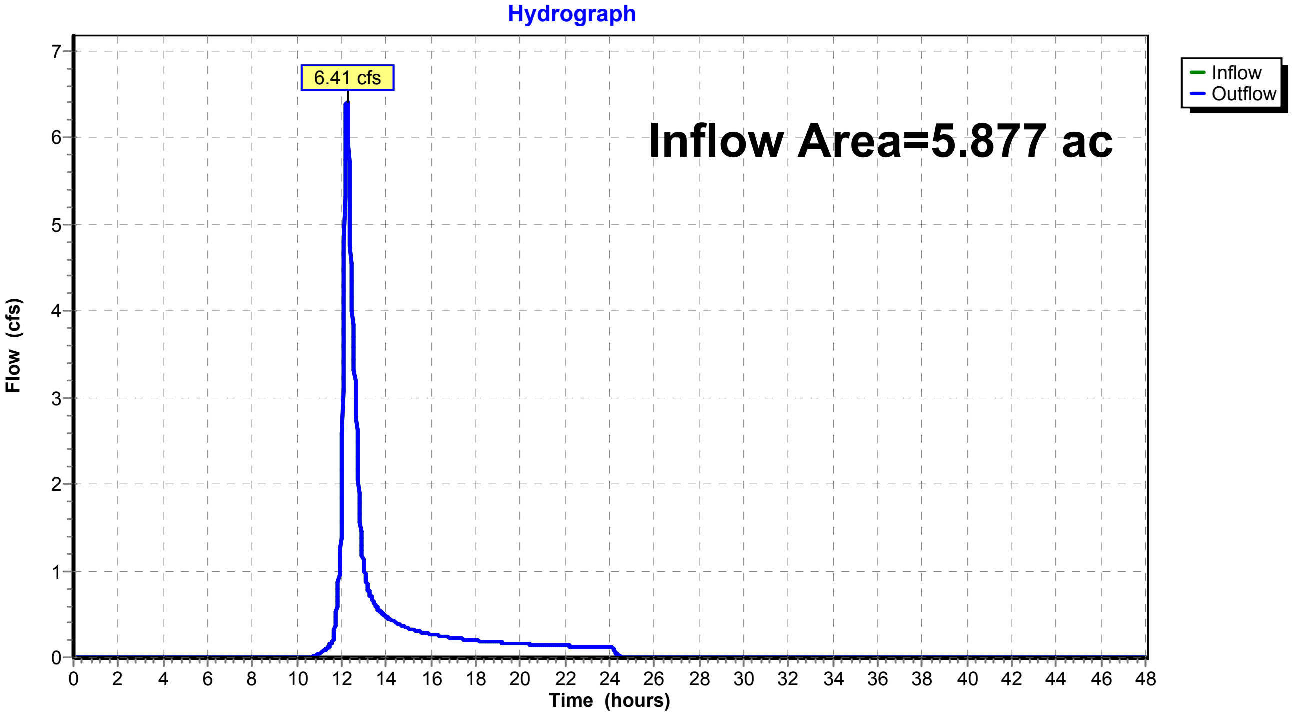
Summary for Reach 84R: Outfall of Future County Road H Subbasin

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	5.877 ac,	0.00% Impervious,	Inflow Depth = 1.12"	for 2-Year event	
Inflow =	6.41 cfs @	12.23 hrs, Volume=	0.547 af		
Outflow =	6.41 cfs @	12.23 hrs, Volume=	0.547 af,	Atten= 0%,	Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 84R: Outfall of Future County Road H Subbasin



Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment1: Sub-basin1	Runoff Area=15.328 ac 0.00% Impervious Runoff Depth=2.84" Tc=16.3 min CN=87 Runoff=47.16 cfs 3.626 af
Subcatchment2: Sub-basin 2	Runoff Area=4.913 ac 0.00% Impervious Runoff Depth=1.83" Tc=12.2 min CN=75 Runoff=10.91 cfs 0.750 af
Subcatchment3: Sub-basin 3	Runoff Area=15.522 ac 0.00% Impervious Runoff Depth=1.83" Tc=32.8 min CN=75 Runoff=21.31 cfs 2.371 af
Subcatchment4S: Sub-basin 4	Runoff Area=23.961 ac 0.00% Impervious Runoff Depth=2.65" Tc=11.3 min CN=85 Runoff=82.03 cfs 5.301 af
Subcatchment5S: Sub-basin 5	Runoff Area=27.171 ac 0.00% Impervious Runoff Depth=2.48" Tc=40.5 min CN=83 Runoff=45.83 cfs 5.610 af
Subcatchment6S: Sub-basin 6	Runoff Area=22.467 ac 0.00% Impervious Runoff Depth=2.06" Tc=46.4 min CN=78 Runoff=29.03 cfs 3.863 af
Subcatchment7S: Sub-basin 7	Runoff Area=9.790 ac 0.00% Impervious Runoff Depth=0.98" Tc=27.0 min CN=62 Runoff=6.82 cfs 0.801 af
Subcatchment8S: Sub-basin 8	Runoff Area=21.017 ac 0.00% Impervious Runoff Depth=2.31" Tc=9.5 min CN=81 Runoff=66.85 cfs 4.041 af
Subcatchment9S: Sub-basin 9	Runoff Area=9.296 ac 0.00% Impervious Runoff Depth=2.39" Tc=12.7 min CN=82 Runoff=27.07 cfs 1.853 af
Subcatchment10S: Sub-basin 10	Runoff Area=30.014 ac 0.00% Impervious Runoff Depth=2.31" Tc=37.7 min CN=81 Runoff=49.02 cfs 5.770 af
Subcatchment11S: Sub-basin 11	Runoff Area=4.343 ac 0.00% Impervious Runoff Depth=1.91" Tc=32.9 min CN=76 Runoff=6.20 cfs 0.691 af
Subcatchment12S: Sub-basin 12	Runoff Area=3.310 ac 0.00% Impervious Runoff Depth=2.22" Tc=14.0 min CN=80 Runoff=8.55 cfs 0.613 af
Subcatchment13S: Sub-basin 13	Runoff Area=2.279 ac 0.00% Impervious Runoff Depth=2.39" Tc=36.2 min CN=82 Runoff=3.95 cfs 0.454 af
Subcatchment14S: Sub-basin 14	Runoff Area=2.518 ac 0.00% Impervious Runoff Depth=2.57" Tc=8.9 min CN=84 Runoff=9.18 cfs 0.538 af
Subcatchment15S: Sub-basin 15	Runoff Area=56.506 ac 0.00% Impervious Runoff Depth=2.39" Tc=28.0 min CN=82 Runoff=112.23 cfs 11.261 af
Subcatchment16S: Sub-basin 16	Runoff Area=44.796 ac 0.00% Impervious Runoff Depth=2.31" Tc=26.3 min CN=81 Runoff=88.44 cfs 8.612 af

Subcatchment17S: Sub-basin 17 Runoff Area=8.010 ac 0.00% Impervious Runoff Depth=2.75"
Tc=11.5 min CN=86 Runoff=28.00 cfs 1.833 af

Subcatchment18S: Sub-basin 18 Runoff Area=35.677 ac 0.00% Impervious Runoff Depth=2.57"
Tc=15.8 min CN=84 Runoff=101.21 cfs 7.627 af

Subcatchment19S: Sub-basin 19 Runoff Area=6.362 ac 0.00% Impervious Runoff Depth=2.06"
Tc=7.3 min CN=78 Runoff=19.90 cfs 1.094 af

Subcatchment20S: Sub-basin 20 Runoff Area=15.897 ac 0.00% Impervious Runoff Depth=2.65"
Tc=17.1 min CN=85 Runoff=44.95 cfs 3.517 af

Subcatchment21S: Sub-basin 21 Runoff Area=7.156 ac 0.00% Impervious Runoff Depth=3.13"
Tc=10.8 min CN=90 Runoff=29.08 cfs 1.865 af

Subcatchment22S: Sub-basin 22 Runoff Area=26.548 ac 0.00% Impervious Runoff Depth=2.39"
Tc=19.6 min CN=82 Runoff=63.21 cfs 5.291 af

Subcatchment23S: Sub-basin 23 Runoff Area=13.825 ac 0.00% Impervious Runoff Depth=3.33"
Tc=9.4 min CN=92 Runoff=62.35 cfs 3.836 af

Subcatchment24S: Sub-basin 24 Runoff Area=13.883 ac 0.00% Impervious Runoff Depth=2.65"
Tc=19.0 min CN=85 Runoff=37.26 cfs 3.071 af

Subcatchment25S: Sub-basin 25 Runoff Area=6.657 ac 0.00% Impervious Runoff Depth=1.83"
Tc=22.6 min CN=75 Runoff=11.10 cfs 1.017 af

Subcatchment26S: Sub-basin 26 Runoff Area=0.823 ac 0.00% Impervious Runoff Depth=1.22"
Tc=38.2 min CN=66 Runoff=0.64 cfs 0.084 af

Subcatchment27S: Sub-basin 27 Runoff Area=2.038 ac 0.00% Impervious Runoff Depth=1.22"
Tc=13.0 min CN=66 Runoff=2.67 cfs 0.207 af

Subcatchment28S: Sub-basin 28 Runoff Area=5.784 ac 0.00% Impervious Runoff Depth=0.19"
Tc=23.9 min CN=44 Runoff=0.36 cfs 0.094 af

Subcatchment29S: Sub-basin 29 Runoff Area=1.255 ac 0.00% Impervious Runoff Depth=0.07"
Tc=26.9 min CN=39 Runoff=0.01 cfs 0.007 af

Subcatchment30S: Sub-basin 30 Runoff Area=31.577 ac 0.00% Impervious Runoff Depth=0.14"
Tc=45.9 min CN=42 Runoff=0.75 cfs 0.366 af

Subcatchment31S: Sub-basin 31 Runoff Area=0.884 ac 0.00% Impervious Runoff Depth=0.07"
Tc=30.2 min CN=39 Runoff=0.01 cfs 0.005 af

Subcatchment32S: Sub-basin 32 Runoff Area=0.878 ac 0.00% Impervious Runoff Depth=0.07"
Tc=27.6 min CN=39 Runoff=0.01 cfs 0.005 af

Subcatchment33S: Sub-basin 33 Runoff Area=3.237 ac 0.00% Impervious Runoff Depth=0.33"
Tc=19.9 min CN=48 Runoff=0.49 cfs 0.088 af

Subcatchment34S: Sub-basin 34 Runoff Area=1.241 ac 0.00% Impervious Runoff Depth=0.36"
Tc=12.1 min CN=49 Runoff=0.23 cfs 0.038 af

Subcatchment35S: Sub-basin 35 Runoff Area=6.229 ac 0.00% Impervious Runoff Depth=0.17"
Tc=16.7 min CN=43 Runoff=0.33 cfs 0.086 af

Subcatchment36S: Sub-basin 36 Runoff Area=11.210 ac 0.00% Impervious Runoff Depth=2.14"
Tc=52.2 min CN=79 Runoff=14.13 cfs 2.002 af

Subcatchment83S: County Road H Runoff Area=5.877 ac 0.00% Impervious Runoff Depth=2.22"
Tc=19.1 min CN=80 Runoff=13.12 cfs 1.089 af

Reach 37R: Outfall of SB 2, 3, 7 Inflow=33.01 cfs 3.922 af
Outflow=33.01 cfs 3.922 af

Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36 Inflow=217.12 cfs 28.714 af
Outflow=217.12 cfs 28.714 af

Reach 40R: 60 in SB 4 Avg. Flow Depth=1.95' Max Vel=31.08 fps Inflow=217.16 cfs 28.714 af
60.0" Round Pipe n=0.013 L=718.0' S=0.0330 '/' Capacity=473.08 cfs Outflow=217.12 cfs 28.714 af

Reach 41R: Channel in SB 9, 10 Avg. Flow Depth=0.55' Max Vel=9.14 fps Inflow=27.07 cfs 1.853 af
n=0.050 L=1,660.0' S=0.0048 '/' Capacity=280.23 cfs Outflow=25.05 cfs 1.853 af

Reach 46R: Channel SB1 Avg. Flow Depth=0.87' Max Vel=6.34 fps Inflow=47.16 cfs 3.626 af
n=0.050 L=841.0' S=0.0071 '/' Capacity=296.86 cfs Outflow=46.50 cfs 3.626 af

Reach 48R: Outfall of SB 8, 13 Inflow=67.32 cfs 4.495 af
Outflow=67.32 cfs 4.495 af

Reach 49R: Channel SB8 Avg. Flow Depth=0.83' Max Vel=6.23 fps Inflow=66.85 cfs 4.041 af
n=0.050 L=521.0' S=0.0077 '/' Capacity=706.58 cfs Outflow=65.69 cfs 4.041 af

Reach 50R: Outfall of SB 12 Inflow=8.55 cfs 0.613 af
Outflow=8.55 cfs 0.613 af

Reach 51R: Outfall of SB 14 Inflow=9.18 cfs 0.538 af
Outflow=9.18 cfs 0.538 af

Reach 52R: Outfall of SB 17 Inflow=28.00 cfs 1.833 af
Outflow=28.00 cfs 1.833 af

Reach 53R: Outfall of SB 18 Inflow=101.21 cfs 7.627 af
Outflow=101.21 cfs 7.627 af

Reach 54R: Outfall of SB 25 Inflow=11.10 cfs 1.017 af
Outflow=11.10 cfs 1.017 af

Reach 55R: Outfall of SB 26 Inflow=0.64 cfs 0.084 af
Outflow=0.64 cfs 0.084 af

Reach 56R: Outfall of SB 23, 24	Inflow=87.74 cfs 6.907 af	Outflow=87.74 cfs 6.907 af
Reach 59R: Outfall of SB 20, 22	Inflow=107.32 cfs 8.807 af	Outflow=107.32 cfs 8.807 af
Reach 61R: Outfall of SB 15, 16, 21	Inflow=212.59 cfs 21.738 af	Outflow=212.59 cfs 21.738 af
Reach 67R: Outfall of SB 28	Inflow=0.36 cfs 0.094 af	Outflow=0.36 cfs 0.094 af
Reach 68R: Outfall of SB 29	Inflow=0.01 cfs 0.007 af	Outflow=0.01 cfs 0.007 af
Reach 69R: Outfall of SB 30	Inflow=0.75 cfs 0.366 af	Outflow=0.75 cfs 0.366 af
Reach 70R: Outfall of SB 31	Inflow=0.01 cfs 0.005 af	Outflow=0.01 cfs 0.005 af
Reach 71R: Outfall of SB 32	Inflow=0.01 cfs 0.005 af	Outflow=0.01 cfs 0.005 af
Reach 72R: Outfall of SB 33	Inflow=0.49 cfs 0.088 af	Outflow=0.49 cfs 0.088 af
Reach 73R: Outfall of SB 34	Inflow=0.23 cfs 0.038 af	Outflow=0.23 cfs 0.038 af
Reach 74R: Outfall of SB 35	Inflow=0.33 cfs 0.086 af	Outflow=0.33 cfs 0.086 af
Reach 75R: Outfall of SB 19	Inflow=19.90 cfs 1.094 af	Outflow=19.90 cfs 1.094 af
Reach 82R: Outfall of SB 27	Inflow=2.67 cfs 0.207 af	Outflow=2.67 cfs 0.207 af
Reach 84R: Outfall of Future County Road H Subbasin	Inflow=13.12 cfs 1.089 af	Outflow=13.12 cfs 1.089 af

Total Runoff Area = 498.279 ac Runoff Volume = 89.375 af Average Runoff Depth = 2.15"
100.00% Pervious = 498.279 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1: Sub-basin1

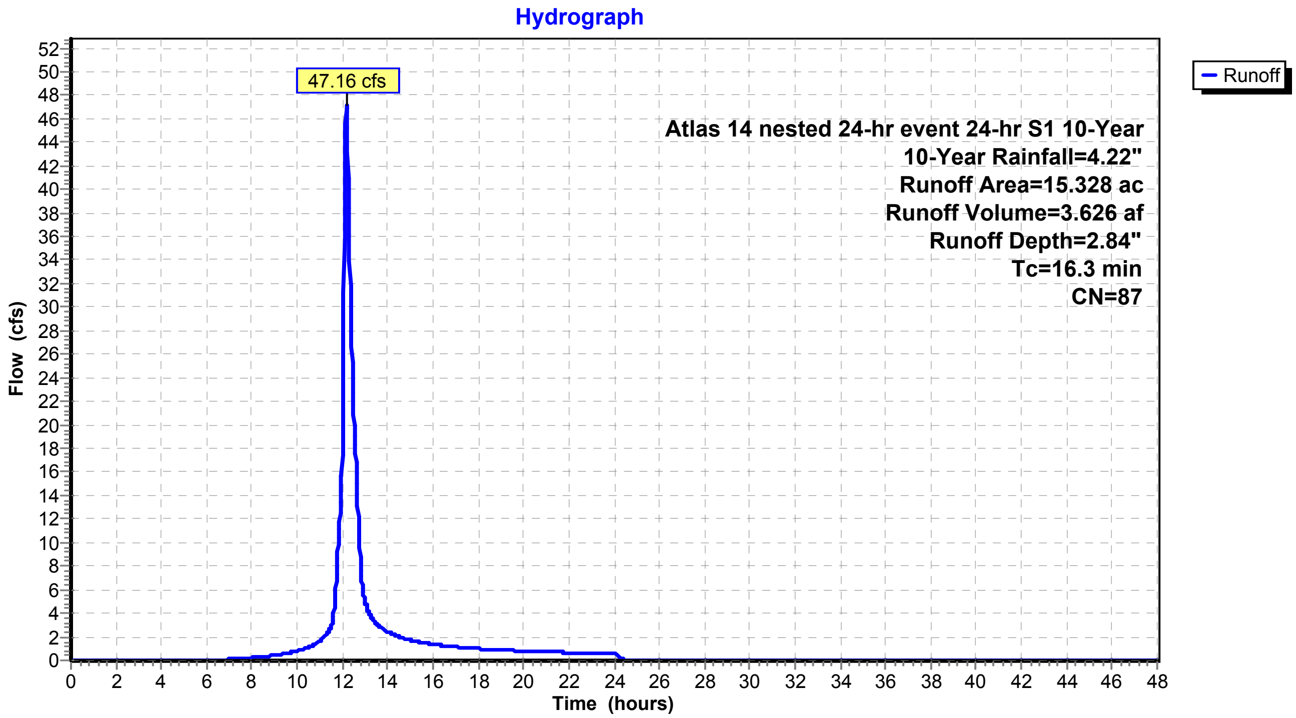
Runoff = 47.16 cfs @ 12.18 hrs, Volume= 3.626 af, Depth= 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	15.328	87	
	15.328		100.00% Pervious Area

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

Subcatchment 1: Sub-basin1



Summary for Subcatchment 2: Sub-basin 2

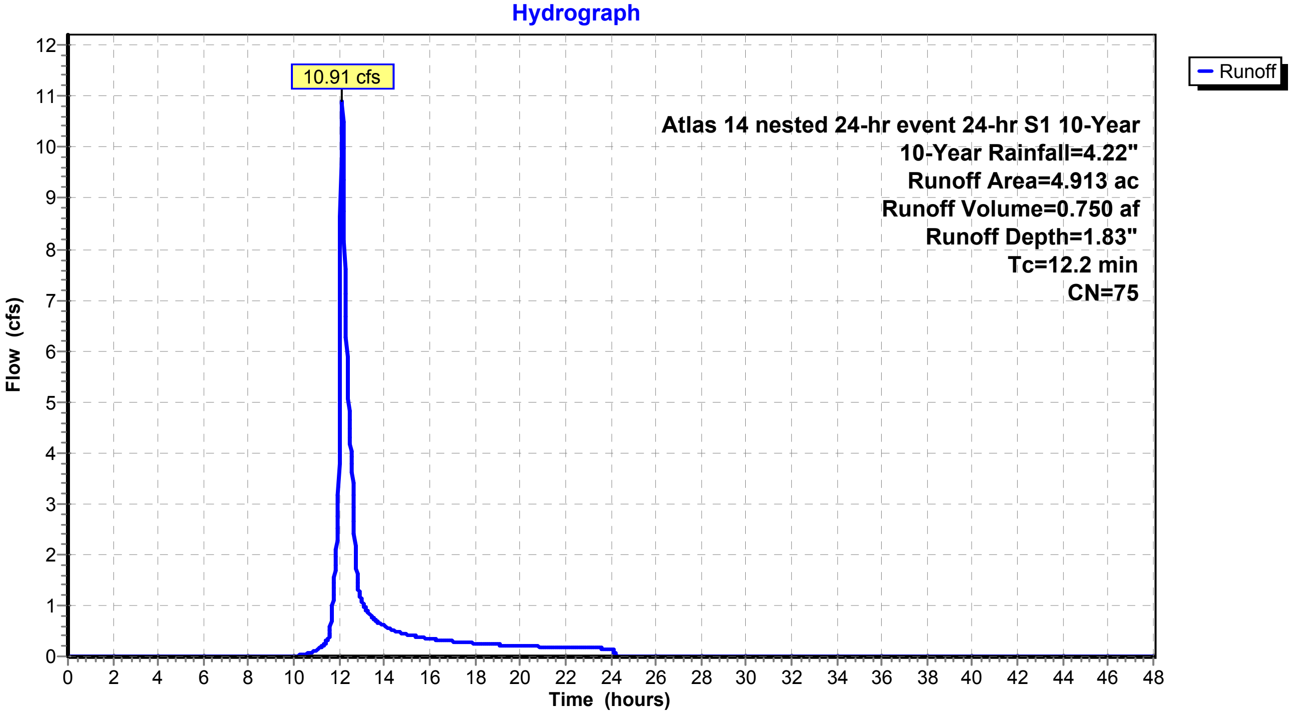
Runoff = 10.91 cfs @ 12.13 hrs, Volume= 0.750 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	4.913	75	
	4.913		100.00% Pervious Area

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

Subcatchment 2: Sub-basin 2



Summary for Subcatchment 3: Sub-basin 3

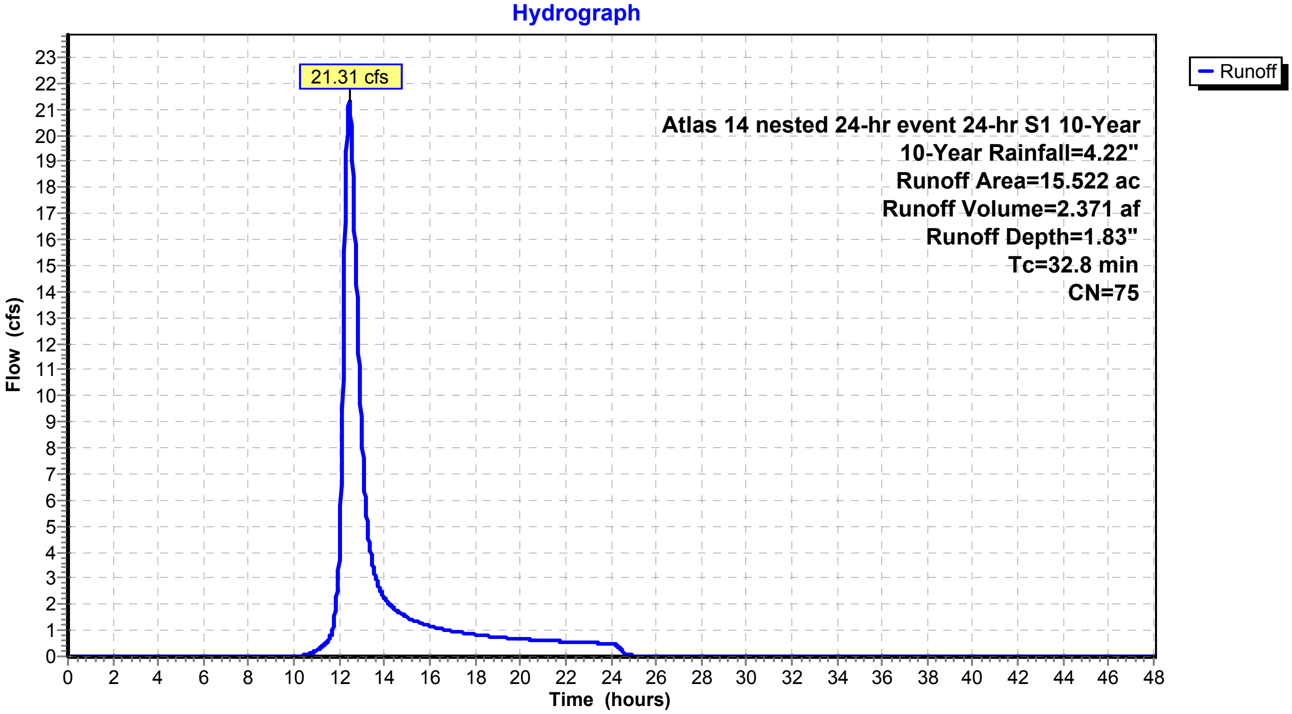
Runoff = 21.31 cfs @ 12.43 hrs, Volume= 2.371 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	15.522	75	
	15.522		100.00% Pervious Area

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

Subcatchment 3: Sub-basin 3



Summary for Subcatchment 4S: Sub-basin 4

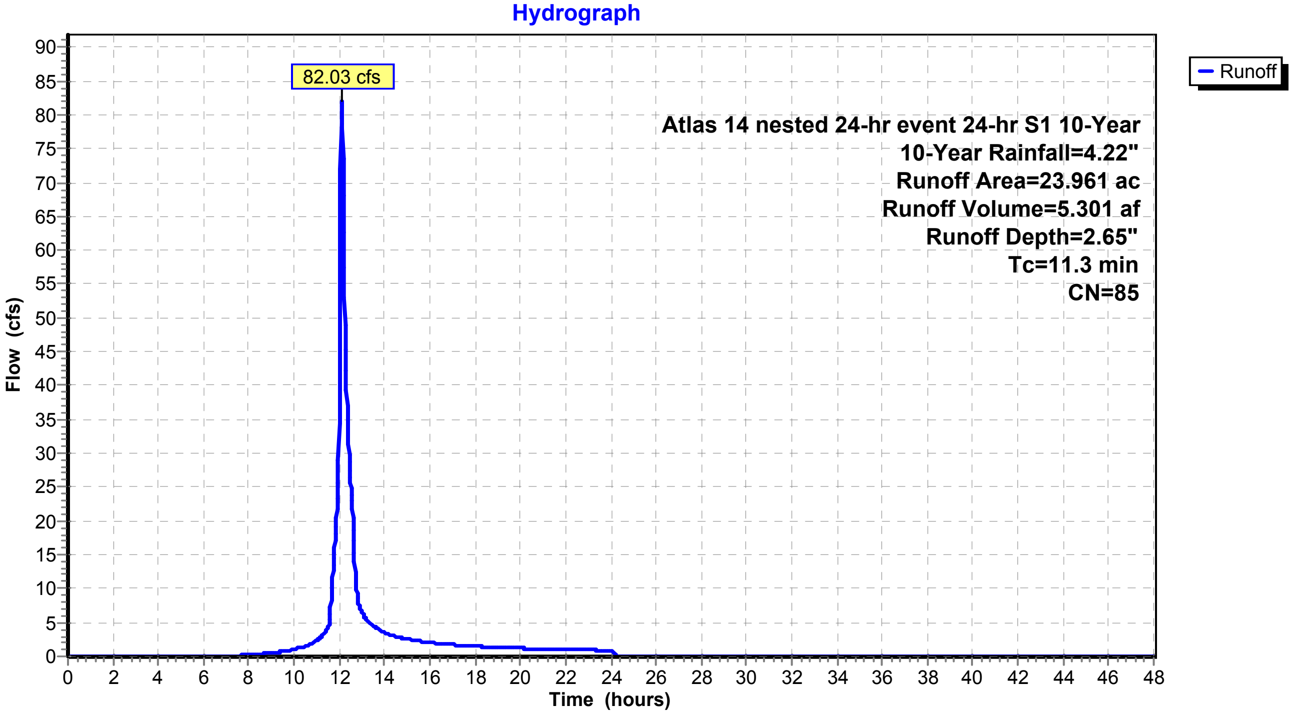
Runoff = 82.03 cfs @ 12.11 hrs, Volume= 5.301 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	23.961	85	
	23.961		100.00% Pervious Area

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

Subcatchment 4S: Sub-basin 4



Summary for Subcatchment 5S: Sub-basin 5

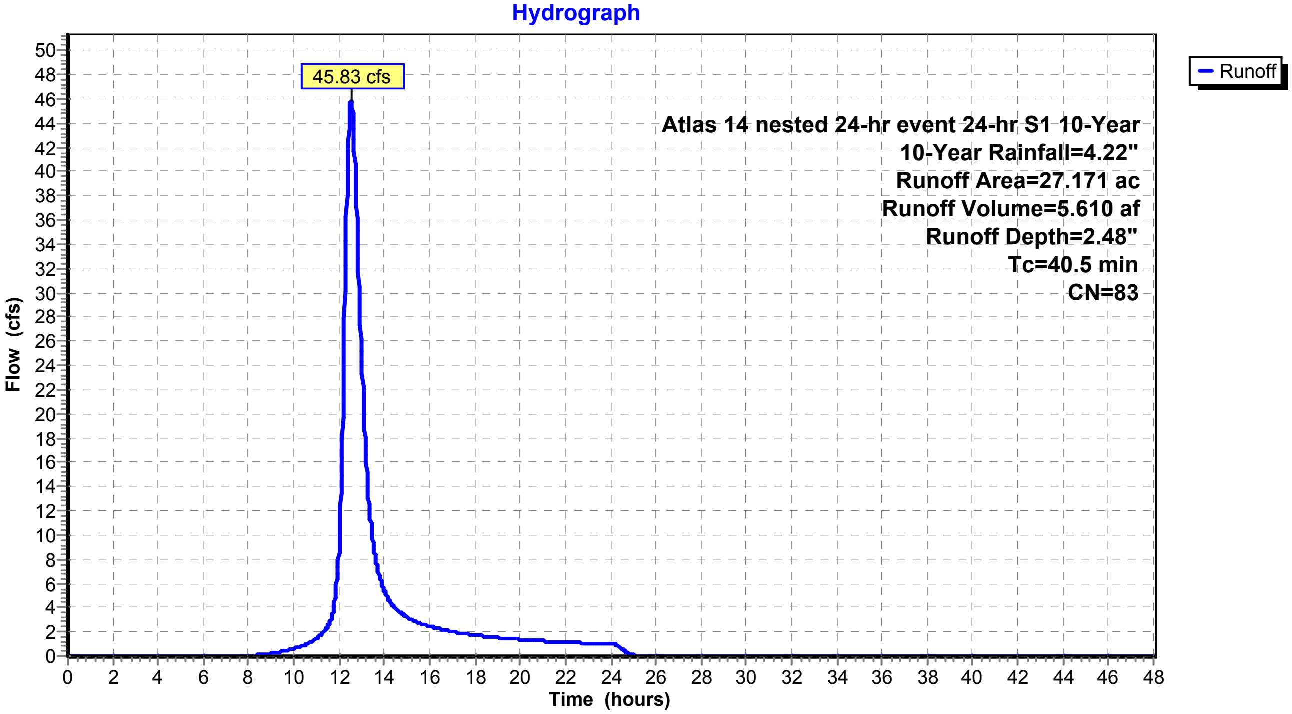
Runoff = 45.83 cfs @ 12.53 hrs, Volume= 5.610 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	27.171	83	
	27.171		100.00% Pervious Area

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

Subcatchment 5S: Sub-basin 5



Summary for Subcatchment 6S: Sub-basin 6

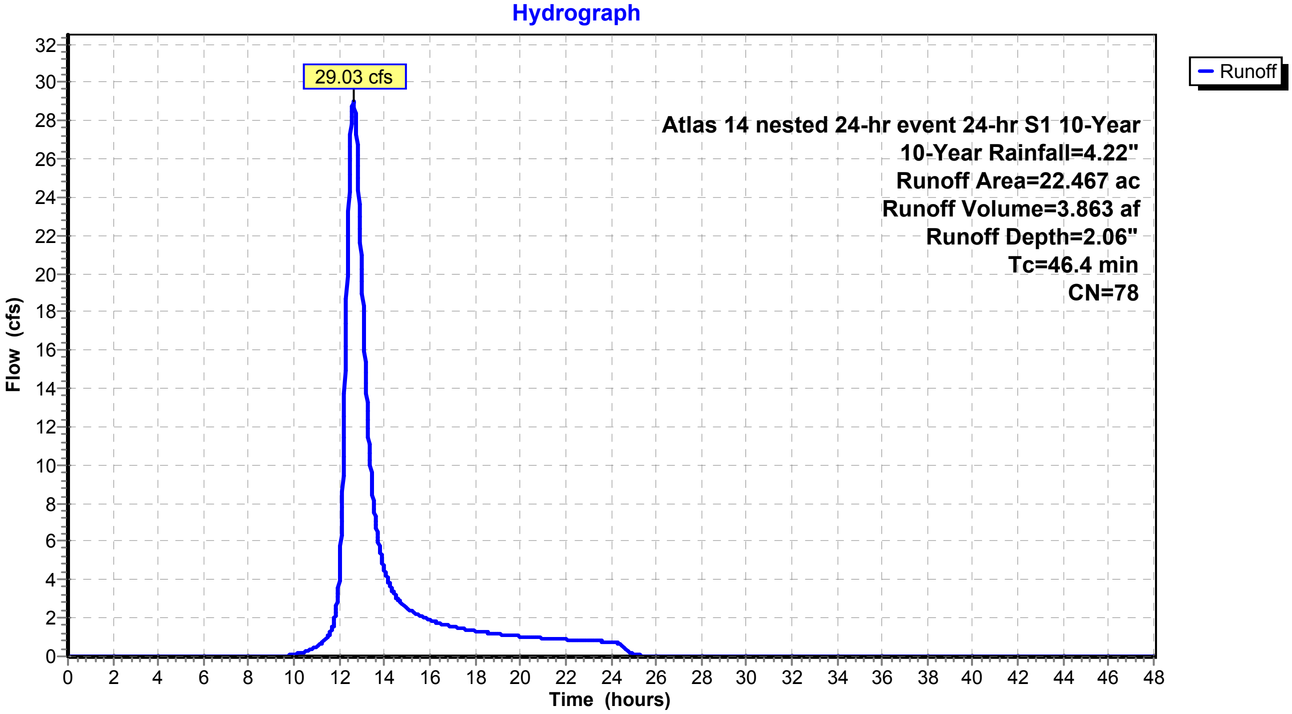
Runoff = 29.03 cfs @ 12.63 hrs, Volume= 3.863 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	22.467	78	
	22.467		100.00% Pervious Area

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

Subcatchment 6S: Sub-basin 6



Summary for Subcatchment 7S: Sub-basin 7

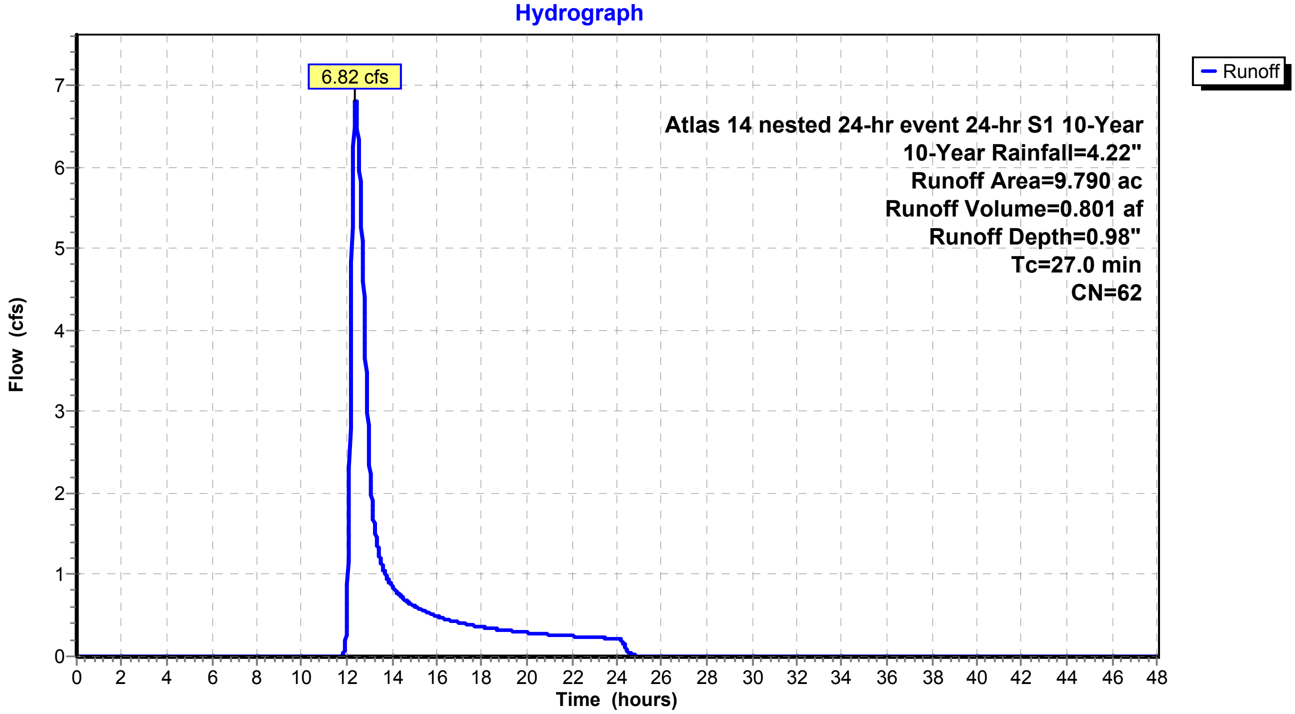
Runoff = 6.82 cfs @ 12.39 hrs, Volume= 0.801 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	9.790	62	
	9.790		100.00% Pervious Area

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

Subcatchment 7S: Sub-basin 7



Summary for Subcatchment 8S: Sub-basin 8

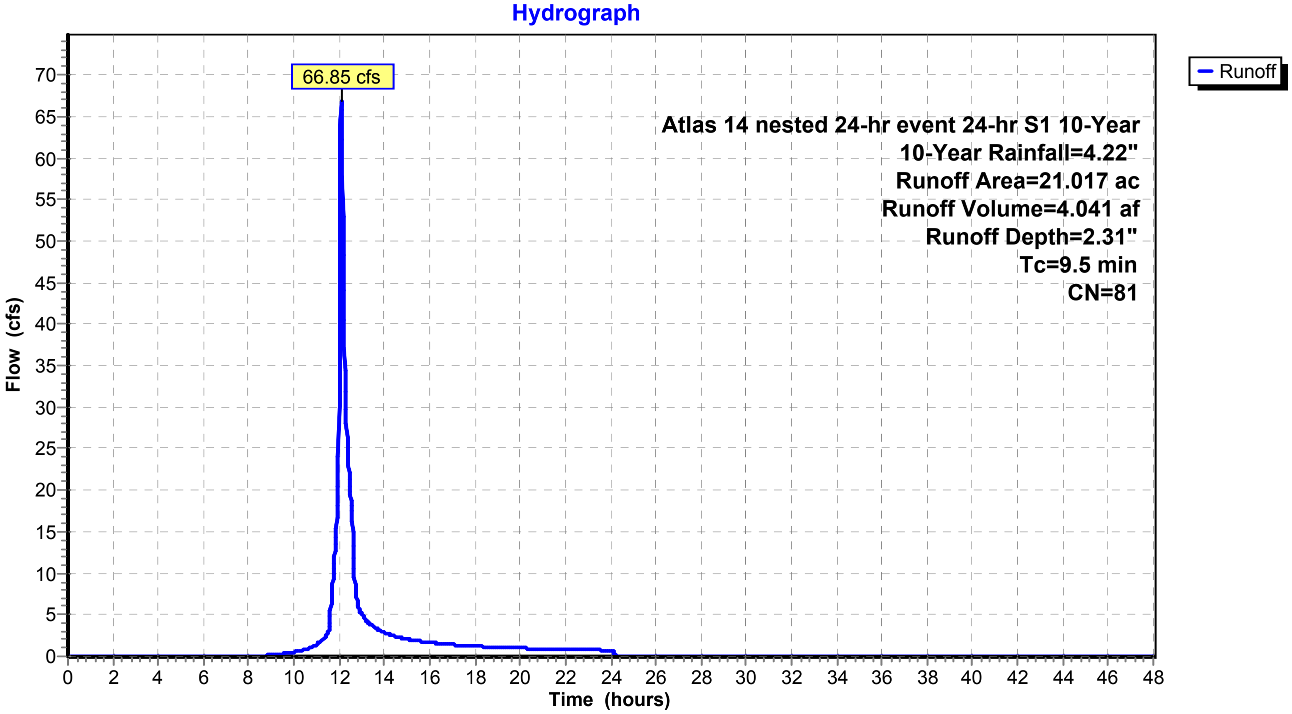
Runoff = 66.85 cfs @ 12.08 hrs, Volume= 4.041 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	21.017	81	
	21.017		100.00% Pervious Area

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

Subcatchment 8S: Sub-basin 8



Summary for Subcatchment 9S: Sub-basin 9

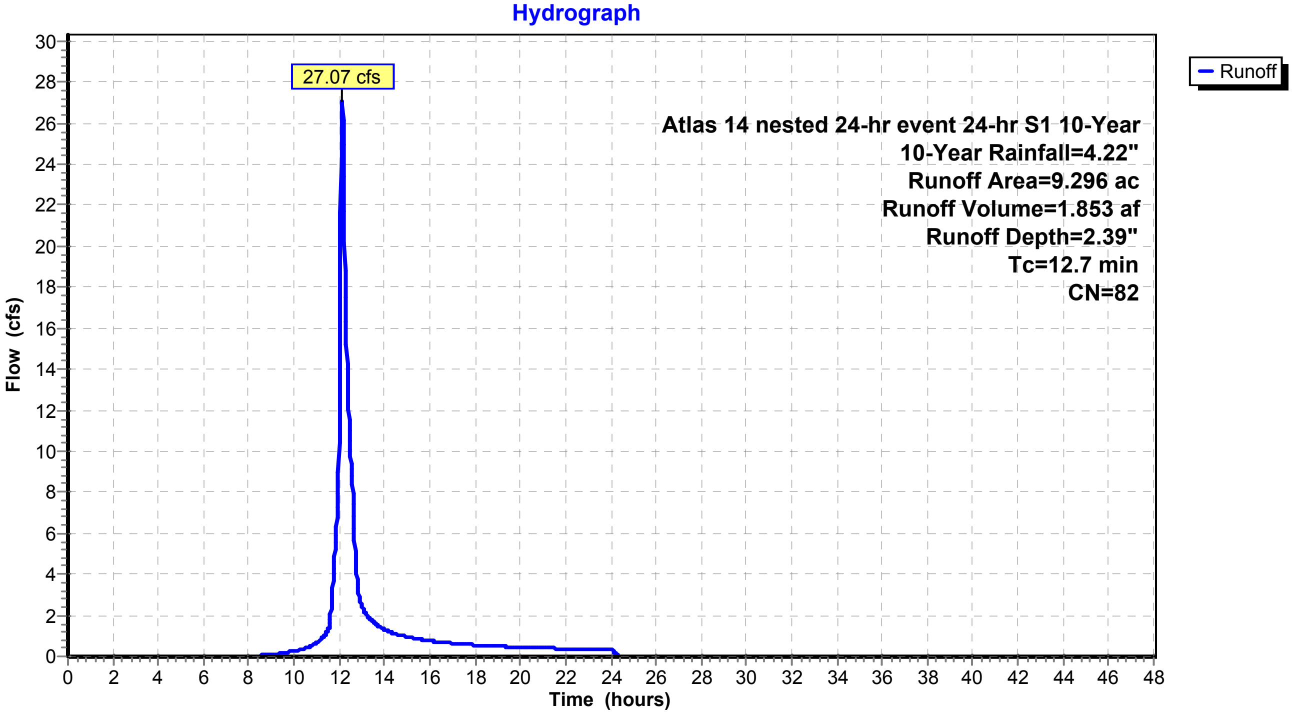
Runoff = 27.07 cfs @ 12.13 hrs, Volume= 1.853 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	9.296	82	
	9.296		100.00% Pervious Area

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

Subcatchment 9S: Sub-basin 9



Summary for Subcatchment 10S: Sub-basin 10

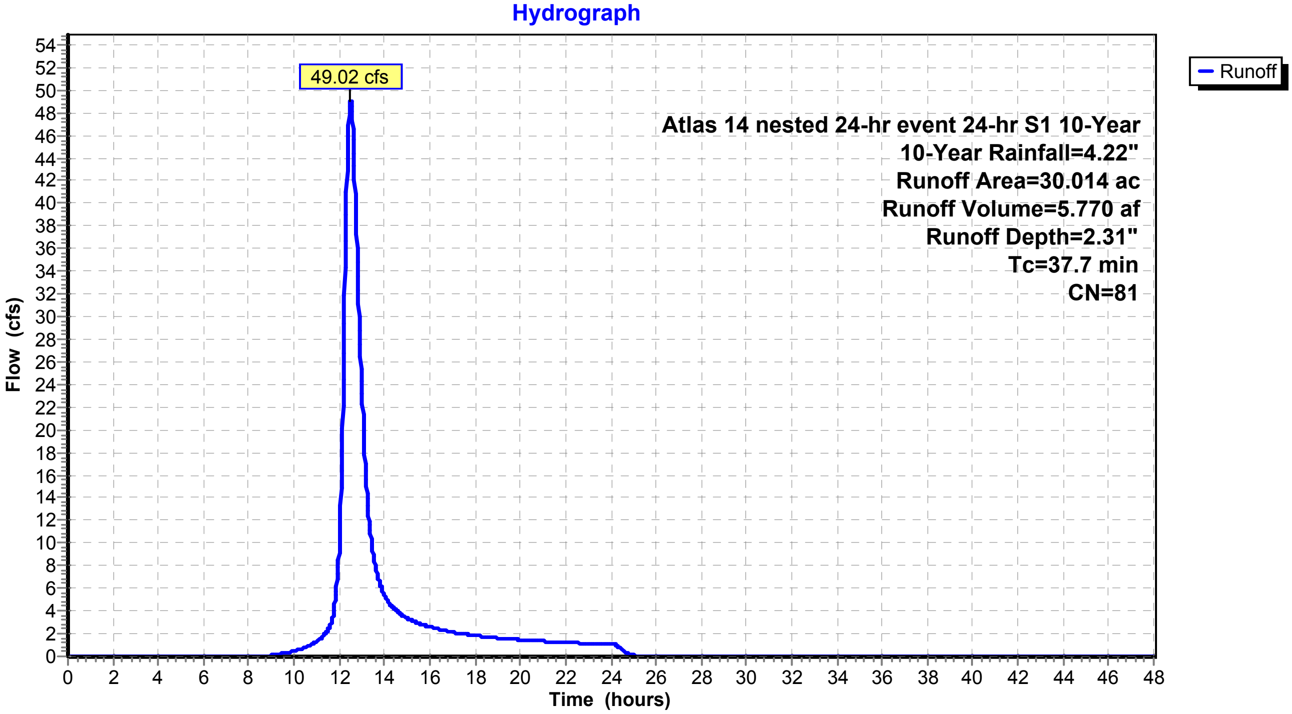
Runoff = 49.02 cfs @ 12.49 hrs, Volume= 5.770 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	30.014	81	
	30.014		100.00% Pervious Area

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

Subcatchment 10S: Sub-basin 10



Summary for Subcatchment 11S: Sub-basin 11

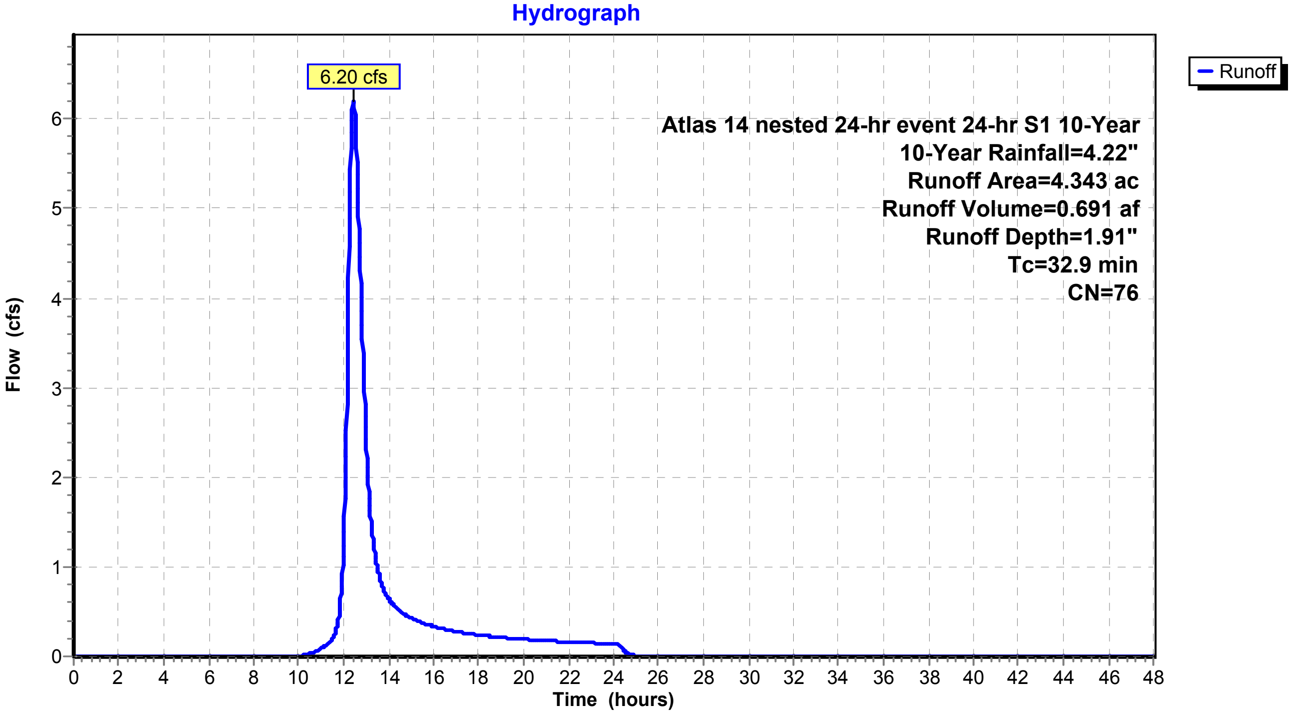
Runoff = 6.20 cfs @ 12.43 hrs, Volume= 0.691 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	4.343	76	
	4.343		100.00% Pervious Area

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

Subcatchment 11S: Sub-basin 11



Summary for Subcatchment 12S: Sub-basin 12

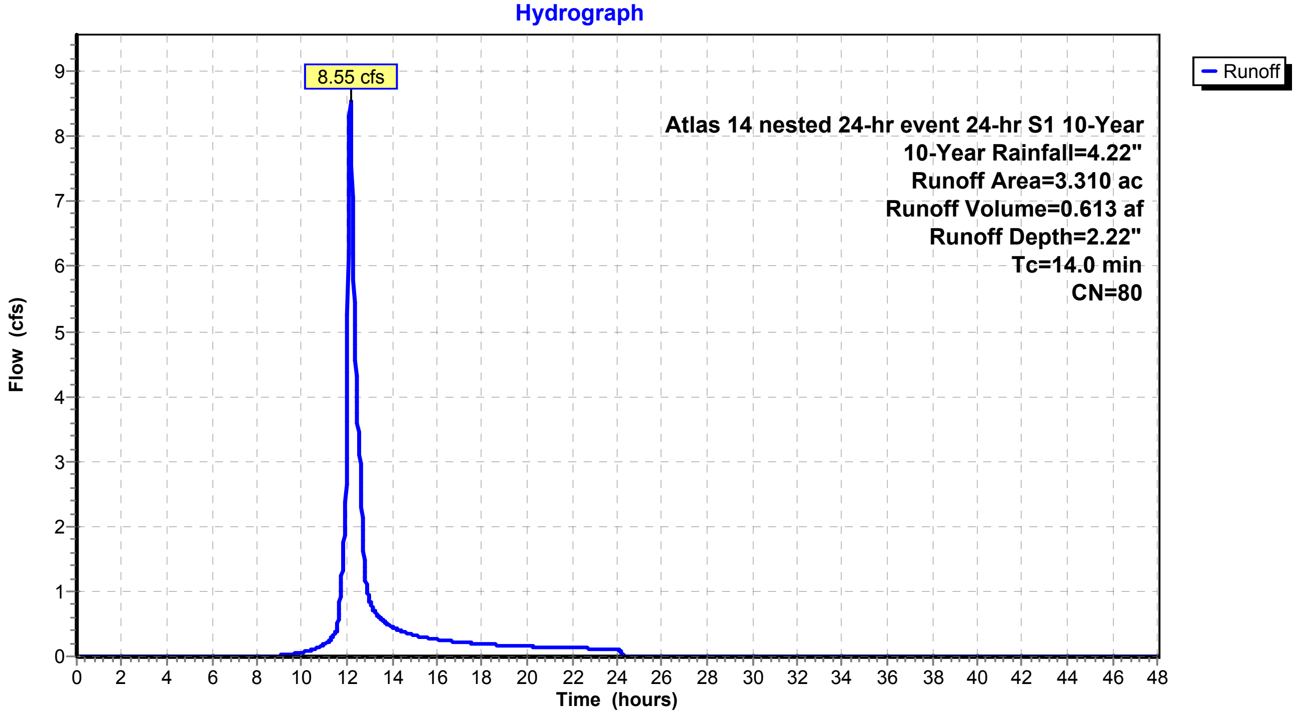
Runoff = 8.55 cfs @ 12.15 hrs, Volume= 0.613 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.310	80	
	3.310		100.00% Pervious Area

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

Subcatchment 12S: Sub-basin 12



Summary for Subcatchment 13S: Sub-basin 13

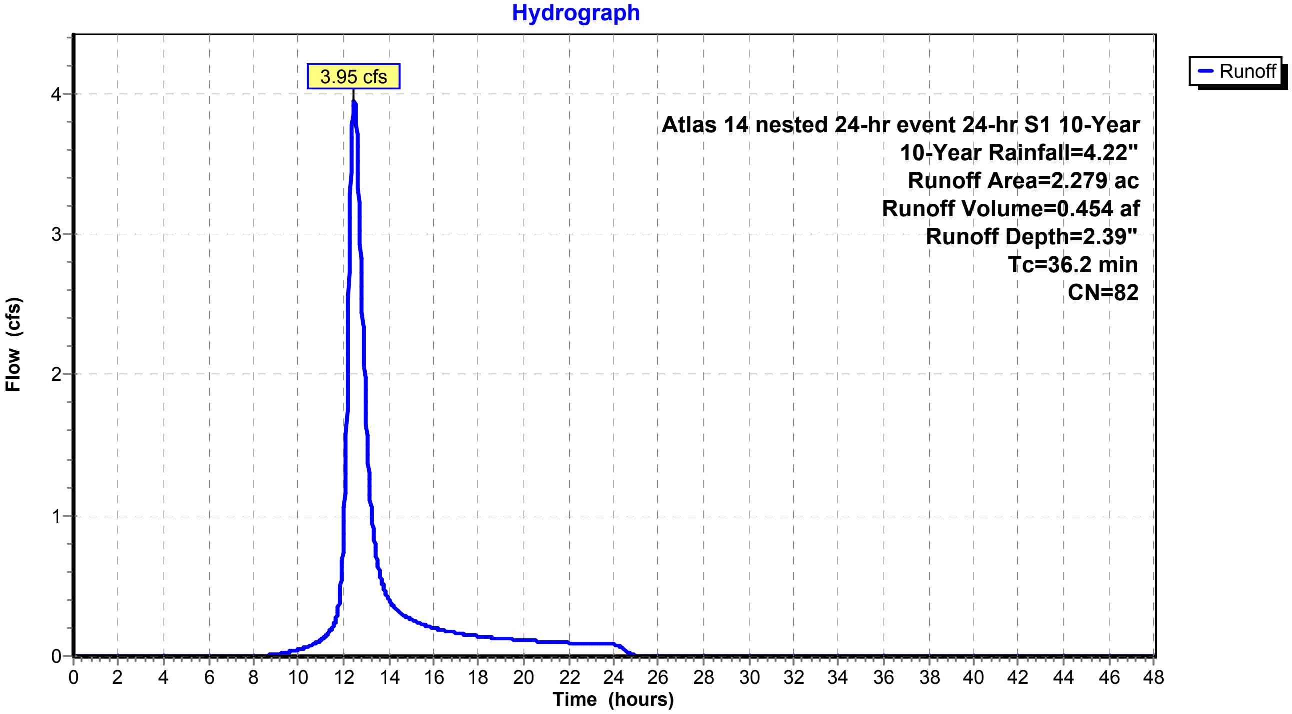
Runoff = 3.95 cfs @ 12.46 hrs, Volume= 0.454 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.279	82	
	2.279		100.00% Pervious Area

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

Subcatchment 13S: Sub-basin 13



Summary for Subcatchment 14S: Sub-basin 14

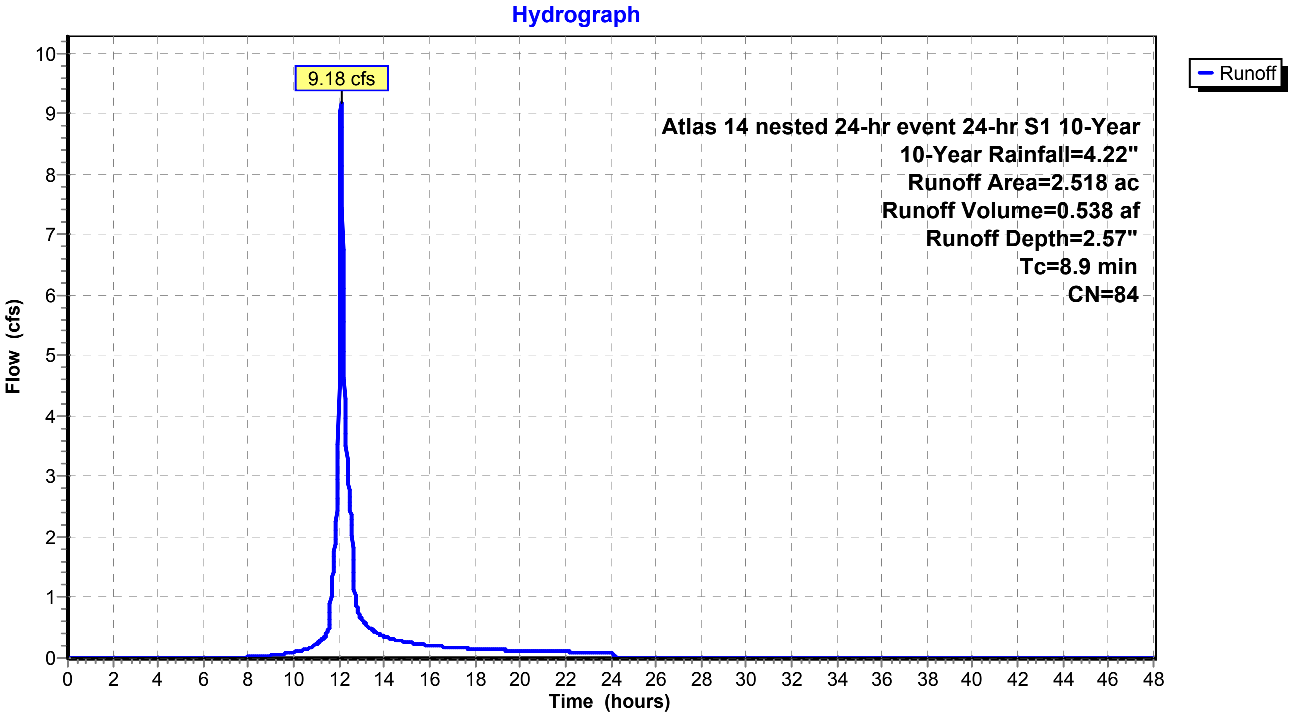
Runoff = 9.18 cfs @ 12.08 hrs, Volume= 0.538 af, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.518	84	
	2.518		100.00% Pervious Area

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

Subcatchment 14S: Sub-basin 14



Summary for Subcatchment 15S: Sub-basin 15

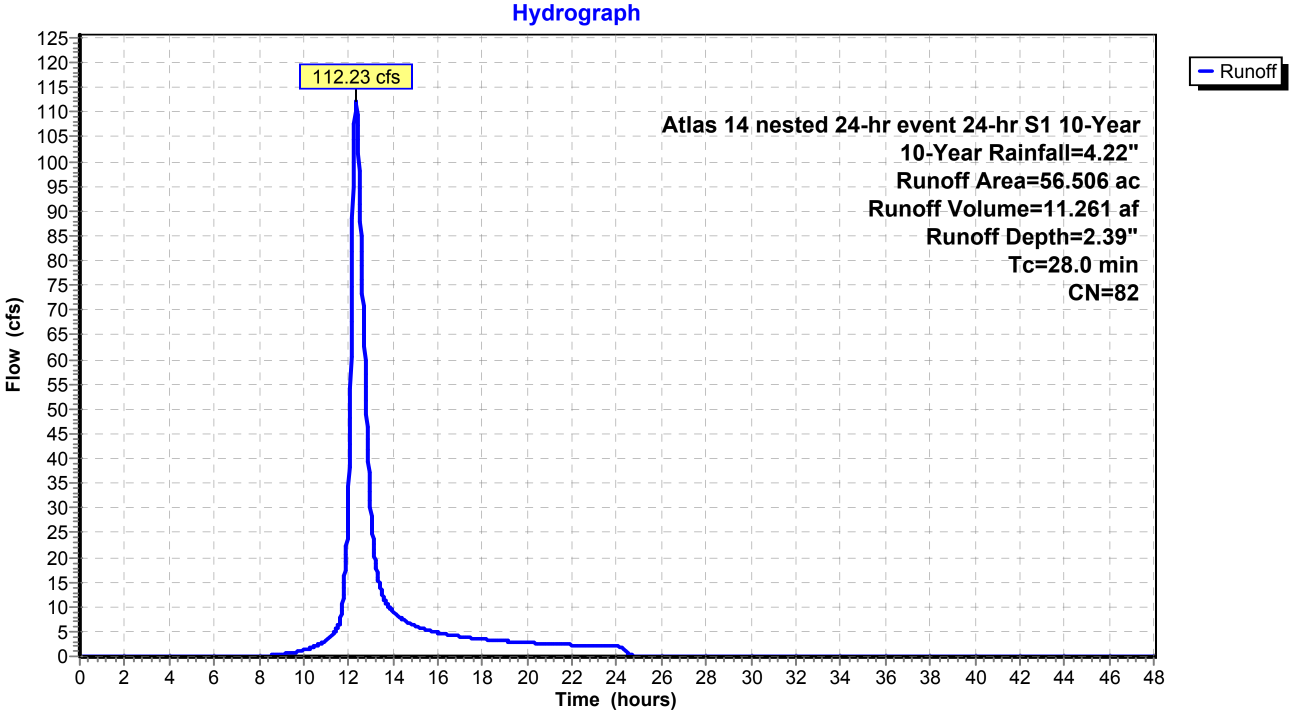
Runoff = 112.23 cfs @ 12.35 hrs, Volume= 11.261 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	56.506	82	
	56.506		100.00% Pervious Area

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

Subcatchment 15S: Sub-basin 15



Summary for Subcatchment 16S: Sub-basin 16

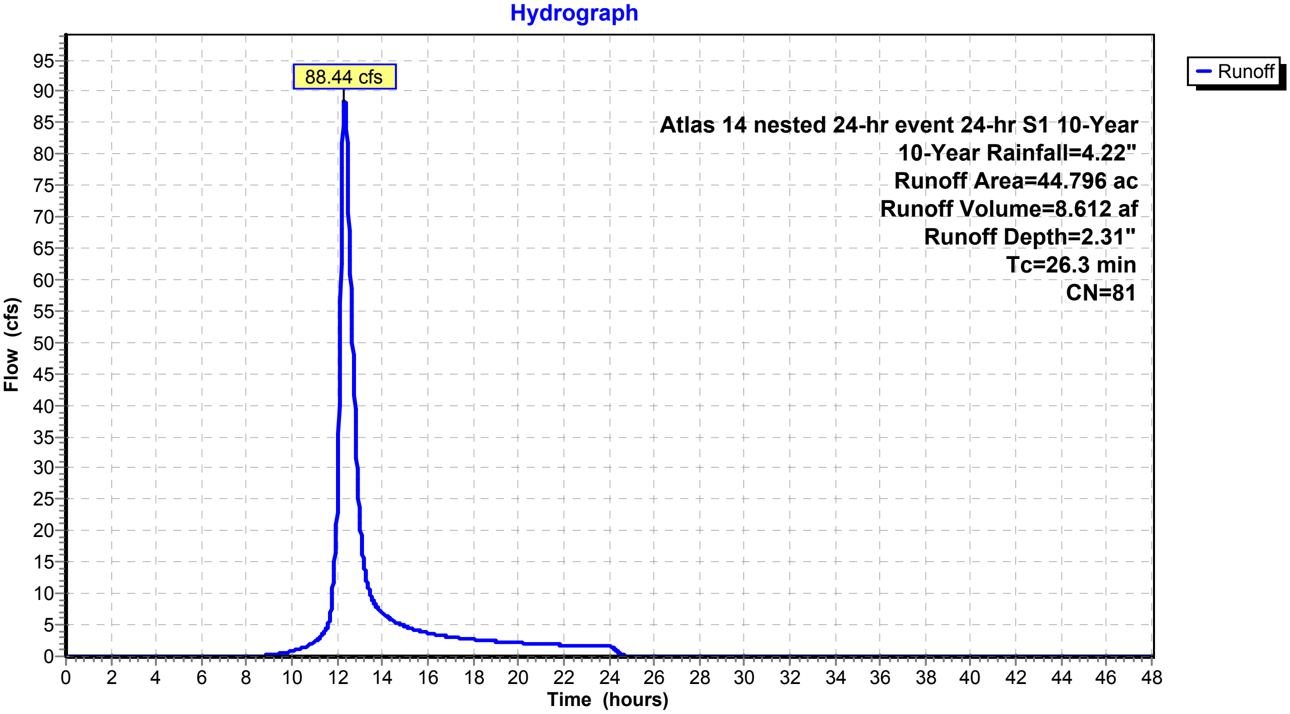
Runoff = 88.44 cfs @ 12.32 hrs, Volume= 8.612 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	44.796	81	
	44.796		100.00% Pervious Area

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

Subcatchment 16S: Sub-basin 16



Summary for Subcatchment 17S: Sub-basin 17

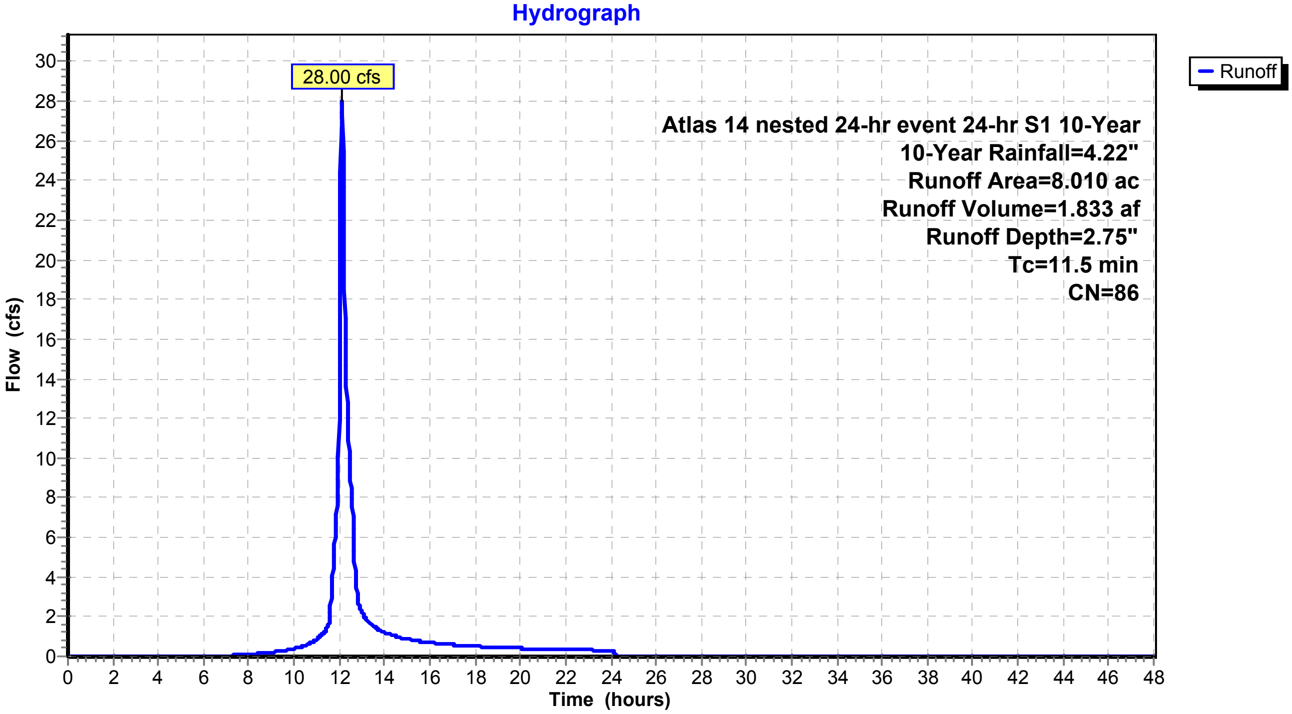
Runoff = 28.00 cfs @ 12.11 hrs, Volume= 1.833 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	8.010	86	
	8.010		100.00% Pervious Area

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

Subcatchment 17S: Sub-basin 17



Summary for Subcatchment 18S: Sub-basin 18

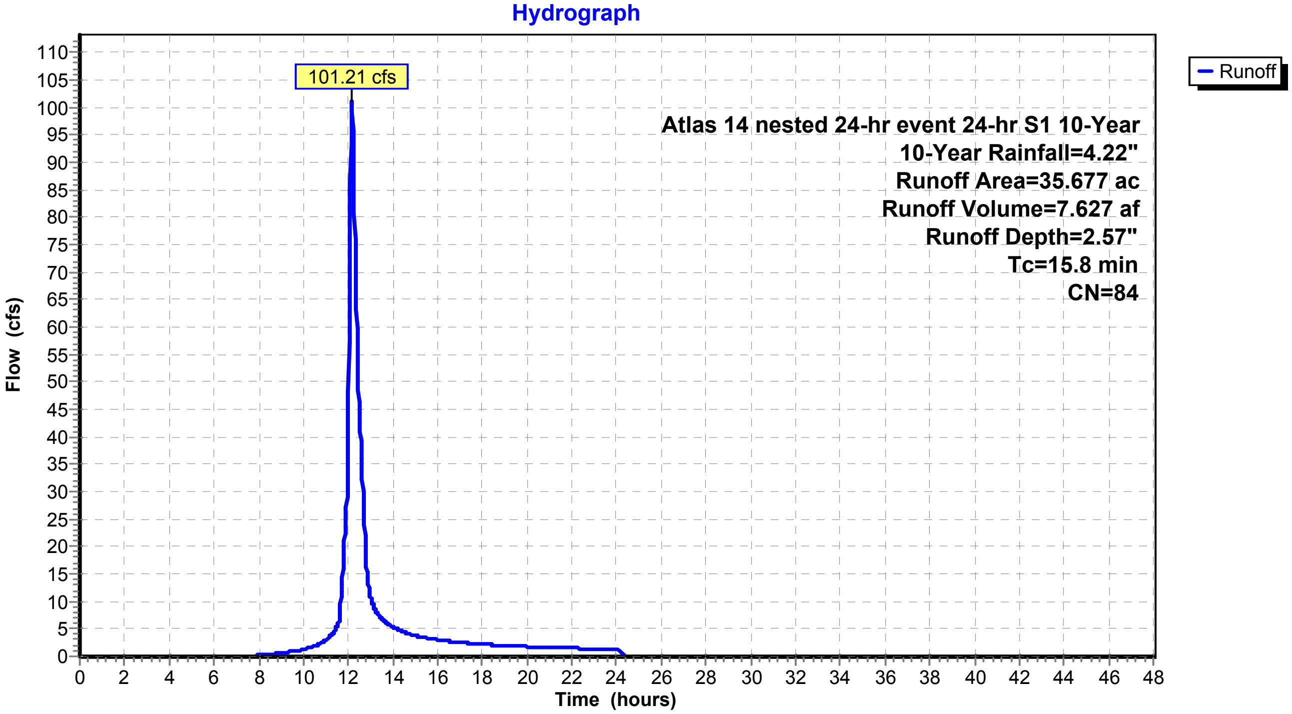
Runoff = 101.21 cfs @ 12.17 hrs, Volume= 7.627 af, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	35.677	84	
	35.677		100.00% Pervious Area

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

Subcatchment 18S: Sub-basin 18



Summary for Subcatchment 19S: Sub-basin 19

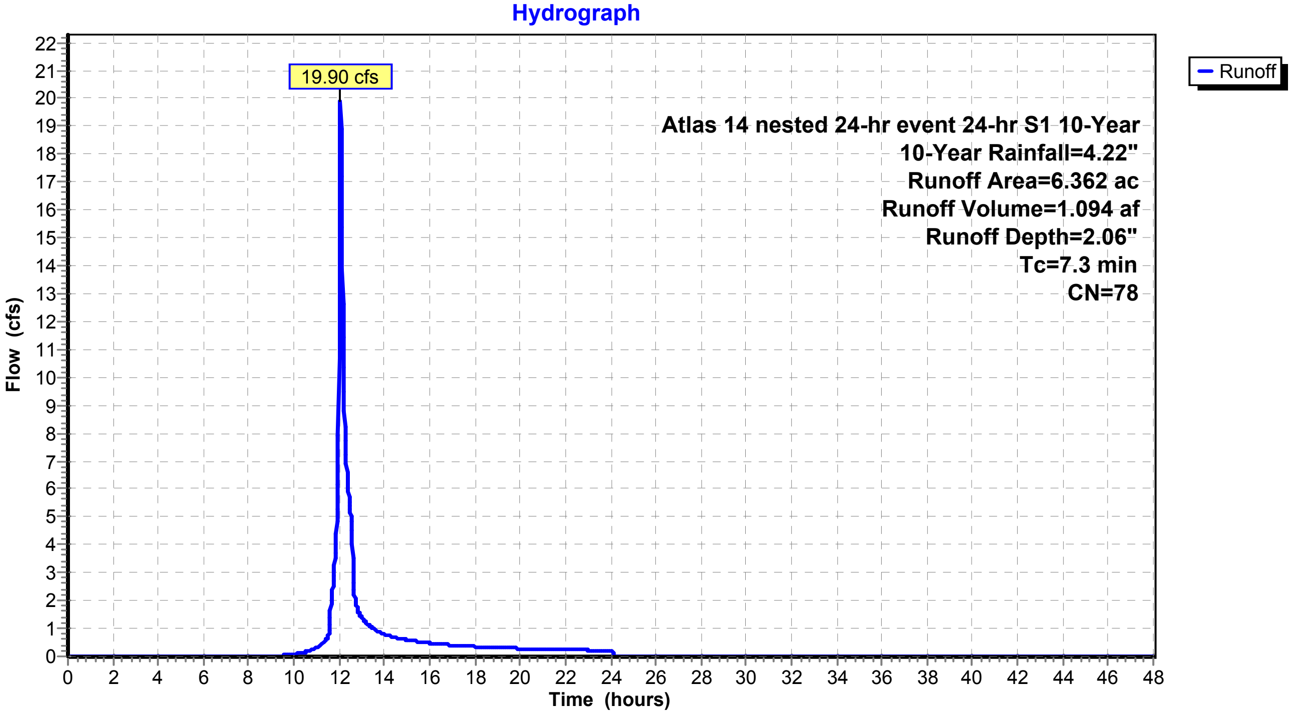
Runoff = 19.90 cfs @ 12.06 hrs, Volume= 1.094 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	6.362	78	
	6.362		100.00% Pervious Area

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

Subcatchment 19S: Sub-basin 19



Summary for Subcatchment 20S: Sub-basin 20

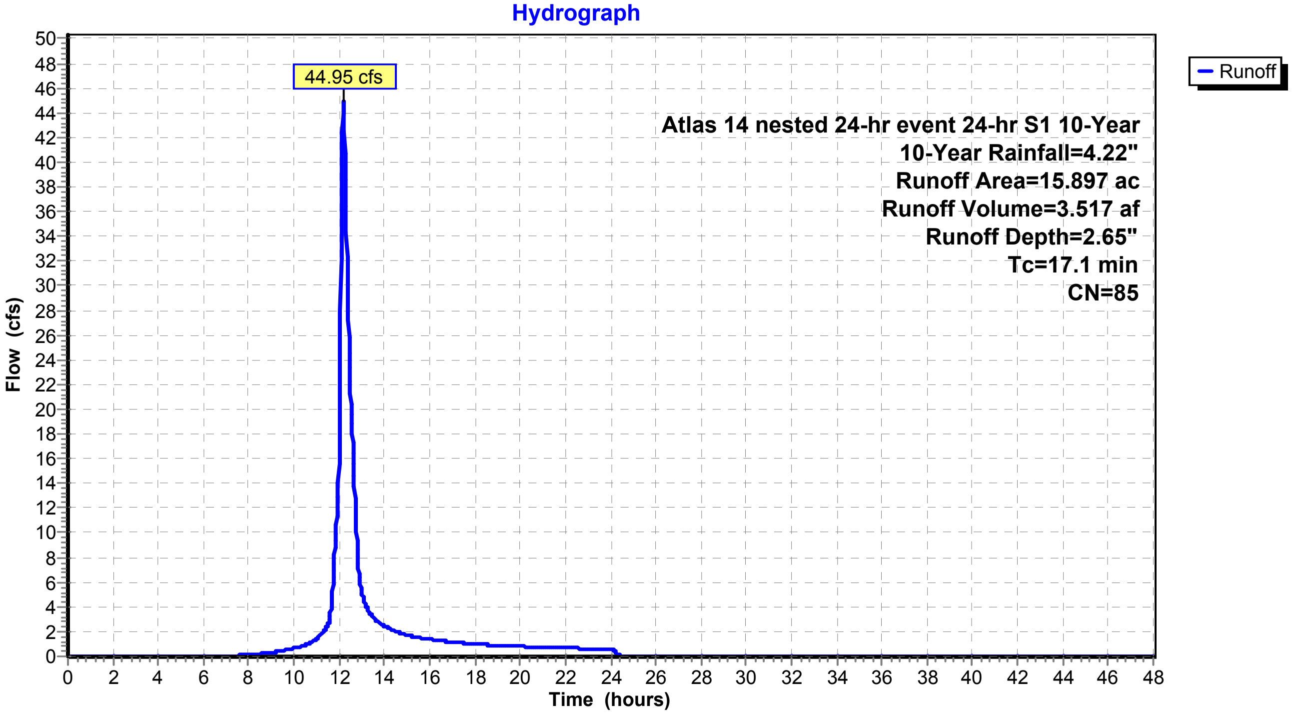
Runoff = 44.95 cfs @ 12.19 hrs, Volume= 3.517 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	15.897	85	
	15.897		100.00% Pervious Area

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

Subcatchment 20S: Sub-basin 20



Summary for Subcatchment 21S: Sub-basin 21

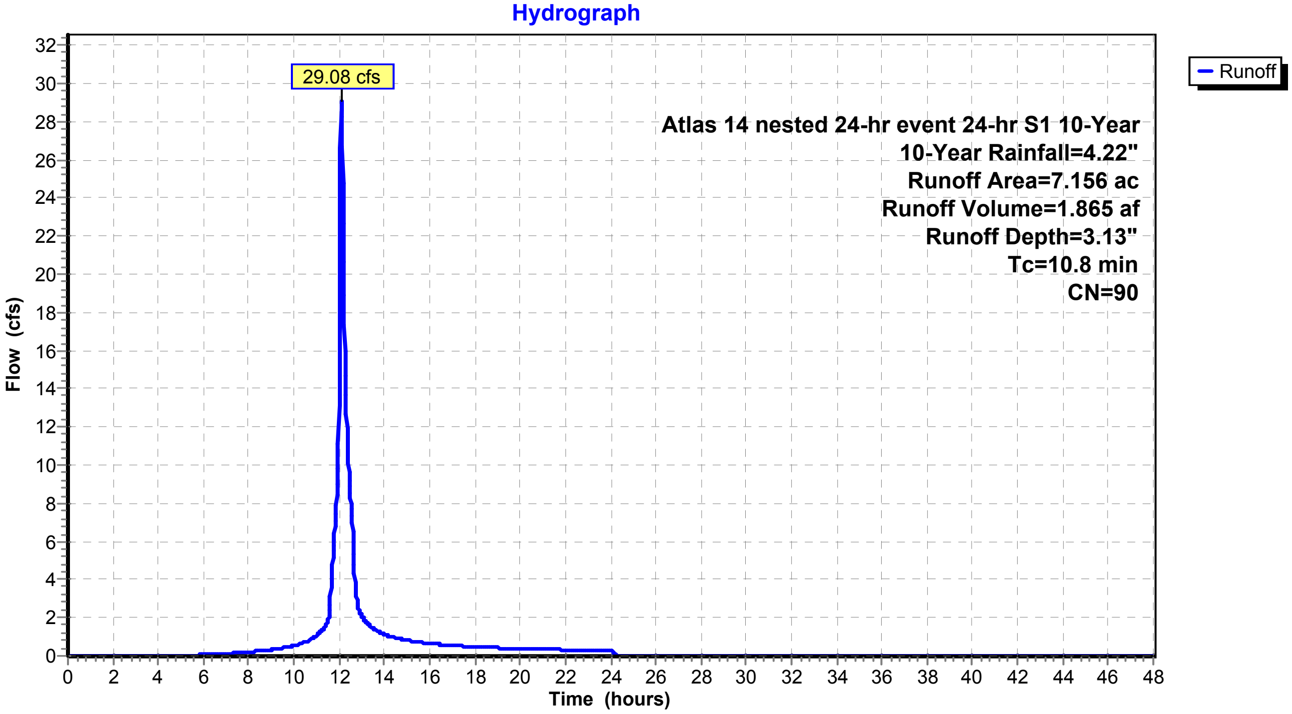
Runoff = 29.08 cfs @ 12.10 hrs, Volume= 1.865 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	7.156	90	
	7.156		100.00% Pervious Area

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

Subcatchment 21S: Sub-basin 21



Summary for Subcatchment 22S: Sub-basin 22

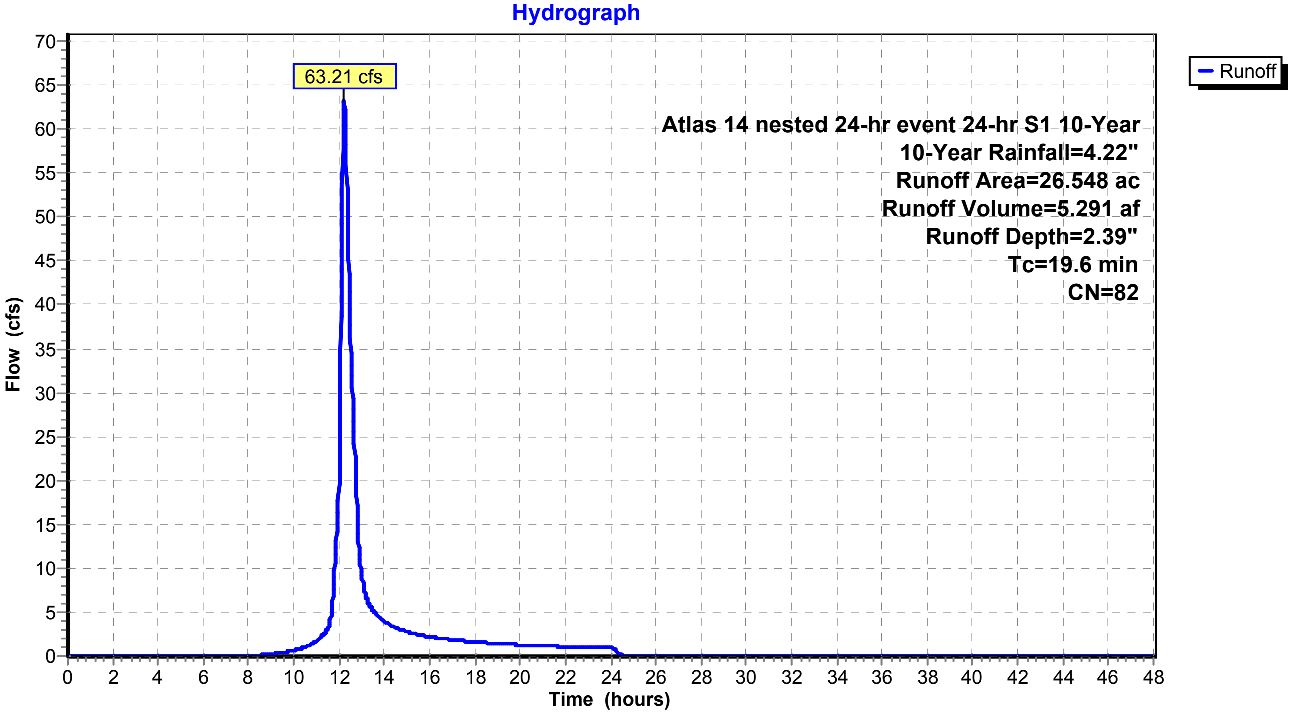
Runoff = 63.21 cfs @ 12.23 hrs, Volume= 5.291 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	26.548	82	
	26.548		100.00% Pervious Area

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

Subcatchment 22S: Sub-basin 22



Summary for Subcatchment 23S: Sub-basin 23

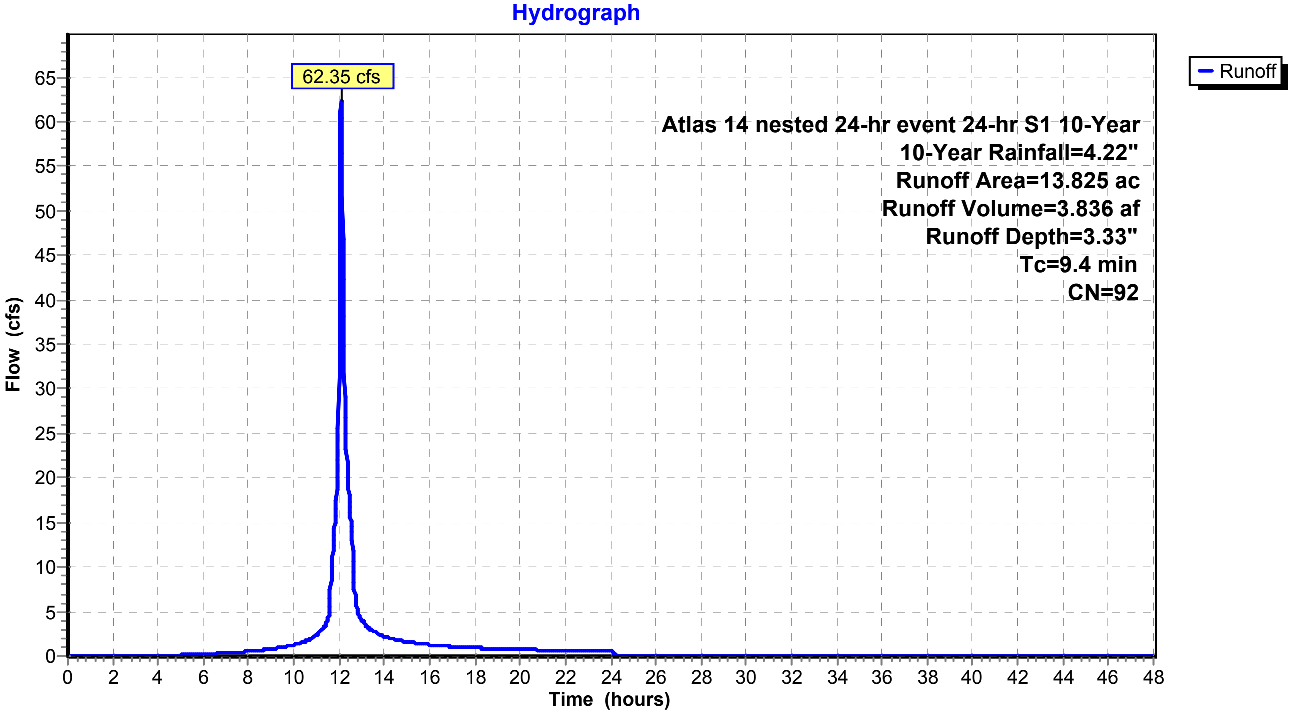
Runoff = 62.35 cfs @ 12.08 hrs, Volume= 3.836 af, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	13.825	92	
	13.825		100.00% Pervious Area

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

Subcatchment 23S: Sub-basin 23



Summary for Subcatchment 24S: Sub-basin 24

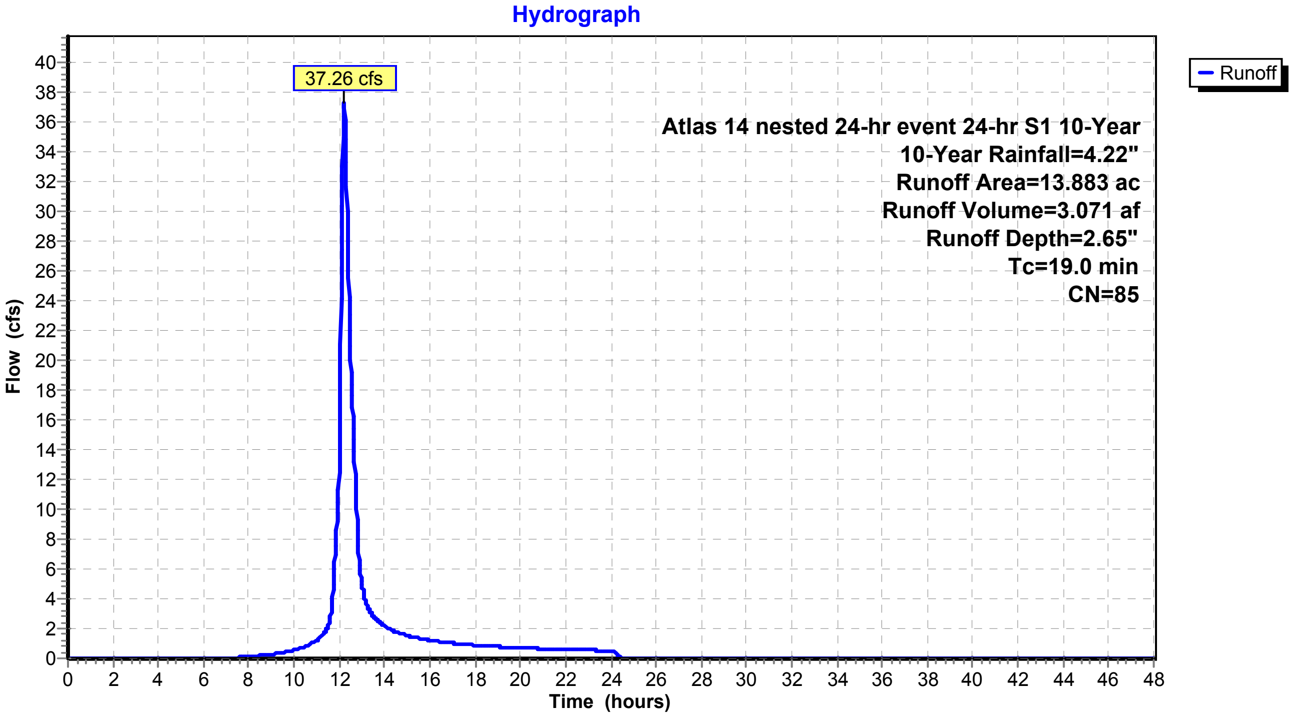
Runoff = 37.26 cfs @ 12.22 hrs, Volume= 3.071 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	13.883	85	
	13.883		100.00% Pervious Area

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

Subcatchment 24S: Sub-basin 24



Summary for Subcatchment 25S: Sub-basin 25

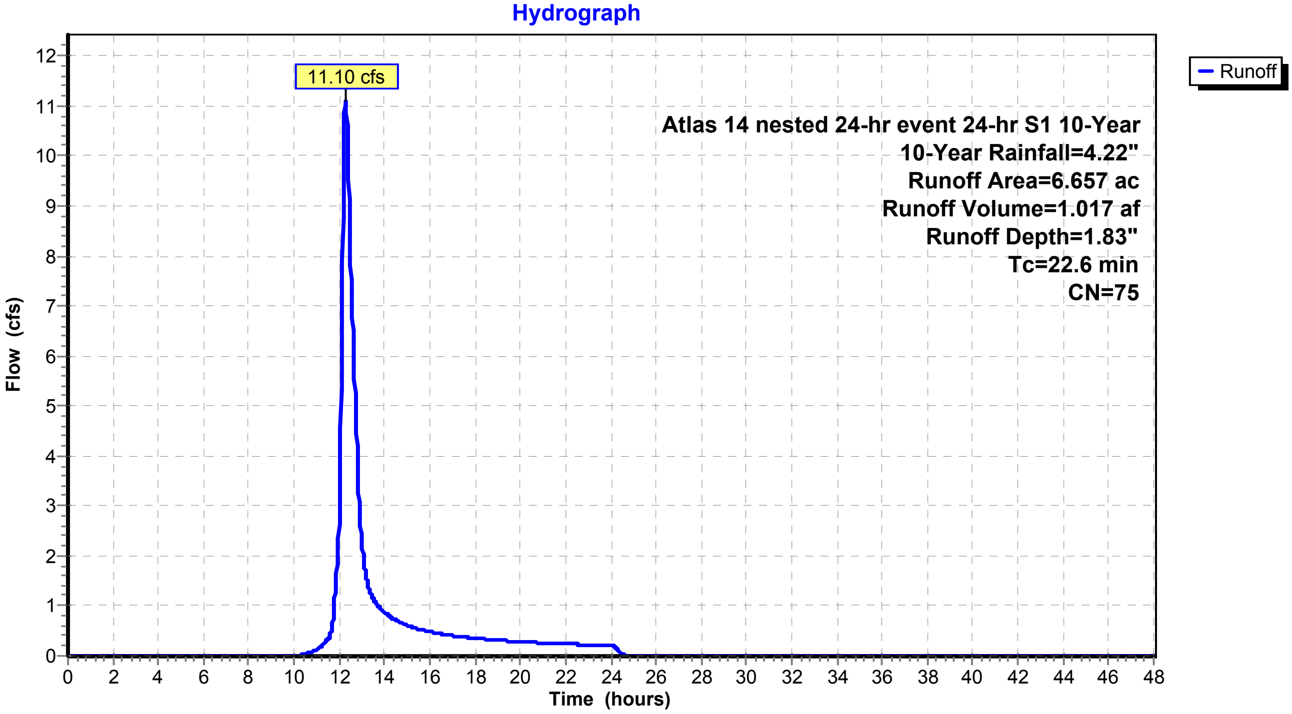
Runoff = 11.10 cfs @ 12.28 hrs, Volume= 1.017 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	6.657	75	
	6.657		100.00% Pervious Area

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

Subcatchment 25S: Sub-basin 25



Summary for Subcatchment 26S: Sub-basin 26

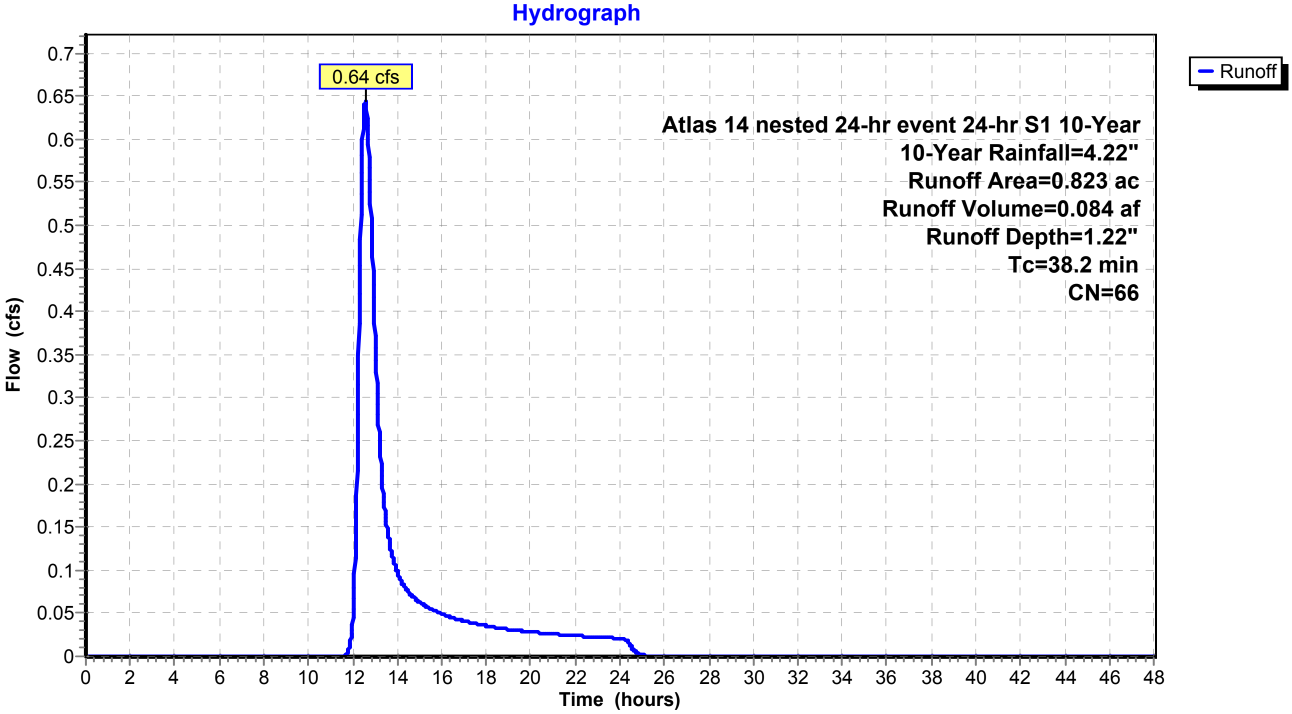
Runoff = 0.64 cfs @ 12.56 hrs, Volume= 0.084 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.823	66	
	0.823		100.00% Pervious Area

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

Subcatchment 26S: Sub-basin 26



Summary for Subcatchment 27S: Sub-basin 27

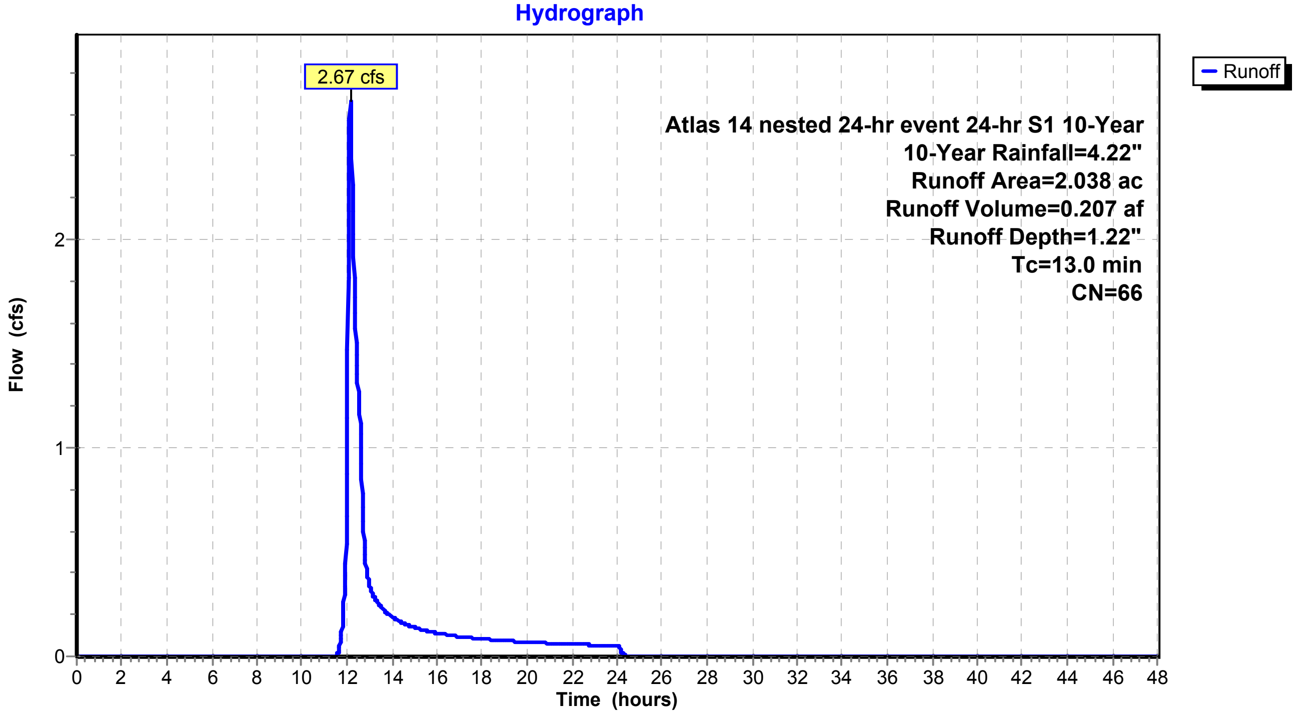
Runoff = 2.67 cfs @ 12.15 hrs, Volume= 0.207 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.038	66	
	2.038		100.00% Pervious Area

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

Subcatchment 27S: Sub-basin 27



Summary for Subcatchment 28S: Sub-basin 28

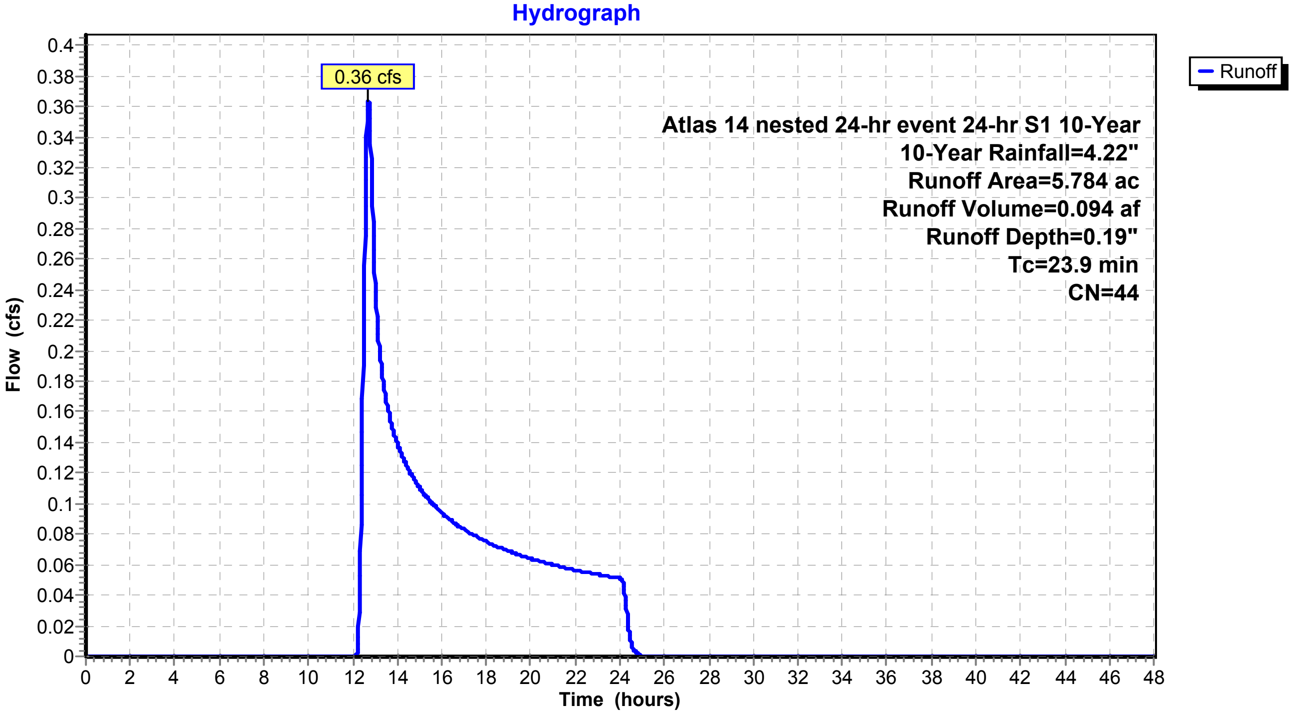
Runoff = 0.36 cfs @ 12.70 hrs, Volume= 0.094 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	5.784	44	
	5.784		100.00% Pervious Area

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

Subcatchment 28S: Sub-basin 28



Summary for Subcatchment 29S: Sub-basin 29

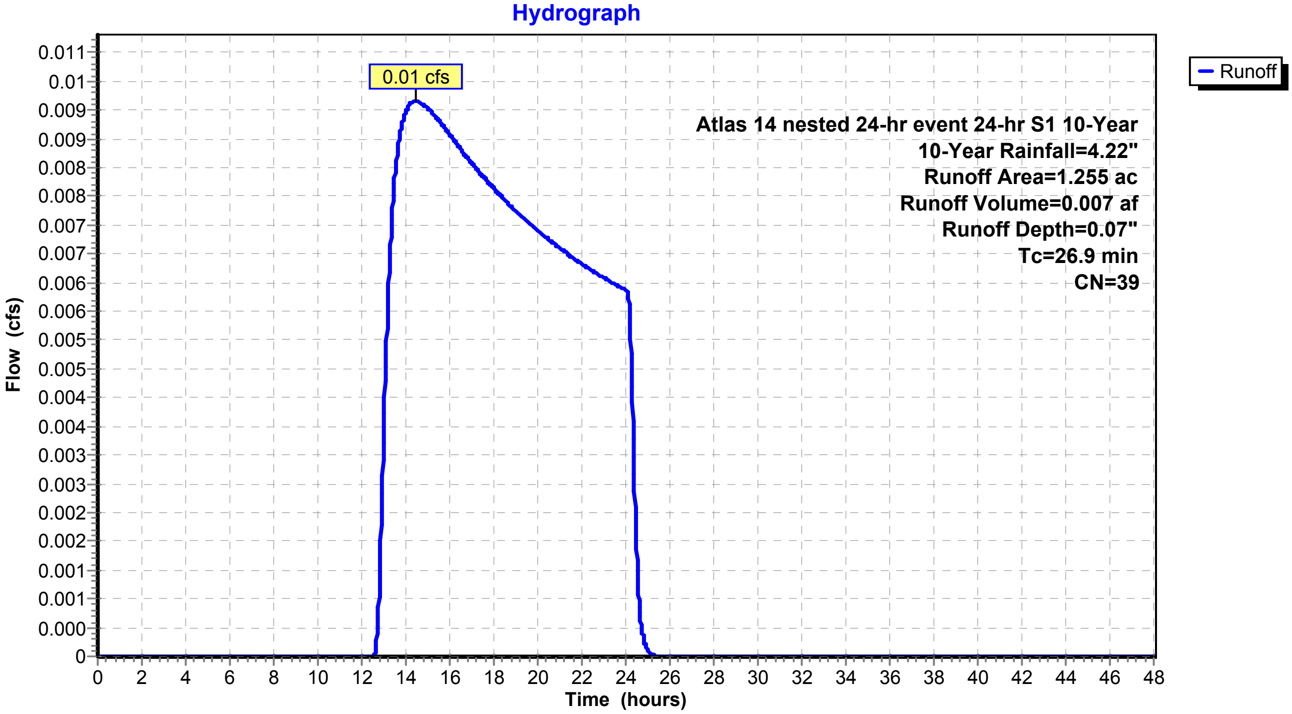
Runoff = 0.01 cfs @ 14.44 hrs, Volume= 0.007 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	1.255	39	
	1.255		100.00% Pervious Area

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

Subcatchment 29S: Sub-basin 29



Summary for Subcatchment 30S: Sub-basin 30

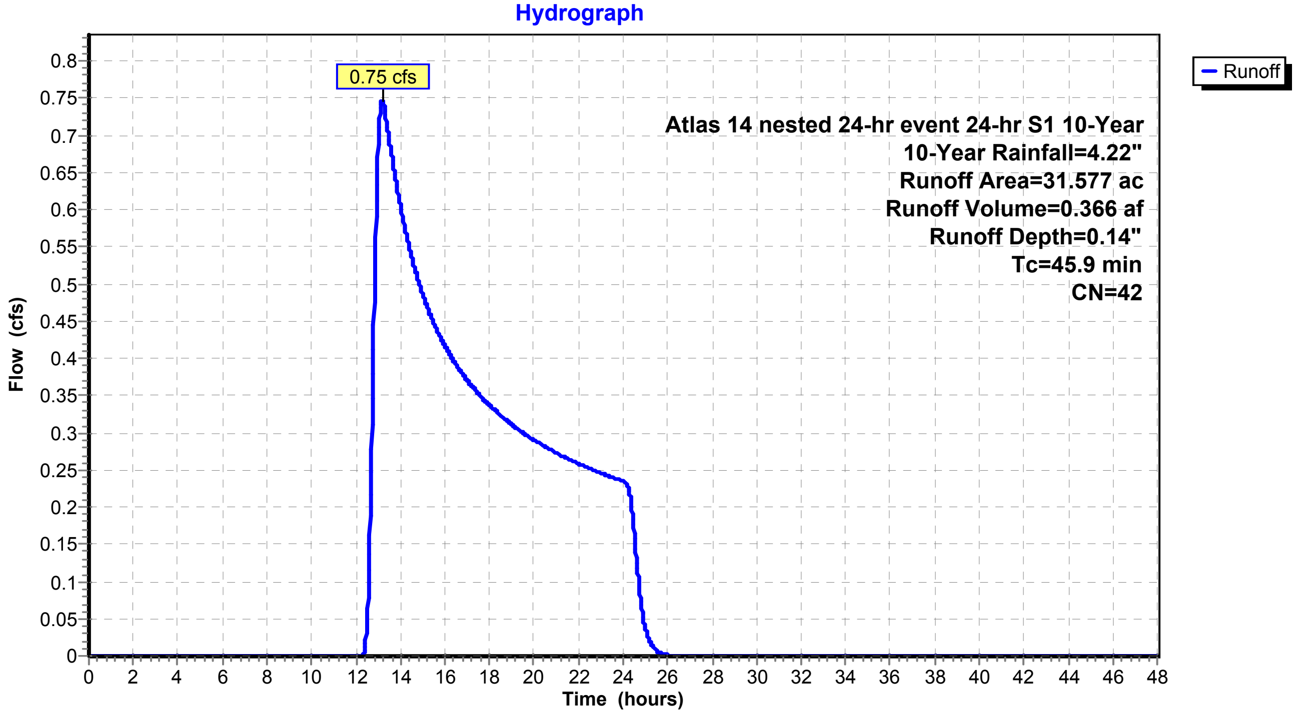
Runoff = 0.75 cfs @ 13.19 hrs, Volume= 0.366 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	31.577	42	
	31.577		100.00% Pervious Area

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

Subcatchment 30S: Sub-basin 30



Summary for Subcatchment 31S: Sub-basin 31

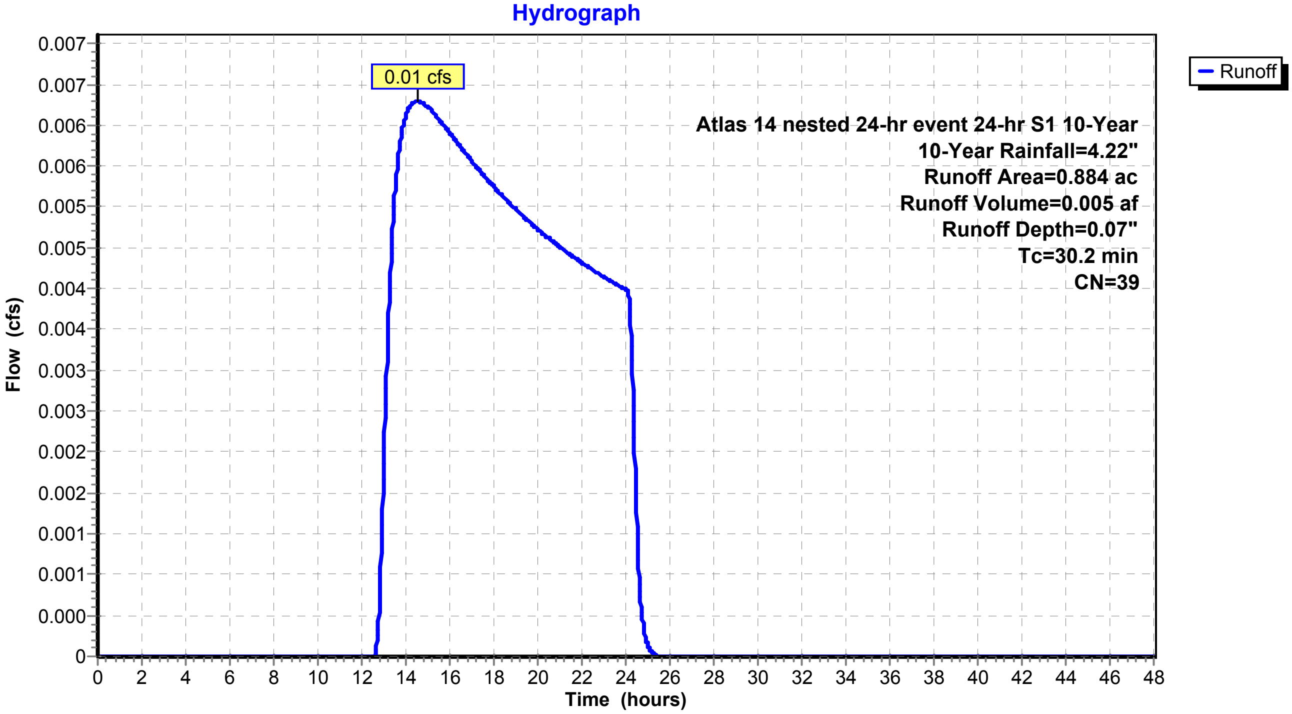
Runoff = 0.01 cfs @ 14.53 hrs, Volume= 0.005 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.884	39	
	0.884		100.00% Pervious Area

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

Subcatchment 31S: Sub-basin 31



Summary for Subcatchment 32S: Sub-basin 32

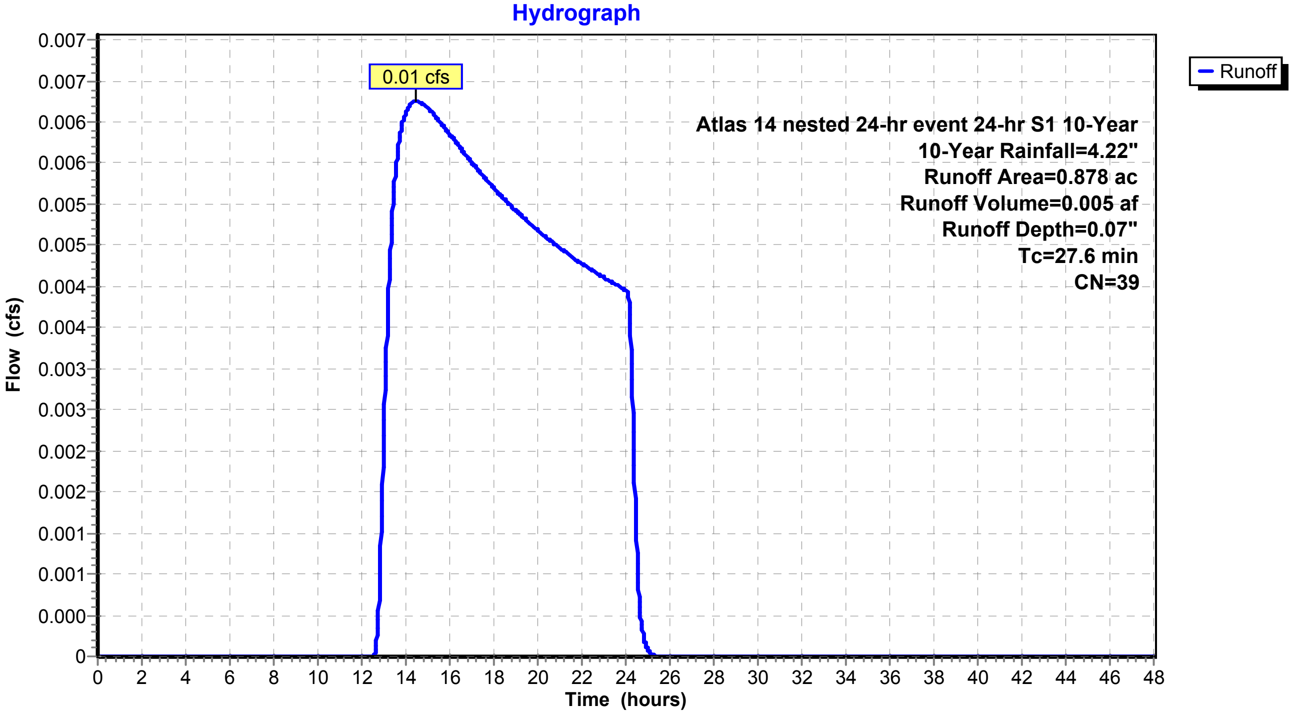
Runoff = 0.01 cfs @ 14.44 hrs, Volume= 0.005 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.878	39	
	0.878		100.00% Pervious Area

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

Subcatchment 32S: Sub-basin 32



Summary for Subcatchment 33S: Sub-basin 33

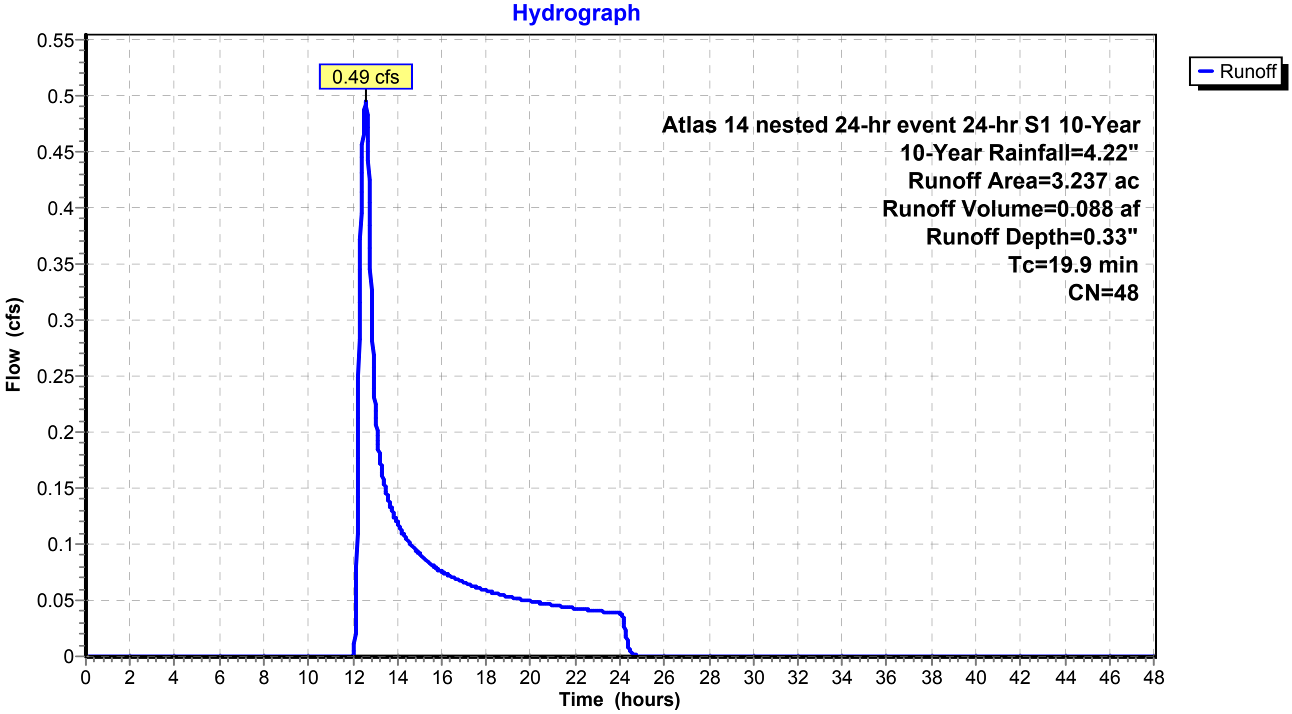
Runoff = 0.49 cfs @ 12.58 hrs, Volume= 0.088 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.237	48	
	3.237		100.00% Pervious Area

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

Subcatchment 33S: Sub-basin 33



Summary for Subcatchment 34S: Sub-basin 34

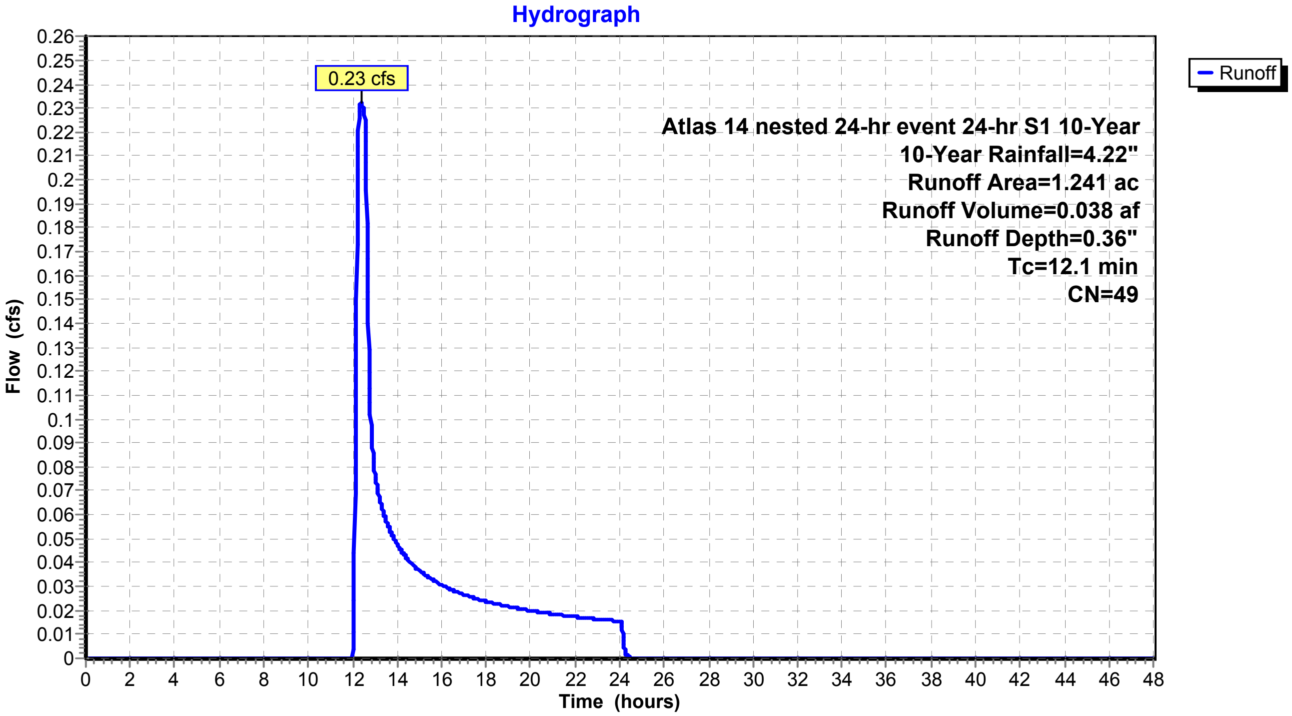
Runoff = 0.23 cfs @ 12.38 hrs, Volume= 0.038 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	1.241	49	
	1.241		100.00% Pervious Area

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

Subcatchment 34S: Sub-basin 34



Summary for Subcatchment 35S: Sub-basin 35

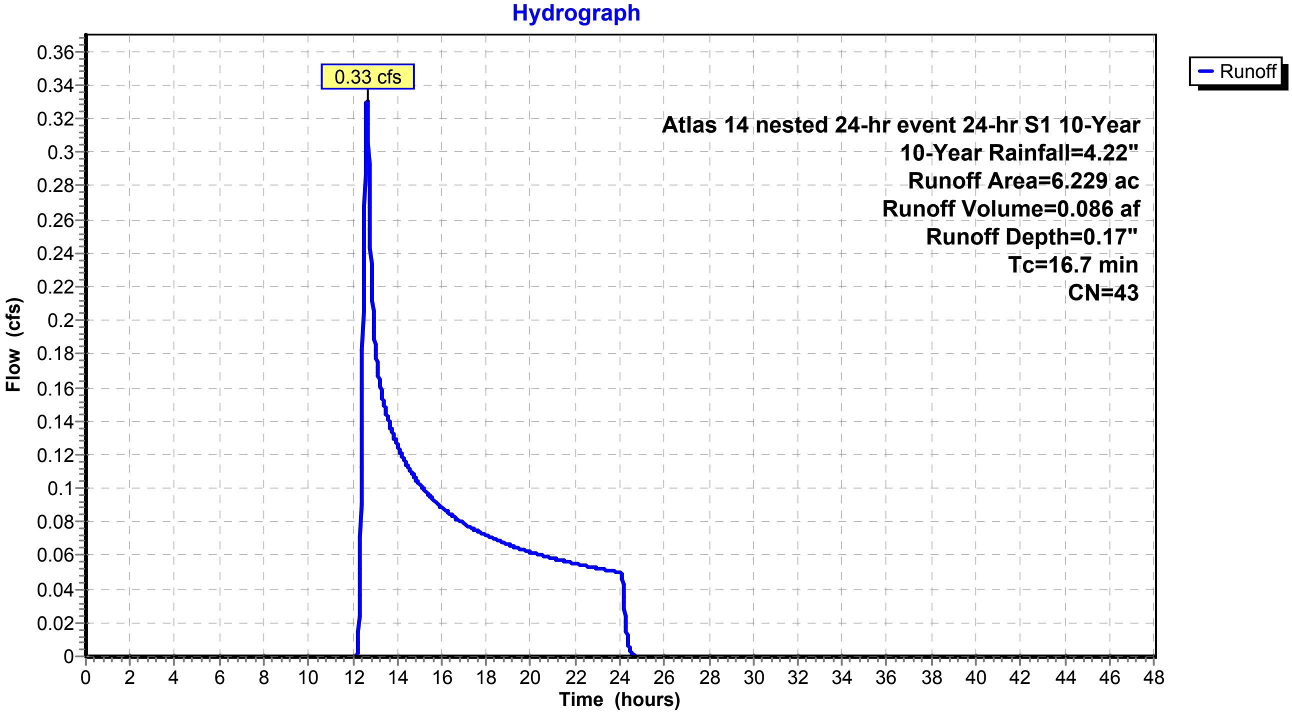
Runoff = 0.33 cfs @ 12.63 hrs, Volume= 0.086 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	6.229	43	
	6.229		100.00% Pervious Area

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

Subcatchment 35S: Sub-basin 35



Summary for Subcatchment 36S: Sub-basin 36

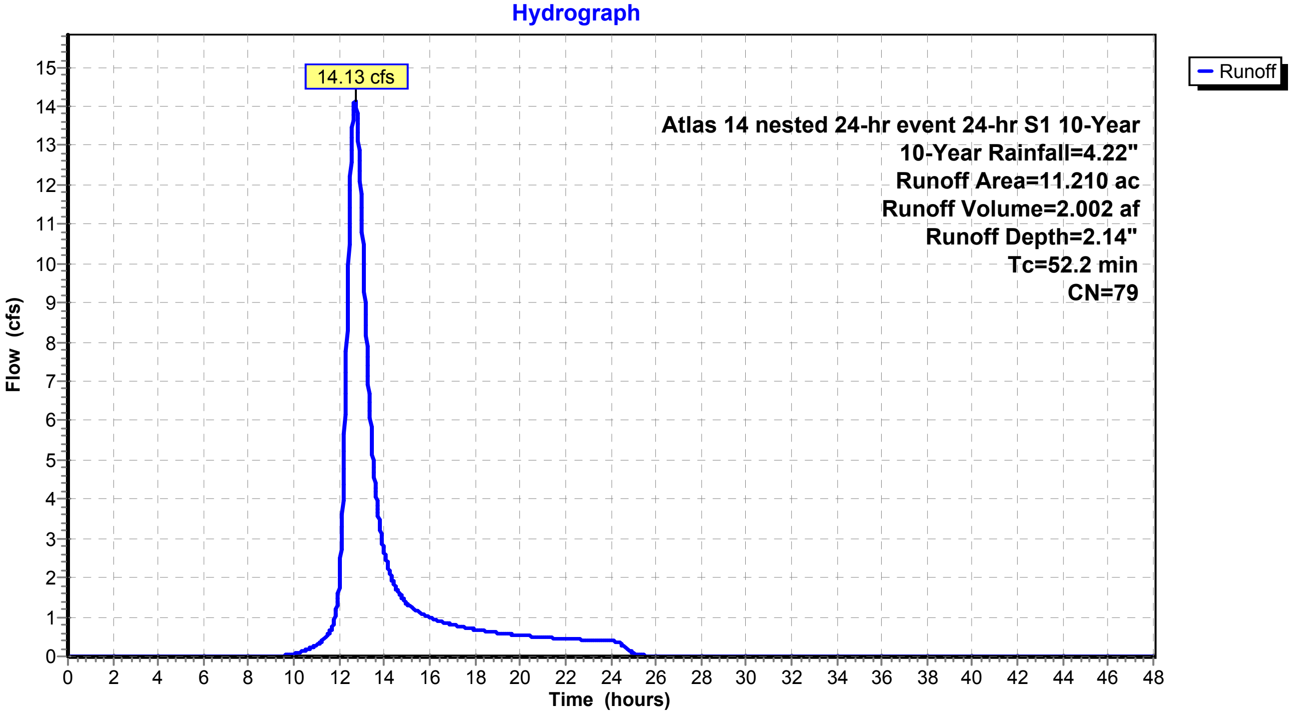
Runoff = 14.13 cfs @ 12.70 hrs, Volume= 2.002 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	11.210	79	
	11.210		100.00% Pervious Area

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

Subcatchment 36S: Sub-basin 36



Summary for Subcatchment 83S: County Road H Subbasin Redirected After Regrading

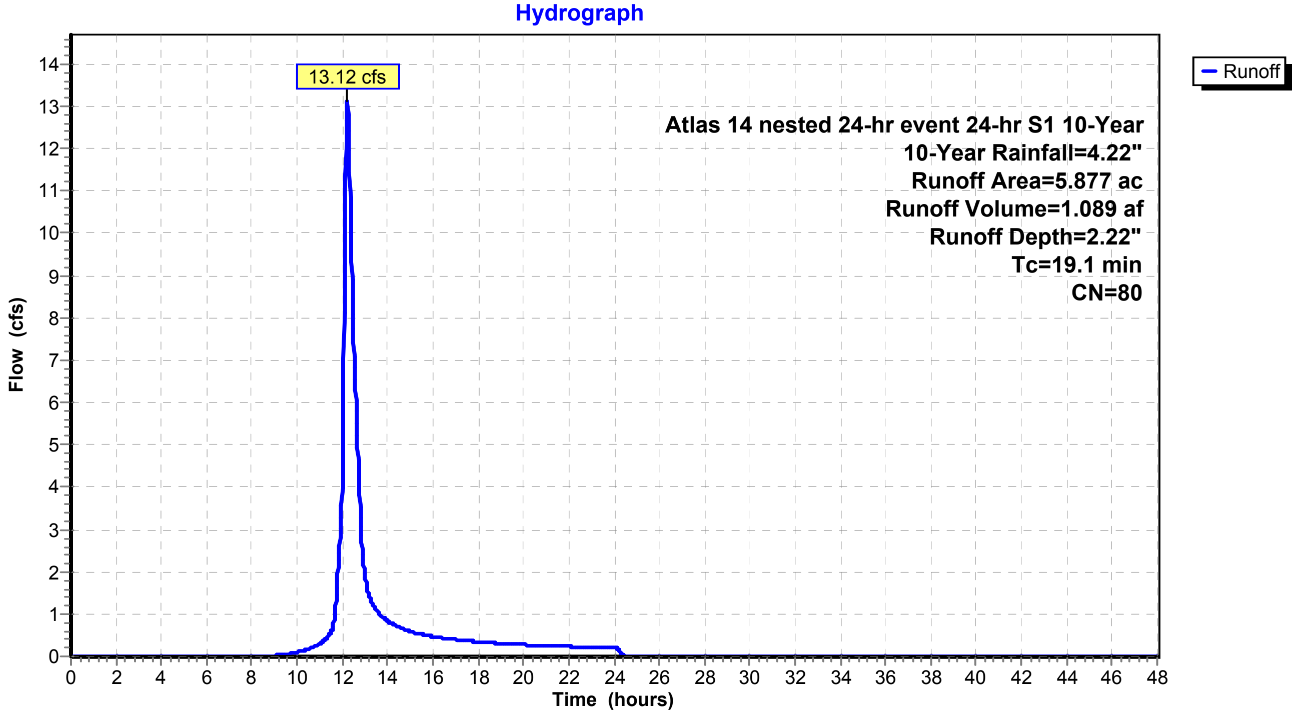
Runoff = 13.12 cfs @ 12.22 hrs, Volume= 1.089 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 10-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	5.877	80	
	5.877		100.00% Pervious Area

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

Subcatchment 83S: County Road H Subbasin Redirected After Regrading



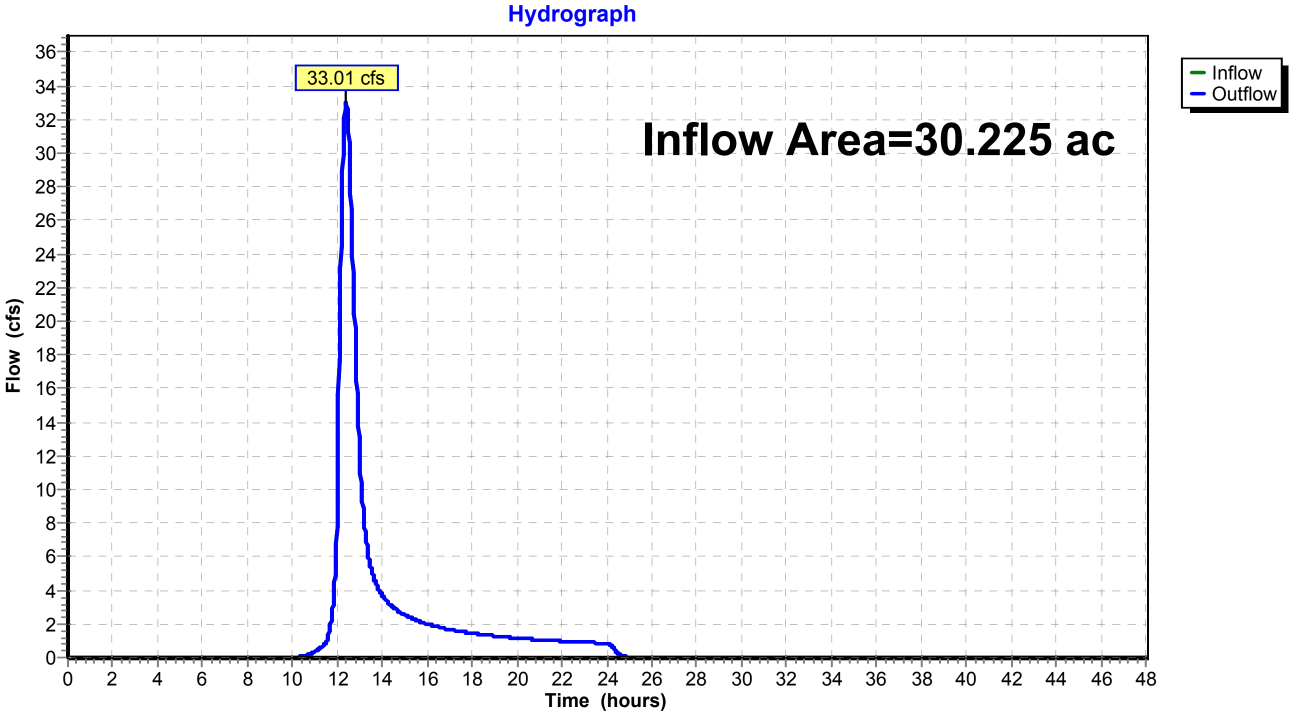
Summary for Reach 37R: Outfall of SB 2, 3, 7

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 30.225 ac, 0.00% Impervious, Inflow Depth = 1.56" for 10-Year event
Inflow = 33.01 cfs @ 12.39 hrs, Volume= 3.922 af
Outflow = 33.01 cfs @ 12.39 hrs, Volume= 3.922 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 37R: Outfall of SB 2, 3, 7



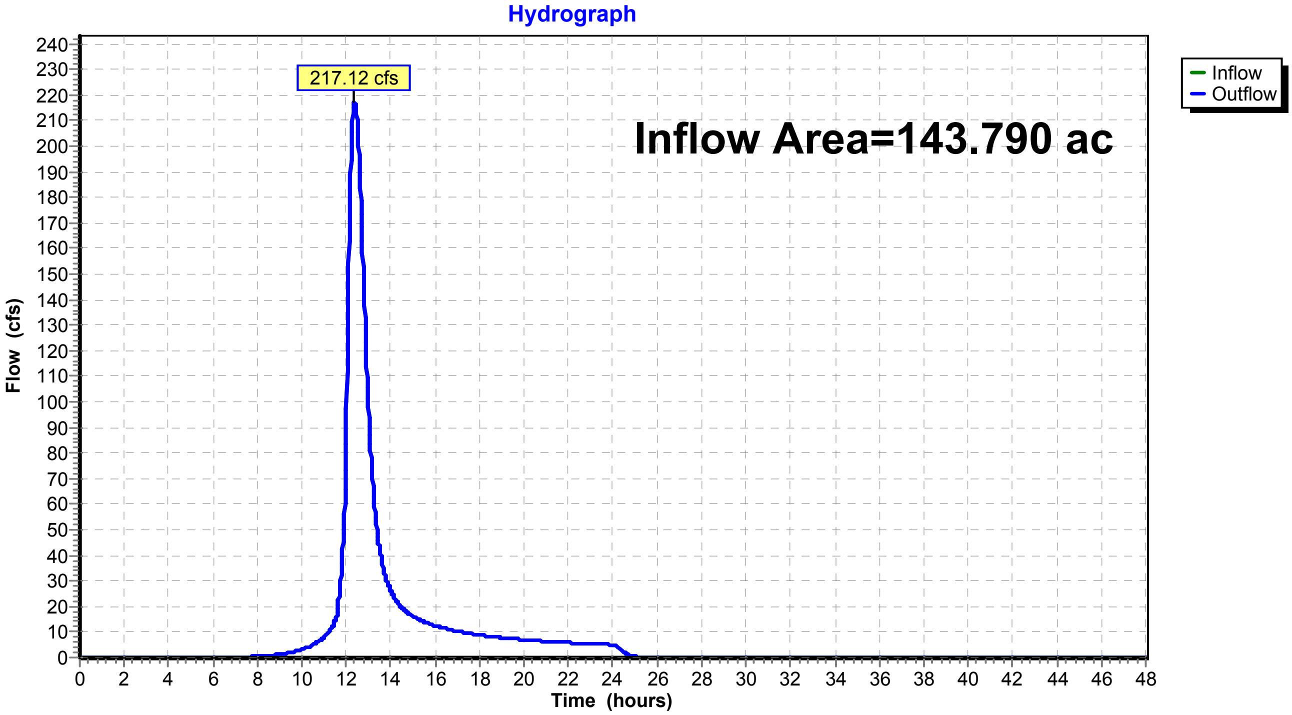
Summary for Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	143.790 ac,	0.00% Impervious,	Inflow Depth = 2.40"	for 10-Year event	
Inflow =	217.12 cfs @	12.37 hrs, Volume=	28.714 af		
Outflow =	217.12 cfs @	12.37 hrs, Volume=	28.714 af,	Atten= 0%,	Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36



Summary for Reach 40R: 60 in SB 4

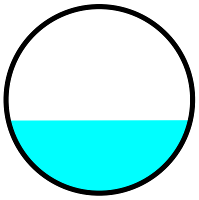
[52] Hint: Inlet/Outlet conditions not evaluated
[65] Warning: Inlet elevation not specified

```
Inflow Area =      143.790 ac,    0.00% Impervious,  Inflow Depth =   2.40"    for  10-Year event
Inflow       =     217.16 cfs @   12.36 hrs,  Volume=          28.714 af
Outflow      =     217.12 cfs @   12.37 hrs,  Volume=          28.714 af,  Atten= 0%,  Lag= 0.5 min
```

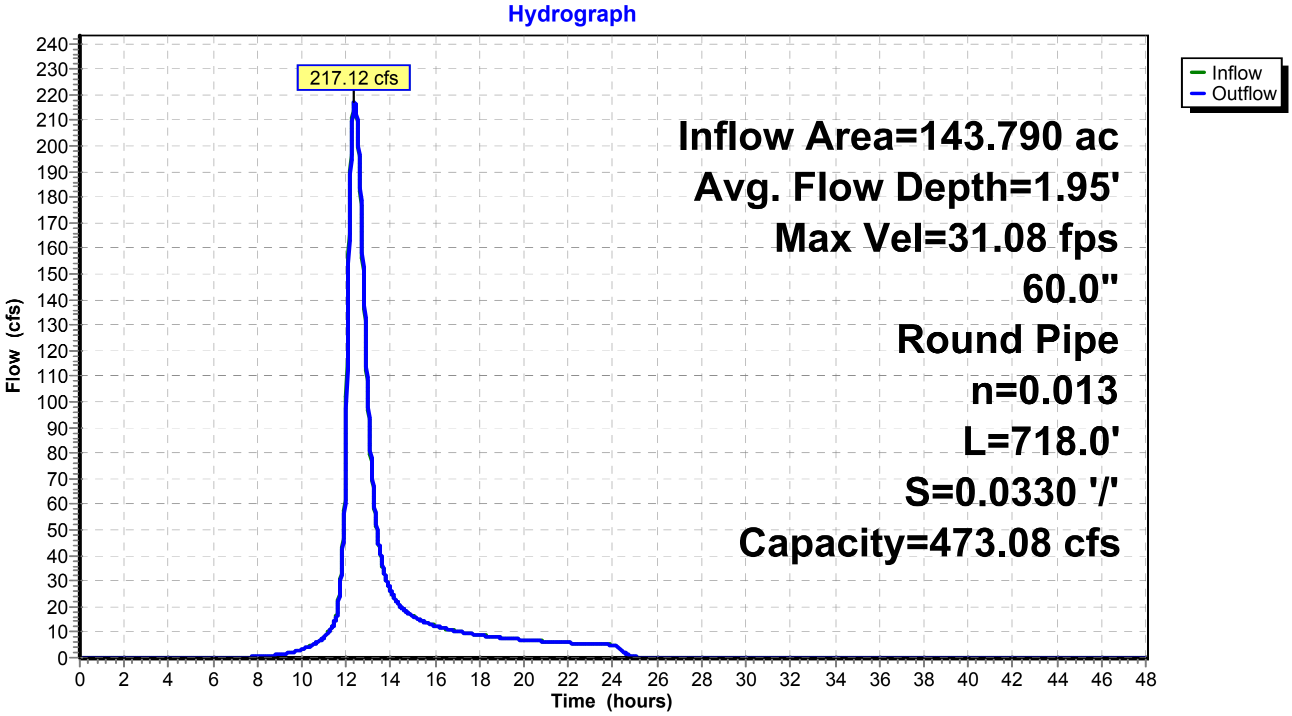
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 162.87 cfs Estimated Depth= 2.02' Velocity= 21.86 fps
m= 1.400, c= 30.61 fps, dt= 1.2 min, dx= 718.0' / 1 = 718.0', K= 0.4 min, X= 0.470
Max. Velocity= 31.08 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 30.61 fps, Avg. Travel Time= 0.4 min

Peak Storage= 5,092 cf @ 12.36 hrs
Average Depth at Peak Storage= 1.95'
Bank-Full Depth= 5.00' Flow Area= 19.6 sf, Capacity= 473.08 cfs

60.0" Round Pipe
n= 0.013
Length= 718.0'   Slope= 0.0330 '/'
Inlet Invert= 0.00', Outlet Invert= -23.69'



Reach 40R: 60 in SB 4



Summary for Reach 41R: Channel in SB 9, 10

[65] Warning: Inlet elevation not specified

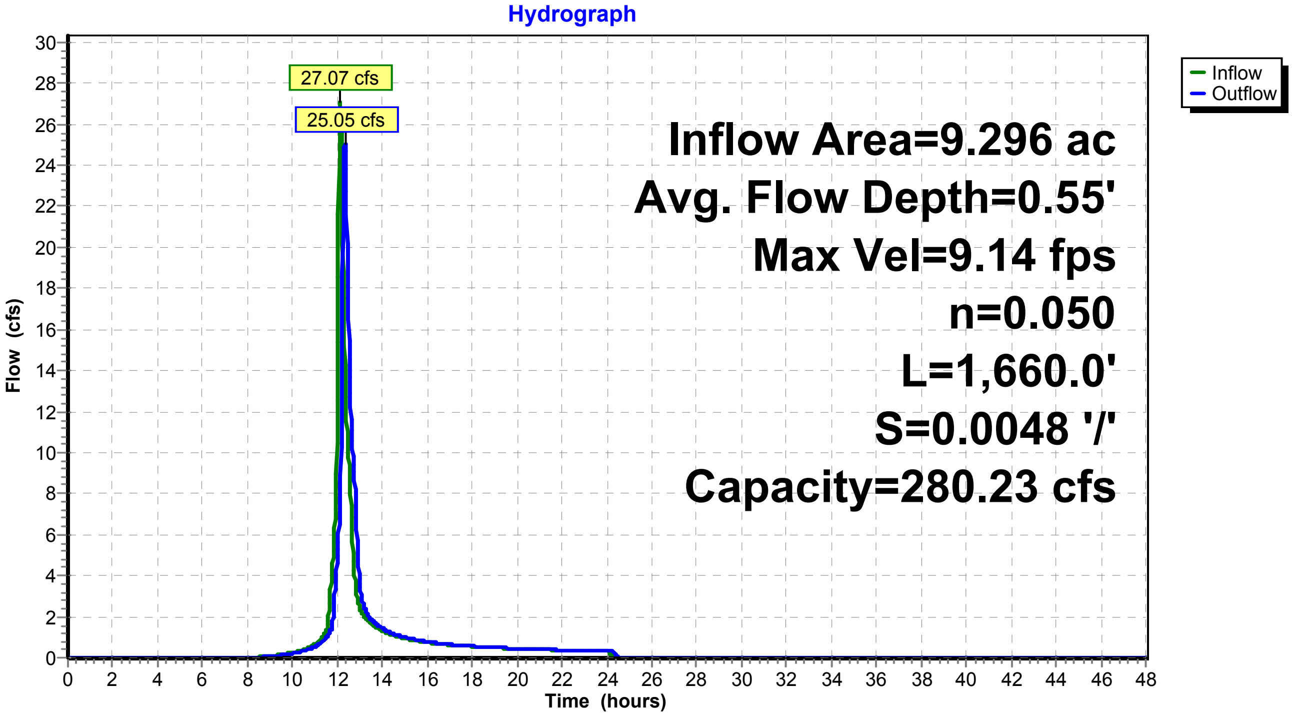
```
Inflow Area =         9.296 ac,    0.00% Impervious,  Inflow Depth =   2.39"    for  10-Year event
Inflow       =       27.07 cfs @   12.13 hrs,  Volume=            1.853 af
Outflow      =       25.05 cfs @   12.34 hrs,  Volume=            1.853 af,  Atten= 7%,  Lag= 12.4 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 20.31 cfs Estimated Depth= 0.72' Velocity= 1.50 fps
m= 1.556, c= 2.33 fps, dt= 1.2 min, dx= 1,660.0' / 10 = 166.0', K= 1.2 min, X= 0.210
Max. Velocity= 9.14 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 11.6 min

Peak Storage= 16,733 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 3.00' Flow Area= 84.0 sf, Capacity= 280.23 cfs

16.00' x 3.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/'   Top Width= 40.00'
Length= 1,660.0'   Slope= 0.0048 '/'
Inlet Invert= 0.00', Outlet Invert= -7.97'

Reach 41R: Channel in SB 9, 10



Summary for Reach 46R: Channel SB1

[65] Warning: Inlet elevation not specified

```
Inflow Area =        15.328 ac,    0.00% Impervious,  Inflow Depth =   2.84"    for  10-Year event
Inflow      =        47.16 cfs @   12.18 hrs,  Volume=            3.626 af
Outflow     =        46.50 cfs @   12.25 hrs,  Volume=            3.626 af,  Atten= 1%,  Lag= 4.4 min
```

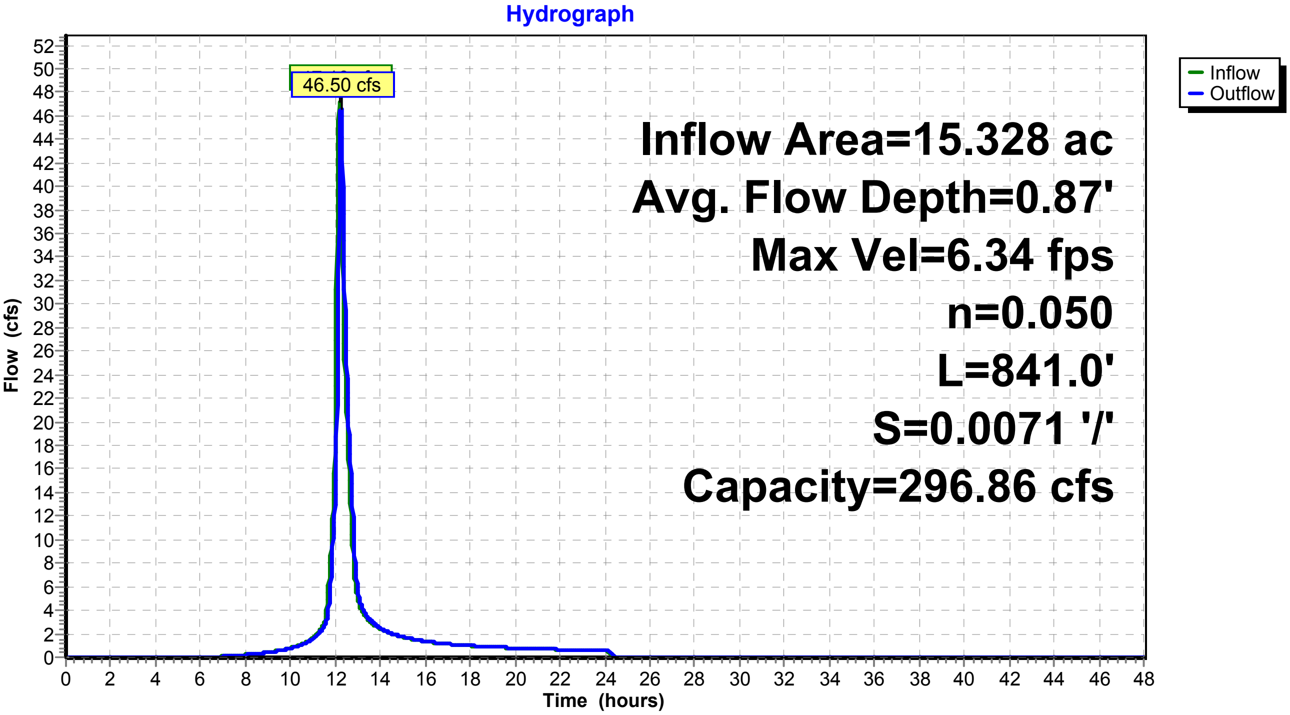
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 35.37 cfs Estimated Depth= 0.98' Velocity= 2.13 fps
m= 1.511, c= 3.22 fps, dt= 1.2 min, dx= 841.0' / 4 = 210.3', K= 1.1 min, X= 0.283
Max. Velocity= 6.34 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 3.23 fps, Avg. Travel Time= 4.3 min

Peak Storage= 12,066 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 3.00' Flow Area= 75.0 sf, Capacity= 296.86 cfs

13.00' x 3.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/'   Top Width= 37.00'
Length= 841.0'   Slope= 0.0071 '/'
Inlet Invert= 0.00', Outlet Invert= -5.97'

‡

Reach 46R: Channel SB1



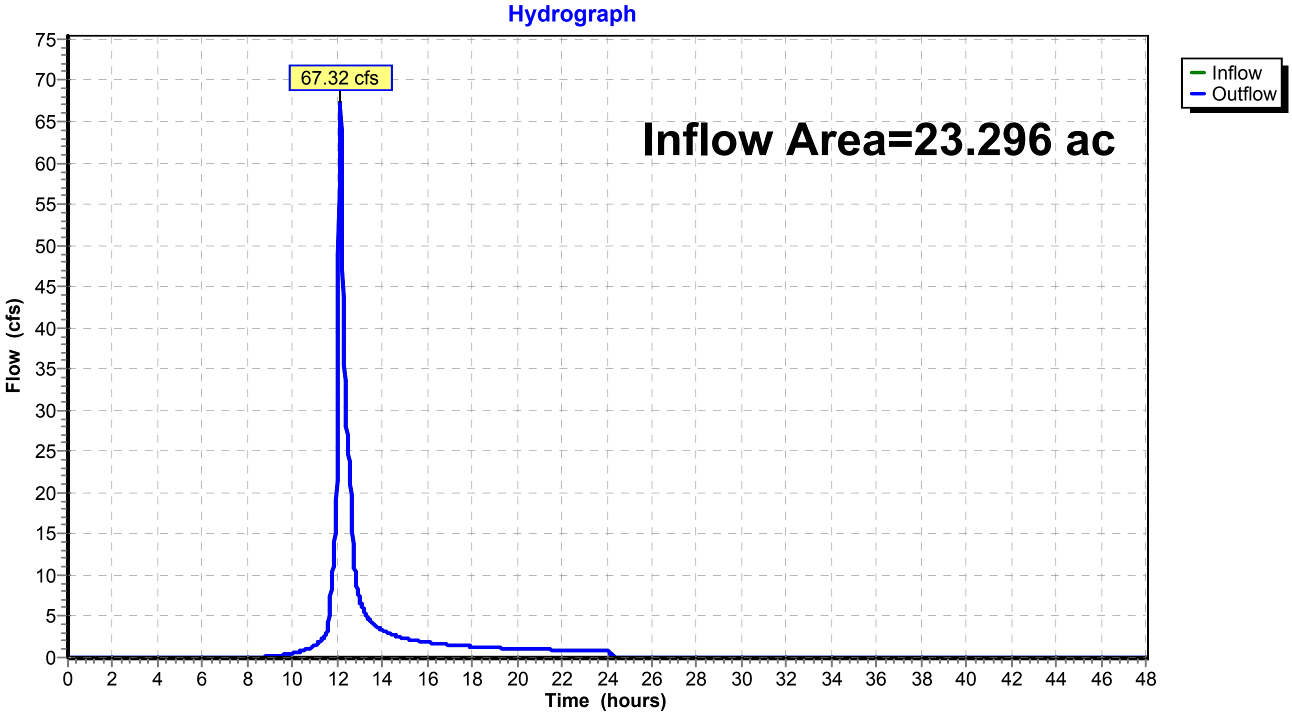
Summary for Reach 48R: Outfall of SB 8, 13

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	23.296 ac,	0.00% Impervious, Inflow Depth = 2.32"	for 10-Year event	
Inflow =	67.32 cfs @	12.13 hrs, Volume=	4.495 af	
Outflow =	67.32 cfs @	12.13 hrs, Volume=	4.495 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 48R: Outfall of SB 8, 13



Summary for Reach 49R: Channel SB8

[65] Warning: Inlet elevation not specified

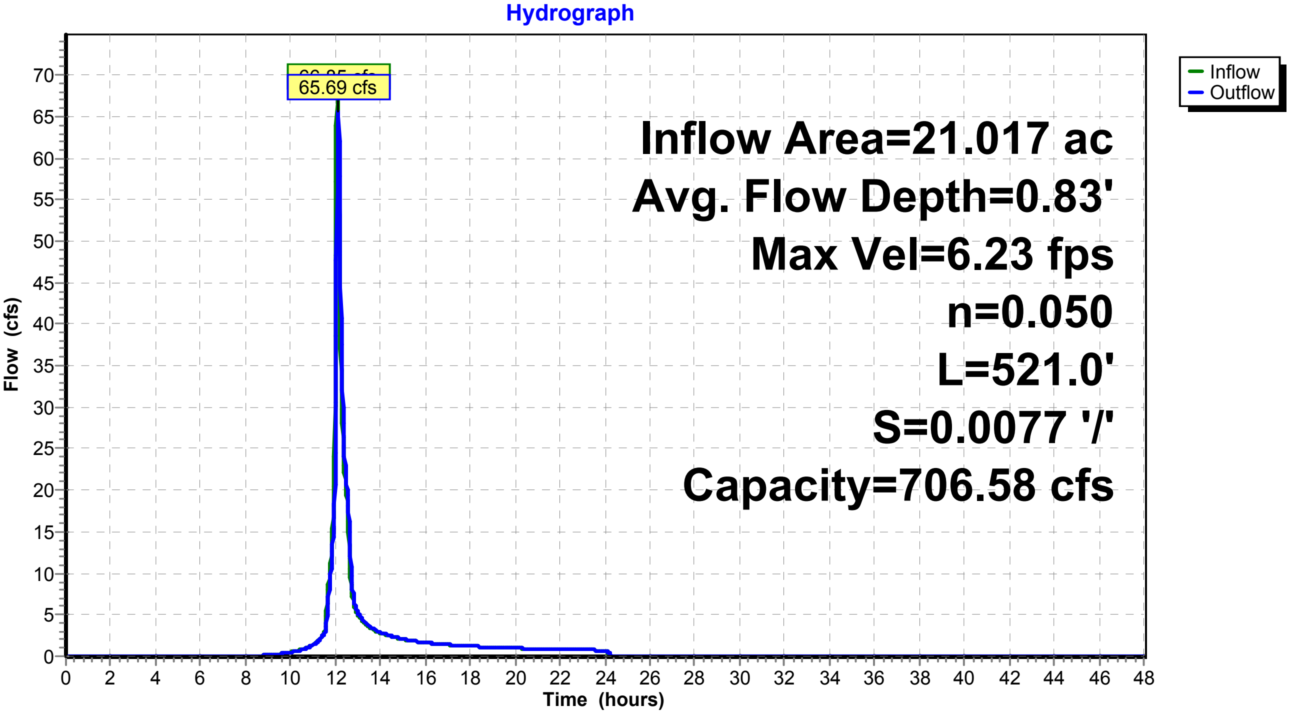
```
Inflow Area =        21.017 ac,    0.00% Impervious,  Inflow Depth =   2.31"    for  10-Year event
Inflow       =       66.85 cfs @   12.08 hrs,  Volume=             4.041 af
Outflow      =       65.69 cfs @   12.13 hrs,  Volume=             4.041 af,  Atten= 2%,  Lag= 2.5 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 50.14 cfs Estimated Depth= 0.96' Velocity= 2.28 fps
m= 1.546, c= 3.52 fps, dt= 1.2 min, dx= 521.0' / 2 = 260.5', K= 1.2 min, X= 0.345
Max. Velocity= 6.23 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 3.53 fps, Avg. Travel Time= 2.5 min

Peak Storage= 9,639 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 4.00' Flow Area= 140.0 sf, Capacity= 706.58 cfs

19.00' x 4.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/' Top Width= 51.00'
Length= 521.0' Slope= 0.0077 '/'
Inlet Invert= 0.00', Outlet Invert= -4.01'

Reach 49R: Channel SB8



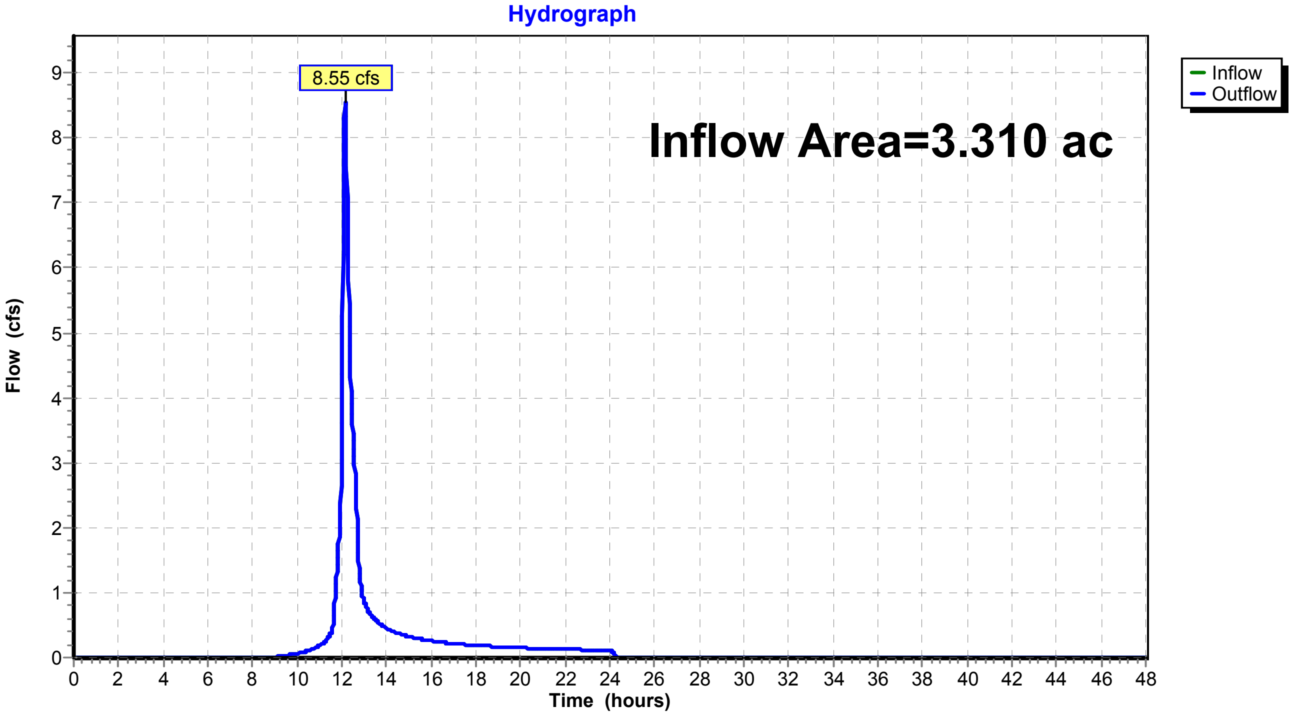
Summary for Reach 50R: Outfall of SB 12

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       3.310 ac,   0.00% Impervious,  Inflow Depth =   2.22"    for  10-Year event
Inflow       =      8.55 cfs @   12.15 hrs,  Volume=            0.613 af
Outflow      =      8.55 cfs @   12.15 hrs,  Volume=            0.613 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 50R: Outfall of SB 12



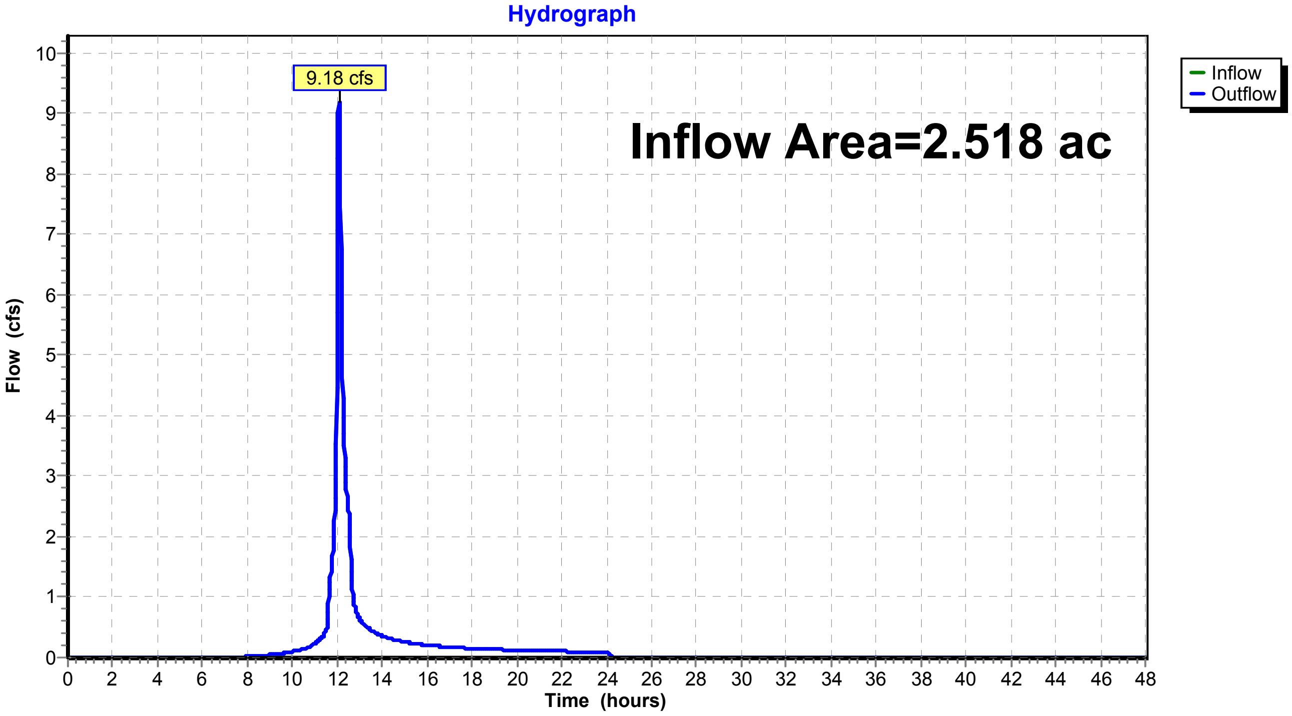
Summary for Reach 51R: Outfall of SB 14

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.518 ac, 0.00% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 9.18 cfs @ 12.08 hrs, Volume= 0.538 af
Outflow = 9.18 cfs @ 12.08 hrs, Volume= 0.538 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 51R: Outfall of SB 14



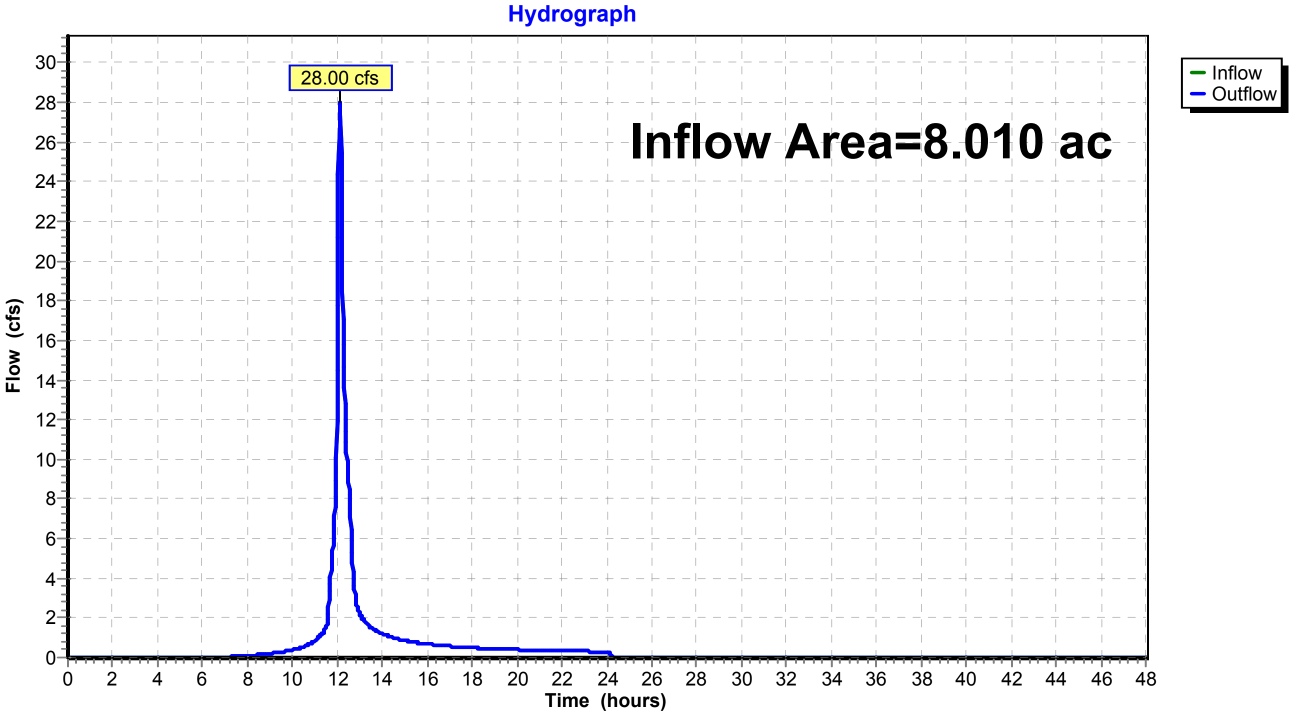
Summary for Reach 52R: Outfall of SB 17

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.010 ac, 0.00% Impervious, Inflow Depth = 2.75" for 10-Year event
Inflow = 28.00 cfs @ 12.11 hrs, Volume= 1.833 af
Outflow = 28.00 cfs @ 12.11 hrs, Volume= 1.833 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 52R: Outfall of SB 17



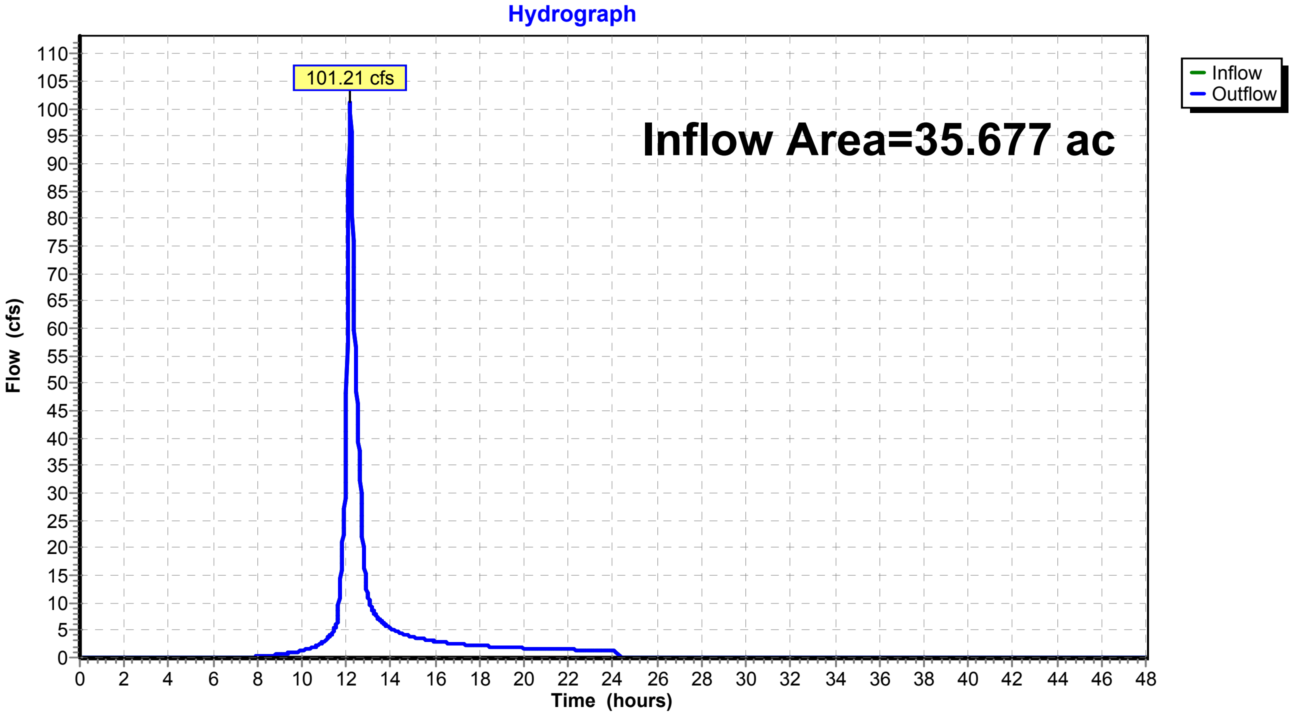
Summary for Reach 53R: Outfall of SB 18

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       35.677 ac,    0.00% Impervious,  Inflow Depth =   2.57"    for  10-Year event
Inflow       =     101.21 cfs @   12.17 hrs,  Volume=             7.627 af
Outflow      =     101.21 cfs @   12.17 hrs,  Volume=             7.627 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 53R: Outfall of SB 18



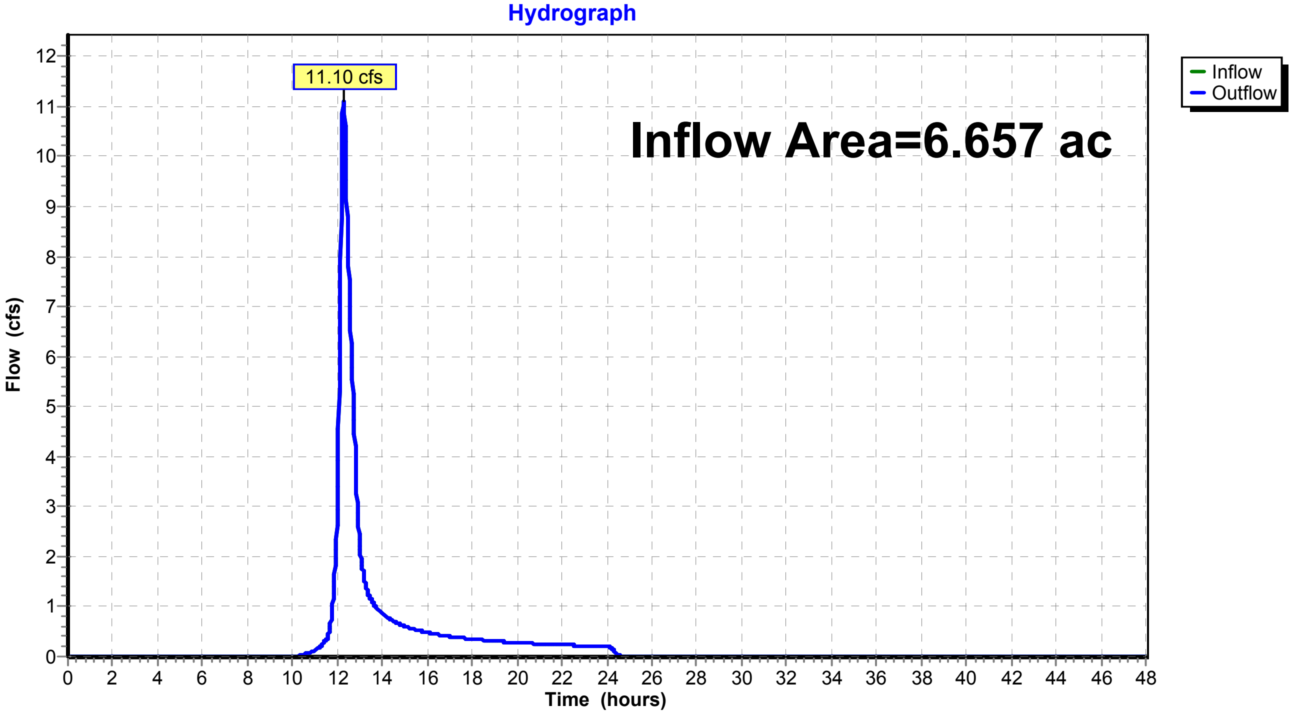
Summary for Reach 54R: Outfall of SB 25

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.657 ac, 0.00% Impervious, Inflow Depth = 1.83" for 10-Year event
Inflow = 11.10 cfs @ 12.28 hrs, Volume= 1.017 af
Outflow = 11.10 cfs @ 12.28 hrs, Volume= 1.017 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 54R: Outfall of SB 25



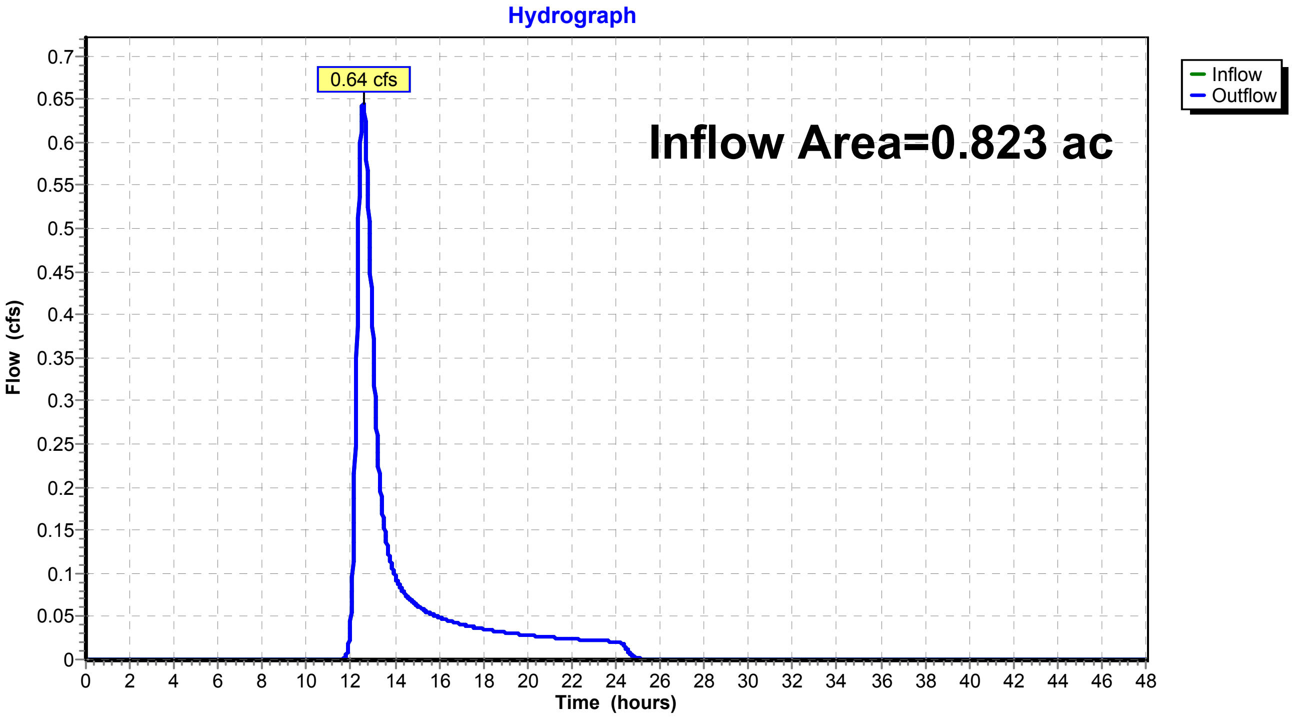
Summary for Reach 55R: Outfall of SB 26

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	0.823 ac,	0.00% Impervious,	Inflow Depth = 1.22"	for 10-Year event	
Inflow =	0.64 cfs @	12.56 hrs,	Volume=	0.084 af	
Outflow =	0.64 cfs @	12.56 hrs,	Volume=	0.084 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 55R: Outfall of SB 26

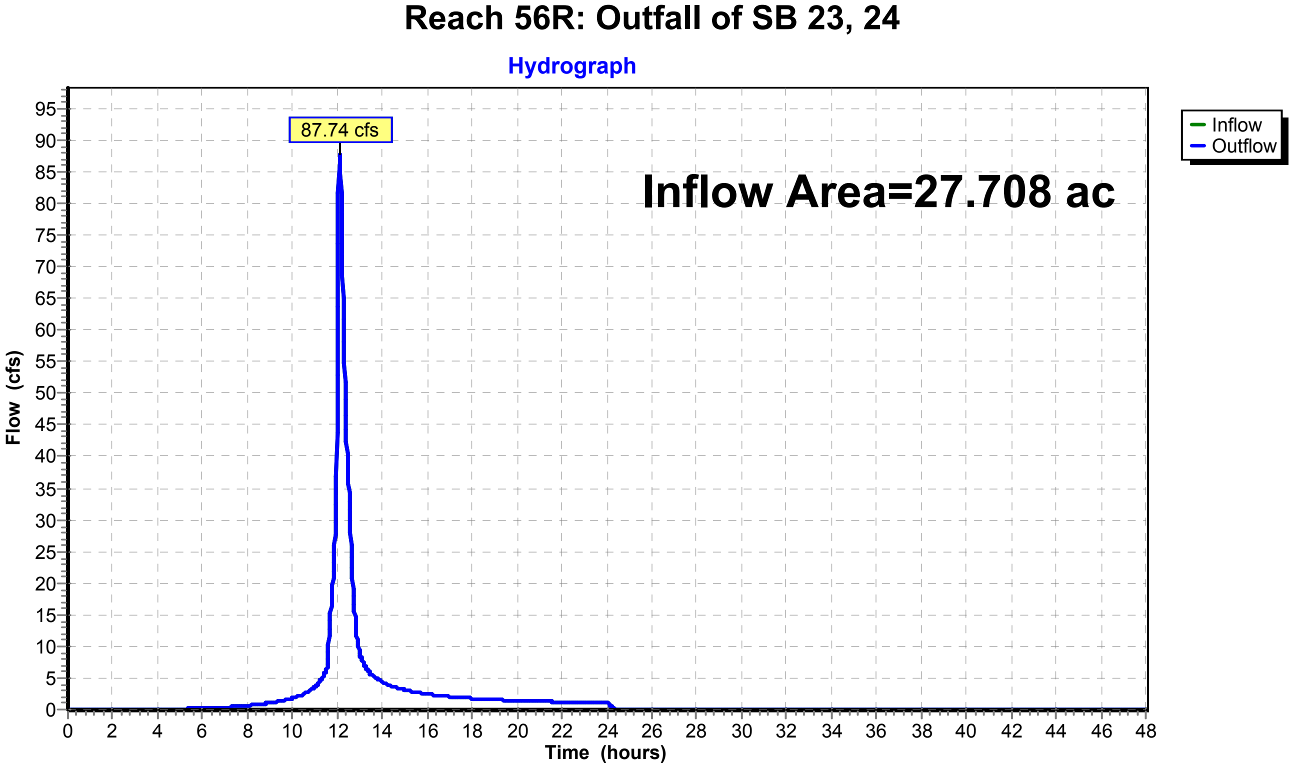


Summary for Reach 56R: Outfall of SB 23, 24

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	27.708 ac,	0.00% Impervious,	Inflow Depth =	2.99"	for 10-Year event
Inflow =	87.74 cfs @	12.10 hrs,	Volume=	6.907 af	
Outflow =	87.74 cfs @	12.10 hrs,	Volume=	6.907 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs



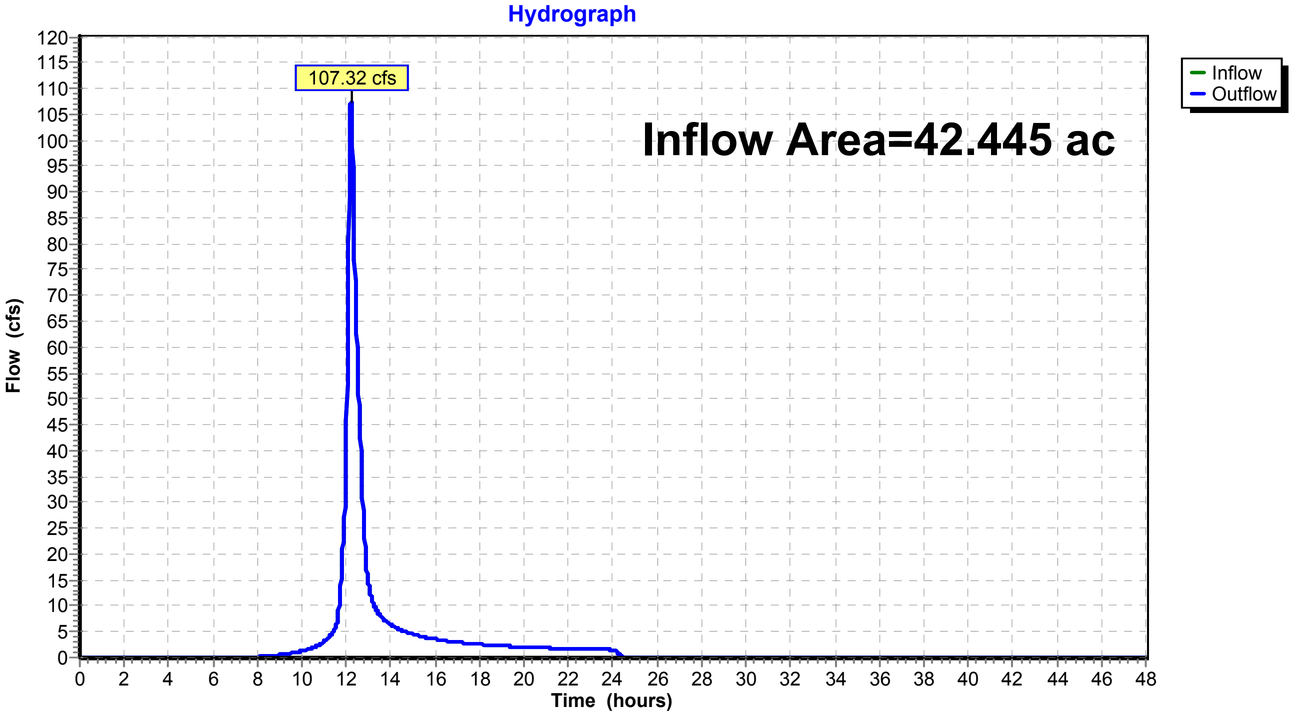
Summary for Reach 59R: Outfall of SB 20, 22

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        42.445 ac,    0.00% Impervious,  Inflow Depth =   2.49"    for  10-Year event
Inflow       =      107.32 cfs @   12.21 hrs,  Volume=             8.807 af
Outflow      =      107.32 cfs @   12.21 hrs,  Volume=             8.807 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 59R: Outfall of SB 20, 22



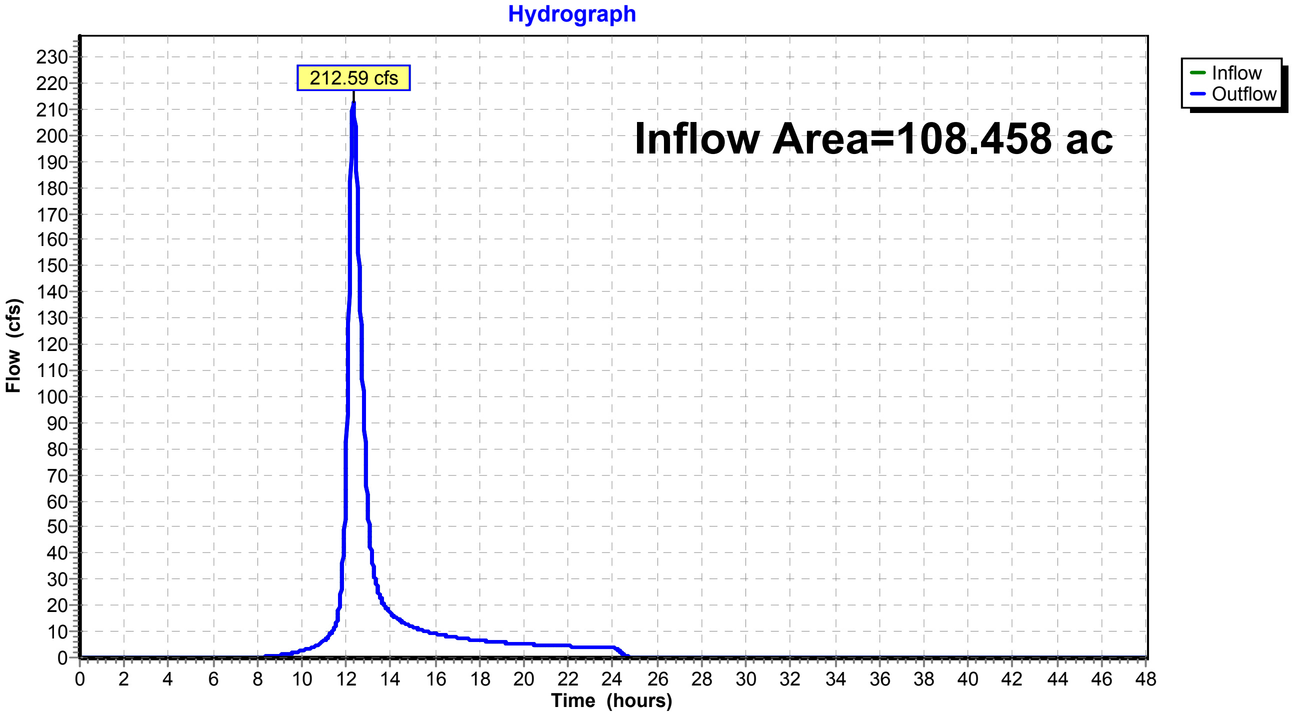
Summary for Reach 61R: Outfall of SB 15, 16, 21

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	108.458 ac,	0.00% Impervious,	Inflow Depth = 2.41"	for 10-Year event	
Inflow =	212.59 cfs @	12.32 hrs,	Volume=	21.738 af	
Outflow =	212.59 cfs @	12.32 hrs,	Volume=	21.738 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 61R: Outfall of SB 15, 16, 21



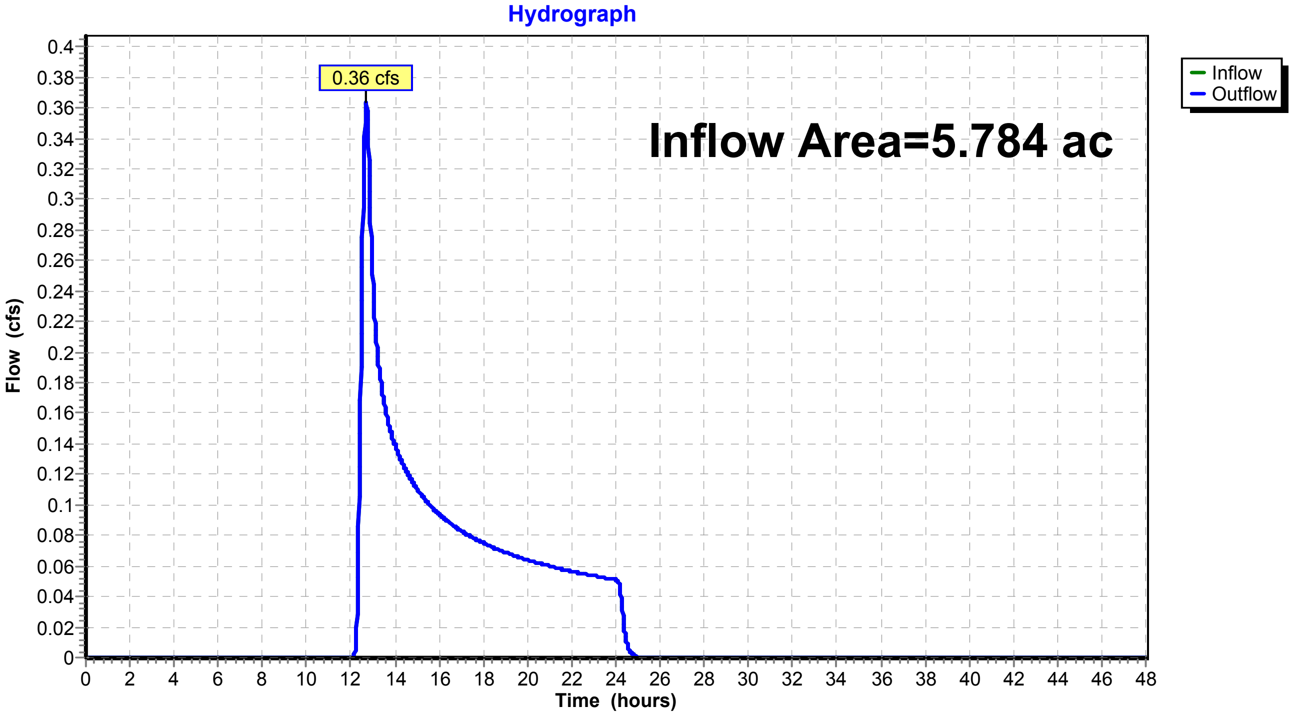
Summary for Reach 67R: Outfall of SB 28

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	5.784 ac,	0.00% Impervious, Inflow Depth = 0.19"	for 10-Year event
Inflow =	0.36 cfs @	12.70 hrs, Volume=	0.094 af
Outflow =	0.36 cfs @	12.70 hrs, Volume=	0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 67R: Outfall of SB 28



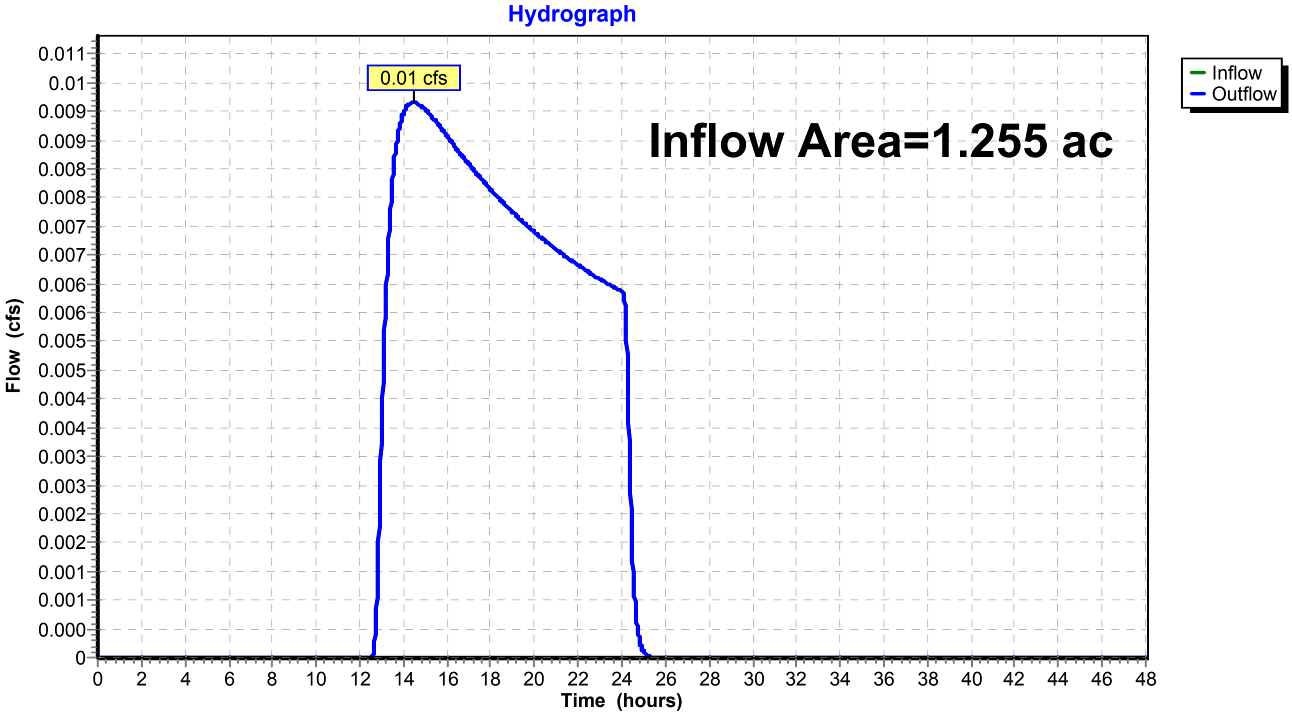
Summary for Reach 68R: Outfall of SB 29

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	1.255 ac,	0.00% Impervious, Inflow Depth = 0.07"	for 10-Year event	
Inflow =	0.01 cfs @	14.44 hrs, Volume=	0.007 af	
Outflow =	0.01 cfs @	14.44 hrs, Volume=	0.007 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 68R: Outfall of SB 29



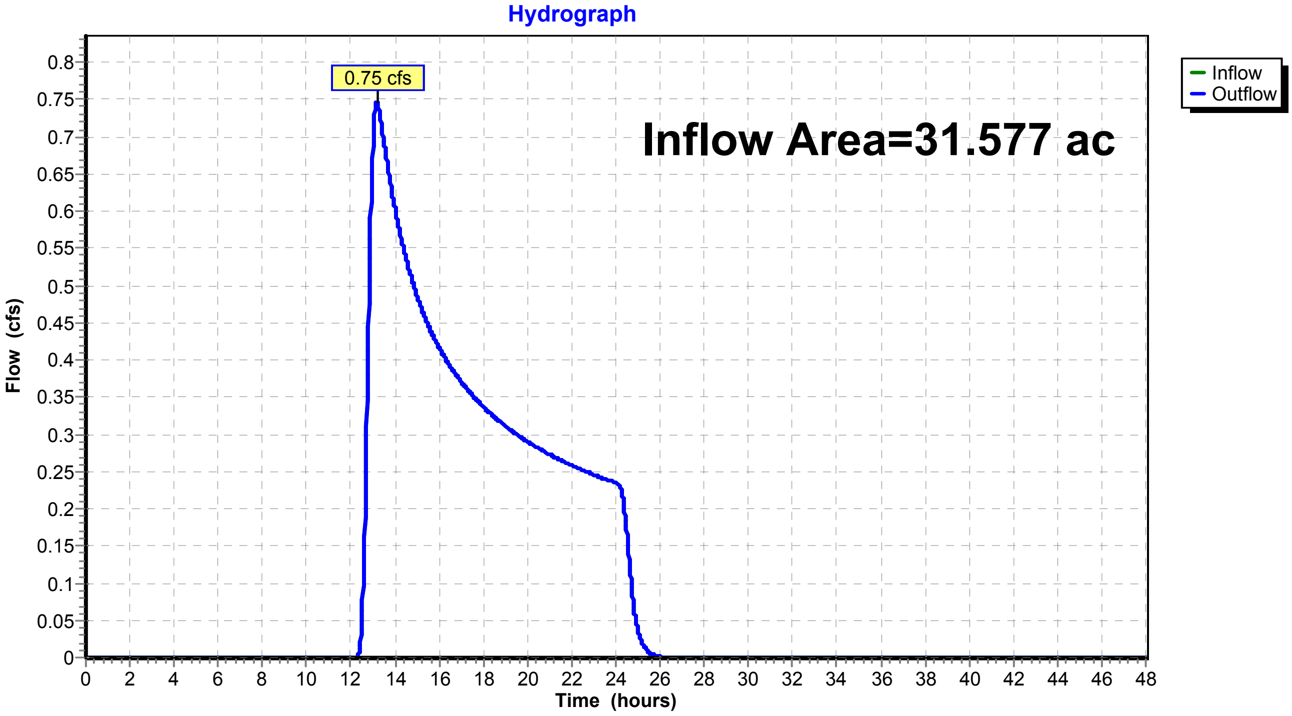
Summary for Reach 69R: Outfall of SB 30

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        31.577 ac,    0.00% Impervious,  Inflow Depth =   0.14"    for  10-Year event
Inflow       =         0.75 cfs @   13.19 hrs,  Volume=             0.366 af
Outflow      =         0.75 cfs @   13.19 hrs,  Volume=             0.366 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 69R: Outfall of SB 30



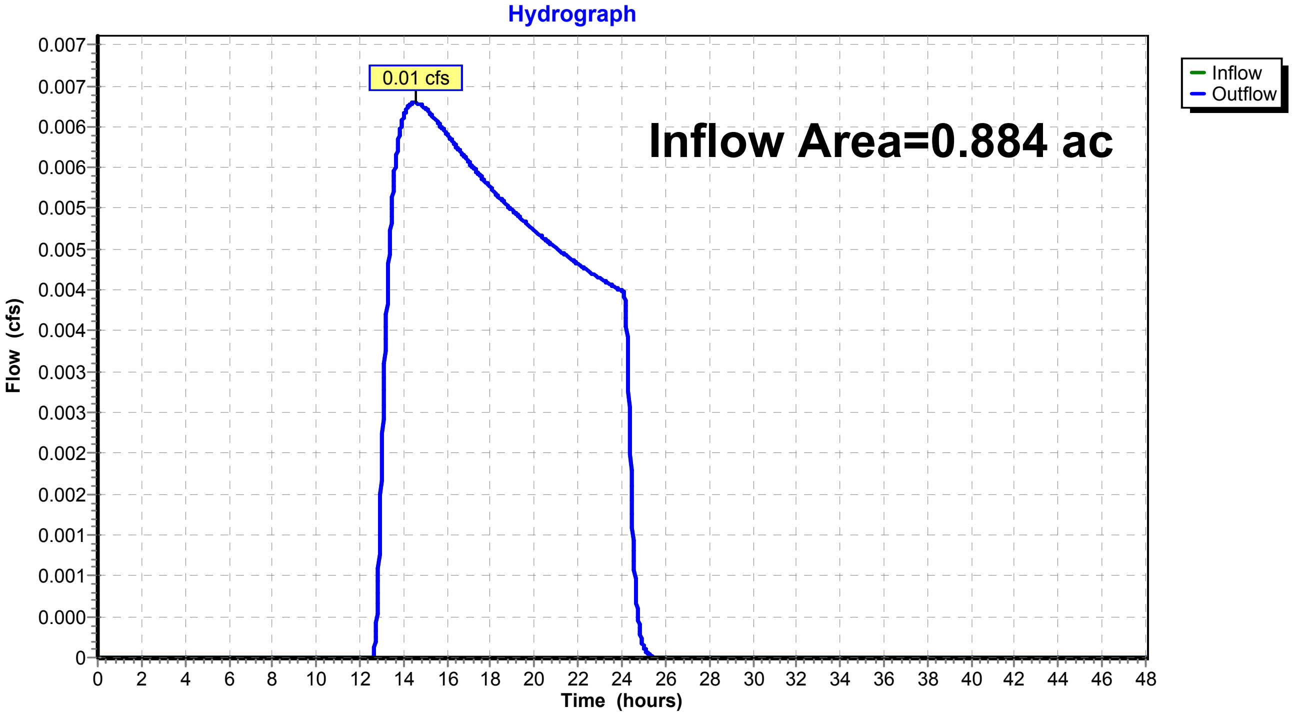
Summary for Reach 70R: Outfall of SB 31

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 0.07" for 10-Year event
Inflow = 0.01 cfs @ 14.53 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 14.53 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 70R: Outfall of SB 31



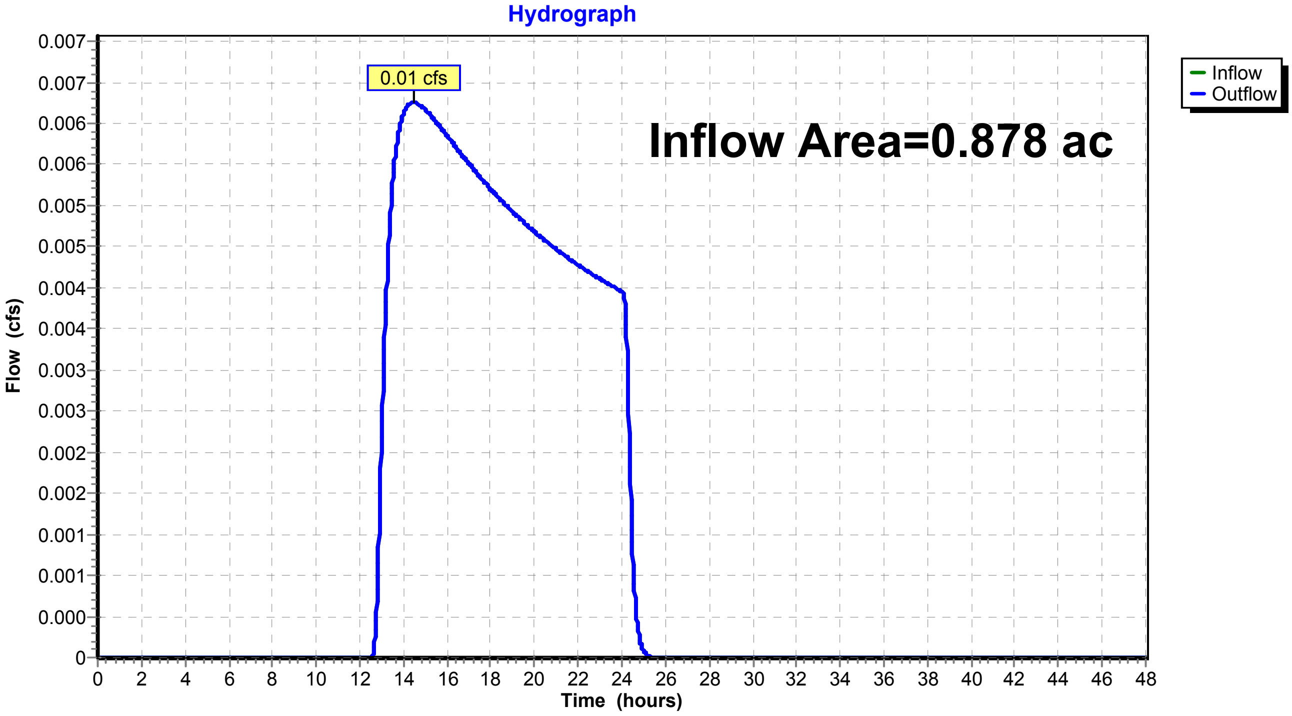
Summary for Reach 71R: Outfall of SB 32

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       0.878 ac,   0.00% Impervious,  Inflow Depth =  0.07"    for  10-Year event
Inflow      =       0.01 cfs @  14.44 hrs,  Volume=          0.005 af
Outflow     =       0.01 cfs @  14.44 hrs,  Volume=          0.005 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 71R: Outfall of SB 32



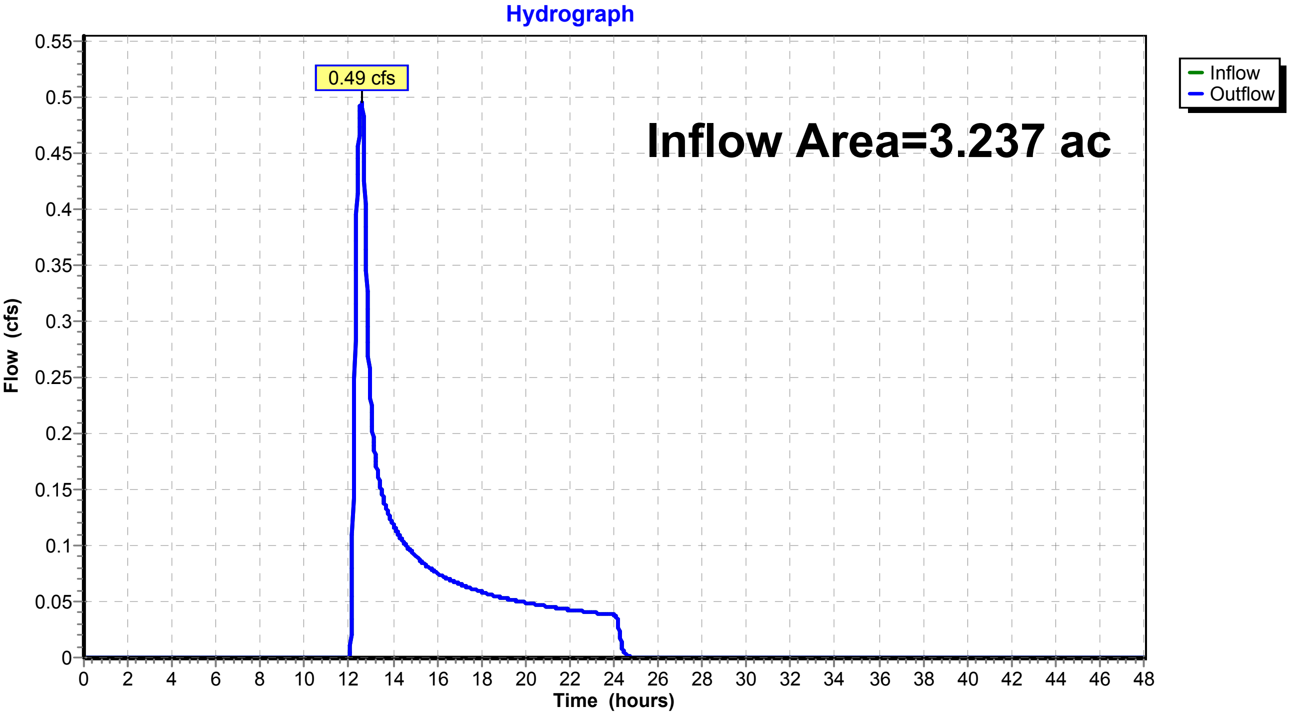
Summary for Reach 72R: Outfall of SB 33

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	3.237 ac,	0.00% Impervious,	Inflow Depth = 0.33"	for 10-Year event	
Inflow =	0.49 cfs @	12.58 hrs,	Volume=	0.088 af	
Outflow =	0.49 cfs @	12.58 hrs,	Volume=	0.088 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 72R: Outfall of SB 33



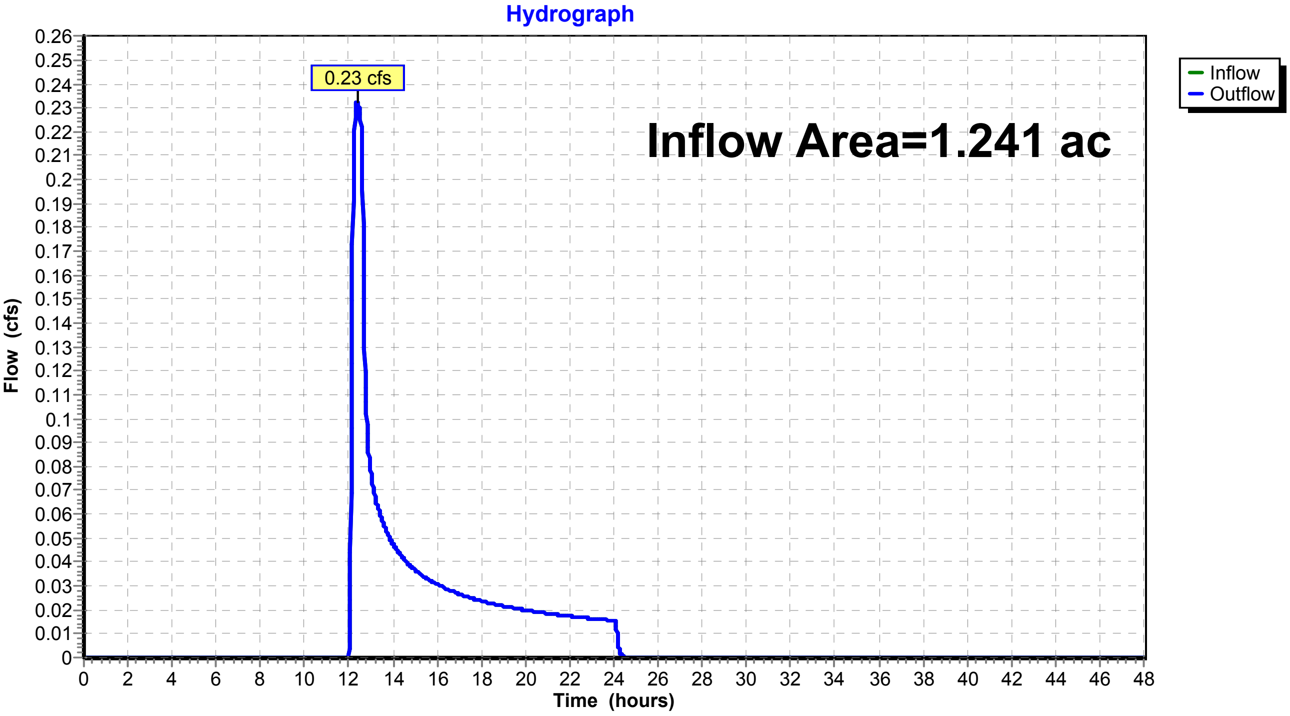
Summary for Reach 73R: Outfall of SB 34

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	1.241 ac,	0.00% Impervious,	Inflow Depth = 0.36"	for 10-Year event	
Inflow =	0.23 cfs @	12.38 hrs,	Volume=	0.038 af	
Outflow =	0.23 cfs @	12.38 hrs,	Volume=	0.038 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 73R: Outfall of SB 34



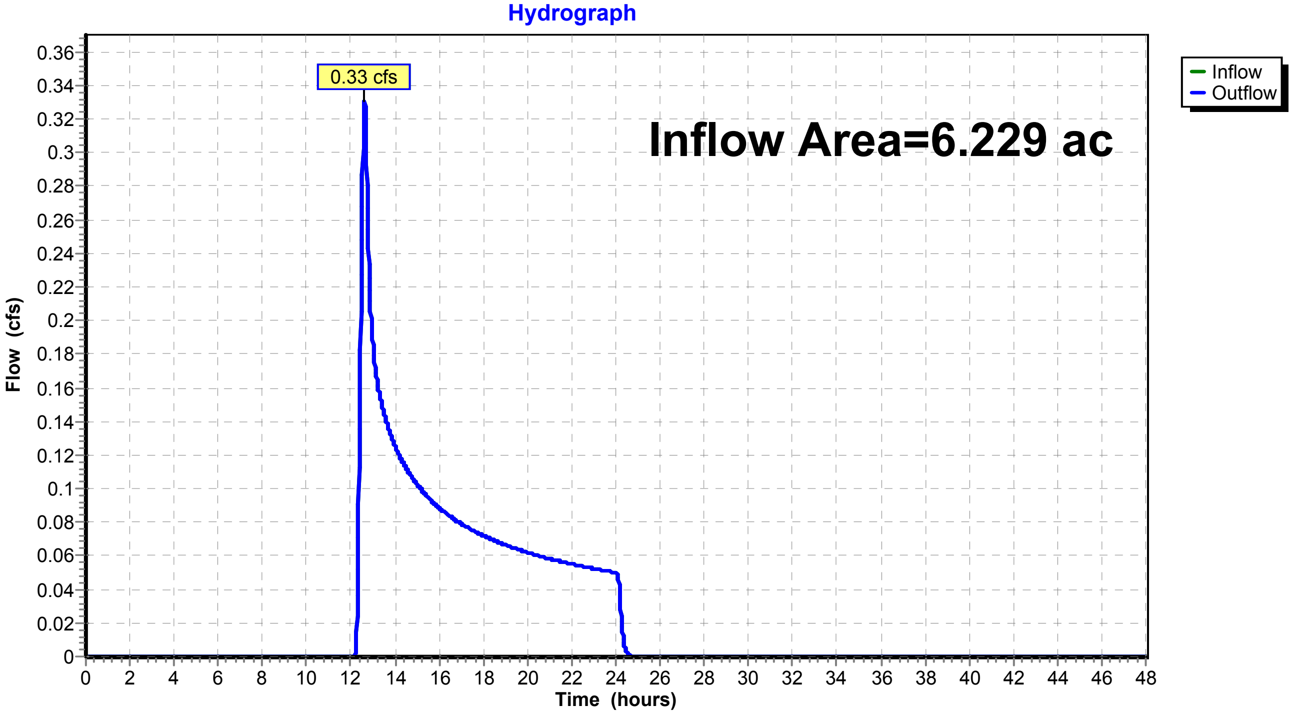
Summary for Reach 74R: Outfall of SB 35

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.229 ac, 0.00% Impervious, Inflow Depth = 0.17" for 10-Year event
Inflow = 0.33 cfs @ 12.63 hrs, Volume= 0.086 af
Outflow = 0.33 cfs @ 12.63 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 74R: Outfall of SB 35



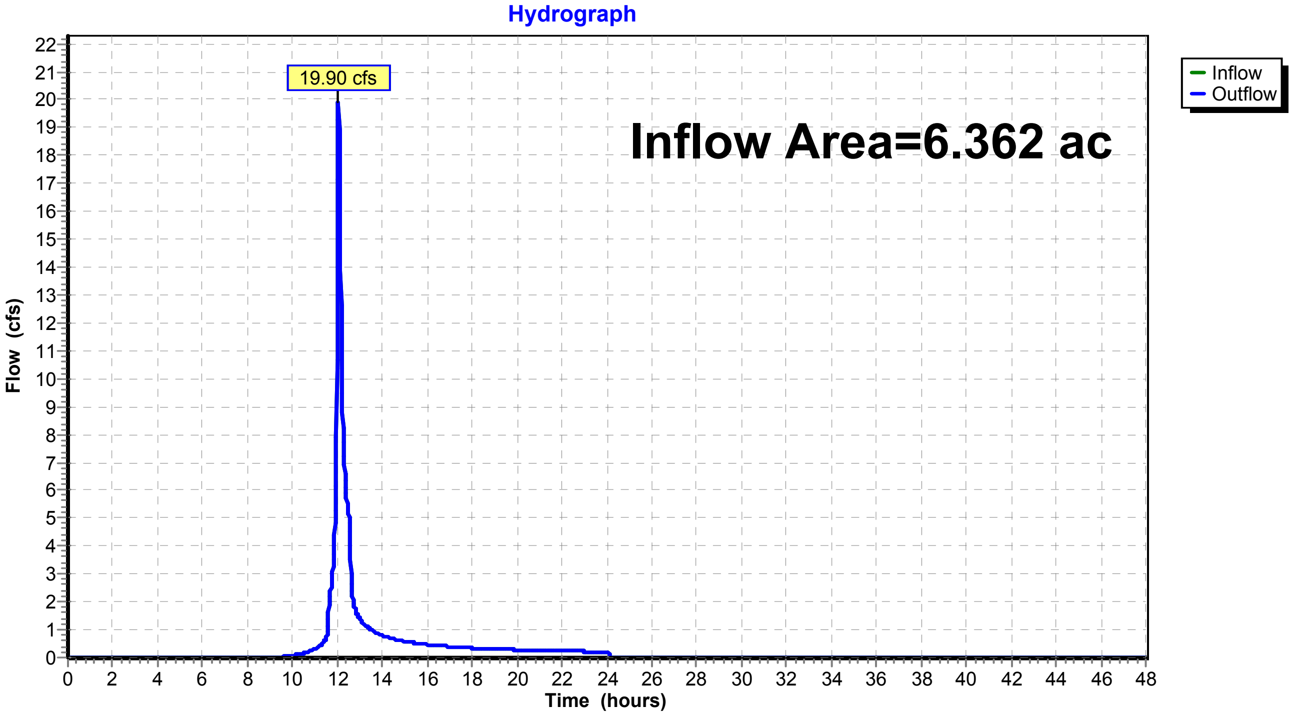
Summary for Reach 75R: Outfall of SB 19

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.362 ac, 0.00% Impervious, Inflow Depth = 2.06" for 10-Year event
Inflow = 19.90 cfs @ 12.06 hrs, Volume= 1.094 af
Outflow = 19.90 cfs @ 12.06 hrs, Volume= 1.094 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 75R: Outfall of SB 19



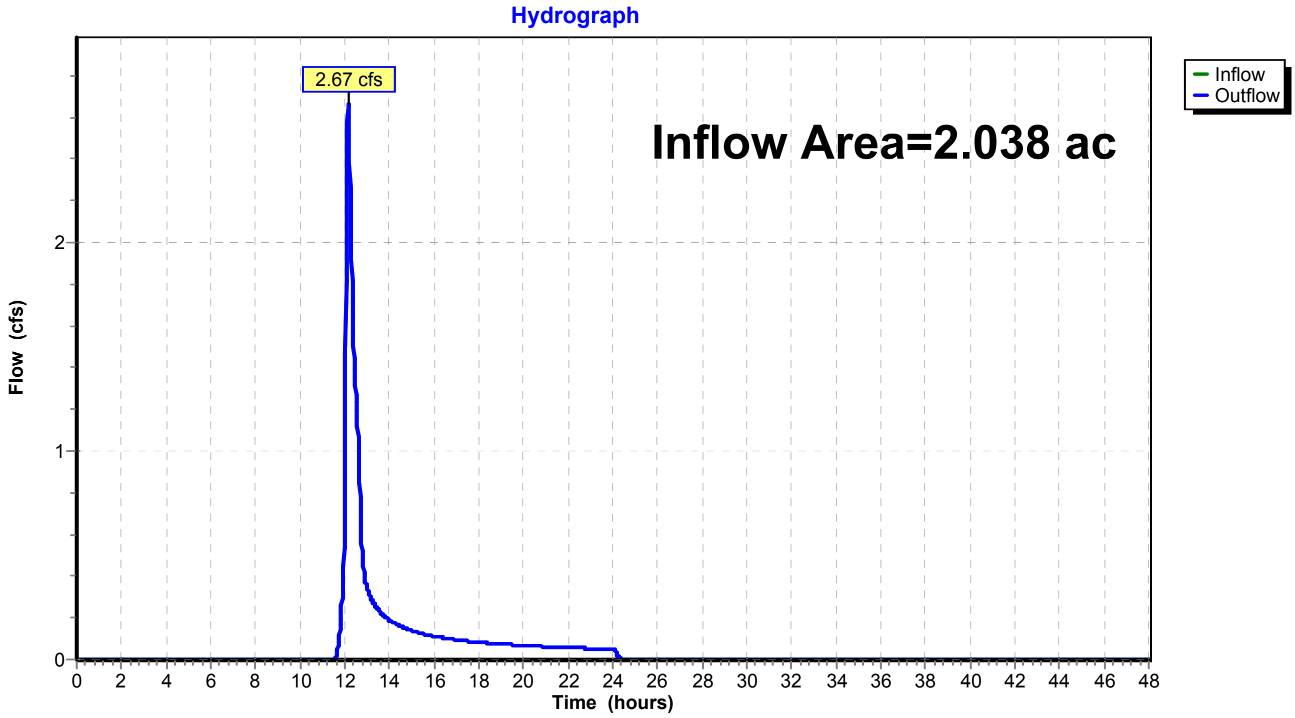
Summary for Reach 82R: Outfall of SB 27

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.038 ac, 0.00% Impervious, Inflow Depth = 1.22" for 10-Year event
Inflow = 2.67 cfs @ 12.15 hrs, Volume= 0.207 af
Outflow = 2.67 cfs @ 12.15 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 82R: Outfall of SB 27



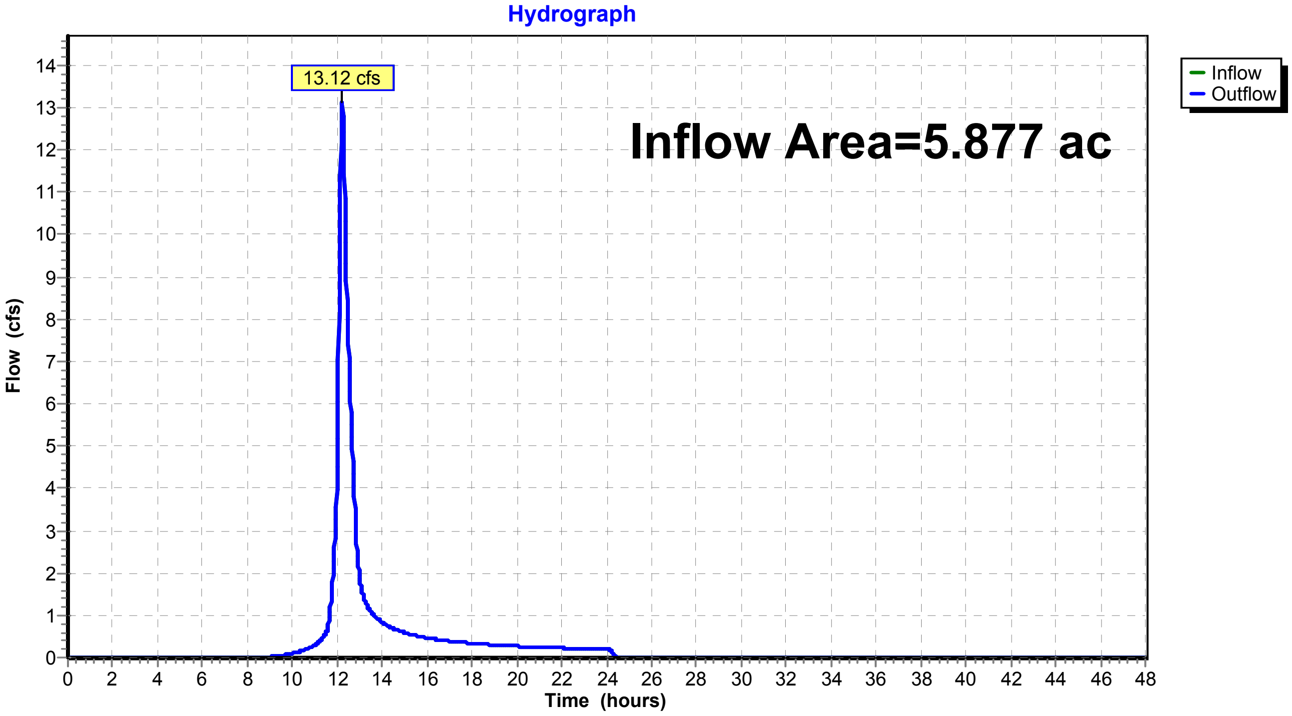
Summary for Reach 84R: Outfall of Future County Road H Subbasin

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       5.877 ac,   0.00% Impervious,  Inflow Depth =   2.22"    for  10-Year event
Inflow      =      13.12 cfs @   12.22 hrs,  Volume=            1.089 af
Outflow     =      13.12 cfs @   12.22 hrs,  Volume=            1.089 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 84R: Outfall of Future County Road H Subbasin



Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment1: Sub-basin1 Runoff Area=15.328 ac 0.00% Impervious Runoff Depth=5.78"
Tc=16.3 min CN=87 Runoff=86.42 cfs 7.383 af

Subcatchment2: Sub-basin 2 Runoff Area=4.913 ac 0.00% Impervious Runoff Depth=4.42"
Tc=12.2 min CN=75 Runoff=24.74 cfs 1.811 af

Subcatchment3: Sub-basin 3 Runoff Area=15.522 ac 0.00% Impervious Runoff Depth=4.42"
Tc=32.8 min CN=75 Runoff=49.25 cfs 5.723 af

Subcatchment4S: Sub-basin 4 Runoff Area=23.961 ac 0.00% Impervious Runoff Depth=5.55"
Tc=11.3 min CN=85 Runoff=153.95 cfs 11.082 af

Subcatchment5S: Sub-basin 5 Runoff Area=27.171 ac 0.00% Impervious Runoff Depth=5.32"
Tc=40.5 min CN=83 Runoff=91.61 cfs 12.049 af

Subcatchment6S: Sub-basin 6 Runoff Area=22.467 ac 0.00% Impervious Runoff Depth=4.76"
Tc=46.4 min CN=78 Runoff=63.49 cfs 8.907 af

Subcatchment7S: Sub-basin 7 Runoff Area=9.790 ac 0.00% Impervious Runoff Depth=3.03"
Tc=27.0 min CN=62 Runoff=22.73 cfs 2.473 af

Subcatchment8S: Sub-basin 8 Runoff Area=21.017 ac 0.00% Impervious Runoff Depth=5.09"
Tc=9.5 min CN=81 Runoff=134.02 cfs 8.923 af

Subcatchment9S: Sub-basin 9 Runoff Area=9.296 ac 0.00% Impervious Runoff Depth=5.21"
Tc=12.7 min CN=82 Runoff=53.64 cfs 4.034 af

Subcatchment10S: Sub-basin 10 Runoff Area=30.014 ac 0.00% Impervious Runoff Depth=5.09"
Tc=37.7 min CN=81 Runoff=101.31 cfs 12.742 af

Subcatchment11S: Sub-basin 11 Runoff Area=4.343 ac 0.00% Impervious Runoff Depth=4.53"
Tc=32.9 min CN=76 Runoff=14.07 cfs 1.641 af

Subcatchment12S: Sub-basin 12 Runoff Area=3.310 ac 0.00% Impervious Runoff Depth=4.98"
Tc=14.0 min CN=80 Runoff=17.60 cfs 1.374 af

Subcatchment13S: Sub-basin 13 Runoff Area=2.279 ac 0.00% Impervious Runoff Depth=5.21"
Tc=36.2 min CN=82 Runoff=8.02 cfs 0.989 af

Subcatchment14S: Sub-basin 14 Runoff Area=2.518 ac 0.00% Impervious Runoff Depth=5.44"
Tc=8.9 min CN=84 Runoff=17.43 cfs 1.141 af

Subcatchment15S: Sub-basin 15 Runoff Area=56.506 ac 0.00% Impervious Runoff Depth=5.21"
Tc=28.0 min CN=82 Runoff=226.35 cfs 24.522 af

Subcatchment16S: Sub-basin 16 Runoff Area=44.796 ac 0.00% Impervious Runoff Depth=5.09"
Tc=26.3 min CN=81 Runoff=181.67 cfs 19.018 af

```
Subcatchment17S: Sub-basin 17         Runoff Area=8.010 ac   0.00% Impervious   Runoff Depth=5.66"
                                            Tc=11.5 min   CN=86   Runoff=51.71 cfs  3.781 af

Subcatchment18S: Sub-basin 18        Runoff Area=35.677 ac   0.00% Impervious   Runoff Depth=5.44"
                                           Tc=15.8 min   CN=84   Runoff=194.75 cfs  16.160 af

Subcatchment19S: Sub-basin 19         Runoff Area=6.362 ac   0.00% Impervious   Runoff Depth=4.76"
                                             Tc=7.3 min   CN=78   Runoff=41.96 cfs  2.522 af

Subcatchment20S: Sub-basin 20        Runoff Area=15.897 ac   0.00% Impervious   Runoff Depth=5.55"
                                            Tc=17.1 min   CN=85   Runoff=85.17 cfs  7.352 af

Subcatchment21S: Sub-basin 21         Runoff Area=7.156 ac   0.00% Impervious   Runoff Depth=6.13"
                                            Tc=10.8 min   CN=90   Runoff=50.44 cfs  3.654 af

Subcatchment22S: Sub-basin 22        Runoff Area=26.548 ac   0.00% Impervious   Runoff Depth=5.21"
                                           Tc=19.6 min   CN=82   Runoff=126.46 cfs  11.521 af

Subcatchment23S: Sub-basin 23        Runoff Area=13.825 ac   0.00% Impervious   Runoff Depth=6.36"
                                            Tc=9.4 min   CN=92   Runoff=104.89 cfs  7.329 af

Subcatchment24S: Sub-basin 24        Runoff Area=13.883 ac   0.00% Impervious   Runoff Depth=5.55"
                                            Tc=19.0 min   CN=85   Runoff=70.75 cfs  6.421 af

Subcatchment25S: Sub-basin 25         Runoff Area=6.657 ac   0.00% Impervious   Runoff Depth=4.42"
                                            Tc=22.6 min   CN=75   Runoff=25.47 cfs  2.454 af

Subcatchment26S: Sub-basin 26         Runoff Area=0.823 ac   0.00% Impervious   Runoff Depth=3.45"
                                             Tc=38.2 min   CN=66   Runoff=1.86 cfs  0.237 af

Subcatchment27S: Sub-basin 27         Runoff Area=2.038 ac   0.00% Impervious   Runoff Depth=3.45"
                                             Tc=13.0 min   CN=66   Runoff=7.67 cfs  0.586 af

Subcatchment28S: Sub-basin 28         Runoff Area=5.784 ac   0.00% Impervious   Runoff Depth=1.30"
                                             Tc=23.9 min   CN=44   Runoff=4.65 cfs  0.626 af

Subcatchment29S: Sub-basin 29         Runoff Area=1.255 ac   0.00% Impervious   Runoff Depth=0.88"
                                             Tc=26.9 min   CN=39   Runoff=0.54 cfs  0.092 af

Subcatchment30S: Sub-basin 30        Runoff Area=31.577 ac   0.00% Impervious   Runoff Depth=1.13"
                                            Tc=45.9 min   CN=42   Runoff=15.95 cfs  2.966 af

Subcatchment31S: Sub-basin 31         Runoff Area=0.884 ac   0.00% Impervious   Runoff Depth=0.88"
                                             Tc=30.2 min   CN=39   Runoff=0.37 cfs  0.065 af

Subcatchment32S: Sub-basin 32         Runoff Area=0.878 ac   0.00% Impervious   Runoff Depth=0.88"
                                             Tc=27.6 min   CN=39   Runoff=0.38 cfs  0.065 af

Subcatchment33S: Sub-basin 33         Runoff Area=3.237 ac   0.00% Impervious   Runoff Depth=1.66"
                                             Tc=19.9 min   CN=48   Runoff=4.03 cfs  0.447 af
```

Subcatchment 34S: Sub-basin 34 Runoff Area=1.241 ac 0.00% Impervious Runoff Depth=1.75"
Tc=12.1 min CN=49 Runoff=2.05 cfs 0.181 af

Subcatchment 35S: Sub-basin 35 Runoff Area=6.229 ac 0.00% Impervious Runoff Depth=1.21"
Tc=16.7 min CN=43 Runoff=5.16 cfs 0.629 af

Subcatchment 36S: Sub-basin 36 Runoff Area=11.210 ac 0.00% Impervious Runoff Depth=4.87"
Tc=52.2 min CN=79 Runoff=30.42 cfs 4.549 af

Subcatchment 83S: County Road H Runoff Area=5.877 ac 0.00% Impervious Runoff Depth=4.98"
Tc=19.1 min CN=80 Runoff=27.19 cfs 2.440 af

Reach 37R: Outfall of SB 2, 3, 7 Inflow=83.23 cfs 10.007 af
Outflow=83.23 cfs 10.007 af

Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36 Inflow=438.22 cfs 62.386 af
Outflow=438.22 cfs 62.386 af

Reach 40R: 60 in SB 4 Avg. Flow Depth=3.01' Max Vel=35.97 fps Inflow=438.10 cfs 62.386 af
60.0" Round Pipe n=0.013 L=718.0' S=0.0330 '/' Capacity=473.08 cfs Outflow=438.22 cfs 62.386 af

Reach 41R: Channel in SB 9, 10 Avg. Flow Depth=0.87' Max Vel=10.60 fps Inflow=53.64 cfs 4.034 af
n=0.050 L=1,660.0' S=0.0048 '/' Capacity=280.23 cfs Outflow=49.75 cfs 4.034 af

Reach 46R: Channel SB1 Avg. Flow Depth=1.24' Max Vel=6.91 fps Inflow=86.42 cfs 7.383 af
n=0.050 L=841.0' S=0.0071 '/' Capacity=296.86 cfs Outflow=85.24 cfs 7.383 af

Reach 48R: Outfall of SB 8, 13 Inflow=135.34 cfs 9.912 af
Outflow=135.34 cfs 9.912 af

Reach 49R: Channel SB8 Avg. Flow Depth=1.27' Max Vel=6.95 fps Inflow=134.02 cfs 8.923 af
n=0.050 L=521.0' S=0.0077 '/' Capacity=706.58 cfs Outflow=131.67 cfs 8.923 af

Reach 50R: Outfall of SB 12 Inflow=17.60 cfs 1.374 af
Outflow=17.60 cfs 1.374 af

Reach 51R: Outfall of SB 14 Inflow=17.43 cfs 1.141 af
Outflow=17.43 cfs 1.141 af

Reach 52R: Outfall of SB 17 Inflow=51.71 cfs 3.781 af
Outflow=51.71 cfs 3.781 af

Reach 53R: Outfall of SB 18 Inflow=194.75 cfs 16.160 af
Outflow=194.75 cfs 16.160 af

Reach 54R: Outfall of SB 25 Inflow=25.47 cfs 2.454 af
Outflow=25.47 cfs 2.454 af

Reach 55R: Outfall of SB 26 Inflow=1.86 cfs 0.237 af
Outflow=1.86 cfs 0.237 af

Reach 56R: Outfall of SB 23, 24 Inflow=155.89 cfs 13.749 af
Outflow=155.89 cfs 13.749 af

Reach 59R: Outfall of SB 20, 22 Inflow=210.05 cfs 18.873 af
Outflow=210.05 cfs 18.873 af

Reach 61R: Outfall of SB 15, 16, 21 Inflow=429.83 cfs 47.194 af
Outflow=429.83 cfs 47.194 af

Reach 67R: Outfall of SB 28 Inflow=4.65 cfs 0.626 af
Outflow=4.65 cfs 0.626 af

Reach 68R: Outfall of SB 29 Inflow=0.54 cfs 0.092 af
Outflow=0.54 cfs 0.092 af

Reach 69R: Outfall of SB 30 Inflow=15.95 cfs 2.966 af
Outflow=15.95 cfs 2.966 af

Reach 70R: Outfall of SB 31 Inflow=0.37 cfs 0.065 af
Outflow=0.37 cfs 0.065 af

Reach 71R: Outfall of SB 32 Inflow=0.38 cfs 0.065 af
Outflow=0.38 cfs 0.065 af

Reach 72R: Outfall of SB 33 Inflow=4.03 cfs 0.447 af
Outflow=4.03 cfs 0.447 af

Reach 73R: Outfall of SB 34 Inflow=2.05 cfs 0.181 af
Outflow=2.05 cfs 0.181 af

Reach 74R: Outfall of SB 35 Inflow=5.16 cfs 0.629 af
Outflow=5.16 cfs 0.629 af

Reach 75R: Outfall of SB 19 Inflow=41.96 cfs 2.522 af
Outflow=41.96 cfs 2.522 af

Reach 82R: Outfall of SB 27 Inflow=7.67 cfs 0.586 af
Outflow=7.67 cfs 0.586 af

Reach 84R: Outfall of Future County Road H Subbasin Inflow=27.19 cfs 2.440 af
Outflow=27.19 cfs 2.440 af

Total Runoff Area = 498.279 ac Runoff Volume = 197.886 af Average Runoff Depth = 4.77"
100.00% Pervious = 498.279 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1: Sub-basin1

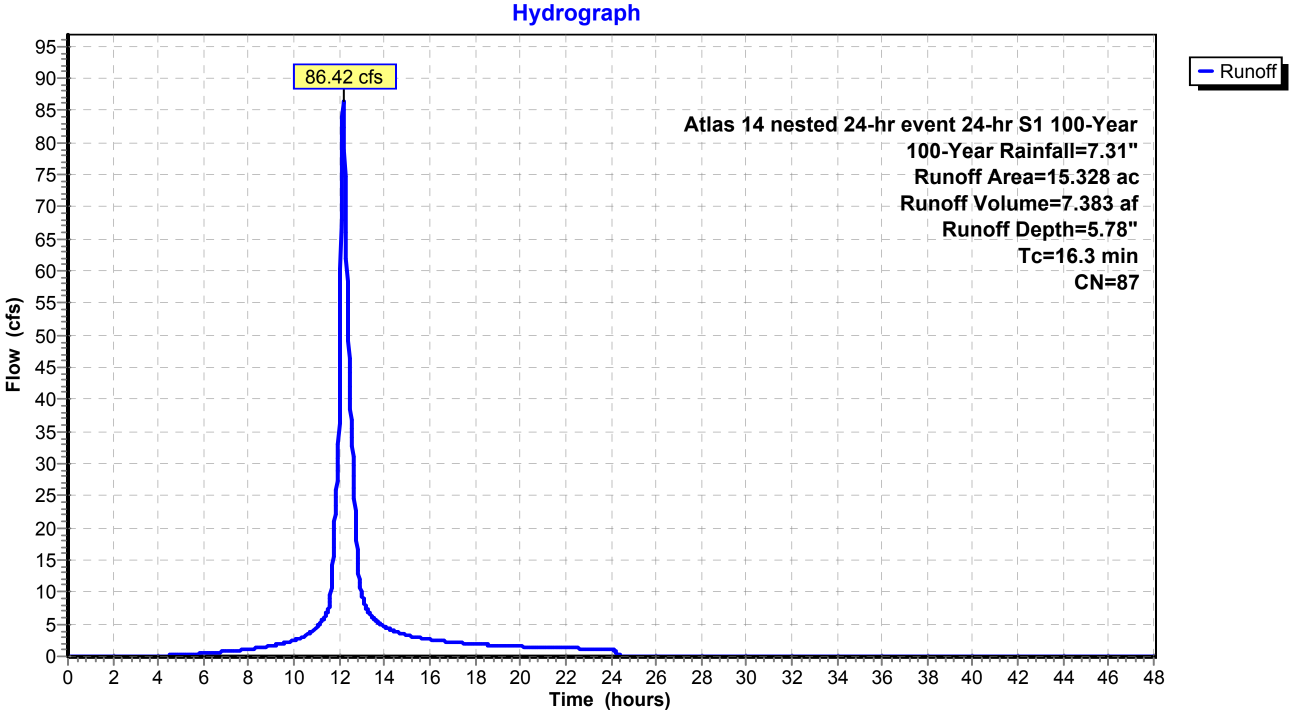
Runoff = 86.42 cfs @ 12.17 hrs, Volume= 7.383 af, Depth= 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	15.328	87	
	15.328		100.00% Pervious Area

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

Subcatchment 1: Sub-basin1



Summary for Subcatchment 2: Sub-basin 2

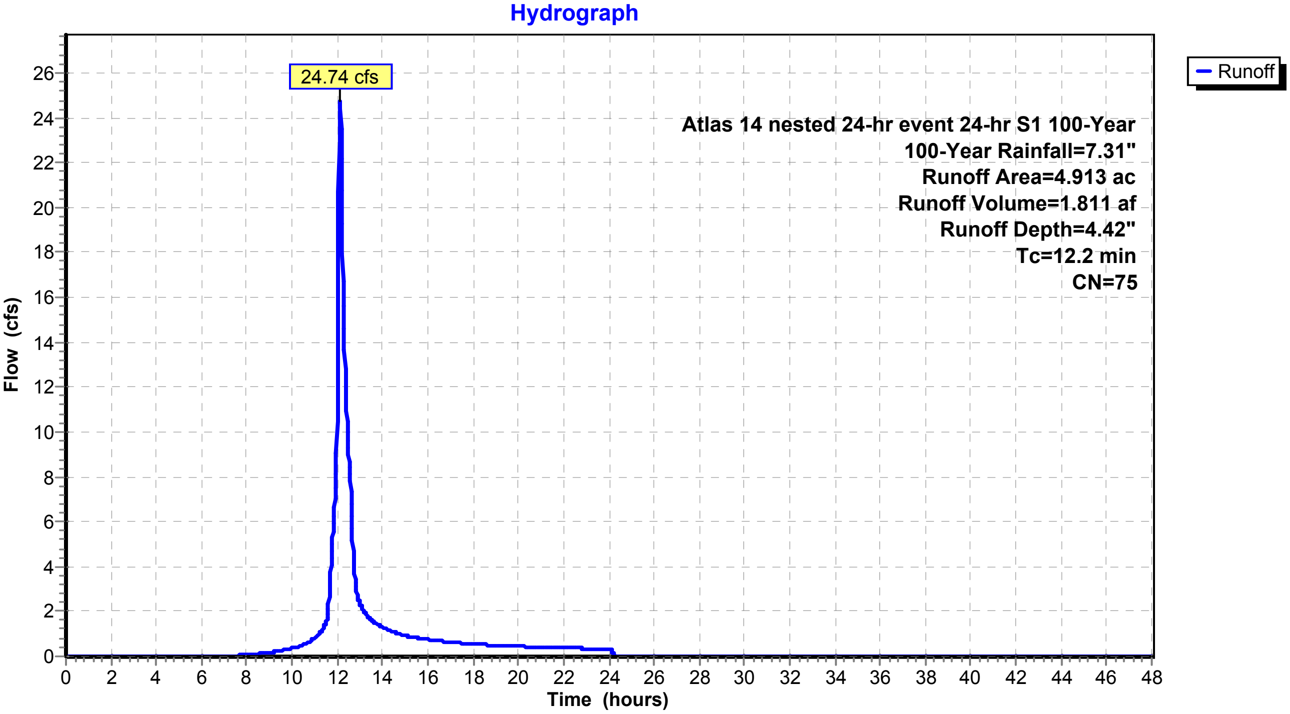
Runoff = 24.74 cfs @ 12.12 hrs, Volume= 1.811 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	4.913	75	
	4.913		100.00% Pervious Area

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

Subcatchment 2: Sub-basin 2



Summary for Subcatchment 3: Sub-basin 3

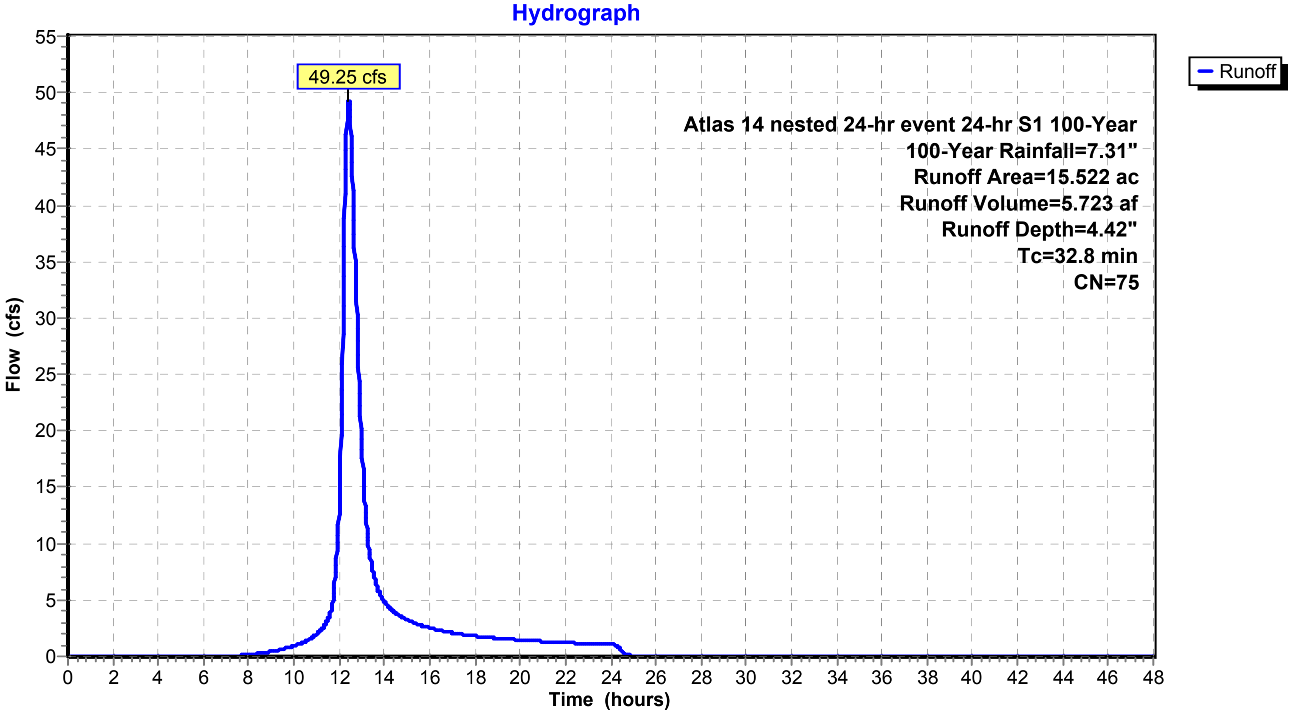
Runoff = 49.25 cfs @ 12.42 hrs, Volume= 5.723 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	15.522	75	
	15.522		100.00% Pervious Area

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

Subcatchment 3: Sub-basin 3



Summary for Subcatchment 4S: Sub-basin 4

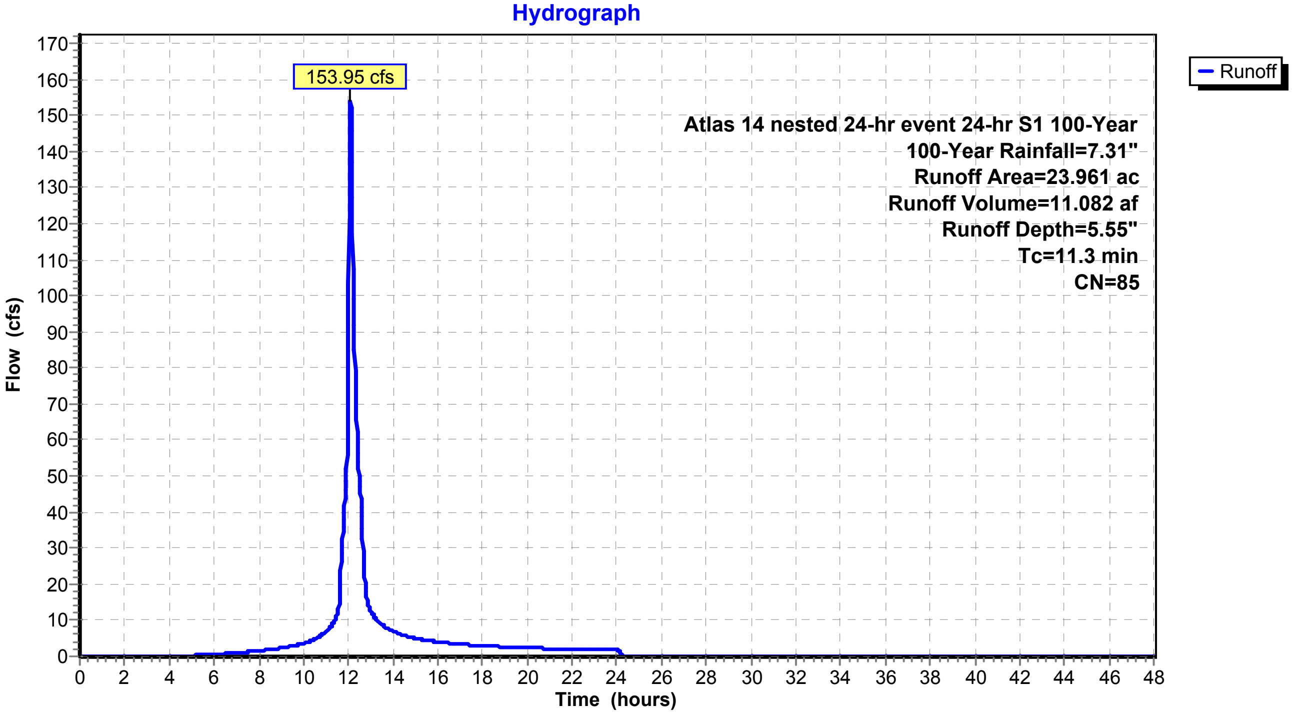
Runoff = 153.95 cfs @ 12.10 hrs, Volume= 11.082 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	23.961	85	
	23.961		100.00% Pervious Area

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

Subcatchment 4S: Sub-basin 4



Summary for Subcatchment 5S: Sub-basin 5

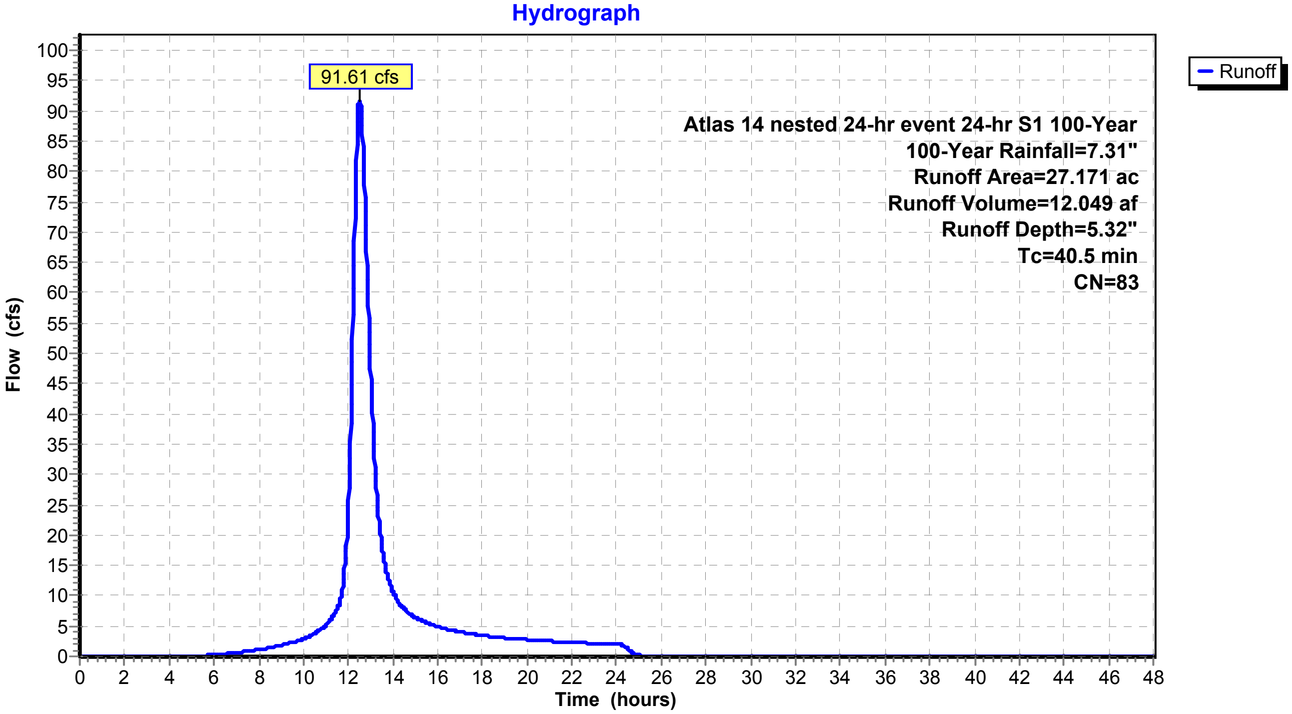
Runoff = 91.61 cfs @ 12.51 hrs, Volume= 12.049 af, Depth= 5.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	27.171	83	
	27.171		100.00% Pervious Area

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

Subcatchment 5S: Sub-basin 5



Summary for Subcatchment 6S: Sub-basin 6

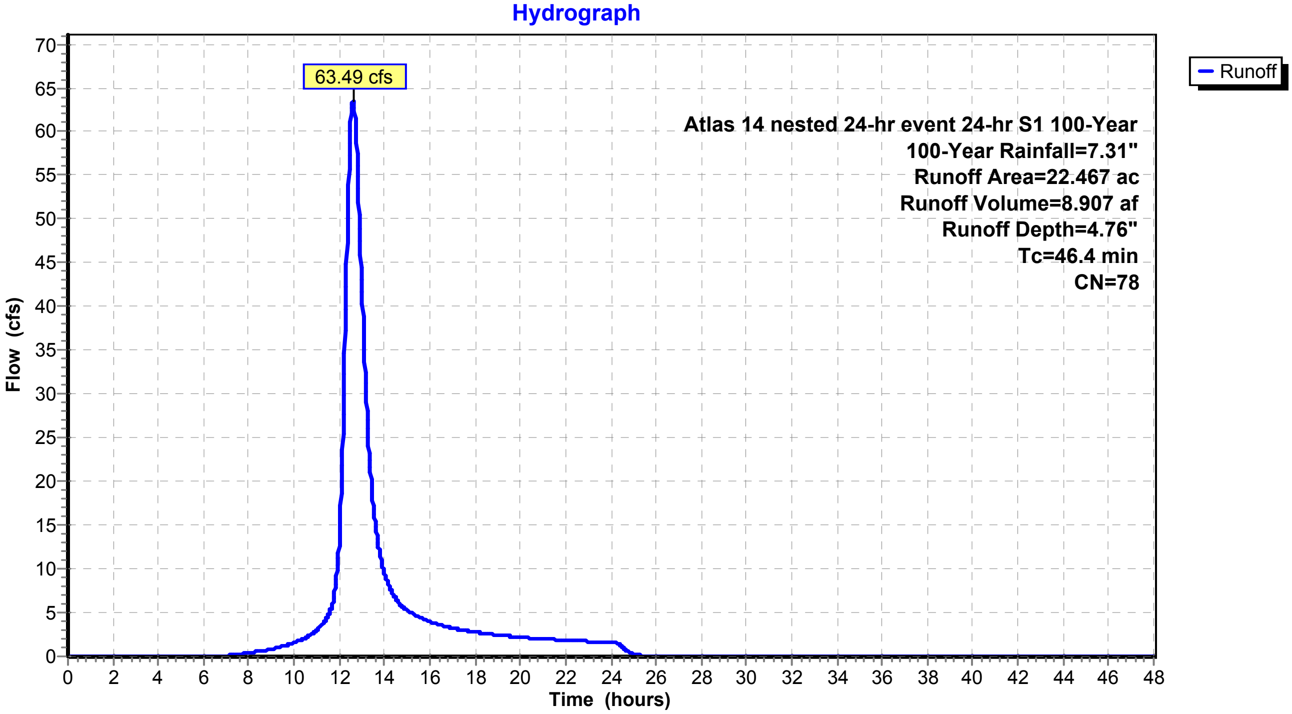
Runoff = 63.49 cfs @ 12.61 hrs, Volume= 8.907 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	22.467	78	
	22.467		100.00% Pervious Area

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

Subcatchment 6S: Sub-basin 6



Summary for Subcatchment 7S: Sub-basin 7

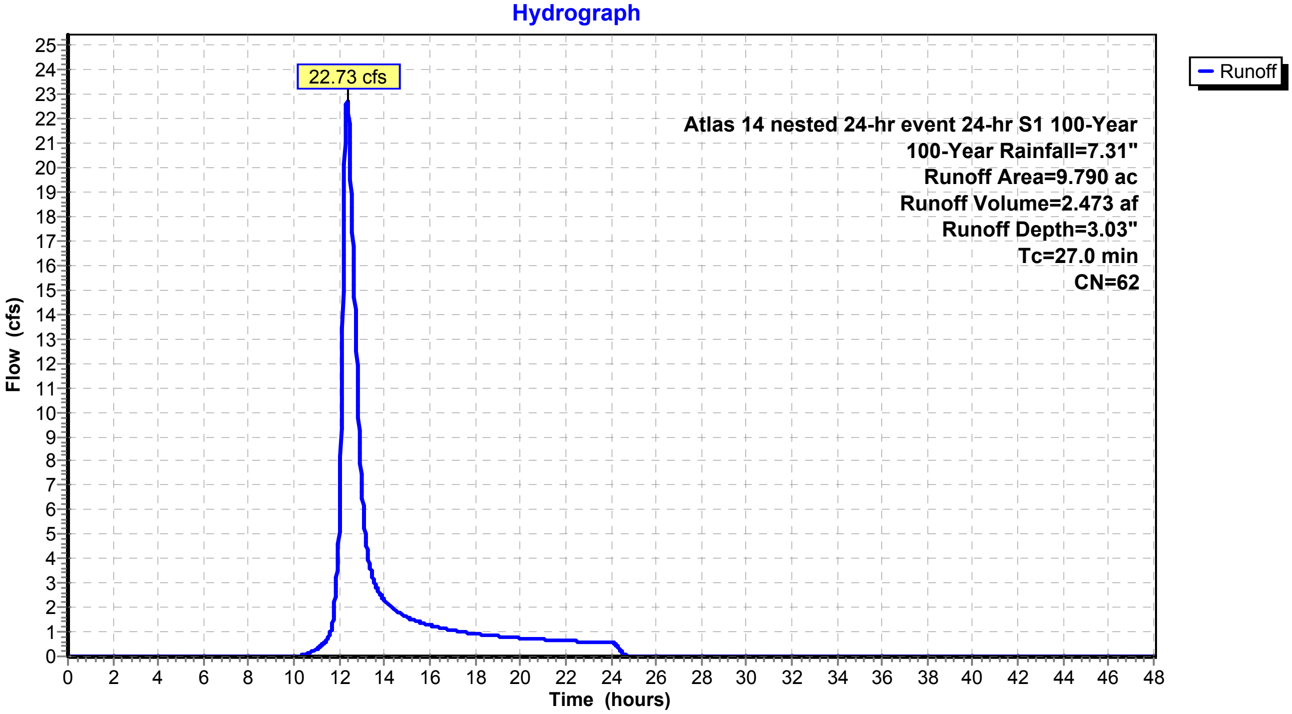
Runoff = 22.73 cfs @ 12.35 hrs, Volume= 2.473 af, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	9.790	62	
	9.790		100.00% Pervious Area

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

Subcatchment 7S: Sub-basin 7



Summary for Subcatchment 8S: Sub-basin 8

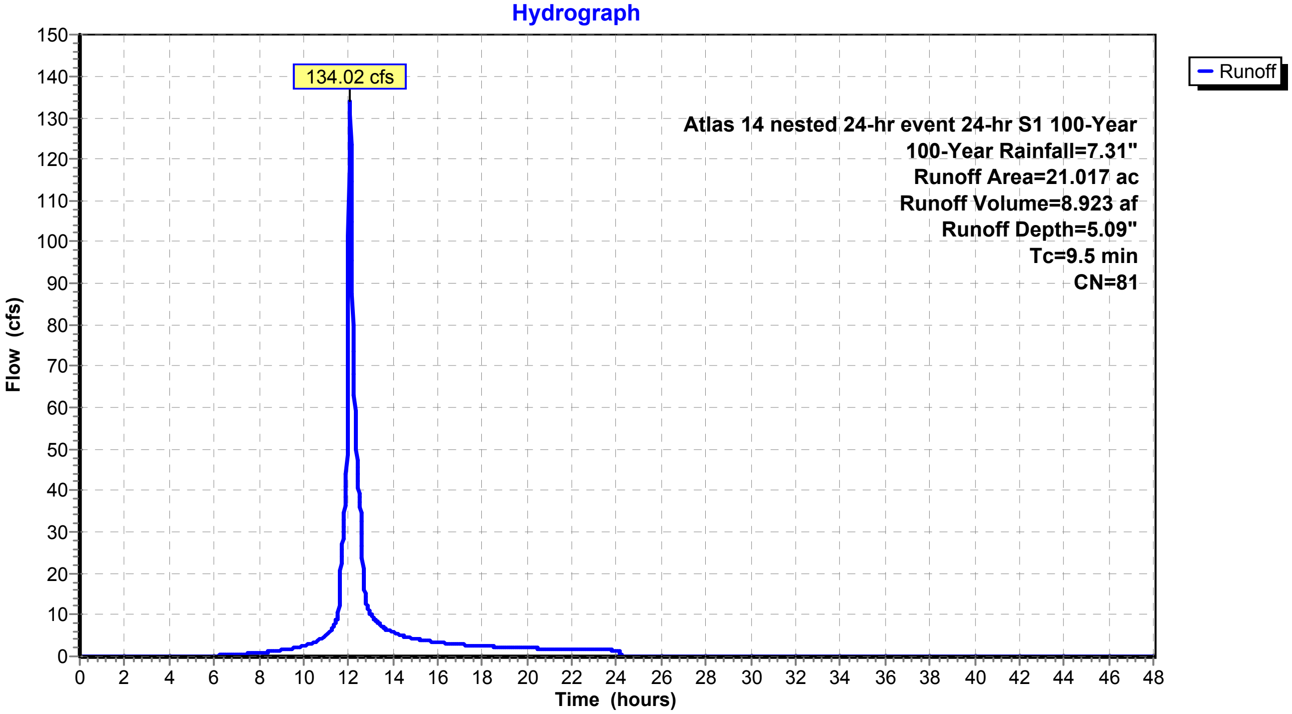
Runoff = 134.02 cfs @ 12.08 hrs, Volume= 8.923 af, Depth= 5.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	21.017	81	
	21.017		100.00% Pervious Area

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

Subcatchment 8S: Sub-basin 8



Summary for Subcatchment 9S: Sub-basin 9

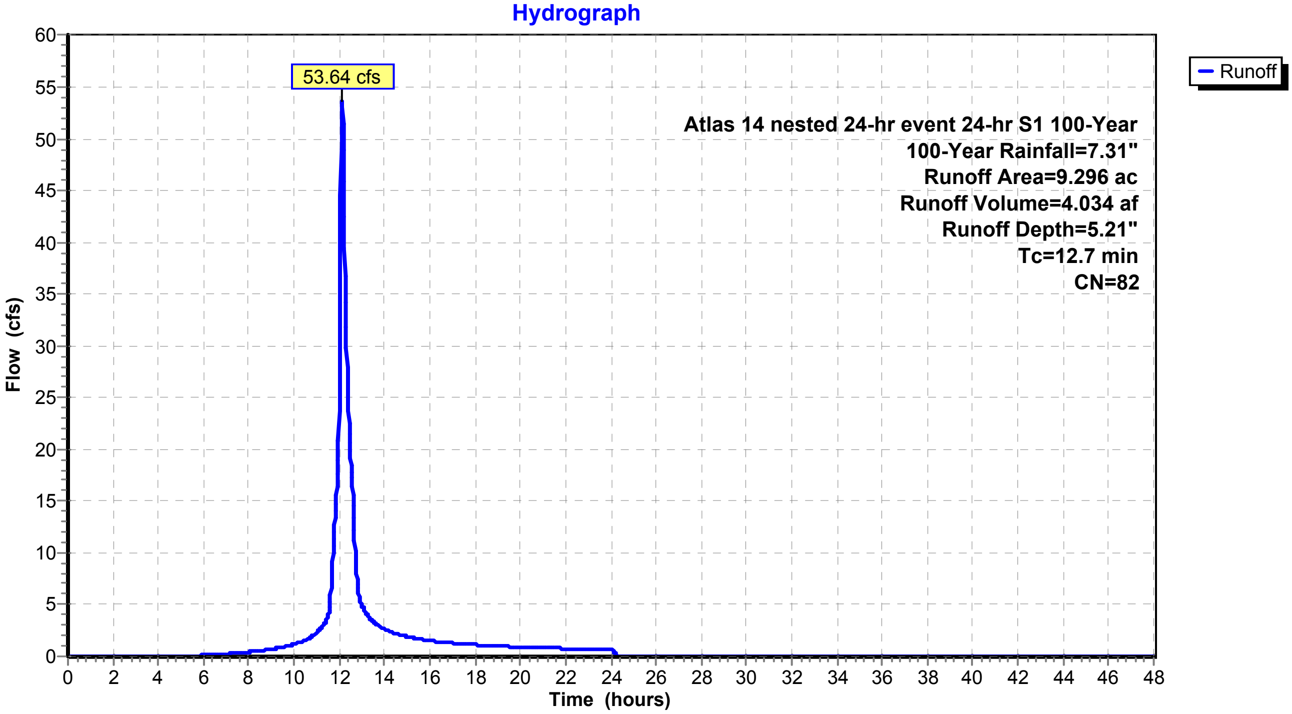
Runoff = 53.64 cfs @ 12.13 hrs, Volume= 4.034 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	9.296	82	
	9.296		100.00% Pervious Area

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

Subcatchment 9S: Sub-basin 9



Summary for Subcatchment 10S: Sub-basin 10

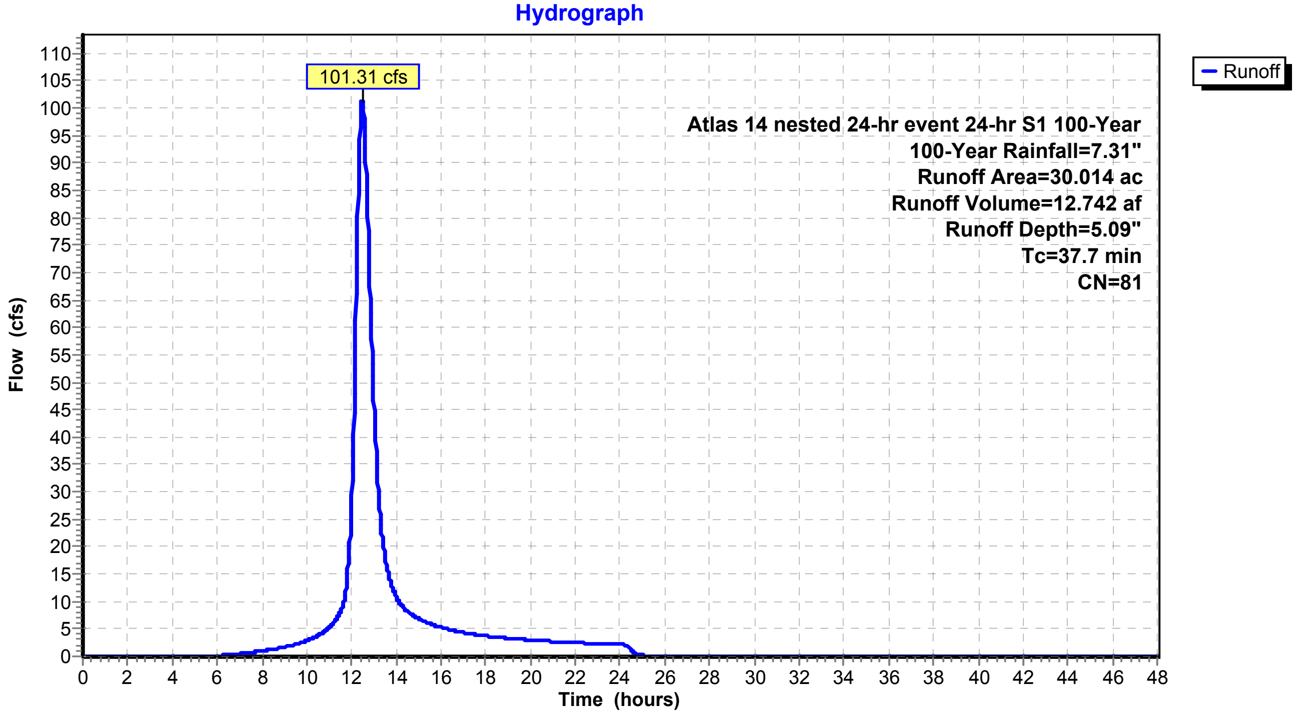
Runoff = 101.31 cfs @ 12.47 hrs, Volume= 12.742 af, Depth= 5.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	30.014	81	
	30.014		100.00% Pervious Area

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

Subcatchment 10S: Sub-basin 10



Summary for Subcatchment 11S: Sub-basin 11

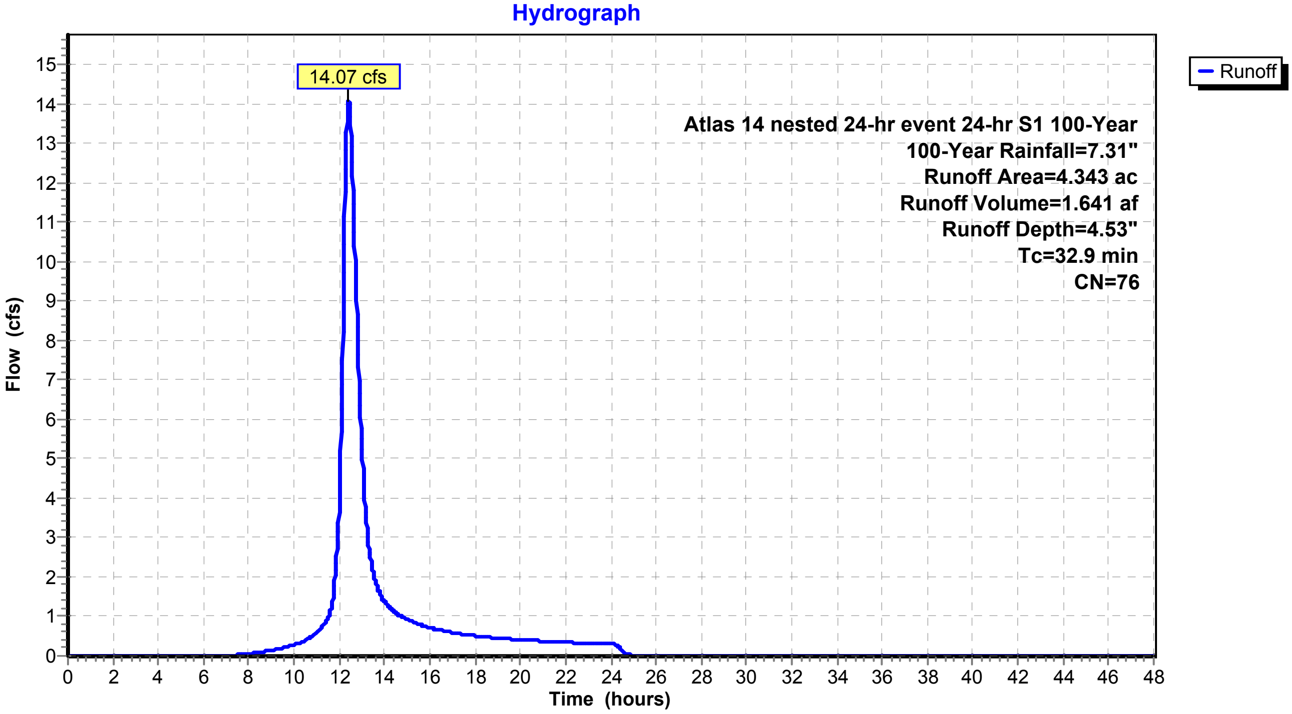
Runoff = 14.07 cfs @ 12.41 hrs, Volume= 1.641 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	4.343	76	
	4.343		100.00% Pervious Area

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

Subcatchment 11S: Sub-basin 11



Summary for Subcatchment 12S: Sub-basin 12

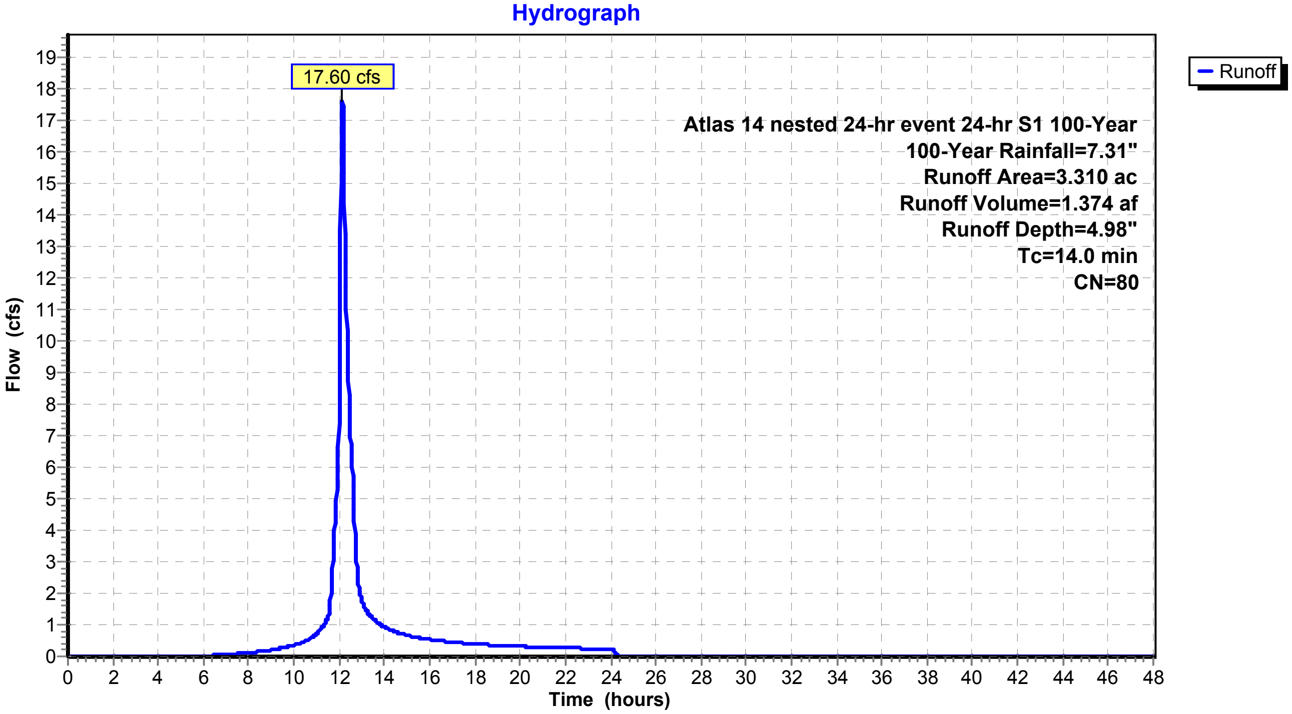
Runoff = 17.60 cfs @ 12.14 hrs, Volume= 1.374 af, Depth= 4.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.310	80	
	3.310		100.00% Pervious Area

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

Subcatchment 12S: Sub-basin 12



Summary for Subcatchment 13S: Sub-basin 13

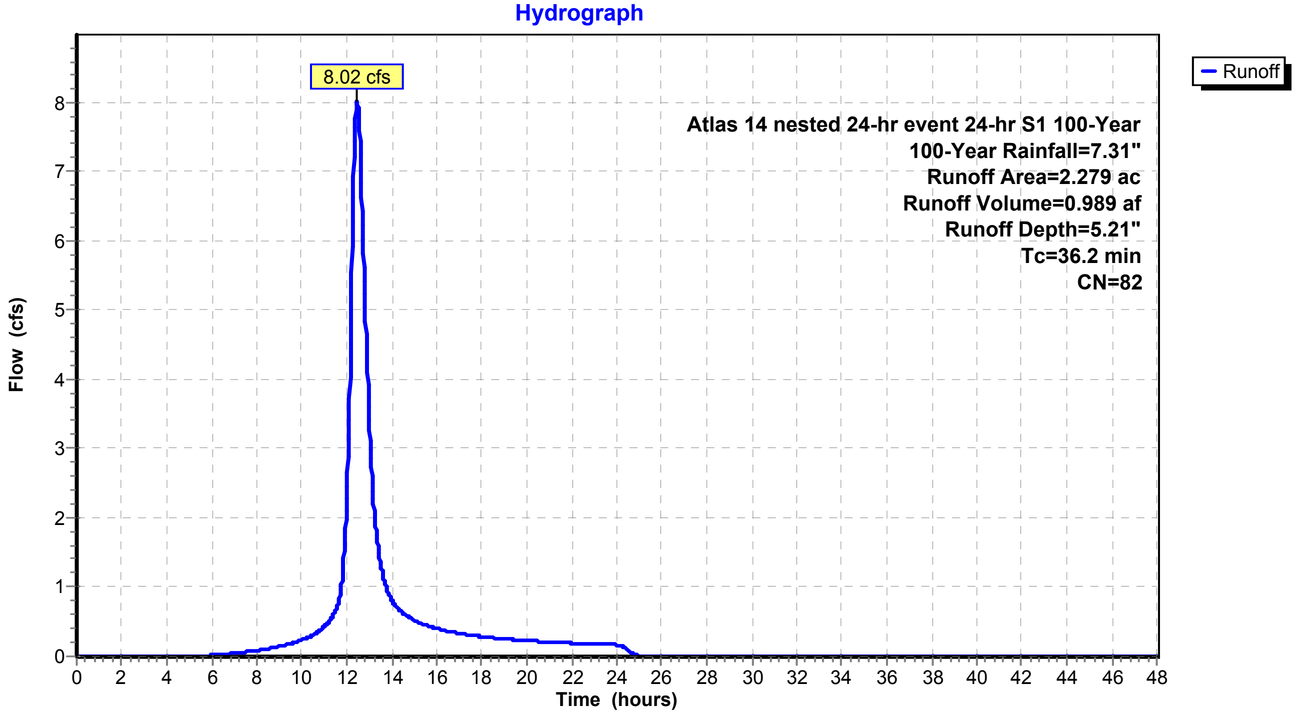
Runoff = 8.02 cfs @ 12.44 hrs, Volume= 0.989 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.279	82	
	2.279		100.00% Pervious Area

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

Subcatchment 13S: Sub-basin 13



Summary for Subcatchment 14S: Sub-basin 14

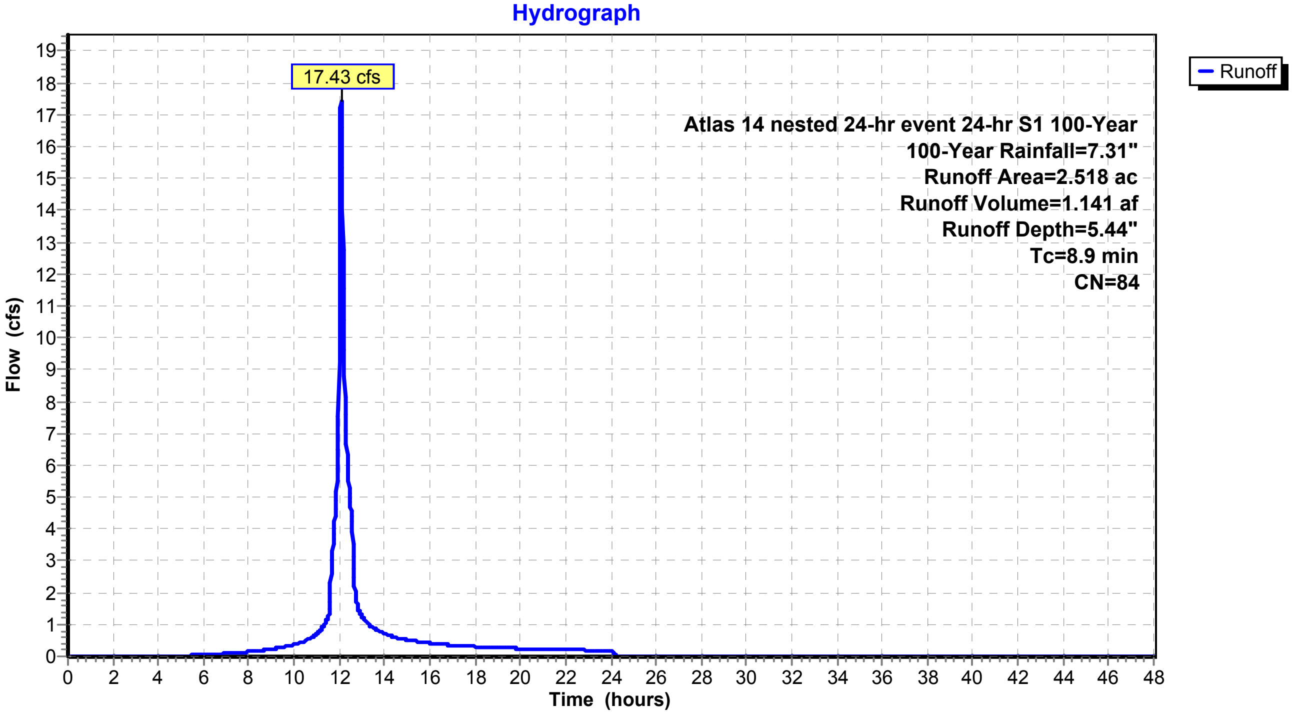
Runoff = 17.43 cfs @ 12.07 hrs, Volume= 1.141 af, Depth= 5.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.518	84	
	2.518		100.00% Pervious Area

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

Subcatchment 14S: Sub-basin 14



Summary for Subcatchment 15S: Sub-basin 15

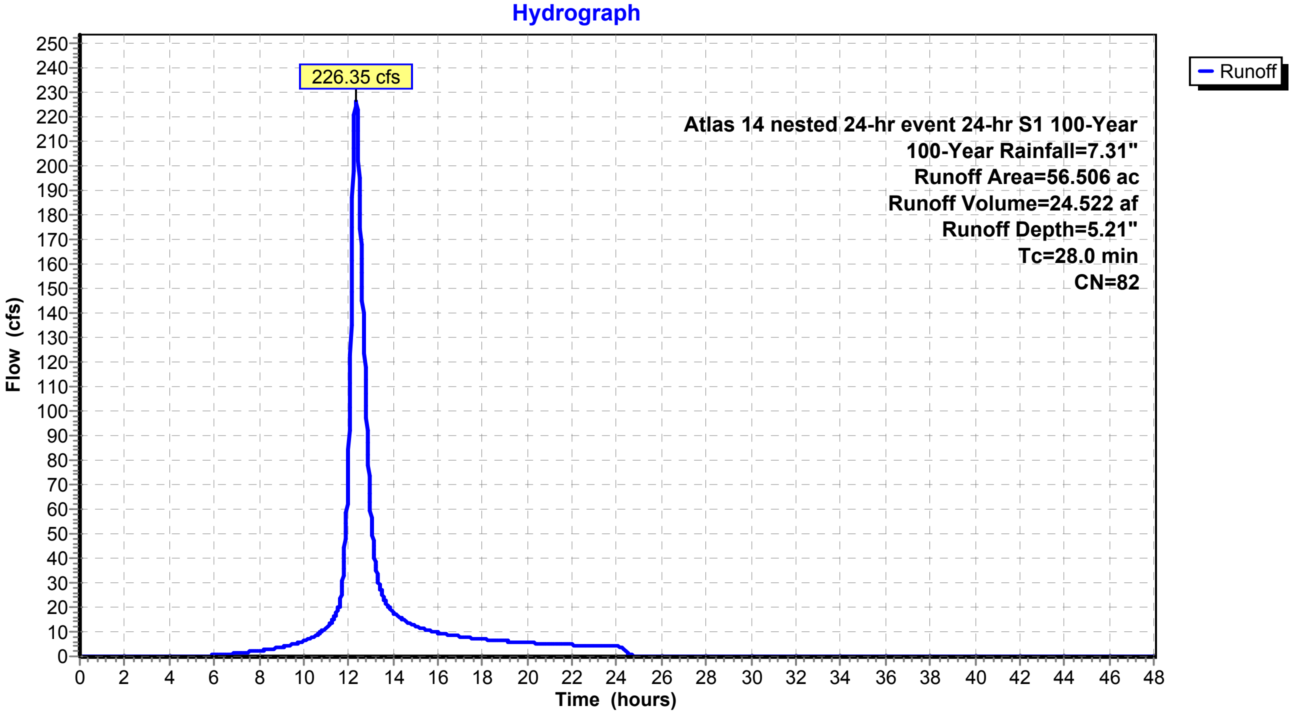
Runoff = 226.35 cfs @ 12.34 hrs, Volume= 24.522 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	56.506	82	
	56.506		100.00% Pervious Area

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

Subcatchment 15S: Sub-basin 15



Summary for Subcatchment 16S: Sub-basin 16

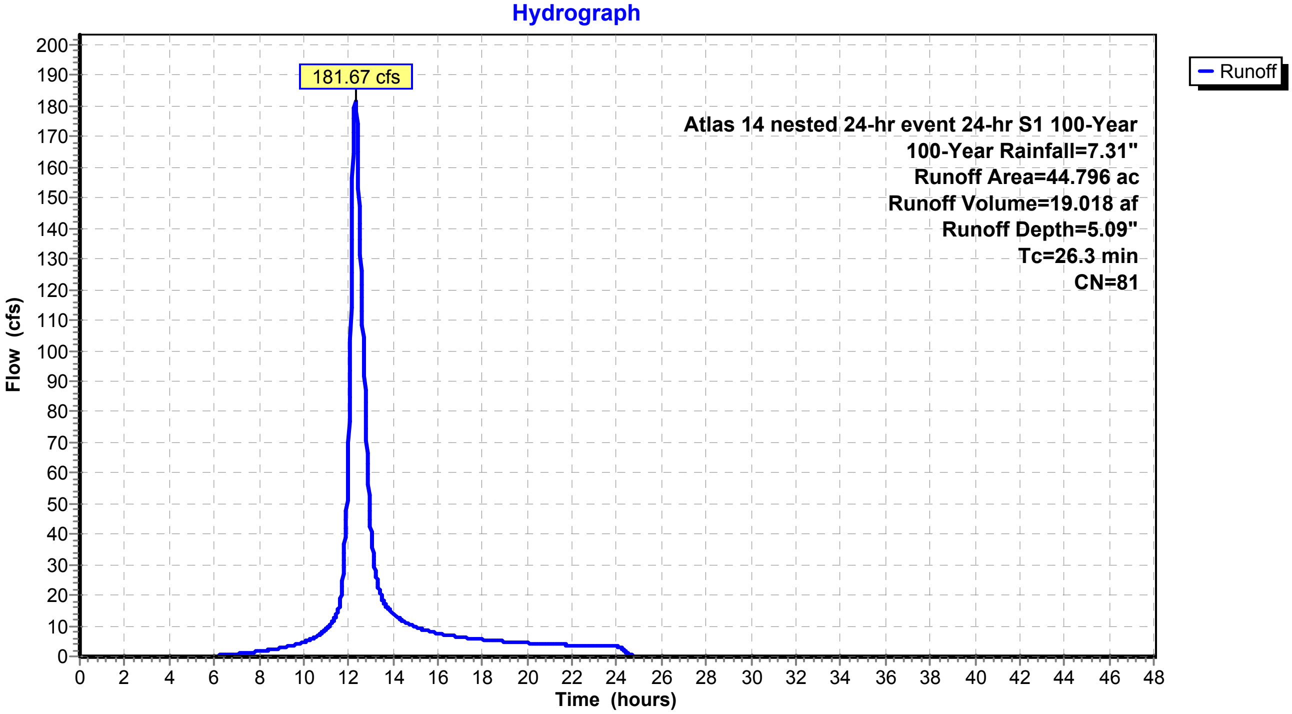
Runoff = 181.67 cfs @ 12.31 hrs, Volume= 19.018 af, Depth= 5.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	44.796	81	
	44.796		100.00% Pervious Area

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

Subcatchment 16S: Sub-basin 16



Summary for Subcatchment 17S: Sub-basin 17

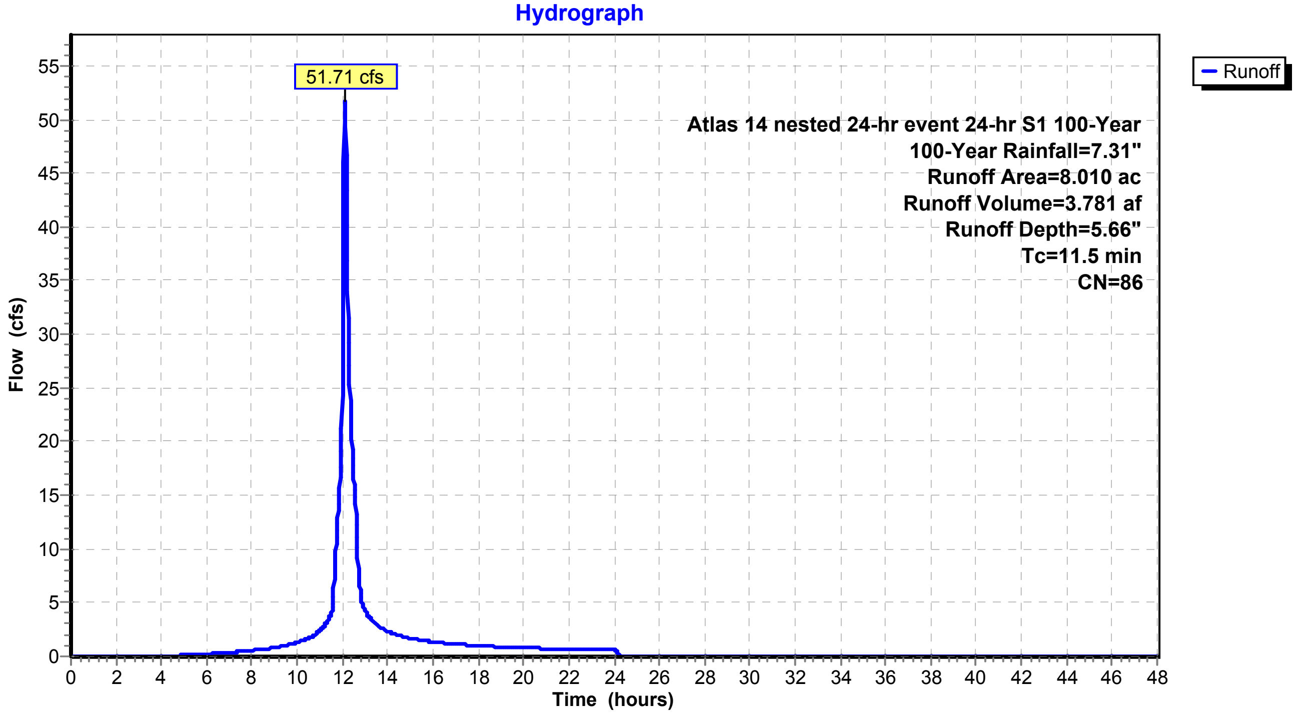
Runoff = 51.71 cfs @ 12.11 hrs, Volume= 3.781 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	8.010	86	
	8.010		100.00% Pervious Area

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

Subcatchment 17S: Sub-basin 17



Summary for Subcatchment 18S: Sub-basin 18

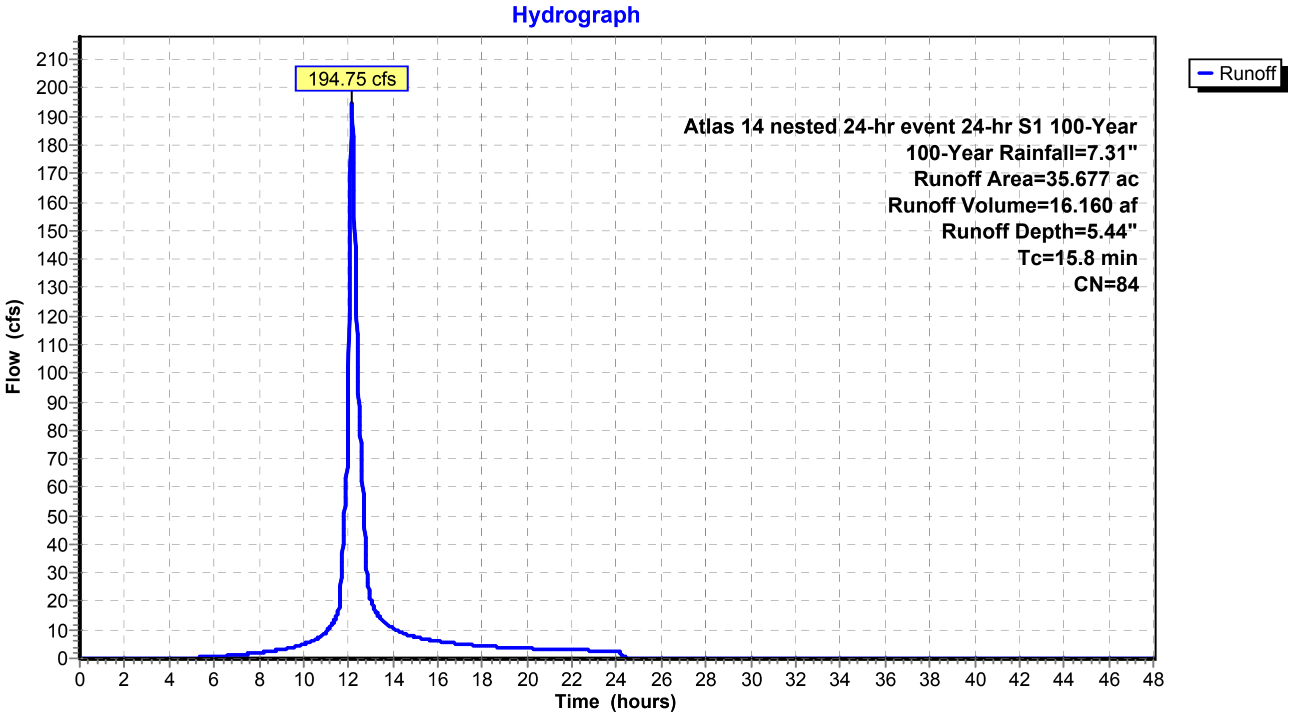
Runoff = 194.75 cfs @ 12.17 hrs, Volume= 16.160 af, Depth= 5.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	35.677	84	
	35.677		100.00% Pervious Area

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

Subcatchment 18S: Sub-basin 18



Summary for Subcatchment 19S: Sub-basin 19

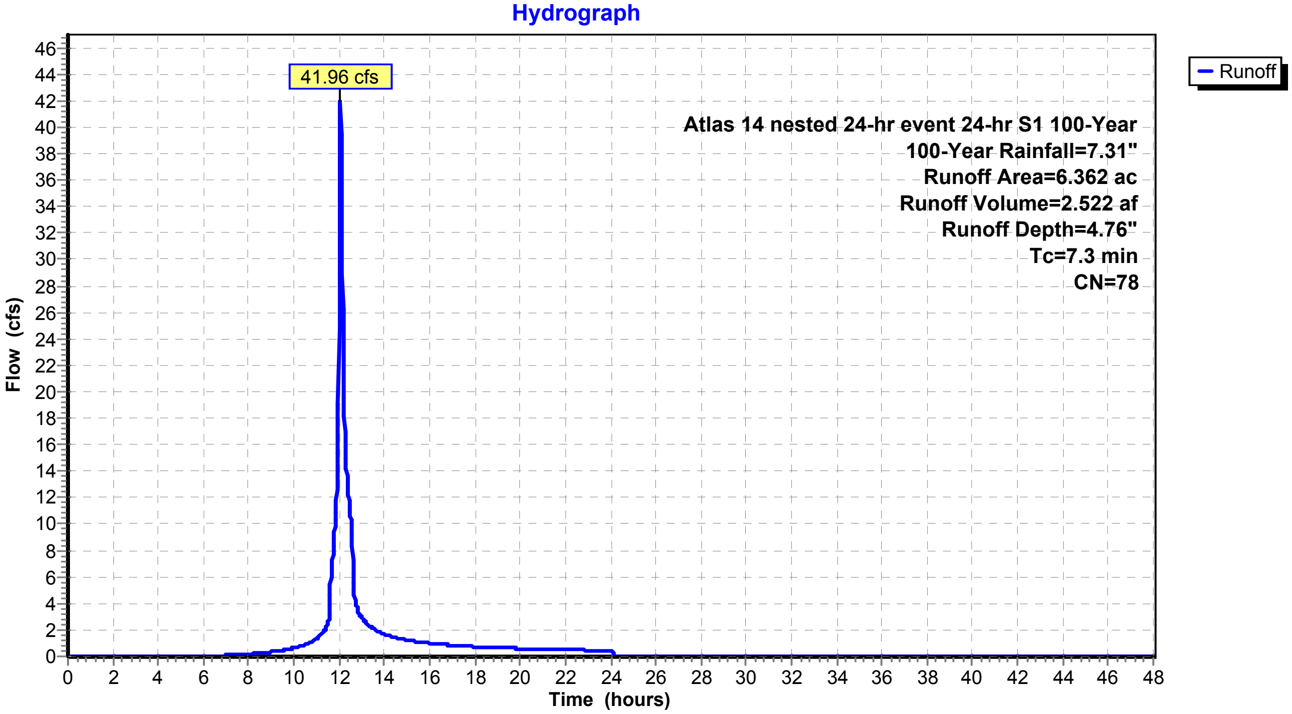
Runoff = 41.96 cfs @ 12.05 hrs, Volume= 2.522 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	6.362	78	
	6.362		100.00% Pervious Area

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

Subcatchment 19S: Sub-basin 19



Summary for Subcatchment 20S: Sub-basin 20

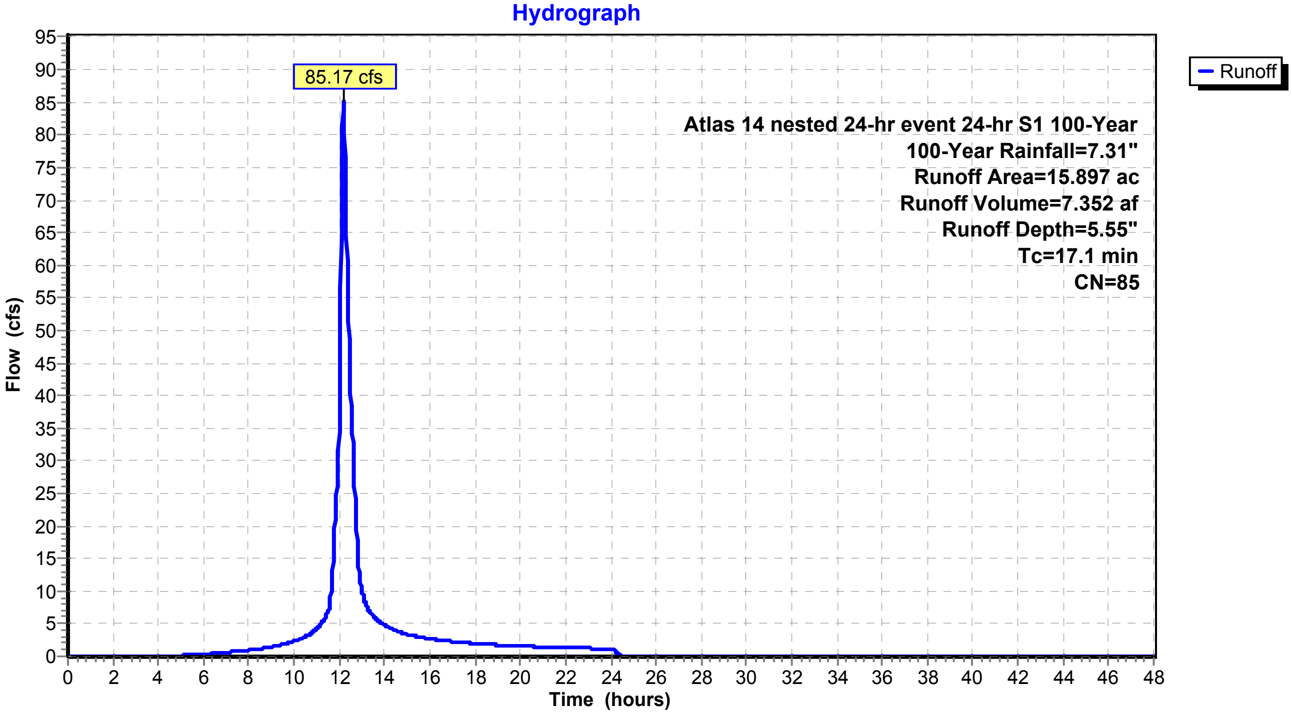
Runoff = 85.17 cfs @ 12.18 hrs, Volume= 7.352 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	15.897	85	
	15.897		100.00% Pervious Area

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

Subcatchment 20S: Sub-basin 20



Summary for Subcatchment 21S: Sub-basin 21

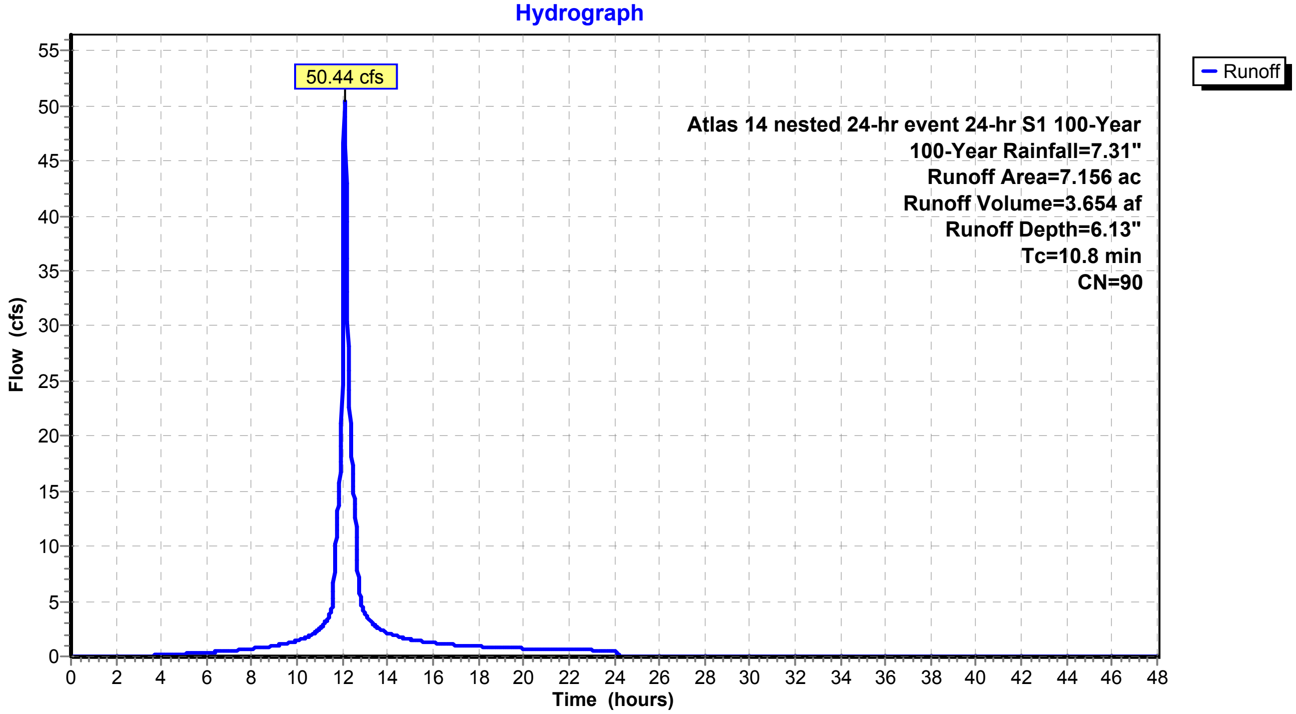
Runoff = 50.44 cfs @ 12.10 hrs, Volume= 3.654 af, Depth= 6.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	7.156	90	
	7.156		100.00% Pervious Area

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

Subcatchment 21S: Sub-basin 21



Summary for Subcatchment 22S: Sub-basin 22

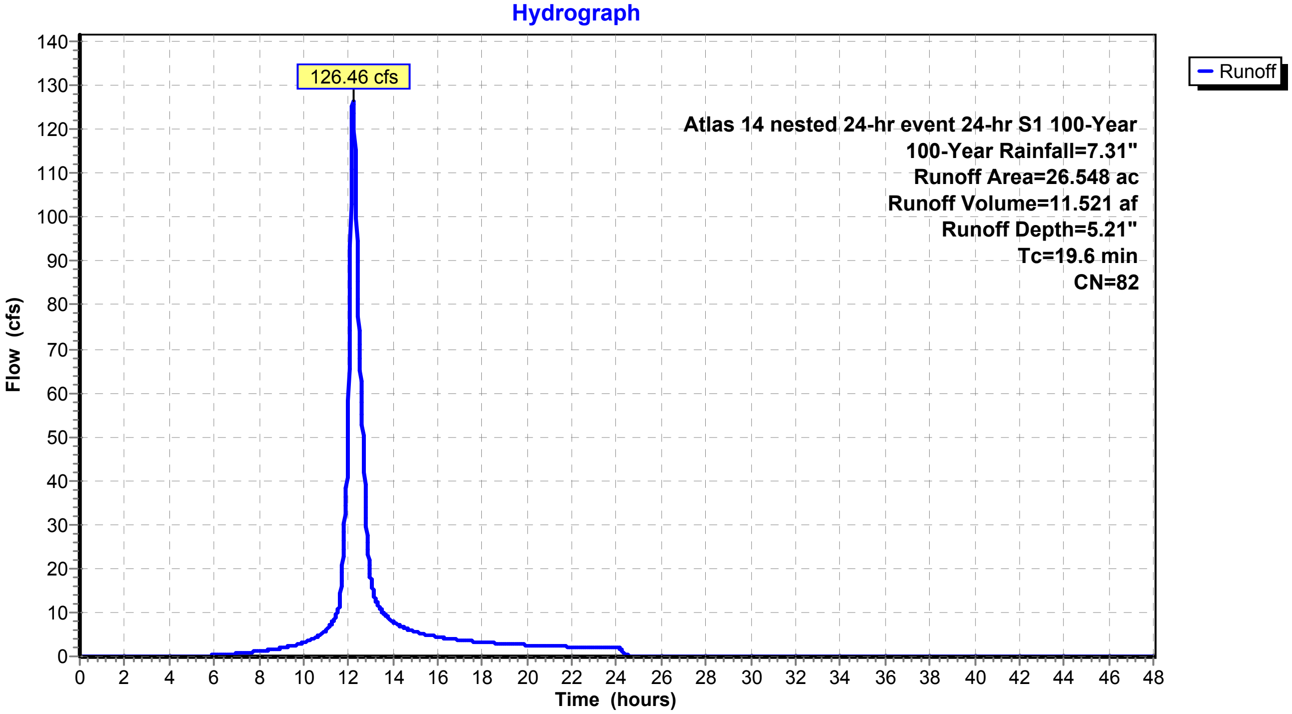
Runoff = 126.46 cfs @ 12.22 hrs, Volume= 11.521 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	26.548	82	
	26.548		100.00% Pervious Area

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

Subcatchment 22S: Sub-basin 22



Summary for Subcatchment 23S: Sub-basin 23

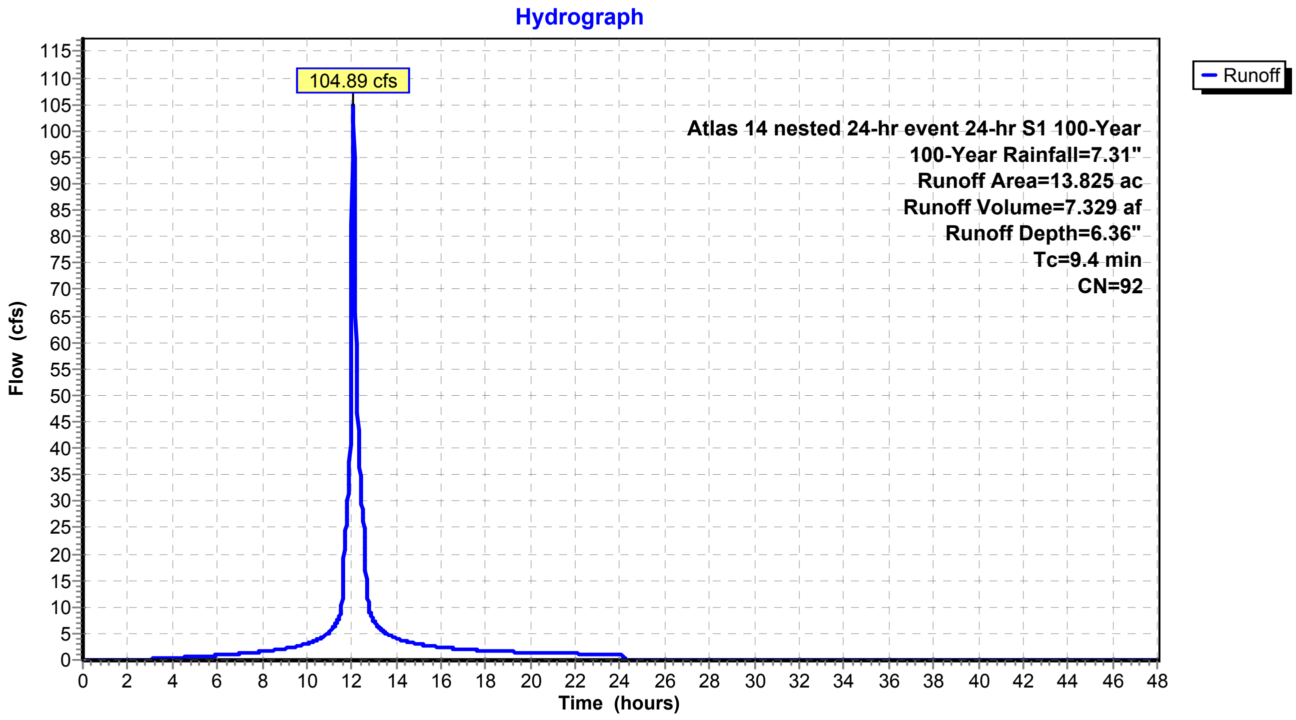
Runoff = 104.89 cfs @ 12.08 hrs, Volume= 7.329 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	13.825	92	
	13.825		100.00% Pervious Area

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

Subcatchment 23S: Sub-basin 23



Summary for Subcatchment 24S: Sub-basin 24

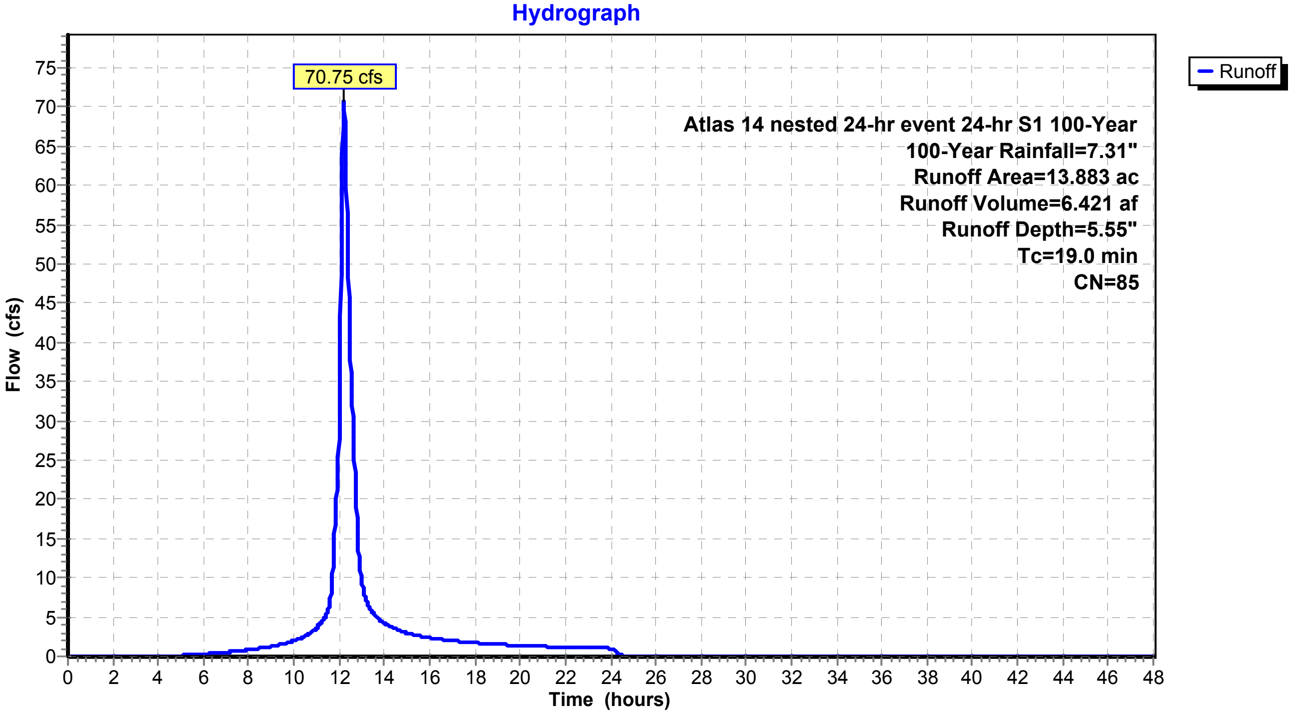
Runoff = 70.75 cfs @ 12.21 hrs, Volume= 6.421 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	13.883	85	
	13.883		100.00% Pervious Area

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

Subcatchment 24S: Sub-basin 24



Summary for Subcatchment 25S: Sub-basin 25

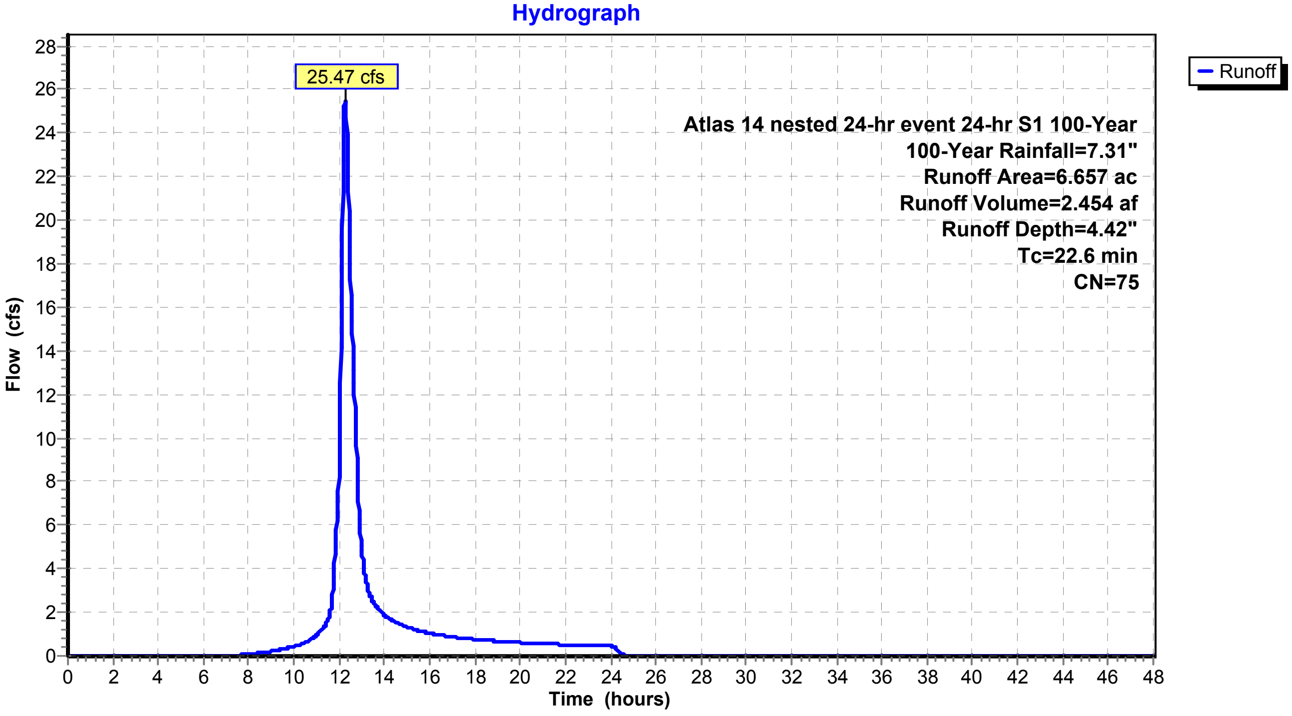
Runoff = 25.47 cfs @ 12.27 hrs, Volume= 2.454 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	6.657	75	
	6.657		100.00% Pervious Area

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

Subcatchment 25S: Sub-basin 25



Summary for Subcatchment 26S: Sub-basin 26

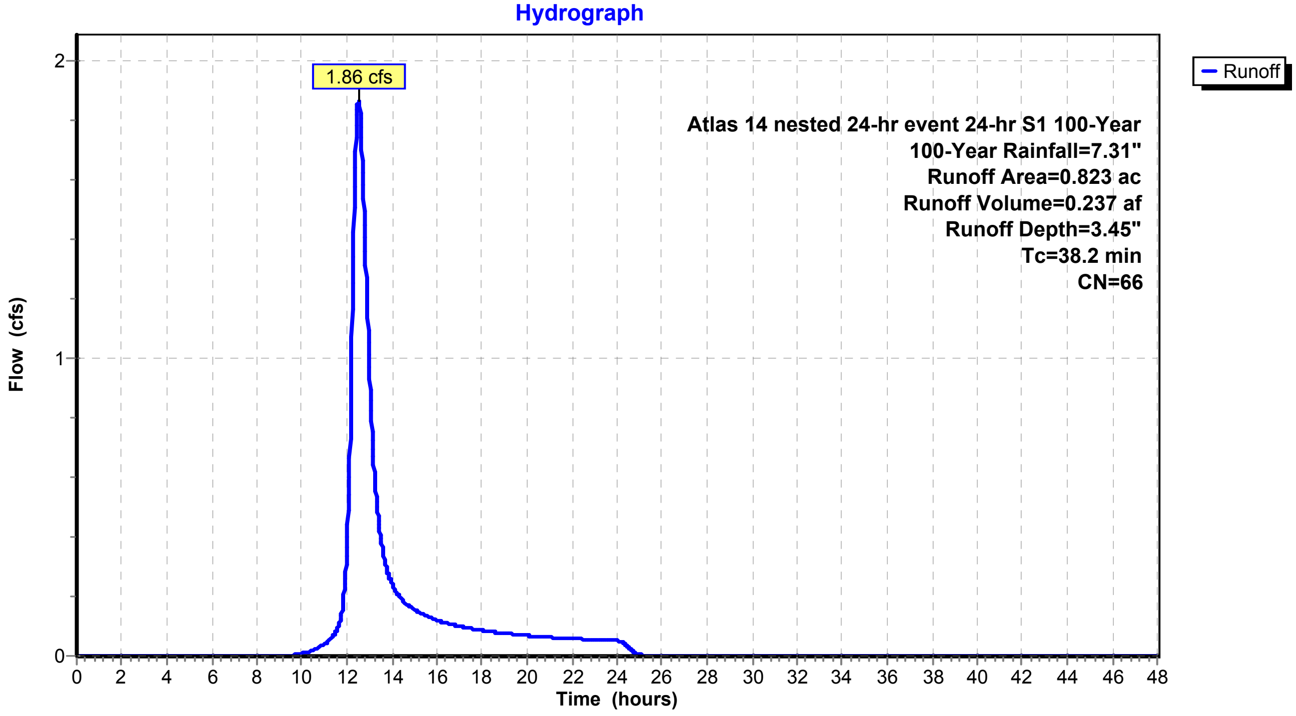
Runoff = 1.86 cfs @ 12.52 hrs, Volume= 0.237 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.823	66	
	0.823		100.00% Pervious Area

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

Subcatchment 26S: Sub-basin 26



Summary for Subcatchment 27S: Sub-basin 27

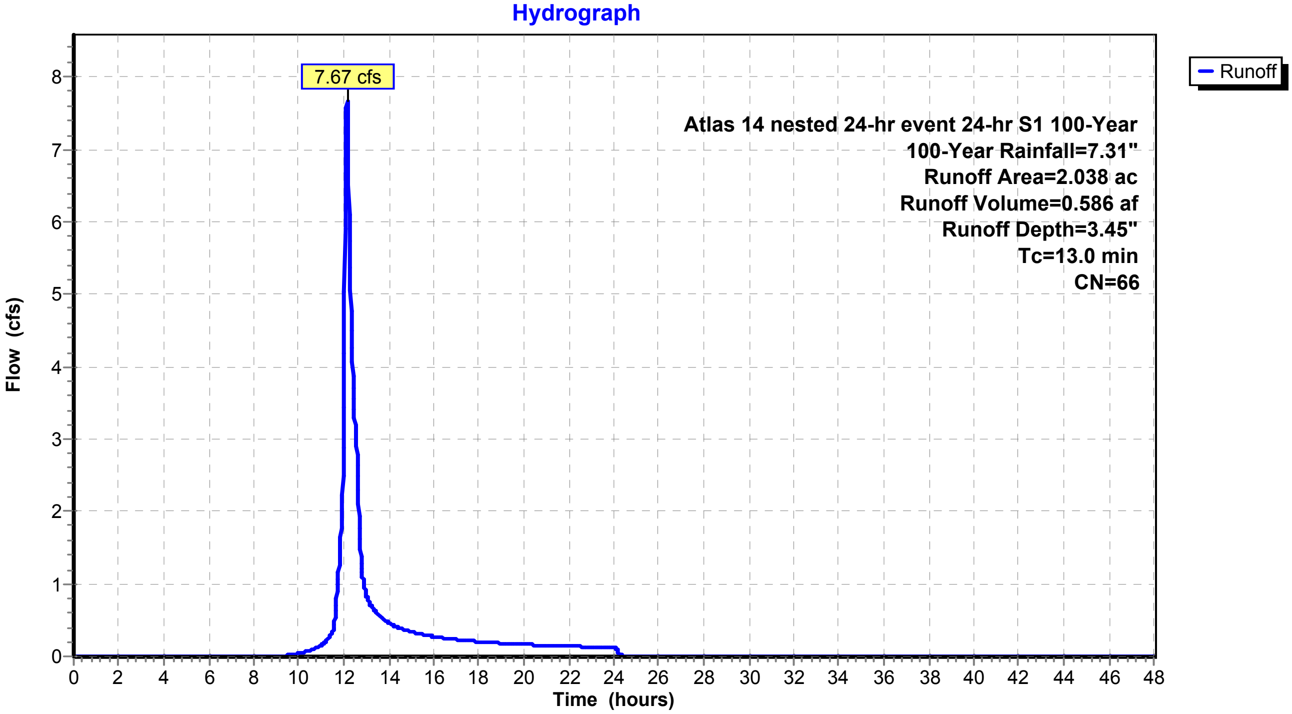
Runoff = 7.67 cfs @ 12.14 hrs, Volume= 0.586 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.038	66	
	2.038		100.00% Pervious Area

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

Subcatchment 27S: Sub-basin 27



Summary for Subcatchment 28S: Sub-basin 28

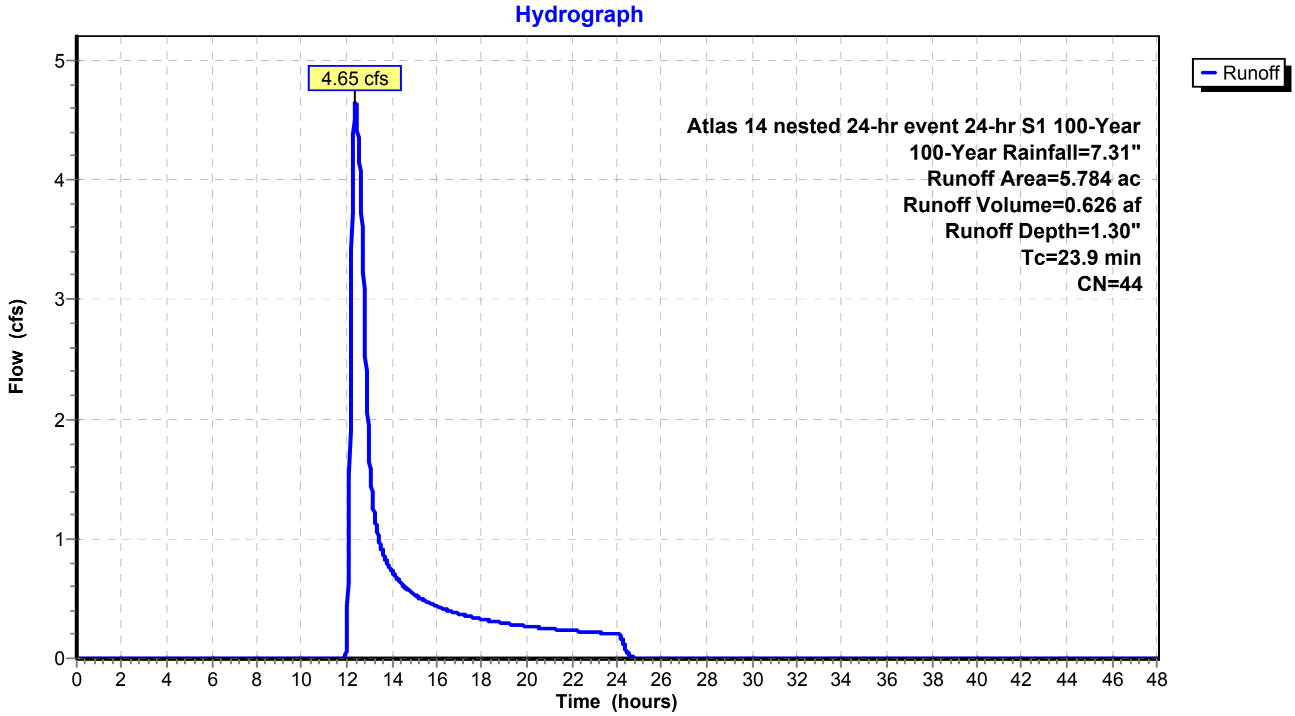
Runoff = 4.65 cfs @ 12.38 hrs, Volume= 0.626 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	5.784	44	
	5.784		100.00% Pervious Area

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

Subcatchment 28S: Sub-basin 28



Summary for Subcatchment 29S: Sub-basin 29

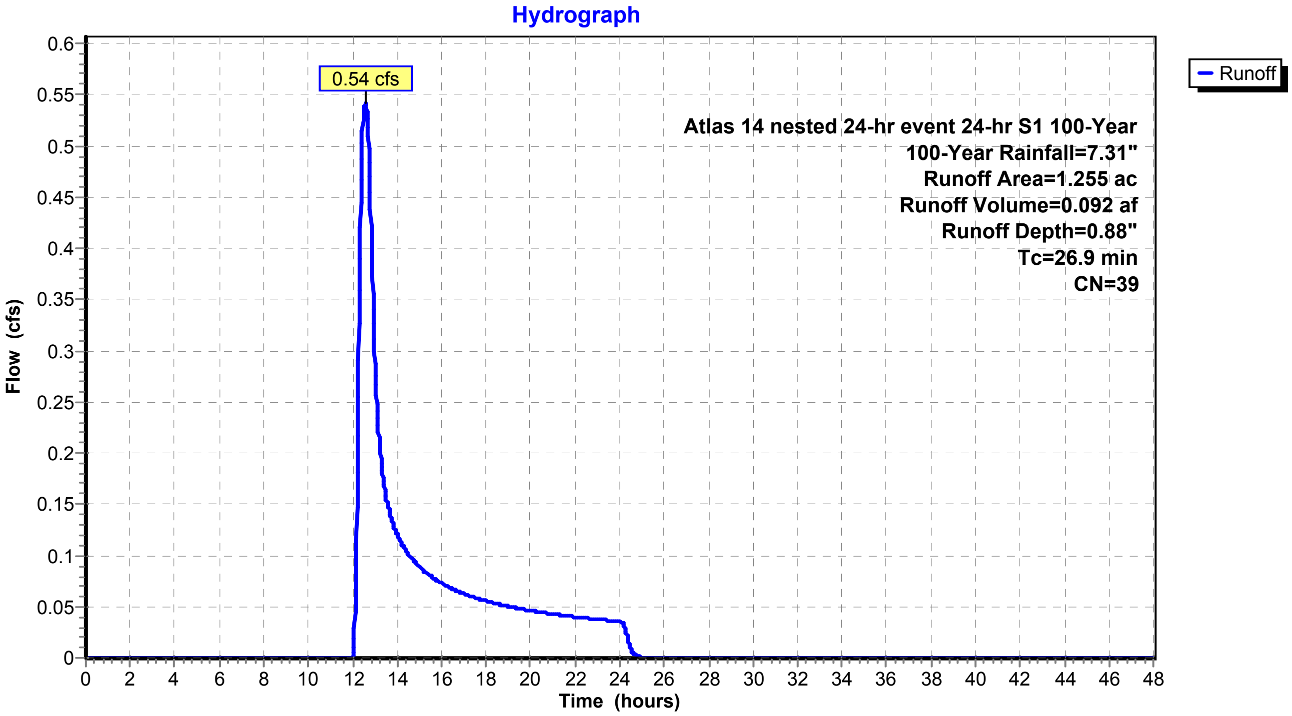
Runoff = 0.54 cfs @ 12.57 hrs, Volume= 0.092 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	1.255	39	
	1.255		100.00% Pervious Area

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

Subcatchment 29S: Sub-basin 29



Summary for Subcatchment 30S: Sub-basin 30

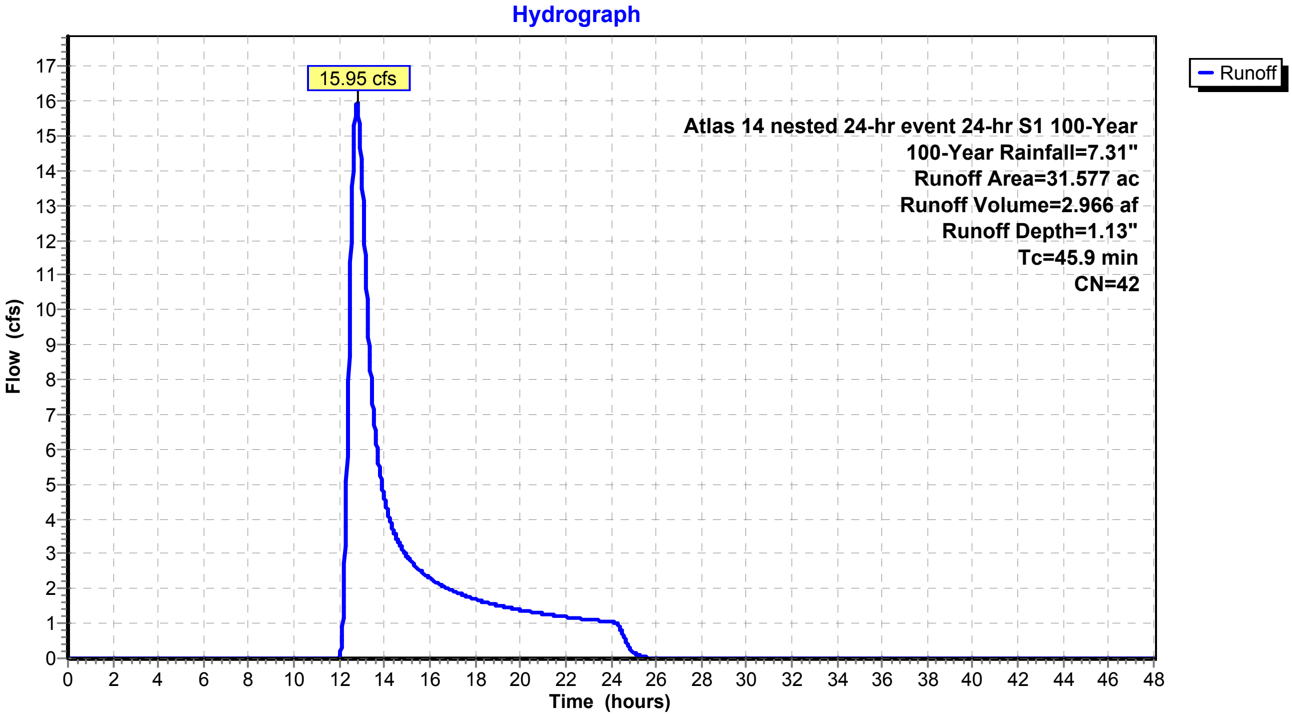
Runoff = 15.95 cfs @ 12.79 hrs, Volume= 2.966 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	31.577	42	
	31.577		100.00% Pervious Area

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

Subcatchment 30S: Sub-basin 30



Summary for Subcatchment 31S: Sub-basin 31

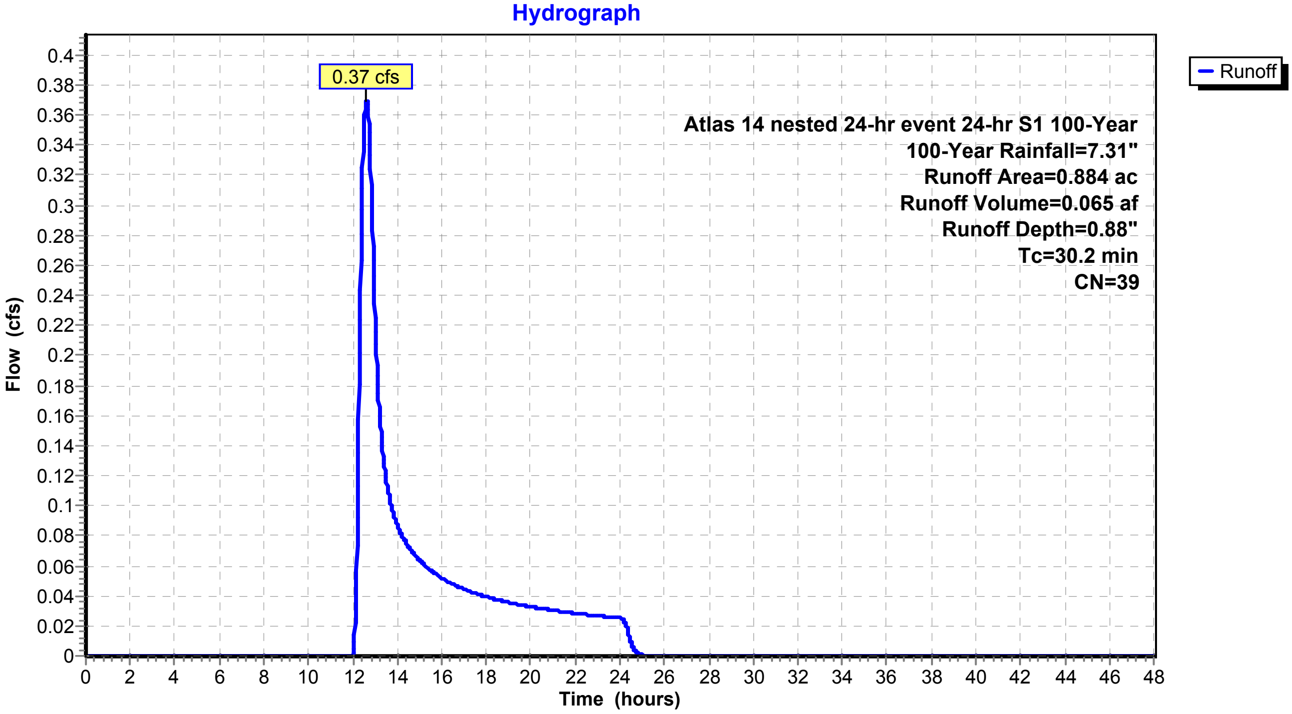
Runoff = 0.37 cfs @ 12.61 hrs, Volume= 0.065 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.884	39	
	0.884		100.00% Pervious Area

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

Subcatchment 31S: Sub-basin 31



Summary for Subcatchment 32S: Sub-basin 32

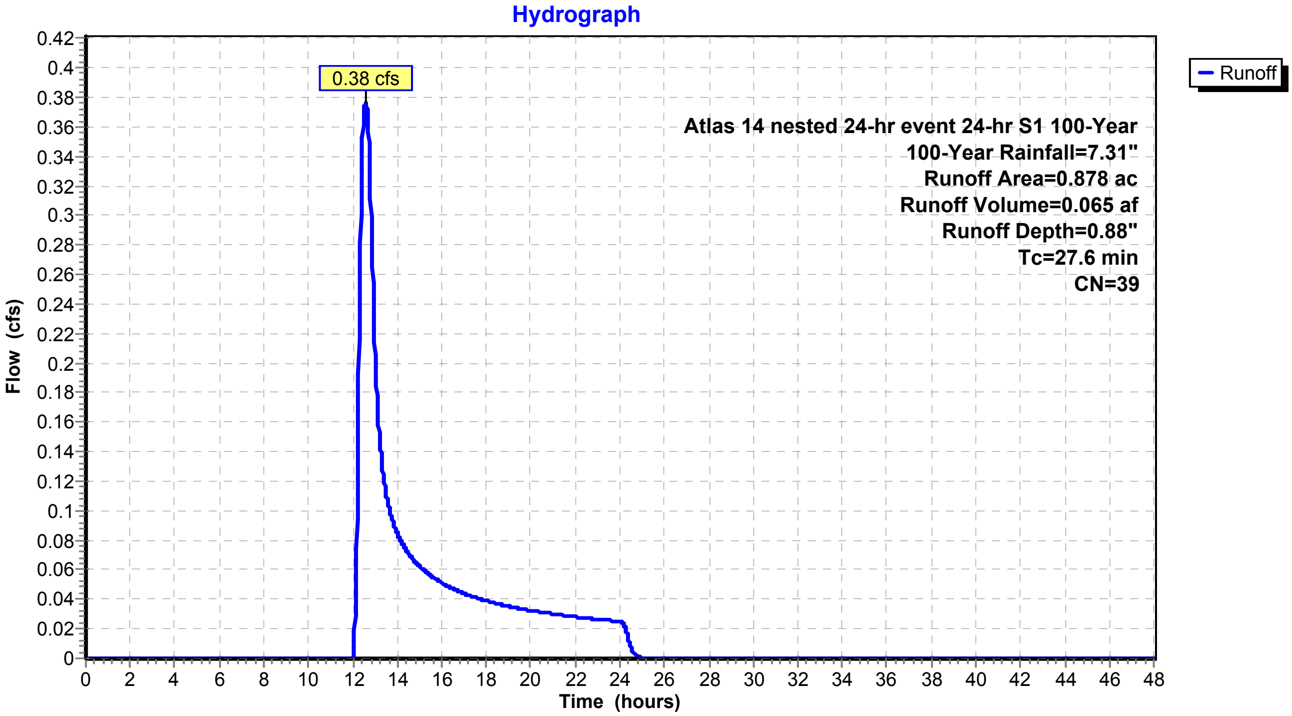
Runoff = 0.38 cfs @ 12.57 hrs, Volume= 0.065 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.878	39	
	0.878		100.00% Pervious Area

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

Subcatchment 32S: Sub-basin 32



Summary for Subcatchment 33S: Sub-basin 33

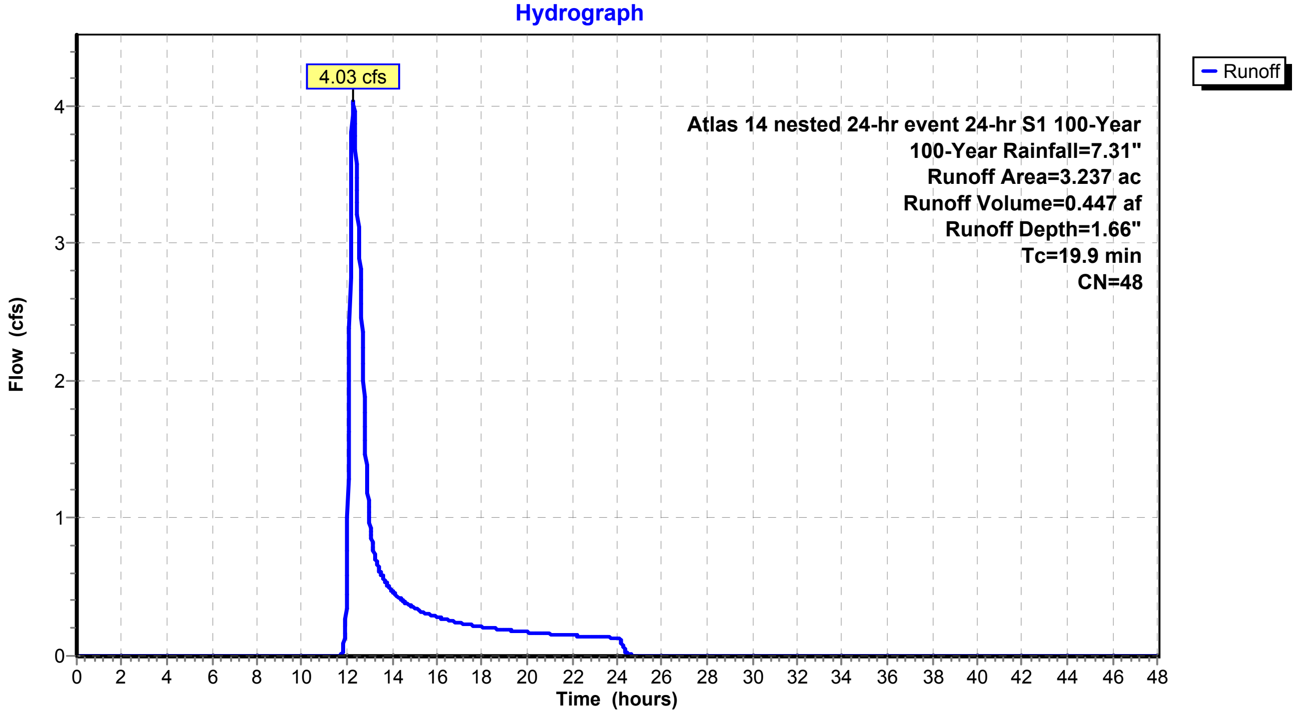
Runoff = 4.03 cfs @ 12.28 hrs, Volume= 0.447 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.237	48	
	3.237		100.00% Pervious Area

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

Subcatchment 33S: Sub-basin 33



Summary for Subcatchment 34S: Sub-basin 34

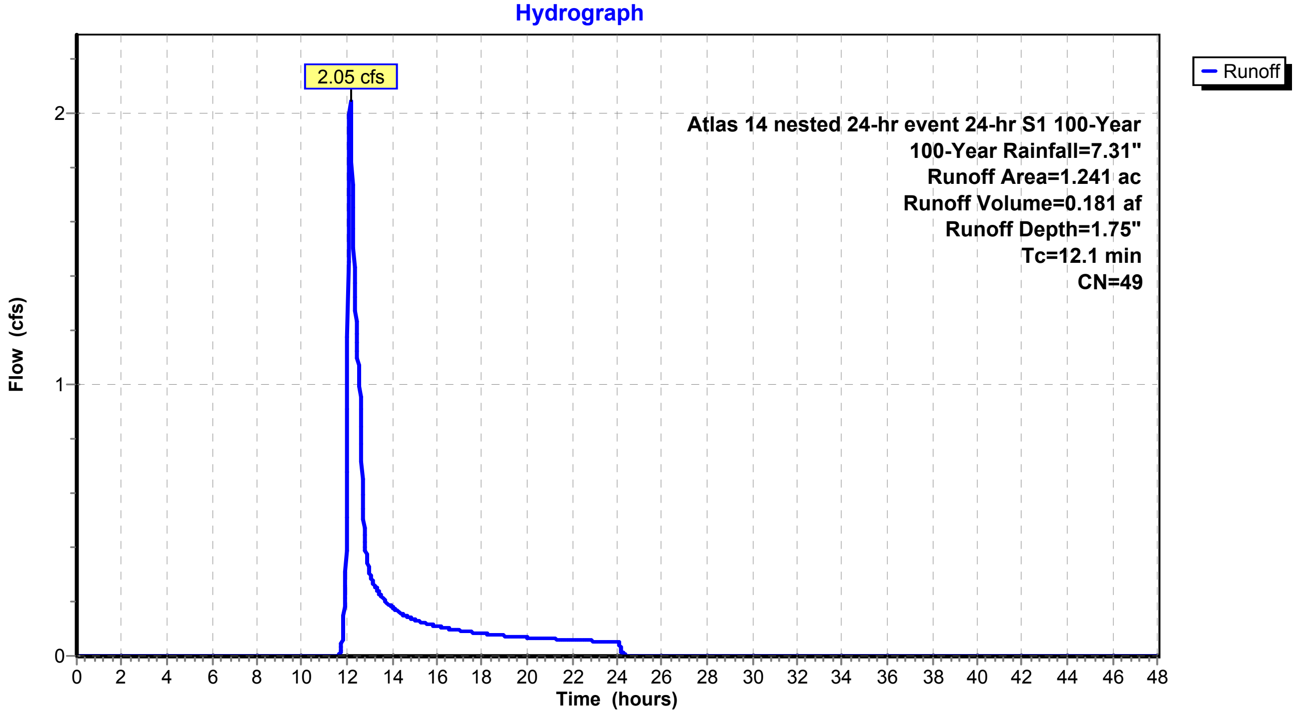
Runoff = 2.05 cfs @ 12.15 hrs, Volume= 0.181 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	1.241	49	
	1.241		100.00% Pervious Area

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

Subcatchment 34S: Sub-basin 34



Summary for Subcatchment 35S: Sub-basin 35

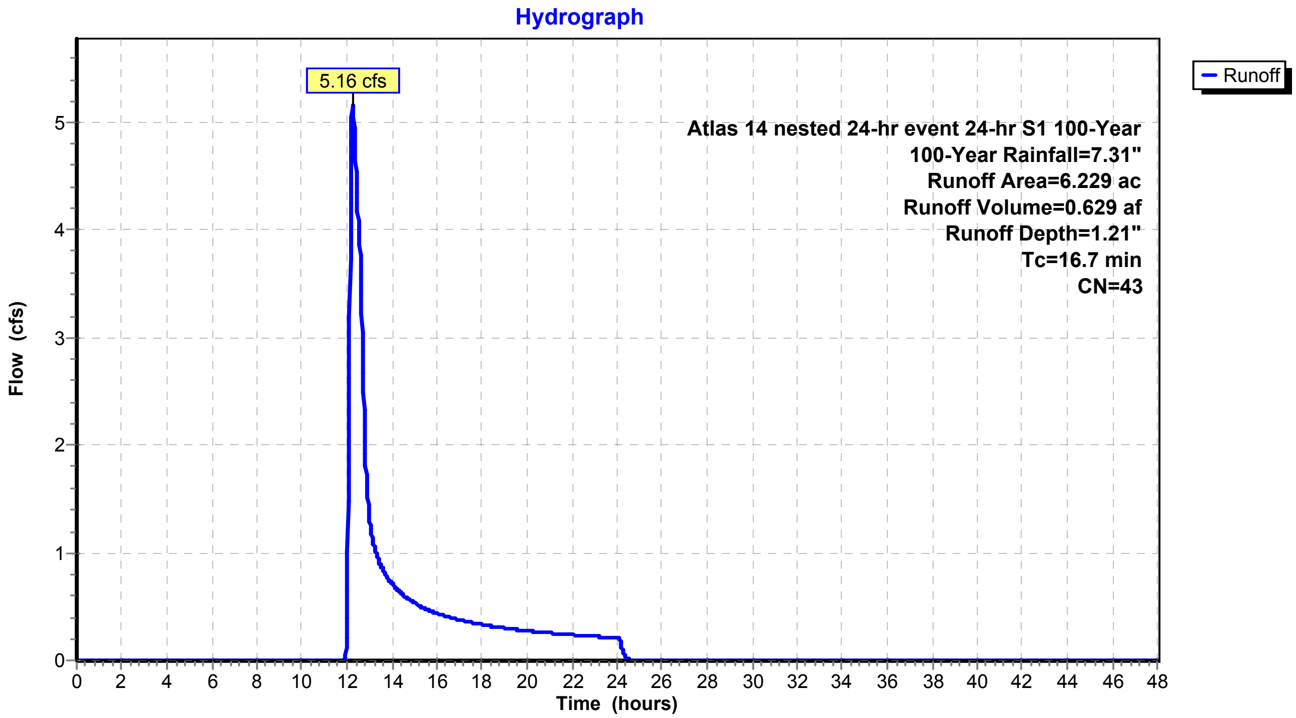
Runoff = 5.16 cfs @ 12.26 hrs, Volume= 0.629 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	6.229	43	
	6.229		100.00% Pervious Area

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

Subcatchment 35S: Sub-basin 35



Summary for Subcatchment 36S: Sub-basin 36

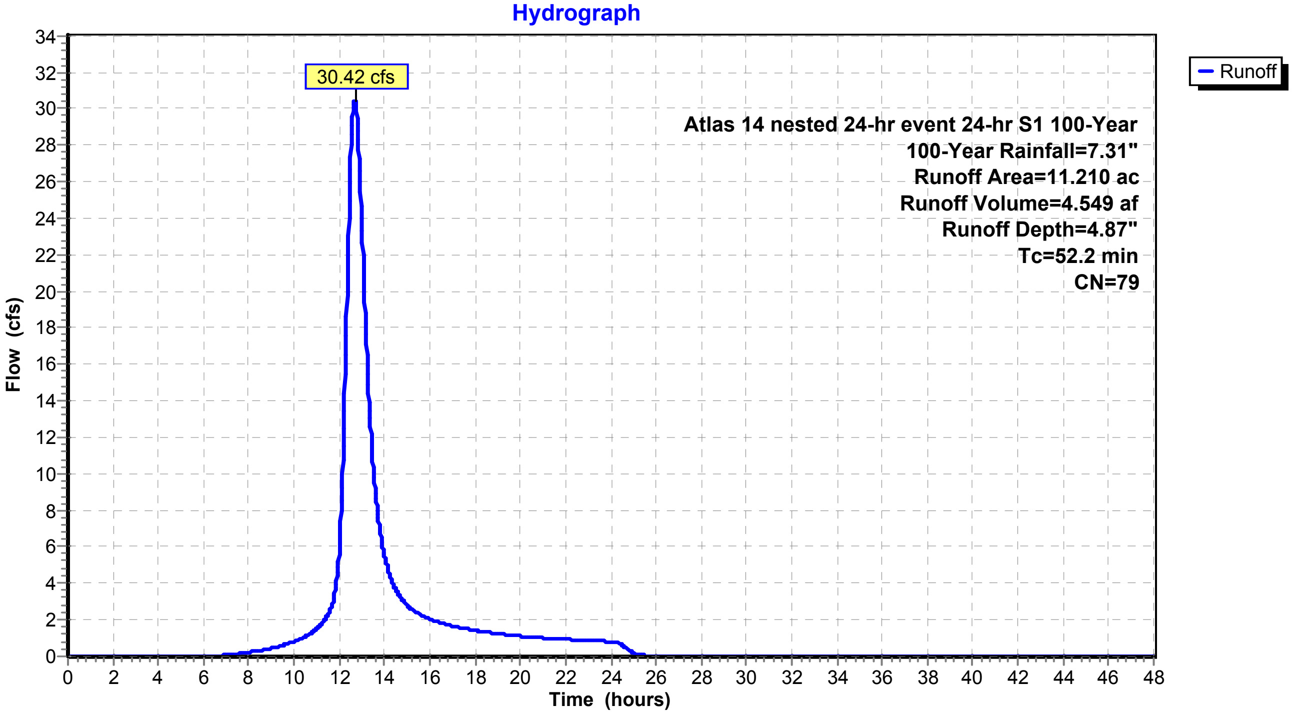
Runoff = 30.42 cfs @ 12.69 hrs, Volume= 4.549 af, Depth= 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	11.210	79	
	11.210		100.00% Pervious Area

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

Subcatchment 36S: Sub-basin 36



Summary for Subcatchment 83S: County Road H Subbasin Redirected After Regrading

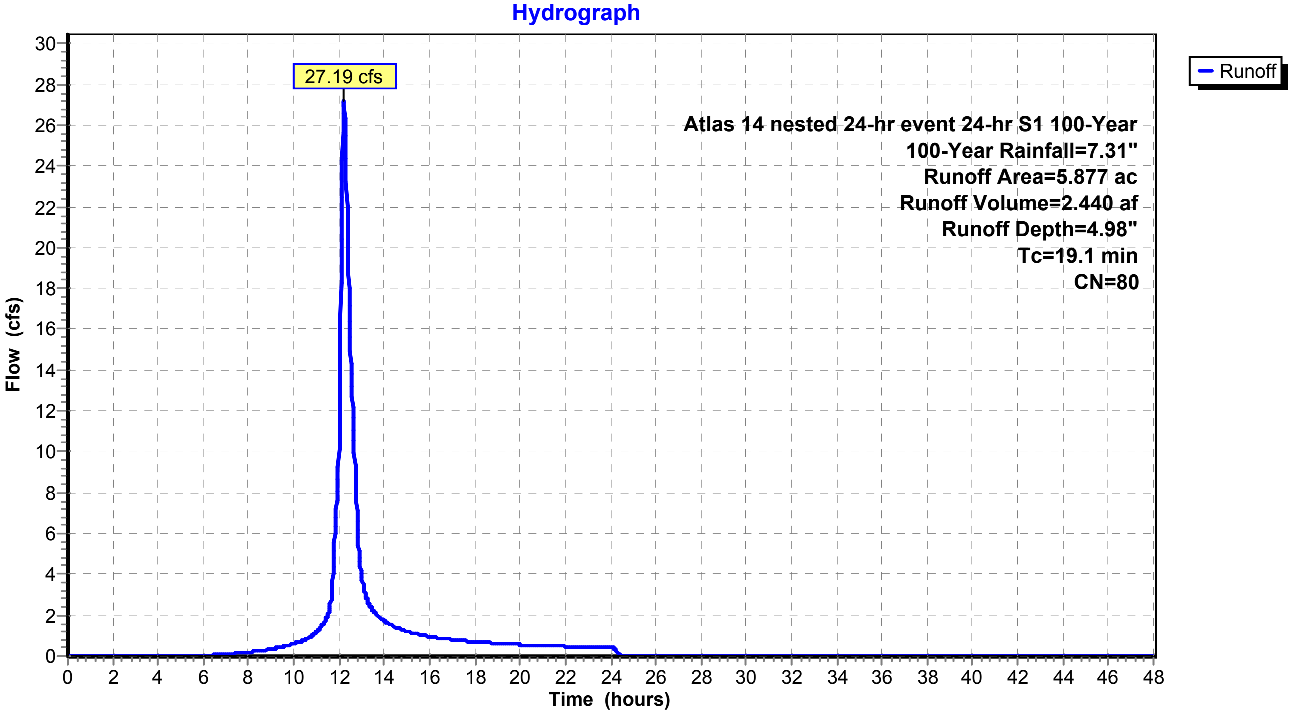
Runoff = 27.19 cfs @ 12.21 hrs, Volume= 2.440 af, Depth= 4.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Atlas 14 nested 24-hr event 24-hr S1 100-Year 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	5.877	80	
	5.877		100.00% Pervious Area

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

Subcatchment 83S: County Road H Subbasin Redirected After Regrading



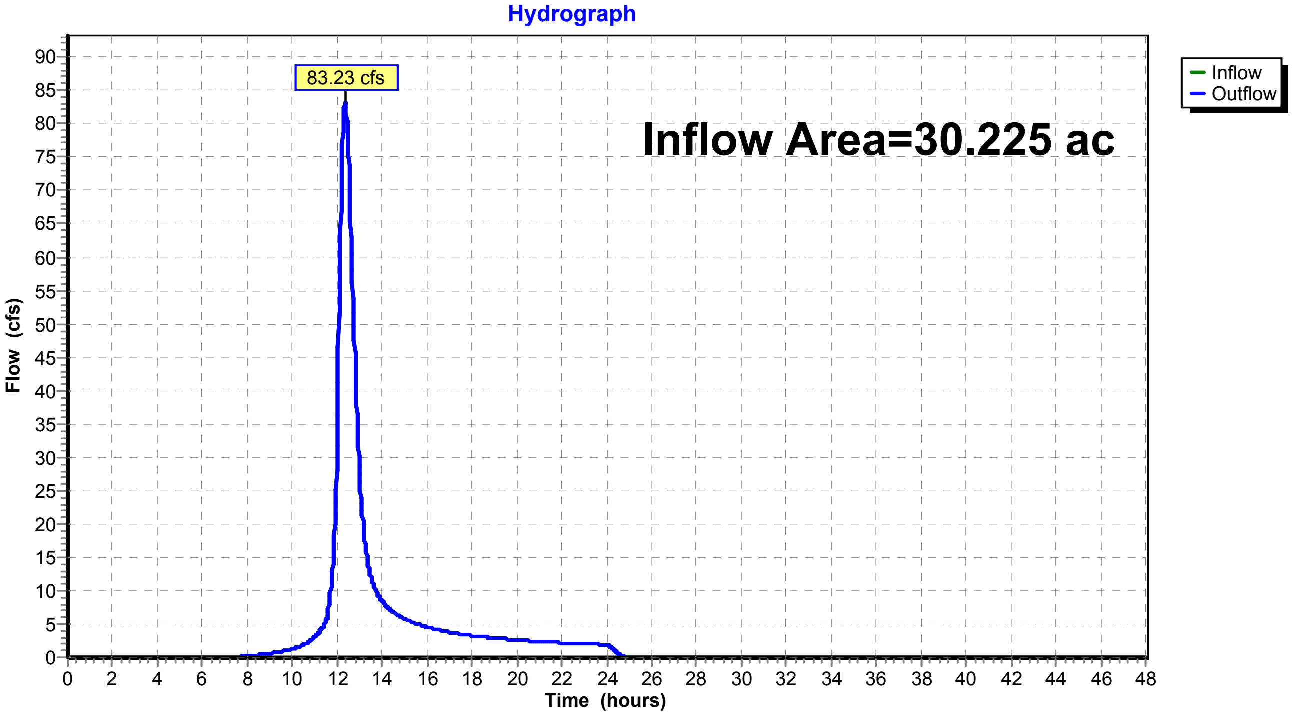
Summary for Reach 37R: Outfall of SB 2, 3, 7

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	30.225 ac,	0.00% Impervious,	Inflow Depth = 3.97"	for 100-Year event	
Inflow =	83.23 cfs @	12.36 hrs,	Volume=	10.007 af	
Outflow =	83.23 cfs @	12.36 hrs,	Volume=	10.007 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 37R: Outfall of SB 2, 3, 7



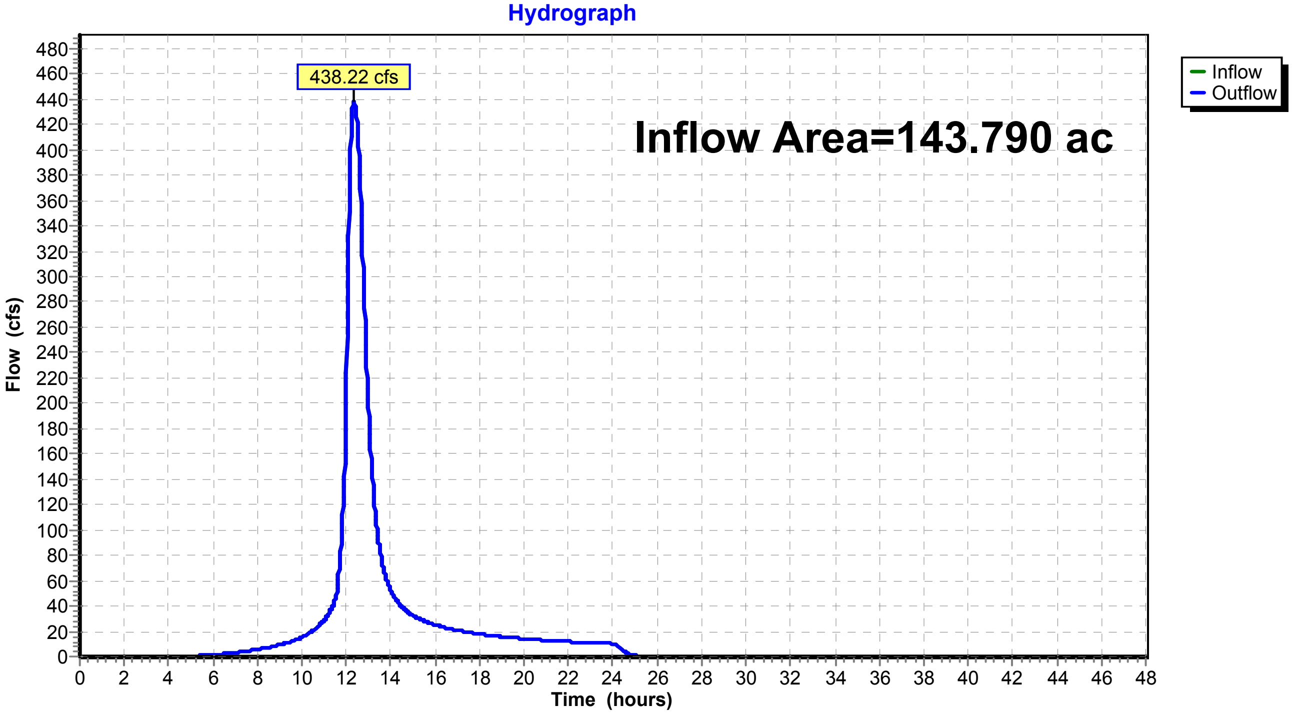
Summary for Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 143.790 ac, 0.00% Impervious, Inflow Depth = 5.21" for 100-Year event
Inflow = 438.22 cfs @ 12.34 hrs, Volume= 62.386 af
Outflow = 438.22 cfs @ 12.34 hrs, Volume= 62.386 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 39R: Outfall of SB 1, 4, 5, 6, 9, 10, 11, 36



Summary for Reach 40R: 60 in SB 4

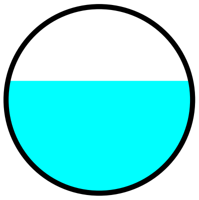
[52] Hint: Inlet/Outlet conditions not evaluated
[65] Warning: Inlet elevation not specified
[88] Warning: Qout>Qin may require Finer Routing>1

```
Inflow Area =      143.790 ac,    0.00% Impervious,  Inflow Depth =   5.21"    for  100-Year event
Inflow       =     438.10 cfs @   12.33 hrs,  Volume=           62.386 af
Outflow      =     438.22 cfs @   12.34 hrs,  Volume=           62.386 af,  Atten= 0%,  Lag= 0.5 min
```

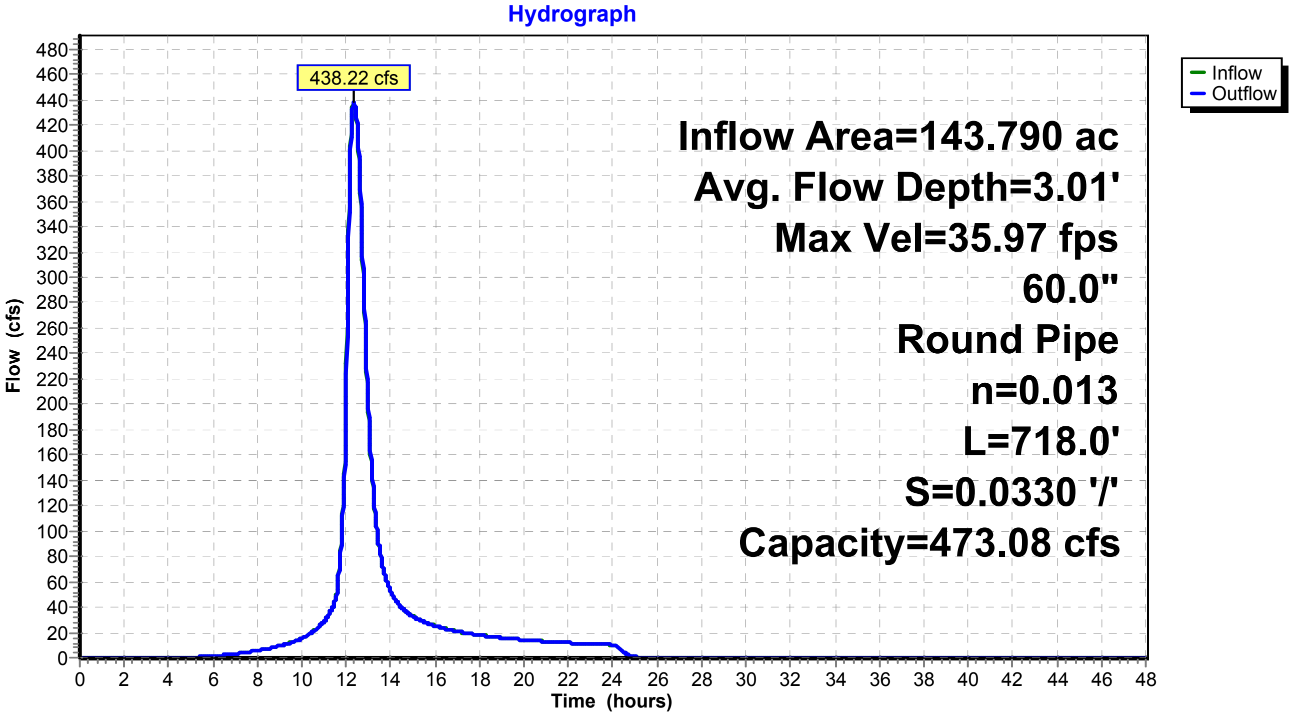
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 328.58 cfs Estimated Depth= 3.07' Velocity= 26.02 fps
m= 1.363, c= 35.46 fps, dt= 1.2 min, dx= 718.0' / 1 = 718.0', K= 0.3 min, X= 0.453
Max. Velocity= 35.97 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 35.46 fps, Avg. Travel Time= 0.3 min

Peak Storage= 8,871 cf @ 12.34 hrs
Average Depth at Peak Storage= 3.01'
Bank-Full Depth= 5.00' Flow Area= 19.6 sf, Capacity= 473.08 cfs

60.0" Round Pipe
n= 0.013
Length= 718.0'   Slope= 0.0330 '/'
Inlet Invert= 0.00', Outlet Invert= -23.69'



Reach 40R: 60 in SB 4



Summary for Reach 41R: Channel in SB 9, 10

[65] Warning: Inlet elevation not specified

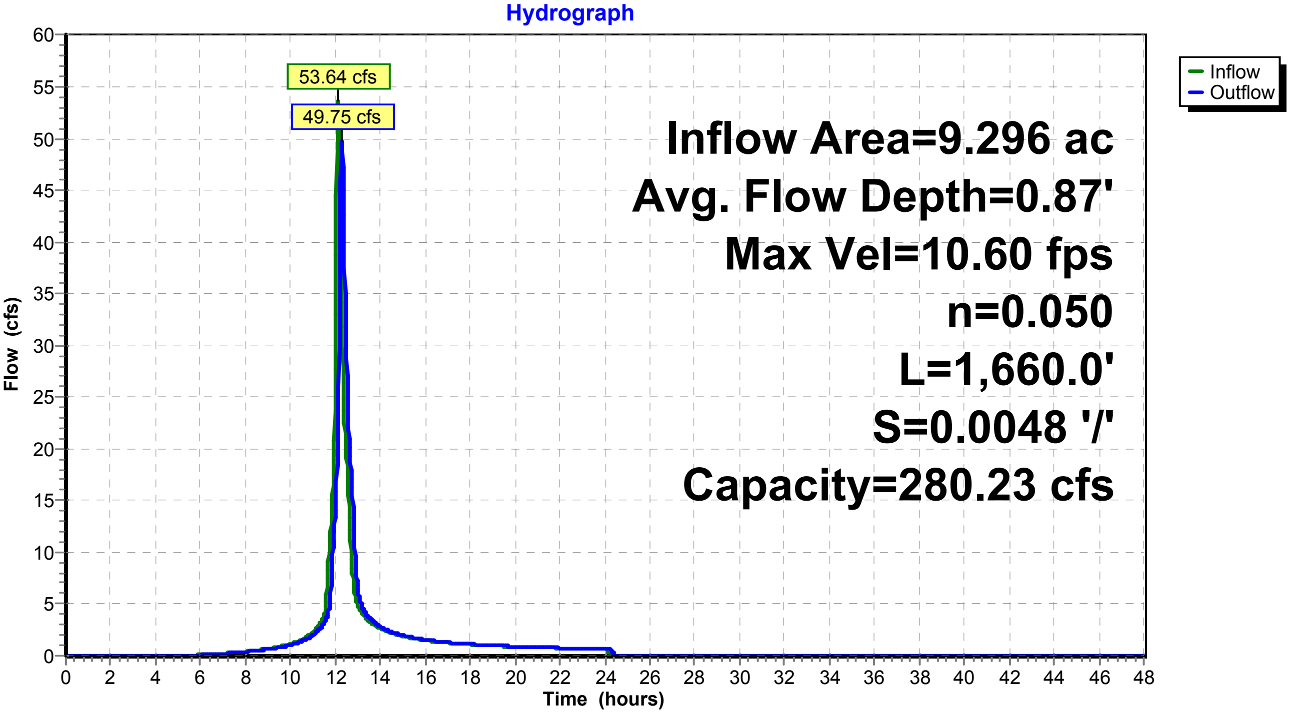
```
Inflow Area =          9.296 ac,    0.00% Impervious,  Inflow Depth =   5.21"    for  100-Year event
Inflow       =        53.64 cfs @   12.13 hrs,  Volume=             4.034 af
Outflow      =        49.75 cfs @   12.29 hrs,  Volume=             4.034 af,  Atten= 7%,  Lag= 10.1 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 40.23 cfs Estimated Depth= 1.06' Velocity= 1.87 fps
m= 1.523, c= 2.85 fps, dt= 1.2 min, dx= 1,660.0' / 8 = 207.5', K= 1.2 min, X= 0.150
Max. Velocity= 10.60 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 2.90 fps, Avg. Travel Time= 9.5 min

Peak Storage= 27,957 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 3.00' Flow Area= 84.0 sf, Capacity= 280.23 cfs

16.00' x 3.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/'   Top Width= 40.00'
Length= 1,660.0'   Slope= 0.0048 '/'
Inlet Invert= 0.00', Outlet Invert= -7.97'

Reach 41R: Channel in SB 9, 10



Summary for Reach 46R: Channel SB1

[65] Warning: Inlet elevation not specified

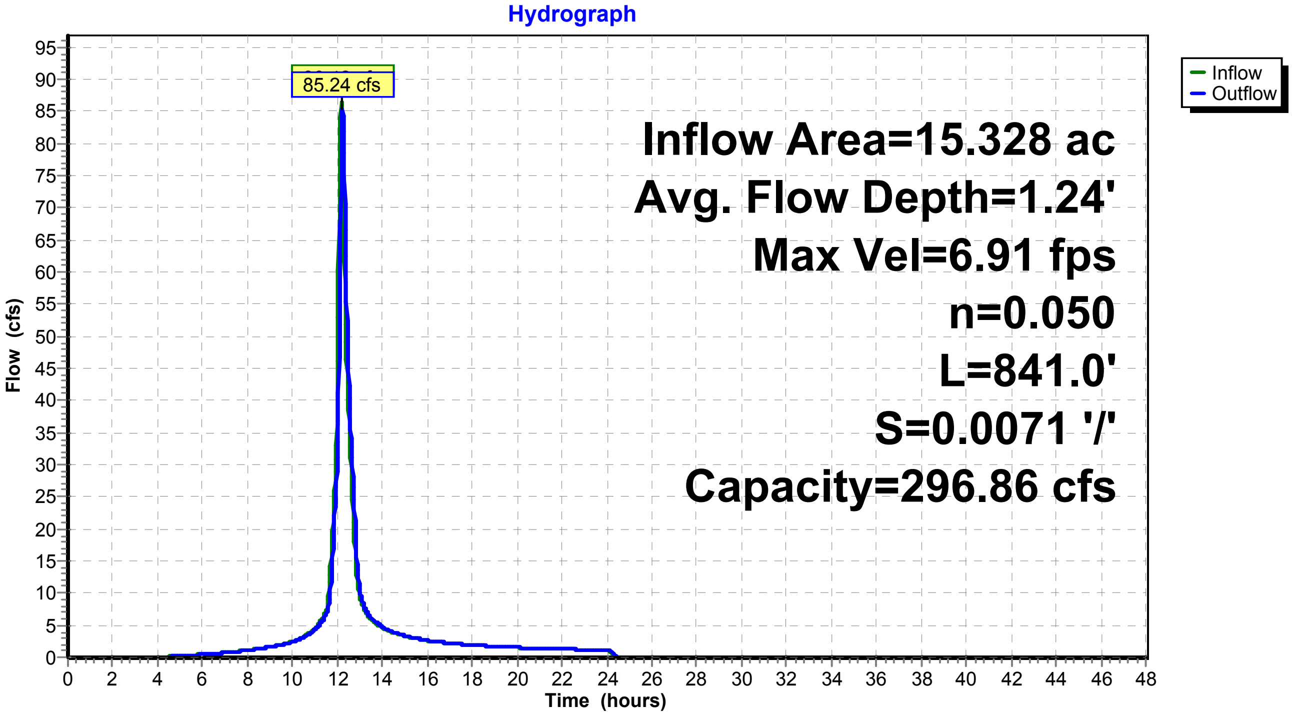
```
Inflow Area =        15.328 ac,    0.00% Impervious,  Inflow Depth =   5.78"    for  100-Year event
Inflow      =        86.42 cfs @   12.17 hrs,  Volume=             7.383 af
Outflow     =        85.24 cfs @   12.24 hrs,  Volume=             7.383 af,  Atten= 1%,  Lag= 3.8 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 64.81 cfs Estimated Depth= 1.37' Velocity= 2.57 fps
m= 1.479, c= 3.80 fps, dt= 1.2 min, dx= 841.0' / 3 = 280.3', K= 1.2 min, X= 0.268
Max. Velocity= 6.91 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 3.81 fps, Avg. Travel Time= 3.7 min

Peak Storage= 18,802 cf @ 12.21 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 3.00' Flow Area= 75.0 sf, Capacity= 296.86 cfs

13.00' x 3.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/'   Top Width= 37.00'
Length= 841.0'   Slope= 0.0071 '/'
Inlet Invert= 0.00', Outlet Invert= -5.97'

Reach 46R: Channel SB1



Hydrograph

Inflow Area=15.328 ac
Avg. Flow Depth=1.24'
Max Vel=6.91 fps
n=0.050
L=841.0'
S=0.0071 '/'
Capacity=296.86 cfs

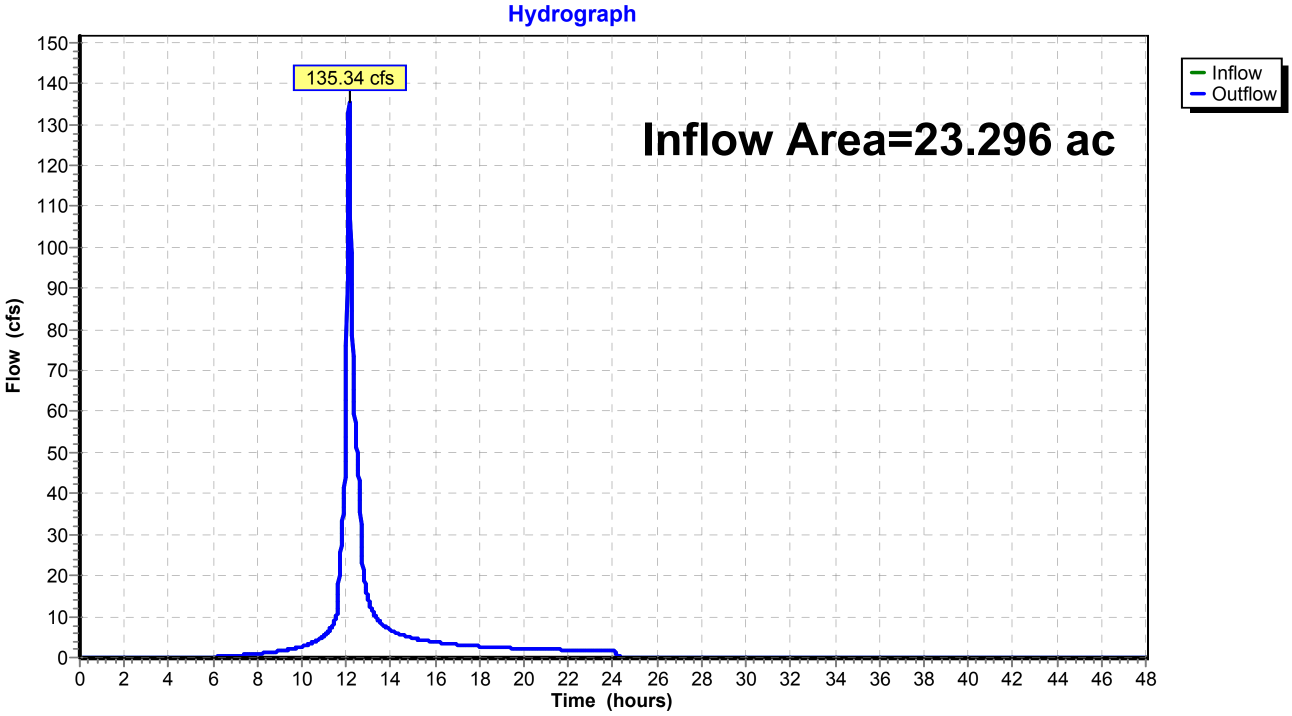
Summary for Reach 48R: Outfall of SB 8, 13

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        23.296 ac,    0.00% Impervious,  Inflow Depth =   5.11"    for  100-Year event
Inflow       =      135.34 cfs @   12.12 hrs,  Volume=           9.912 af
Outflow      =      135.34 cfs @   12.12 hrs,  Volume=           9.912 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 48R: Outfall of SB 8, 13



Summary for Reach 49R: Channel SB8

[65] Warning: Inlet elevation not specified

```
Inflow Area =       21.017 ac,    0.00% Impervious,  Inflow Depth =   5.09"    for  100-Year event
Inflow      =      134.02 cfs @   12.08 hrs,  Volume=            8.923 af
Outflow     =      131.67 cfs @   12.12 hrs,  Volume=            8.923 af,  Atten= 2%,  Lag= 2.1 min
```

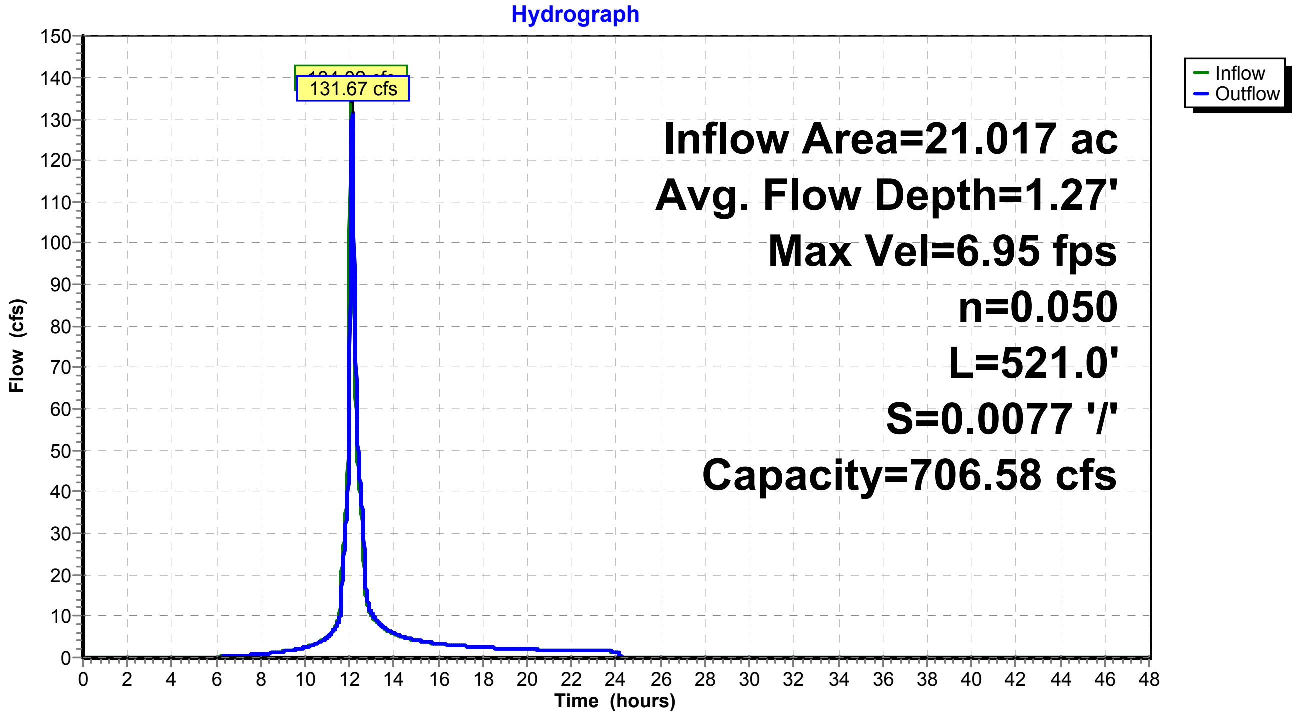
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Reference Flow= 100.52 cfs Estimated Depth= 1.43' Velocity= 2.85 fps
m= 1.511, c= 4.31 fps, dt= 1.2 min, dx= 521.0' / 2 = 260.5', K= 1.0 min, X= 0.265
Max. Velocity= 6.95 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 4.32 fps, Avg. Travel Time= 2.0 min

Peak Storage= 15,883 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.27'
Bank-Full Depth= 4.00' Flow Area= 140.0 sf, Capacity= 706.58 cfs

19.00' x 4.00' deep channel, n= 0.050
Side Slope Z-value= 4.0 '/' Top Width= 51.00'
Length= 521.0' Slope= 0.0077 '/'
Inlet Invert= 0.00', Outlet Invert= -4.01'

‡

Reach 49R: Channel SB8



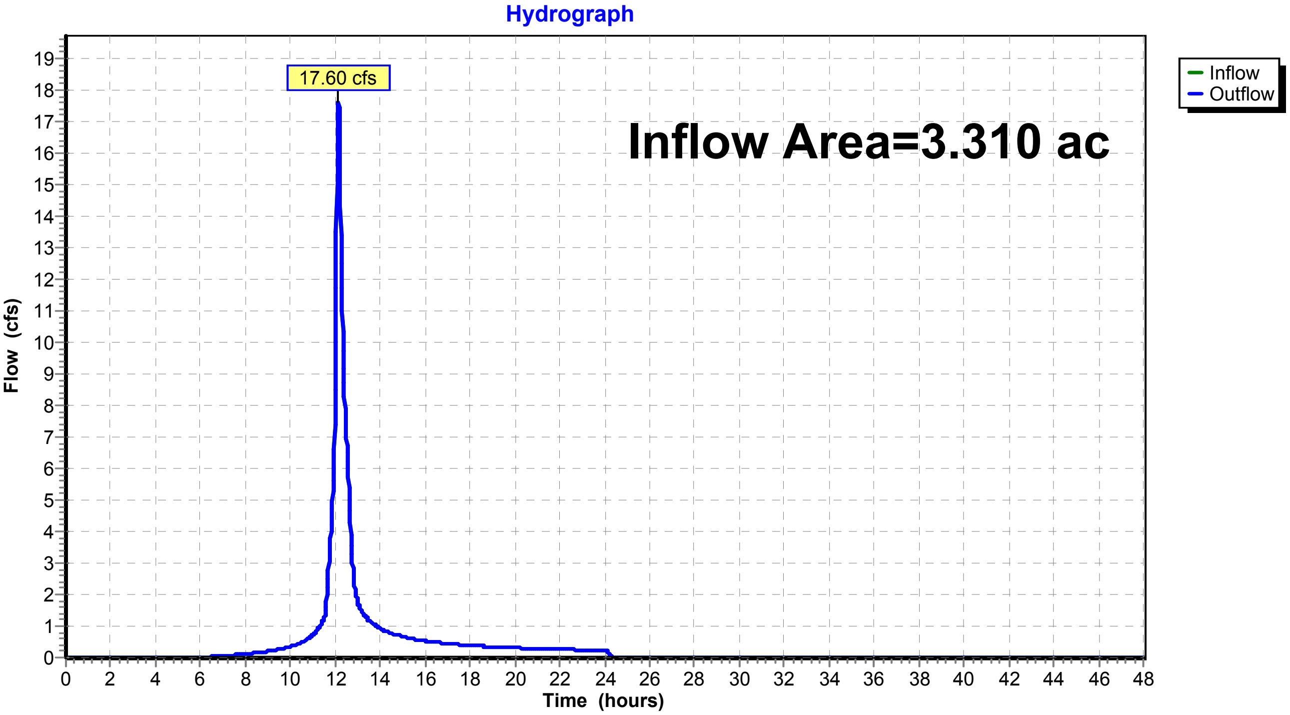
Summary for Reach 50R: Outfall of SB 12

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	3.310 ac,	0.00% Impervious,	Inflow Depth = 4.98"	for 100-Year event	
Inflow =	17.60 cfs @	12.14 hrs,	Volume=	1.374 af	
Outflow =	17.60 cfs @	12.14 hrs,	Volume=	1.374 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 50R: Outfall of SB 12



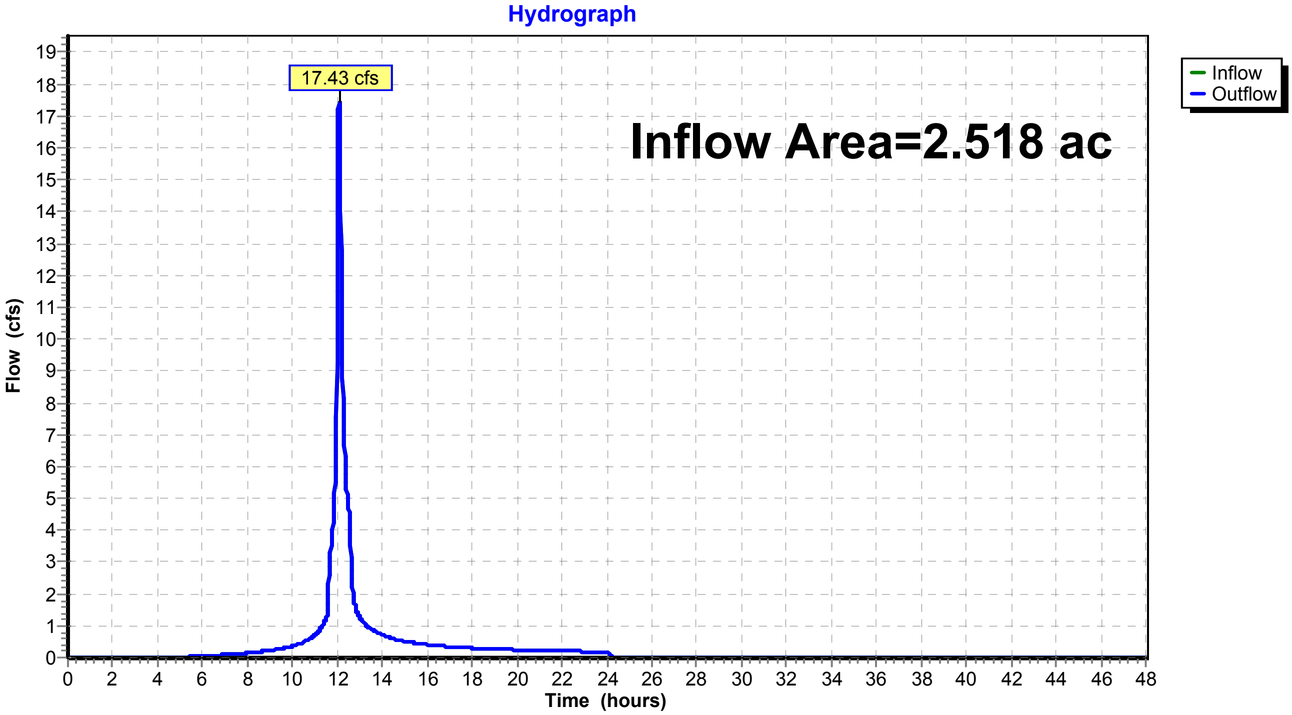
Summary for Reach 51R: Outfall of SB 14

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	2.518 ac,	0.00% Impervious,	Inflow Depth = 5.44"	for 100-Year event	
Inflow =	17.43 cfs @	12.07 hrs,	Volume=	1.141 af	
Outflow =	17.43 cfs @	12.07 hrs,	Volume=	1.141 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 51R: Outfall of SB 14



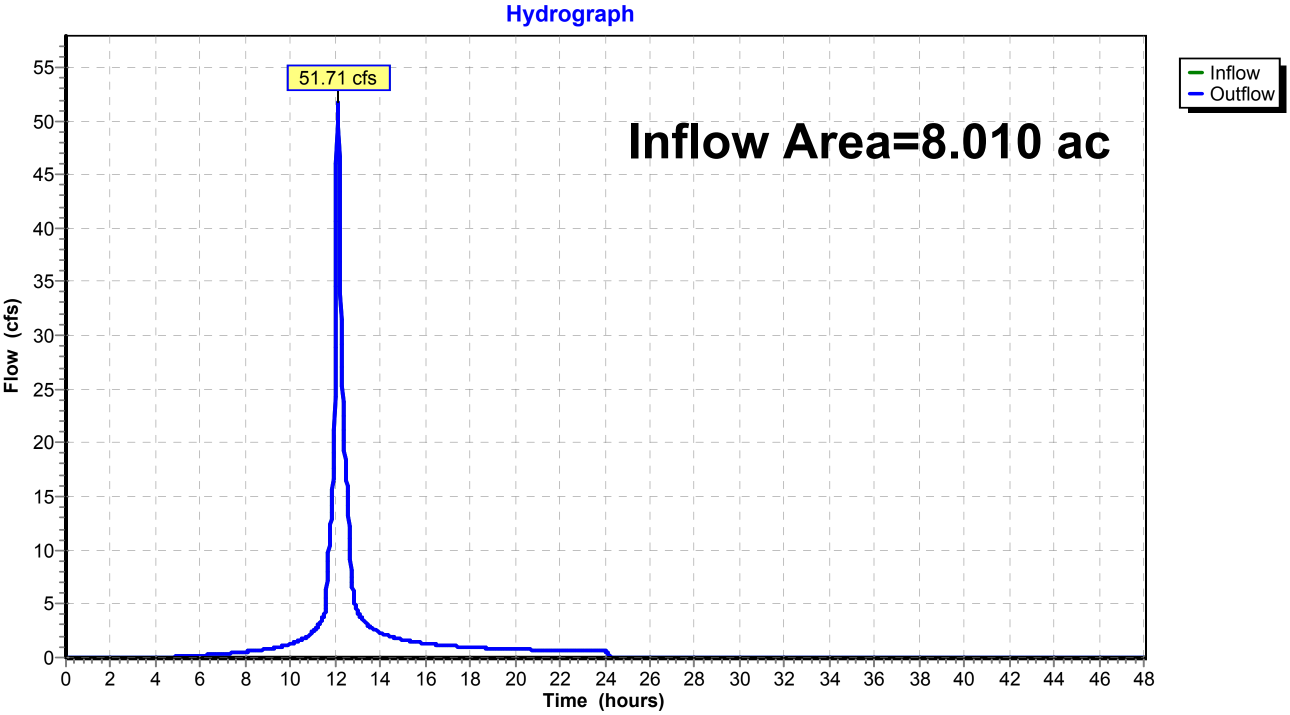
Summary for Reach 52R: Outfall of SB 17

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	8.010 ac,	0.00% Impervious,	Inflow Depth = 5.66"	for 100-Year event	
Inflow =	51.71 cfs @	12.11 hrs,	Volume=	3.781 af	
Outflow =	51.71 cfs @	12.11 hrs,	Volume=	3.781 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 52R: Outfall of SB 17



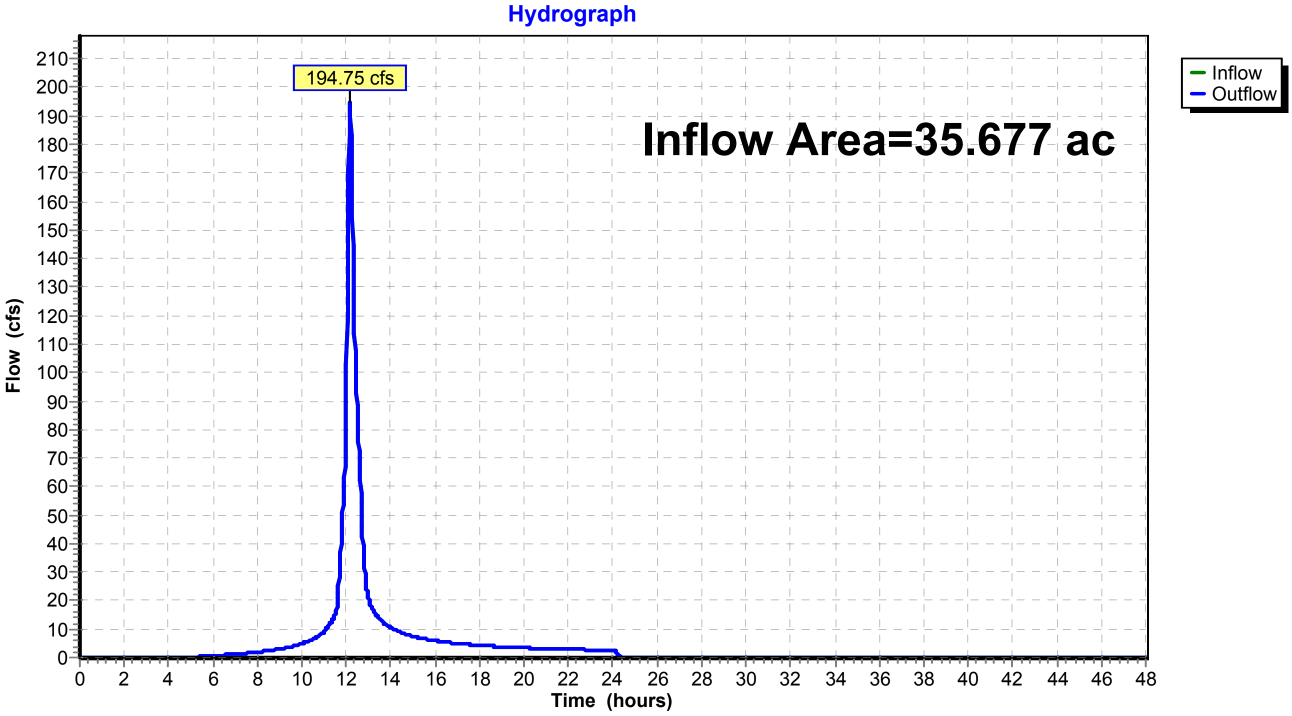
Summary for Reach 53R: Outfall of SB 18

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 35.677 ac, 0.00% Impervious, Inflow Depth = 5.44" for 100-Year event
Inflow = 194.75 cfs @ 12.17 hrs, Volume= 16.160 af
Outflow = 194.75 cfs @ 12.17 hrs, Volume= 16.160 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 53R: Outfall of SB 18



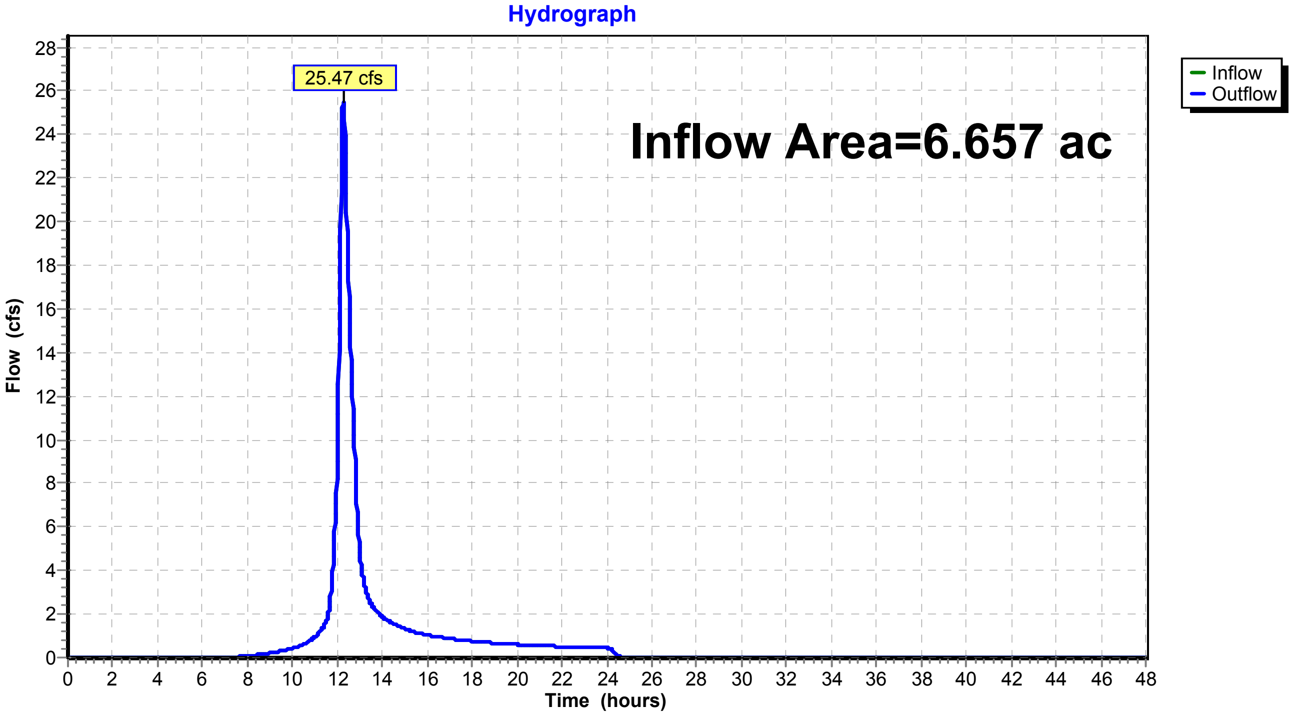
Summary for Reach 54R: Outfall of SB 25

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       6.657 ac,   0.00% Impervious,  Inflow Depth =  4.42"    for  100-Year event
Inflow      =      25.47 cfs @   12.27 hrs,  Volume=          2.454 af
Outflow     =      25.47 cfs @   12.27 hrs,  Volume=          2.454 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 54R: Outfall of SB 25



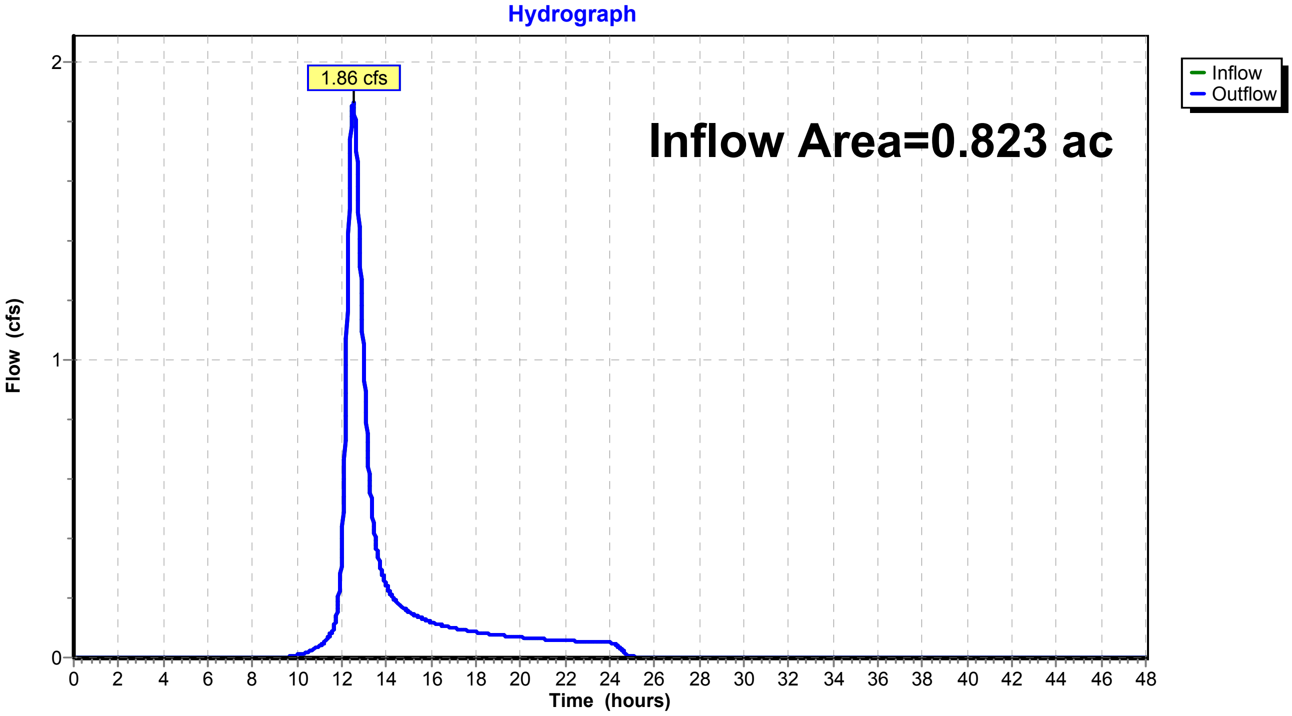
Summary for Reach 55R: Outfall of SB 26

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =         0.823 ac,    0.00% Impervious,  Inflow Depth =   3.45"    for  100-Year event
Inflow       =        1.86 cfs @   12.52 hrs,  Volume=             0.237 af
Outflow      =        1.86 cfs @   12.52 hrs,  Volume=             0.237 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 55R: Outfall of SB 26



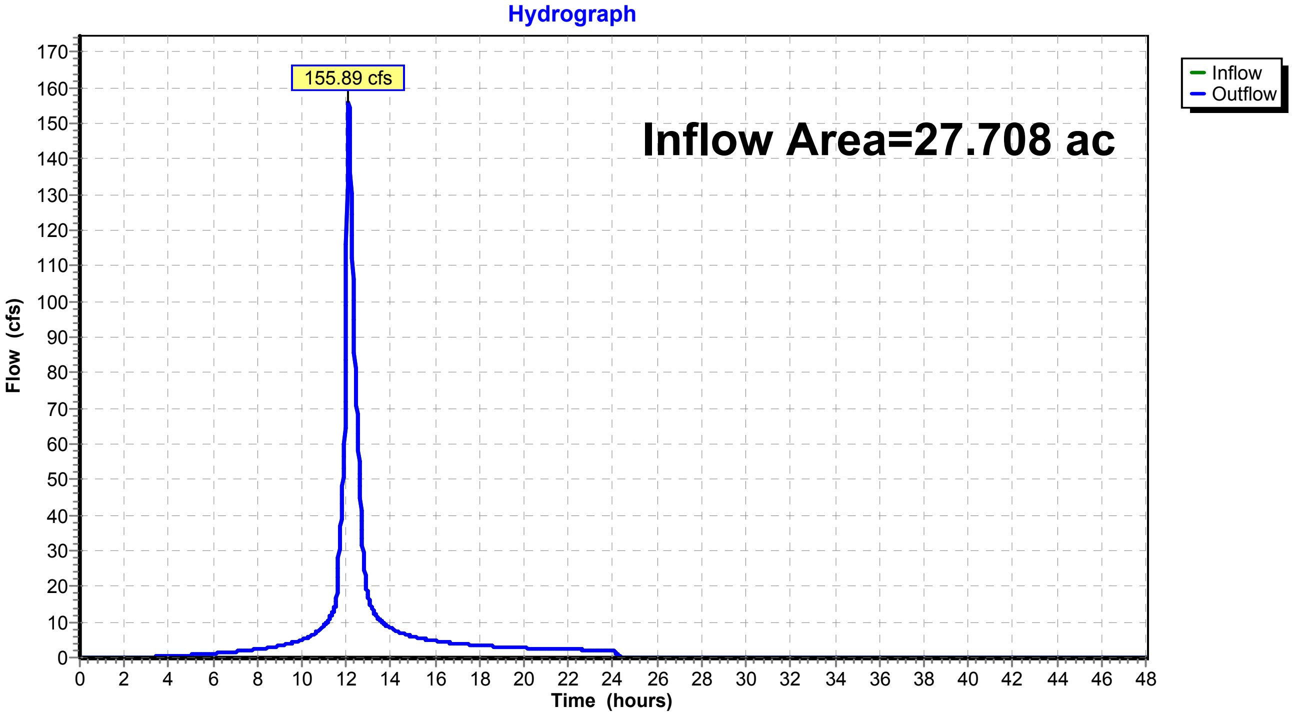
Summary for Reach 56R: Outfall of SB 23, 24

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      27.708 ac,   0.00% Impervious,  Inflow Depth =  5.95"   for  100-Year event
Inflow       =    155.89 cfs @  12.10 hrs,  Volume=         13.749 af
Outflow      =    155.89 cfs @  12.10 hrs,  Volume=         13.749 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 56R: Outfall of SB 23, 24



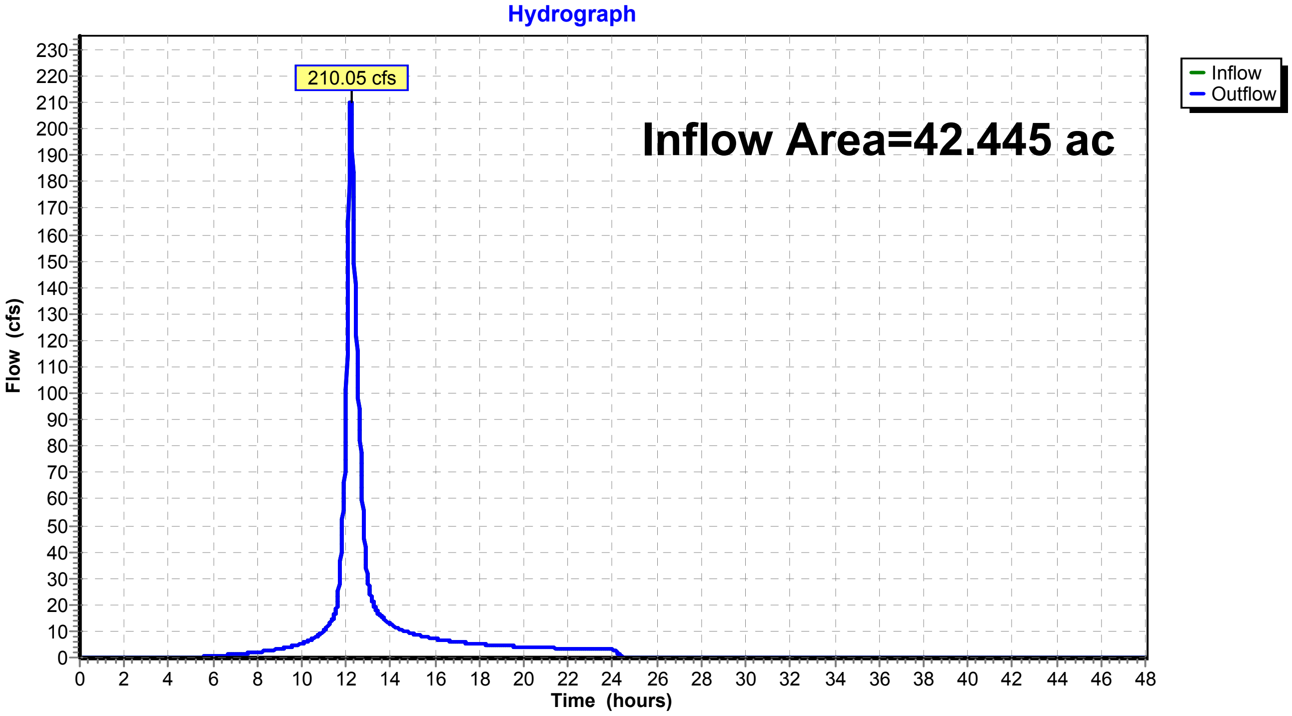
Summary for Reach 59R: Outfall of SB 20, 22

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       42.445 ac,    0.00% Impervious,  Inflow Depth =   5.34"    for  100-Year event
Inflow      =      210.05 cfs @   12.21 hrs,  Volume=         18.873 af
Outflow     =      210.05 cfs @   12.21 hrs,  Volume=         18.873 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 59R: Outfall of SB 20, 22



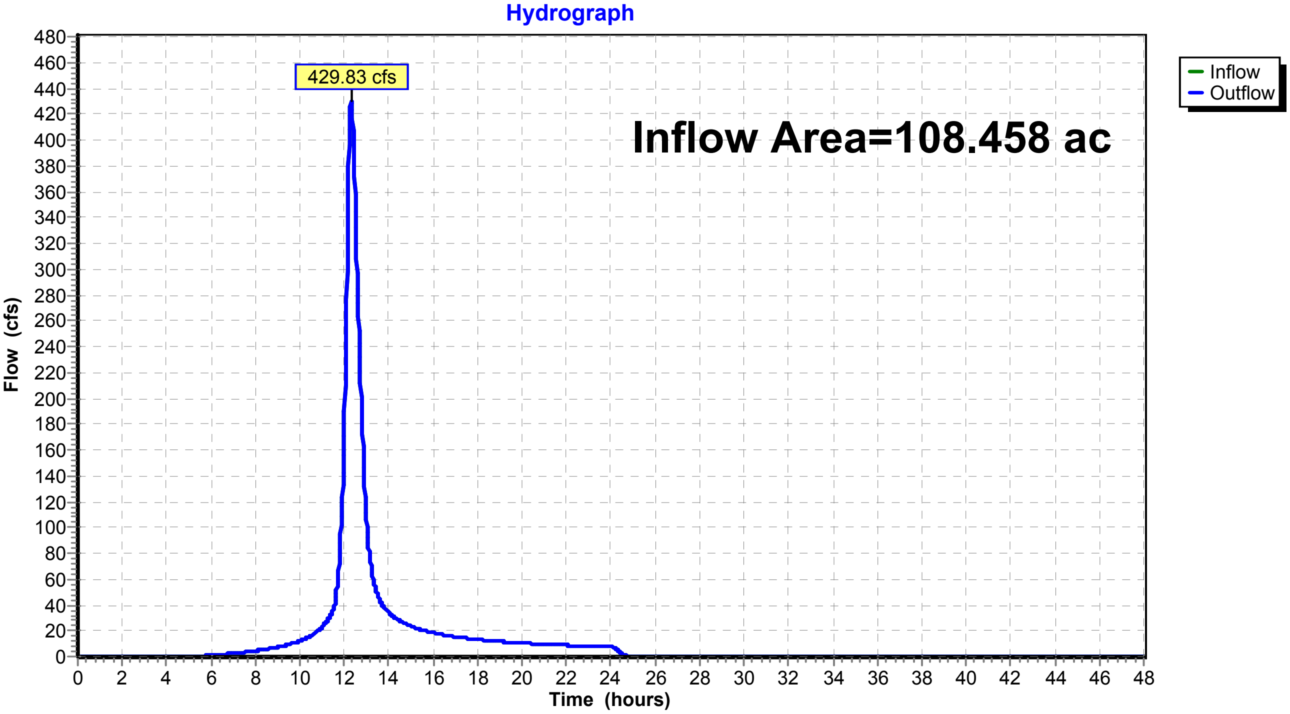
Summary for Reach 61R: Outfall of SB 15, 16, 21

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 108.458 ac, 0.00% Impervious, Inflow Depth = 5.22" for 100-Year event
Inflow = 429.83 cfs @ 12.31 hrs, Volume= 47.194 af
Outflow = 429.83 cfs @ 12.31 hrs, Volume= 47.194 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 61R: Outfall of SB 15, 16, 21



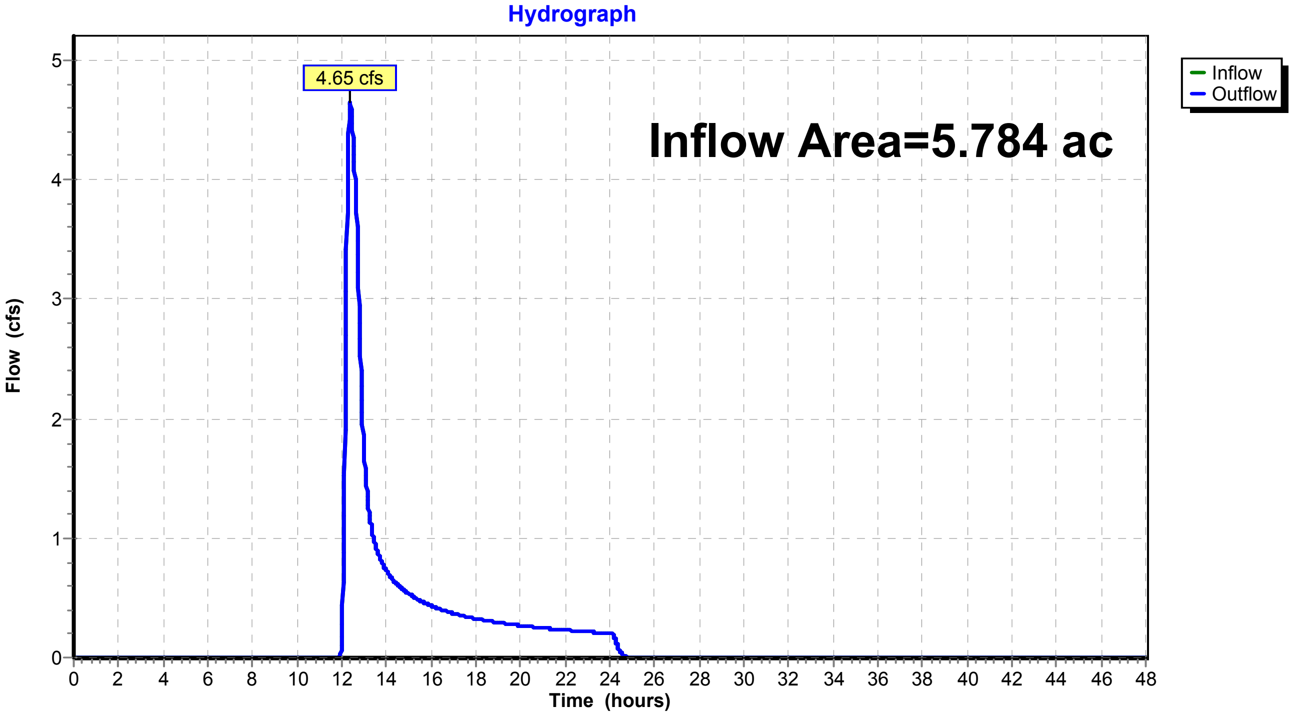
Summary for Reach 67R: Outfall of SB 28

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	5.784 ac,	0.00% Impervious,	Inflow Depth = 1.30"	for 100-Year event	
Inflow =	4.65 cfs @	12.38 hrs,	Volume=	0.626 af	
Outflow =	4.65 cfs @	12.38 hrs,	Volume=	0.626 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 67R: Outfall of SB 28



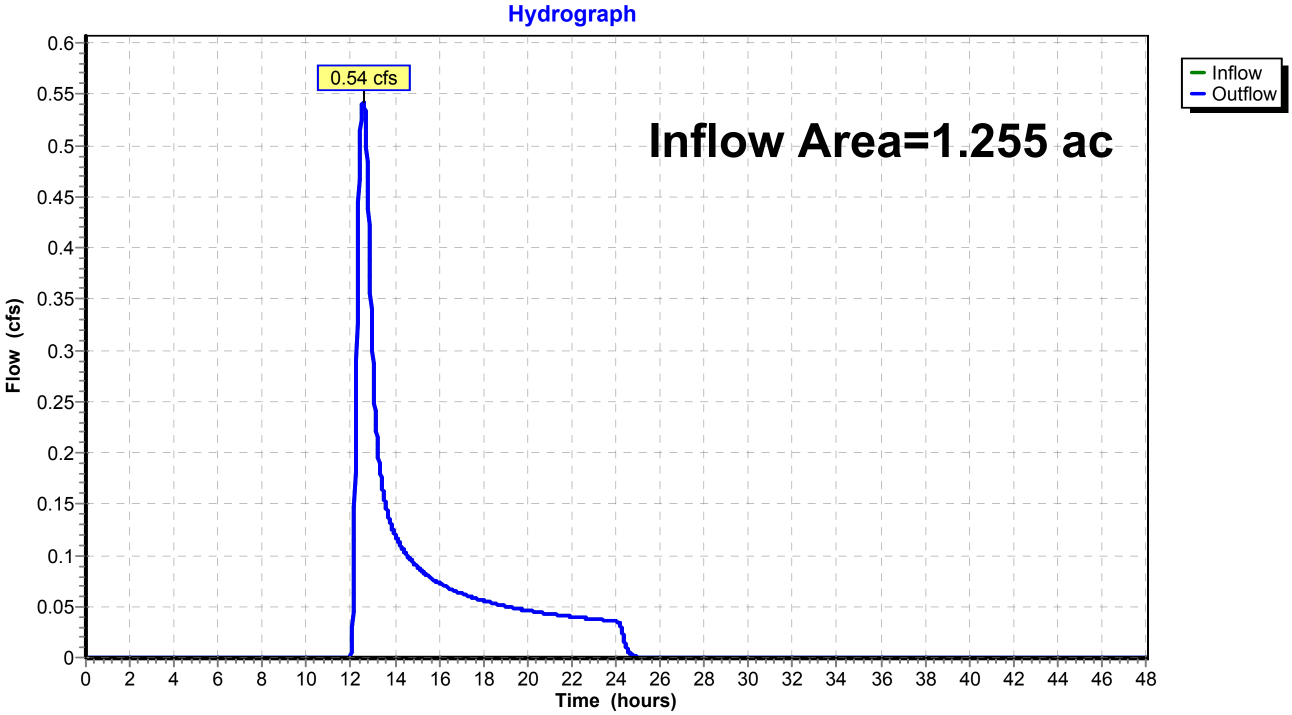
Summary for Reach 68R: Outfall of SB 29

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	1.255 ac,	0.00% Impervious,	Inflow Depth = 0.88"	for 100-Year event
Inflow =	0.54 cfs @	12.57 hrs, Volume=	0.092 af	
Outflow =	0.54 cfs @	12.57 hrs, Volume=	0.092 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 68R: Outfall of SB 29



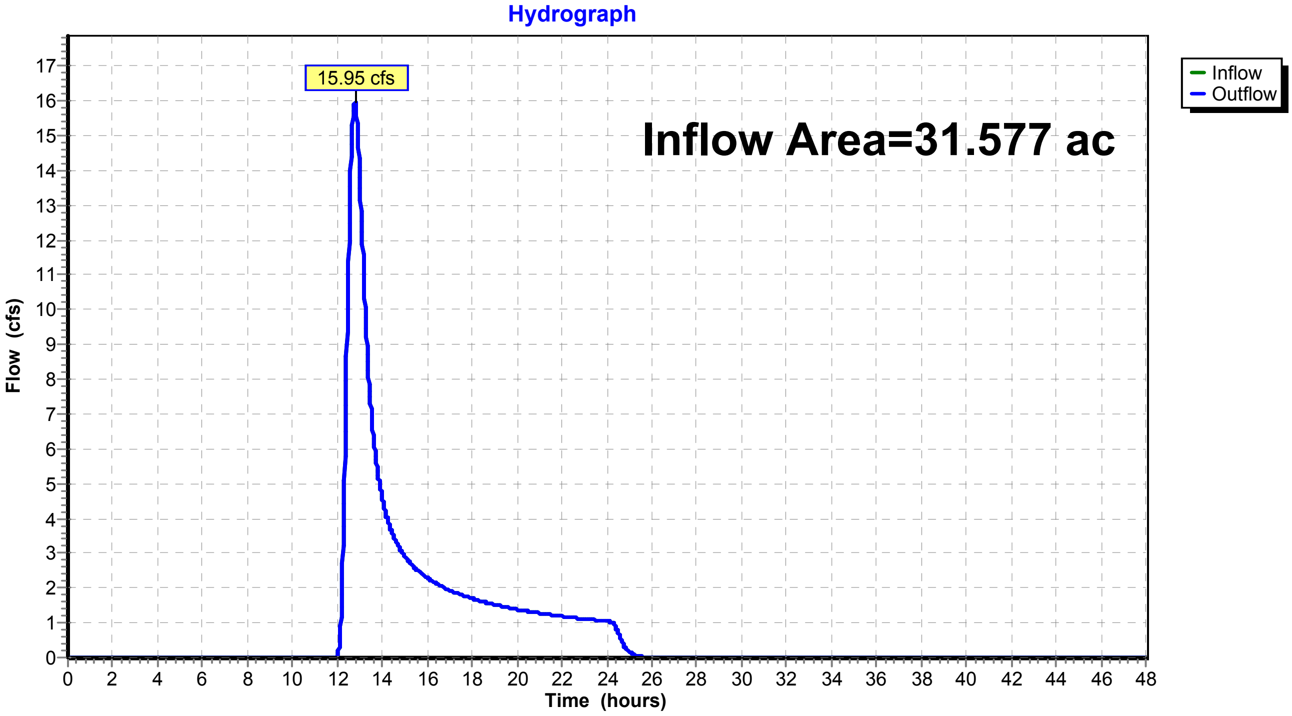
Summary for Reach 69R: Outfall of SB 30

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 31.577 ac, 0.00% Impervious, Inflow Depth = 1.13" for 100-Year event
Inflow = 15.95 cfs @ 12.79 hrs, Volume= 2.966 af
Outflow = 15.95 cfs @ 12.79 hrs, Volume= 2.966 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 69R: Outfall of SB 30



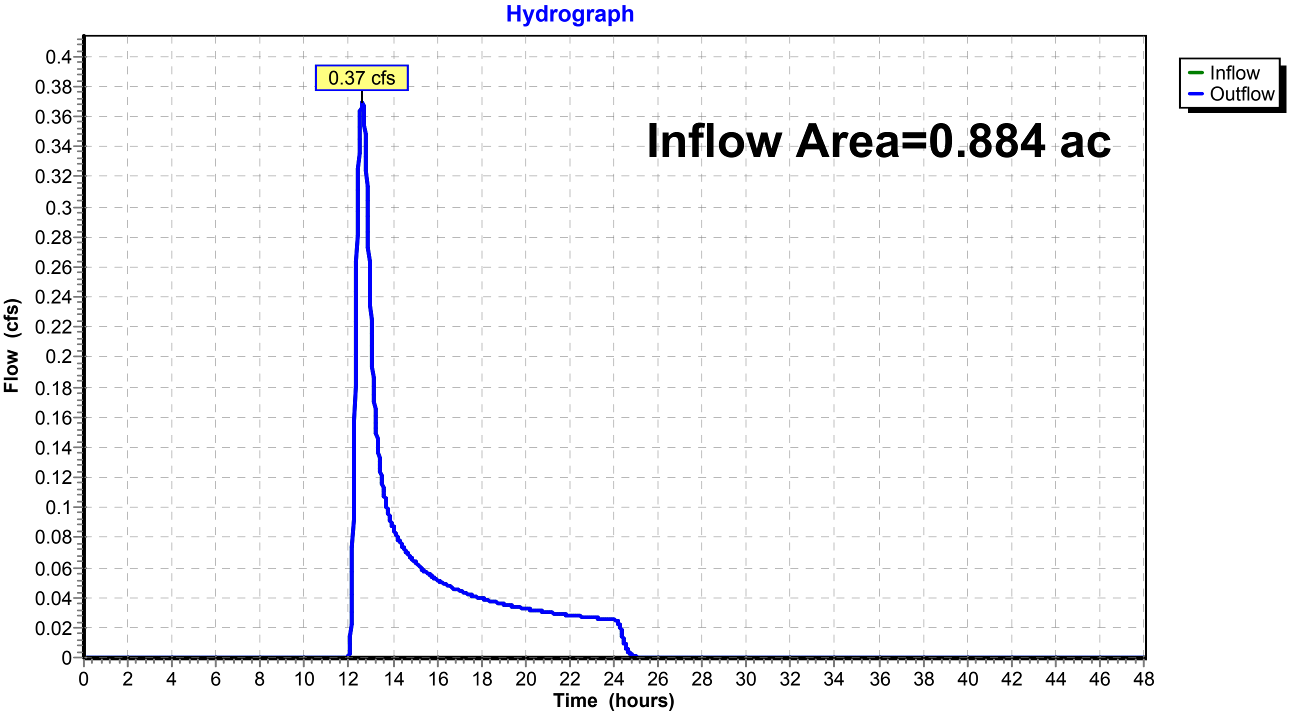
Summary for Reach 70R: Outfall of SB 31

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        0.884 ac,   0.00% Impervious,  Inflow Depth =   0.88"    for  100-Year event
Inflow      =        0.37 cfs @   12.61 hrs,  Volume=          0.065 af
Outflow     =        0.37 cfs @   12.61 hrs,  Volume=          0.065 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 70R: Outfall of SB 31



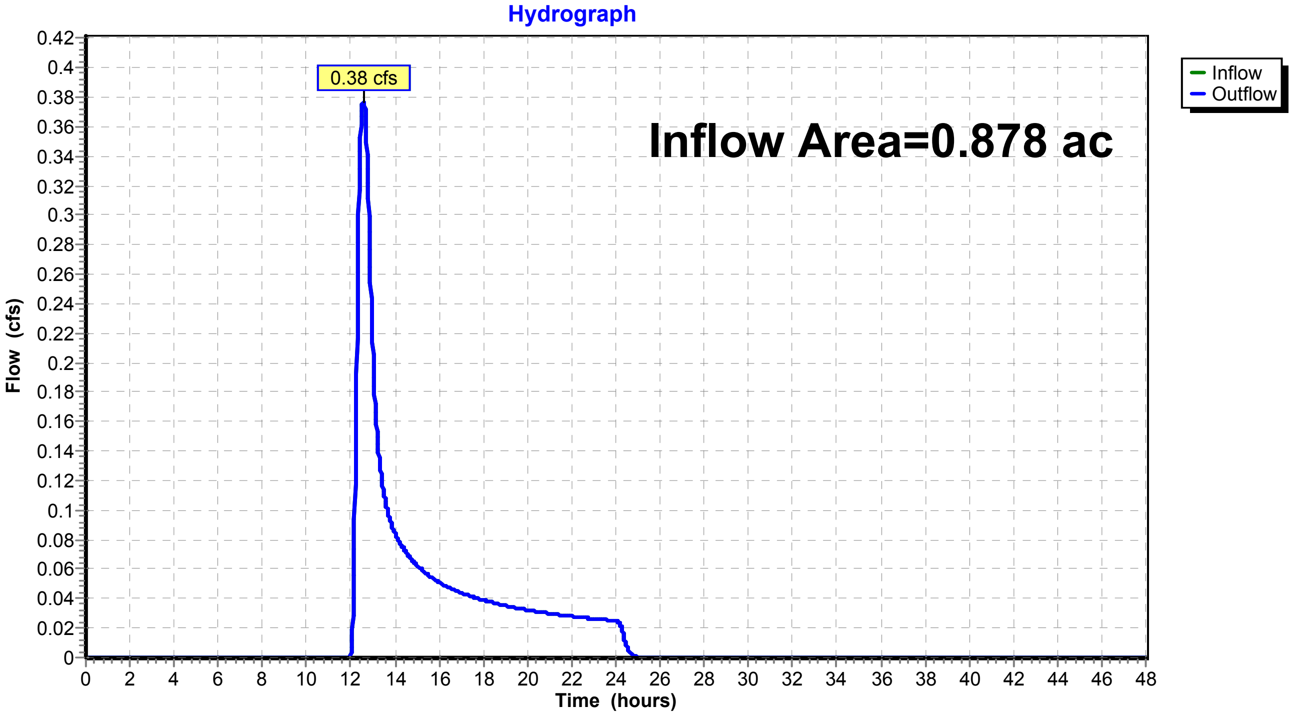
Summary for Reach 71R: Outfall of SB 32

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      0.878 ac,   0.00% Impervious,  Inflow Depth =   0.88"    for  100-Year event
Inflow      =     0.38 cfs @  12.57 hrs,  Volume=          0.065 af
Outflow     =     0.38 cfs @  12.57 hrs,  Volume=          0.065 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 71R: Outfall of SB 32



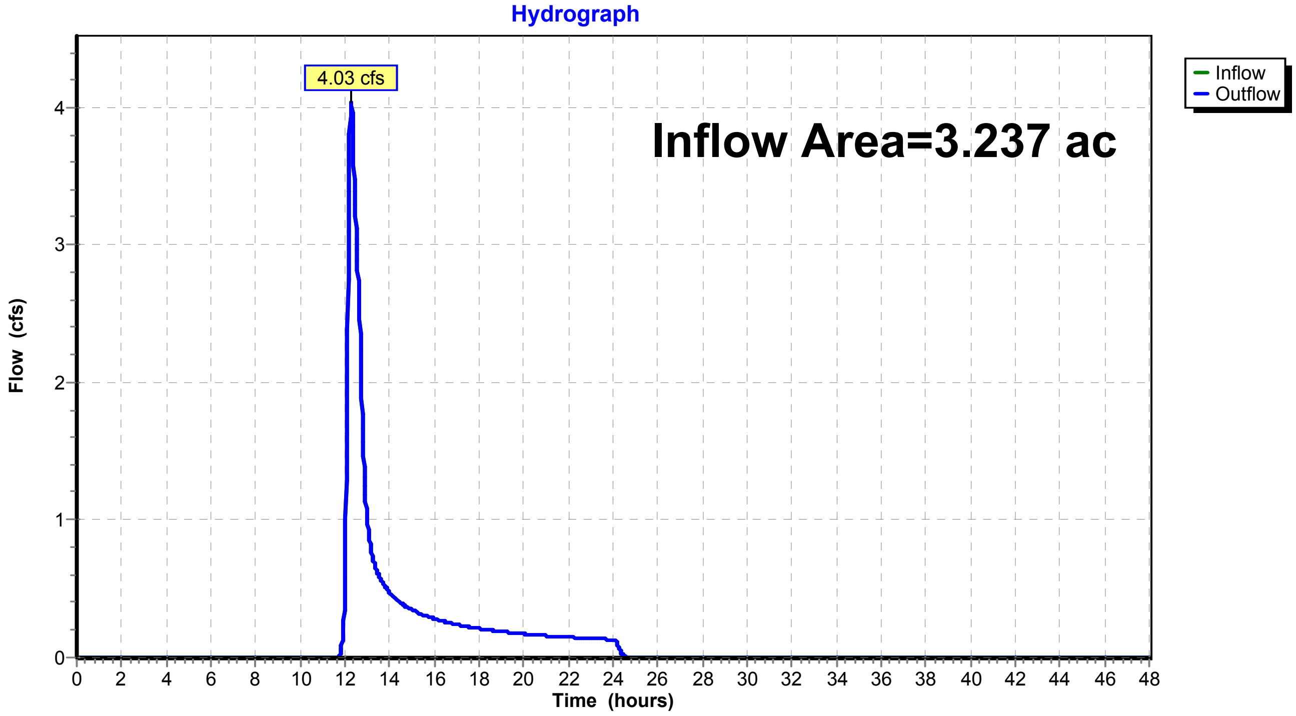
Summary for Reach 72R: Outfall of SB 33

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.237 ac, 0.00% Impervious, Inflow Depth = 1.66" for 100-Year event
Inflow = 4.03 cfs @ 12.28 hrs, Volume= 0.447 af
Outflow = 4.03 cfs @ 12.28 hrs, Volume= 0.447 af, Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 72R: Outfall of SB 33



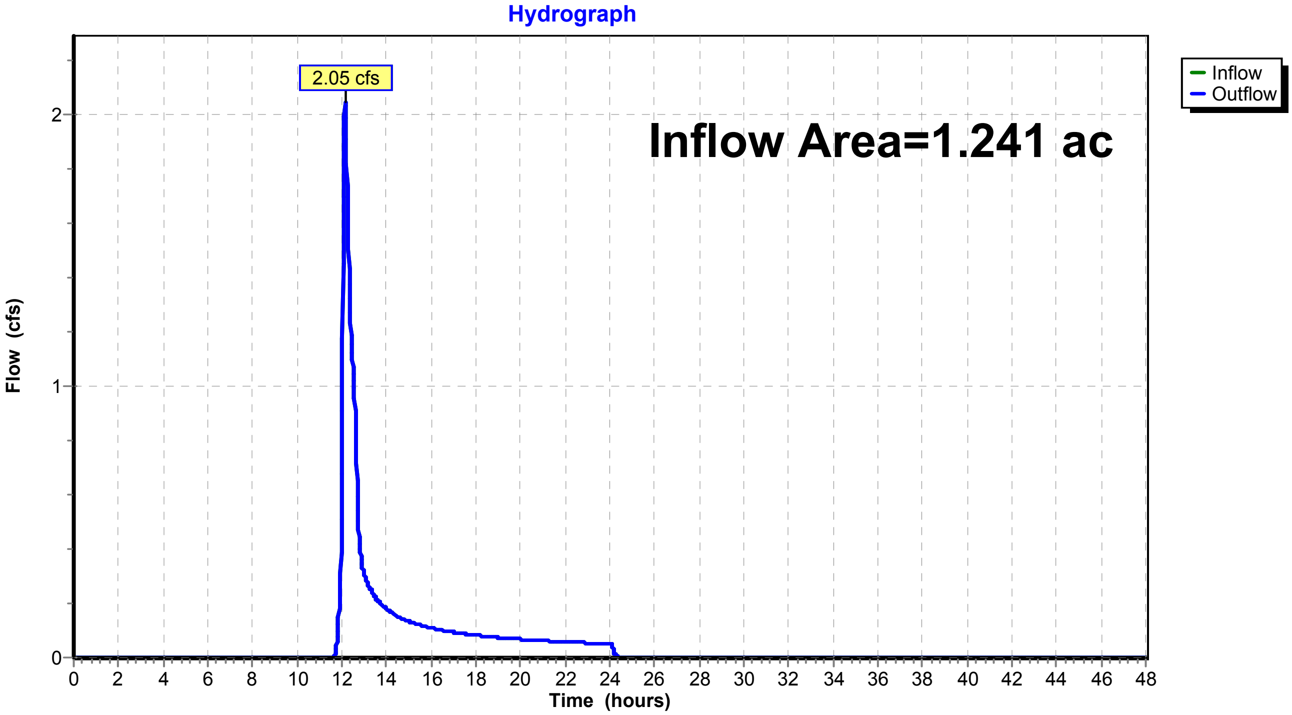
Summary for Reach 73R: Outfall of SB 34

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	1.241 ac,	0.00% Impervious,	Inflow Depth = 1.75"	for 100-Year event	
Inflow =	2.05 cfs @	12.15 hrs,	Volume=	0.181 af	
Outflow =	2.05 cfs @	12.15 hrs,	Volume=	0.181 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 73R: Outfall of SB 34

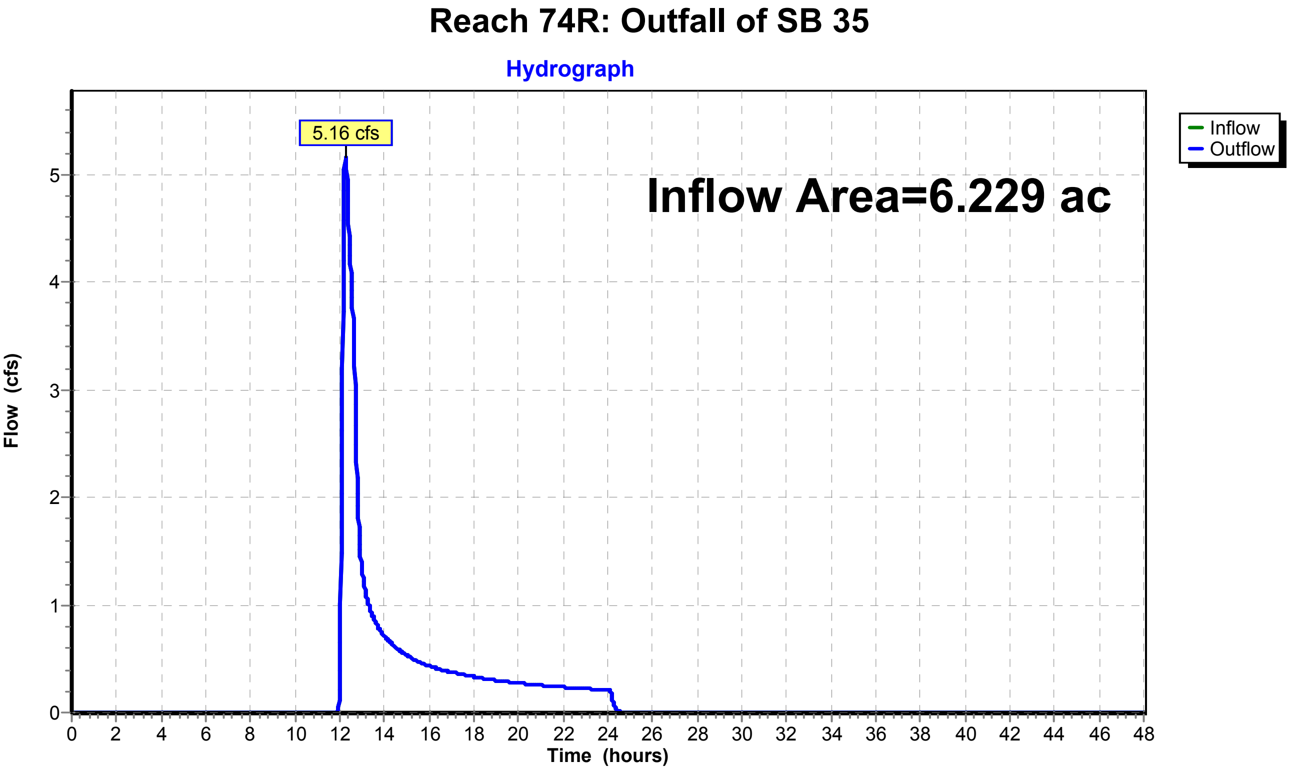


Summary for Reach 74R: Outfall of SB 35

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        6.229 ac,    0.00% Impervious,  Inflow Depth =   1.21"    for  100-Year event
Inflow       =       5.16 cfs @   12.26 hrs,  Volume=            0.629 af
Outflow      =       5.16 cfs @   12.26 hrs,  Volume=            0.629 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs



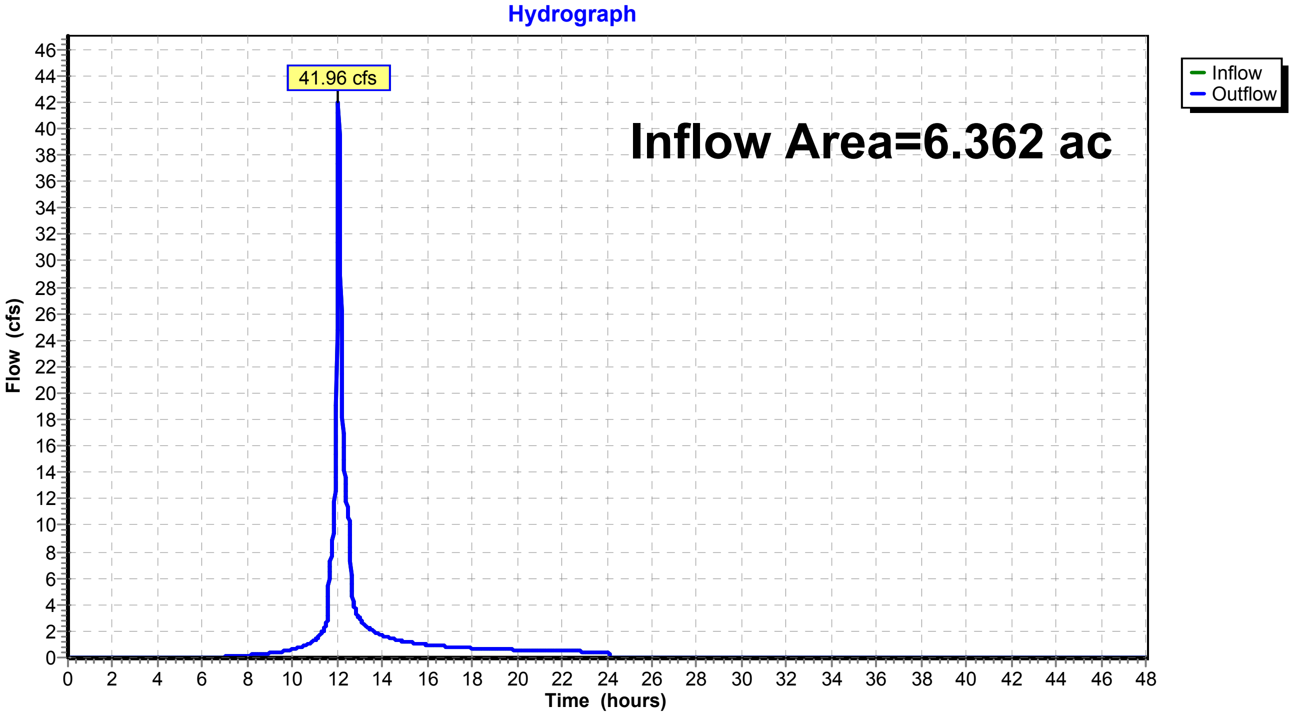
Summary for Reach 75R: Outfall of SB 19

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	6.362 ac,	0.00% Impervious, Inflow Depth = 4.76"	for 100-Year event	
Inflow =	41.96 cfs @	12.05 hrs, Volume=	2.522 af	
Outflow =	41.96 cfs @	12.05 hrs, Volume=	2.522 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 75R: Outfall of SB 19



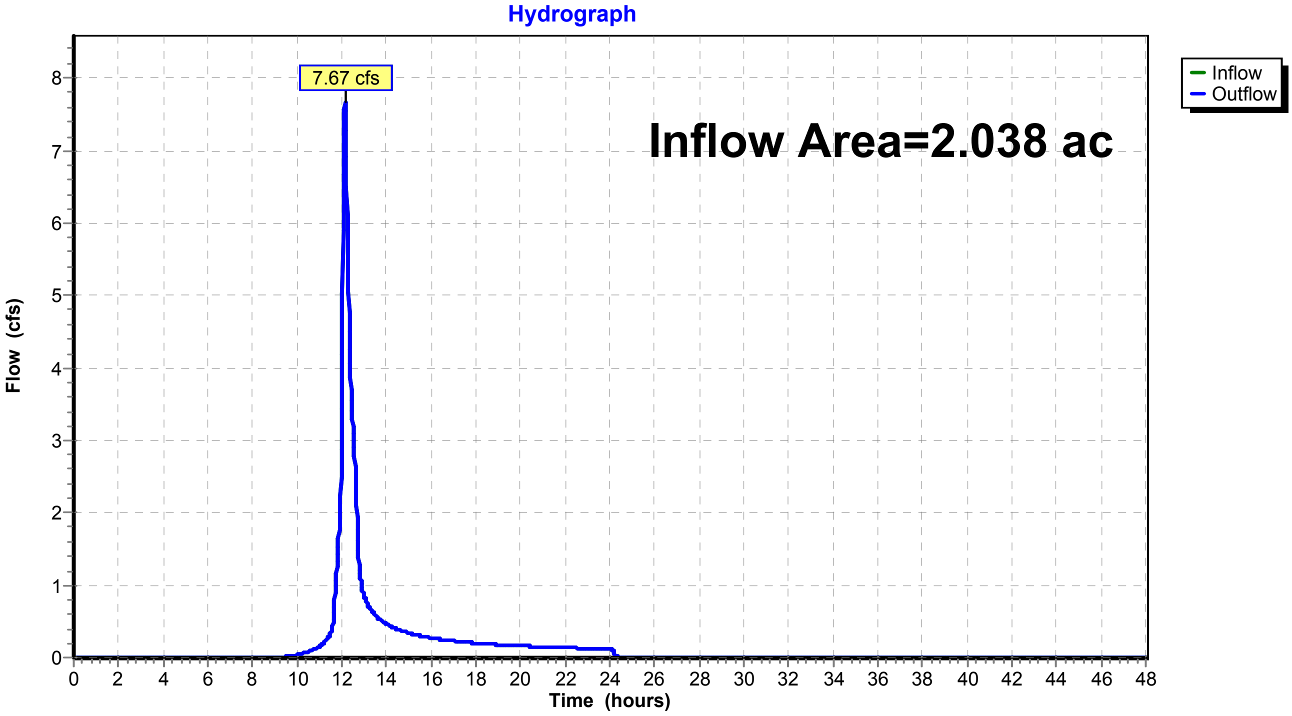
Summary for Reach 82R: Outfall of SB 27

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	2.038 ac,	0.00% Impervious,	Inflow Depth = 3.45"	for 100-Year event	
Inflow =	7.67 cfs @	12.14 hrs,	Volume=	0.586 af	
Outflow =	7.67 cfs @	12.14 hrs,	Volume=	0.586 af,	Atten= 0%, Lag= 0.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 82R: Outfall of SB 27



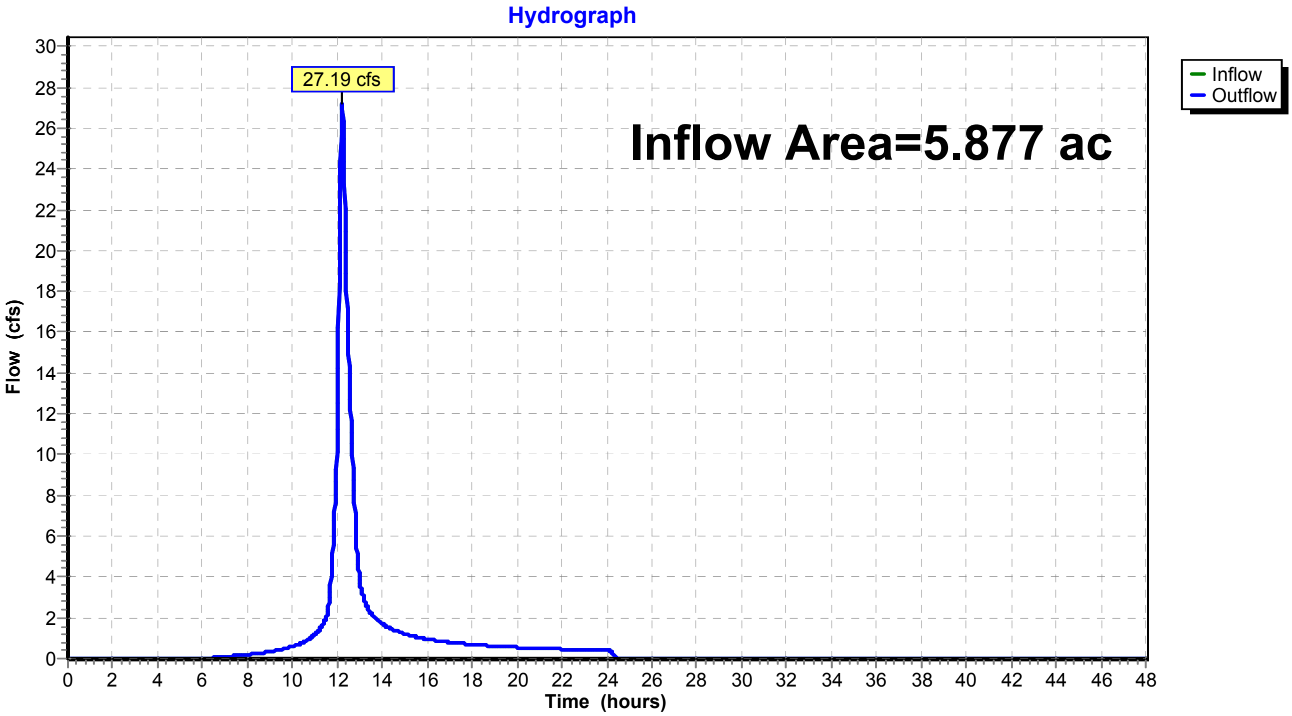
Summary for Reach 84R: Outfall of Future County Road H Subbasin

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       5.877 ac,   0.00% Impervious,  Inflow Depth =   4.98"    for  100-Year event
Inflow      =      27.19 cfs @   12.21 hrs,  Volume=          2.440 af
Outflow     =      27.19 cfs @   12.21 hrs,  Volume=          2.440 af,  Atten= 0%,  Lag= 0.0 min
```

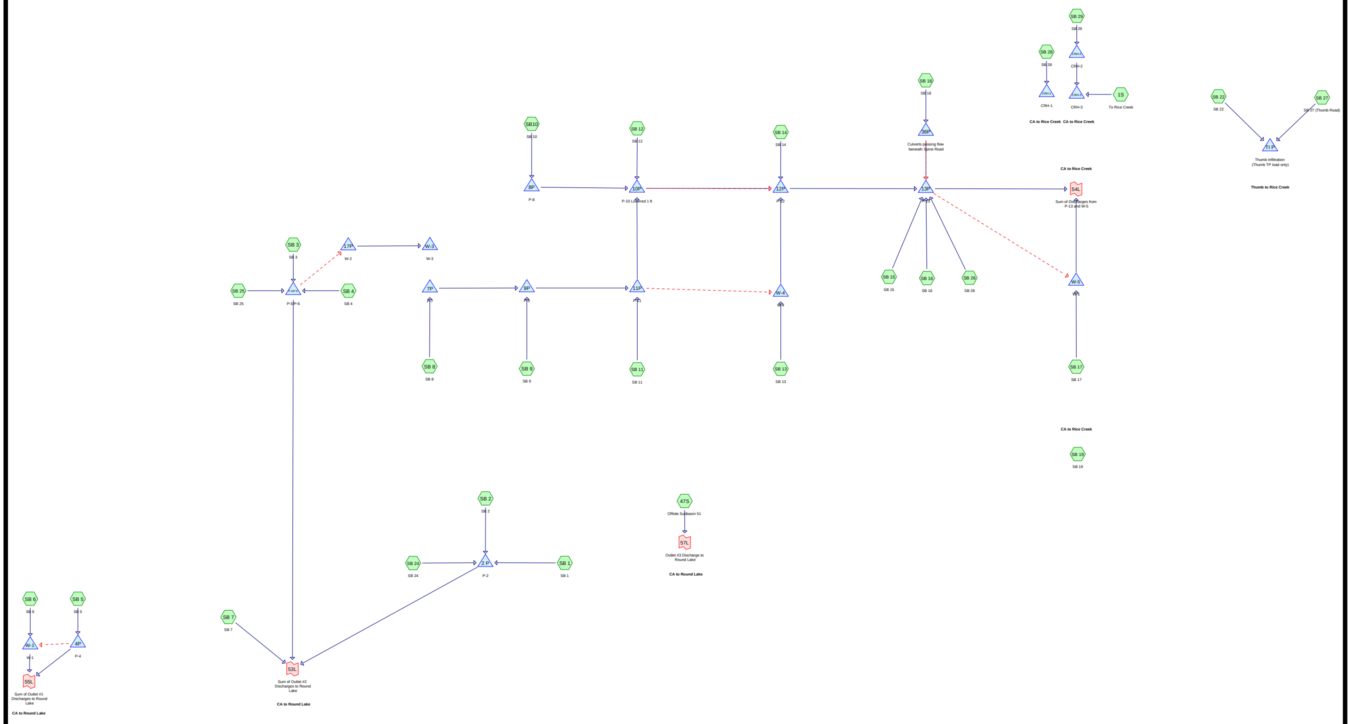
Routing by Muskingum-Cunge method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

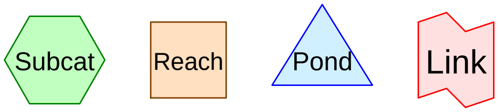
Reach 84R: Outfall of Future County Road H Subbasin



Appendix B

Interim Conditions (Public Infrastructure)
Hydrology and Hydraulics Modeling (HydroCAD)





Routing Diagram for Interim Spine Road_HydroCAD Model_20150830

Prepared by {enter your company name here}, Printed 1/28/2016

HydroCAD® 10.00 s/n 09165 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.038	98	(47S)
8.414	98	Impervious (SB 27, SB 3)
20.200	65	Offsite subbasin 51 (47S)
41.910	49	Pervious (SB 22)
35.825	74	Pervious (SB 27, SB 3)
4.950	98	impermiable (SB 24, SB 9)
32.898	98	impervious (1S, SB 12, SB 14, SB 15, SB 16, SB 2, SB 25, SB 26, SB 28, SB 29, SB 5, SB 8, SB10)
6.033	100	impervious (SB 11, SB 13, SB 17, SB 4, SB 6)
25.873	74	permiable (SB 24, SB 9)
319.995	74	pervious (1S, SB 1, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 25, SB 26, SB 28, SB 29, SB 4, SB 5, SB 6, SB 7, SB 8, SB10)
501.136	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
501.136	Other	1S, 47S, SB 1, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 22, SB 24, SB 25, SB 26, SB 27, SB 28, SB 29, SB 3, SB 4, SB 5, SB 6, SB 7, SB 8, SB 9, SB10
501.136		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	5.038	5.038		47S
0.000	0.000	0.000	0.000	8.414	8.414	Impervious	SB 27, SB 3
0.000	0.000	0.000	0.000	20.200	20.200	Offsite subbasin 51	47S
0.000	0.000	0.000	0.000	77.735	77.735	Pervious	SB 22, SB 27, SB 3
0.000	0.000	0.000	0.000	4.950	4.950	impermiable	SB 24, SB 9
0.000	0.000	0.000	0.000	38.931	38.931	impervious	1S, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 2, SB 25, SB 26, SB 28, SB 29, SB 4, SB 5, SB 6, SB 8, SB10
0.000	0.000	0.000	0.000	25.873	25.873	permiable	SB 24, SB 9
0.000	0.000	0.000	0.000	319.995	319.995	pervious	1S, SB 1, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 25, SB 26, SB 28, SB 29, SB 4, SB 5, SB 6, SB 7, SB 8, SB10
0.000	**0.000**	**0.000**	**0.000**	**501.136**	**501.136**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	4P	915.80	915.95	50.0	-0.0030	0.013	24.0	0.0	0.0
2	8P	897.00	895.94	380.0	0.0028	0.013	24.0	0.0	0.0
3	11P	910.00	909.00	200.0	0.0050	0.013	24.0	0.0	0.0
4	11P	910.00	909.00	200.0	0.0050	0.013	24.0	0.0	0.0
5	11P	909.00	908.00	150.0	0.0067	0.013	12.0	0.0	0.0
6	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
7	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
8	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
9	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
10	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
11	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
12	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
13	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
14	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
15	17P	929.10	916.00	300.0	0.0437	0.013	12.0	0.0	0.0
16	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
17	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
18	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
19	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
20	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
21	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
22	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
23	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
24	CRH-1	877.00	876.00	155.0	0.0065	0.013	24.0	0.0	0.0
25	CRH-1	877.00	876.00	155.0	0.0065	0.013	24.0	0.0	0.0
26	CRH-2	881.50	881.00	155.0	0.0032	0.013	24.0	0.0	0.0
27	CRH-2	881.50	881.00	155.0	0.0032	0.013	24.0	0.0	0.0
28	CRH-3	878.00	877.00	155.0	0.0065	0.013	24.0	0.0	0.0
29	CRH-3	878.00	877.00	155.0	0.0065	0.013	24.0	0.0	0.0
30	W-4	908.00	904.00	170.0	0.0235	0.013	12.0	0.0	0.0

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: To Rice Creek Runoff Area=1.601 ac 31.98% Impervious Runoff Depth=1.37"
Tc=5.7 min CN=74/98 Runoff=2.97 cfs 0.183 af

Subcatchment 47S: Offsite Subbasin 51 Runoff Area=25.238 ac 19.96% Impervious Runoff Depth=0.86"
Tc=32.8 min CN=65/98 Runoff=12.44 cfs 1.805 af

Subcatchment SB 1: SB 1 Runoff Area=52.150 ac 0.00% Impervious Runoff Depth=0.80"
Tc=53.1 min CN=74/0 Runoff=21.06 cfs 3.460 af

Subcatchment SB 11: SB 11 Runoff Area=3.290 ac 36.78% Impervious Runoff Depth=1.54"
Tc=11.7 min CN=74/100 Runoff=5.05 cfs 0.422 af

Subcatchment SB 12: SB 12 Runoff Area=1.390 ac 20.86% Impervious Runoff Depth=1.17"
Tc=9.5 min CN=74/98 Runoff=1.83 cfs 0.136 af

Subcatchment SB 13: SB 13 Runoff Area=2.980 ac 26.17% Impervious Runoff Depth=1.33"
Tc=9.4 min CN=74/100 Runoff=4.32 cfs 0.329 af

Subcatchment SB 14: SB 14 Runoff Area=10.230 ac 16.03% Impervious Runoff Depth=1.08"
Tc=4.3 min CN=74/98 Runoff=16.11 cfs 0.924 af

Subcatchment SB 15: SB 15 Runoff Area=58.570 ac 0.05% Impervious Runoff Depth=0.80"
Tc=31.3 min CN=74/98 Runoff=30.89 cfs 3.890 af

Subcatchment SB 16: SB 16 Runoff Area=32.440 ac 5.76% Impervious Runoff Depth=0.90"
Tc=12.1 min CN=74/98 Runoff=29.45 cfs 2.432 af

Subcatchment SB 17: SB 17 Runoff Area=7.608 ac 48.41% Impervious Runoff Depth=1.78"
Tc=4.3 min CN=74/100 Runoff=18.70 cfs 1.126 af

Subcatchment SB 18: SB 18 Runoff Area=52.790 ac 0.00% Impervious Runoff Depth=0.80"
Tc=33.5 min CN=74/0 Runoff=26.87 cfs 3.502 af

Subcatchment SB 19: SB 19 Runoff Area=21.190 ac 0.00% Impervious Runoff Depth=0.80"
Tc=24.7 min CN=74/0 Runoff=12.45 cfs 1.406 af

Subcatchment SB 2: SB 2 Runoff Area=11.067 ac 0.33% Impervious Runoff Depth=0.80"
Tc=16.6 min CN=74/98 Runoff=7.83 cfs 0.740 af

Subcatchment SB 22: SB 22 Runoff Area=41.910 ac 0.00% Impervious Runoff Depth=0.05"
Tc=41.0 min CN=49/0 Runoff=0.21 cfs 0.171 af

Subcatchment SB 24: SB 24 Runoff Area=5.043 ac 97.56% Impervious Runoff Depth=2.55"
Tc=7.5 min CN=74/98 Runoff=16.33 cfs 1.070 af

Subcatchment SB 25: SB 25 Runoff Area=5.136 ac 95.72% Impervious Runoff Depth=2.51"
Tc=10.7 min CN=74/98 Runoff=14.24 cfs 1.075 af

Subcatchment SB 26: SB 26 Runoff Area=14.335 ac 98.27% Impervious Runoff Depth=2.56"
Tc=25.4 min CN=74/98 Runoff=27.53 cfs 3.056 af

Subcatchment SB 27: SB 27 (Thumb Road) Runoff Area=6.629 ac 83.33% Impervious Runoff Depth=2.29"
Tc=27.6 min CN=74/98 Runoff=10.90 cfs 1.265 af

Subcatchment SB 28: SB 28 Runoff Area=6.955 ac 46.76% Impervious Runoff Depth=1.63"
Tc=14.6 min CN=74/98 Runoff=10.87 cfs 0.947 af

Subcatchment SB 29: SB 29 Runoff Area=10.214 ac 37.73% Impervious Runoff Depth=1.47"
Tc=19.1 min CN=74/98 Runoff=12.67 cfs 1.253 af

Subcatchment SB 3: SB 3 Runoff Area=37.610 ac 7.68% Impervious Runoff Depth=0.93"
Tc=15.3 min CN=74/98 Runoff=32.32 cfs 2.927 af

Subcatchment SB 4: SB 4 Runoff Area=0.600 ac 43.33% Impervious Runoff Depth=1.67"
Tc=5.9 min CN=74/100 Runoff=1.29 cfs 0.084 af

Subcatchment SB 5: SB 5 Runoff Area=7.860 ac 5.98% Impervious Runoff Depth=0.90"
Tc=59.3 min CN=74/98 Runoff=3.34 cfs 0.592 af

Subcatchment SB 6: SB 6 Runoff Area=1.000 ac 10.00% Impervious Runoff Depth=1.00"
Tc=20.3 min CN=74/100 Runoff=0.79 cfs 0.083 af

Subcatchment SB 7: SB 7 Runoff Area=21.550 ac 0.00% Impervious Runoff Depth=0.80"
Tc=5.7 min CN=74/0 Runoff=22.95 cfs 1.430 af

Subcatchment SB 8: SB 8 Runoff Area=29.580 ac 5.51% Impervious Runoff Depth=0.89"
Tc=47.1 min CN=74/98 Runoff=14.20 cfs 2.206 af

Subcatchment SB 9: SB 9 Runoff Area=25.780 ac 0.12% Impervious Runoff Depth=0.80"
Tc=30.0 min CN=74/98 Runoff=13.82 cfs 1.715 af

Subcatchment SB10: SB 10 Runoff Area=6.390 ac 4.85% Impervious Runoff Depth=0.88"
Tc=7.3 min CN=74/98 Runoff=6.95 cfs 0.470 af

Pond 2 P: P-2 Peak Elev=924.73' Storage=1.016 af Inflow=25.48 cfs 5.269 af
Outflow=25.29 cfs 5.269 af

Pond 4P: P-4 Peak Elev=915.44' Storage=0.773 af Inflow=3.34 cfs 0.592 af
Primary=0.63 cfs 0.211 af Secondary=1.41 cfs 0.381 af Outflow=2.04 cfs 0.592 af

Pond 7P: P-7 Peak Elev=915.29' Storage=1.196 af Inflow=14.20 cfs 2.206 af
Outflow=14.39 cfs 2.206 af

Pond 8P: P-8 Peak Elev=897.58' Storage=0.694 af Inflow=6.95 cfs 0.470 af
24.0" Round Culvert n=0.013 L=380.0' S=0.0028 '/' Outflow=1.19 cfs 0.465 af

Pond 9P: P-9 Peak Elev=915.26' Storage=0.414 af Inflow=25.40 cfs 3.921 af
Outflow=25.36 cfs 3.921 af

Pond 10P: P-10 Lowered 1 ft Peak Elev=896.83' Storage=0.954 af Inflow=6.10 cfs 3.683 af
Primary=5.76 cfs 3.682 af Secondary=0.00 cfs 0.000 af Outflow=5.76 cfs 3.682 af

```
Pond 11P: P-11                              Peak Elev=910.30'  Storage=5.310 af   Inflow=26.75 cfs  4.343 af
                         Primary=5.18 cfs  3.083 af   Secondary=3.14 cfs  1.259 af   Outflow=8.30 cfs  4.342 af

Pond 12P: P-12                              Peak Elev=893.62'  Storage=6.109 af   Inflow=16.56 cfs  6.175 af
                                                                                     Outflow=6.46 cfs  6.168 af

Pond 13P: P-13                             Peak Elev=883.70'  Storage=5.659 af   Inflow=99.54 cfs  19.048 af
                     Primary=86.58 cfs  18.259 af   Secondary=5.32 cfs  0.787 af   Outflow=91.90 cfs  19.046 af

Pond 17P: W-2                                Peak Elev=929.35'  Storage=0.390 af   Inflow=1.51 cfs  0.492 af
                              12.0"  Round Culvert  n=0.013  L=300.0'  S=0.0437 '/'   Outflow=0.32 cfs  0.351 af

Pond 36P: Culverts passing flow beneath     Peak Elev=887.11'  Storage=0.000 af   Inflow=26.87 cfs  3.502 af
                        Primary=26.87 cfs  3.502 af   Secondary=0.00 cfs  0.000 af   Outflow=26.87 cfs  3.502 af

Pond CRH-1: CRH-1                           Peak Elev=877.67'  Storage=0.354 af   Inflow=10.87 cfs  0.947 af
                         Discarded=0.22 cfs  0.471 af   Primary=4.58 cfs  0.476 af   Outflow=4.80 cfs  0.947 af

Pond CRH-2: CRH-2                           Peak Elev=882.04'  Storage=0.617 af   Inflow=12.67 cfs  1.253 af
                         Discarded=0.33 cfs  0.833 af   Primary=2.29 cfs  0.420 af   Outflow=2.62 cfs  1.254 af

Pond CRH-3: CRH-3                            Peak Elev=878.30'  Storage=0.259 af   Inflow=2.97 cfs  0.603 af
                         Discarded=0.20 cfs  0.381 af   Primary=0.97 cfs  0.222 af   Outflow=1.17 cfs  0.603 af

Pond P-5/P-6: P-5/P-6                       Peak Elev=929.88'  Storage=6.897 af   Inflow=44.72 cfs  4.086 af
                        Primary=8.78 cfs  3.587 af   Secondary=1.51 cfs  0.492 af   Outflow=10.29 cfs  4.079 af

Pond TI P: Thumb Infiltration (Thumb TP     Peak Elev=901.44'  Storage=1.436 af   Inflow=10.90 cfs  1.436 af
                                                                                     Outflow=0.00 cfs  0.000 af

Pond W-1: W-1                                Peak Elev=914.97'  Storage=0.148 af   Inflow=1.52 cfs  0.464 af
                                                                                     Outflow=1.05 cfs  0.464 af

Pond W-3: W-3                                Peak Elev=914.92'  Storage=0.351 af   Inflow=0.32 cfs  0.351 af
                                                                                     Outflow=0.00 cfs  0.000 af

Pond W-4: W-4                                Peak Elev=908.71'  Storage=0.649 af   Inflow=4.39 cfs  1.588 af
                              12.0"  Round Culvert  n=0.013  L=170.0'  S=0.0235 '/'   Outflow=2.16 cfs  1.570 af

Pond W-5: W-5                               Peak Elev=882.93'  Storage=4.298 af   Inflow=19.24 cfs  1.913 af
                                                                                     Outflow=2.91 cfs  1.906 af

Link 53L: Sum of Outlet #2 Discharges to Round Lake                                Inflow=40.20 cfs  10.286 af
                                                                                  Primary=40.20 cfs  10.286 af

Link 54L: Sum of Discharges from P-13 and W-5                                      Inflow=88.88 cfs  20.165 af
                                                                                  Primary=88.88 cfs  20.165 af

Link 55L: Sum of Outlet #1 Discharges to Round Lake                                  Inflow=1.55 cfs  0.675 af
                                                                                    Primary=1.55 cfs  0.675 af
```

Link 57L: Outlet #3 Discharge to Round Lake

Inflow=12.44 cfs 1.805 af
Primary=12.44 cfs 1.805 af

Total Runoff Area = 501.136 ac Runoff Volume = 38.698 af Average Runoff Depth = 0.93"
88.56% Pervious = 443.803 ac 11.44% Impervious = 57.333 ac

Summary for Subcatchment 1S: To Rice Creek

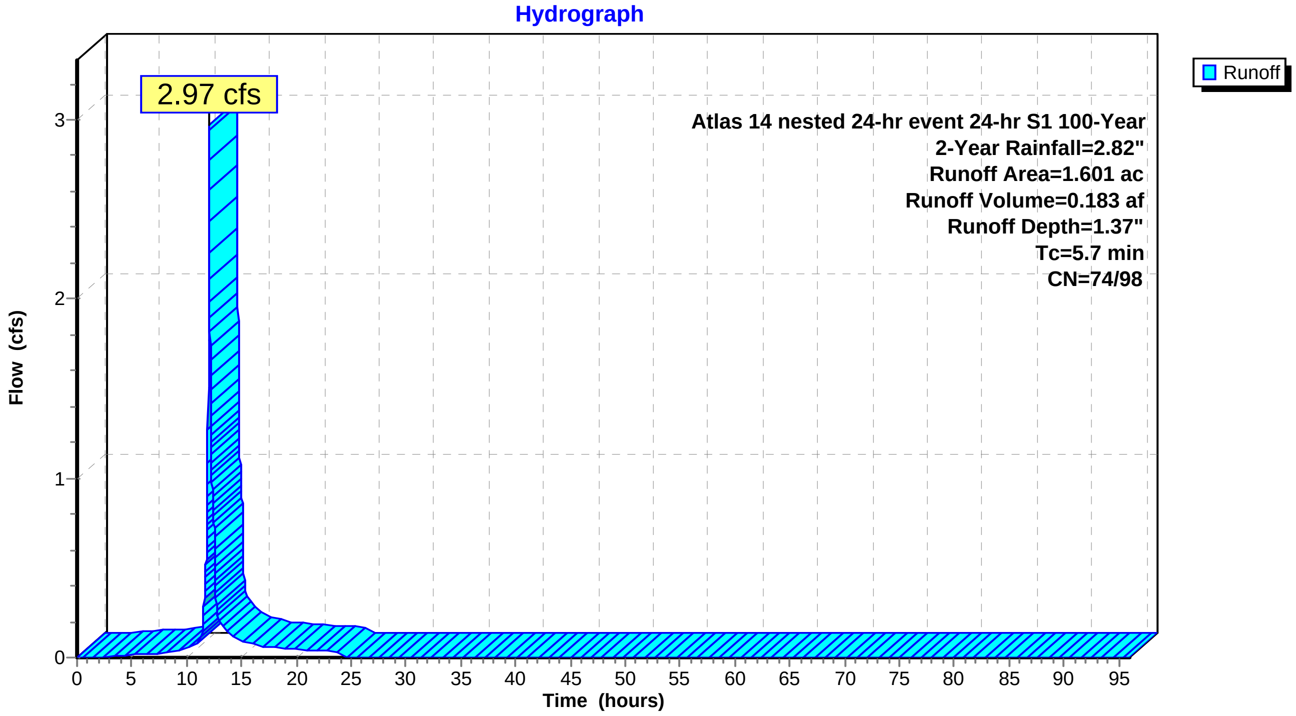
Runoff = 2.97 cfs @ 12.04 hrs, Volume= 0.183 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.512	98	impervious
*	1.089	74	pervious
	1.601	82	Weighted Average
	1.089		68.02% Pervious Area
	0.512		31.98% Impervious Area

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

Subcatchment 1S: To Rice Creek



Summary for Subcatchment 47S: Offsite Subbasin 51

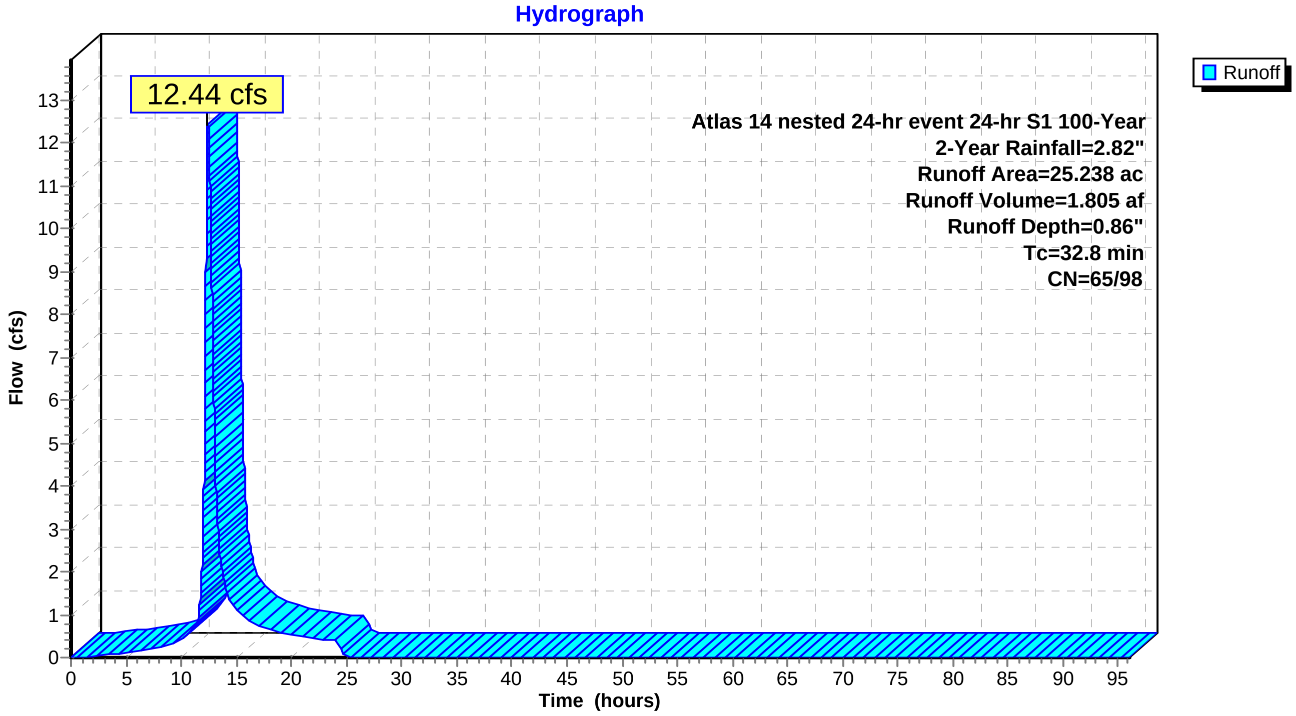
Runoff = 12.44 cfs @ 12.43 hrs, Volume= 1.805 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	20.200	65	Offsite subbasin 51
*	5.038	98	
	25.238	72	Weighted Average
	20.200		80.04% Pervious Area
	5.038		19.96% Impervious Area

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

Subcatchment 47S: Offsite Subbasin 51



Summary for Subcatchment SB 1: SB 1

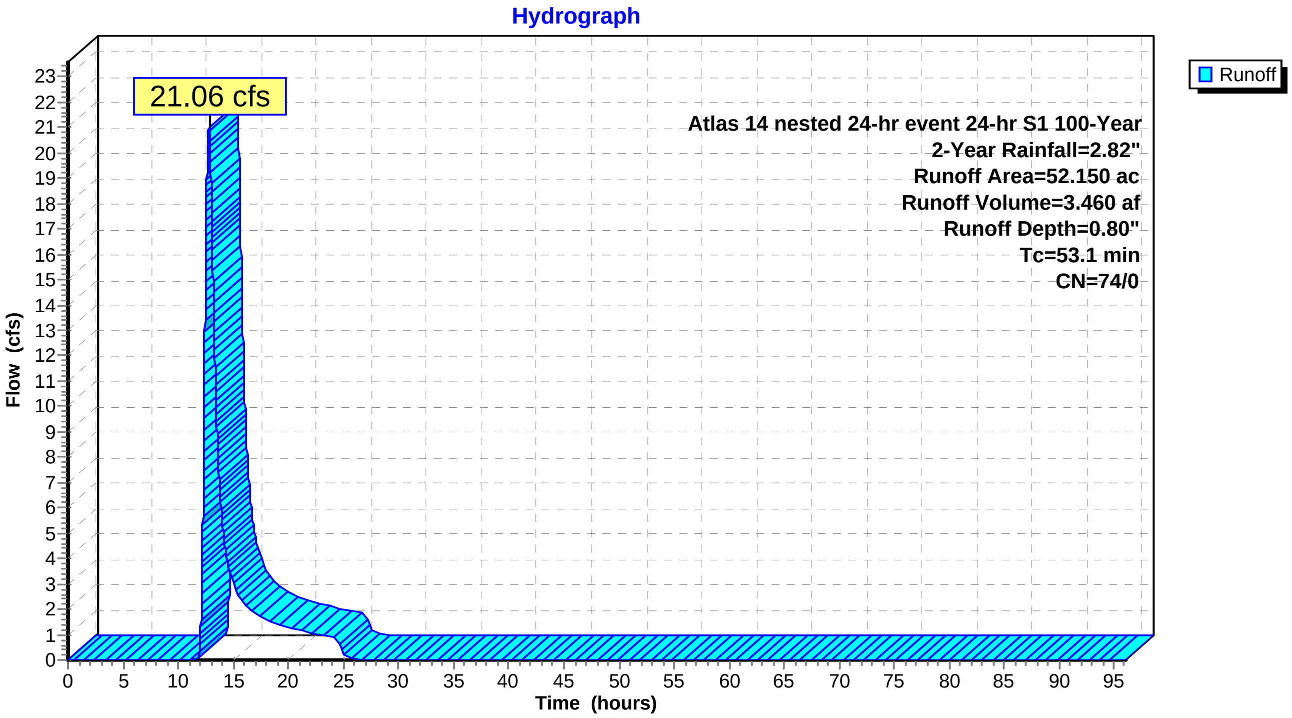
Runoff = 21.06 cfs @ 12.80 hrs, Volume= 3.460 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	52.150	74	pervious
*	0.000	98	impervious
	52.150	74	Weighted Average
	52.150		100.00% Pervious Area

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

Subcatchment SB 1: SB 1



Summary for Subcatchment SB 11: SB 11

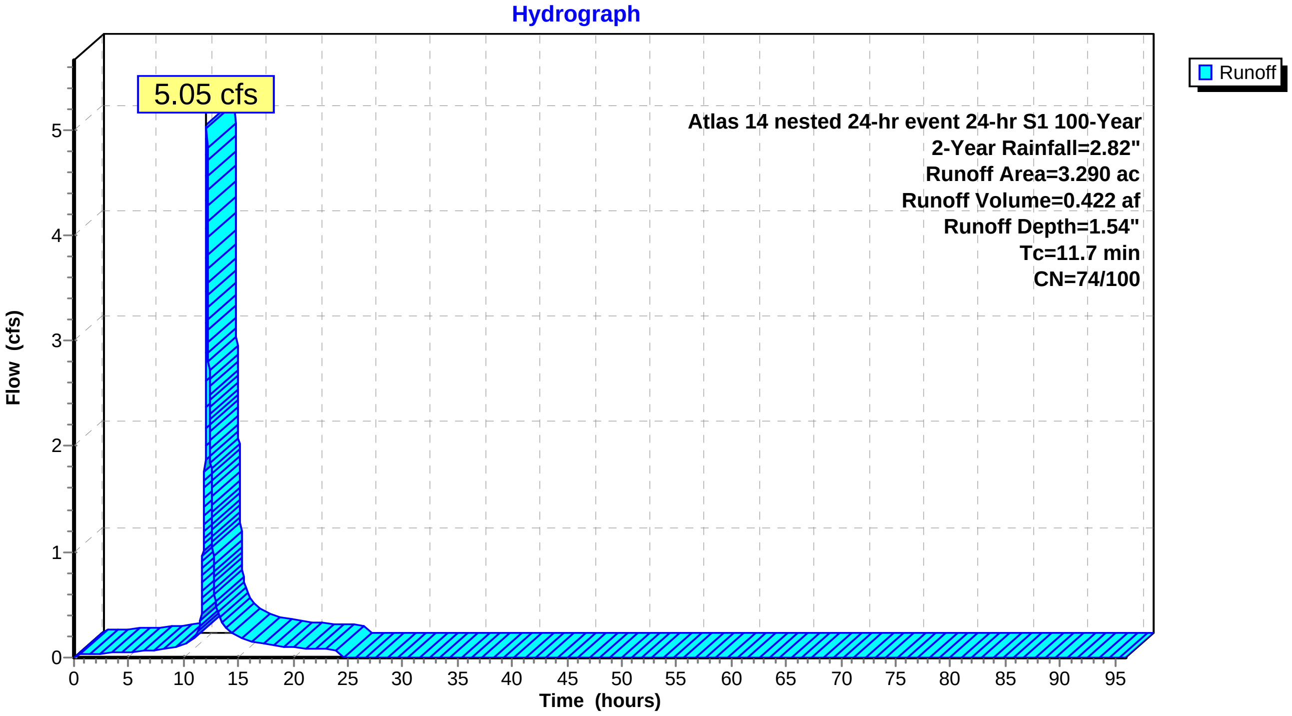
Runoff = 5.05 cfs @ 12.11 hrs, Volume= 0.422 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.080	74	pervious
*	1.210	100	impervious
	3.290	84	Weighted Average
	2.080		63.22% Pervious Area
	1.210		36.78% Impervious Area

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

Subcatchment SB 11: SB 11



Summary for Subcatchment SB 12: SB 12

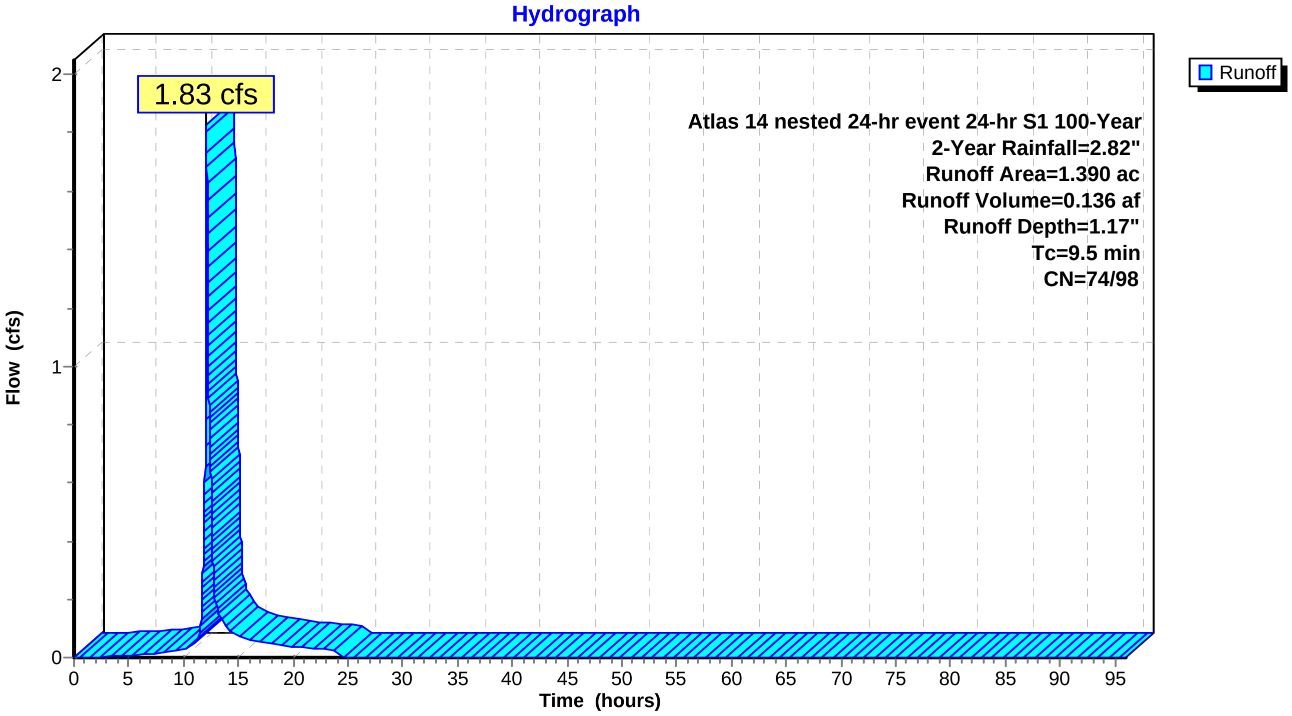
Runoff = 1.83 cfs @ 12.09 hrs, Volume= 0.136 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	1.100	74	pervious
*	0.290	98	impervious
	1.390	79	Weighted Average
	1.100		79.14% Pervious Area
	0.290		20.86% Impervious Area

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

Subcatchment SB 12: SB 12



Summary for Subcatchment SB 13: SB 13

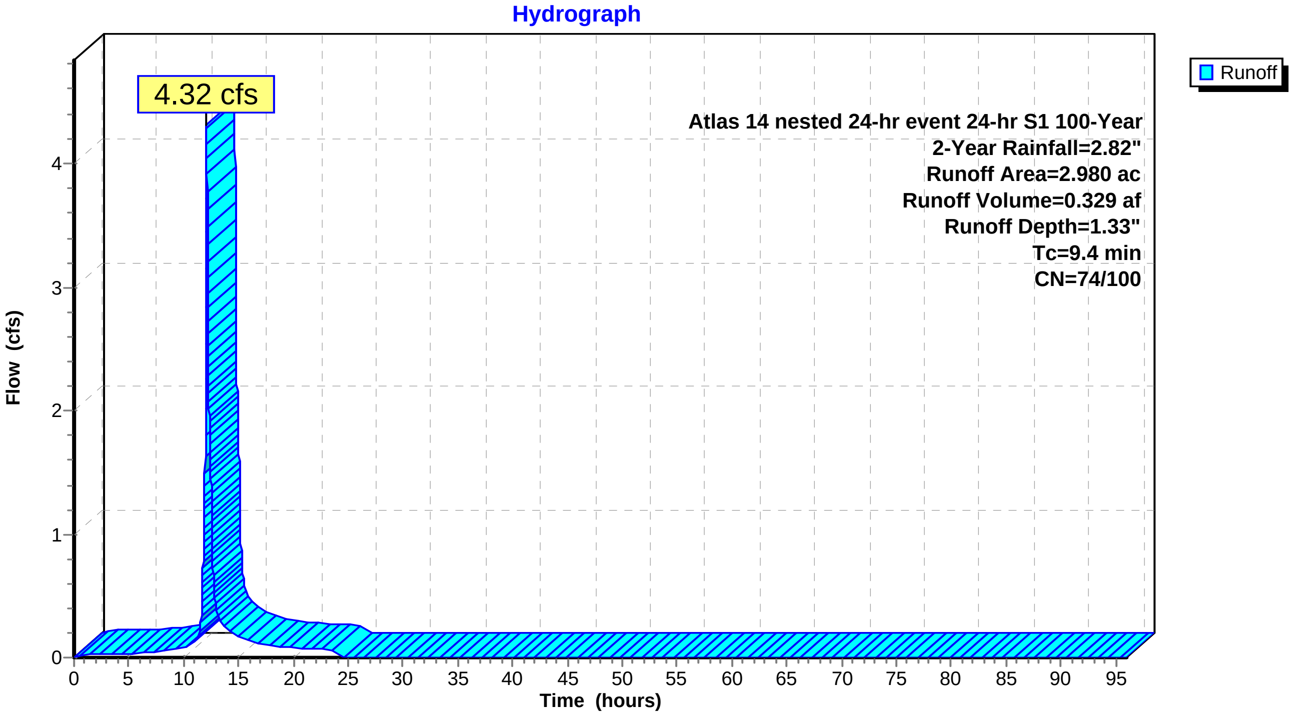
Runoff = 4.32 cfs @ 12.08 hrs, Volume= 0.329 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.200	74	pervious
*	0.780	100	impervious
	2.980	81	Weighted Average
	2.200		73.83% Pervious Area
	0.780		26.17% Impervious Area

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

Subcatchment SB 13: SB 13



Summary for Subcatchment SB 14: SB 14

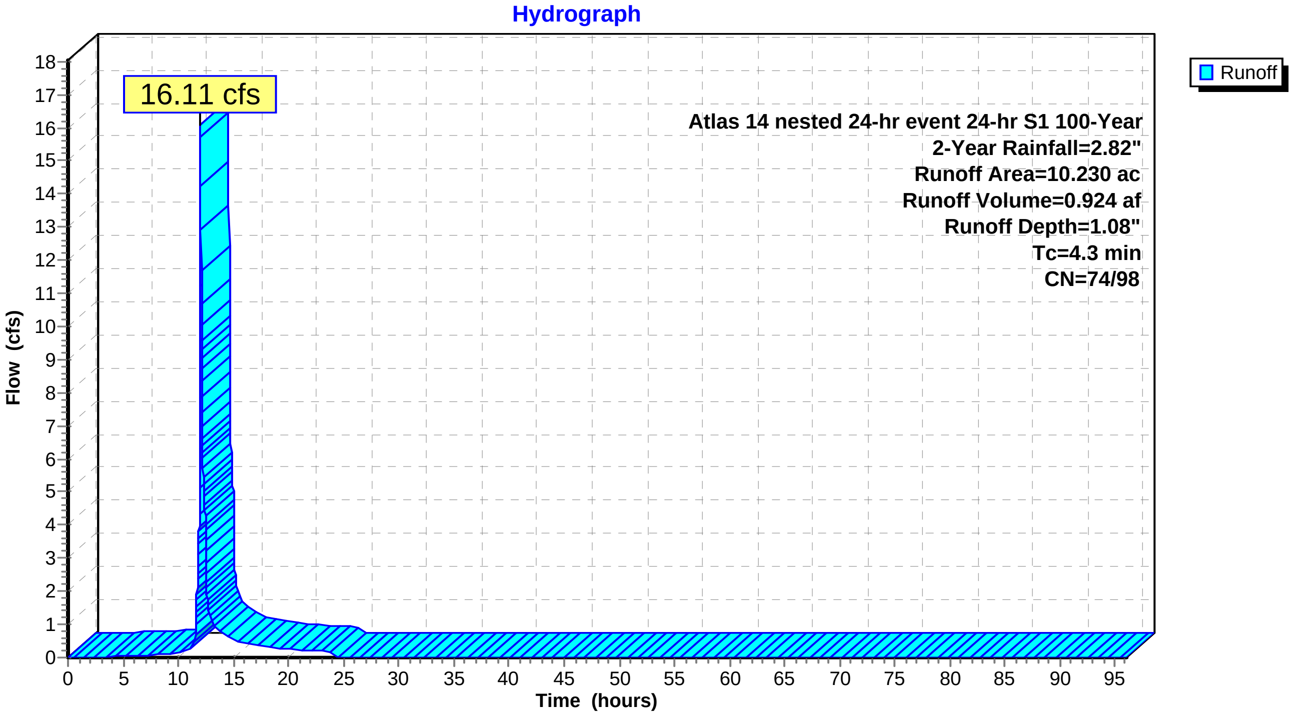
Runoff = 16.11 cfs @ 12.03 hrs, Volume= 0.924 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	8.590	74	pervious
*	1.640	98	impervious
	10.230	78	Weighted Average
	8.590		83.97% Pervious Area
	1.640		16.03% Impervious Area

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

Subcatchment SB 14: SB 14



Summary for Subcatchment SB 15: SB 15

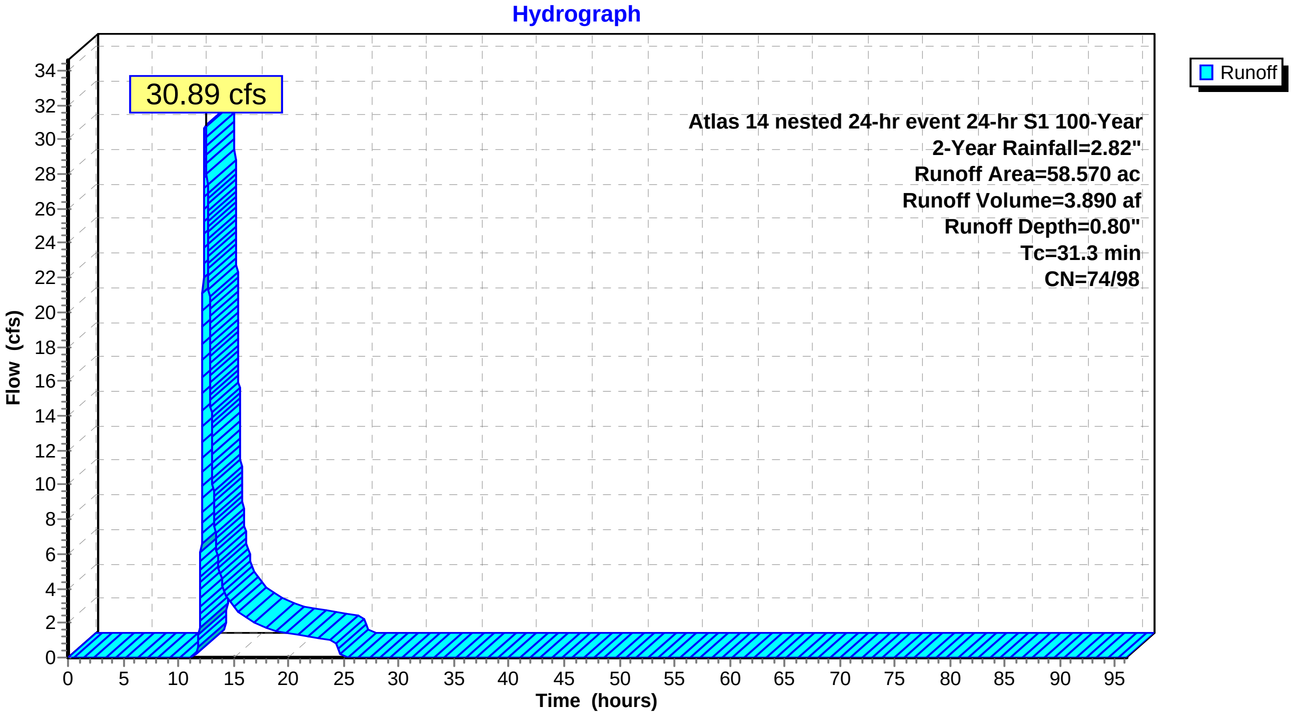
Runoff = 30.89 cfs @ 12.45 hrs, Volume= 3.890 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	58.540	74	pervious
*	0.030	98	impervious
	58.570	74	Weighted Average
	58.540		99.95% Pervious Area
	0.030		0.05% Impervious Area

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

Subcatchment SB 15: SB 15



Summary for Subcatchment SB 16: SB 16

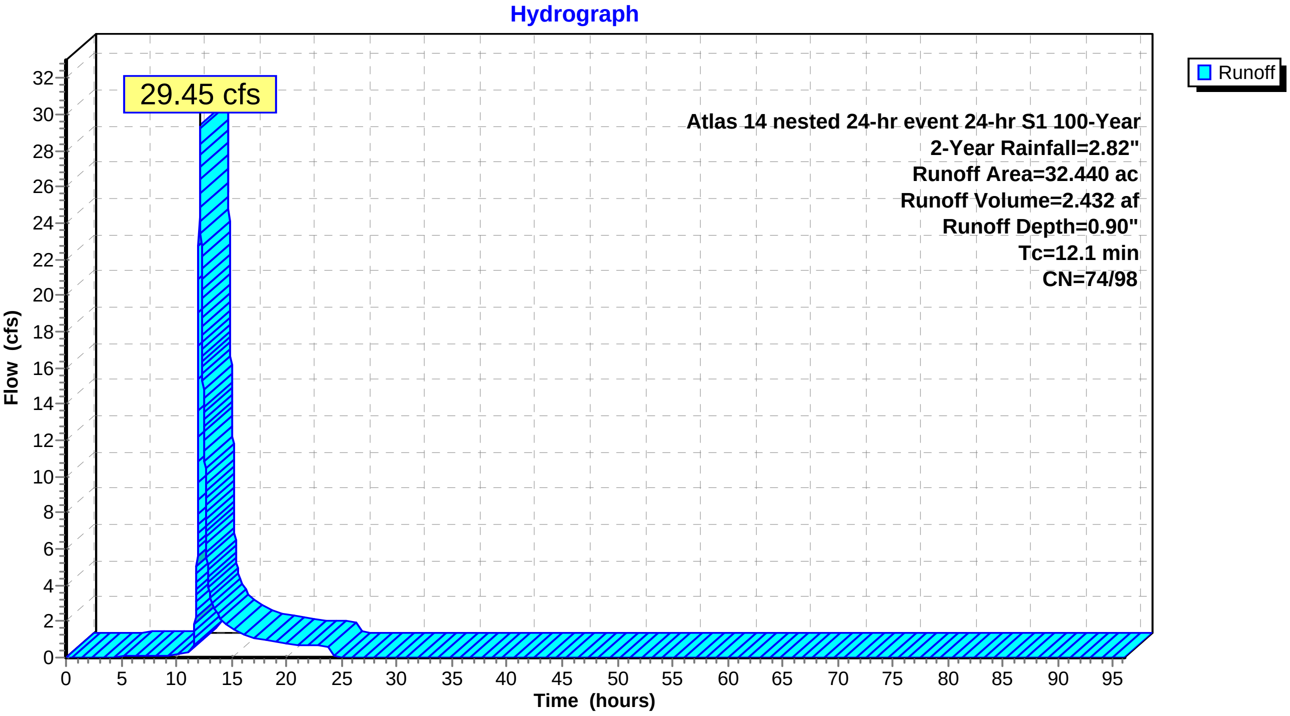
Runoff = 29.45 cfs @ 12.14 hrs, Volume= 2.432 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	30.570	74	pervious
*	1.870	98	impervious
	32.440	75	Weighted Average
	30.570		94.24% Pervious Area
	1.870		5.76% Impervious Area

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

Subcatchment SB 16: SB 16



Summary for Subcatchment SB 17: SB 17

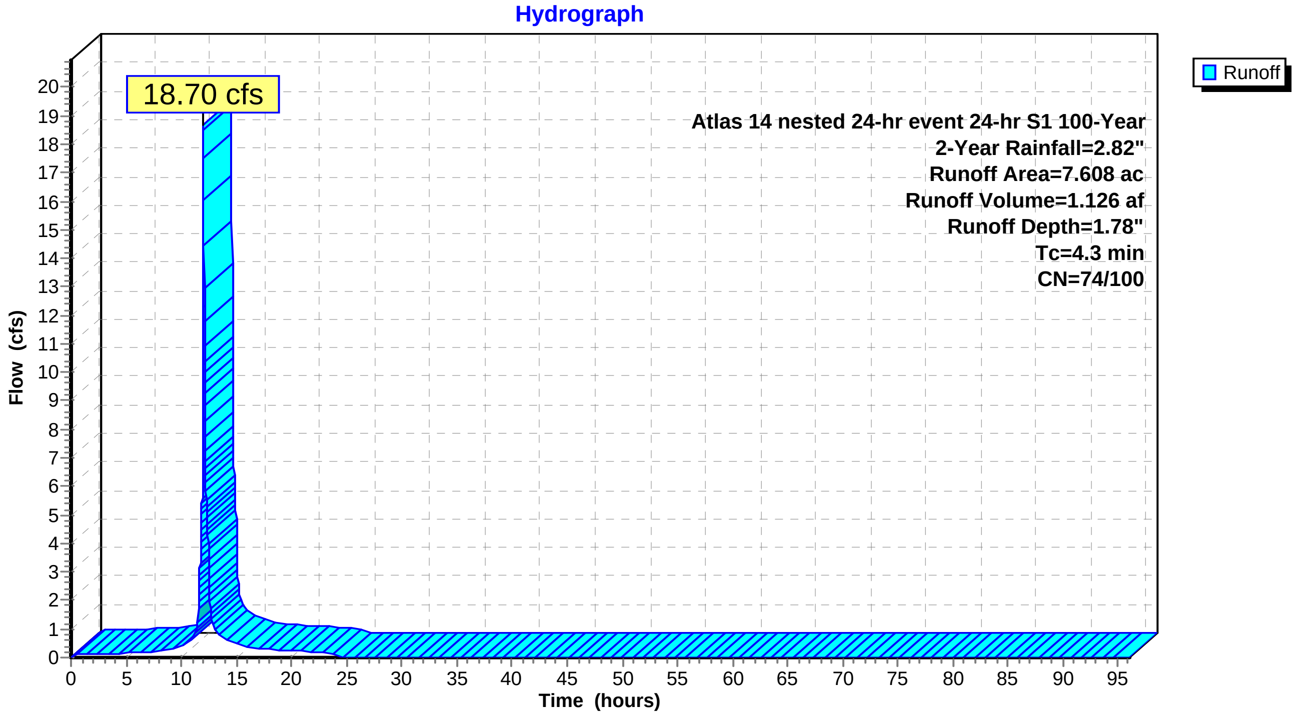
Runoff = 18.70 cfs @ 12.02 hrs, Volume= 1.126 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.925	74	pervious
*	3.683	100	impervious
	7.608	87	Weighted Average
	3.925		51.59% Pervious Area
	3.683		48.41% Impervious Area

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

Subcatchment SB 17: SB 17



Summary for Subcatchment SB 18: SB 18

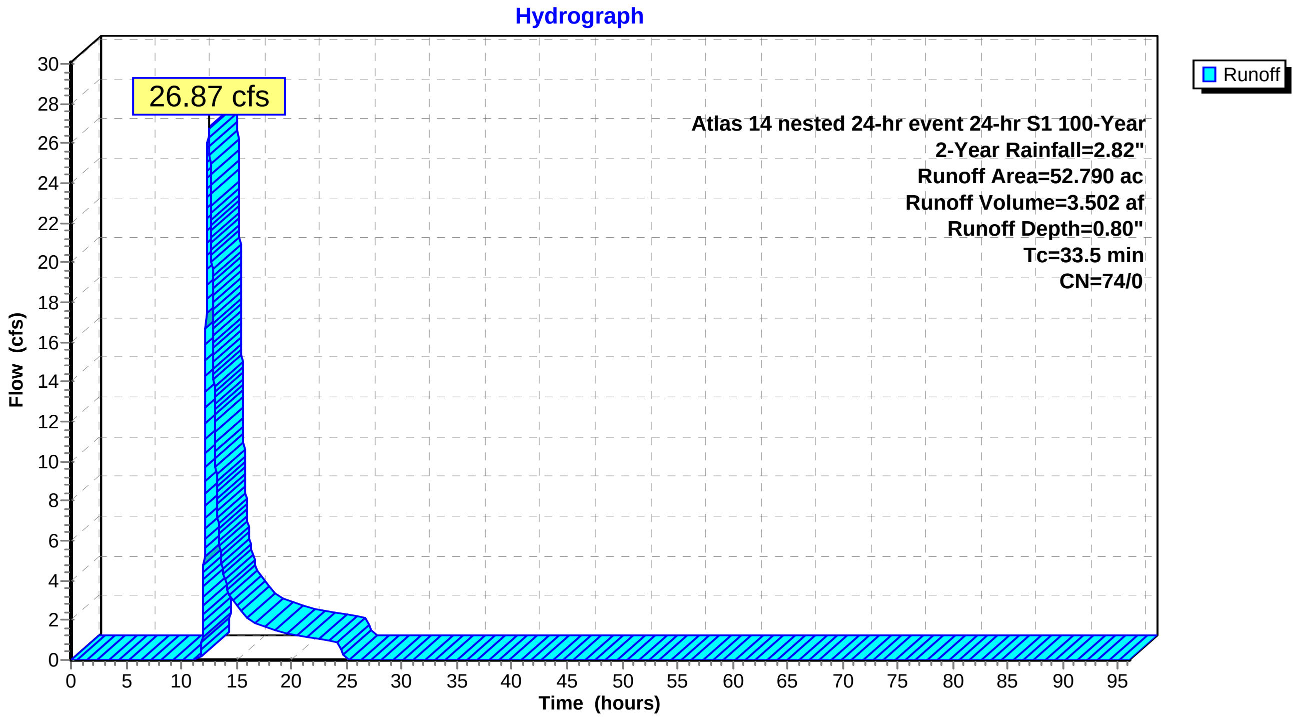
Runoff = 26.87 cfs @ 12.48 hrs, Volume= 3.502 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	52.790	74	pervious
*	0.000	98	impervious
	52.790	74	Weighted Average
	52.790		100.00% Pervious Area

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

Subcatchment SB 18: SB 18



Summary for Subcatchment SB 19: SB 19

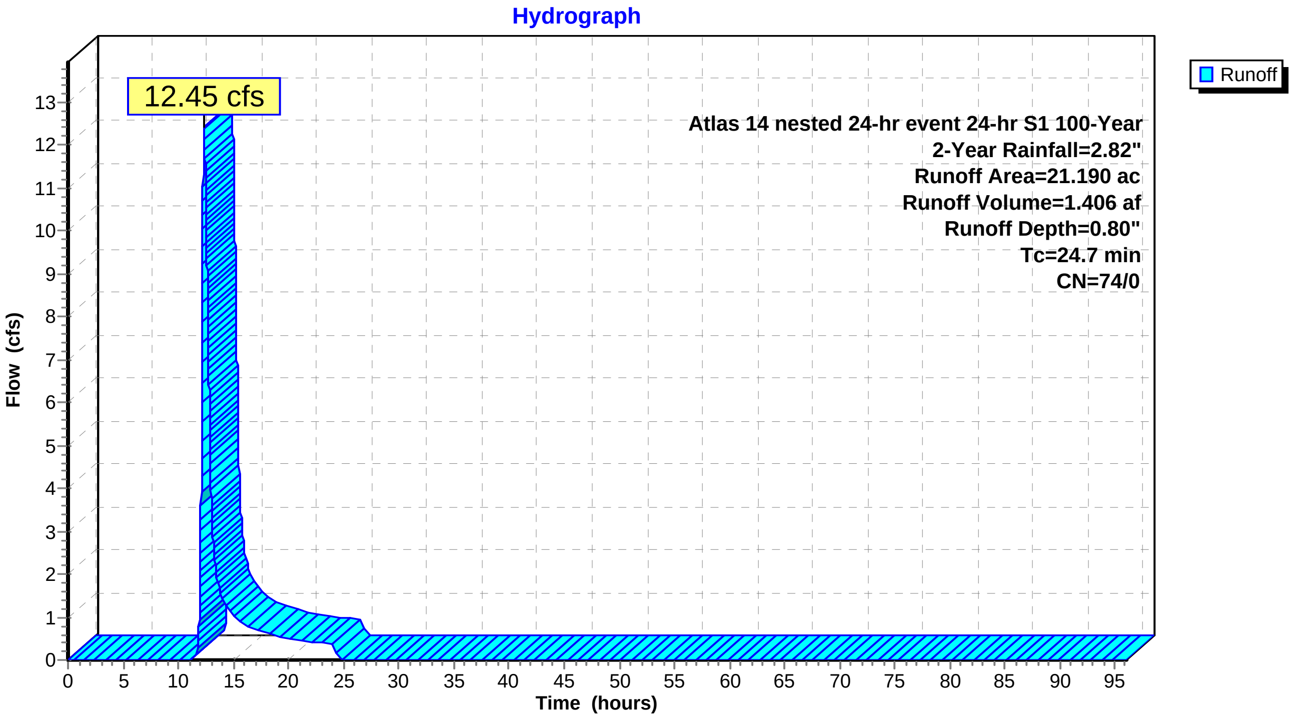
Runoff = 12.45 cfs @ 12.34 hrs, Volume= 1.406 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	21.190	74	pervious
*	0.000	98	impervious
	21.190	74	Weighted Average
	21.190		100.00% Pervious Area

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

Subcatchment SB 19: SB 19



Summary for Subcatchment SB 2: SB 2

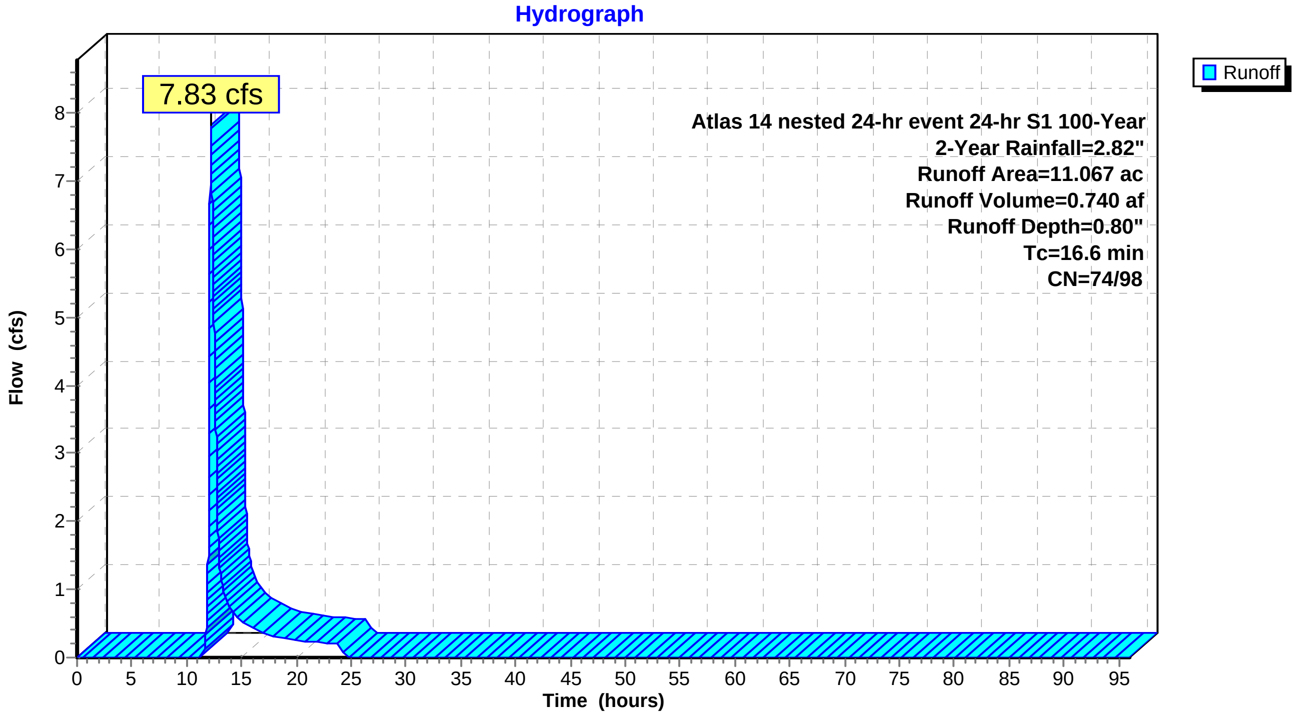
Runoff = 7.83 cfs @ 12.21 hrs, Volume= 0.740 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	11.030	74	pervious
*	0.037	98	impervious
	11.067	74	Weighted Average
	11.030		99.67% Pervious Area
	0.037		0.33% Impervious Area

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

Subcatchment SB 2: SB 2



Summary for Subcatchment SB 22: SB 22

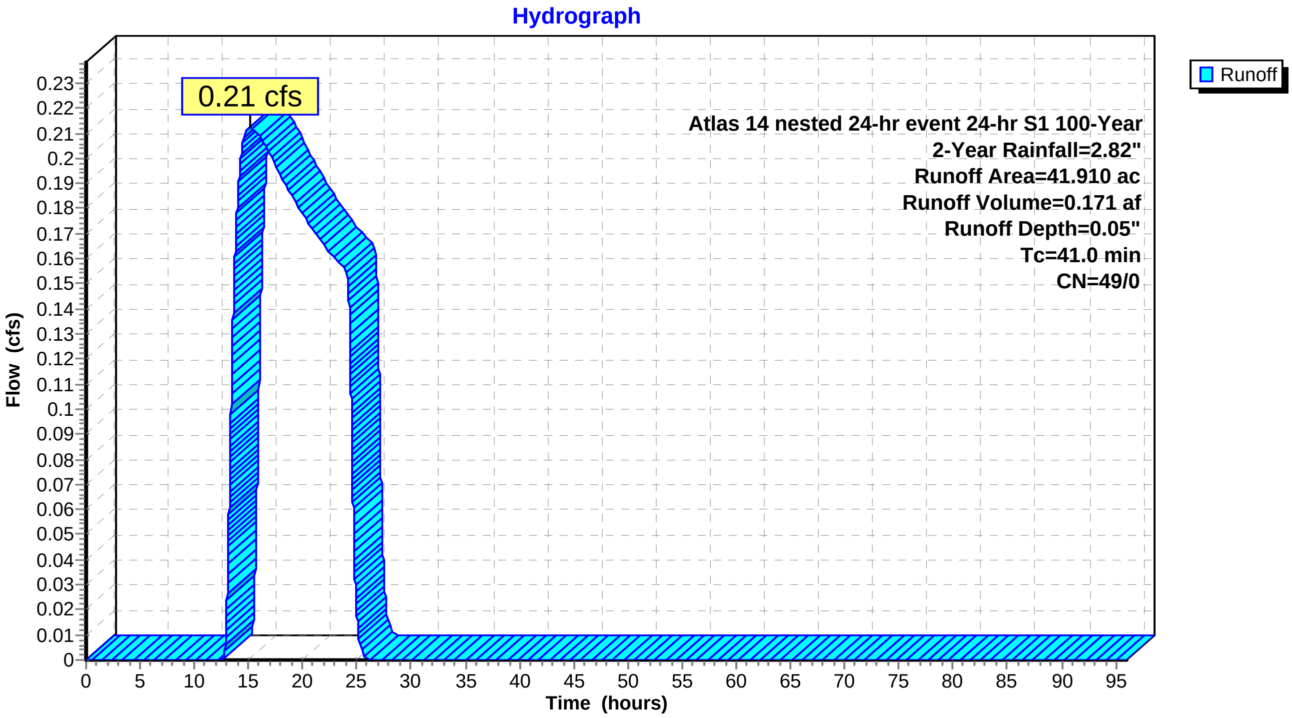
Runoff = 0.21 cfs @ 15.17 hrs, Volume= 0.171 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	41.910	49	Pervious
*	0.000	98	Impervious
	41.910	49	Weighted Average
	41.910		100.00% Pervious Area

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

Subcatchment SB 22: SB 22



Summary for Subcatchment SB 24: SB 24

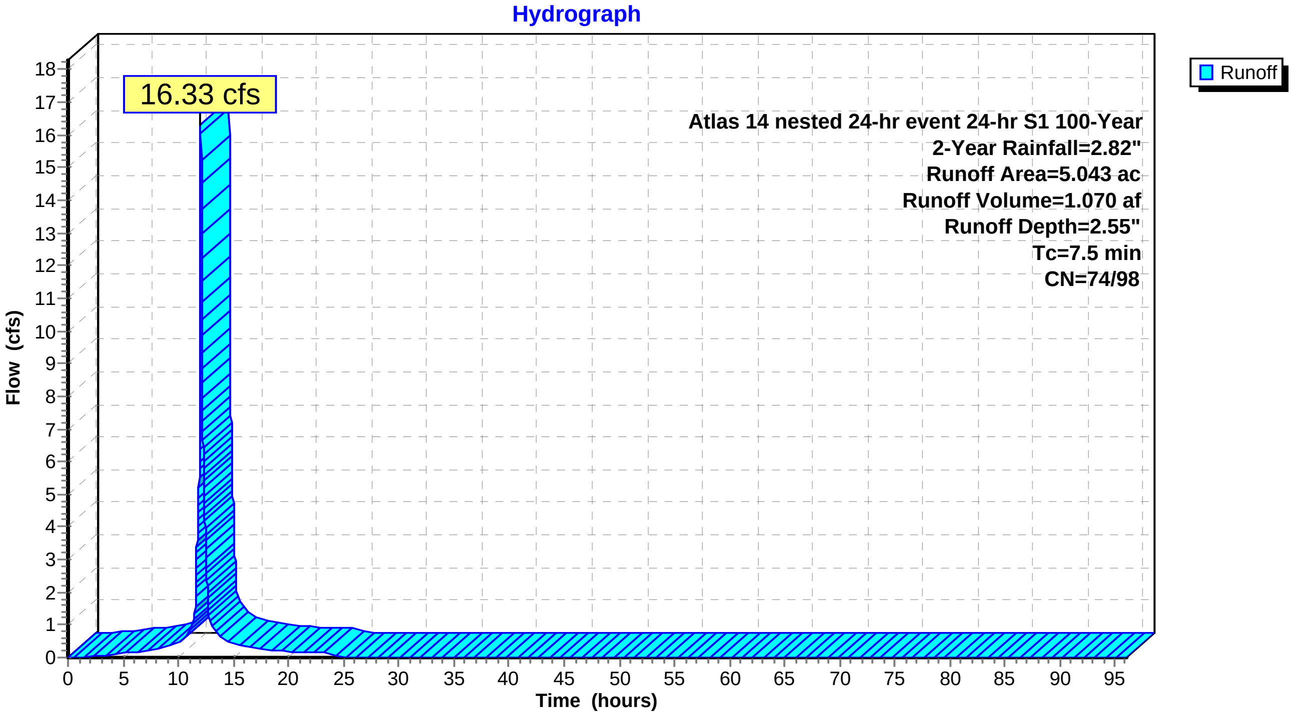
Runoff = 16.33 cfs @ 12.05 hrs, Volume= 1.070 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.123	74	permiable
*	4.920	98	impermiable
	5.043	97	Weighted Average
	0.123		2.44% Pervious Area
	4.920		97.56% Impervious Area

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

Subcatchment SB 24: SB 24



Summary for Subcatchment SB 25: SB 25

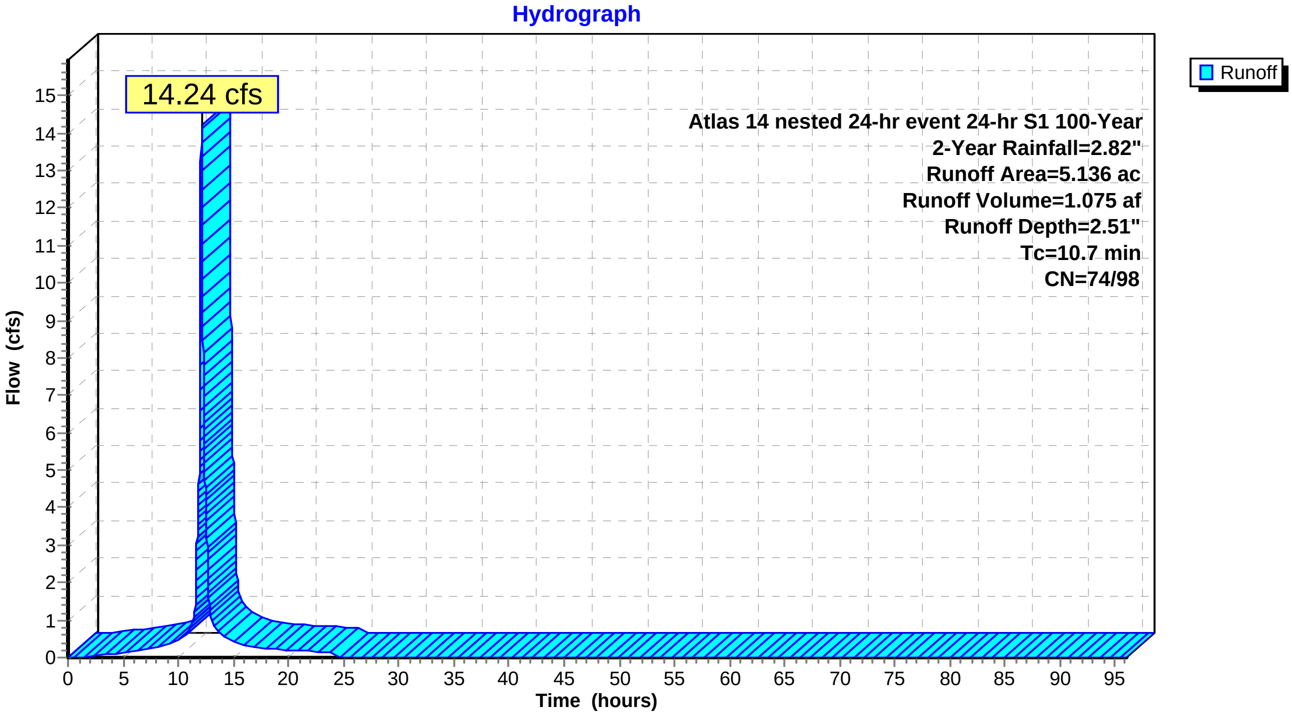
Runoff = 14.24 cfs @ 12.09 hrs, Volume= 1.075 af, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.220	74	pervious
*	4.916	98	impervious
	5.136	97	Weighted Average
	0.220		4.28% Pervious Area
	4.916		95.72% Impervious Area

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

Subcatchment SB 25: SB 25



Summary for Subcatchment SB 26: SB 26

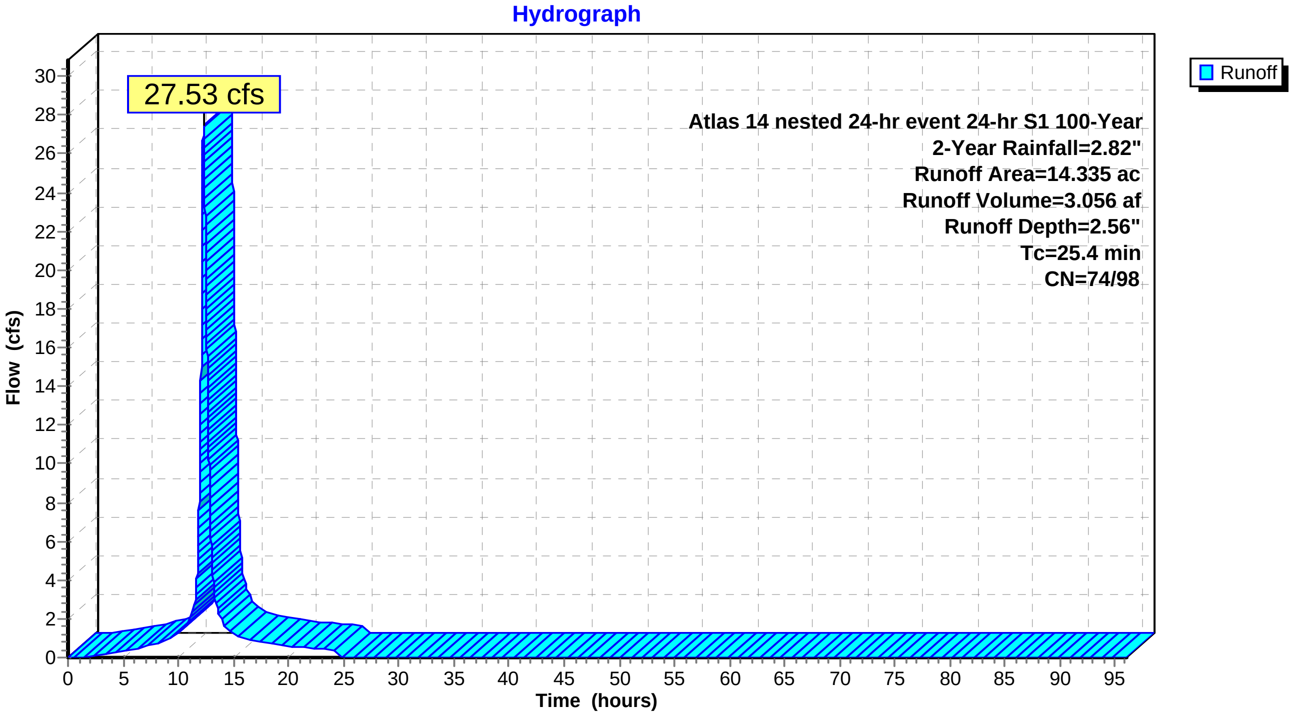
Runoff = 27.53 cfs @ 12.28 hrs, Volume= 3.056 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.248	74	pervious
*	14.087	98	impervious
	14.335	98	Weighted Average
	0.248		1.73% Pervious Area
	14.087		98.27% Impervious Area

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

Subcatchment SB 26: SB 26



Summary for Subcatchment SB 27: SB 27 (Thumb Road)

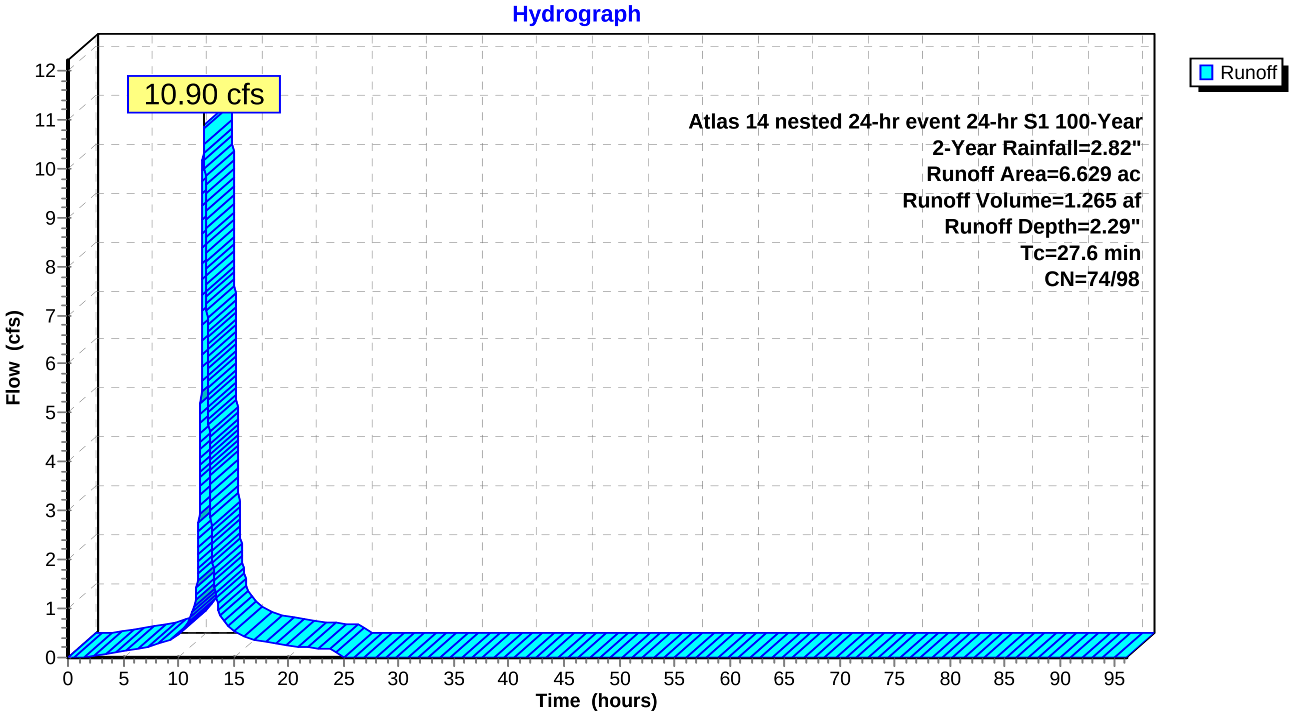
Runoff = 10.90 cfs @ 12.32 hrs, Volume= 1.265 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	1.105	74	Pervious
*	5.524	98	Impervious
	6.629	94	Weighted Average
	1.105		16.67% Pervious Area
	5.524		83.33% Impervious Area

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

Subcatchment SB 27: SB 27 (Thumb Road)



Summary for Subcatchment SB 28: SB 28

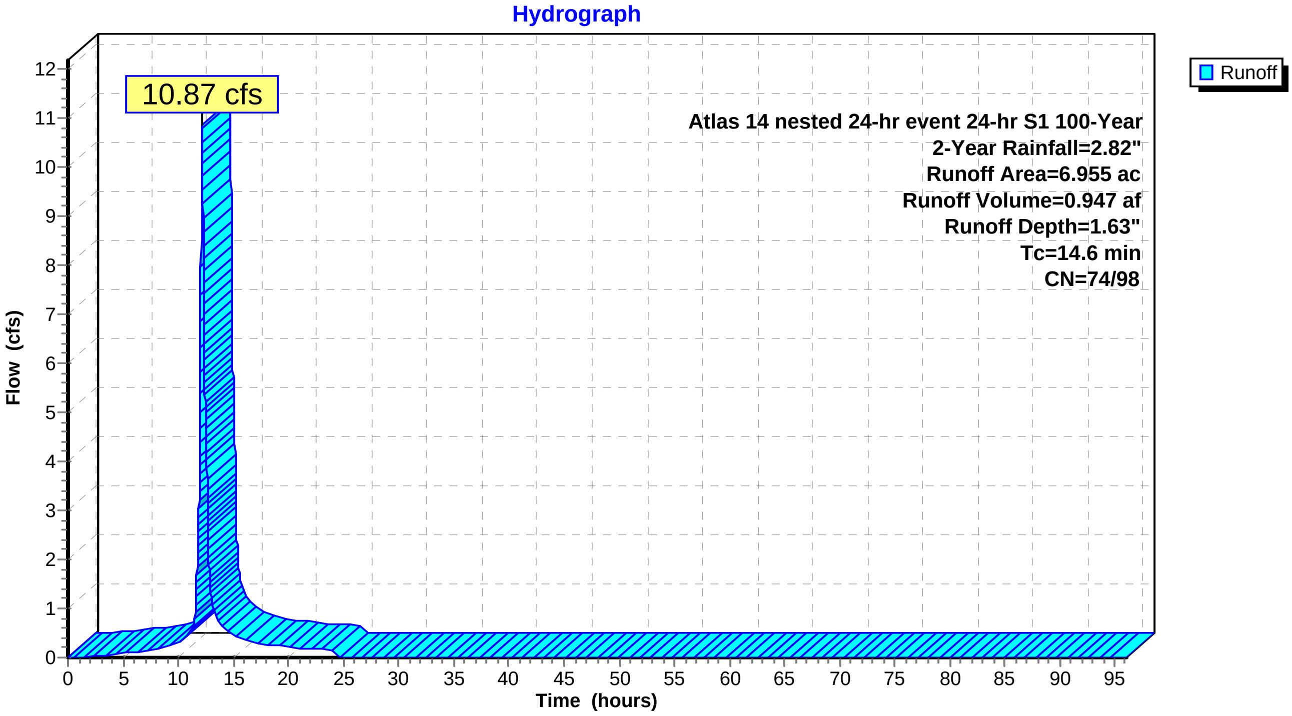
Runoff = 10.87 cfs @ 12.15 hrs, Volume= 0.947 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.703	74	pervious
*	3.252	98	impervious
	6.955	85	Weighted Average
	3.703		53.24% Pervious Area
	3.252		46.76% Impervious Area

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

Subcatchment SB 28: SB 28



Summary for Subcatchment SB 29: SB 29

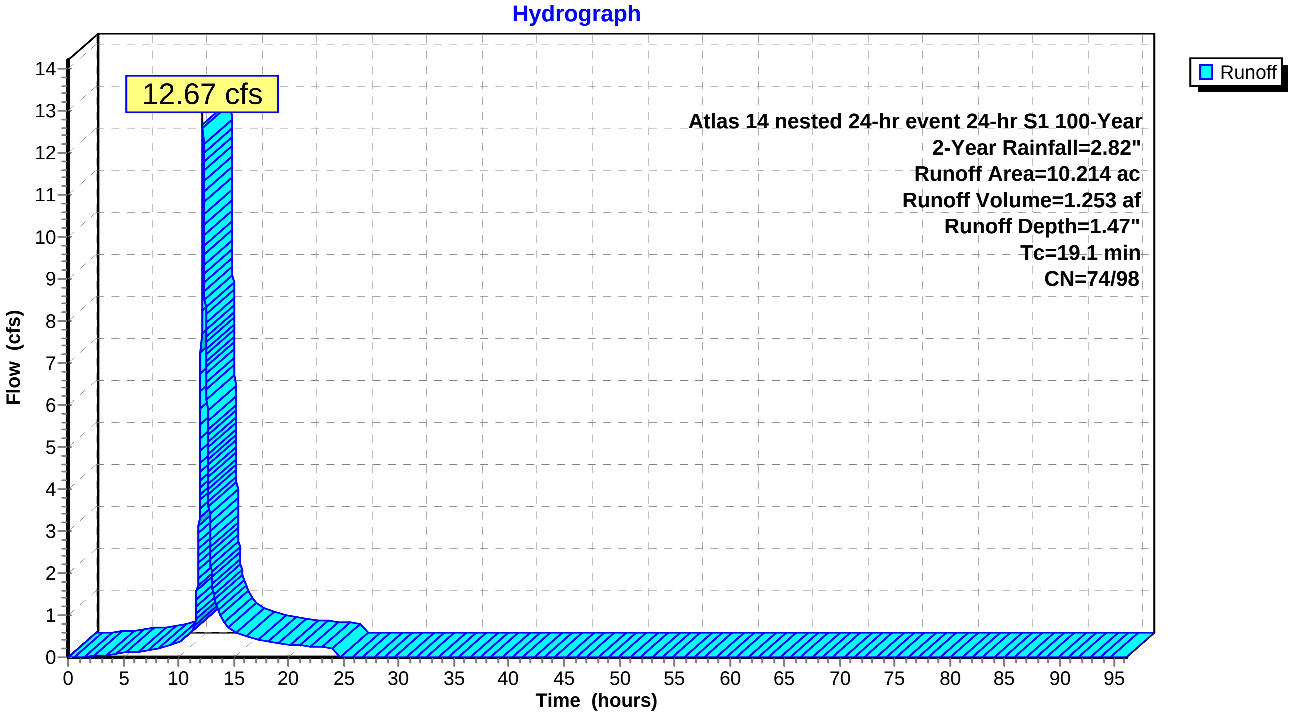
Runoff = 12.67 cfs @ 12.22 hrs, Volume= 1.253 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	6.360	74	pervious
*	3.854	98	impervious
	10.214	83	Weighted Average
	6.360		62.27% Pervious Area
	3.854		37.73% Impervious Area

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

Subcatchment SB 29: SB 29



Summary for Subcatchment SB 3: SB 3

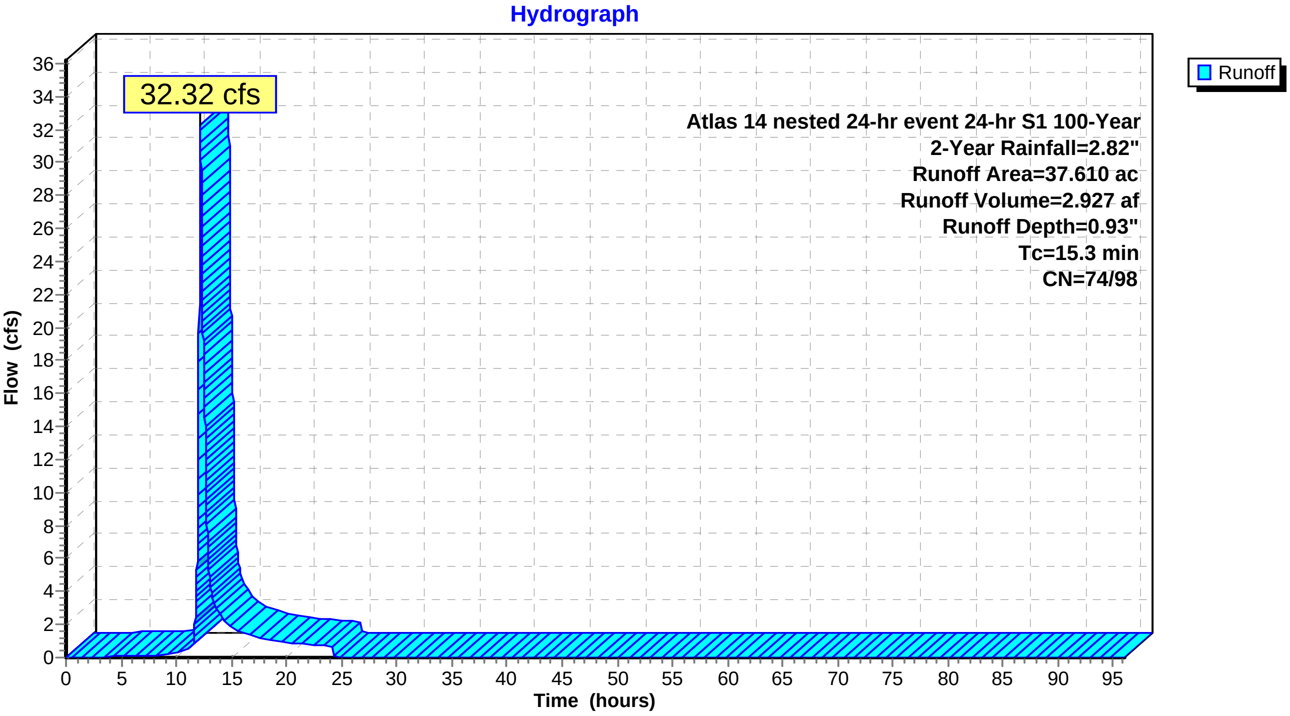
Runoff = 32.32 cfs @ 12.19 hrs, Volume= 2.927 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	34.720	74	Pervious
*	2.890	98	Impervious
	37.610	76	Weighted Average
	34.720		92.32% Pervious Area
	2.890		7.68% Impervious Area

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

Subcatchment SB 3: SB 3



Summary for Subcatchment SB 4: SB 4

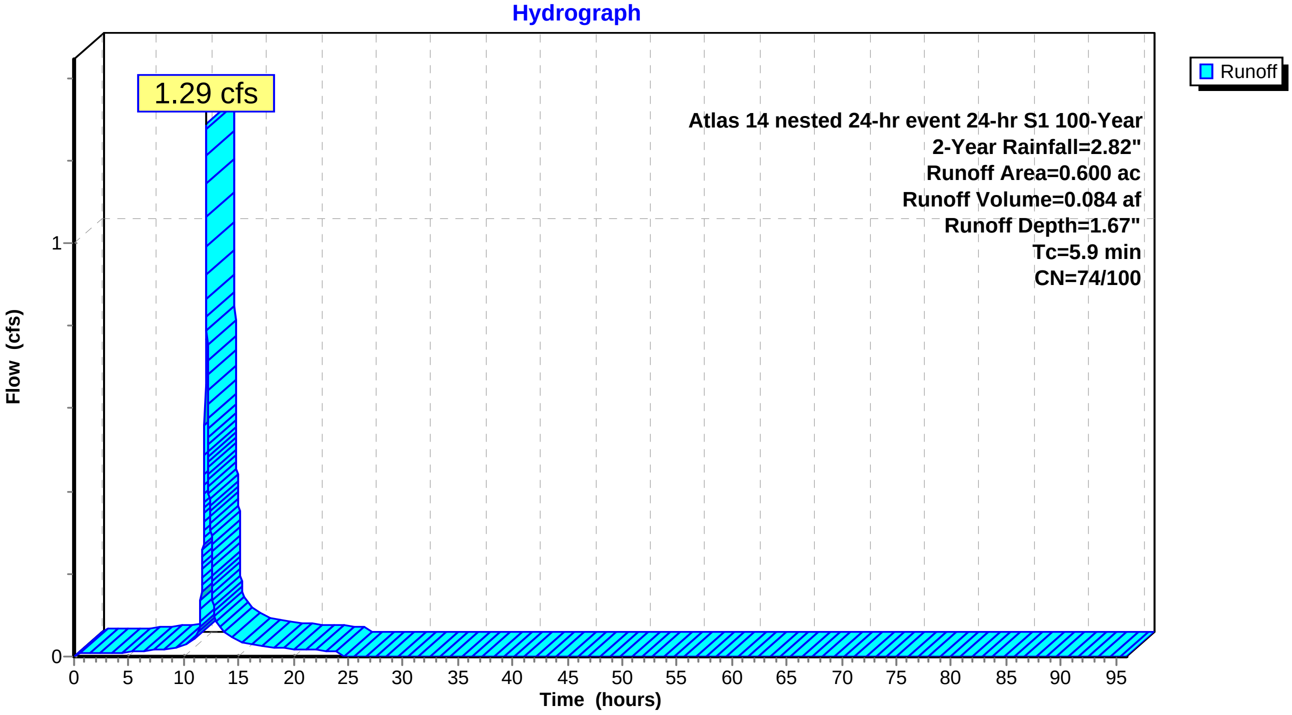
Runoff = 1.29 cfs @ 12.04 hrs, Volume= 0.084 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.340	74	pervious
*	0.260	100	impervious
	0.600	85	Weighted Average
	0.340		56.67% Pervious Area
	0.260		43.33% Impervious Area

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

Subcatchment SB 4: SB 4



Summary for Subcatchment SB 5: SB 5

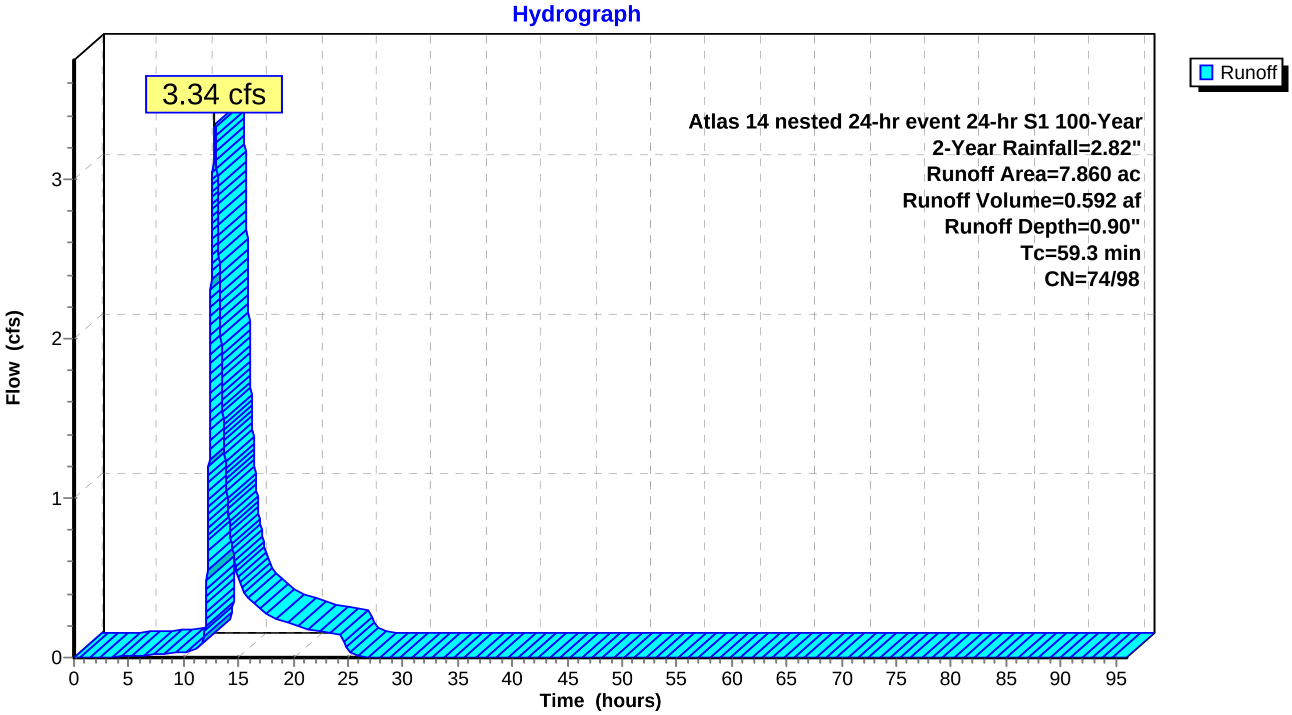
Runoff = 3.34 cfs @ 12.85 hrs, Volume= 0.592 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	7.390	74	pervious
*	0.470	98	impervious
	7.860	75	Weighted Average
	7.390		94.02% Pervious Area
	0.470		5.98% Impervious Area

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

Subcatchment SB 5: SB 5



Summary for Subcatchment SB 6: SB 6

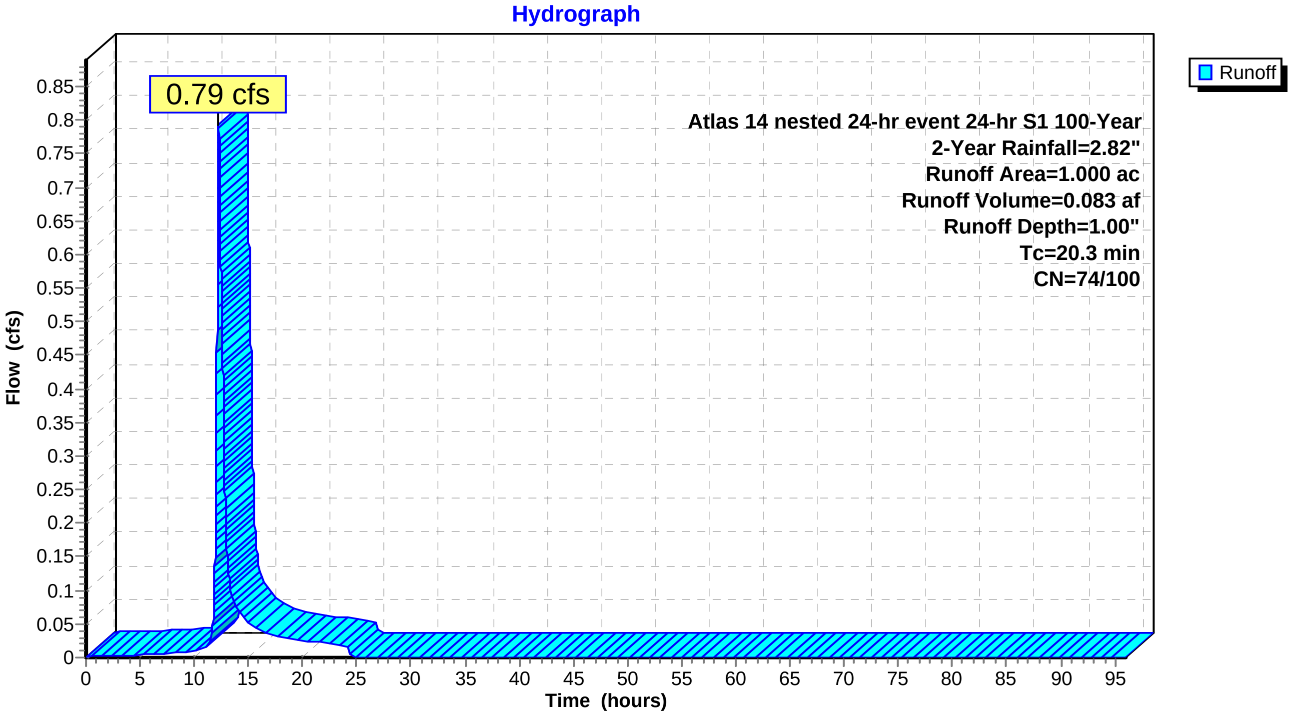
Runoff = 0.79 cfs @ 12.25 hrs, Volume= 0.083 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.900	74	pervious
*	0.100	100	impervious
	1.000	77	Weighted Average
	0.900		90.00% Pervious Area
	0.100		10.00% Impervious Area

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

Subcatchment SB 6: SB 6



Summary for Subcatchment SB 7: SB 7

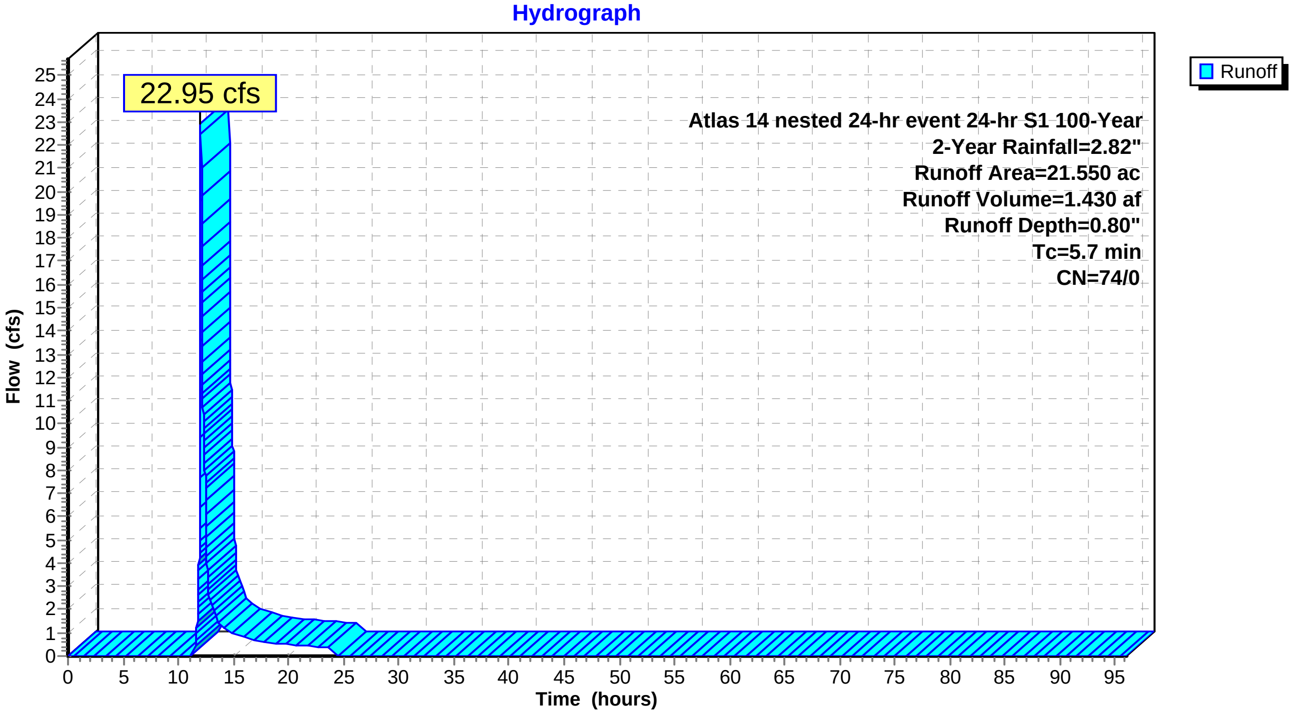
Runoff = 22.95 cfs @ 12.04 hrs, Volume= 1.430 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	21.550	74	pervious
*	0.000	98	impervious
	21.550	74	Weighted Average
	21.550		100.00% Pervious Area

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

Subcatchment SB 7: SB 7



Summary for Subcatchment SB 8: SB 8

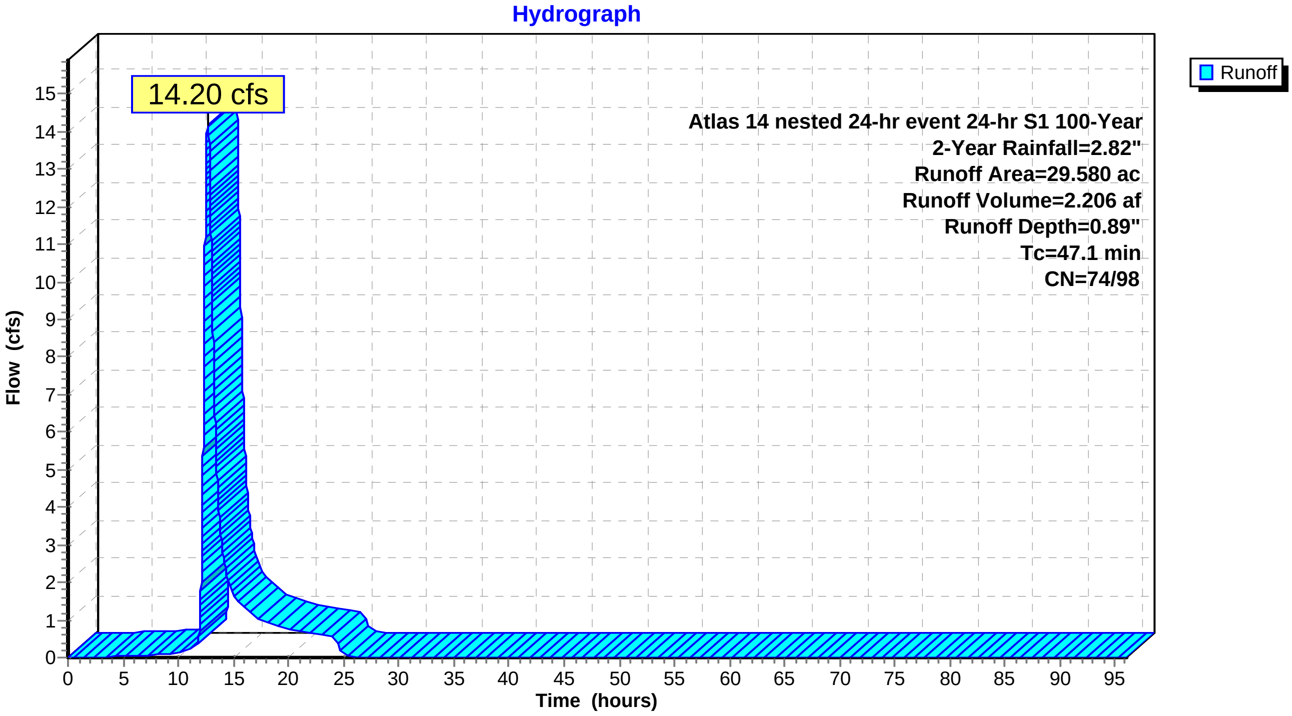
Runoff = 14.20 cfs @ 12.67 hrs, Volume= 2.206 af, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	27.950	74	pervious
*	1.630	98	impervious
	29.580	75	Weighted Average
	27.950		94.49% Pervious Area
	1.630		5.51% Impervious Area

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

Subcatchment SB 8: SB 8



Summary for Subcatchment SB 9: SB 9

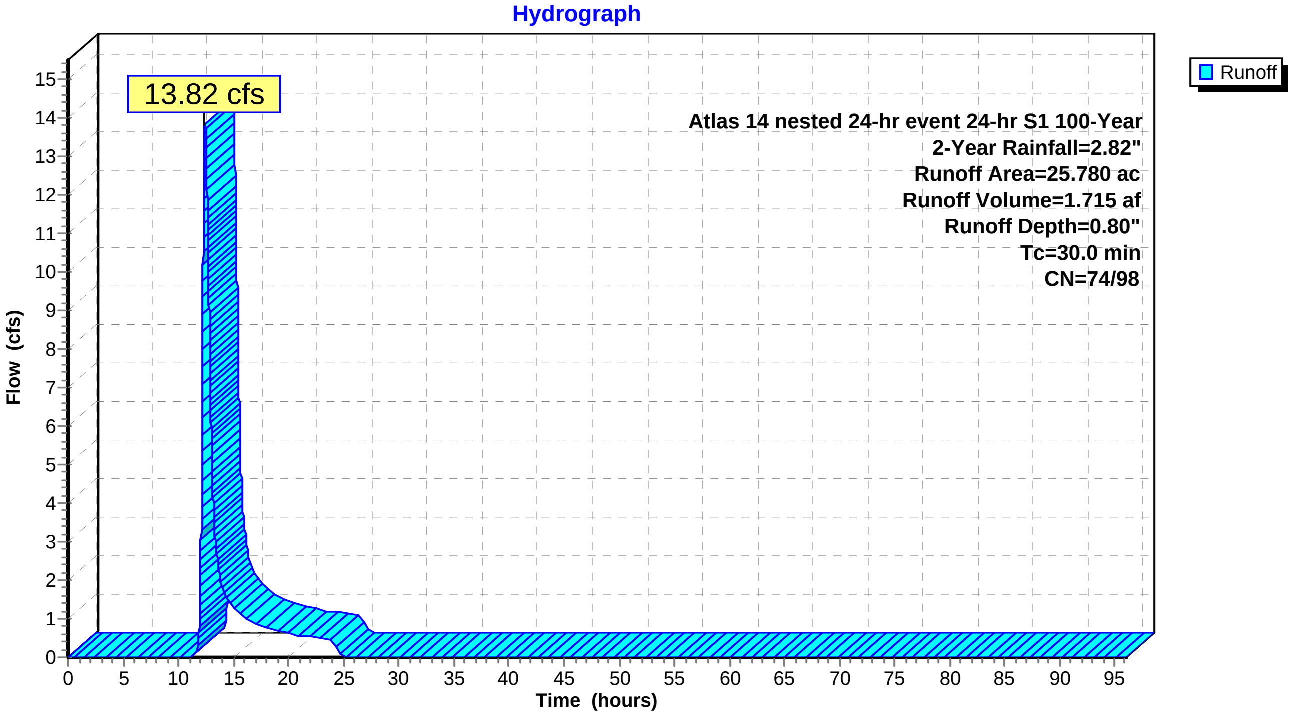
Runoff = 13.82 cfs @ 12.43 hrs, Volume= 1.715 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	25.750	74	permiable
*	0.030	98	impermiable
	25.780	74	Weighted Average
	25.750		99.88% Pervious Area
	0.030		0.12% Impervious Area

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

Subcatchment SB 9: SB 9



Summary for Subcatchment SB10: SB 10

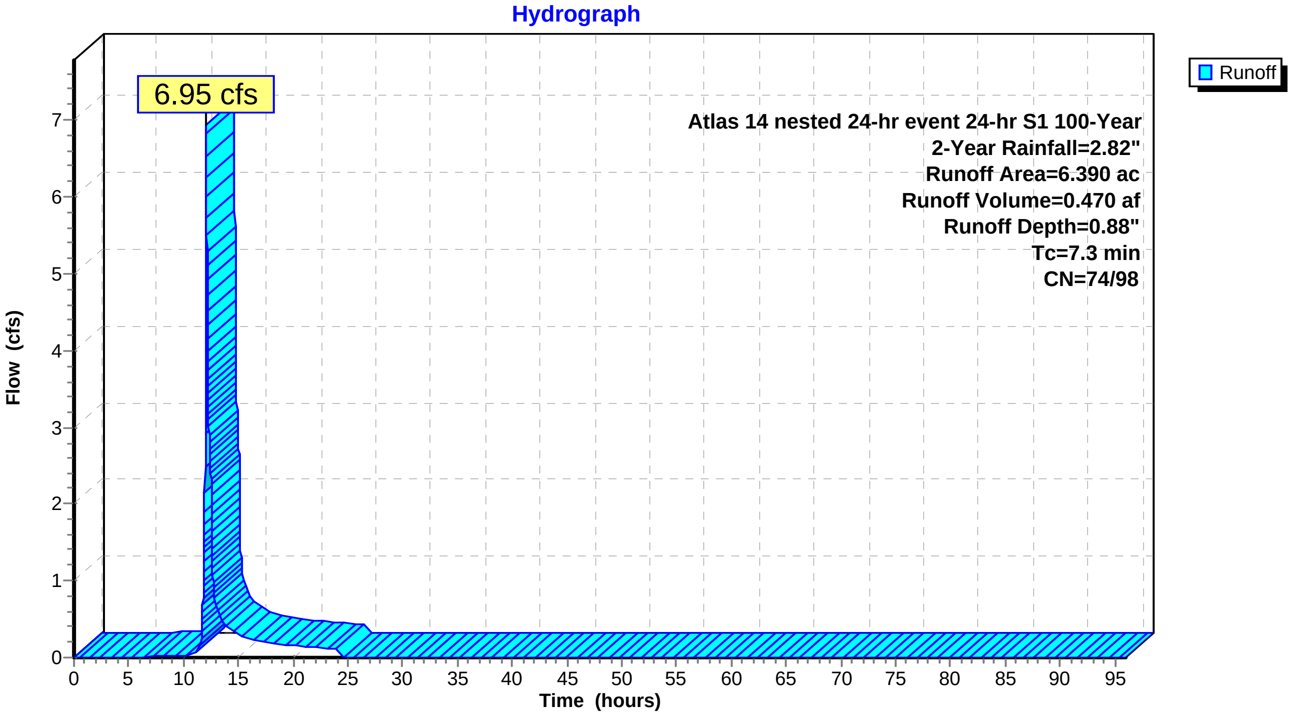
Runoff = 6.95 cfs @ 12.06 hrs, Volume= 0.470 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	6.080	74	pervious
*	0.310	98	impervious
	6.390	75	Weighted Average
	6.080		95.15% Pervious Area
	0.310		4.85% Impervious Area

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

Subcatchment SB10: SB 10



Summary for Pond 2 P: P-2

Inflow Area = 68.260 ac, 7.26% Impervious, Inflow Depth = 0.93" for 2-Year event
Inflow = 25.48 cfs @ 12.57 hrs, Volume= 5.269 af
Outflow = 25.29 cfs @ 12.69 hrs, Volume= 5.269 af, Atten= 1%, Lag= 6.8 min
Primary = 25.29 cfs @ 12.69 hrs, Volume= 5.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 924.00' Surf.Area= 0.370 ac Storage= 0.730 af
Peak Elev= 924.73' @ 12.69 hrs Surf.Area= 0.417 ac Storage= 1.016 af (0.286 af above start)

Plug-Flow detention time= 138.8 min calculated for 4.539 af (86% of inflow)
Center-of-Mass det. time= 37.3 min (912.7 - 875.4)

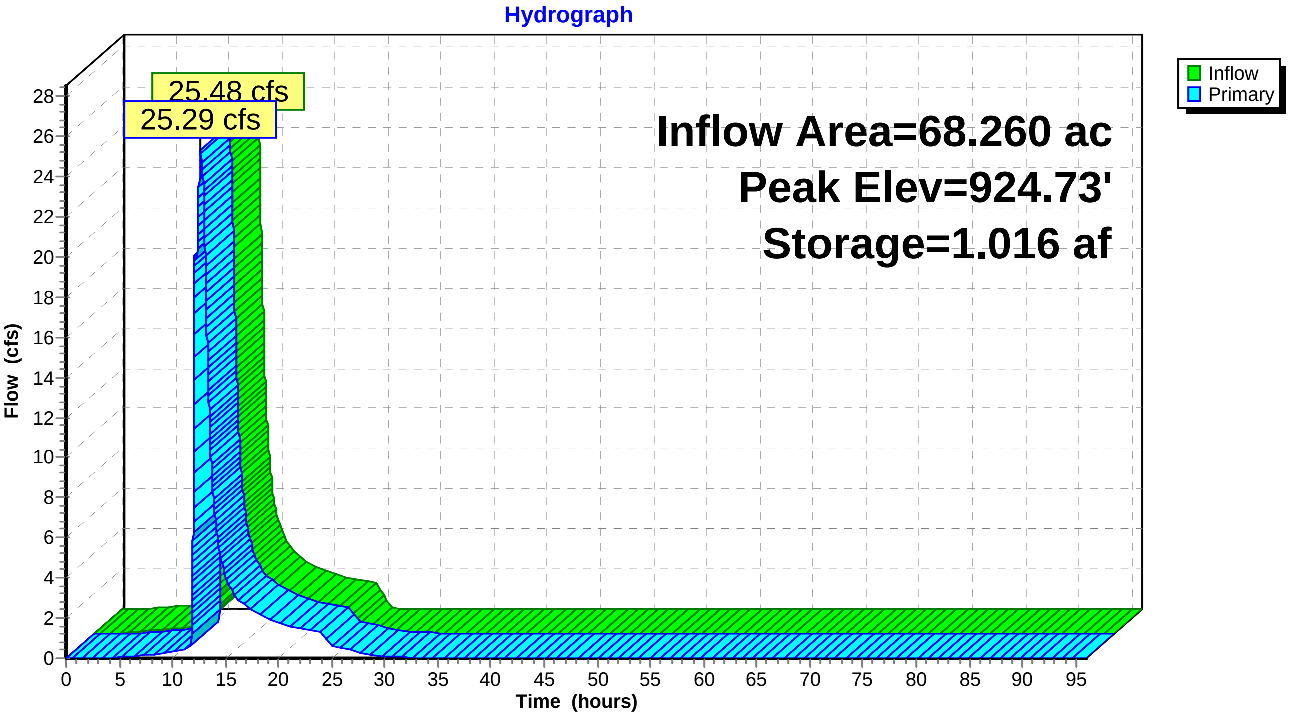
Volume	Invert	Avail.Storage	Storage Description
#1	920.00'	1.600 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
920.00	0.100	0.000	0.000
922.00	0.130	0.230	0.230
924.00	0.370	0.500	0.730
926.00	0.500	0.870	1.600

Device	Routing	Invert	Outlet Devices
#1	Primary	924.40'	**40.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	924.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=25.29 cfs @ 12.69 hrs HW=924.73' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 24.48 cfs @ 1.87 fps)
└—**2=Orifice/Grate** (Orifice Controls 0.81 cfs @ 4.11 fps)

Pond 2 P: P-2


Hydrograph
25.48 cfs
25.29 cfs
Inflow Area=68.260 ac
Peak Elev=924.73'
Storage=1.016 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 4P: P-4

```
Inflow Area =        7.860 ac,    5.98% Impervious,  Inflow Depth =   0.90"    for  2-Year event
Inflow       =       3.34 cfs @   12.85 hrs,  Volume=            0.592 af
Outflow      =       2.04 cfs @   13.38 hrs,  Volume=            0.592 af,  Atten= 39%,  Lag= 31.9 min
Primary      =       0.63 cfs @   13.38 hrs,  Volume=            0.211 af
Secondary =          1.41 cfs @   13.38 hrs,  Volume=            0.381 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00'   Surf.Area= 0.275 ac   Storage= 0.646 af
Peak Elev= 915.44' @ 13.38 hrs   Surf.Area= 0.299 ac   Storage= 0.773 af   (0.127 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 50.2 min ( 948.0 - 897.8 )

Volume       Invert    Avail.Storage    Storage Description
   #1        910.90'        1.728 af    Custom Stage Data (Prismatic)Listed below (Recalc)

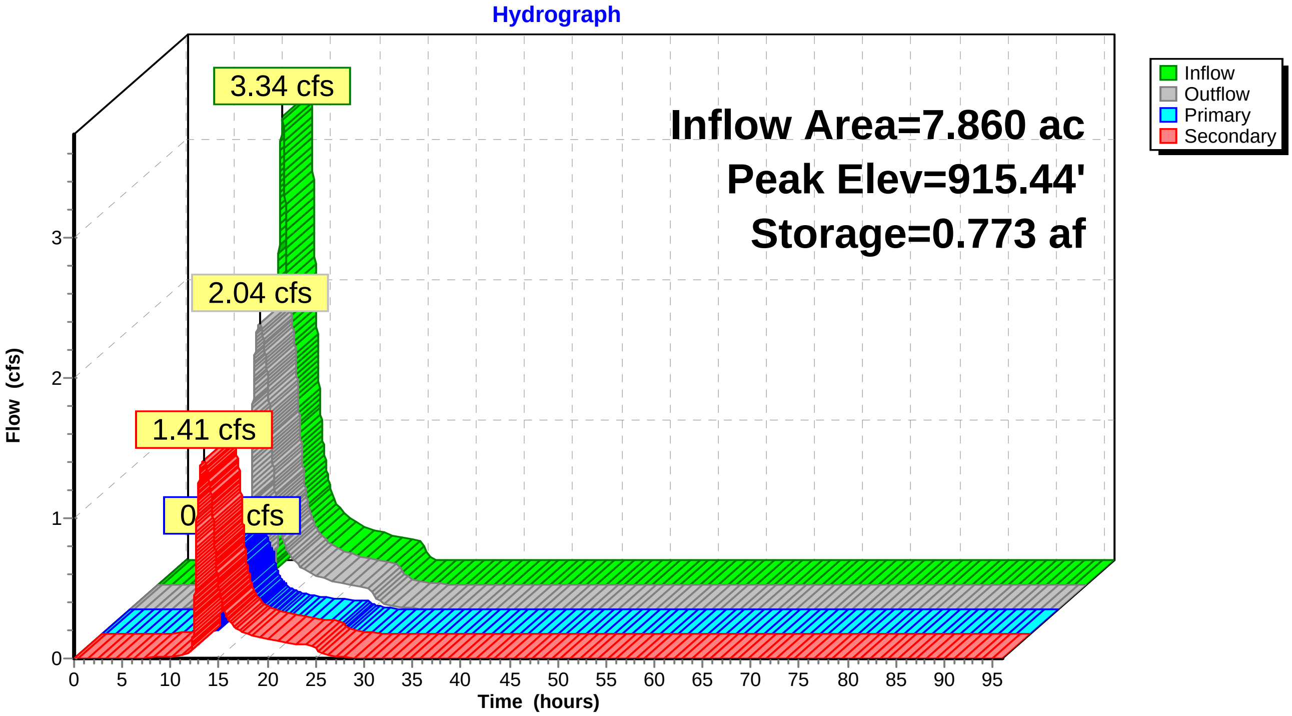
 Elevation      Surf.Area        Inc.Store        Cum.Store
    (feet)        (acres)      (acre-feet)      (acre-feet)
    910.90          0.070            0.000            0.000
    912.00          0.090            0.088            0.088
    914.00          0.220            0.310            0.398
    916.00          0.330            0.550            0.948
    918.00          0.450            0.780            1.728

Device   Routing            Invert   Outlet Devices
   #1    Primary           915.00'   6.0" Horiz. Orifice/Grate   C= 0.600
                                     Limited to weir flow at low heads
   #2    Secondary         915.00'   9.0" Horiz. Orifice/Grate   C= 0.600
                                     Limited to weir flow at low heads
   #3    Primary           915.95'   24.0"  Round RCP_Round  24"
                                     L= 50.0'   RCP, groove end w/headwall,  Ke= 0.200
                                     Inlet / Outlet Invert= 915.80' / 915.95'   S= -0.0030 '/'   Cc= 0.900
                                     n= 0.013,  Flow Area= 3.14 sf

Primary OutFlow  Max=0.63 cfs @ 13.38 hrs  HW=915.44'  TW=0.00'   (Dynamic Tailwater)
├─1=Orifice/Grate  (Orifice Controls 0.63 cfs @ 3.20 fps)
└─3=RCP_Round  24"  ( Controls 0.00 cfs)

Secondary OutFlow  Max=1.41 cfs @ 13.38 hrs  HW=915.44'  TW=914.92'   (Dynamic Tailwater)
└─2=Orifice/Grate  (Orifice Controls 1.41 cfs @ 3.20 fps)
```

Pond 4P: P-4


Hydrograph
Inflow Area=7.860 ac
Peak Elev=915.44'
Storage=0.773 af
3.34 cfs
2.04 cfs
1.41 cfs
0
cfs
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
1
2
3
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 7P: P-7

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 29.580 ac, 5.51% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 14.20 cfs @ 12.67 hrs, Volume= 2.206 af
Outflow = 14.39 cfs @ 12.74 hrs, Volume= 2.206 af, Atten= 0%, Lag= 4.4 min
Primary = 14.39 cfs @ 12.74 hrs, Volume= 2.206 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.440 ac Storage= 1.062 af
Peak Elev= 915.29' @ 12.69 hrs Surf.Area= 0.475 ac Storage= 1.196 af (0.134 af above start)

Plug-Flow detention time= 279.4 min calculated for 1.144 af (52% of inflow)
Center-of-Mass det. time= 12.1 min (900.0 - 887.9)

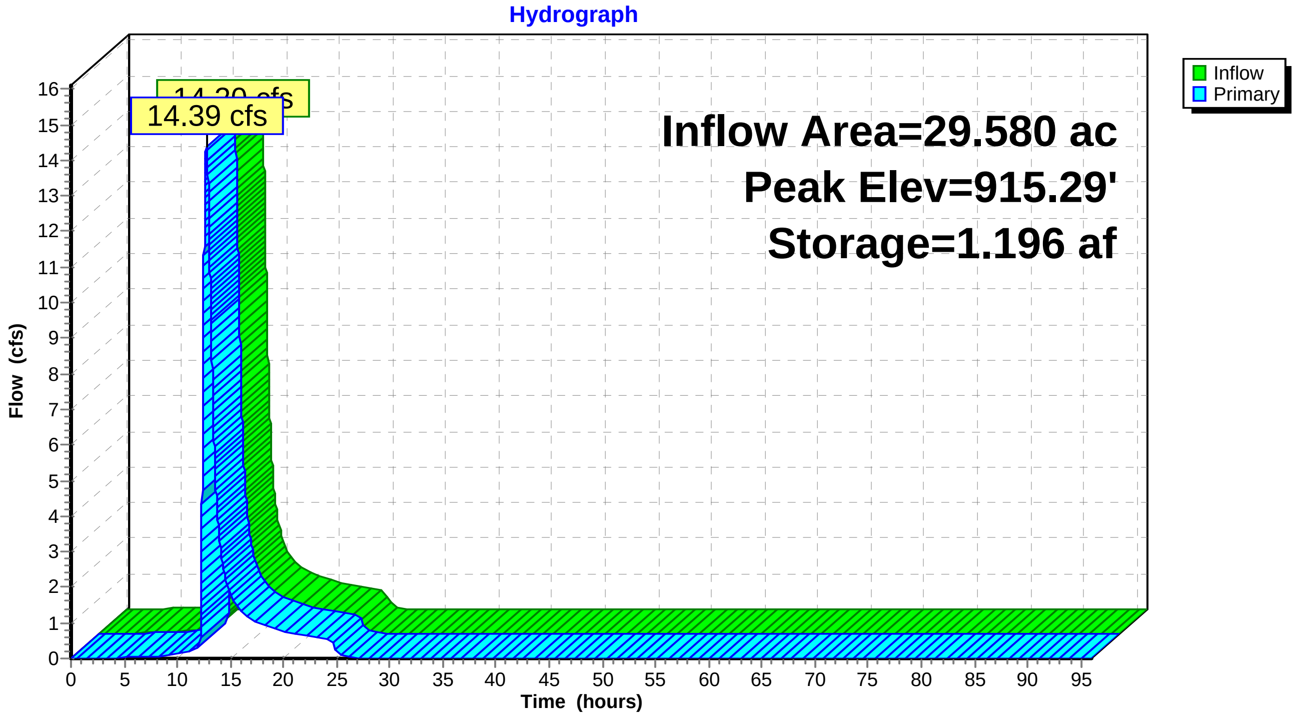
Volume	Invert	Avail.Storage	Storage Description
#1	910.95'	1.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.95	0.110	0.000	0.000
912.00	0.180	0.152	0.152
914.00	0.340	0.520	0.672
915.00	0.440	0.390	1.062
916.00	0.560	0.500	1.562

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**75.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=14.52 cfs @ 12.74 hrs HW=915.29' TW=915.26' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 14.52 cfs @ 0.67 fps)

Pond 7P: P-7


Hydrograph
14.20 cfs
14.39 cfs
Inflow Area=29.580 ac
Peak Elev=915.29'
Storage=1.196 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 8P: P-8

Inflow Area = 6.390 ac, 4.85% Impervious, Inflow Depth = 0.88" for 2-Year event
Inflow = 6.95 cfs @ 12.06 hrs, Volume= 0.470 af
Outflow = 1.19 cfs @ 12.61 hrs, Volume= 0.465 af, Atten= 83%, Lag= 32.9 min
Primary = 1.19 cfs @ 12.61 hrs, Volume= 0.465 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 897.00' Surf.Area= 0.300 ac Storage= 0.495 af
Peak Elev= 897.58' @ 12.65 hrs Surf.Area= 0.387 ac Storage= 0.694 af (0.199 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 260.3 min (1,113.1 - 852.8)

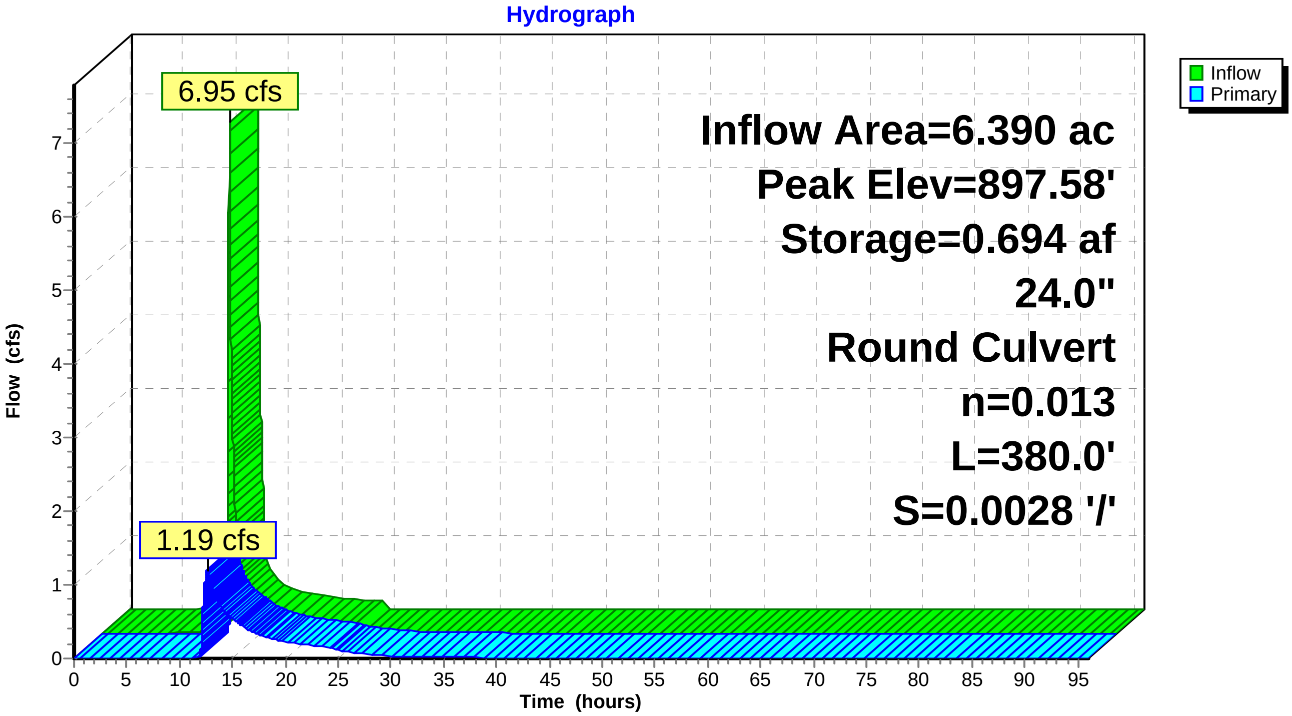
Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	1.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
893.00	0.030	0.000	0.000
894.00	0.070	0.050	0.050
896.00	0.150	0.220	0.270
897.00	0.300	0.225	0.495
898.00	0.450	0.375	0.870
900.00	0.530	0.980	1.850

Device	Routing	Invert	Outlet Devices
#1	Primary	897.00'	**24.0" Round RCP_Round 24"** L= 380.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 897.00' / 895.94' S= 0.0028 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=1.19 cfs @ 12.61 hrs HW=897.58' TW=896.49' (Dynamic Tailwater)
↰**1=RCP_Round 24"** (Outlet Controls 1.19 cfs @ 2.36 fps)

Pond 8P: P-8


Hydrograph
6.95 cfs
1.19 cfs
Inflow Area=6.390 ac
Peak Elev=897.58'
Storage=0.694 af
24.0"
Round Culvert
n=0.013
L=380.0'
S=0.0028 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
5
6
7
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 9P: P-9

[80] Warning: Exceeded Pond 7P by 0.01' @ 12.19 hrs (2.42 cfs 0.050 af)

Inflow Area = 55.360 ac, 3.00% Impervious, Inflow Depth = 0.85" for 2-Year event
Inflow = 25.40 cfs @ 12.62 hrs, Volume= 3.921 af
Outflow = 25.36 cfs @ 12.64 hrs, Volume= 3.921 af, Atten= 0%, Lag= 1.0 min
Primary = 25.36 cfs @ 12.64 hrs, Volume= 3.921 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.210 ac Storage= 0.353 af
Peak Elev= 915.26' @ 12.64 hrs Surf.Area= 0.262 ac Storage= 0.414 af (0.061 af above start)

Plug-Flow detention time= 68.6 min calculated for 3.568 af (91% of inflow)
Center-of-Mass det. time= 2.9 min (898.1 - 895.1)

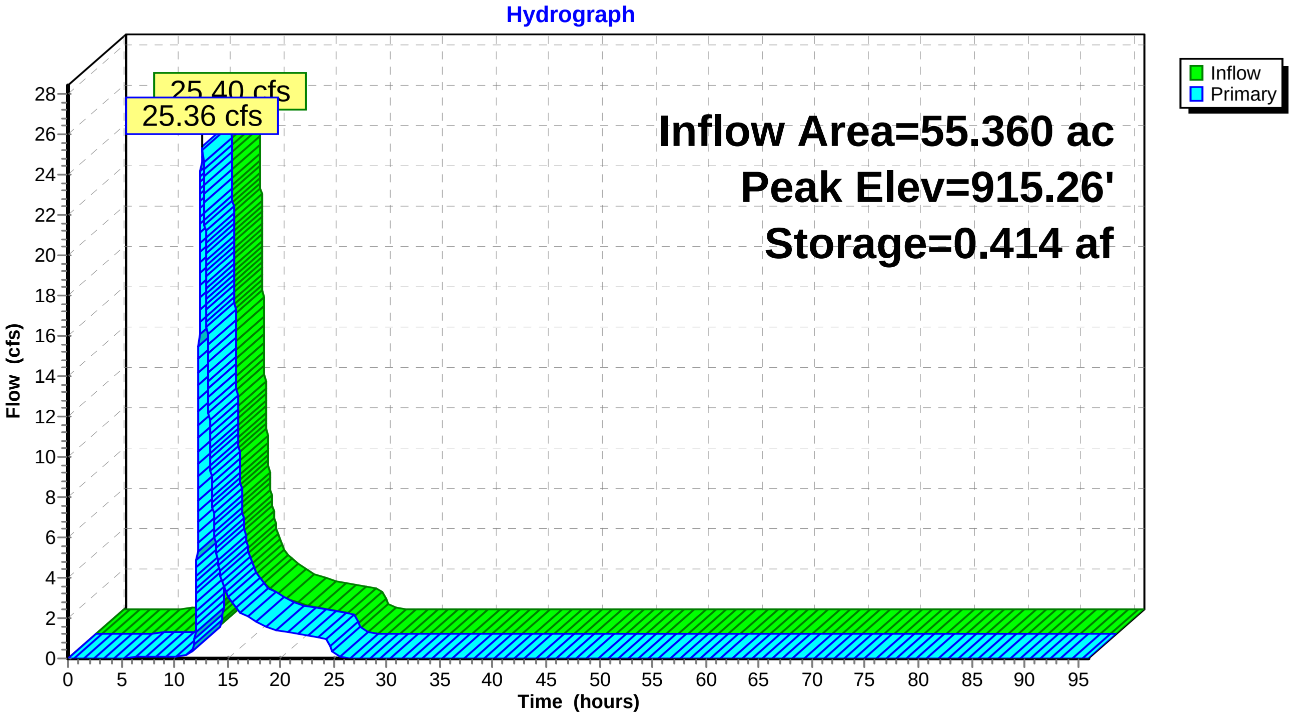
Volume	Invert	Avail.Storage	Storage Description
#1	910.50'	1.673 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.50	0.020	0.000	0.000
912.00	0.050	0.052	0.052
913.00	0.070	0.060	0.112
914.00	0.100	0.085	0.198
915.00	0.210	0.155	0.353
916.00	0.410	0.310	0.662
918.00	0.600	1.010	1.673

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**80.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=25.36 cfs @ 12.64 hrs HW=915.26' TW=909.74' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 25.36 cfs @ 1.22 fps)

Pond 9P: P-9


Hydrograph
25.40 cfs
25.36 cfs
Inflow Area=55.360 ac
Peak Elev=915.26'
Storage=0.414 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 10P: P-10 Lowered 1 ft

Inflow Area =	66.430 ac,	5.22% Impervious,	Inflow Depth > 0.67"	for 2-Year event		
Inflow =	6.10 cfs @	13.48 hrs,	Volume=	3.683 af		
Outflow =	5.76 cfs @	13.93 hrs,	Volume=	3.682 af,	Atten= 6%,	Lag= 26.8 min
Primary =	5.76 cfs @	13.93 hrs,	Volume=	3.682 af		
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 896.00' Surf.Area= 0.290 ac Storage= 0.700 af
Peak Elev= 896.83' @ 13.93 hrs Surf.Area= 0.323 ac Storage= 0.954 af (0.254 af above start)

Plug-Flow detention time= 239.7 min calculated for 2.982 af (81% of inflow)
Center-of-Mass det. time= 42.5 min (1,113.2 - 1,070.7)

Volume	Invert	Avail.Storage	Storage Description
#1	892.00'	1.760 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

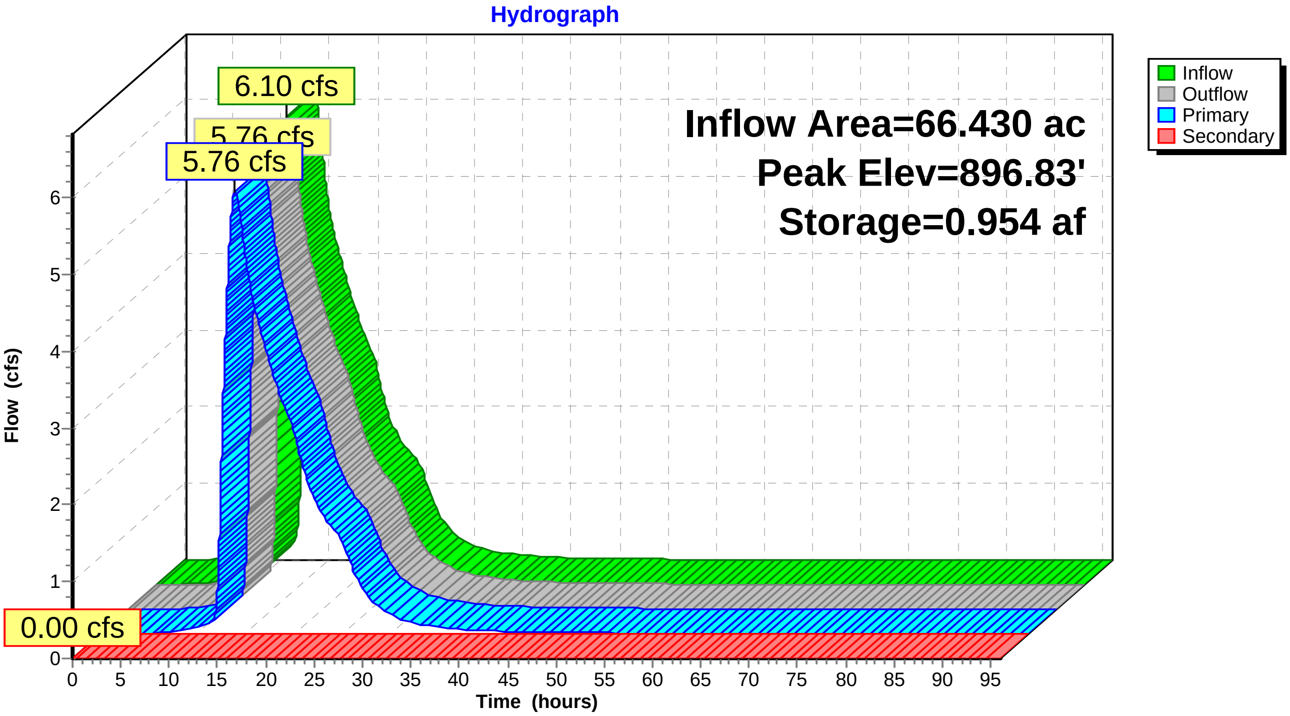
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
892.00	0.120	0.000	0.000
893.00	0.140	0.130	0.130
895.00	0.190	0.330	0.460
896.00	0.290	0.240	0.700
897.00	0.330	0.310	1.010
899.00	0.420	0.750	1.760

Device	Routing	Invert	Outlet Devices
#1	Primary	896.00'	**2.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	897.40'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.76 cfs @ 13.93 hrs HW=896.83' TW=893.44' (Dynamic Tailwater)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 5.76 cfs @ 2.98 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=896.00' TW=893.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 10P: P-10 Lowered 1 ft



Summary for Pond 11P: P-11

Inflow Area = 58.650 ac, 4.89% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 26.75 cfs @ 12.60 hrs, Volume= 4.343 af
Outflow = 8.30 cfs @ 13.57 hrs, Volume= 4.342 af, Atten= 69%, Lag= 58.0 min
Primary = 5.18 cfs @ 13.57 hrs, Volume= 3.083 af
Secondary = 3.14 cfs @ 13.91 hrs, Volume= 1.259 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 909.00' Surf.Area= 1.210 ac Storage= 3.640 af
Peak Elev= 910.30' @ 13.57 hrs Surf.Area= 1.356 ac Storage= 5.310 af (1.670 af above start)

Plug-Flow detention time= 838.1 min calculated for 0.702 af (16% of inflow)
Center-of-Mass det. time= 153.5 min (1,039.7 - 886.2)

Volume	Invert	Avail.Storage	Storage Description
#1	905.00'	9.405 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

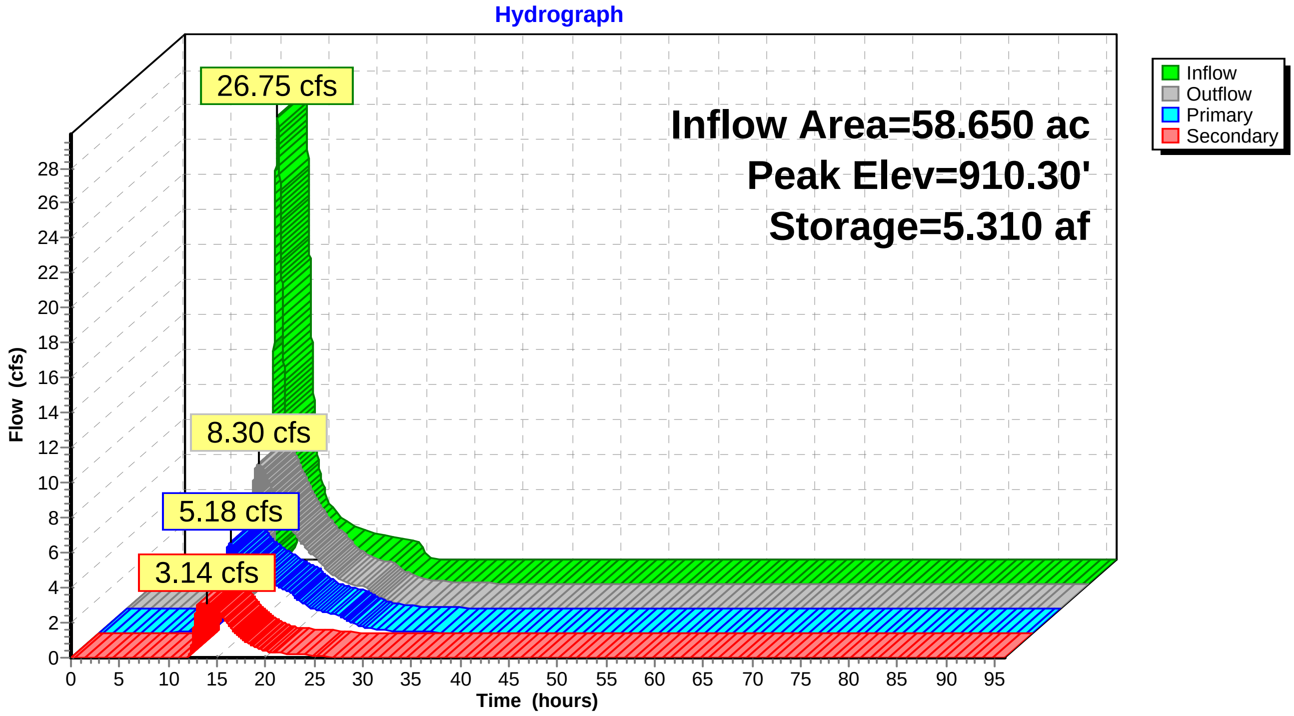
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
905.00	0.760	0.000	0.000
906.00	0.820	0.790	0.790
908.00	0.950	1.770	2.560
909.00	1.210	1.080	3.640
910.00	1.320	1.265	4.905
912.00	1.560	2.880	7.785
913.00	1.680	1.620	9.405

Device	Routing	Invert	Outlet Devices
#1	Primary	909.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#4	Primary	912.00'	**60.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#5	Secondary	909.00'	**12.0" Round RCP_Round 12"** L= 150.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 909.00' / 908.00' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=5.18 cfs @ 13.57 hrs HW=910.30' TW=896.80' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 4.32 cfs @ 5.50 fps)
- **2=RCP_Round 24"** (Barrel Controls 0.43 cfs @ 2.19 fps)
- **3=RCP_Round 24"** (Barrel Controls 0.43 cfs @ 2.19 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=3.14 cfs @ 13.91 hrs HW=910.28' TW=908.54' (Dynamic Tailwater)
- **5=RCP_Round 12"** (Barrel Controls 3.14 cfs @ 4.05 fps)

Pond 11P: P-11



Summary for Pond 12P: P-12

```
Inflow Area =        79.640 ac,    7.40% Impervious,  Inflow Depth >   0.93"    for  2-Year event
Inflow       =       16.56 cfs @   12.03 hrs,  Volume=            6.175 af
Outflow      =        6.46 cfs @   16.56 hrs,  Volume=            6.168 af,  Atten= 61%,  Lag= 271.9 min
Primary      =        6.46 cfs @   16.56 hrs,  Volume=            6.168 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 893.00'   Surf.Area= 1.640 ac   Storage= 5.075 af
Peak Elev= 893.62' @ 16.56 hrs   Surf.Area= 1.720 ac   Storage= 6.109 af   (1.034 af above start)

Plug-Flow detention time= 1,198.1 min calculated for 1.093 af (18% of inflow)
Center-of-Mass det. time= 124.6 min (1,225.3 - 1,100.7)

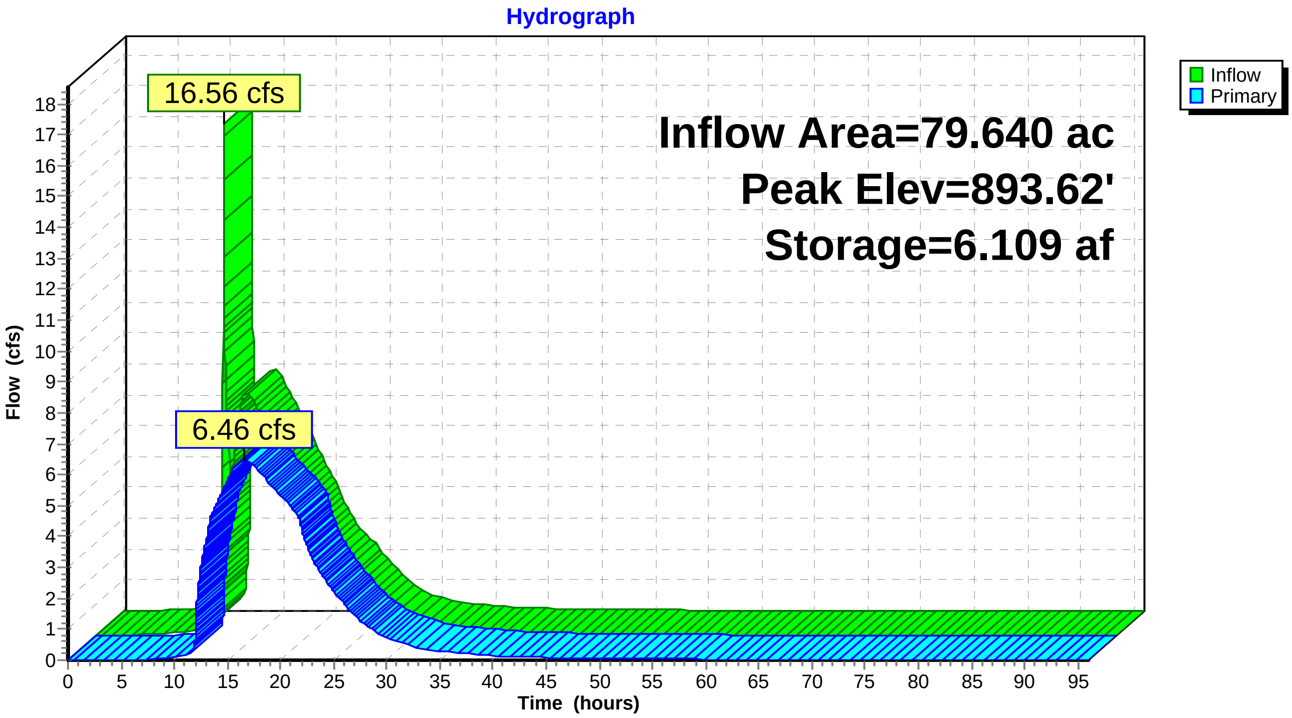
Volume	Invert	Avail.Storage	Storage Description
#1	889.00'	10.590 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
889.00	1.070	0.000	0.000
890.00	1.150	1.110	1.110
892.00	1.330	2.480	3.590
893.00	1.640	1.485	5.075
894.00	1.770	1.705	6.780
896.00	2.040	3.810	10.590

Device	Routing	Invert	Outlet Devices
#1	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#4	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#5	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#6	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf

Primary OutFlow Max=6.46 cfs @ 16.56 hrs HW=893.62' TW=883.21' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 2.97 cfs @ 3.78 fps)
2=Orifice/Grate (Orifice Controls 2.97 cfs @ 3.78 fps)
3=RCP_Arch 44x27 (Barrel Controls 0.13 cfs @ 1.21 fps)
4=RCP_Arch 44x27 (Barrel Controls 0.13 cfs @ 1.21 fps)
5=RCP_Arch 44x27 (Barrel Controls 0.13 cfs @ 1.21 fps)
6=RCP_Arch 44x27 (Barrel Controls 0.13 cfs @ 1.21 fps)

Pond 12P: P-12



Summary for Pond 13P: P-13

```
Inflow Area =      237.775 ac,    9.20% Impervious,  Inflow Depth =   0.96"    for  2-Year event
Inflow      =        99.54 cfs @  12.38 hrs,  Volume=          19.048 af
Outflow     =        91.90 cfs @  12.52 hrs,  Volume=          19.046 af,  Atten= 8%,  Lag= 8.4 min
Primary     =        86.58 cfs @  12.52 hrs,  Volume=          18.259 af
Secondary =           5.32 cfs @  12.52 hrs,  Volume=           0.787 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 883.00'   Surf.Area= 1.870 ac   Storage= 4.265 af
Peak Elev= 883.70' @ 12.52 hrs   Surf.Area= 2.115 ac   Storage= 5.659 af   (1.394 af above start)

Plug-Flow detention time= 243.6 min calculated for 14.781 af (78% of inflow)
Center-of-Mass det. time= 22.5 min ( 999.0 - 976.5 )
```

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	11.490 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
878.00	0.000	0.000	0.000
879.00	0.630	0.315	0.315
880.00	0.730	0.680	0.995
882.00	1.070	1.800	2.795
883.00	1.870	1.470	4.265
884.00	2.220	2.045	6.310
886.00	2.960	5.180	11.490

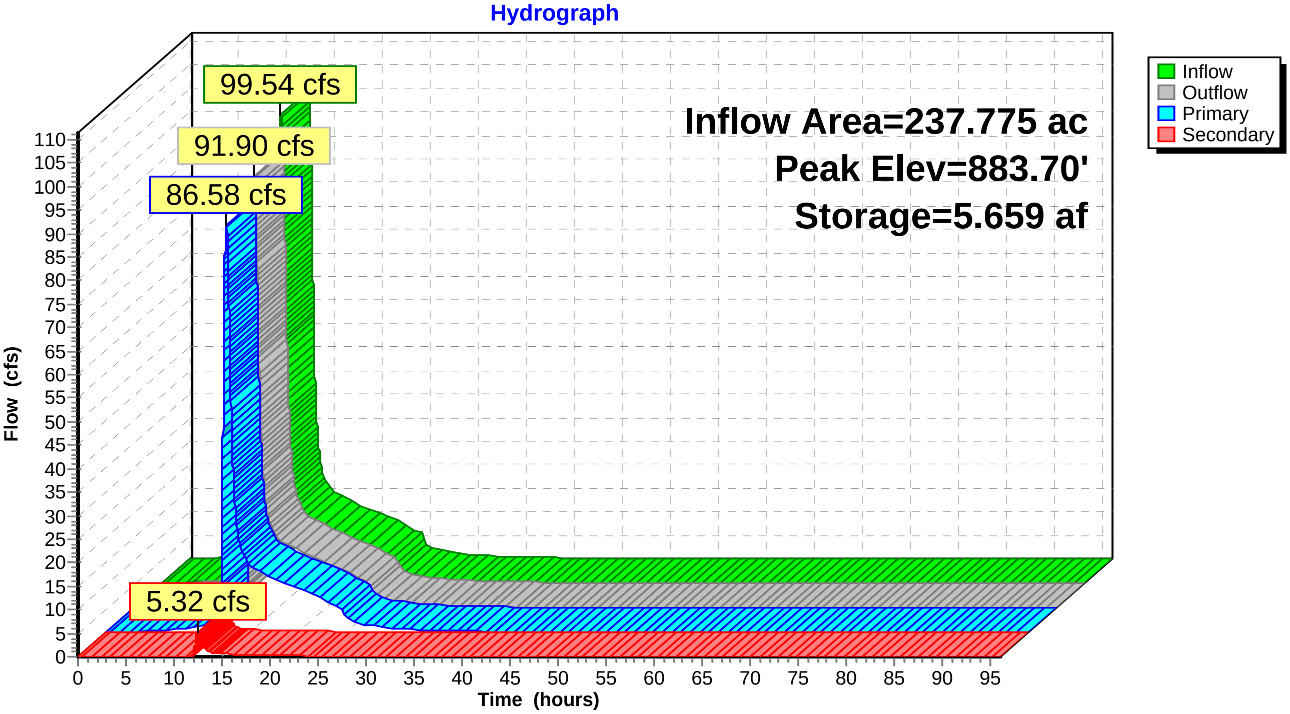
Device	Routing	Invert	Outlet Devices
#1	Primary	883.00'	**55.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#5	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#6	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200

Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=86.58 cfs @ 12.52 hrs HW=883.70' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 86.58 cfs @ 2.25 fps)

Secondary OutFlow Max=5.32 cfs @ 12.52 hrs HW=883.70' TW=882.90' (Dynamic Tailwater)
├─**2=RCP_Round 12"** (Barrel Controls 1.06 cfs @ 2.55 fps)
├─**3=RCP_Round 12"** (Barrel Controls 1.06 cfs @ 2.55 fps)
├─**4=RCP_Round 12"** (Barrel Controls 1.06 cfs @ 2.55 fps)
├─**5=RCP_Round 12"** (Barrel Controls 1.06 cfs @ 2.55 fps)
└─**6=RCP_Round 12"** (Barrel Controls 1.06 cfs @ 2.55 fps)

Pond 13P: P-13



Summary for Pond 17P: W-2

[80] Warning: Exceeded Pond P-5/P-6 by 0.15' @ 40.43 hrs (0.12 cfs 0.597 af)

Inflow = 1.51 cfs @ 12.76 hrs, Volume= 0.492 af
Outflow = 0.32 cfs @ 17.83 hrs, Volume= 0.351 af, Atten= 79%, Lag= 304.6 min
Primary = 0.32 cfs @ 17.83 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 929.35' @ 17.83 hrs Surf.Area= 1.149 ac Storage= 0.390 af

Plug-Flow detention time= 904.5 min calculated for 0.351 af (71% of inflow)
Center-of-Mass det. time= 847.7 min (1,717.9 - 870.2)

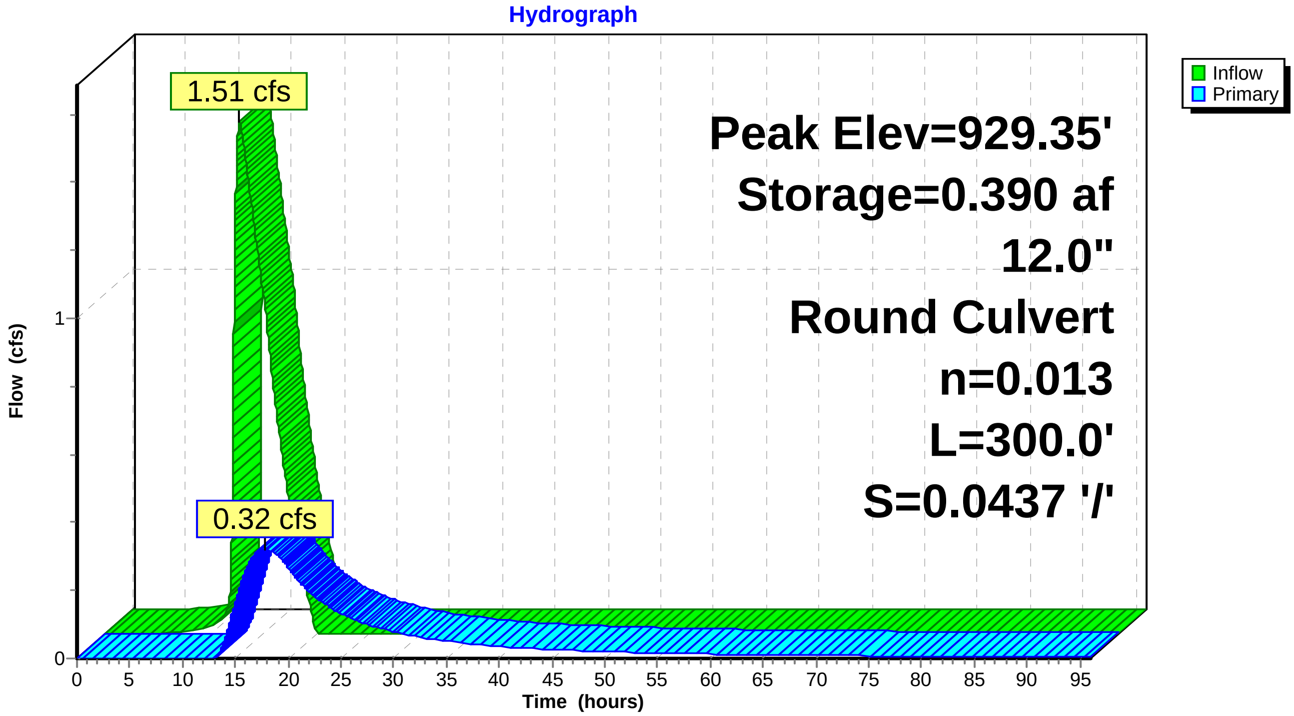
Volume	Invert	Avail.Storage	Storage Description
#1	929.00'	1.175 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
929.00	1.090	0.000	0.000
930.00	1.260	1.175	1.175

Device	Routing	Invert	Outlet Devices
#1	Primary	929.10'	**12.0" Round RCP_Round 12"** L= 300.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 929.10' / 916.00' S= 0.0437 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.32 cfs @ 17.83 hrs HW=929.35' TW=914.79' (Dynamic Tailwater)
↑—**1=RCP_Round 12"** (Inlet Controls 0.32 cfs @ 2.12 fps)

Pond 17P: W-2


Hydrograph
1.51 cfs
0.32 cfs
Peak Elev=929.35'
Storage=0.390 af
12.0"
Round Culvert
n=0.013
L=300.0'
S=0.0437 '/'
Inflow
Primary
Flow (cfs)
0
1
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 36P: Culverts passing flow beneath Spine Road

```
Inflow Area =         52.790 ac,    0.00% Impervious,  Inflow Depth =   0.80"    for  2-Year event
Inflow        =        26.87 cfs @   12.48 hrs,  Volume=             3.502 af
Outflow      =        26.87 cfs @   12.48 hrs,  Volume=             3.502 af,  Atten= 0%,  Lag= 0.0 min
Primary      =        26.87 cfs @   12.48 hrs,  Volume=             3.502 af
Secondary =          0.00 cfs @    0.00 hrs,  Volume=             0.000 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 887.11' @ 12.48 hrs   Surf.Area= 0.000 ac   Storage= 0.000 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (892.6 - 892.6)

Volume	Invert	Avail.Storage	Storage Description
#1	887.00'	0.026 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
887.00	0.000	0.000	0.000
887.50	0.002	0.001	0.001
890.50	0.007	0.014	0.014
892.00	0.009	0.012	0.026

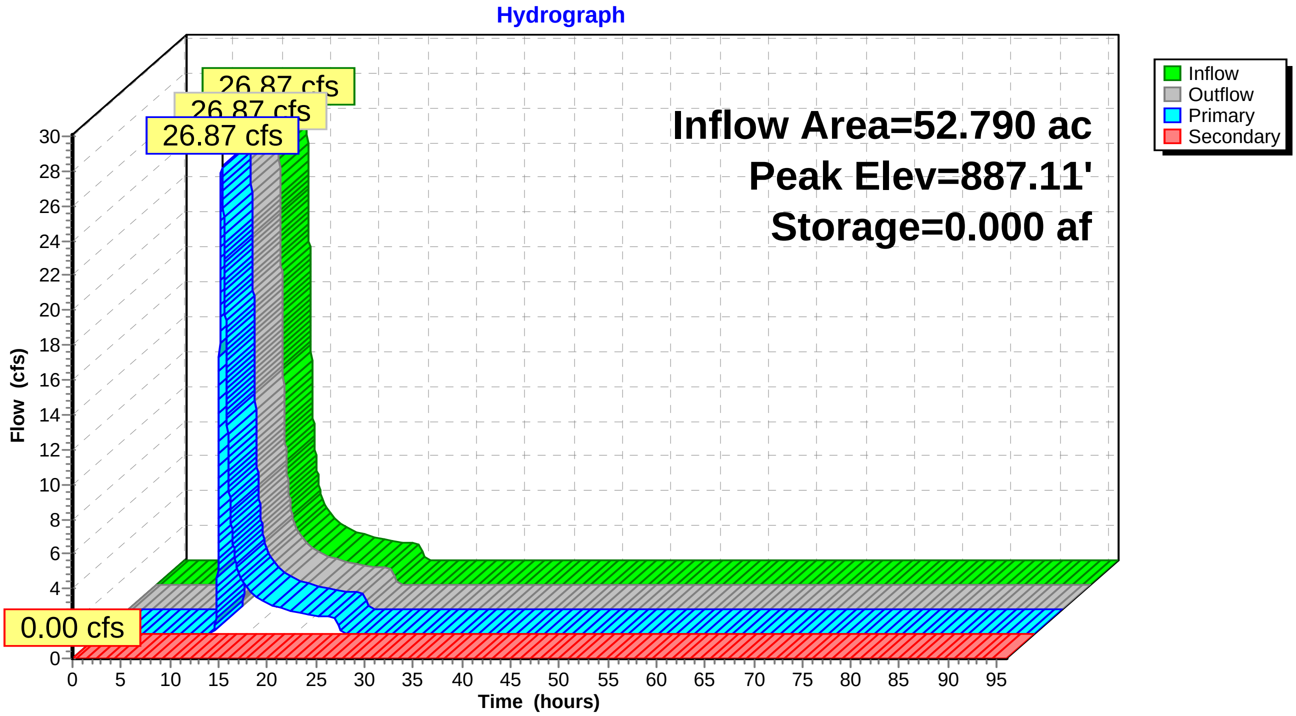
Device	Routing	Invert	Outlet Devices
#1	Primary	887.00'	**Special & User-Defined** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 5.00 Disch. (cfs) 0.000 25.000 50.000 75.000 100.000 127.000 127.000
#2	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#4	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#5	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#6	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#7	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900

			n= 0.013, Flow Area= 1.77 sf
#8	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#9	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=26.87 cfs @ 12.48 hrs HW=887.11' TW=883.70' (Dynamic Tailwater)
1=Special & User-Defined (Custom Controls 26.87 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=887.00' TW=883.00' (Dynamic Tailwater)
2=RCP_Round 18" (Controls 0.00 cfs)
3=RCP_Round 18" (Controls 0.00 cfs)
4=RCP_Round 18" (Controls 0.00 cfs)
5=RCP_Round 18" (Controls 0.00 cfs)
6=RCP_Round 18" (Controls 0.00 cfs)
7=RCP_Round 18" (Controls 0.00 cfs)
8=RCP_Round 18" (Controls 0.00 cfs)
9=RCP_Round 18" (Controls 0.00 cfs)

Pond 36P: Culverts passing flow beneath Spine Road



Summary for Pond CRH-1: CRH-1

```
Inflow Area =        6.955 ac,  46.76% Impervious,  Inflow Depth =   1.63"    for  2-Year event
Inflow      =       10.87 cfs @  12.15 hrs,  Volume=          0.947 af
Outflow     =        4.80 cfs @  12.48 hrs,  Volume=          0.947 af,  Atten= 56%,  Lag= 19.6 min
Discarded   =        0.22 cfs @  12.48 hrs,  Volume=          0.471 af
Primary     =        4.58 cfs @  12.48 hrs,  Volume=          0.476 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 877.67' @ 12.48 hrs   Surf.Area= 0.275 ac   Storage= 0.354 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 270.2 min ( 1,064.9 - 794.7 )

Volume       Invert    Avail.Storage   Storage Description
   #1        876.00'        0.850 af   Custom Stage Data (Prismatic)Listed below (Recalc)

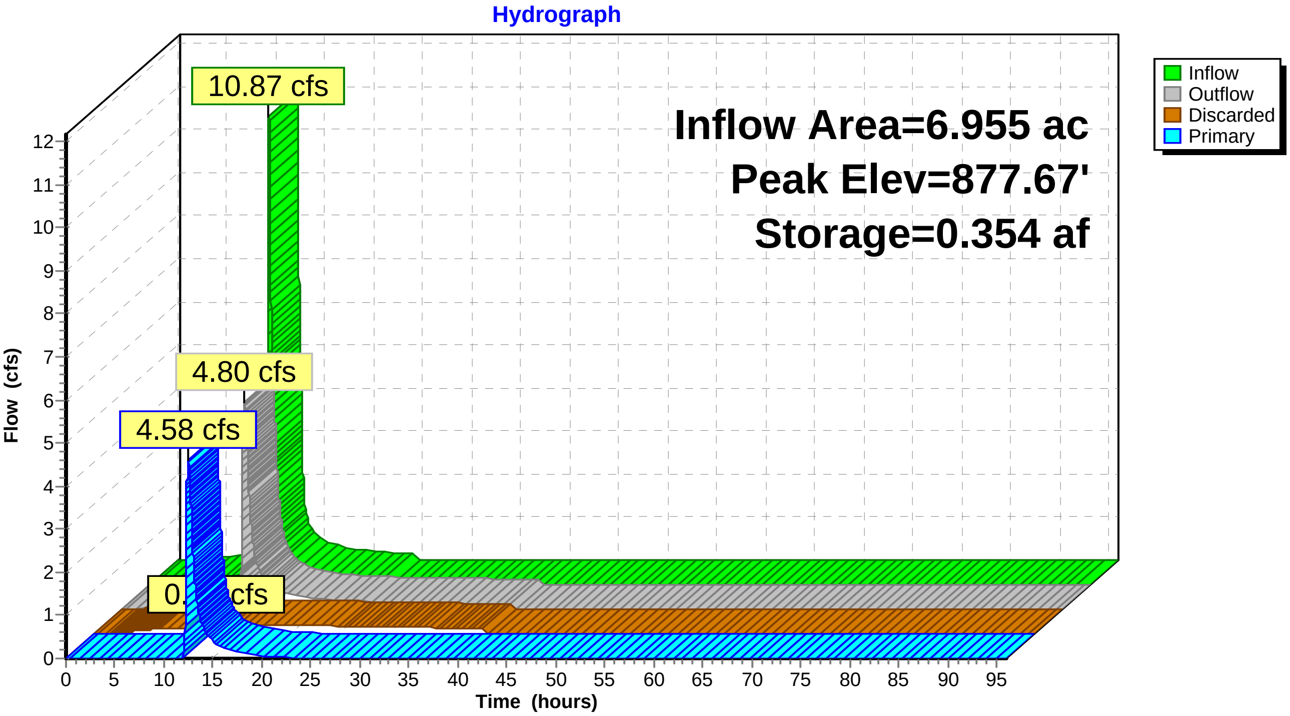
 Elevation      Surf.Area        Inc.Store       Cum.Store
    (feet)        (acres)      (acre-feet)     (acre-feet)
    876.00          0.150            0.000           0.000
    878.00          0.300            0.450           0.450
    879.00          0.500            0.400           0.850

Device   Routing        Invert   Outlet Devices
   #1    Discarded     876.00'   0.800 in/hr Exfiltration over Surface area
                                 Conductivity to Groundwater Elevation = 0.00'
   #2    Primary       877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                 Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                 n= 0.013,  Flow Area= 3.14 sf
   #3    Primary       877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                 Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                 n= 0.013,  Flow Area= 3.14 sf

Discarded OutFlow  Max=0.22 cfs @ 12.48 hrs  HW=877.67'   (Free Discharge)
↑
└─1=Exfiltration  ( Controls 0.22 cfs)

Primary OutFlow  Max=4.58 cfs @ 12.48 hrs  HW=877.67'   (Free Discharge)
↑
├─2=Culvert  (Barrel Controls 2.29 cfs @ 3.72 fps)
└─3=Culvert  (Barrel Controls 2.29 cfs @ 3.72 fps)
```

Pond CRH-1: CRH-1



Summary for Pond CRH-2: CRH-2

Inflow Area = 10.214 ac, 37.73% Impervious, Inflow Depth = 1.47" for 2-Year event
Inflow = 12.67 cfs @ 12.22 hrs, Volume= 1.253 af
Outflow = 2.62 cfs @ 12.88 hrs, Volume= 1.254 af, Atten= 79%, Lag= 39.4 min
Discarded = 0.33 cfs @ 12.88 hrs, Volume= 0.833 af
Primary = 2.29 cfs @ 12.88 hrs, Volume= 0.420 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 882.04' @ 12.88 hrs Surf.Area= 0.404 ac Storage= 0.617 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 500.6 min (1,307.9 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	1.600 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

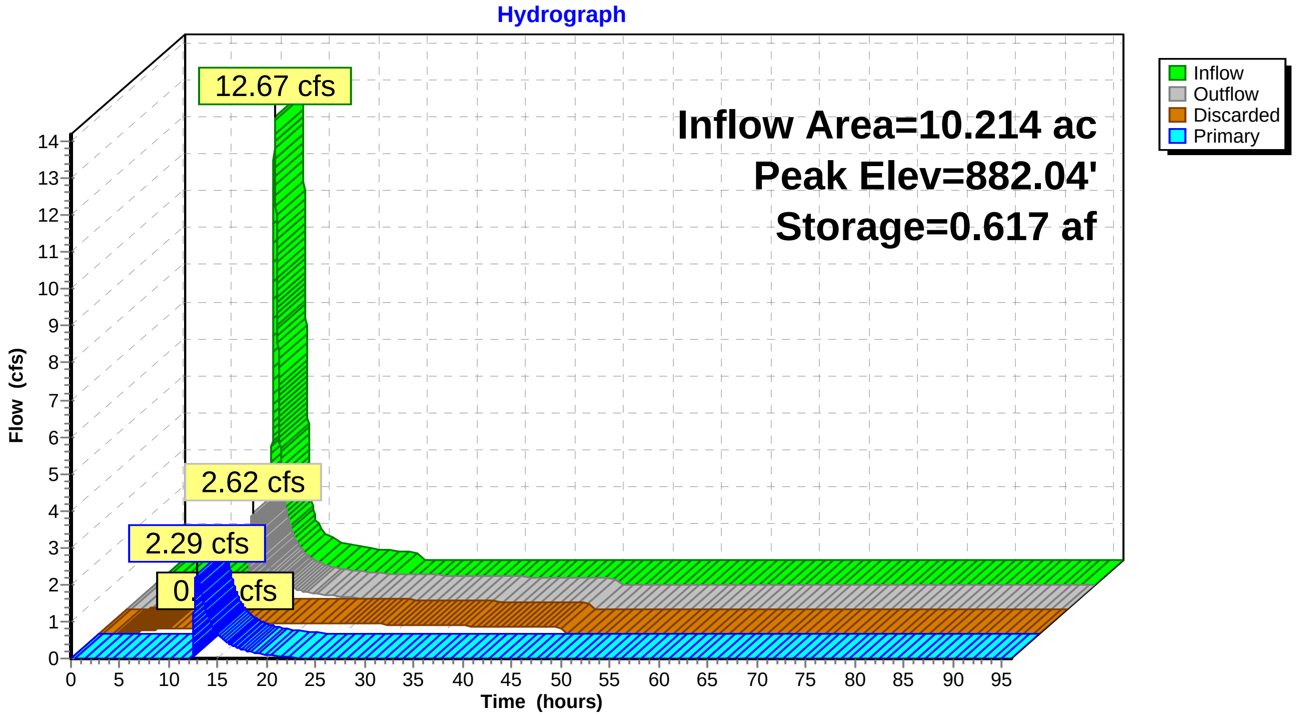
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
880.00	0.200	0.000	0.000
882.00	0.400	0.600	0.600
884.00	0.600	1.000	1.600

Device	Routing	Invert	Outlet Devices
#1	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.33 cfs @ 12.88 hrs HW=882.04' (Free Discharge)
└─**3=Exfiltration** (Controls 0.33 cfs)

Primary OutFlow Max=2.29 cfs @ 12.88 hrs HW=882.04' TW=877.79' (Dynamic Tailwater)
├─**1=Culvert** (Barrel Controls 1.15 cfs @ 2.51 fps)
└─**2=Culvert** (Barrel Controls 1.15 cfs @ 2.51 fps)

Pond CRH-2: CRH-2



Summary for Pond CRH-3: CRH-3

Inflow Area = 11.815 ac, 36.95% Impervious, Inflow Depth = 0.61" for 2-Year event
Inflow = 2.97 cfs @ 12.04 hrs, Volume= 0.603 af
Outflow = 1.17 cfs @ 14.13 hrs, Volume= 0.603 af, Atten= 61%, Lag= 125.4 min
Discarded = 0.20 cfs @ 14.13 hrs, Volume= 0.381 af
Primary = 0.97 cfs @ 14.13 hrs, Volume= 0.222 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.30' @ 14.13 hrs Surf.Area= 0.248 ac Storage= 0.259 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 351.8 min (1,209.1 - 857.3)

Volume	Invert	Avail.Storage	Storage Description
#1	877.00'	0.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

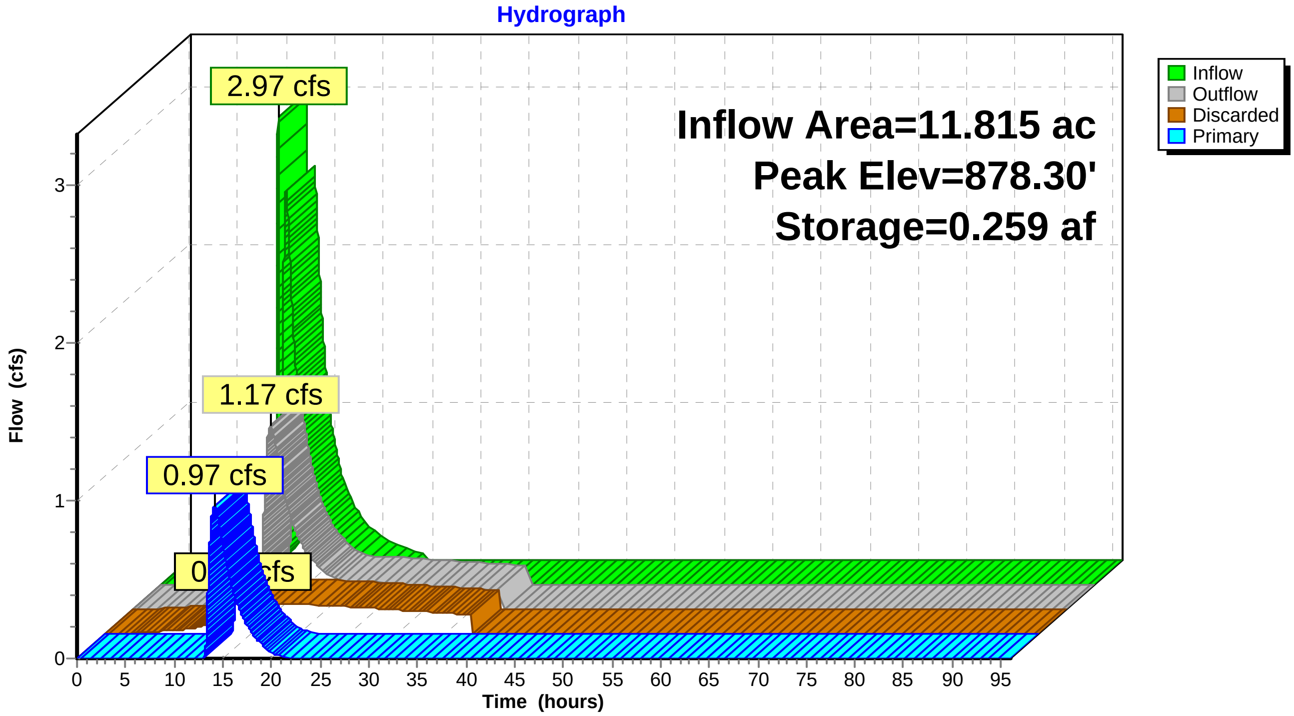
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
877.00	0.150	0.000	0.000
879.00	0.300	0.450	0.450
880.00	0.500	0.400	0.850

Device	Routing	Invert	Outlet Devices
#1	Discarded	877.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.20 cfs @ 14.13 hrs HW=878.30' (Free Discharge)
└─**1=Exfiltration** (Controls 0.20 cfs)

Primary OutFlow Max=0.97 cfs @ 14.13 hrs HW=878.30' (Free Discharge)
├─**2=Culvert** (Barrel Controls 0.48 cfs @ 2.44 fps)
└─**3=Culvert** (Barrel Controls 0.48 cfs @ 2.44 fps)

Pond CRH-3: CRH-3



Summary for Pond P-5/P-6: P-5/P-6

Inflow Area =	43.346 ac,	18.61% Impervious,	Inflow Depth = 1.13"	for 2-Year event	
Inflow =	44.72 cfs @	12.15 hrs,	Volume=	4.086 af	
Outflow =	10.29 cfs @	12.76 hrs,	Volume=	4.079 af,	Atten= 77%, Lag= 36.3 min
Primary =	8.78 cfs @	12.76 hrs,	Volume=	3.587 af	
Secondary =	1.51 cfs @	12.76 hrs,	Volume=	0.492 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 929.00' Surf.Area= 1.975 ac Storage= 5.062 af
Peak Elev= 929.88' @ 12.76 hrs Surf.Area= 2.207 ac Storage= 6.897 af (1.834 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 231.0 min (1,058.6 - 827.5)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	14.650 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

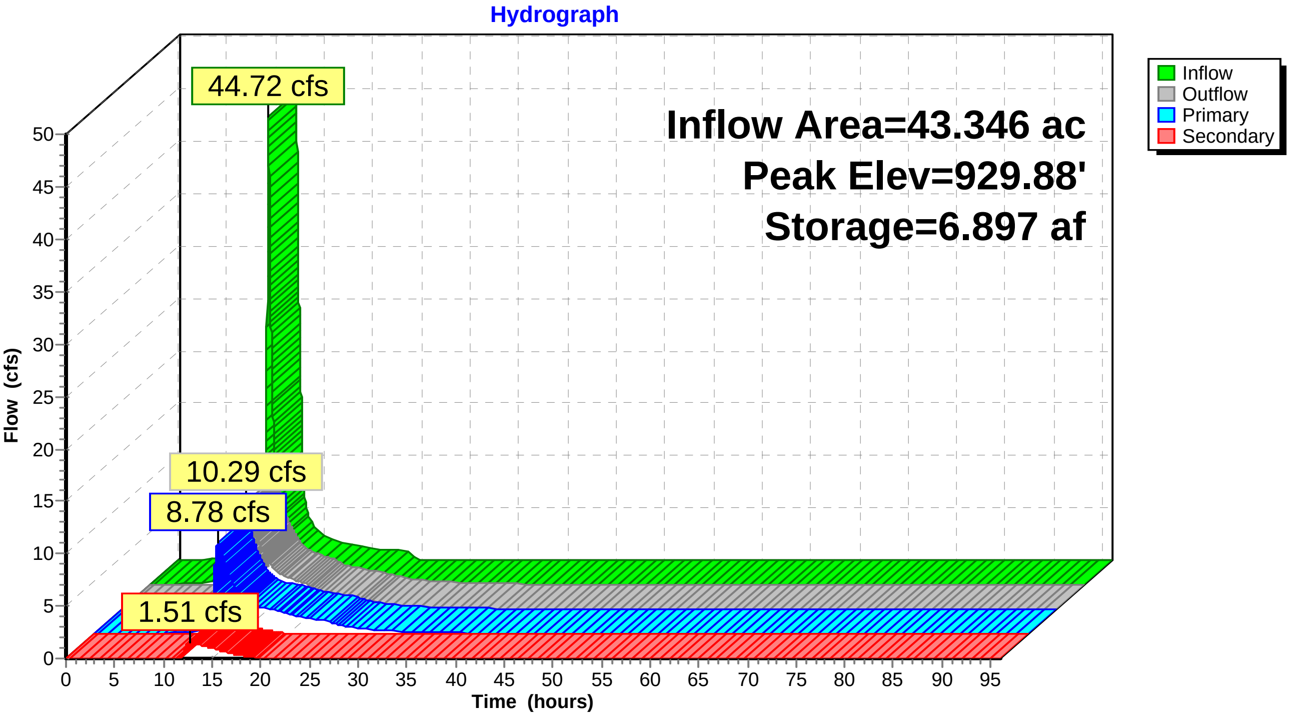
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
926.00	1.510	0.000	0.000
928.00	1.710	3.220	3.220
930.00	2.240	3.950	7.170
931.00	2.400	2.320	9.490
933.00	2.760	5.160	14.650

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	929.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	930.50'	**14.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	929.00'	**9.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=8.78 cfs @ 12.76 hrs HW=929.88' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 3.54 cfs @ 4.51 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 5.24 cfs @ 2.01 fps)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=1.51 cfs @ 12.76 hrs HW=929.88' TW=929.08' (Dynamic Tailwater)
4=Orifice/Grate (Orifice Controls 1.51 cfs @ 3.41 fps)

Pond P-5/P-6: P-5/P-6



Summary for Pond TI P: Thumb Infiltration (Thumb TP load only)

Inflow Area = 48.539 ac, 11.38% Impervious, Inflow Depth = 0.36" for 2-Year event
Inflow = 10.90 cfs @ 12.32 hrs, Volume= 1.436 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 901.44' @ 26.34 hrs Surf.Area= 1.000 ac Storage= 1.436 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

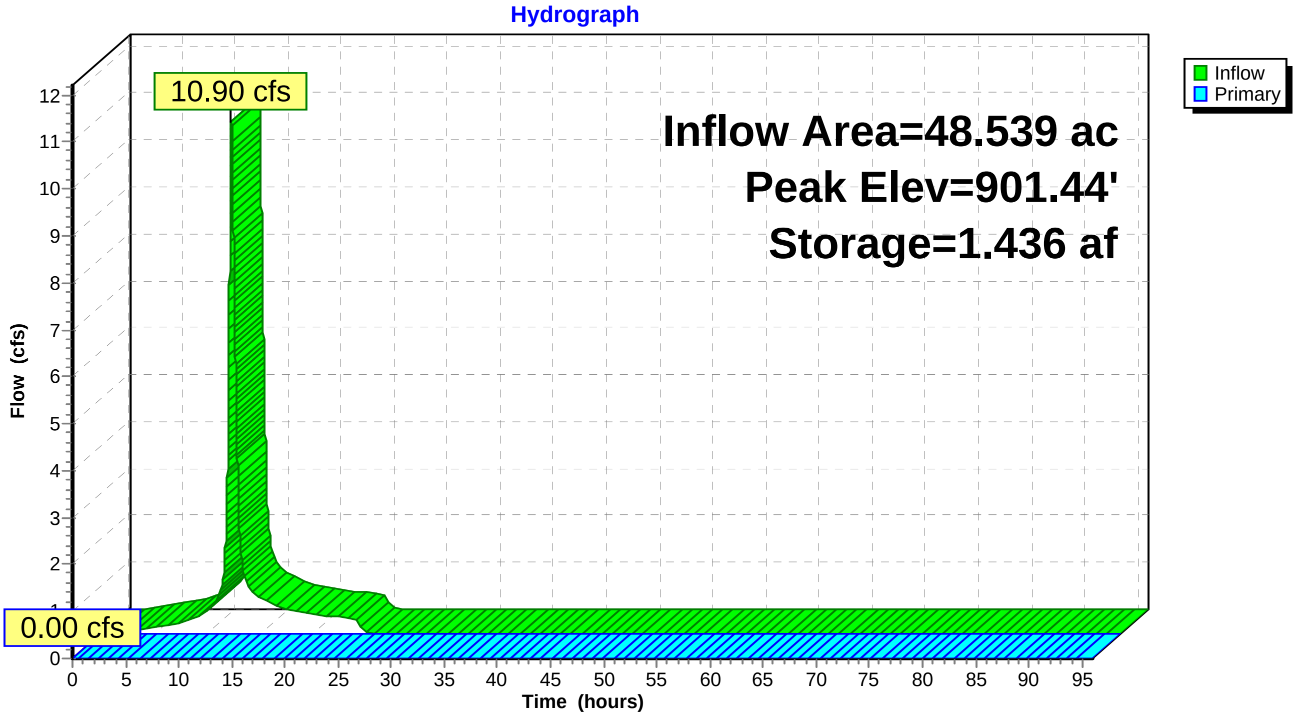
Volume	Invert	Avail.Storage	Storage Description
#1	900.00'	5.000 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
900.00	1.000	0.000	0.000
901.00	1.000	1.000	1.000
902.00	1.000	1.000	2.000
903.00	1.000	1.000	3.000
904.00	1.000	1.000	4.000
905.00	1.000	1.000	5.000

Device	Routing	Invert	Outlet Devices
#1	Primary	903.74'	**1,000.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=900.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond TI P: Thumb Infiltration (Thumb TP load only)



Summary for Pond W-1: W-1

```
Inflow Area =         1.000 ac,  10.00% Impervious,  Inflow Depth =   5.57"    for  2-Year event
Inflow       =        1.52 cfs @   13.30 hrs,  Volume=            0.464 af
Outflow      =        1.05 cfs @   14.39 hrs,  Volume=            0.464 af,  Atten= 31%,  Lag= 65.6 min
Primary      =        1.05 cfs @   14.39 hrs,  Volume=            0.464 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 914.97' @ 14.39 hrs   Surf.Area= 0.695 ac   Storage= 0.148 af

Plug-Flow detention time= 154.8 min calculated for 0.464 af (100% of inflow)
Center-of-Mass det. time= 153.7 min ( 1,074.9 - 921.2 )

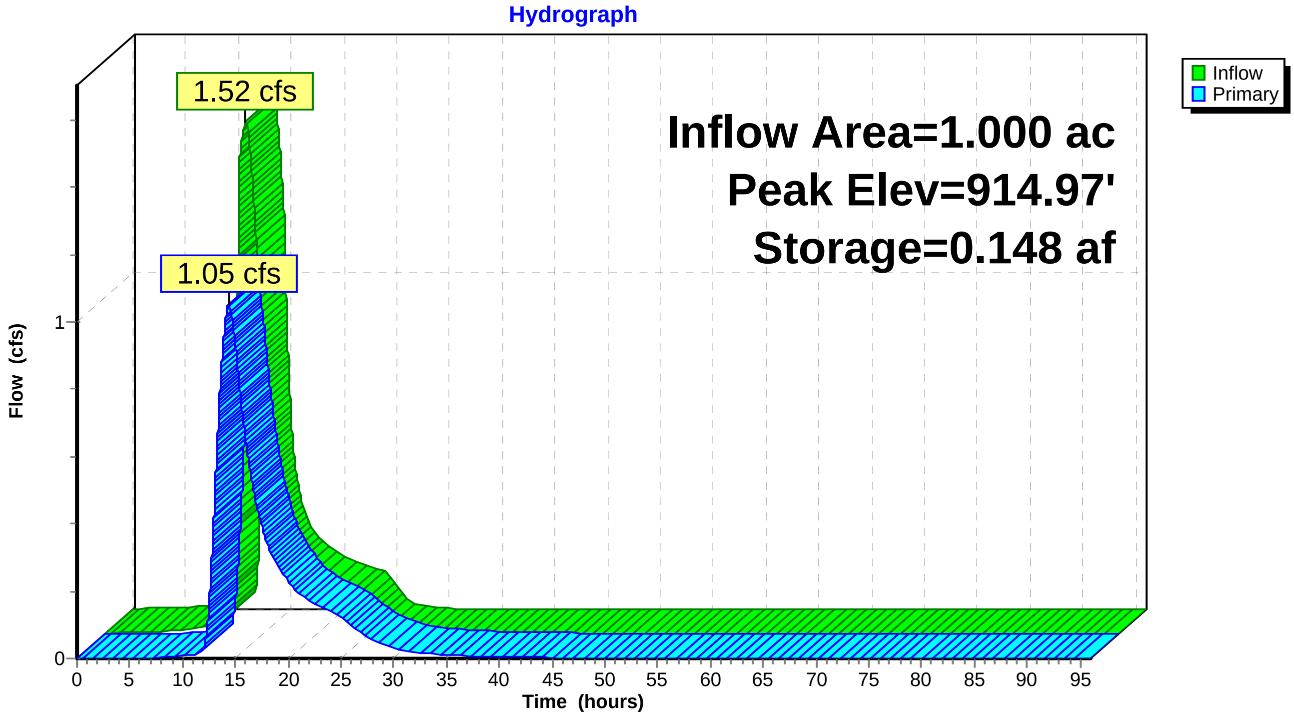
Volume        Invert    Avail.Storage   Storage Description
  #1          914.75'        0.950 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area         Inc.Store        Cum.Store
    (feet)        (acres)       (acre-feet)      (acre-feet)
    914.75          0.660             0.000            0.000
    916.00          0.860             0.950            0.950

Device   Routing              Invert   Outlet Devices
   #1    Primary             914.75'   12.0" Horiz. Orifice/Grate   C= 0.600
                                       Limited to weir flow at low heads

Primary OutFlow  Max=1.05 cfs @ 14.39 hrs  HW=914.97'  TW=0.00'   (Dynamic Tailwater)
  └─1=Orifice/Grate  (Weir Controls 1.05 cfs @ 1.53 fps)
```

Pond W-1: W-1


Hydrograph
1.52 cfs
1.05 cfs
Inflow Area=1.000 ac
Peak Elev=914.97'
Storage=0.148 af
Inflow
Primary
Flow (cfs)
1
0
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-3: W-3

```
Inflow   =    0.32 cfs @  17.83 hrs,  Volume=        0.351 af
Outflow  =    0.00 cfs @   0.00 hrs,  Volume=        0.000 af,  Atten= 100%,  Lag= 0.0 min
```

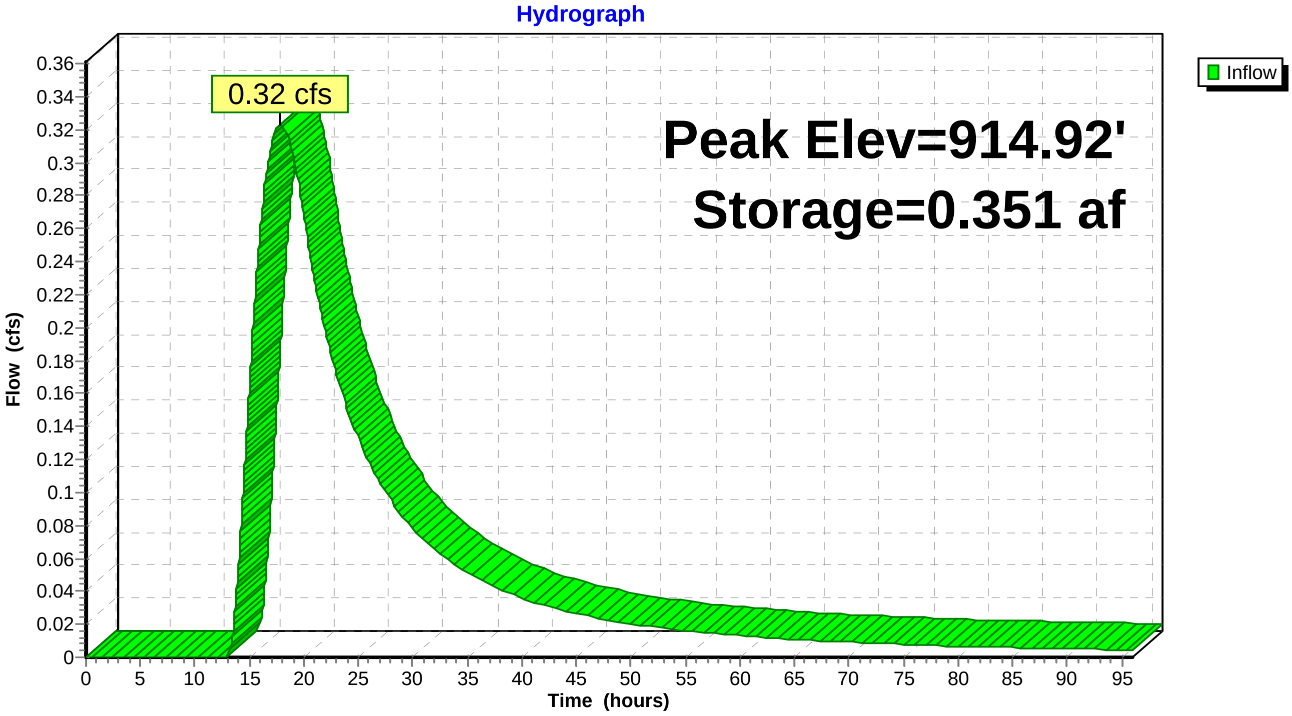
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 914.92' @ 96.00 hrs   Surf.Area= 2.067 ac   Storage= 0.351 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	2.680 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	2.040	0.000	0.000
915.00	2.080	0.515	0.515
916.00	2.250	2.165	2.680

Pond W-3: W-3



Summary for Pond W-4: W-4

Inflow Area = 2.980 ac, 26.17% Impervious, Inflow Depth = 6.40" for 2-Year event
Inflow = 4.39 cfs @ 12.08 hrs, Volume= 1.588 af
Outflow = 2.16 cfs @ 16.02 hrs, Volume= 1.570 af, Atten= 51%, Lag= 236.1 min
Primary = 2.16 cfs @ 16.02 hrs, Volume= 1.570 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 908.71' @ 16.02 hrs Surf.Area= 1.037 ac Storage= 0.649 af

Plug-Flow detention time= 324.3 min calculated for 1.570 af (99% of inflow)
Center-of-Mass det. time= 315.3 min (1,234.3 - 919.0)

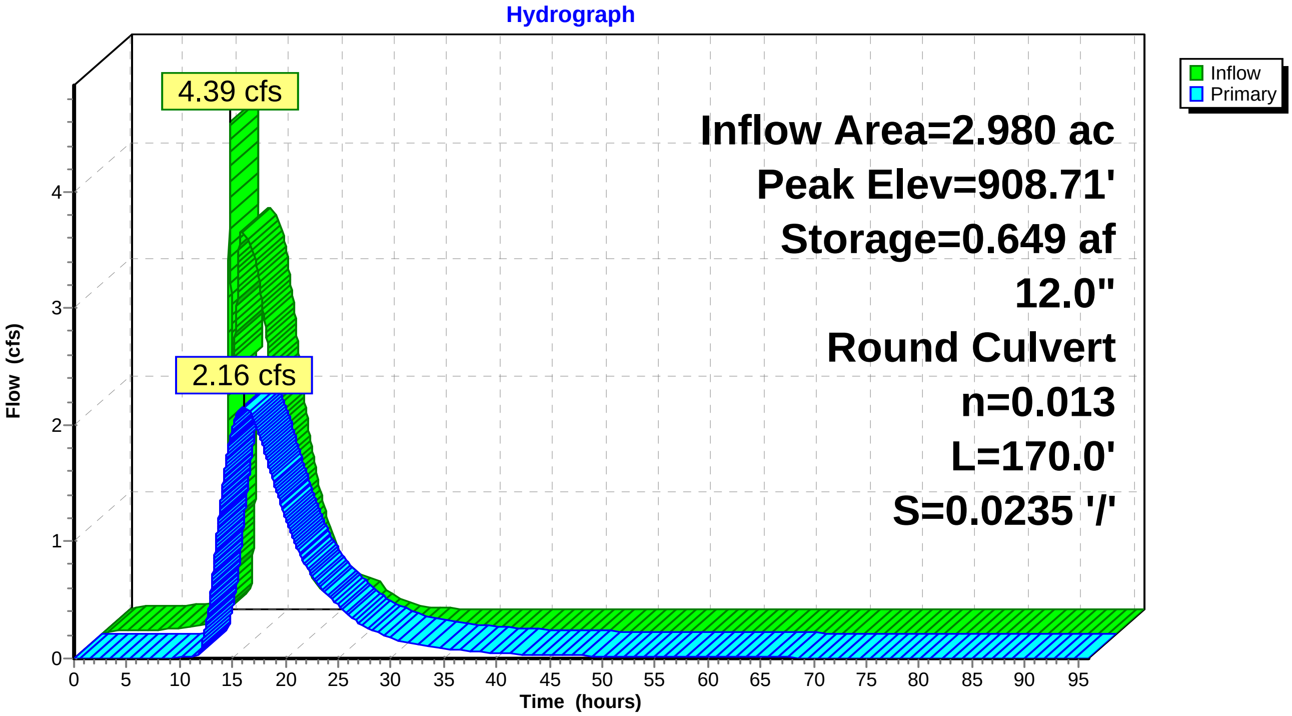
Volume	Invert	Avail.Storage	Storage Description
#1	908.00'	2.280 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
908.00	0.780	0.000	0.000
910.00	1.500	2.280	2.280

Device	Routing	Invert	Outlet Devices
#1	Primary	908.00'	**12.0" Round RCP_Round 12"** L= 170.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 908.00' / 904.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.16 cfs @ 16.02 hrs HW=908.71' TW=893.61' (Dynamic Tailwater)
⬑**1=RCP_Round 12"** (Inlet Controls 2.16 cfs @ 3.60 fps)

Pond W-4: W-4


Hydrograph
4.39 cfs
2.16 cfs
Inflow Area=2.980 ac
Peak Elev=908.71'
Storage=0.649 af
12.0"
Round Culvert
n=0.013
L=170.0'
S=0.0235 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-5: W-5

Inflow Area = 7.608 ac, 48.41% Impervious, Inflow Depth = 3.02" for 2-Year event
Inflow = 19.24 cfs @ 12.02 hrs, Volume= 1.913 af
Outflow = 2.91 cfs @ 13.19 hrs, Volume= 1.906 af, Atten= 85%, Lag= 70.2 min
Primary = 2.91 cfs @ 13.19 hrs, Volume= 1.906 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 882.75' Surf.Area= 4.910 ac Storage= 3.412 af
Peak Elev= 882.93' @ 13.19 hrs Surf.Area= 5.080 ac Storage= 4.298 af (0.886 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 325.7 min (1,149.4 - 823.6)

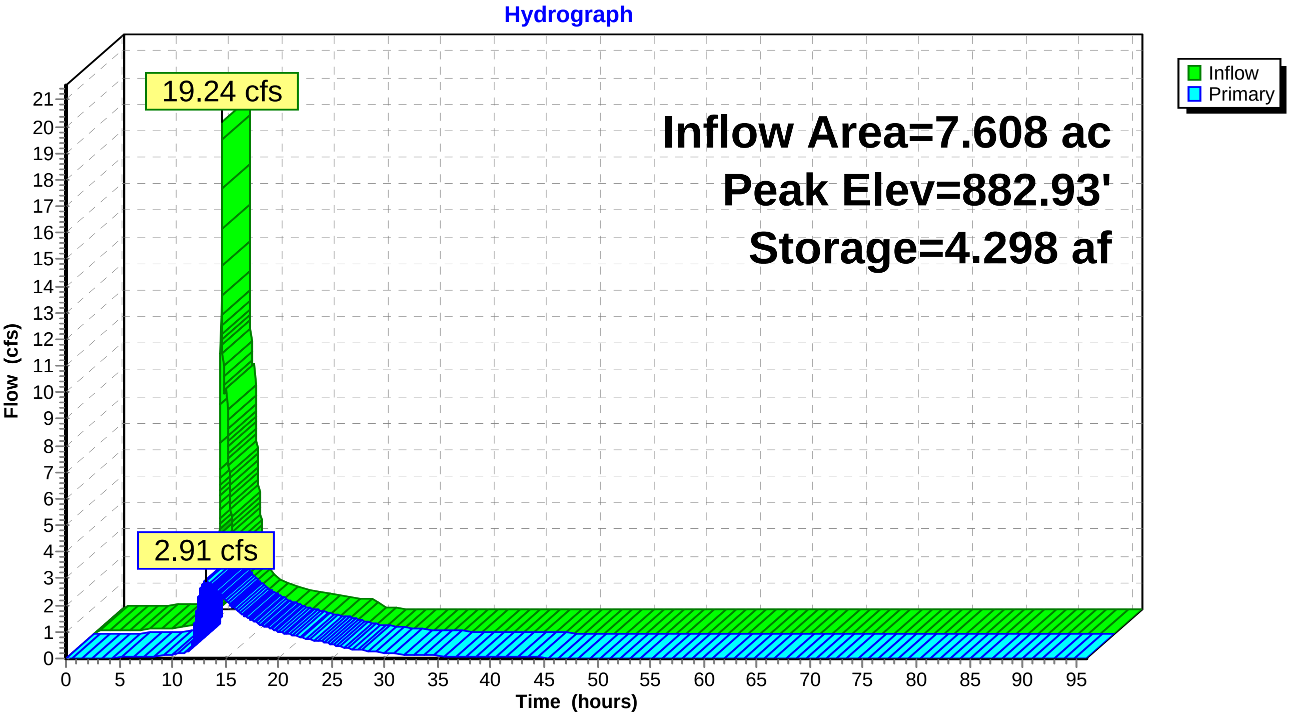
Volume	Invert	Avail.Storage	Storage Description
#1	882.00'	7.390 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
882.00	4.190	0.000	0.000
883.00	5.150	4.670	4.670
883.49	5.950	2.720	7.390

Device	Routing	Invert	Outlet Devices
#1	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=2.91 cfs @ 13.19 hrs HW=882.93' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.46 cfs @ 1.38 fps)
└—**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.46 cfs @ 1.38 fps)

Pond W-5: W-5

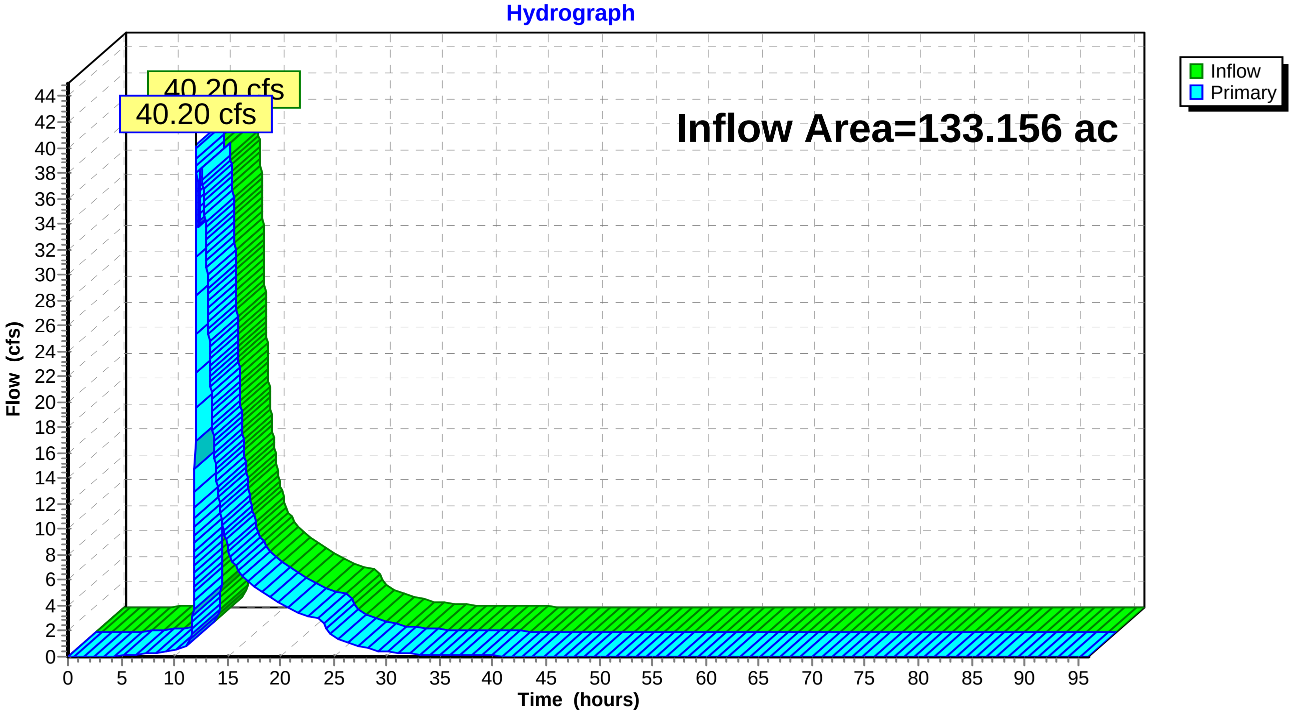

Hydrograph
19.24 cfs
2.91 cfs
Inflow Area=7.608 ac
Peak Elev=882.93'
Storage=4.298 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Link 53L: Sum of Outlet #2 Discharges to Round Lake

Inflow Area =	133.156 ac,	9.78% Impervious, Inflow Depth = 0.93"	for 2-Year event	
Inflow =	40.20 cfs @	12.07 hrs, Volume=	10.286 af	
Primary =	40.20 cfs @	12.07 hrs, Volume=	10.286 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 53L: Sum of Outlet #2 Discharges to Round Lake

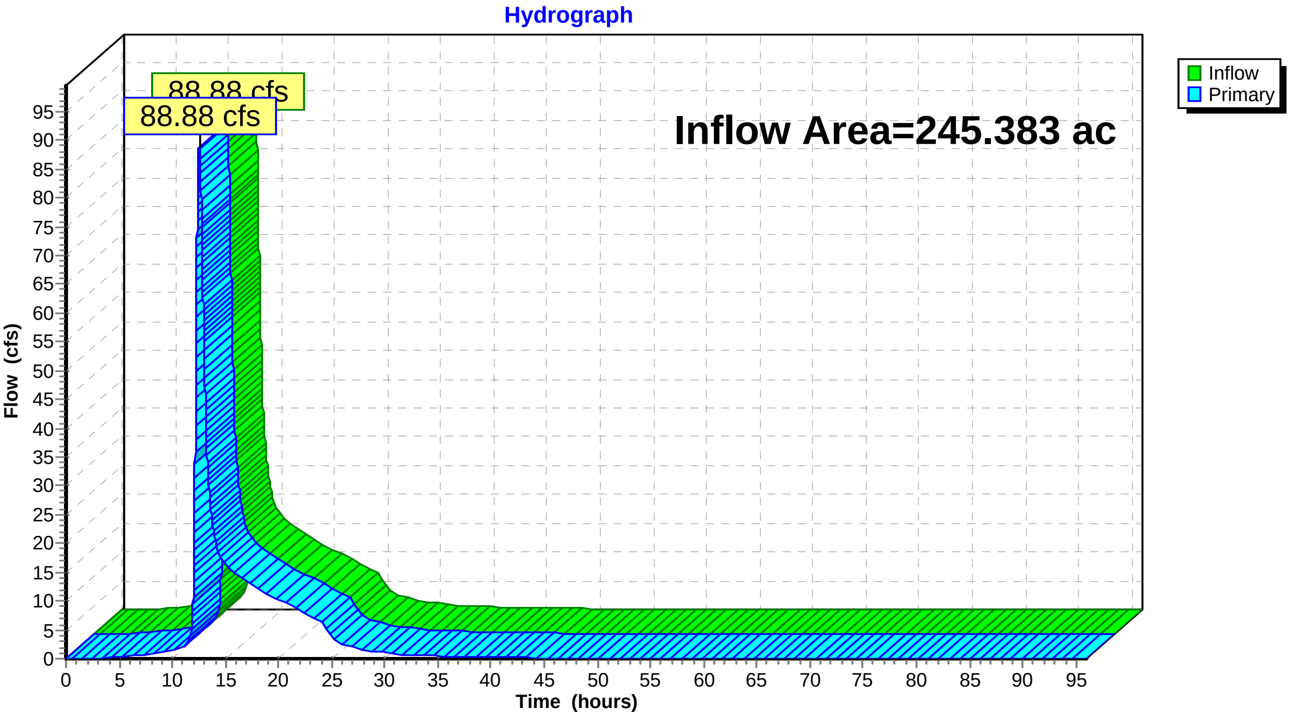


Summary for Link 54L: Sum of Discharges from P-13 and W-5

Inflow Area =	245.383 ac,	10.42% Impervious,	Inflow Depth = 0.99"	for 2-Year event
Inflow =	88.88 cfs @	12.53 hrs, Volume=	20.165 af	
Primary =	88.88 cfs @	12.53 hrs, Volume=	20.165 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 54L: Sum of Discharges from P-13 and W-5

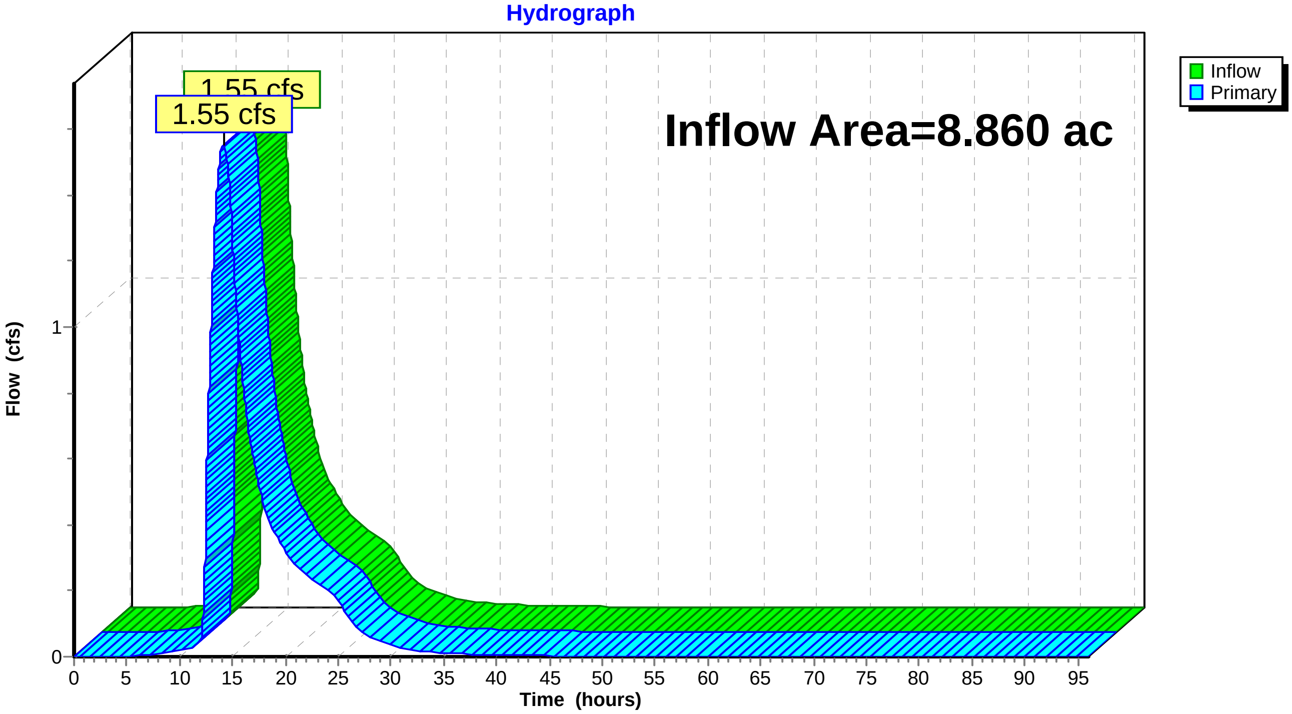


Summary for Link 55L: Sum of Outlet #1 Discharges to Round Lake

Inflow Area = 8.860 ac, 6.43% Impervious, Inflow Depth = 0.91" for 2-Year event
Inflow = 1.55 cfs @ 14.14 hrs, Volume= 0.675 af
Primary = 1.55 cfs @ 14.14 hrs, Volume= 0.675 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 55L: Sum of Outlet #1 Discharges to Round Lake

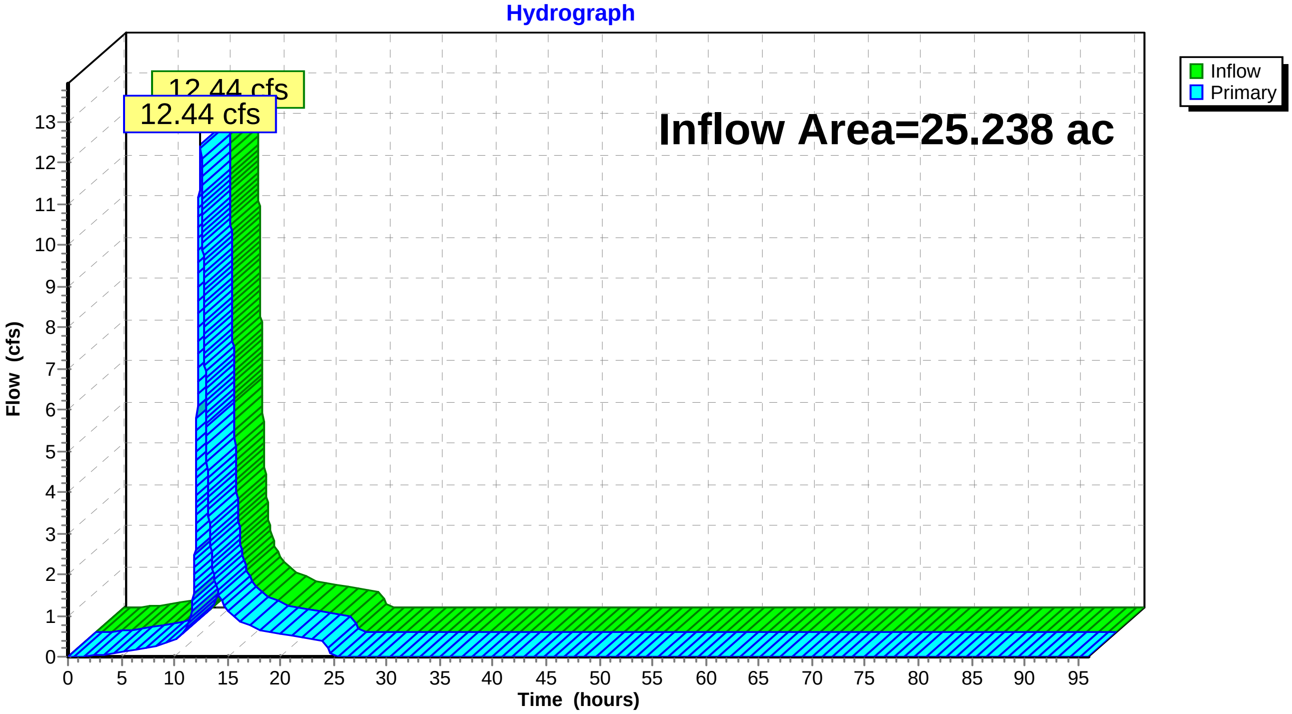


Summary for Link 57L: Outlet #3 Discharge to Round Lake

Inflow Area = 25.238 ac, 19.96% Impervious, Inflow Depth = 0.86" for 2-Year event
Inflow = 12.44 cfs @ 12.43 hrs, Volume= 1.805 af
Primary = 12.44 cfs @ 12.43 hrs, Volume= 1.805 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 57L: Outlet #3 Discharge to Round Lake



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: To Rice Creek Runoff Area=1.601 ac 31.98% Impervious Runoff Depth=2.47"
Tc=5.7 min CN=74/98 Runoff=5.55 cfs 0.330 af

Subcatchment 47S: Offsite Subbasin 51 Runoff Area=25.238 ac 19.96% Impervious Runoff Depth=1.72"
Tc=32.8 min CN=65/98 Runoff=27.74 cfs 3.622 af

Subcatchment SB 1: SB 1 Runoff Area=52.150 ac 0.00% Impervious Runoff Depth=1.76"
Tc=53.1 min CN=74/0 Runoff=49.76 cfs 7.644 af

Subcatchment SB 11: SB 11 Runoff Area=3.290 ac 36.78% Impervious Runoff Depth=2.66"
Tc=11.7 min CN=74/100 Runoff=9.15 cfs 0.730 af

Subcatchment SB 12: SB 12 Runoff Area=1.390 ac 20.86% Impervious Runoff Depth=2.22"
Tc=9.5 min CN=74/98 Runoff=3.67 cfs 0.258 af

Subcatchment SB 13: SB 13 Runoff Area=2.980 ac 26.17% Impervious Runoff Depth=2.40"
Tc=9.4 min CN=74/100 Runoff=8.31 cfs 0.597 af

Subcatchment SB 14: SB 14 Runoff Area=10.230 ac 16.03% Impervious Runoff Depth=2.12"
Tc=4.3 min CN=74/98 Runoff=33.20 cfs 1.804 af

Subcatchment SB 15: SB 15 Runoff Area=58.570 ac 0.05% Impervious Runoff Depth=1.76"
Tc=31.3 min CN=74/98 Runoff=73.90 cfs 8.591 af

Subcatchment SB 16: SB 16 Runoff Area=32.440 ac 5.76% Impervious Runoff Depth=1.89"
Tc=12.1 min CN=74/98 Runoff=66.93 cfs 5.102 af

Subcatchment SB 17: SB 17 Runoff Area=7.608 ac 48.41% Impervious Runoff Depth=2.95"
Tc=4.3 min CN=74/100 Runoff=32.13 cfs 1.870 af

Subcatchment SB 18: SB 18 Runoff Area=52.790 ac 0.00% Impervious Runoff Depth=1.76"
Tc=33.5 min CN=74/0 Runoff=64.04 cfs 7.738 af

Subcatchment SB 19: SB 19 Runoff Area=21.190 ac 0.00% Impervious Runoff Depth=1.76"
Tc=24.7 min CN=74/0 Runoff=29.93 cfs 3.106 af

Subcatchment SB 2: SB 2 Runoff Area=11.067 ac 0.33% Impervious Runoff Depth=1.77"
Tc=16.6 min CN=74/98 Runoff=18.86 cfs 1.629 af

Subcatchment SB 22: SB 22 Runoff Area=41.910 ac 0.00% Impervious Runoff Depth=0.36"
Tc=41.0 min CN=49/0 Runoff=5.43 cfs 1.272 af

Subcatchment SB 24: SB 24 Runoff Area=5.043 ac 97.56% Impervious Runoff Depth=3.93"
Tc=7.5 min CN=74/98 Runoff=24.79 cfs 1.651 af

Subcatchment SB 25: SB 25 Runoff Area=5.136 ac 95.72% Impervious Runoff Depth=3.89"
Tc=10.7 min CN=74/98 Runoff=21.69 cfs 1.664 af

Subcatchment SB 26: SB 26 Runoff Area=14.335 ac 98.27% Impervious Runoff Depth=3.95"
Tc=25.4 min CN=74/98 Runoff=41.75 cfs 4.713 af

Subcatchment SB 27: SB 27 (Thumb Road) Runoff Area=6.629 ac 83.33% Impervious Runoff Depth=3.61"
Tc=27.6 min CN=74/98 Runoff=17.05 cfs 1.996 af

Subcatchment SB 28: SB 28 Runoff Area=6.955 ac 46.76% Impervious Runoff Depth=2.80"
Tc=14.6 min CN=74/98 Runoff=18.97 cfs 1.622 af

Subcatchment SB 29: SB 29 Runoff Area=10.214 ac 37.73% Impervious Runoff Depth=2.60"
Tc=19.1 min CN=74/98 Runoff=23.01 cfs 2.212 af

Subcatchment SB 3: SB 3 Runoff Area=37.610 ac 7.68% Impervious Runoff Depth=1.93"
Tc=15.3 min CN=74/98 Runoff=71.94 cfs 6.049 af

Subcatchment SB 4: SB 4 Runoff Area=0.600 ac 43.33% Impervious Runoff Depth=2.83"
Tc=5.9 min CN=74/100 Runoff=2.26 cfs 0.141 af

Subcatchment SB 5: SB 5 Runoff Area=7.860 ac 5.98% Impervious Runoff Depth=1.89"
Tc=59.3 min CN=74/98 Runoff=7.43 cfs 1.239 af

Subcatchment SB 6: SB 6 Runoff Area=1.000 ac 10.00% Impervious Runoff Depth=2.01"
Tc=20.3 min CN=74/100 Runoff=1.72 cfs 0.167 af

Subcatchment SB 7: SB 7 Runoff Area=21.550 ac 0.00% Impervious Runoff Depth=1.76"
Tc=5.7 min CN=74/0 Runoff=55.54 cfs 3.159 af

Subcatchment SB 8: SB 8 Runoff Area=29.580 ac 5.51% Impervious Runoff Depth=1.88"
Tc=47.1 min CN=74/98 Runoff=31.84 cfs 4.638 af

Subcatchment SB 9: SB 9 Runoff Area=25.780 ac 0.12% Impervious Runoff Depth=1.76"
Tc=30.0 min CN=74/98 Runoff=33.02 cfs 3.784 af

Subcatchment SB10: SB 10 Runoff Area=6.390 ac 4.85% Impervious Runoff Depth=1.87"
Tc=7.3 min CN=74/98 Runoff=15.99 cfs 0.994 af

Pond 2 P: P-2 Peak Elev=924.98' Storage=1.125 af Inflow=59.33 cfs 10.925 af
Outflow=59.01 cfs 10.925 af

Pond 4P: P-4 Peak Elev=916.17' Storage=1.005 af Inflow=7.43 cfs 1.239 af
Primary=1.35 cfs 0.436 af Secondary=2.26 cfs 0.803 af Outflow=3.61 cfs 1.239 af

Pond 7P: P-7 Peak Elev=915.49' Storage=1.291 af Inflow=31.84 cfs 4.638 af
Outflow=32.31 cfs 4.638 af

Pond 8P: P-8 Peak Elev=898.05' Storage=0.895 af Inflow=15.99 cfs 0.994 af
24.0" Round Culvert n=0.013 L=380.0' S=0.0028 '/' Outflow=3.70 cfs 0.989 af

Pond 9P: P-9 Peak Elev=915.44' Storage=0.464 af Inflow=58.97 cfs 8.423 af
Outflow=58.93 cfs 8.423 af

Pond 10P: P-10 Lowered 1 ft Peak Elev=897.64' Storage=1.230 af Inflow=25.80 cfs 8.191 af
Primary=11.94 cfs 6.845 af Secondary=13.80 cfs 1.346 af Outflow=25.74 cfs 8.190 af

Pond 11P: P-11 Peak Elev=911.47' Storage=6.979 af Inflow=61.92 cfs 9.153 af
Primary=23.80 cfs 6.945 af Secondary=4.08 cfs 2.206 af Outflow=27.87 cfs 9.151 af

Pond 12P: P-12 Peak Elev=894.12' Storage=6.997 af Inflow=34.82 cfs 12.778 af
Outflow=24.47 cfs 12.770 af

Pond 13P: P-13 Peak Elev=884.19' Storage=6.735 af Inflow=213.60 cfs 38.914 af
Primary=189.63 cfs 37.025 af Secondary=11.45 cfs 1.886 af Outflow=201.08 cfs 38.911 af

Pond 17P: W-2 Peak Elev=929.45' Storage=0.512 af Inflow=2.25 cfs 0.809 af
12.0" Round Culvert n=0.013 L=300.0' S=0.0437 '/' Outflow=0.63 cfs 0.666 af

Pond 36P: Culverts passing flow beneath Peak Elev=887.26' Storage=0.000 af Inflow=64.04 cfs 7.738 af
Primary=64.04 cfs 7.738 af Secondary=0.00 cfs 0.000 af Outflow=64.04 cfs 7.738 af

Pond CRH-1: CRH-1 Peak Elev=878.12' Storage=0.489 af Inflow=18.97 cfs 1.622 af
Discarded=0.26 cfs 0.512 af Primary=11.80 cfs 1.110 af Outflow=12.06 cfs 1.622 af

Pond CRH-2: CRH-2 Peak Elev=882.67' Storage=0.888 af Inflow=23.01 cfs 2.212 af
Discarded=0.38 cfs 0.904 af Primary=9.82 cfs 1.308 af Outflow=10.19 cfs 2.212 af

Pond CRH-3: CRH-3 Peak Elev=878.90' Storage=0.421 af Inflow=10.84 cfs 1.637 af
Discarded=0.24 cfs 0.449 af Primary=7.98 cfs 1.188 af Outflow=8.22 cfs 1.637 af

Pond P-5/P-6: P-5/P-6 Peak Elev=930.49' Storage=8.298 af Inflow=91.40 cfs 7.854 af
Primary=26.70 cfs 7.038 af Secondary=2.25 cfs 0.809 af Outflow=28.95 cfs 7.848 af

Pond TI P: Thumb Infiltration (Thumb TP Peak Elev=903.27' Storage=3.268 af Inflow=18.36 cfs 3.268 af
Outflow=0.00 cfs 0.000 af

Pond W-1: W-1 Peak Elev=915.09' Storage=0.231 af Inflow=2.45 cfs 0.971 af
Outflow=2.00 cfs 0.970 af

Pond W-3: W-3 Peak Elev=915.07' Storage=0.666 af Inflow=0.63 cfs 0.666 af
Outflow=0.00 cfs 0.000 af

Pond W-4: W-4 Peak Elev=908.93' Storage=0.878 af Inflow=8.82 cfs 2.803 af
12.0" Round Culvert n=0.013 L=170.0' S=0.0235 '/' Outflow=3.11 cfs 2.784 af

Pond W-5: W-5 Peak Elev=883.06' Storage=4.998 af Inflow=34.78 cfs 3.757 af
Outflow=6.80 cfs 3.750 af

Link 53L: Sum of Outlet #2 Discharges to Round Lake Inflow=96.75 cfs 21.122 af
Primary=96.75 cfs 21.122 af

Link 54L: Sum of Discharges from P-13 and W-5 Inflow=194.85 cfs 40.774 af
Primary=194.85 cfs 40.774 af

Link 55L: Sum of Outlet #1 Discharges to Round Lake Inflow=3.08 cfs 1.406 af
Primary=3.08 cfs 1.406 af

Link 57L: Outlet #3 Discharge to Round Lake

Inflow=27.74 cfs 3.622 af
Primary=27.74 cfs 3.622 af

Total Runoff Area = 501.136 ac Runoff Volume = 78.323 af Average Runoff Depth = 1.88"
88.56% Pervious = 443.803 ac 11.44% Impervious = 57.333 ac

Summary for Subcatchment 1S: To Rice Creek

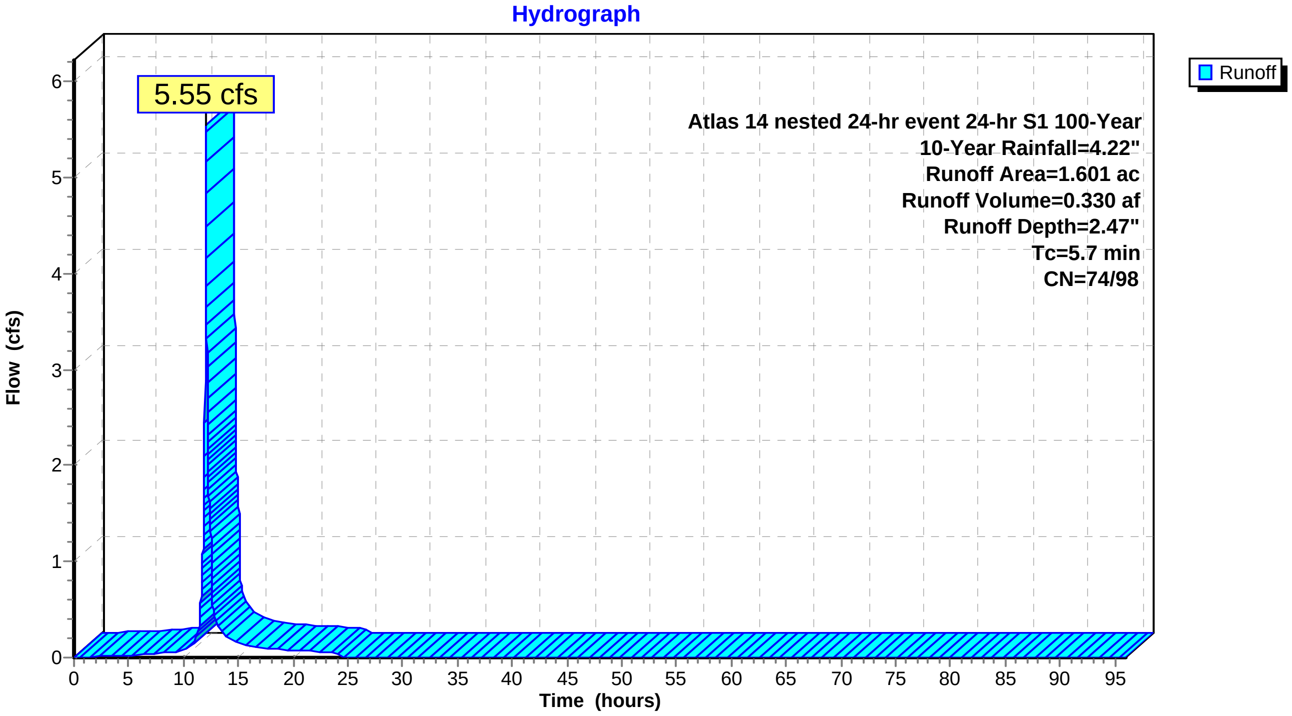
Runoff = 5.55 cfs @ 12.04 hrs, Volume= 0.330 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.512	98	impervious
*	1.089	74	pervious
	1.601	82	Weighted Average
	1.089		68.02% Pervious Area
	0.512		31.98% Impervious Area

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

Subcatchment 1S: To Rice Creek



Summary for Subcatchment 47S: Offsite Subbasin 51

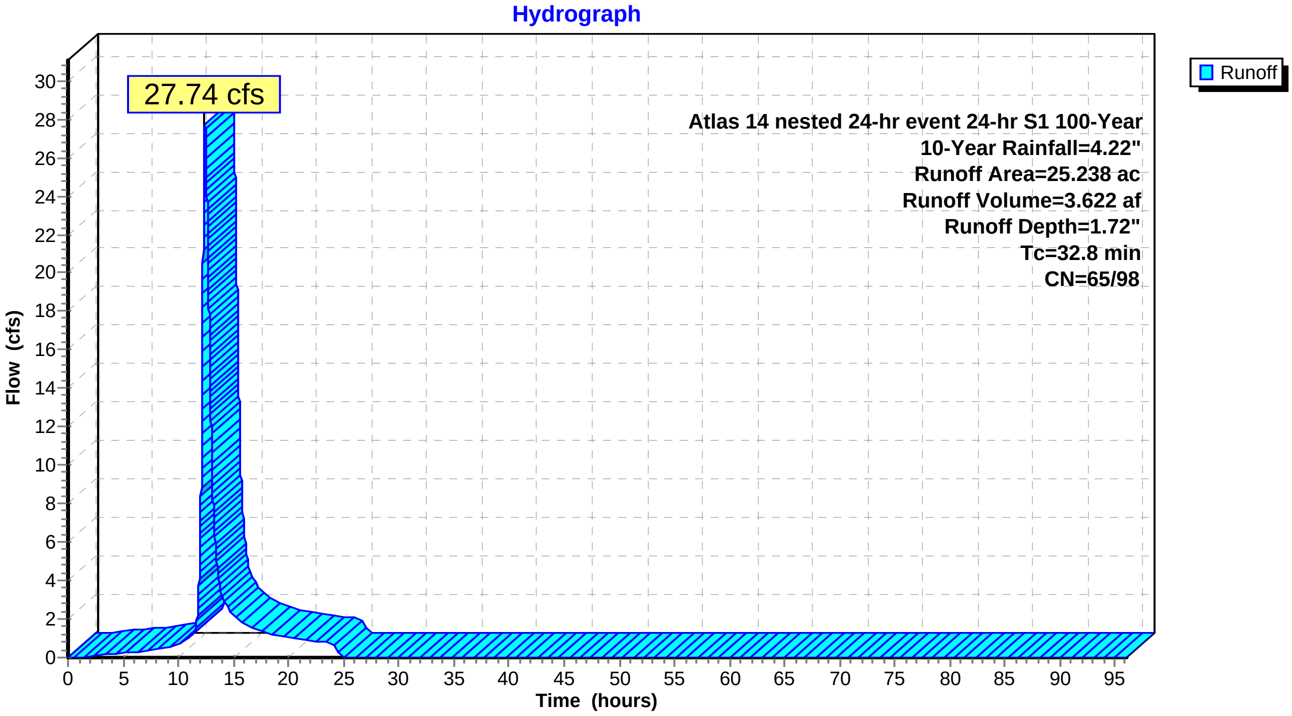
Runoff = 27.74 cfs @ 12.43 hrs, Volume= 3.622 af, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	20.200	65	Offsite subbasin 51
*	5.038	98	
	25.238	72	Weighted Average
	20.200		80.04% Pervious Area
	5.038		19.96% Impervious Area

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

Subcatchment 47S: Offsite Subbasin 51



Summary for Subcatchment SB 1: SB 1

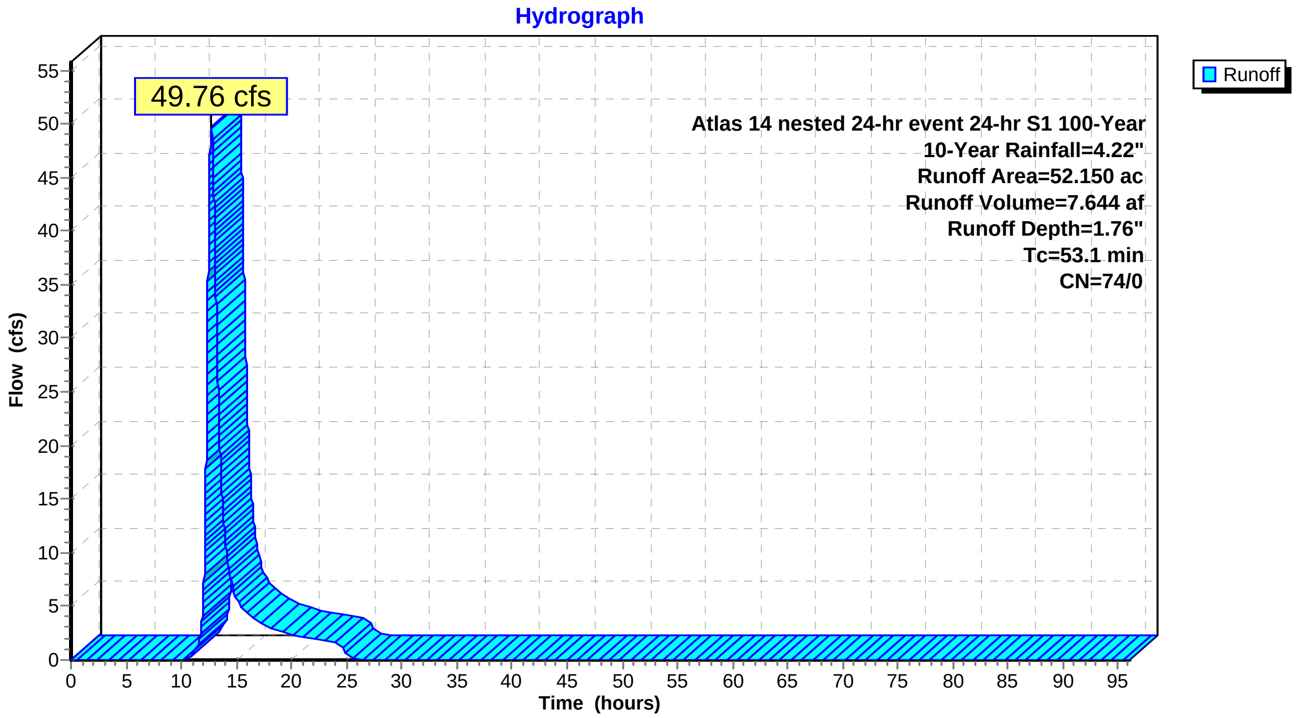
Runoff = 49.76 cfs @ 12.74 hrs, Volume= 7.644 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	52.150	74	pervious
*	0.000	98	impervious
	52.150	74	Weighted Average
	52.150		100.00% Pervious Area

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

Subcatchment SB 1: SB 1



Summary for Subcatchment SB 11: SB 11

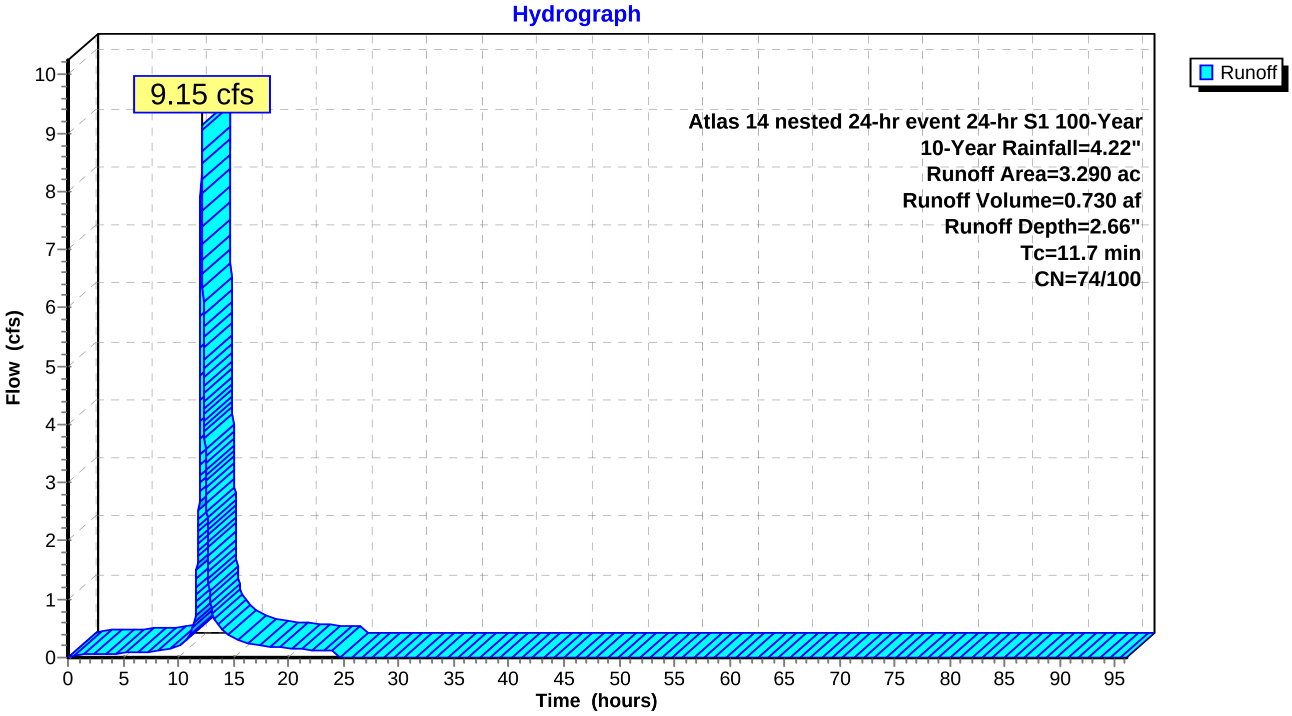
Runoff = 9.15 cfs @ 12.11 hrs, Volume= 0.730 af, Depth= 2.66"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.080	74	pervious
*	1.210	100	impervious
	3.290	84	Weighted Average
	2.080		63.22% Pervious Area
	1.210		36.78% Impervious Area

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

Subcatchment SB 11: SB 11



Summary for Subcatchment SB 12: SB 12

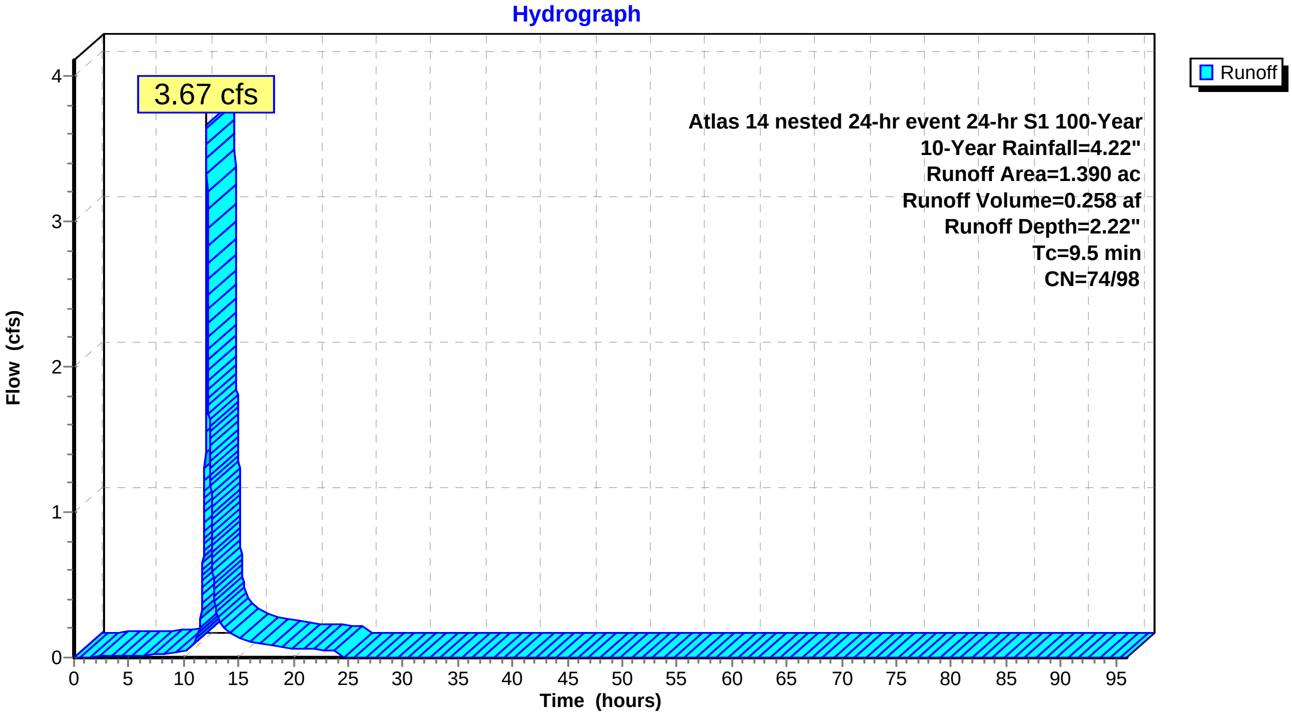
Runoff = 3.67 cfs @ 12.08 hrs, Volume= 0.258 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	1.100	74	pervious
*	0.290	98	impervious
	1.390	79	Weighted Average
	1.100		79.14% Pervious Area
	0.290		20.86% Impervious Area

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

Subcatchment SB 12: SB 12



Summary for Subcatchment SB 13: SB 13

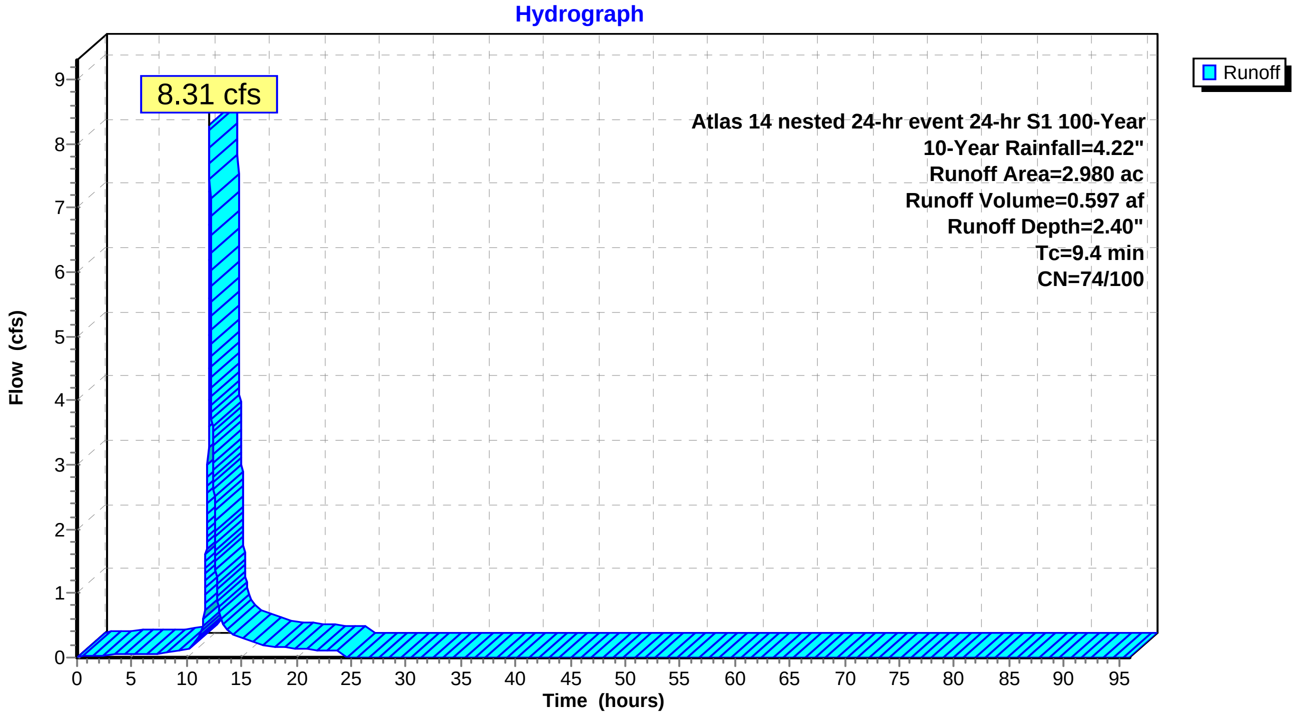
Runoff = 8.31 cfs @ 12.08 hrs, Volume= 0.597 af, Depth= 2.40"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.200	74	pervious
*	0.780	100	impervious
	2.980	81	Weighted Average
	2.200		73.83% Pervious Area
	0.780		26.17% Impervious Area

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

Subcatchment SB 13: SB 13



Summary for Subcatchment SB 14: SB 14

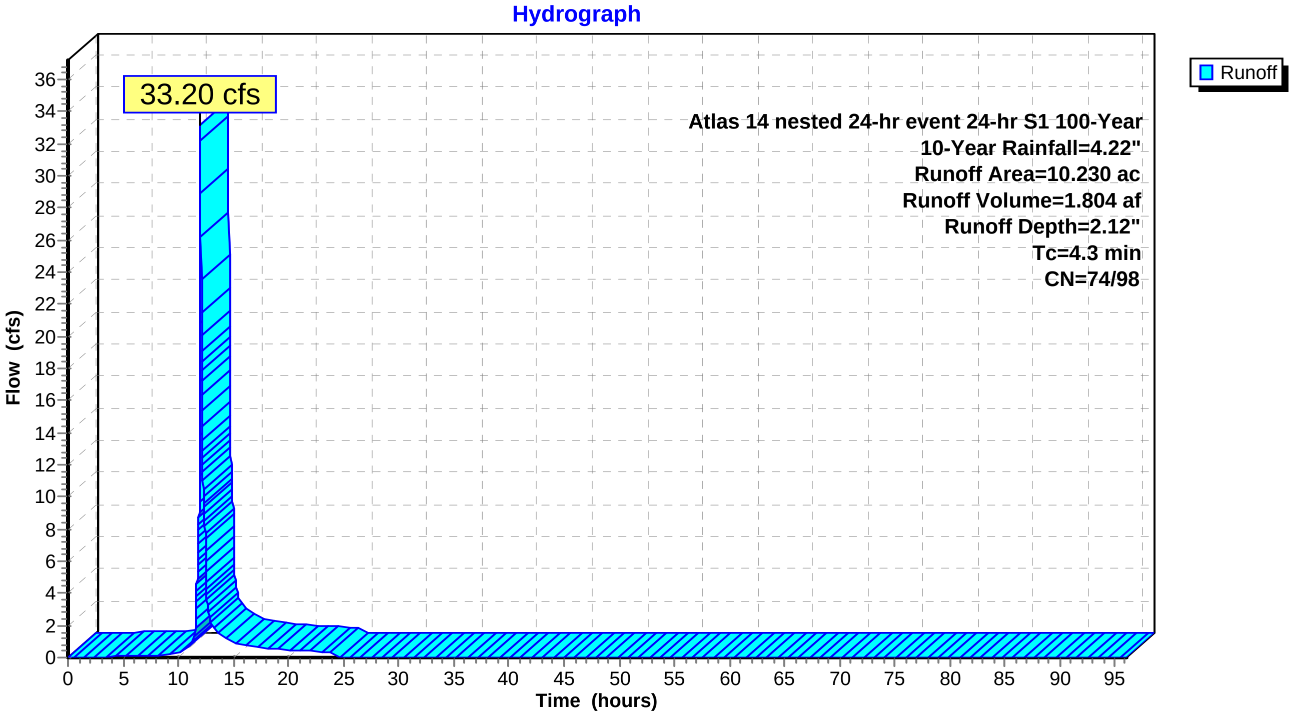
Runoff = 33.20 cfs @ 12.02 hrs, Volume= 1.804 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	8.590	74	pervious
*	1.640	98	impervious
	10.230	78	Weighted Average
	8.590		83.97% Pervious Area
	1.640		16.03% Impervious Area

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

Subcatchment SB 14: SB 14



Summary for Subcatchment SB 15: SB 15

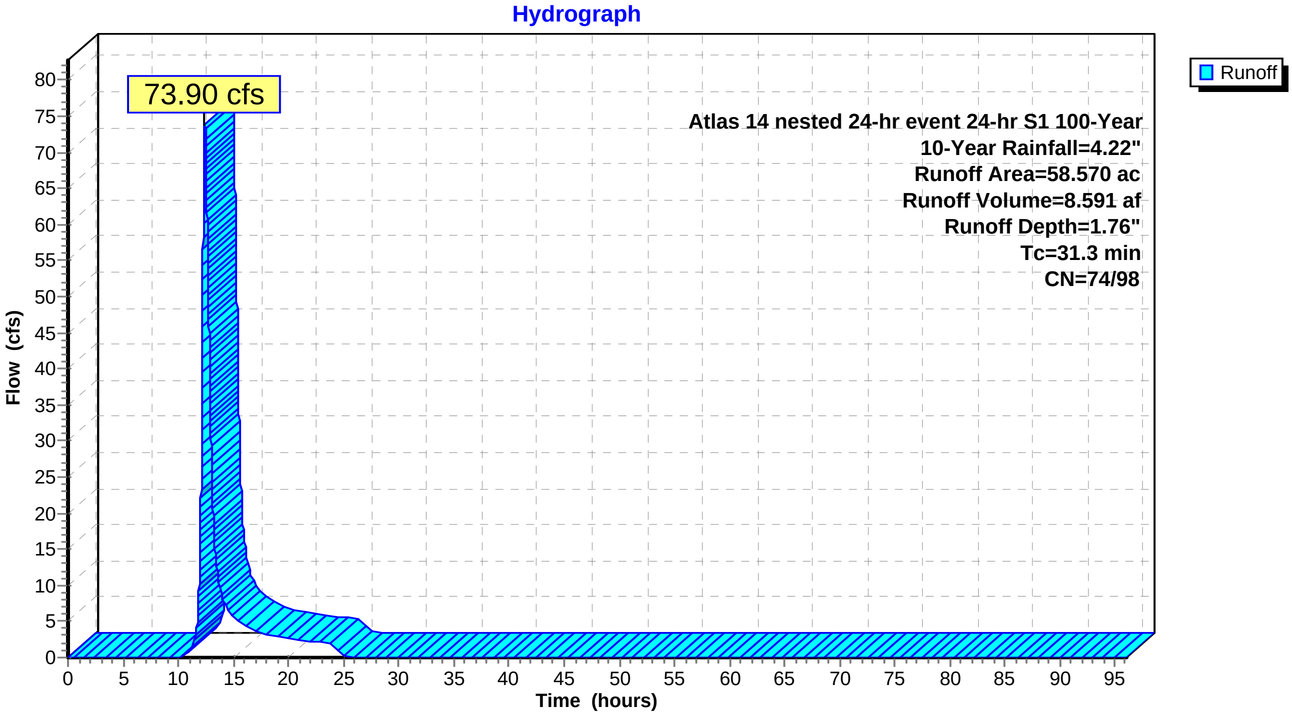
Runoff = 73.90 cfs @ 12.42 hrs, Volume= 8.591 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	58.540	74	pervious
*	0.030	98	impervious
	58.570	74	Weighted Average
	58.540		99.95% Pervious Area
	0.030		0.05% Impervious Area

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

Subcatchment SB 15: SB 15



Summary for Subcatchment SB 16: SB 16

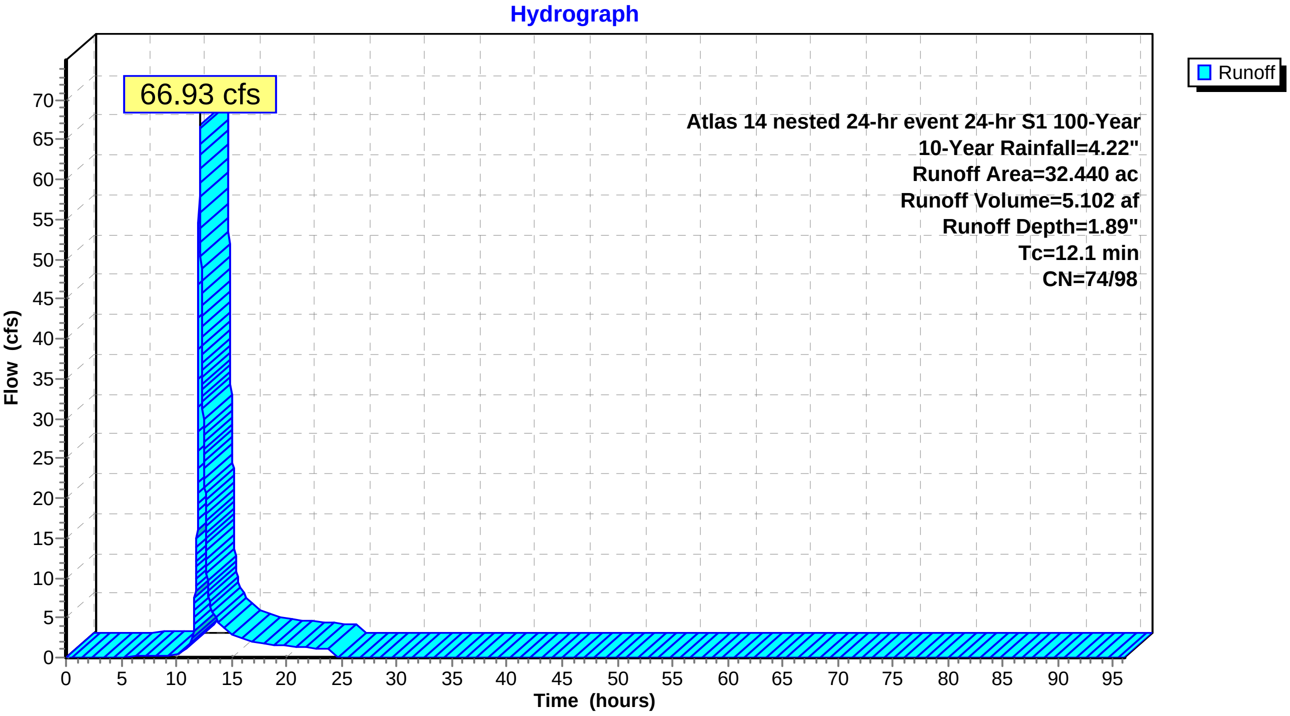
Runoff = 66.93 cfs @ 12.13 hrs, Volume= 5.102 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	30.570	74	pervious
*	1.870	98	impervious
	32.440	75	Weighted Average
	30.570		94.24% Pervious Area
	1.870		5.76% Impervious Area

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

Subcatchment SB 16: SB 16



Summary for Subcatchment SB 17: SB 17

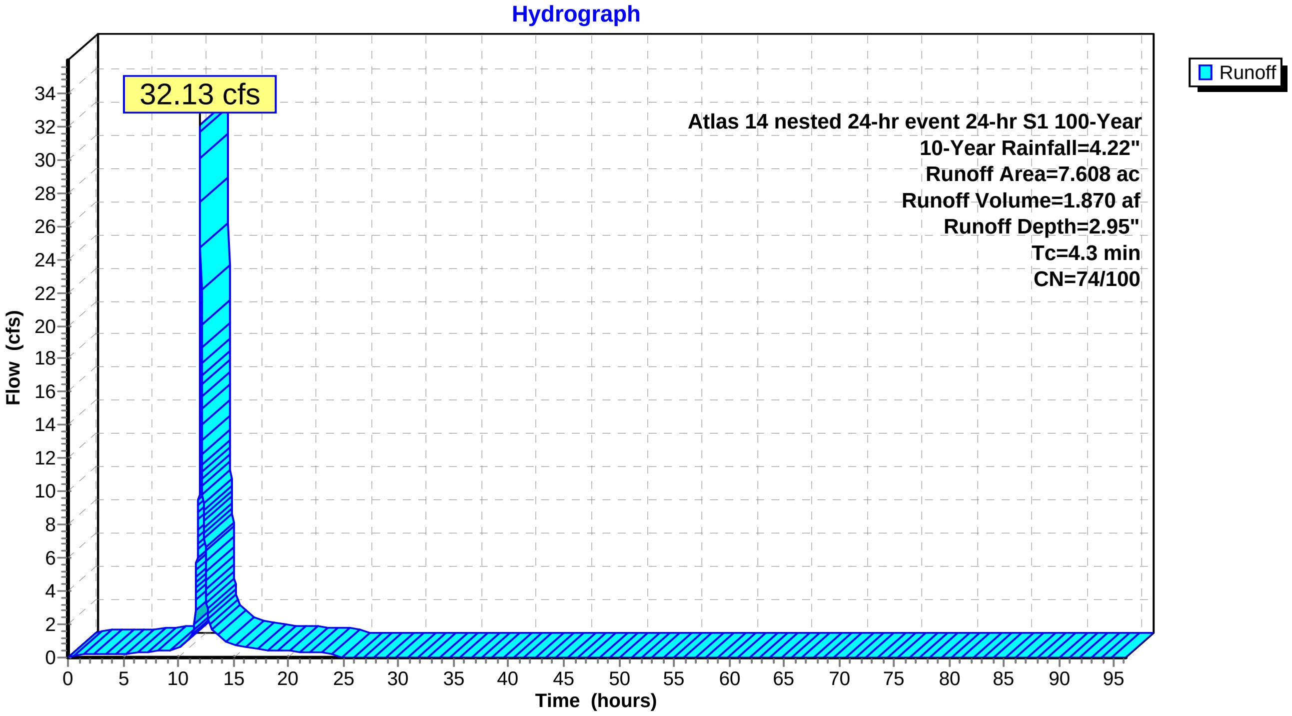
Runoff = 32.13 cfs @ 12.02 hrs, Volume= 1.870 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.925	74	pervious
*	3.683	100	impervious
	7.608	87	Weighted Average
	3.925		51.59% Pervious Area
	3.683		48.41% Impervious Area

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

Subcatchment SB 17: SB 17



Summary for Subcatchment SB 18: SB 18

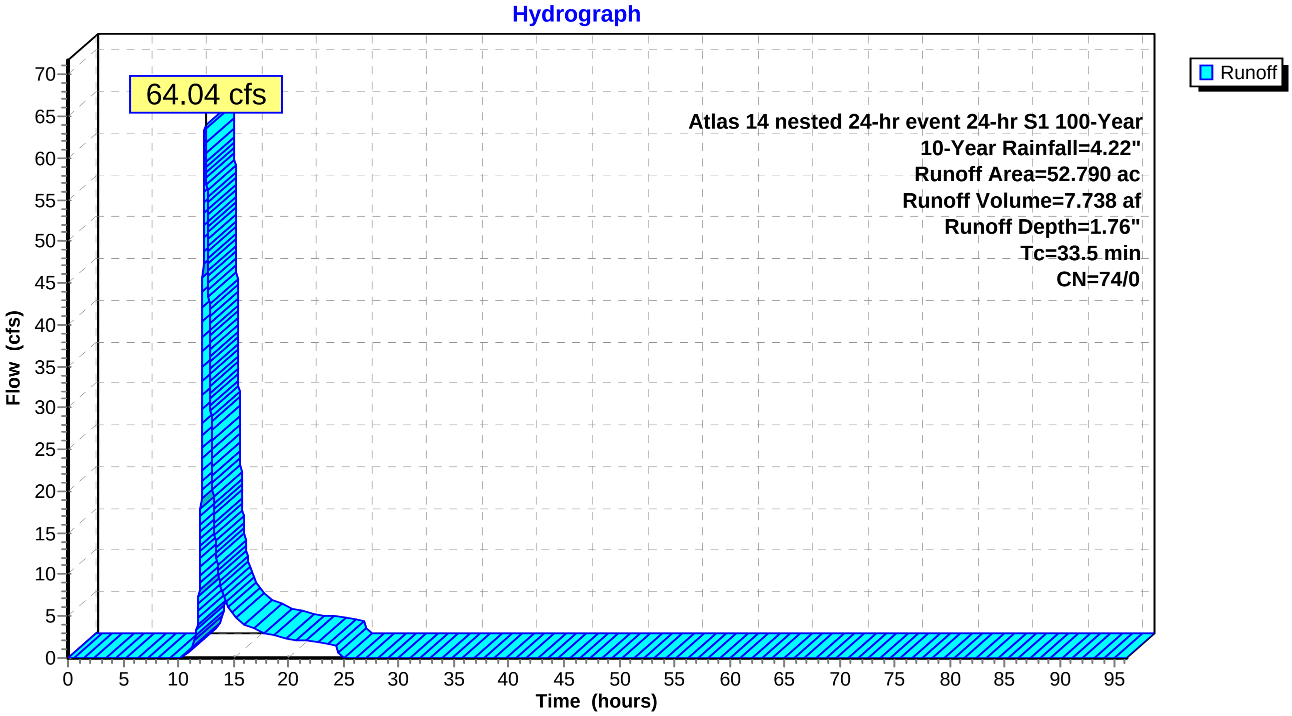
Runoff = 64.04 cfs @ 12.46 hrs, Volume= 7.738 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	52.790	74	pervious
*	0.000	98	impervious
	52.790	74	Weighted Average
	52.790		100.00% Pervious Area

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

Subcatchment SB 18: SB 18



Summary for Subcatchment SB 19: SB 19

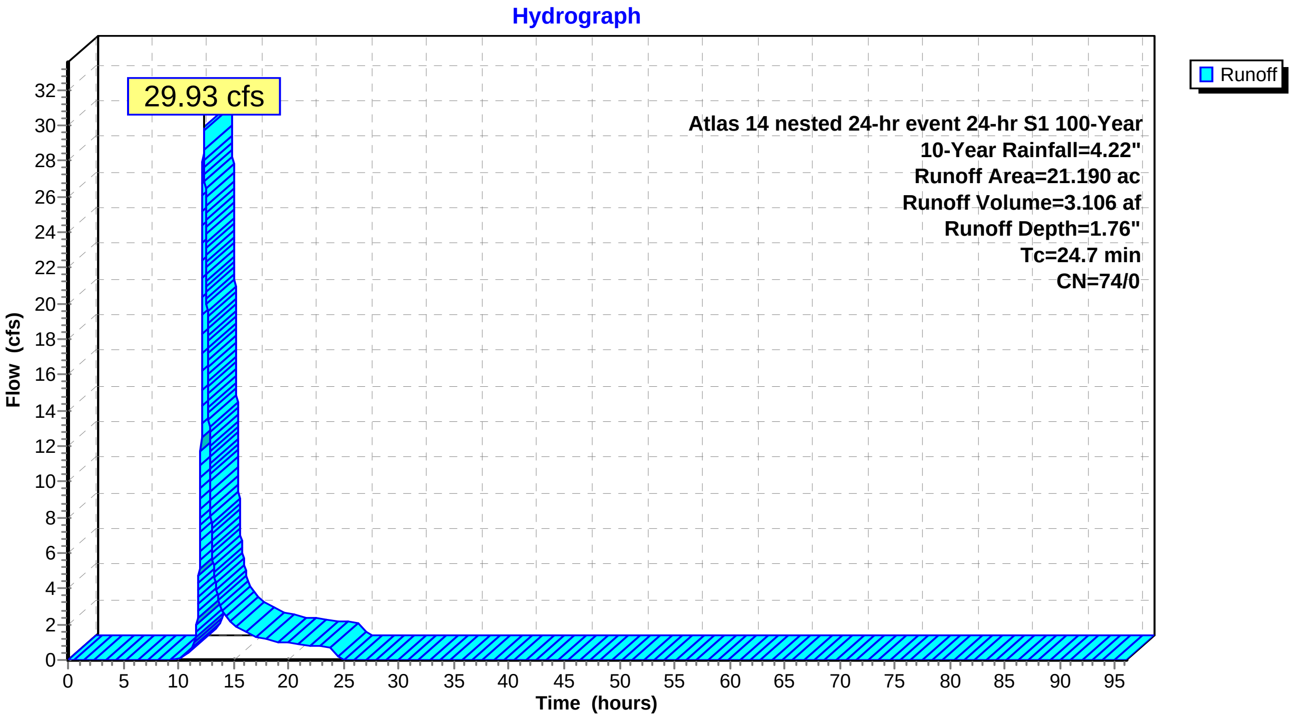
Runoff = 29.93 cfs @ 12.32 hrs, Volume= 3.106 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	21.190	74	pervious
*	0.000	98	impervious
	21.190	74	Weighted Average
	21.190		100.00% Pervious Area

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

Subcatchment SB 19: SB 19



Summary for Subcatchment SB 2: SB 2

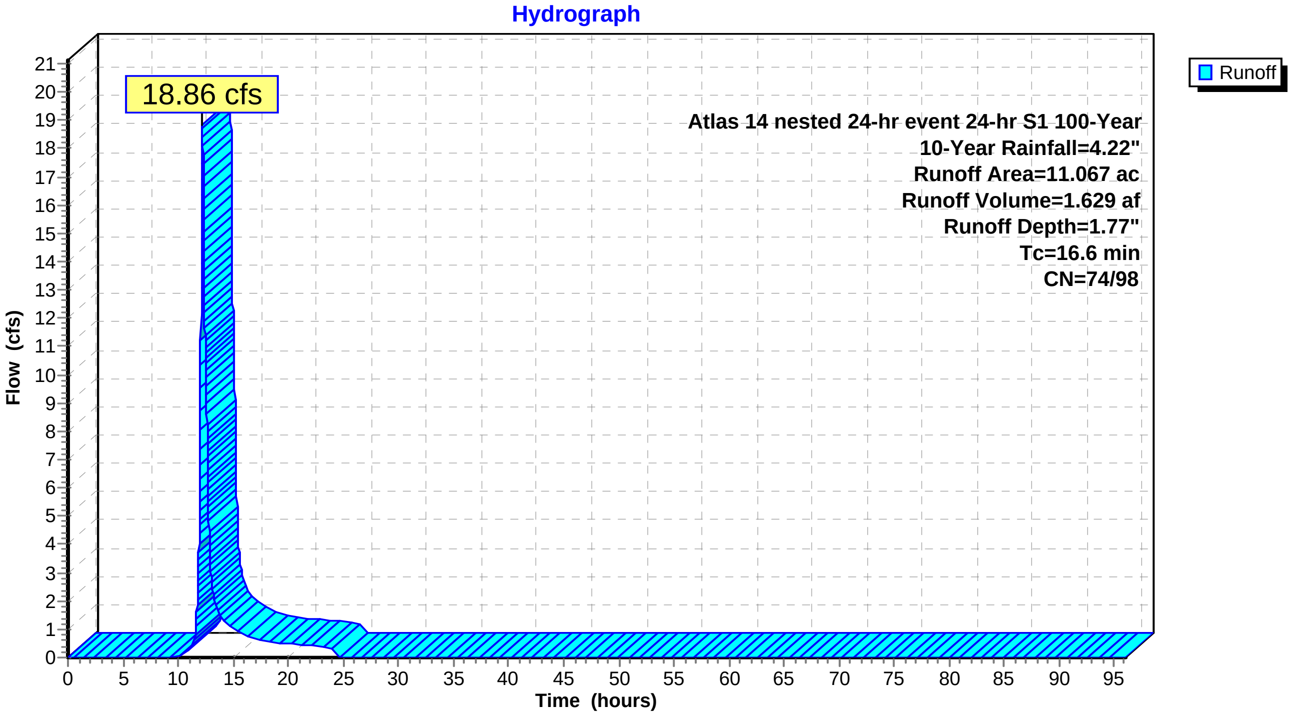
Runoff = 18.86 cfs @ 12.19 hrs, Volume= 1.629 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	11.030	74	pervious
*	0.037	98	impervious
	11.067	74	Weighted Average
	11.030		99.67% Pervious Area
	0.037		0.33% Impervious Area

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

Subcatchment SB 2: SB 2



Summary for Subcatchment SB 22: SB 22

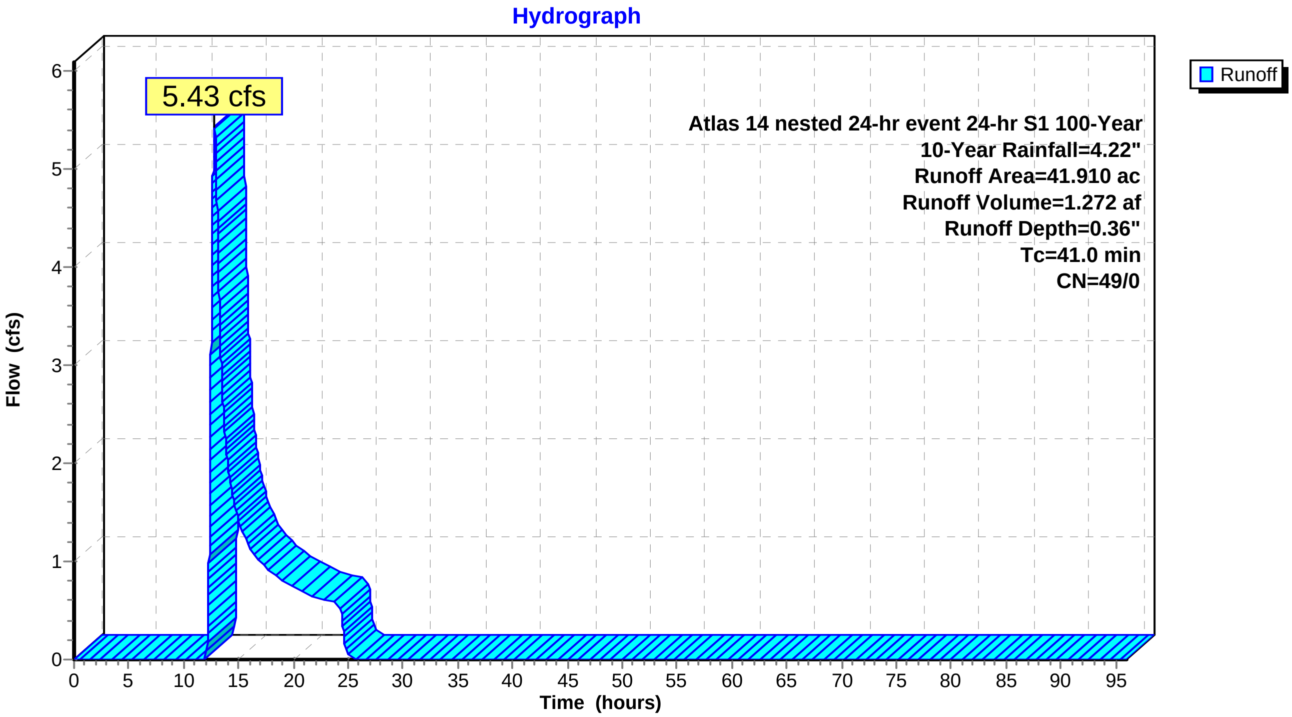
Runoff = 5.43 cfs @ 12.81 hrs, Volume= 1.272 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	41.910	49	Pervious
*	0.000	98	Impervious
	41.910	49	Weighted Average
	41.910		100.00% Pervious Area

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

Subcatchment SB 22: SB 22



Summary for Subcatchment SB 24: SB 24

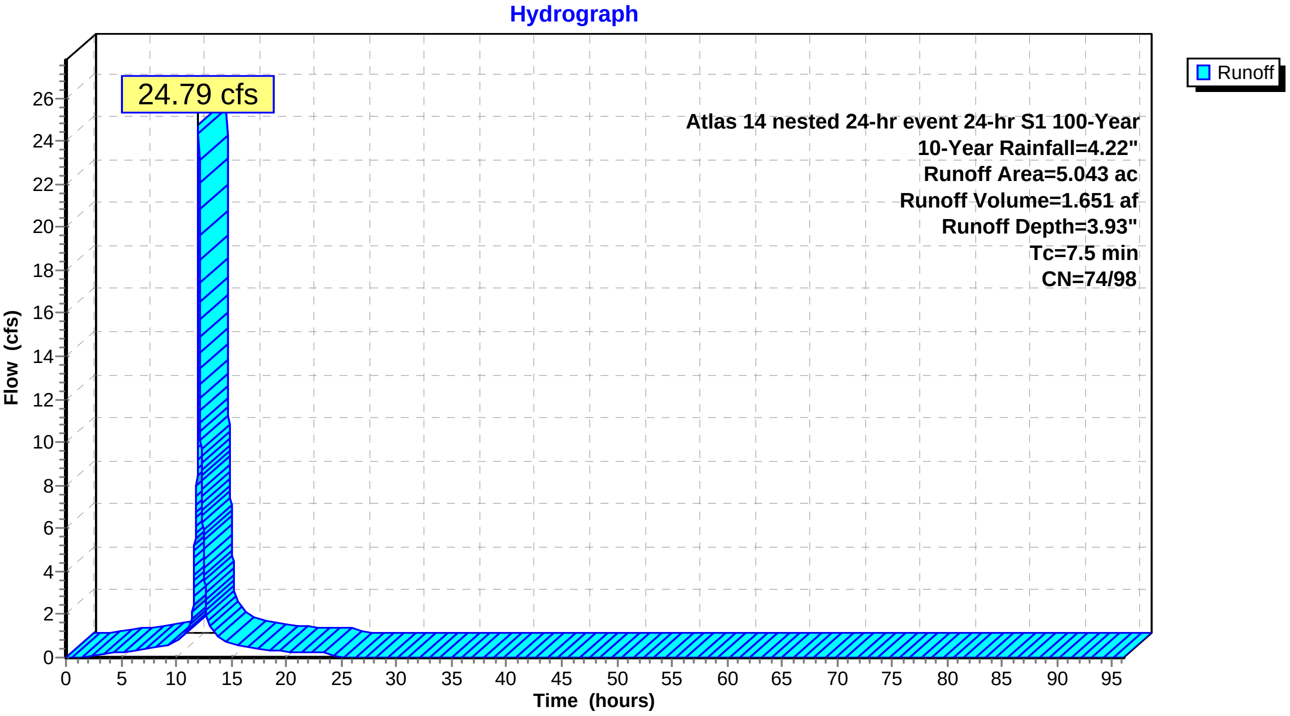
Runoff = 24.79 cfs @ 12.05 hrs, Volume= 1.651 af, Depth= 3.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.123	74	permiable
*	4.920	98	impermiable
	5.043	97	Weighted Average
	0.123		2.44% Pervious Area
	4.920		97.56% Impervious Area

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

Subcatchment SB 24: SB 24



Summary for Subcatchment SB 25: SB 25

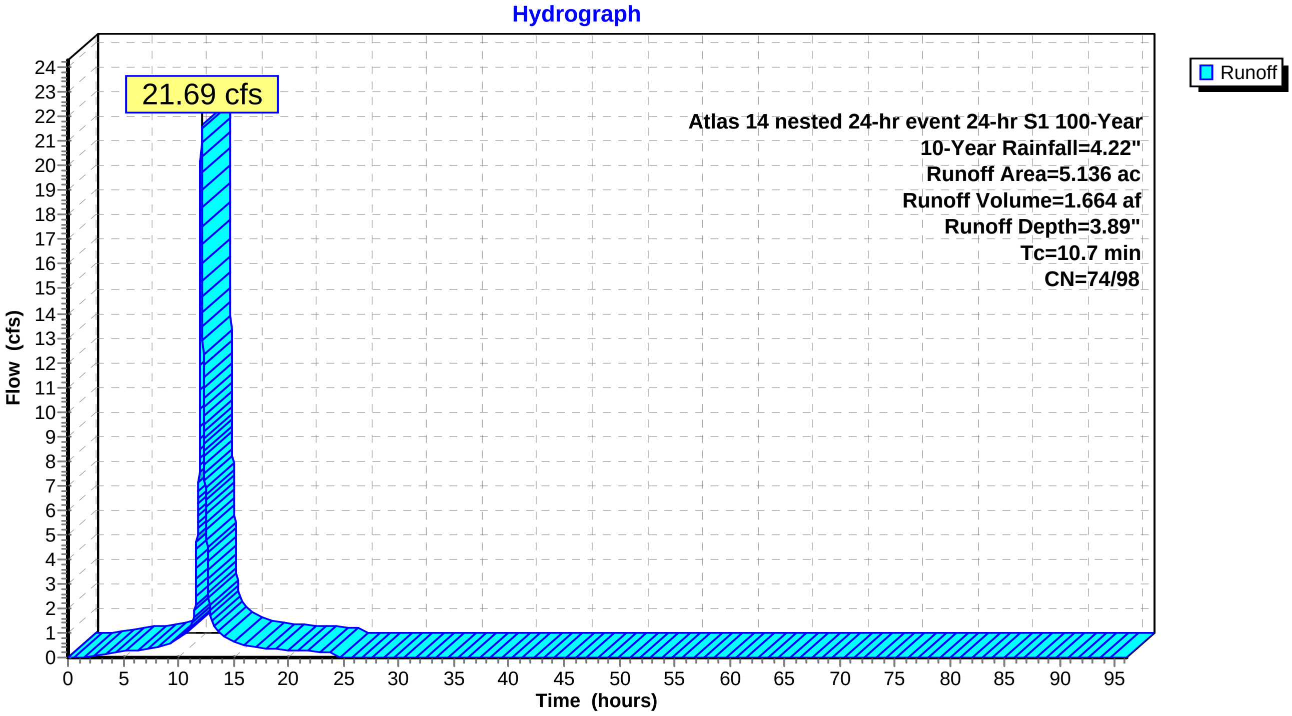
Runoff = 21.69 cfs @ 12.09 hrs, Volume= 1.664 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.220	74	pervious
*	4.916	98	impervious
	5.136	97	Weighted Average
	0.220		4.28% Pervious Area
	4.916		95.72% Impervious Area

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

Subcatchment SB 25: SB 25



Summary for Subcatchment SB 26: SB 26

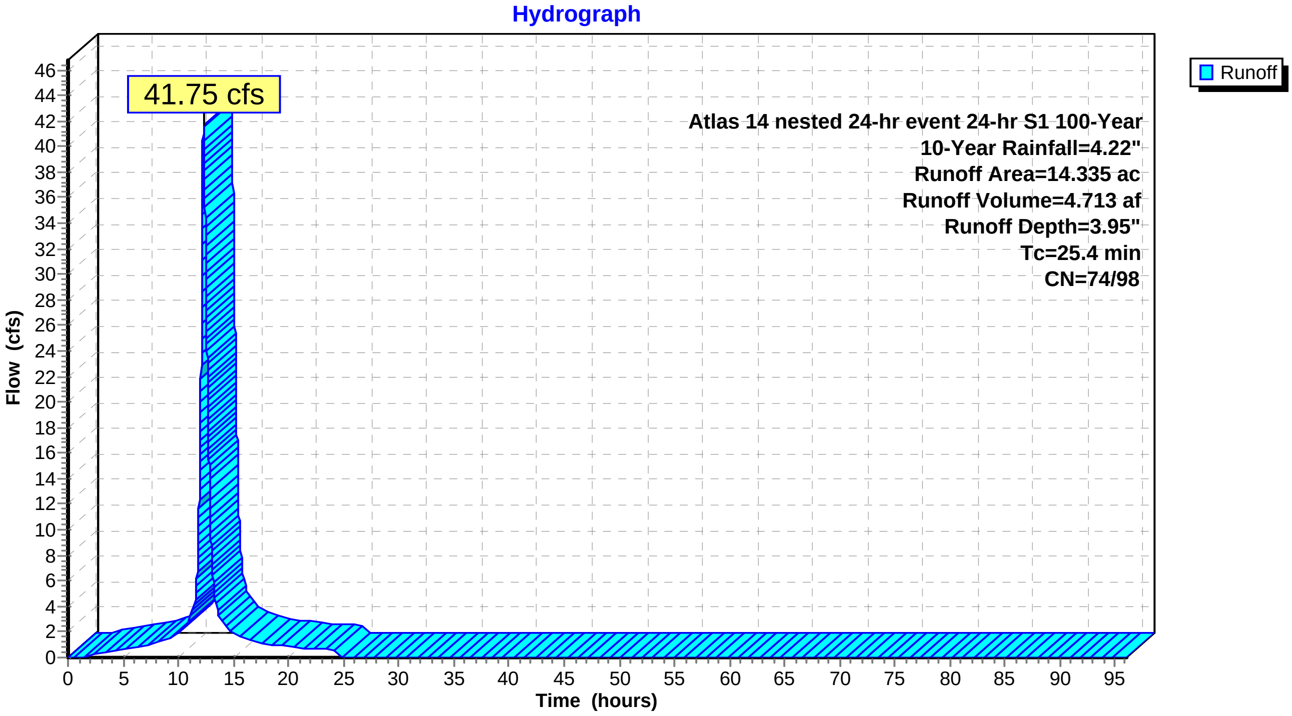
Runoff = 41.75 cfs @ 12.28 hrs, Volume= 4.713 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.248	74	pervious
*	14.087	98	impervious
	14.335	98	Weighted Average
	0.248		1.73% Pervious Area
	14.087		98.27% Impervious Area

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

Subcatchment SB 26: SB 26



Summary for Subcatchment SB 27: SB 27 (Thumb Road)

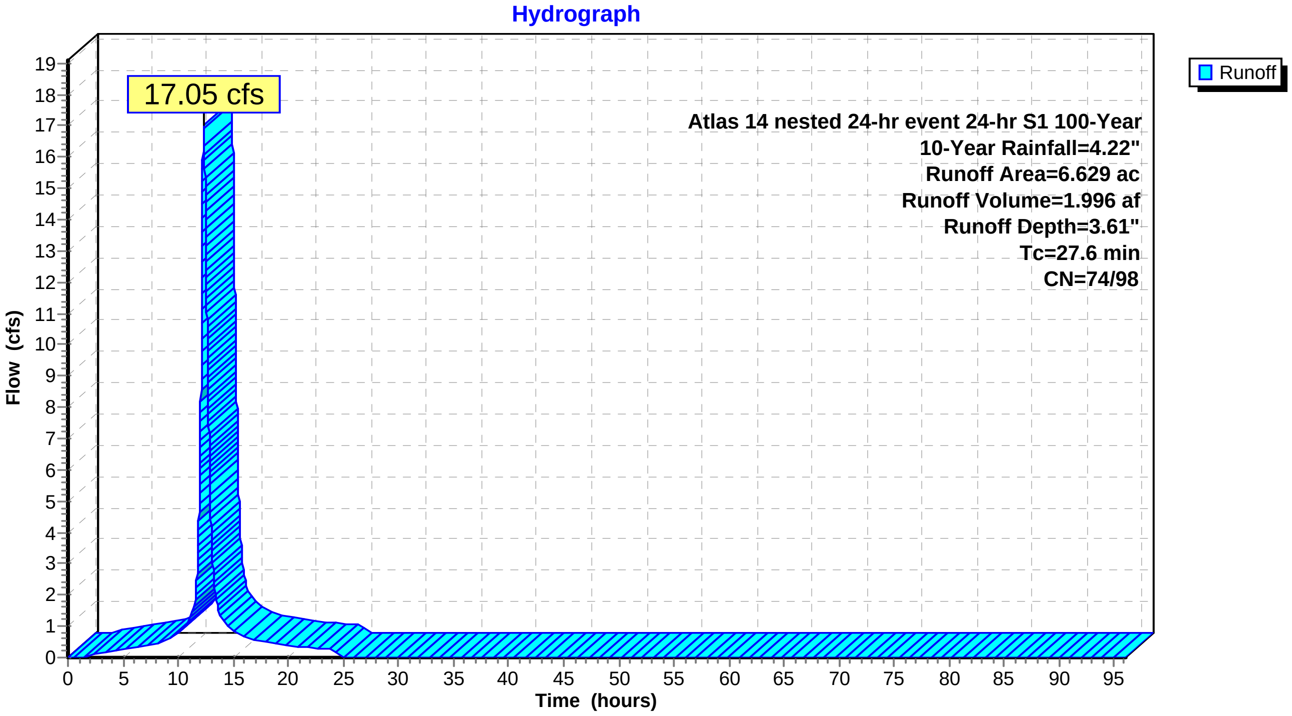
Runoff = 17.05 cfs @ 12.32 hrs, Volume= 1.996 af, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	1.105	74	Pervious
*	5.524	98	Impervious
	6.629	94	Weighted Average
	1.105		16.67% Pervious Area
	5.524		83.33% Impervious Area

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

Subcatchment SB 27: SB 27 (Thumb Road)



Summary for Subcatchment SB 28: SB 28

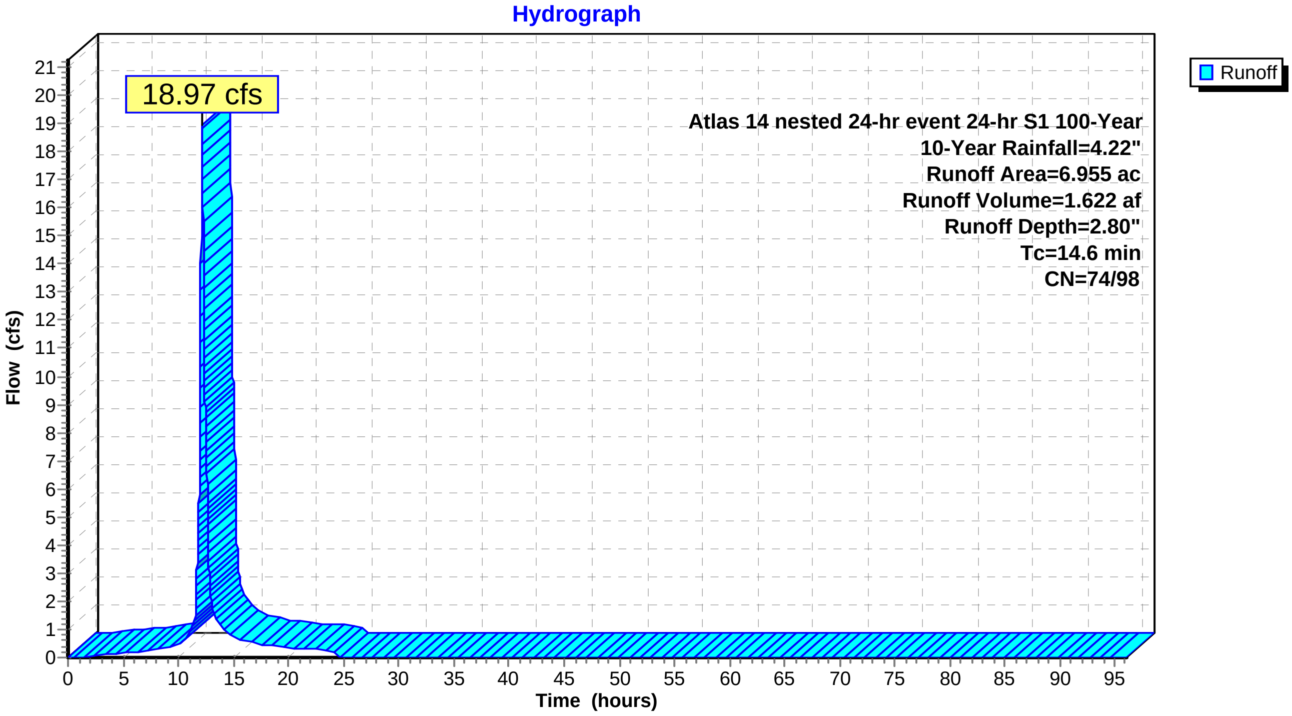
Runoff = 18.97 cfs @ 12.15 hrs, Volume= 1.622 af, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.703	74	pervious
*	3.252	98	impervious
	6.955	85	Weighted Average
	3.703		53.24% Pervious Area
	3.252		46.76% Impervious Area

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

Subcatchment SB 28: SB 28



Summary for Subcatchment SB 29: SB 29

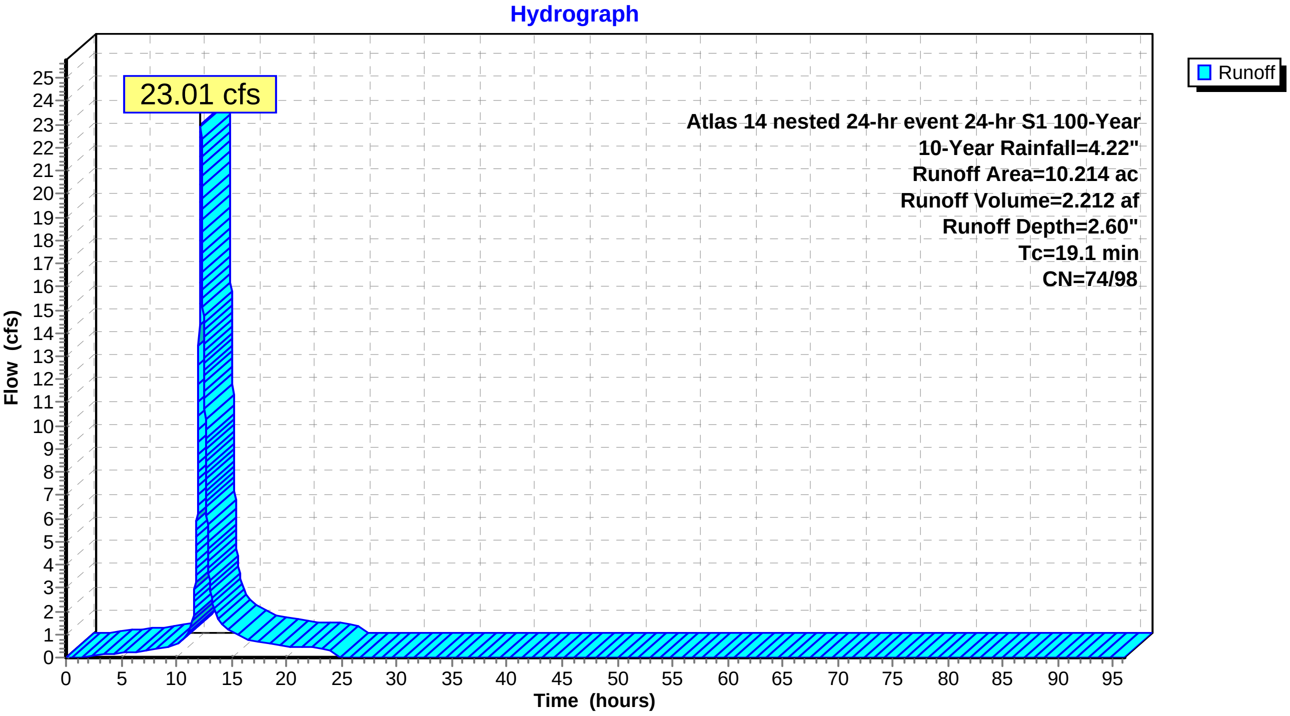
Runoff = 23.01 cfs @ 12.22 hrs, Volume= 2.212 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	6.360	74	pervious
*	3.854	98	impervious
	10.214	83	Weighted Average
	6.360		62.27% Pervious Area
	3.854		37.73% Impervious Area

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

Subcatchment SB 29: SB 29



Summary for Subcatchment SB 3: SB 3

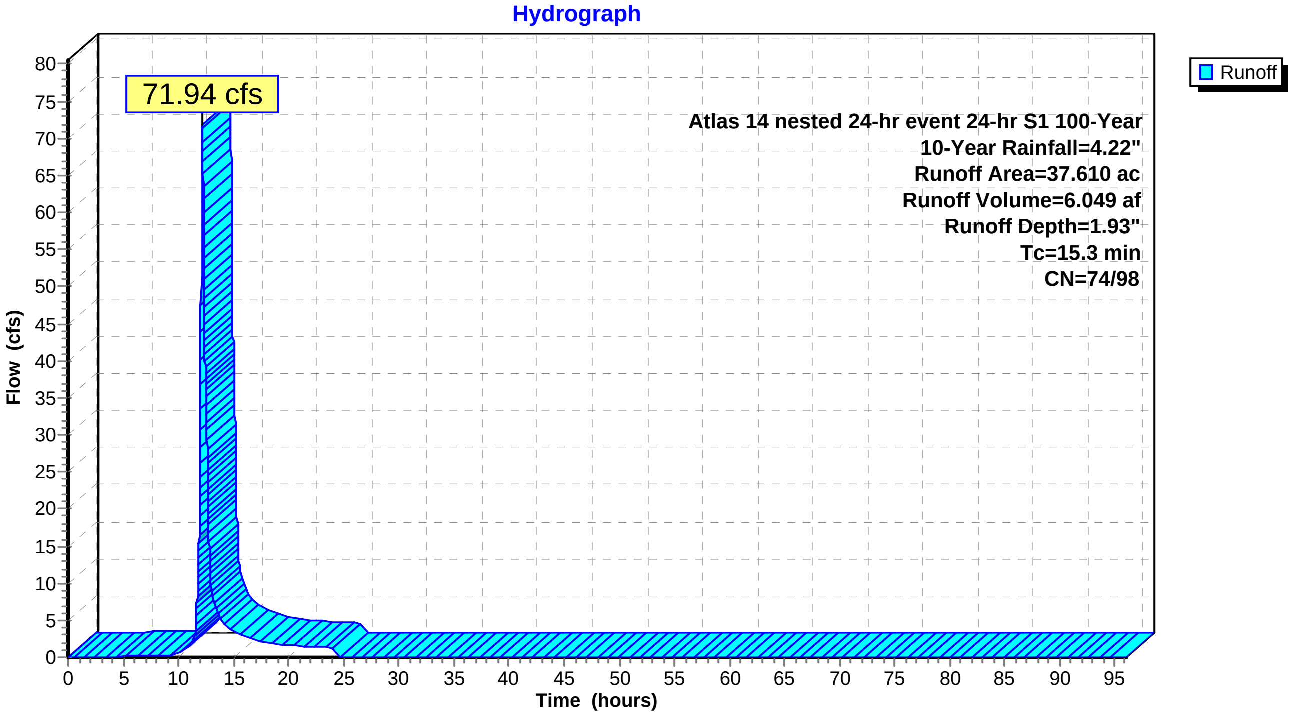
Runoff = 71.94 cfs @ 12.17 hrs, Volume= 6.049 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	34.720	74	Pervious
*	2.890	98	Impervious
	37.610	76	Weighted Average
	34.720		92.32% Pervious Area
	2.890		7.68% Impervious Area

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

Subcatchment SB 3: SB 3



Summary for Subcatchment SB 4: SB 4

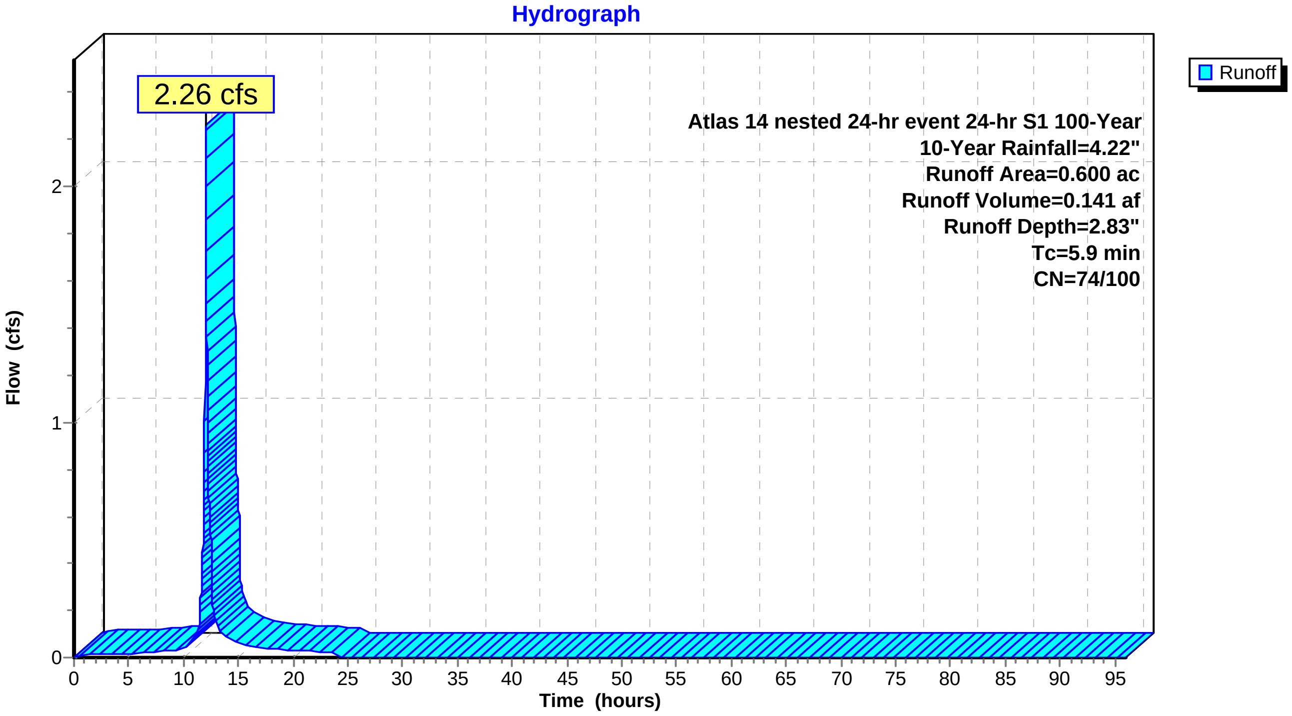
Runoff = 2.26 cfs @ 12.04 hrs, Volume= 0.141 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.340	74	pervious
*	0.260	100	impervious
	0.600	85	Weighted Average
	0.340		56.67% Pervious Area
	0.260		43.33% Impervious Area

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

Subcatchment SB 4: SB 4



Summary for Subcatchment SB 5: SB 5

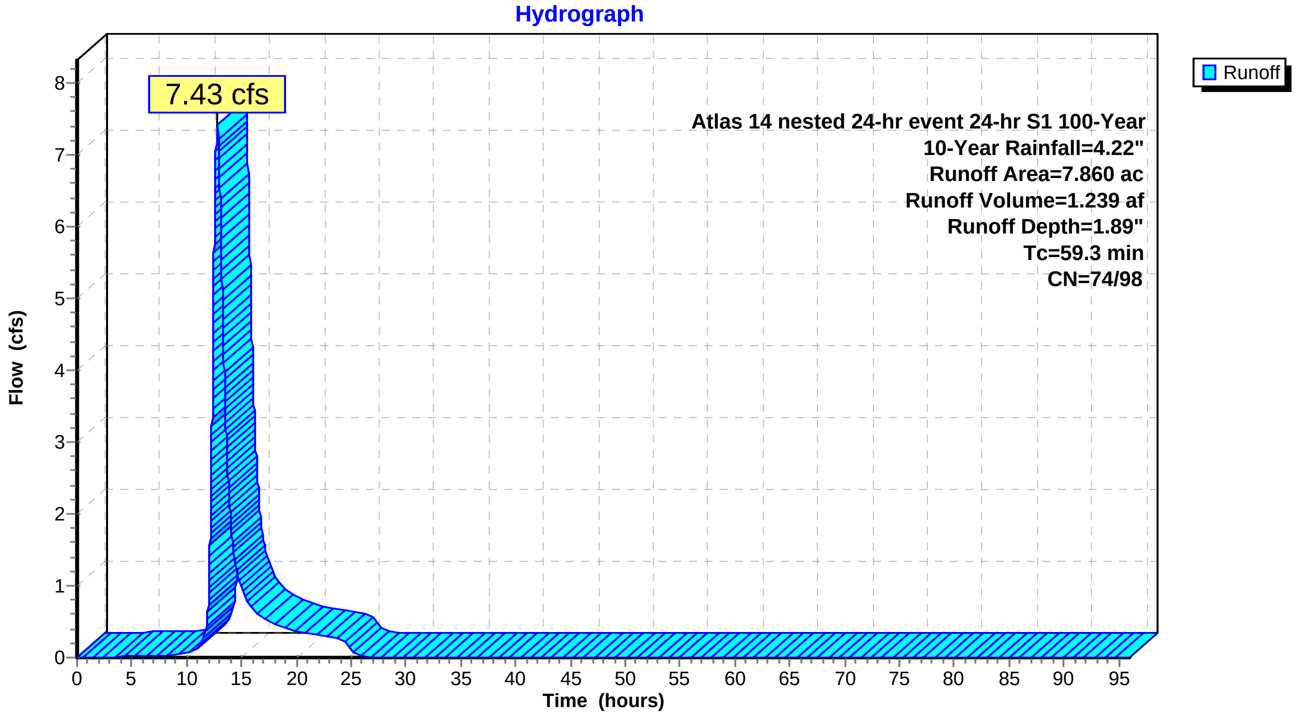
Runoff = 7.43 cfs @ 12.84 hrs, Volume= 1.239 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	7.390	74	pervious
*	0.470	98	impervious
	7.860	75	Weighted Average
	7.390		94.02% Pervious Area
	0.470		5.98% Impervious Area

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

Subcatchment SB 5: SB 5



Summary for Subcatchment SB 6: SB 6

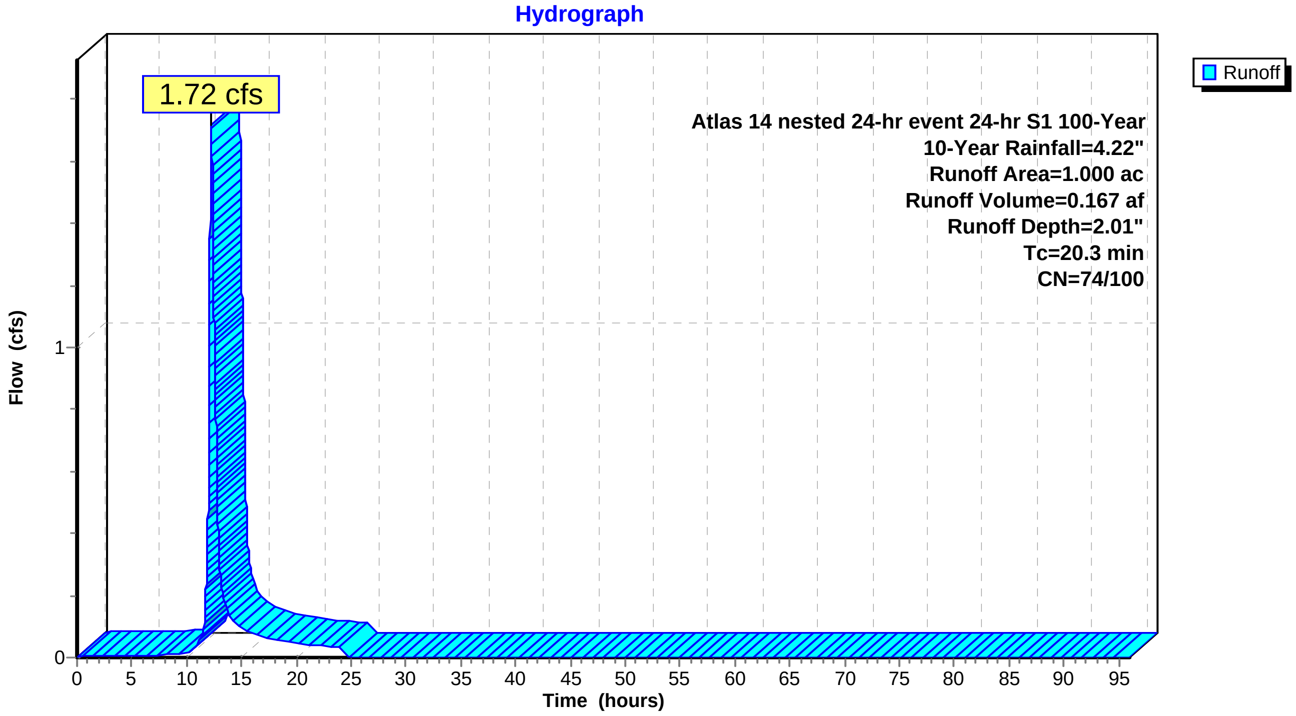
Runoff = 1.72 cfs @ 12.25 hrs, Volume= 0.167 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.900	74	pervious
*	0.100	100	impervious
	1.000	77	Weighted Average
	0.900		90.00% Pervious Area
	0.100		10.00% Impervious Area

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

Subcatchment SB 6: SB 6



Summary for Subcatchment SB 7: SB 7

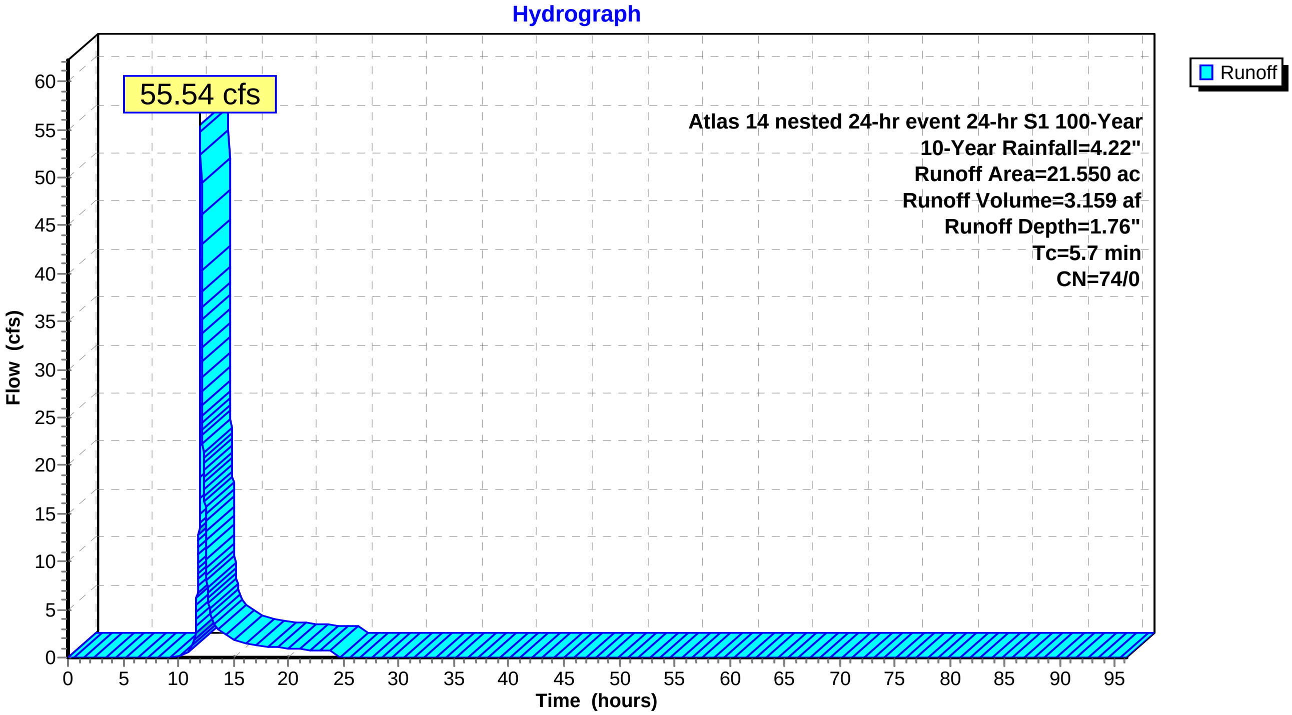
Runoff = 55.54 cfs @ 12.04 hrs, Volume= 3.159 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	21.550	74	pervious
*	0.000	98	impervious
	21.550	74	Weighted Average
	21.550		100.00% Pervious Area

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

Subcatchment SB 7: SB 7



Summary for Subcatchment SB 8: SB 8

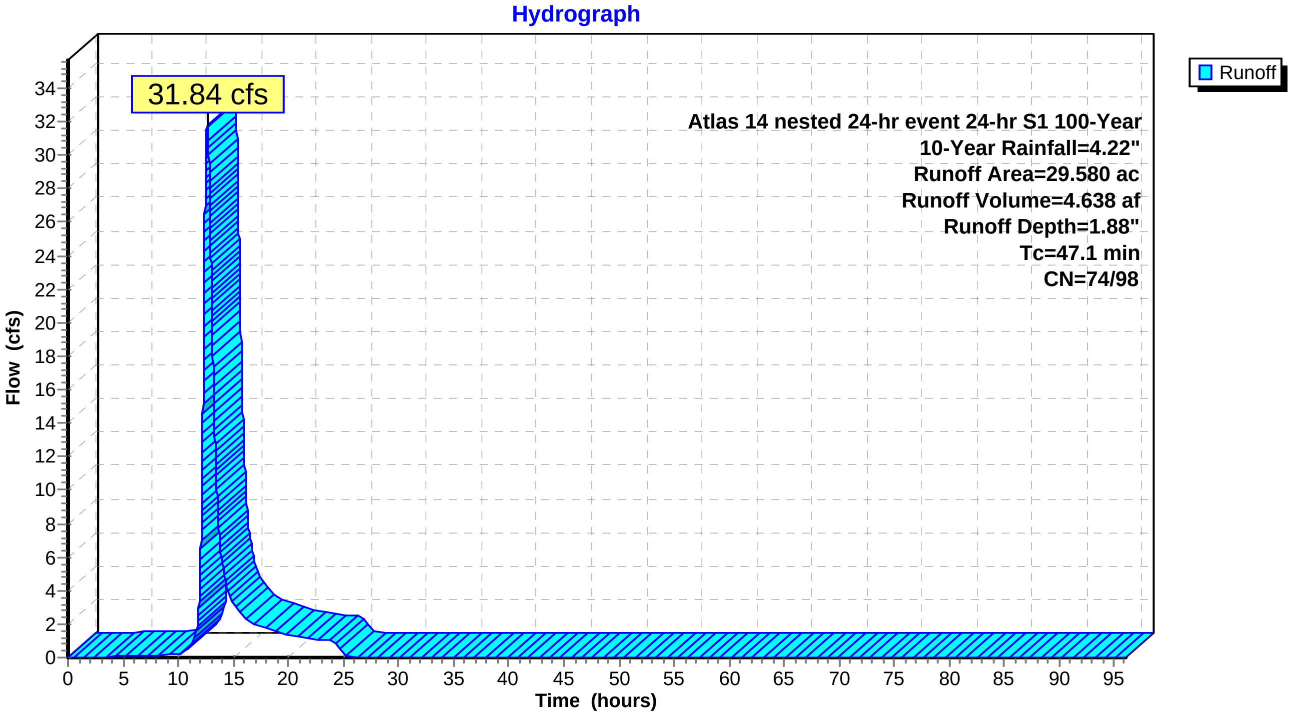
Runoff = 31.84 cfs @ 12.62 hrs, Volume= 4.638 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	27.950	74	pervious
*	1.630	98	impervious
	29.580	75	Weighted Average
	27.950		94.49% Pervious Area
	1.630		5.51% Impervious Area

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

Subcatchment SB 8: SB 8



Summary for Subcatchment SB 9: SB 9

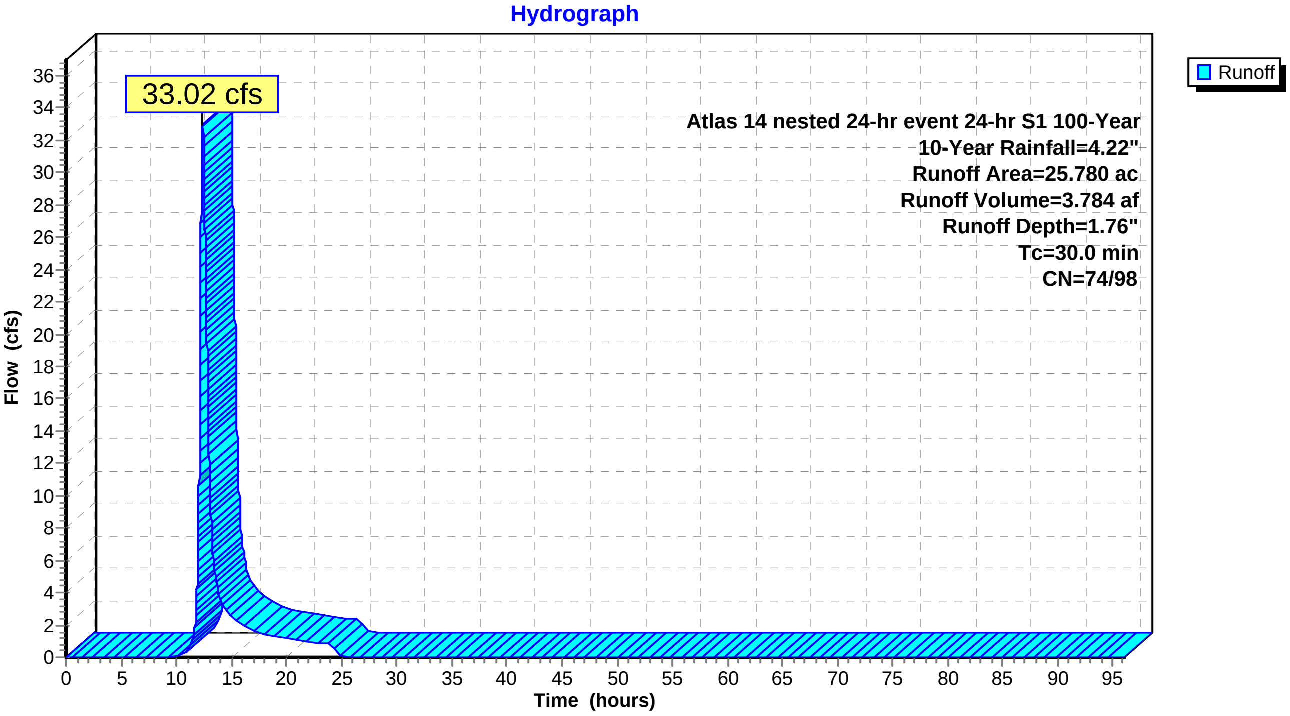
Runoff = 33.02 cfs @ 12.40 hrs, Volume= 3.784 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	25.750	74	permiable
*	0.030	98	impermiable
	25.780	74	Weighted Average
	25.750		99.88% Pervious Area
	0.030		0.12% Impervious Area

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

Subcatchment SB 9: SB 9



Summary for Subcatchment SB10: SB 10

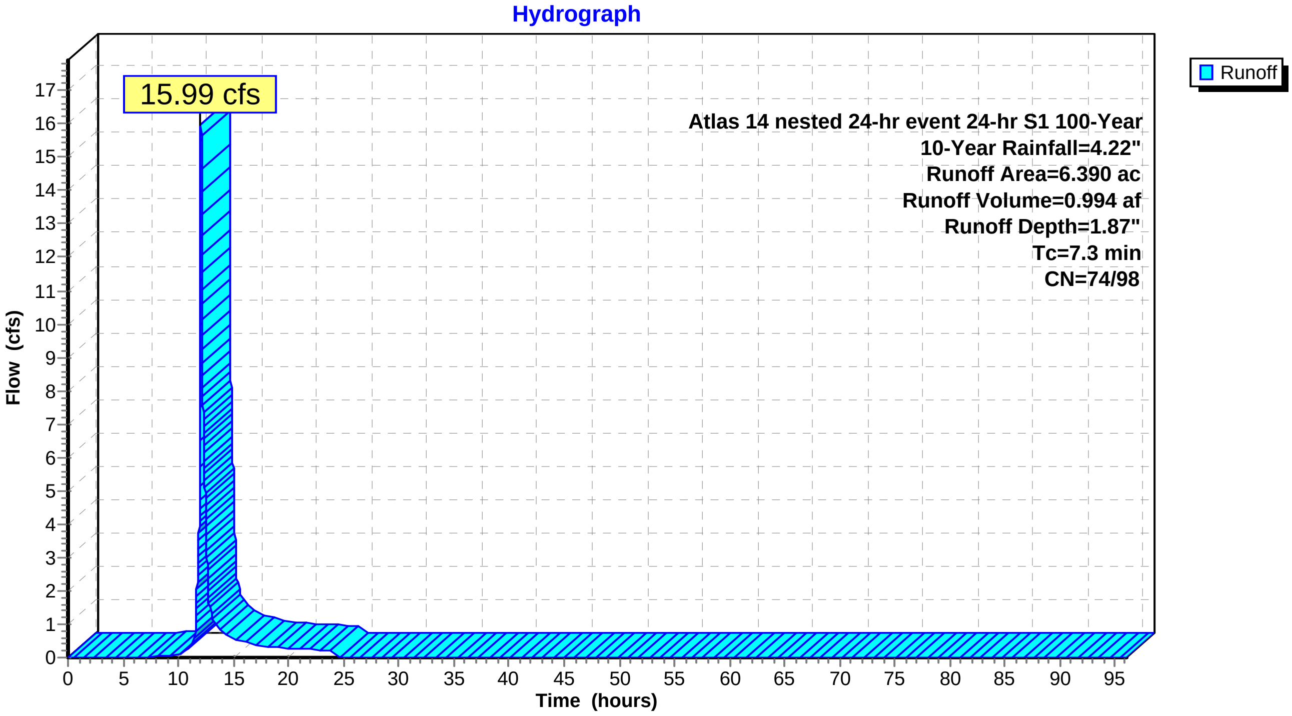
Runoff = 15.99 cfs @ 12.06 hrs, Volume= 0.994 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	6.080	74	pervious
*	0.310	98	impervious
	6.390	75	Weighted Average
	6.080		95.15% Pervious Area
	0.310		4.85% Impervious Area

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

Subcatchment SB10: SB 10



Summary for Pond 2 P: P-2

Inflow Area = 68.260 ac, 7.26% Impervious, Inflow Depth = 1.92" for 10-Year event
Inflow = 59.33 cfs @ 12.57 hrs, Volume= 10.925 af
Outflow = 59.01 cfs @ 12.64 hrs, Volume= 10.925 af, Atten= 1%, Lag= 3.9 min
Primary = 59.01 cfs @ 12.64 hrs, Volume= 10.925 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 924.00' Surf.Area= 0.370 ac Storage= 0.730 af
Peak Elev= 924.98' @ 12.64 hrs Surf.Area= 0.434 ac Storage= 1.125 af (0.395 af above start)

Plug-Flow detention time= 73.9 min calculated for 10.195 af (93% of inflow)
Center-of-Mass det. time= 21.2 min (883.0 - 861.8)

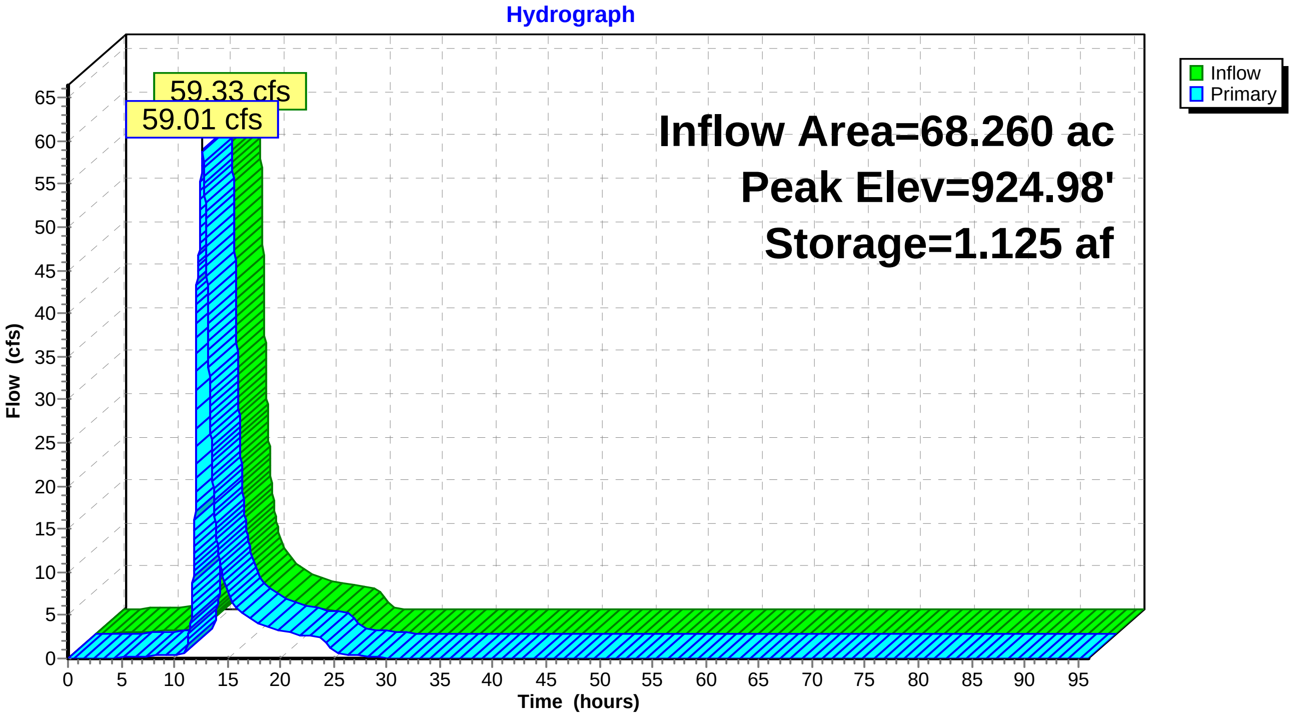
Volume	Invert	Avail.Storage	Storage Description
#1	920.00'	1.600 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
920.00	0.100	0.000	0.000
922.00	0.130	0.230	0.230
924.00	0.370	0.500	0.730
926.00	0.500	0.870	1.600

Device	Routing	Invert	Outlet Devices
#1	Primary	924.40'	**40.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	924.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=59.01 cfs @ 12.64 hrs HW=924.98' TW=0.00' (Dynamic Tailwater)
1=Sharp-Crested Rectangular Weir (Weir Controls 58.07 cfs @ 2.50 fps)
2=Orifice/Grate (Orifice Controls 0.94 cfs @ 4.77 fps)

Pond 2 P: P-2


Hydrograph
59.33 cfs
59.01 cfs
Inflow Area=68.260 ac
Peak Elev=924.98'
Storage=1.125 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 4P: P-4

```
Inflow Area =        7.860 ac,    5.98% Impervious,  Inflow Depth =   1.89"    for  10-Year event
Inflow      =        7.43 cfs @   12.84 hrs,  Volume=           1.239 af
Outflow     =        3.61 cfs @   13.47 hrs,  Volume=           1.239 af,  Atten= 51%,  Lag= 38.2 min
Primary     =        1.35 cfs @   13.50 hrs,  Volume=           0.436 af
Secondary =          2.26 cfs @   13.42 hrs,  Volume=           0.803 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00'   Surf.Area= 0.275 ac   Storage= 0.646 af
Peak Elev= 916.17' @ 13.50 hrs   Surf.Area= 0.340 ac   Storage= 1.005 af   (0.359 af above start)

Plug-Flow detention time= 335.5 min calculated for 0.594 af (48% of inflow)
Center-of-Mass det. time= 60.0 min ( 941.2 - 881.1 )

Volume       Invert    Avail.Storage    Storage Description
   #1        910.90'        1.728 af    Custom Stage Data (Prismatic)Listed below (Recalc)

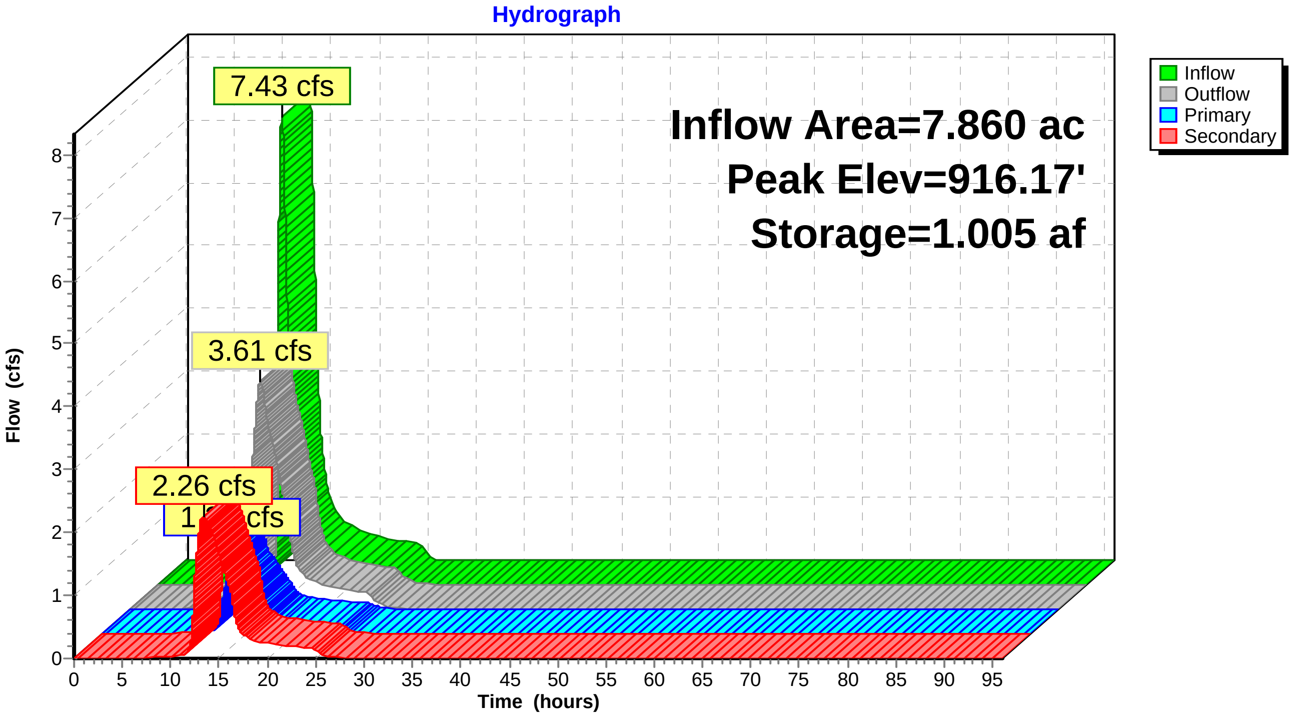
 Elevation        Surf.Area          Inc.Store          Cum.Store
    (feet)          (acres)        (acre-feet)        (acre-feet)
    910.90            0.070              0.000              0.000
    912.00            0.090              0.088              0.088
    914.00            0.220              0.310              0.398
    916.00            0.330              0.550              0.948
    918.00            0.450              0.780              1.728

Device   Routing            Invert   Outlet Devices
    #1   Primary           915.00'   6.0" Horiz. Orifice/Grate   C= 0.600
                                     Limited to weir flow at low heads
    #2   Secondary         915.00'   9.0" Horiz. Orifice/Grate   C= 0.600
                                     Limited to weir flow at low heads
    #3   Primary           915.95'   24.0"  Round RCP_Round  24"
                                     L= 50.0'   RCP, groove end w/headwall,  Ke= 0.200
                                     Inlet / Outlet Invert= 915.80' / 915.95'   S= -0.0030 '/'   Cc= 0.900
                                     n= 0.013,  Flow Area= 3.14 sf

Primary OutFlow  Max=1.35 cfs @ 13.50 hrs  HW=916.17'  TW=0.00'   (Dynamic Tailwater)
├─1=Orifice/Grate  (Orifice Controls 1.02 cfs @ 5.21 fps)
└─3=RCP_Round  24"  (Barrel Controls 0.33 cfs @ 1.25 fps)

Secondary OutFlow  Max=2.26 cfs @ 13.42 hrs  HW=916.17'  TW=915.04'   (Dynamic Tailwater)
└─2=Orifice/Grate  (Orifice Controls 2.26 cfs @ 5.12 fps)
```

Pond 4P: P-4


Hydrograph
7.43 cfs
3.61 cfs
2.26 cfs
1 cfs
Inflow Area=7.860 ac
Peak Elev=916.17'
Storage=1.005 af
🟩 Inflow
▨ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
1
2
3
4
5
6
7
8
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 7P: P-7

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 29.580 ac, 5.51% Impervious, Inflow Depth = 1.88" for 10-Year event
Inflow = 31.84 cfs @ 12.62 hrs, Volume= 4.638 af
Outflow = 32.31 cfs @ 12.68 hrs, Volume= 4.638 af, Atten= 0%, Lag= 3.8 min
Primary = 32.31 cfs @ 12.68 hrs, Volume= 4.638 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.440 ac Storage= 1.062 af
Peak Elev= 915.49' @ 12.62 hrs Surf.Area= 0.498 ac Storage= 1.291 af (0.228 af above start)

Plug-Flow detention time= 146.3 min calculated for 3.576 af (77% of inflow)
Center-of-Mass det. time= 9.4 min (880.2 - 870.8)

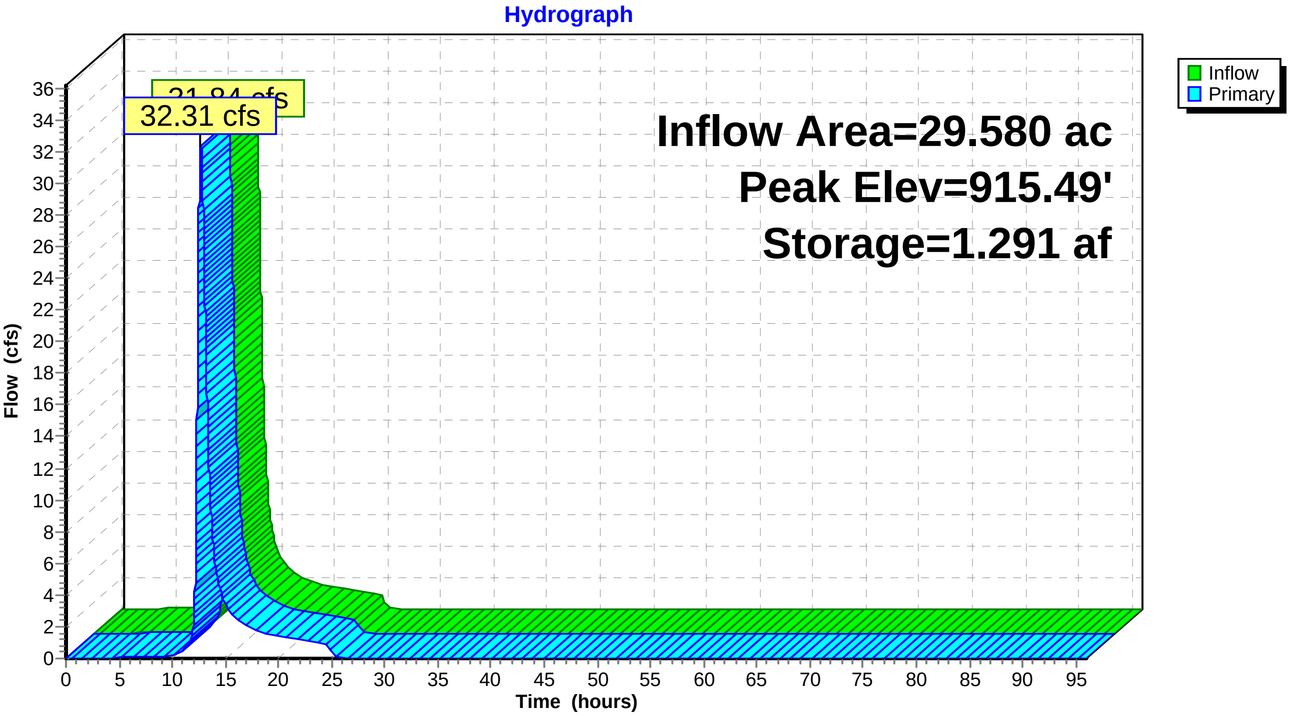
Volume	Invert	Avail.Storage	Storage Description
#1	910.95'	1.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.95	0.110	0.000	0.000
912.00	0.180	0.152	0.152
914.00	0.340	0.520	0.672
915.00	0.440	0.390	1.062
916.00	0.560	0.500	1.562

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**75.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=32.64 cfs @ 12.68 hrs HW=915.48' TW=915.43' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 32.64 cfs @ 0.90 fps)

Pond 7P: P-7


Hydrograph
31.84 cfs
32.31 cfs
Inflow Area=29.580 ac
Peak Elev=915.49'
Storage=1.291 af
Inflow
Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 8P: P-8

Inflow Area = 6.390 ac, 4.85% Impervious, Inflow Depth = 1.87" for 10-Year event
Inflow = 15.99 cfs @ 12.06 hrs, Volume= 0.994 af
Outflow = 3.70 cfs @ 12.47 hrs, Volume= 0.989 af, Atten= 77%, Lag= 24.8 min
Primary = 3.70 cfs @ 12.47 hrs, Volume= 0.989 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 897.00' Surf.Area= 0.300 ac Storage= 0.495 af
Peak Elev= 898.05' @ 12.58 hrs Surf.Area= 0.452 ac Storage= 0.895 af (0.400 af above start)

Plug-Flow detention time= 544.3 min calculated for 0.494 af (50% of inflow)
Center-of-Mass det. time= 189.5 min (1,024.6 - 835.1)

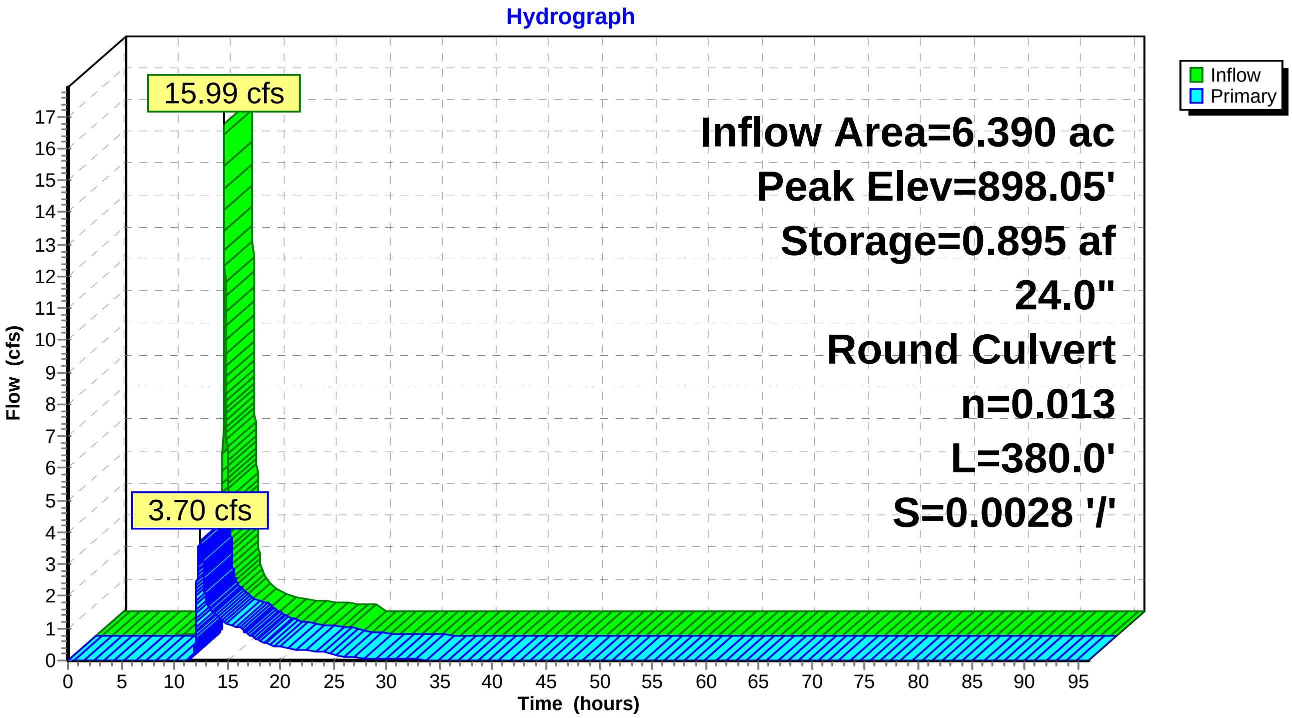
Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	1.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
893.00	0.030	0.000	0.000
894.00	0.070	0.050	0.050
896.00	0.150	0.220	0.270
897.00	0.300	0.225	0.495
898.00	0.450	0.375	0.870
900.00	0.530	0.980	1.850

Device	Routing	Invert	Outlet Devices
#1	Primary	897.00'	**24.0" Round RCP_Round 24"** L= 380.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 897.00' / 895.94' S= 0.0028 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=3.68 cfs @ 12.47 hrs HW=898.04' TW=896.86' (Dynamic Tailwater)
└─**1=RCP_Round 24"** (Outlet Controls 3.68 cfs @ 3.25 fps)

Pond 8P: P-8


Hydrograph
15.99 cfs
3.70 cfs
Inflow Area=6.390 ac
Peak Elev=898.05'
Storage=0.895 af
24.0"
Round Culvert
n=0.013
L=380.0'
S=0.0028 '/'
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 9P: P-9

Inflow Area = 55.360 ac, 3.00% Impervious, Inflow Depth = 1.83" for 10-Year event
Inflow = 58.97 cfs @ 12.53 hrs, Volume= 8.423 af
Outflow = 58.93 cfs @ 12.55 hrs, Volume= 8.423 af, Atten= 0%, Lag= 1.2 min
Primary = 58.93 cfs @ 12.55 hrs, Volume= 8.423 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.210 ac Storage= 0.353 af
Peak Elev= 915.44' @ 12.55 hrs Surf.Area= 0.298 ac Storage= 0.464 af (0.111 af above start)

Plug-Flow detention time= 35.5 min calculated for 8.069 af (96% of inflow)
Center-of-Mass det. time= 2.3 min (875.9 - 873.6)

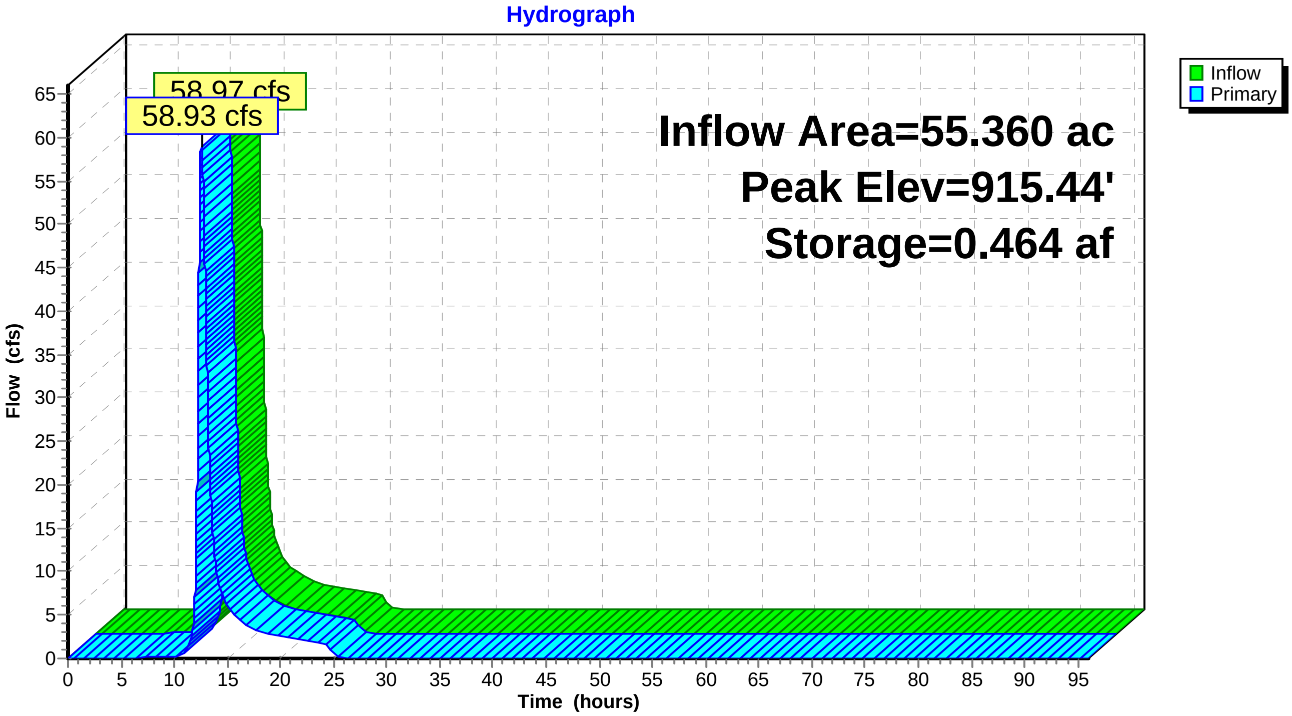
Volume	Invert	Avail.Storage	Storage Description
#1	910.50'	1.673 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.50	0.020	0.000	0.000
912.00	0.050	0.052	0.052
913.00	0.070	0.060	0.112
914.00	0.100	0.085	0.198
915.00	0.210	0.155	0.353
916.00	0.410	0.310	0.662
918.00	0.600	1.010	1.673

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**80.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=58.93 cfs @ 12.55 hrs HW=915.44' TW=910.57' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 58.93 cfs @ 1.68 fps)

Pond 9P: P-9


Hydrograph
58.97 cfs
58.93 cfs
Inflow Area=55.360 ac
Peak Elev=915.44'
Storage=0.464 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 10P: P-10 Lowered 1 ft

[95] Warning: Outlet Device #1 rise exceeded

```
Inflow Area =        66.430 ac,    5.22% Impervious,  Inflow Depth =   1.48"    for  10-Year event
Inflow      =        25.80 cfs @   13.18 hrs,  Volume=            8.191 af
Outflow     =        25.74 cfs @   13.23 hrs,  Volume=            8.190 af,  Atten= 0%,  Lag= 3.0 min
Primary     =        11.94 cfs @   13.23 hrs,  Volume=            6.845 af
Secondary =          13.80 cfs @   13.23 hrs,  Volume=            1.346 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 896.00' Surf.Area= 0.290 ac Storage= 0.700 af
Peak Elev= 897.64' @ 13.23 hrs Surf.Area= 0.359 ac Storage= 1.230 af (0.530 af above start)

Plug-Flow detention time= 120.2 min calculated for 7.490 af (91% of inflow)
Center-of-Mass det. time= 30.6 min (1,024.6 - 994.0)

Volume	Invert	Avail.Storage	Storage Description
#1	892.00'	1.760 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

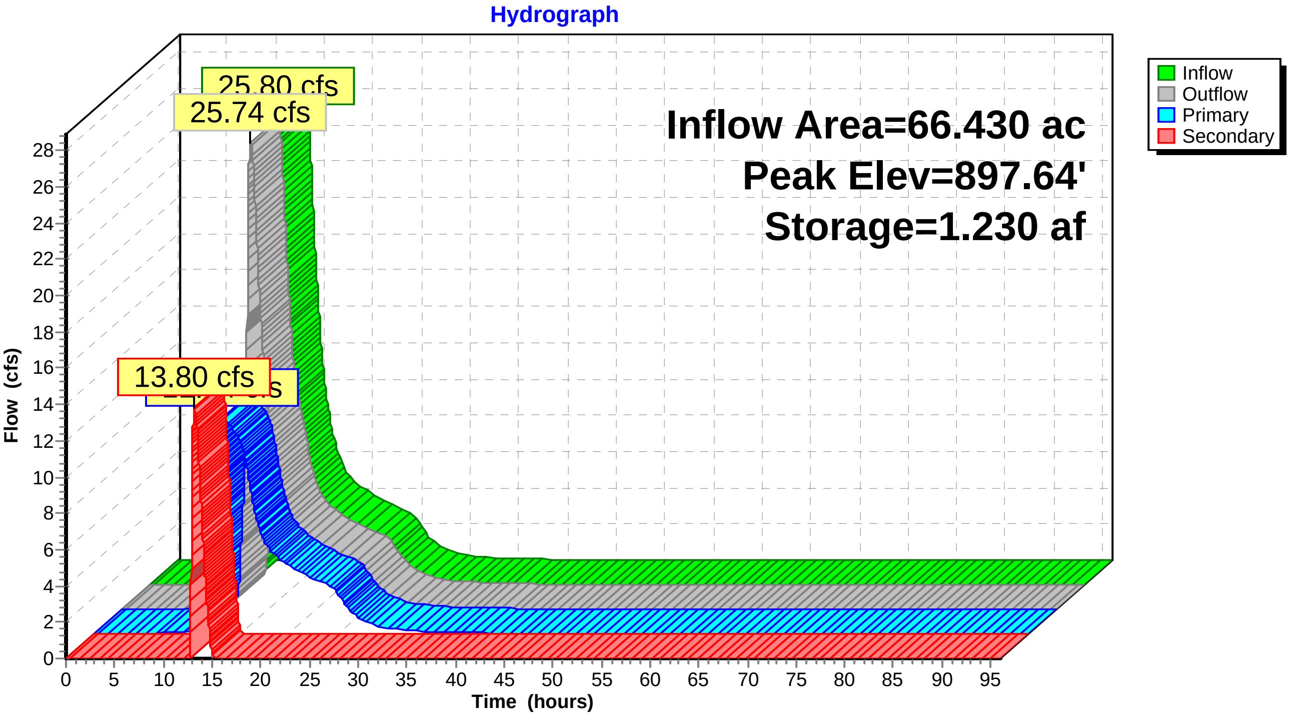
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
892.00	0.120	0.000	0.000
893.00	0.140	0.130	0.130
895.00	0.190	0.330	0.460
896.00	0.290	0.240	0.700
897.00	0.330	0.310	1.010
899.00	0.420	0.750	1.760

Device	Routing	Invert	Outlet Devices
#1	Primary	896.00'	**2.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	897.40'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=11.94 cfs @ 13.23 hrs HW=897.64' TW=893.98' (Dynamic Tailwater)
└─**1=Sharp-Crested Rectangular Weir** (Orifice Controls 11.94 cfs @ 5.19 fps)

Secondary OutFlow Max=13.80 cfs @ 13.23 hrs HW=897.64' TW=893.98' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 13.80 cfs @ 1.16 fps)

Pond 10P: P-10 Lowered 1 ft



Summary for Pond 11P: P-11

Inflow Area = 58.650 ac, 4.89% Impervious, Inflow Depth = 1.87" for 10-Year event
Inflow = 61.92 cfs @ 12.53 hrs, Volume= 9.153 af
Outflow = 27.87 cfs @ 13.20 hrs, Volume= 9.151 af, Atten= 55%, Lag= 39.7 min
Primary = 23.80 cfs @ 13.20 hrs, Volume= 6.945 af
Secondary = 4.08 cfs @ 13.20 hrs, Volume= 2.206 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 909.00' Surf.Area= 1.210 ac Storage= 3.640 af
Peak Elev= 911.47' @ 13.20 hrs Surf.Area= 1.497 ac Storage= 6.979 af (3.339 af above start)

Plug-Flow detention time= 380.0 min calculated for 5.511 af (60% of inflow)
Center-of-Mass det. time= 127.9 min (996.0 - 868.2)

Volume	Invert	Avail.Storage	Storage Description
#1	905.00'	9.405 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

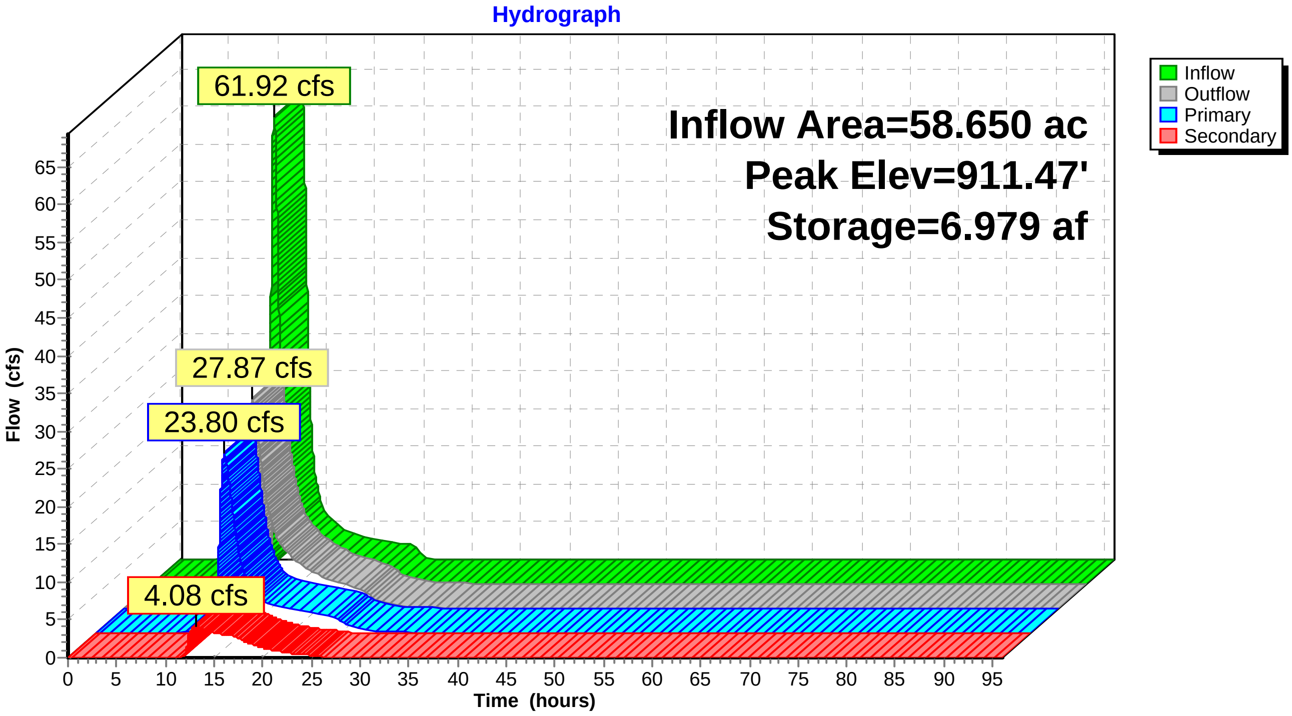
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
905.00	0.760	0.000	0.000
906.00	0.820	0.790	0.790
908.00	0.950	1.770	2.560
909.00	1.210	1.080	3.640
910.00	1.320	1.265	4.905
912.00	1.560	2.880	7.785
913.00	1.680	1.620	9.405

Device	Routing	Invert	Outlet Devices
#1	Primary	909.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#4	Primary	912.00'	**60.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#5	Secondary	909.00'	**12.0" Round RCP_Round 12"** L= 150.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 909.00' / 908.00' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=23.79 cfs @ 13.20 hrs HW=911.47' TW=897.64' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 5.95 cfs @ 7.57 fps)
2=RCP_Round 24" (Barrel Controls 8.92 cfs @ 5.02 fps)
3=RCP_Round 24" (Barrel Controls 8.92 cfs @ 5.02 fps)
4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=4.08 cfs @ 13.20 hrs HW=911.47' TW=908.66' (Dynamic Tailwater)
5=RCP_Round 12" (Barrel Controls 4.08 cfs @ 5.19 fps)

Pond 11P: P-11



Summary for Pond 12P: P-12

Inflow Area =	79.640 ac,	7.40% Impervious, Inflow Depth > 1.93"	for 10-Year event		
Inflow =	34.82 cfs @	12.02 hrs, Volume=	12.778 af		
Outflow =	24.47 cfs @	13.83 hrs, Volume=	12.770 af,	Atten= 30%,	Lag= 108.4 min
Primary =	24.47 cfs @	13.83 hrs, Volume=	12.770 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 893.00' Surf.Area= 1.640 ac Storage= 5.075 af
Peak Elev= 894.12' @ 13.83 hrs Surf.Area= 1.787 ac Storage= 6.997 af (1.922 af above start)

Plug-Flow detention time= 491.3 min calculated for 7.695 af (60% of inflow)
Center-of-Mass det. time= 96.5 min (1,132.1 - 1,035.6)

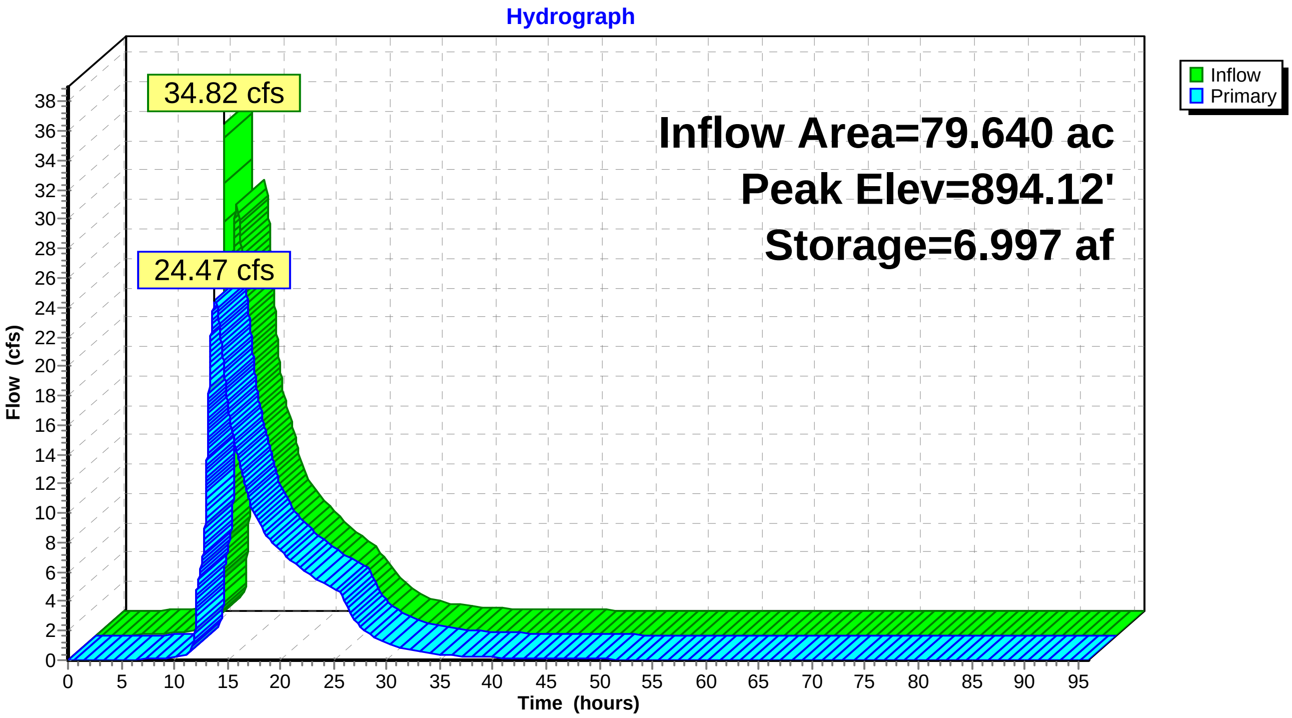
Volume	Invert	Avail.Storage	Storage Description
#1	889.00'	10.590 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
889.00	1.070	0.000	0.000
890.00	1.150	1.110	1.110
892.00	1.330	2.480	3.590
893.00	1.640	1.485	5.075
894.00	1.770	1.705	6.780
896.00	2.040	3.810	10.590

Device	Routing	Invert	Outlet Devices
#1	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#4	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#5	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#6	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf

Primary OutFlow Max=24.47 cfs @ 13.83 hrs HW=894.12' TW=883.49' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 4.01 cfs @ 5.10 fps)
- **2=Orifice/Grate** (Orifice Controls 4.01 cfs @ 5.10 fps)
- **3=RCP_Arch 44x27** (Barrel Controls 4.12 cfs @ 3.27 fps)
- **4=RCP_Arch 44x27** (Barrel Controls 4.12 cfs @ 3.27 fps)
- **5=RCP_Arch 44x27** (Barrel Controls 4.12 cfs @ 3.27 fps)
- **6=RCP_Arch 44x27** (Barrel Controls 4.12 cfs @ 3.27 fps)

Pond 12P: P-12



Summary for Pond 13P: P-13

```
Inflow Area =      237.775 ac,    9.20% Impervious,  Inflow Depth =   1.96"    for  10-Year event
Inflow      =      213.60 cfs @   12.36 hrs,  Volume=         38.914 af
Outflow     =      201.08 cfs @   12.48 hrs,  Volume=         38.911 af,  Atten= 6%,  Lag= 7.5 min
Primary     =      189.63 cfs @   12.48 hrs,  Volume=         37.025 af
Secondary =         11.45 cfs @   12.48 hrs,  Volume=          1.886 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 883.00'   Surf.Area= 1.870 ac   Storage= 4.265 af
Peak Elev= 884.19' @ 12.48 hrs   Surf.Area= 2.290 ac   Storage= 6.735 af   (2.470 af above start)

Plug-Flow detention time= 130.0 min calculated for 34.646 af (89% of inflow)
Center-of-Mass det. time= 17.0 min ( 955.7 - 938.7 )

Volume         Invert    Avail.Storage    Storage Description
   #1         878.00'        11.490 af    Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation        Surf.Area         Inc.Store         Cum.Store
    (feet)          (acres)       (acre-feet)       (acre-feet)
    878.00            0.000             0.000             0.000
    879.00            0.630             0.315             0.315
    880.00            0.730             0.680             0.995
    882.00            1.070             1.800             2.795
    883.00            1.870             1.470             4.265
    884.00            2.220             2.045             6.310
    886.00            2.960             5.180            11.490

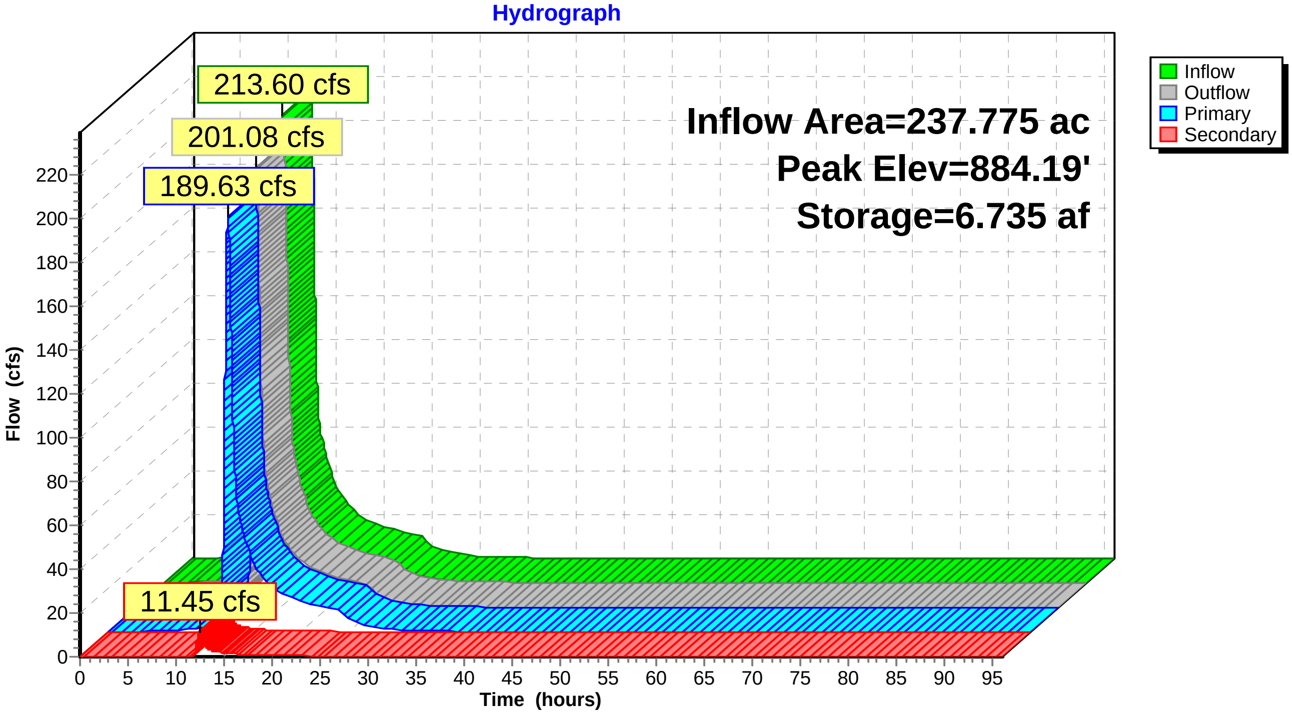
Device    Routing            Invert    Outlet Devices
   #1     Primary           883.00'    55.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                                       Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                                       2.50  3.00  3.50  4.00  4.50  5.00  5.50
                                       Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                                       2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88
   #2     Secondary         883.00'    12.0"  Round RCP_Round  12"
                                       L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                       Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 0.79 sf
   #3     Secondary         883.00'    12.0"  Round RCP_Round  12"
                                       L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                       Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 0.79 sf
   #4     Secondary         883.00'    12.0"  Round RCP_Round  12"
                                       L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                       Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 0.79 sf
   #5     Secondary         883.00'    12.0"  Round RCP_Round  12"
                                       L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                       Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 0.79 sf
   #6     Secondary         883.00'    12.0"  Round RCP_Round  12"
                                       L= 100.0'   RCP, groove end projecting,  Ke= 0.200
```

Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=189.63 cfs @ 12.48 hrs HW=884.19' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 189.63 cfs @ 2.90 fps)

Secondary OutFlow Max=11.45 cfs @ 12.48 hrs HW=884.19' TW=883.01' (Dynamic Tailwater)
├─**2=RCP_Round 12"** (Barrel Controls 2.29 cfs @ 3.10 fps)
├─**3=RCP_Round 12"** (Barrel Controls 2.29 cfs @ 3.10 fps)
├─**4=RCP_Round 12"** (Barrel Controls 2.29 cfs @ 3.10 fps)
├─**5=RCP_Round 12"** (Barrel Controls 2.29 cfs @ 3.10 fps)
└─**6=RCP_Round 12"** (Barrel Controls 2.29 cfs @ 3.10 fps)

Pond 13P: P-13



Summary for Pond 17P: W-2

```
[80] Warning: Exceeded Pond P-5/P-6 by 0.16' @ 37.70 hrs (0.15 cfs 0.642 af)

Inflow     =        2.25 cfs @  12.65 hrs,  Volume=          0.809 af
Outflow    =        0.63 cfs @  17.34 hrs,  Volume=          0.666 af,  Atten= 72%,  Lag= 281.1 min
Primary    =        0.63 cfs @  17.34 hrs,  Volume=          0.666 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 929.45' @ 17.34 hrs   Surf.Area= 1.167 ac   Storage= 0.512 af

Plug-Flow detention time= 707.8 min calculated for 0.666 af (82% of inflow)
Center-of-Mass det. time= 649.7 min ( 1,547.3 - 897.6 )

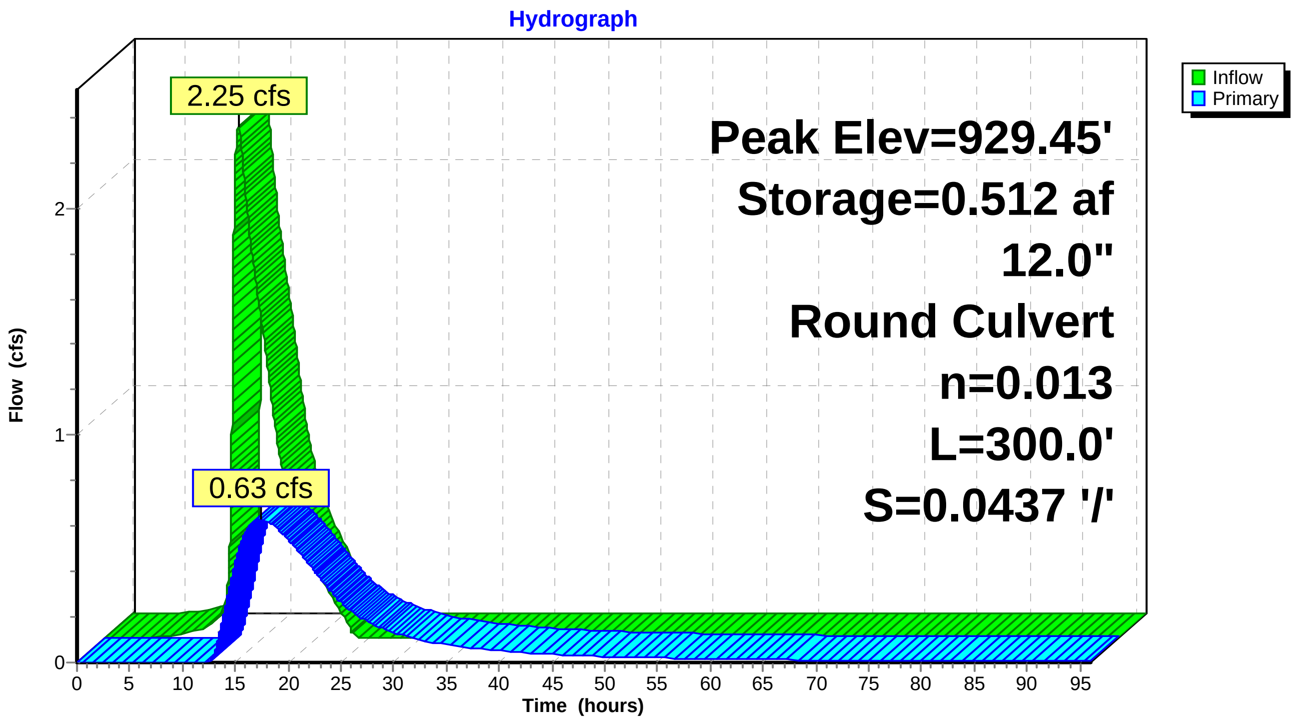
Volume       Invert    Avail.Storage   Storage Description
   #1       929.00'         1.175 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area        Inc.Store        Cum.Store
    (feet)        (acres)      (acre-feet)      (acre-feet)
    929.00          1.090            0.000            0.000
    930.00          1.260            1.175            1.175

Device   Routing          Invert   Outlet Devices
    #1   Primary         929.10'   12.0"  Round RCP_Round  12"
                                   L= 300.0'   RCP, groove end projecting,  Ke= 0.200
                                   Inlet / Outlet Invert= 929.10' / 916.00'   S= 0.0437 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 0.79 sf

Primary OutFlow  Max=0.63 cfs @ 17.34 hrs  HW=929.45'  TW=914.82'   (Dynamic Tailwater)
└─1=RCP_Round  12"  (Inlet Controls 0.63 cfs @ 2.53 fps)
```

Pond 17P: W-2


Hydrograph
2.25 cfs
0.63 cfs
Peak Elev=929.45'
Storage=0.512 af
12.0"
Round Culvert
n=0.013
L=300.0'
S=0.0437 '/'
Inflow
Primary
Flow (cfs)
0
1
2
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 36P: Culverts passing flow beneath Spine Road

Inflow Area = 52.790 ac, 0.00% Impervious, Inflow Depth = 1.76" for 10-Year event
Inflow = 64.04 cfs @ 12.46 hrs, Volume= 7.738 af
Outflow = 64.04 cfs @ 12.46 hrs, Volume= 7.738 af, Atten= 0%, Lag= 0.0 min
Primary = 64.04 cfs @ 12.46 hrs, Volume= 7.738 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 887.26' @ 12.46 hrs Surf.Area= 0.001 ac Storage= 0.000 af

Plug-Flow detention time= 0.0 min calculated for 7.737 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (869.1 - 869.1)

Volume	Invert	Avail.Storage	Storage Description
#1	887.00'	0.026 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
887.00	0.000	0.000	0.000
887.50	0.002	0.001	0.001
890.50	0.007	0.014	0.014
892.00	0.009	0.012	0.026

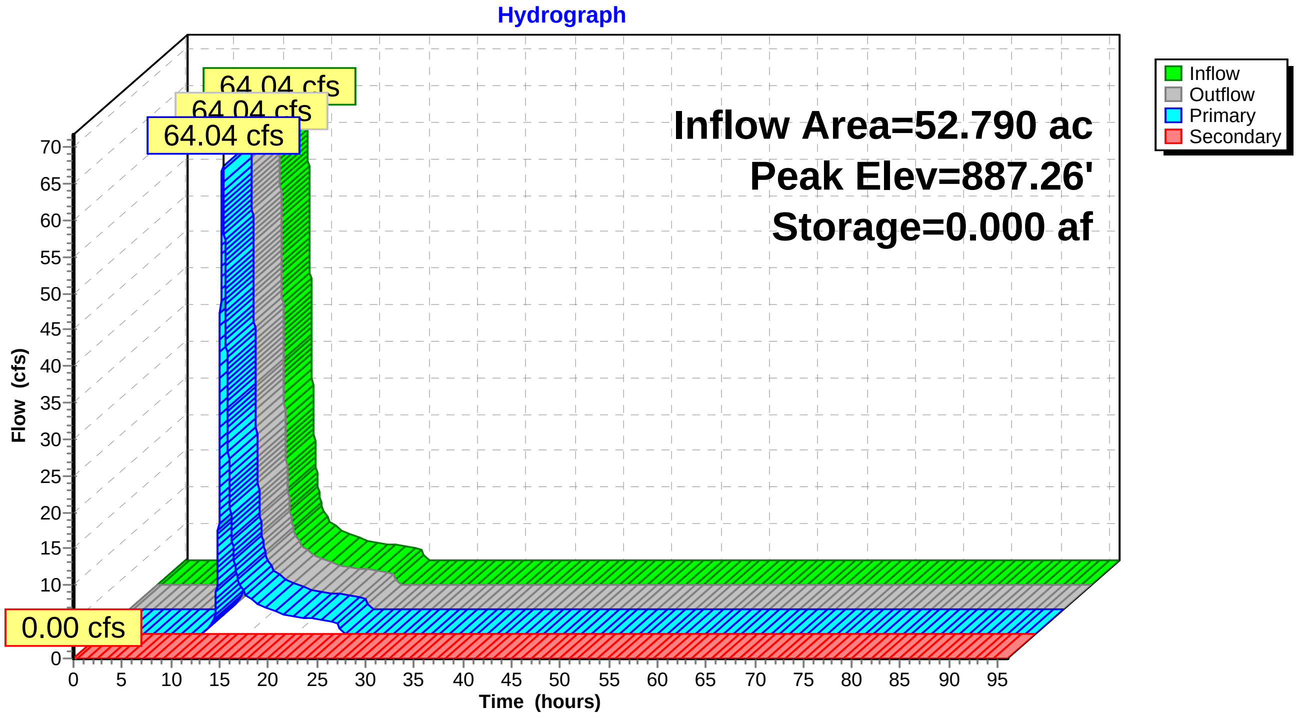
Device	Routing	Invert	Outlet Devices
#1	Primary	887.00'	**Special & User-Defined** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 5.00 Disch. (cfs) 0.000 25.000 50.000 75.000 100.000 127.000 127.000
#2	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#4	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#5	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#6	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#7	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900

			n= 0.013, Flow Area= 1.77 sf
#8	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#9	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=64.03 cfs @ 12.46 hrs HW=887.26' TW=884.19' (Dynamic Tailwater)
└─**1=Special & User-Defined** (Custom Controls 64.03 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=887.00' TW=883.00' (Dynamic Tailwater)
├─**2=RCP_Round 18"** (Controls 0.00 cfs)
├─**3=RCP_Round 18"** (Controls 0.00 cfs)
├─**4=RCP_Round 18"** (Controls 0.00 cfs)
├─**5=RCP_Round 18"** (Controls 0.00 cfs)
├─**6=RCP_Round 18"** (Controls 0.00 cfs)
├─**7=RCP_Round 18"** (Controls 0.00 cfs)
├─**8=RCP_Round 18"** (Controls 0.00 cfs)
└─**9=RCP_Round 18"** (Controls 0.00 cfs)

Pond 36P: Culverts passing flow beneath Spine Road



Summary for Pond CRH-1: CRH-1

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Inflow Area =        6.955 ac,  46.76% Impervious,  Inflow Depth =   2.80"    for  10-Year event
Inflow      =       18.97 cfs @   12.15 hrs,  Volume=           1.622 af
Outflow     =       12.06 cfs @   12.33 hrs,  Volume=           1.622 af,  Atten= 36%,  Lag= 10.6 min
Discarded   =        0.26 cfs @   12.33 hrs,  Volume=           0.512 af
Primary     =       11.80 cfs @   12.33 hrs,  Volume=           1.110 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.12' @ 12.33 hrs   Surf.Area= 0.325 ac   Storage= 0.489 af

Plug-Flow detention time= 182.4 min calculated for 1.622 af (100% of inflow)
Center-of-Mass det. time= 182.5 min ( 971.9 - 789.5 )

Volume        Invert    Avail.Storage   Storage Description
   #1        876.00'         0.850 af   Custom Stage Data (Prismatic)Listed below (Recalc)

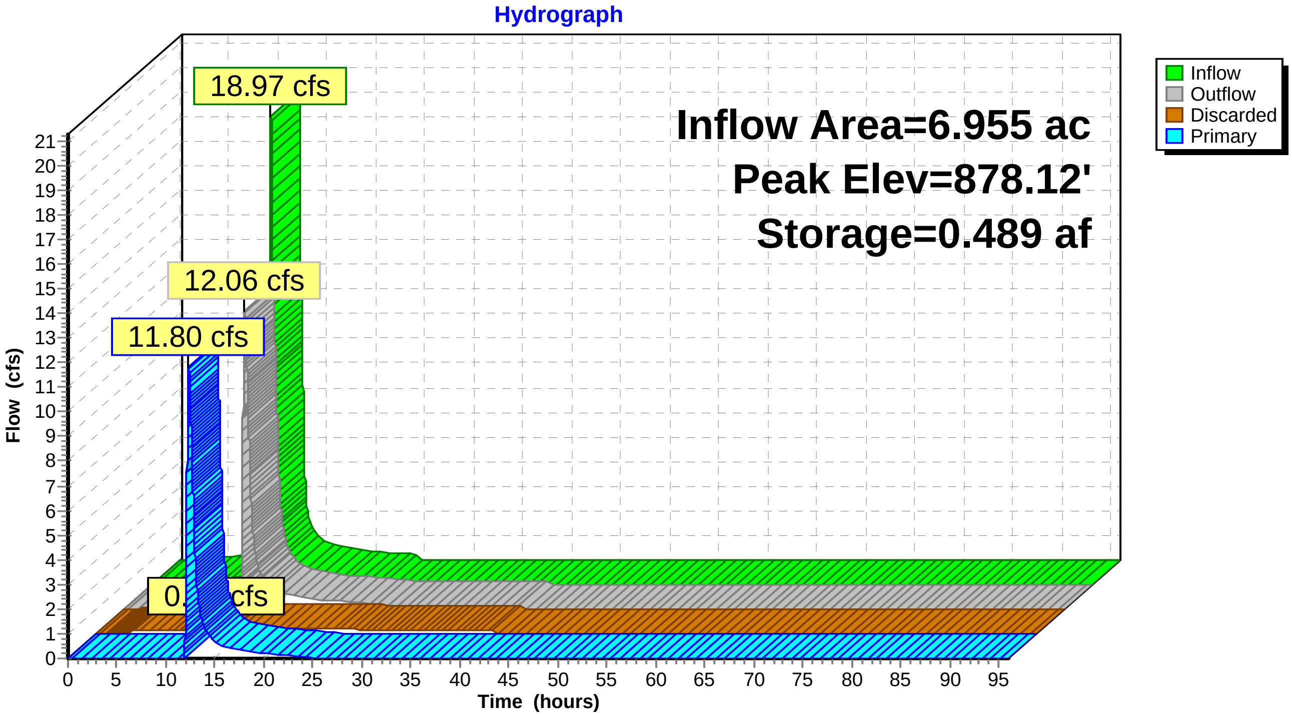
 Elevation      Surf.Area         Inc.Store        Cum.Store
    (feet)        (acres)       (acre-feet)      (acre-feet)
    876.00          0.150             0.000            0.000
    878.00          0.300             0.450            0.450
    879.00          0.500             0.400            0.850

Device   Routing           Invert   Outlet Devices
    #1   Discarded        876.00'   0.800 in/hr Exfiltration over Surface area
                                    Conductivity to Groundwater Elevation = 0.00'
    #2   Primary          877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                    Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                    n= 0.013,  Flow Area= 3.14 sf
    #3   Primary          877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                    Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                    n= 0.013,  Flow Area= 3.14 sf

Discarded OutFlow  Max=0.26 cfs @ 12.33 hrs  HW=878.12'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.26 cfs)

Primary OutFlow  Max=11.80 cfs @ 12.33 hrs  HW=878.12'   (Free Discharge)
├─2=Culvert  (Barrel Controls 5.90 cfs @ 4.69 fps)
└─3=Culvert  (Barrel Controls 5.90 cfs @ 4.69 fps)
```

Pond CRH-1: CRH-1



Summary for Pond CRH-2: CRH-2

```
Inflow Area =        10.214 ac, 37.73% Impervious,  Inflow Depth =   2.60"    for  10-Year event
Inflow      =        23.01 cfs @   12.22 hrs,  Volume=           2.212 af
Outflow     =        10.19 cfs @   12.62 hrs,  Volume=           2.212 af,  Atten= 56%,  Lag= 24.1 min
Discarded   =         0.38 cfs @   12.62 hrs,  Volume=           0.904 af
Primary     =         9.82 cfs @   12.62 hrs,  Volume=           1.308 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 882.67' @ 12.62 hrs   Surf.Area= 0.467 ac   Storage= 0.888 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 323.8 min ( 1,125.6 - 801.7 )

Volume        Invert    Avail.Storage   Storage Description
   #1         880.00'        1.600 af   Custom Stage Data (Prismatic)Listed below (Recalc)

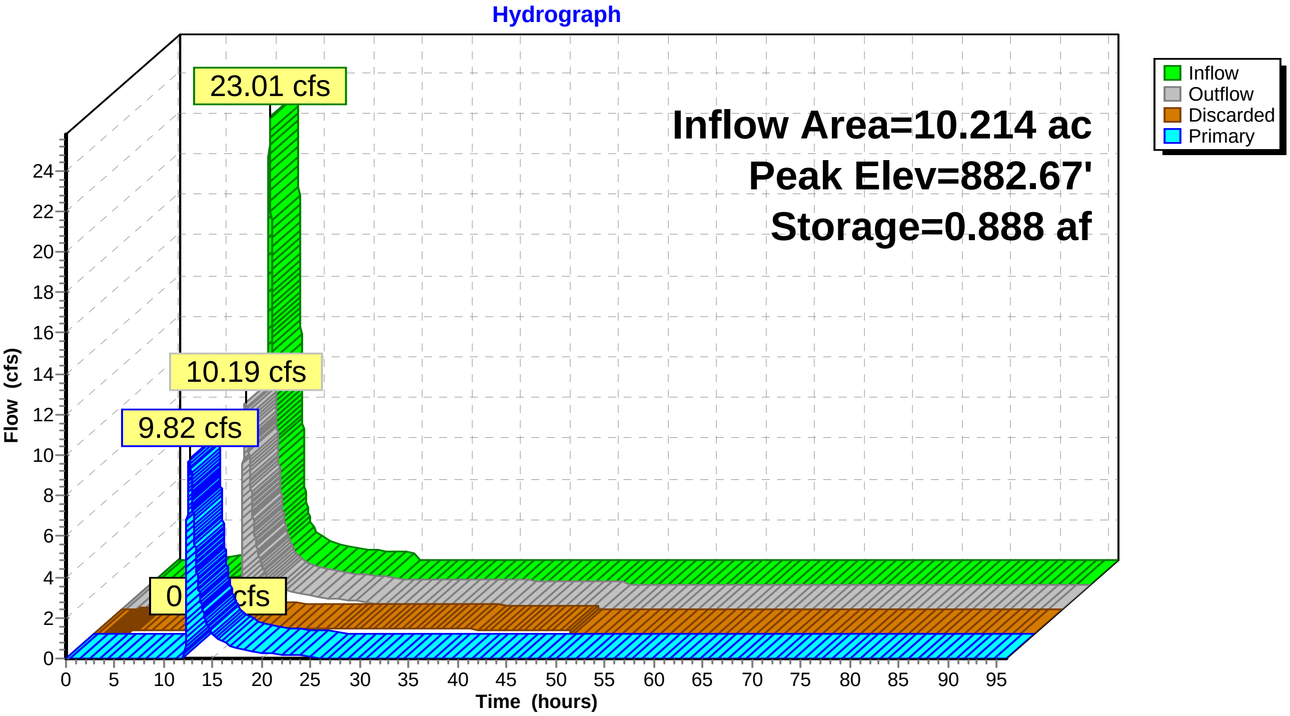
Elevation      Surf.Area         Inc.Store        Cum.Store
   (feet)        (acres)       (acre-feet)      (acre-feet)
   880.00          0.200             0.000            0.000
   882.00          0.400             0.600            0.600
   884.00          0.600             1.000            1.600

Device  Routing             Invert   Outlet Devices
   #1   Primary            881.50'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                     Inlet / Outlet Invert= 881.50' / 881.00'   S= 0.0032 '/'   Cc= 0.900
                                     n= 0.013,  Flow Area= 3.14 sf
   #2   Primary            881.50'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                     Inlet / Outlet Invert= 881.50' / 881.00'   S= 0.0032 '/'   Cc= 0.900
                                     n= 0.013,  Flow Area= 3.14 sf
   #3   Discarded          880.00'   0.800 in/hr Exfiltration over Surface area
                                     Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow  Max=0.38 cfs @ 12.62 hrs  HW=882.67'   (Free Discharge)
 └─3=Exfiltration  ( Controls 0.38 cfs)

Primary OutFlow  Max=9.82 cfs @ 12.62 hrs  HW=882.67'  TW=878.71'   (Dynamic Tailwater)
 ├─1=Culvert  (Barrel Controls 4.91 cfs @ 3.72 fps)
 └─2=Culvert  (Barrel Controls 4.91 cfs @ 3.72 fps)
```

Pond CRH-2: CRH-2



Summary for Pond CRH-3: CRH-3

Inflow Area = 11.815 ac, 36.95% Impervious, Inflow Depth = 1.66" for 10-Year event
Inflow = 10.84 cfs @ 12.54 hrs, Volume= 1.637 af
Outflow = 8.22 cfs @ 12.91 hrs, Volume= 1.637 af, Atten= 24%, Lag= 22.1 min
Discarded = 0.24 cfs @ 12.91 hrs, Volume= 0.449 af
Primary = 7.98 cfs @ 12.91 hrs, Volume= 1.188 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.90' @ 12.91 hrs Surf.Area= 0.293 ac Storage= 0.421 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 170.2 min (1,018.1 - 847.9)

Volume	Invert	Avail.Storage	Storage Description
#1	877.00'	0.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

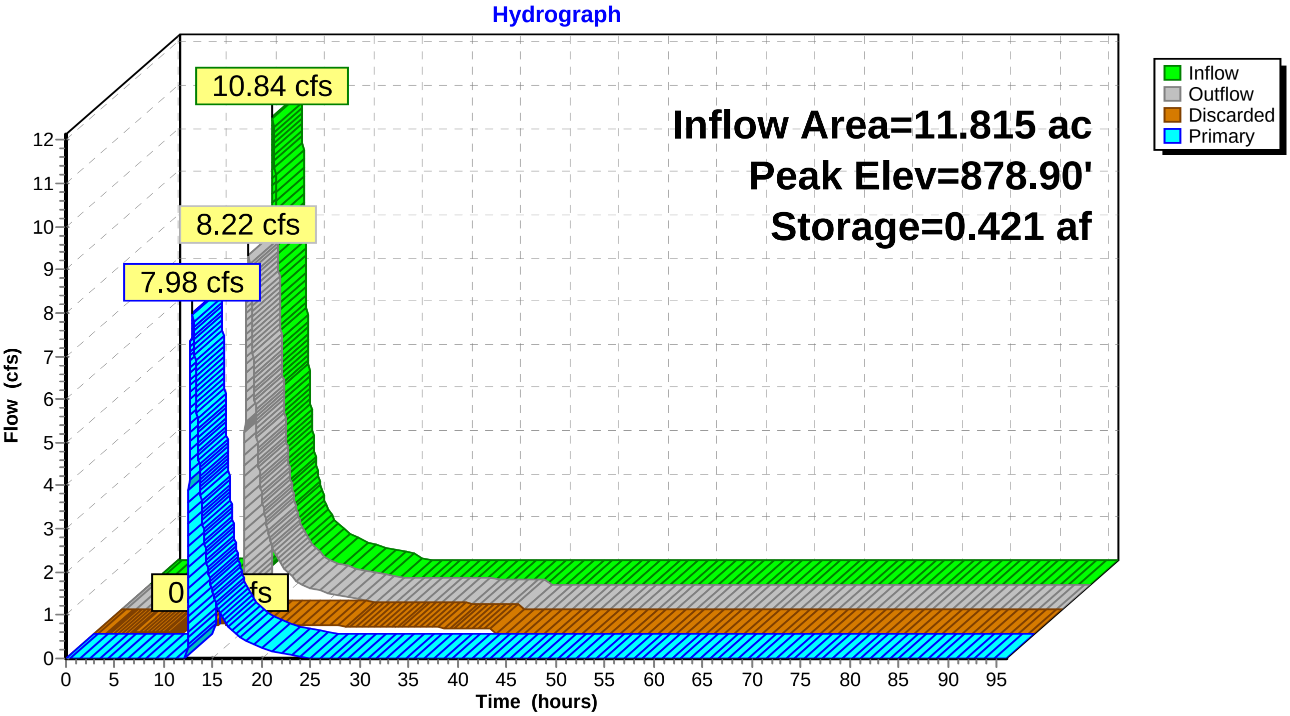
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
877.00	0.150	0.000	0.000
879.00	0.300	0.450	0.450
880.00	0.500	0.400	0.850

Device	Routing	Invert	Outlet Devices
#1	Discarded	877.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.24 cfs @ 12.91 hrs HW=878.90' (Free Discharge)
└─**1=Exfiltration** (Controls 0.24 cfs)

Primary OutFlow Max=7.98 cfs @ 12.91 hrs HW=878.90' (Free Discharge)
├─**2=Culvert** (Barrel Controls 3.99 cfs @ 4.27 fps)
└─**3=Culvert** (Barrel Controls 3.99 cfs @ 4.27 fps)

Pond CRH-3: CRH-3



Summary for Pond P-5/P-6: P-5/P-6

Inflow Area = 43.346 ac, 18.61% Impervious, Inflow Depth = 2.17" for 10-Year event
Inflow = 91.40 cfs @ 12.15 hrs, Volume= 7.854 af
Outflow = 28.95 cfs @ 12.65 hrs, Volume= 7.848 af, Atten= 68%, Lag= 30.1 min
Primary = 26.70 cfs @ 12.65 hrs, Volume= 7.038 af
Secondary = 2.25 cfs @ 12.65 hrs, Volume= 0.809 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 929.00' Surf.Area= 1.975 ac Storage= 5.062 af
Peak Elev= 930.49' @ 12.65 hrs Surf.Area= 2.319 ac Storage= 8.298 af (3.236 af above start)

Plug-Flow detention time= 660.8 min calculated for 2.785 af (35% of inflow)
Center-of-Mass det. time= 172.6 min (991.5 - 819.0)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	14.650 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

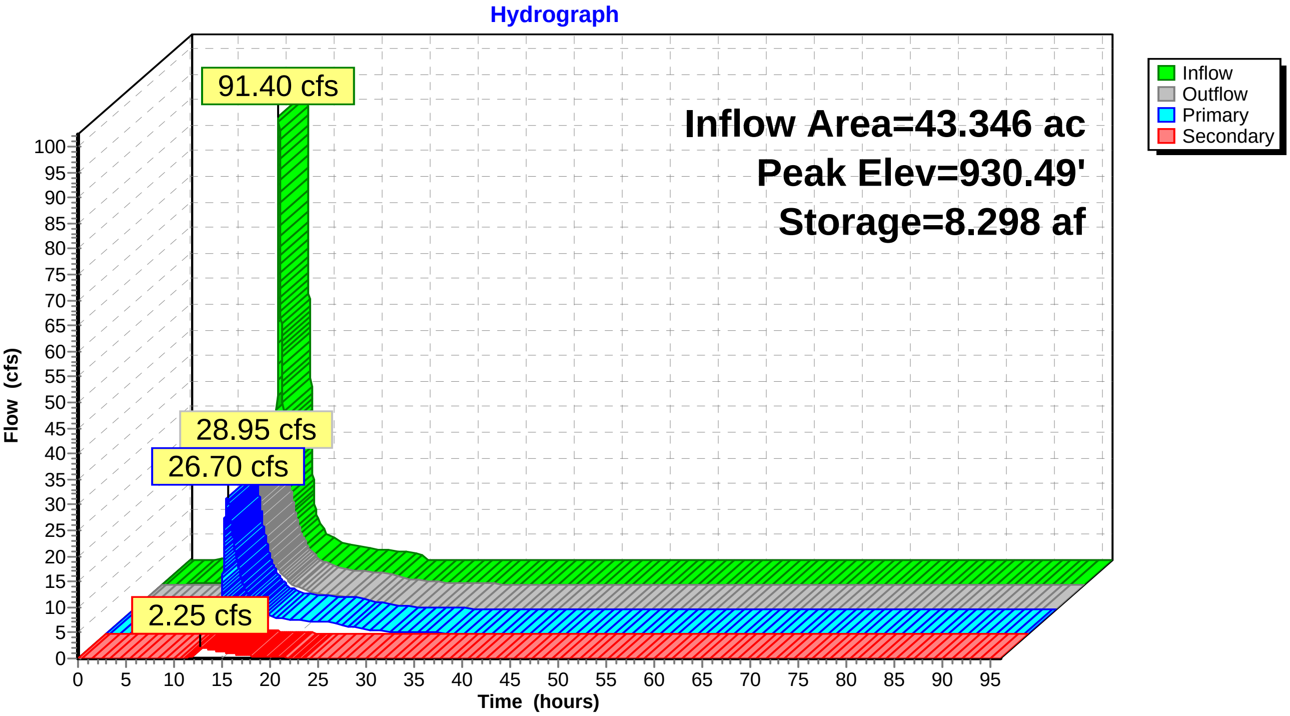
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
926.00	1.510	0.000	0.000
928.00	1.710	3.220	3.220
930.00	2.240	3.950	7.170
931.00	2.400	2.320	9.490
933.00	2.760	5.160	14.650

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	929.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	930.50'	**14.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	929.00'	**9.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=26.69 cfs @ 12.65 hrs HW=930.49' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 4.62 cfs @ 5.89 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 22.07 cfs @ 3.26 fps)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=2.25 cfs @ 12.65 hrs HW=930.49' TW=929.13' (Dynamic Tailwater)
4=Orifice/Grate (Orifice Controls 2.25 cfs @ 5.10 fps)

Pond P-5/P-6: P-5/P-6



Summary for Pond TI P: Thumb Infiltration (Thumb TP load only)

Inflow Area = 48.539 ac, 11.38% Impervious, Inflow Depth = 0.81" for 10-Year event
Inflow = 18.36 cfs @ 12.36 hrs, Volume= 3.268 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.27' @ 26.34 hrs Surf.Area= 1.000 ac Storage= 3.268 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

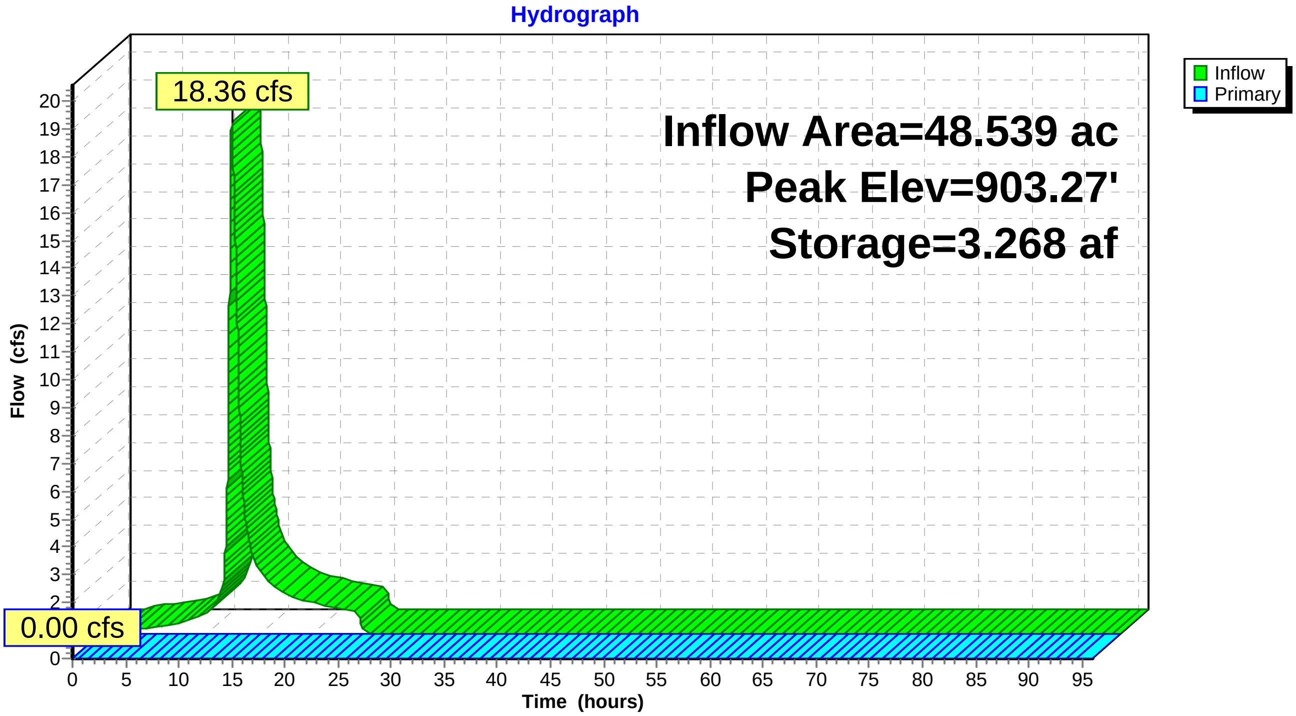
Volume	Invert	Avail.Storage	Storage Description
#1	900.00'	5.000 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
900.00	1.000	0.000	0.000
901.00	1.000	1.000	1.000
902.00	1.000	1.000	2.000
903.00	1.000	1.000	3.000
904.00	1.000	1.000	4.000
905.00	1.000	1.000	5.000

Device	Routing	Invert	Outlet Devices
#1	Primary	903.74'	**1,000.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=900.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond TI P: Thumb Infiltration (Thumb TP load only)



Summary for Pond W-1: W-1

```
Inflow Area =        1.000 ac,  10.00% Impervious,  Inflow Depth = 11.65"    for  10-Year event
Inflow      =       2.45 cfs @   13.29 hrs,  Volume=             0.971 af
Outflow     =       2.00 cfs @   14.54 hrs,  Volume=             0.970 af,  Atten= 18%,  Lag= 74.8 min
Primary     =       2.00 cfs @   14.54 hrs,  Volume=             0.970 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.09' @ 14.54 hrs   Surf.Area= 0.714 ac   Storage= 0.231 af

Plug-Flow detention time= 117.7 min calculated for 0.970 af (100% of inflow)
Center-of-Mass det. time= 117.1 min ( 1,034.4 - 917.2 )

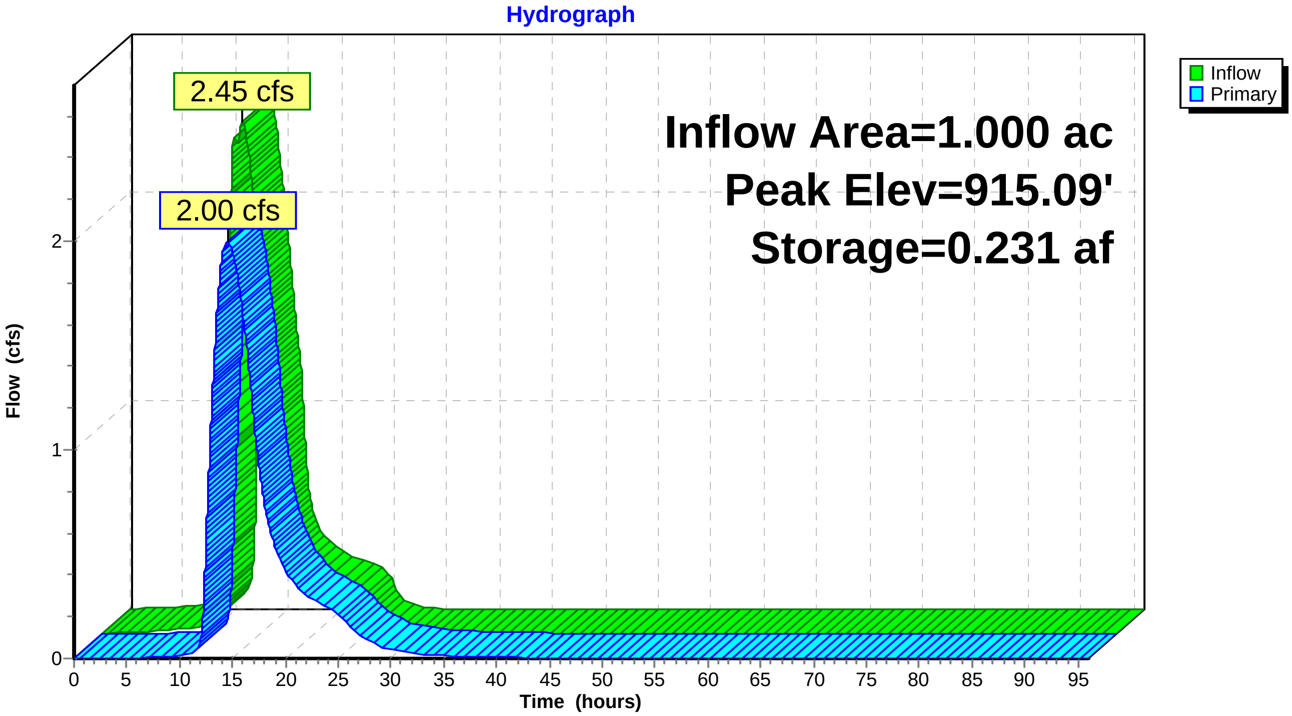
Volume        Invert    Avail.Storage   Storage Description
   #1        914.75'         0.950 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area        Inc.Store       Cum.Store
    (feet)        (acres)      (acre-feet)     (acre-feet)
    914.75          0.660            0.000           0.000
    916.00          0.860            0.950           0.950

Device   Routing             Invert   Outlet Devices
   #1    Primary            914.75'   12.0" Horiz. Orifice/Grate   C= 0.600
                                      Limited to weir flow at low heads

Primary OutFlow  Max=2.00 cfs @ 14.54 hrs  HW=915.09'  TW=0.00'   (Dynamic Tailwater)
  └─1=Orifice/Grate  (Weir Controls 2.00 cfs @ 1.90 fps)
```

Pond W-1: W-1


Hydrograph
2.45 cfs
2.00 cfs
Inflow Area=1.000 ac
Peak Elev=915.09'
Storage=0.231 af
Inflow
Primary
Flow (cfs)
0
1
2
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond W-3: W-3

```
Inflow      =     0.63 cfs @   17.34 hrs,  Volume=          0.666 af
Outflow     =     0.00 cfs @    0.00 hrs,  Volume=          0.000 af,  Atten= 100%,  Lag= 0.0 min
```

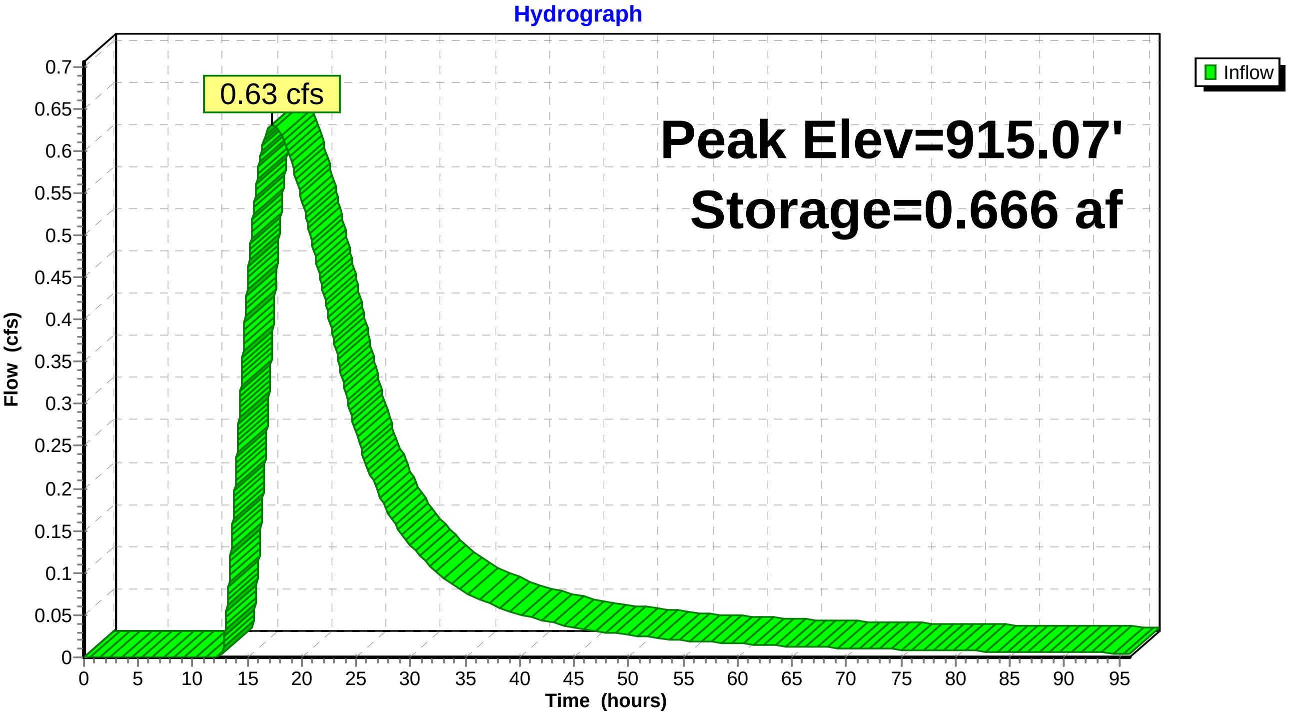
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.07' @ 96.00 hrs   Surf.Area= 2.092 ac   Storage= 0.666 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	2.680 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	2.040	0.000	0.000
915.00	2.080	0.515	0.515
916.00	2.250	2.165	2.680

Pond W-3: W-3



Summary for Pond W-4: W-4

Inflow Area = 2.980 ac, 26.17% Impervious, Inflow Depth = 11.29" for 10-Year event
Inflow = 8.82 cfs @ 12.08 hrs, Volume= 2.803 af
Outflow = 3.11 cfs @ 16.96 hrs, Volume= 2.784 af, Atten= 65%, Lag= 292.4 min
Primary = 3.11 cfs @ 16.96 hrs, Volume= 2.784 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 908.93' @ 16.96 hrs Surf.Area= 1.114 ac Storage= 0.878 af

Plug-Flow detention time= 264.8 min calculated for 2.783 af (99% of inflow)
Center-of-Mass det. time= 259.8 min (1,211.6 - 951.8)

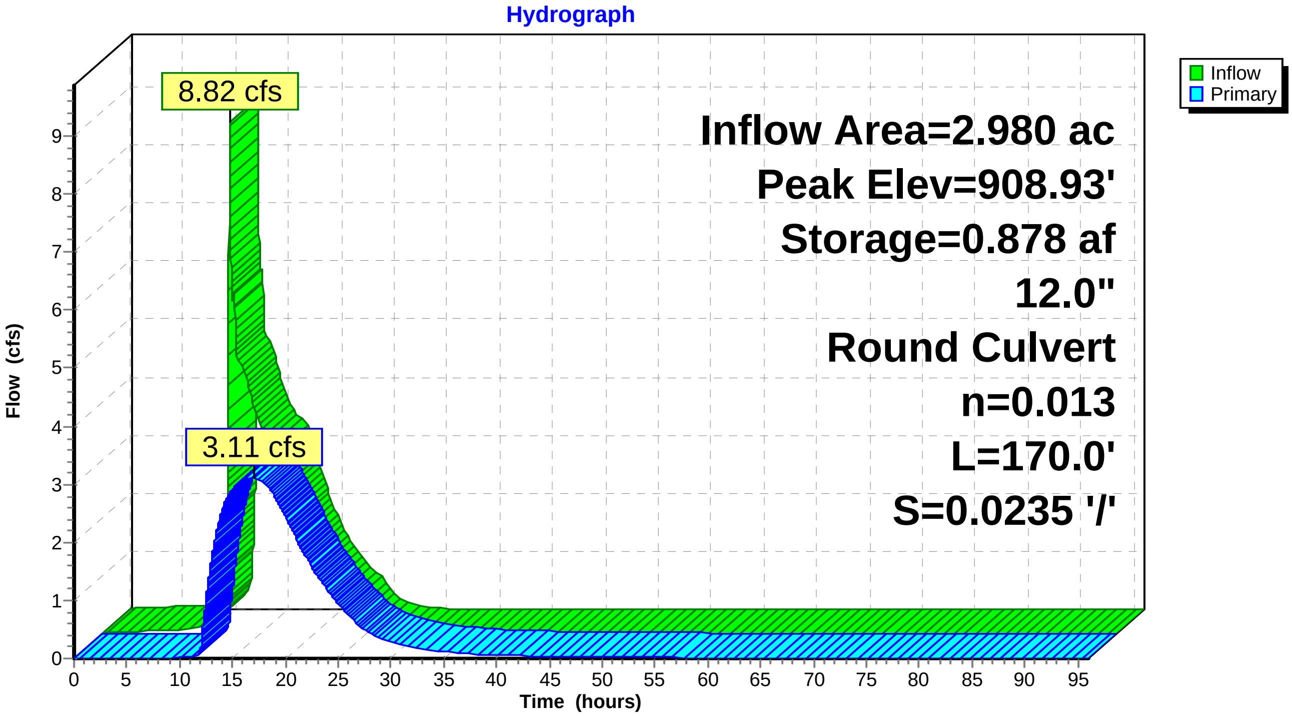
Volume	Invert	Avail.Storage	Storage Description
#1	908.00'	2.280 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
908.00	0.780	0.000	0.000
910.00	1.500	2.280	2.280

Device	Routing	Invert	Outlet Devices
#1	Primary	908.00'	**12.0" Round RCP_Round 12"** L= 170.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 908.00' / 904.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=3.11 cfs @ 16.96 hrs HW=908.93' TW=893.81' (Dynamic Tailwater)
↑**1=RCP_Round 12"** (Inlet Controls 3.11 cfs @ 4.10 fps)

Pond W-4: W-4


Hydrograph
Inflow
Primary
8.82 cfs
3.11 cfs
Inflow Area=2.980 ac
Peak Elev=908.93'
Storage=0.878 af
12.0"
Round Culvert
n=0.013
L=170.0'
S=0.0235 '/'
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-5: W-5

Inflow Area = 7.608 ac, 48.41% Impervious, Inflow Depth = 5.93" for 10-Year event
Inflow = 34.78 cfs @ 12.02 hrs, Volume= 3.757 af
Outflow = 6.80 cfs @ 13.11 hrs, Volume= 3.750 af, Atten= 80%, Lag= 65.1 min
Primary = 6.80 cfs @ 13.11 hrs, Volume= 3.750 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 882.75' Surf.Area= 4.910 ac Storage= 3.412 af
Peak Elev= 883.06' @ 13.11 hrs Surf.Area= 5.253 ac Storage= 4.998 af (1.586 af above start)

Plug-Flow detention time= 1,663.5 min calculated for 0.337 af (9% of inflow)
Center-of-Mass det. time= 252.4 min (1,083.4 - 831.0)

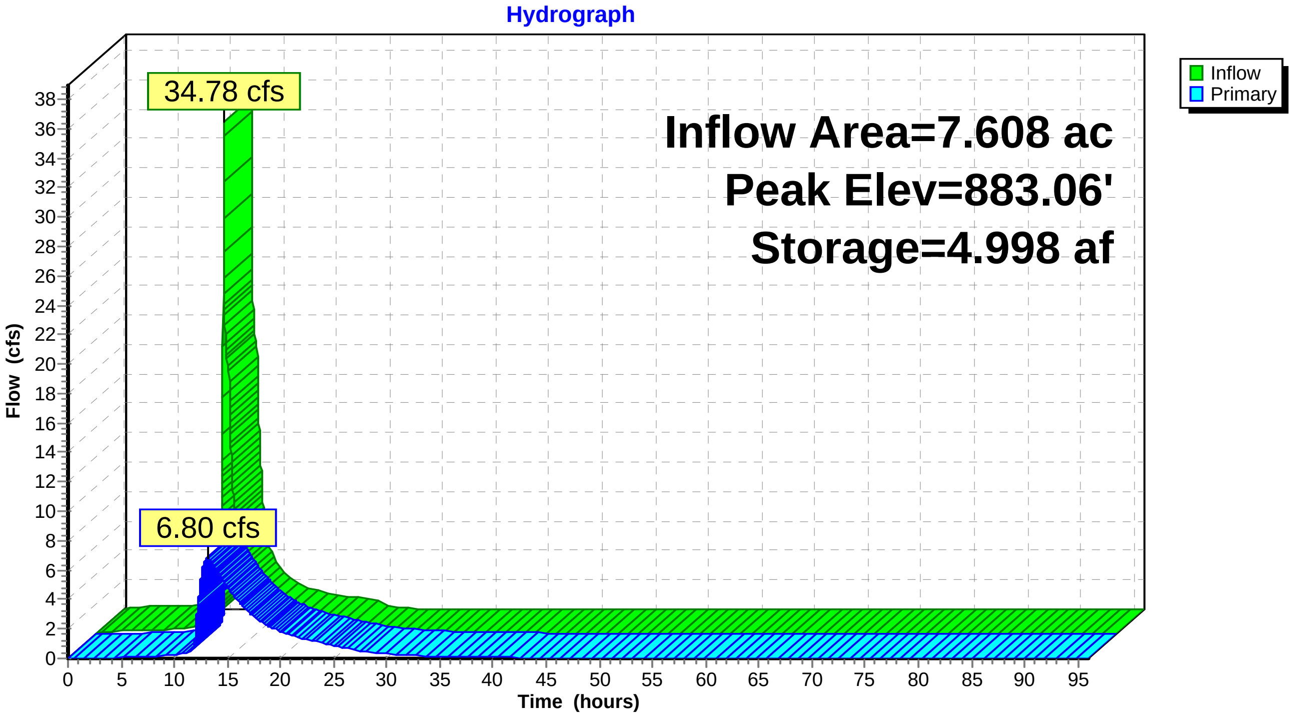
Volume	Invert	Avail.Storage	Storage Description
#1	882.00'	7.390 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
882.00	4.190	0.000	0.000
883.00	5.150	4.670	4.670
883.49	5.950	2.720	7.390

Device	Routing	Invert	Outlet Devices
#1	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=6.80 cfs @ 13.11 hrs HW=883.06' TW=0.00' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 3.40 cfs @ 1.83 fps)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 3.40 cfs @ 1.83 fps)

Pond W-5: W-5

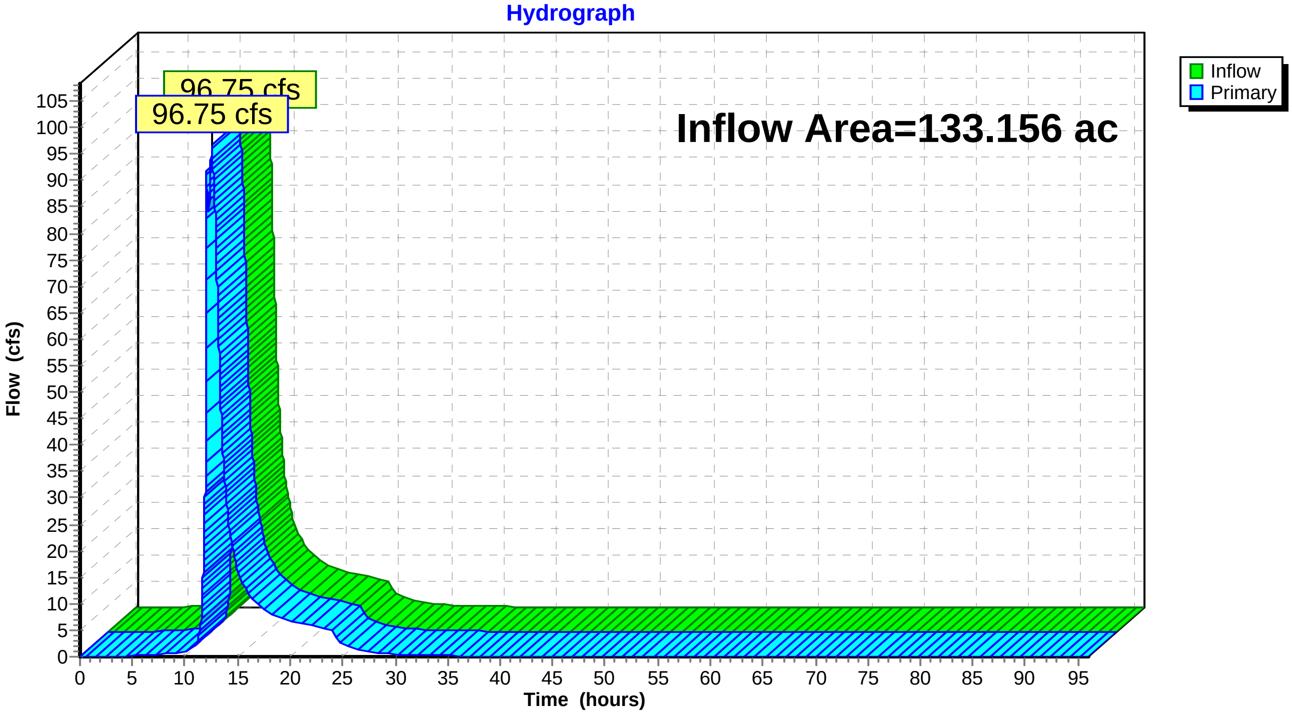

Hydrograph
34.78 cfs
6.80 cfs
Inflow Area=7.608 ac
Peak Elev=883.06'
Storage=4.998 af
Inflow
Primary
Flow (cfs)
Time (hours)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Link 53L: Sum of Outlet #2 Discharges to Round Lake

Inflow Area =	133.156 ac,	9.78% Impervious,	Inflow Depth = 1.90"	for 10-Year event	
Inflow =	96.75 cfs @	12.54 hrs,	Volume=	21.122 af	
Primary =	96.75 cfs @	12.54 hrs,	Volume=	21.122 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 53L: Sum of Outlet #2 Discharges to Round Lake

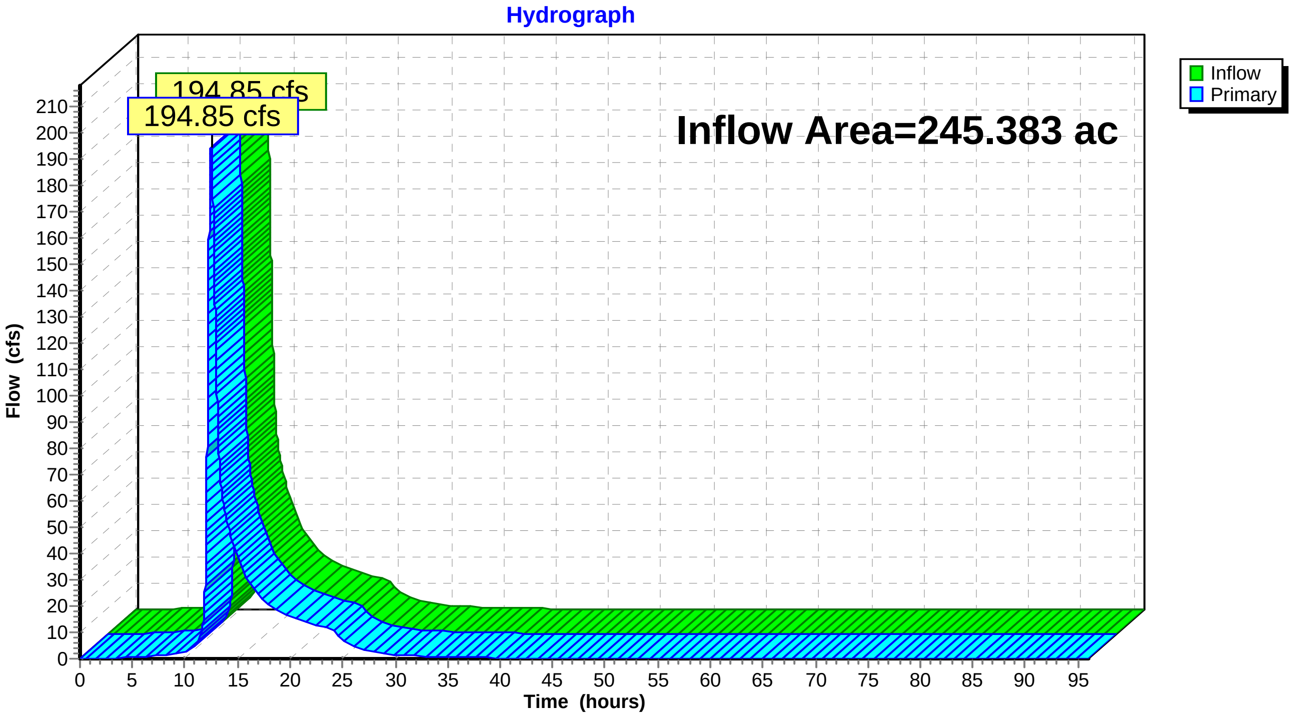


Summary for Link 54L: Sum of Discharges from P-13 and W-5

Inflow Area = 245.383 ac, 10.42% Impervious, Inflow Depth = 1.99" for 10-Year event
Inflow = 194.85 cfs @ 12.48 hrs, Volume= 40.774 af
Primary = 194.85 cfs @ 12.48 hrs, Volume= 40.774 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 54L: Sum of Discharges from P-13 and W-5

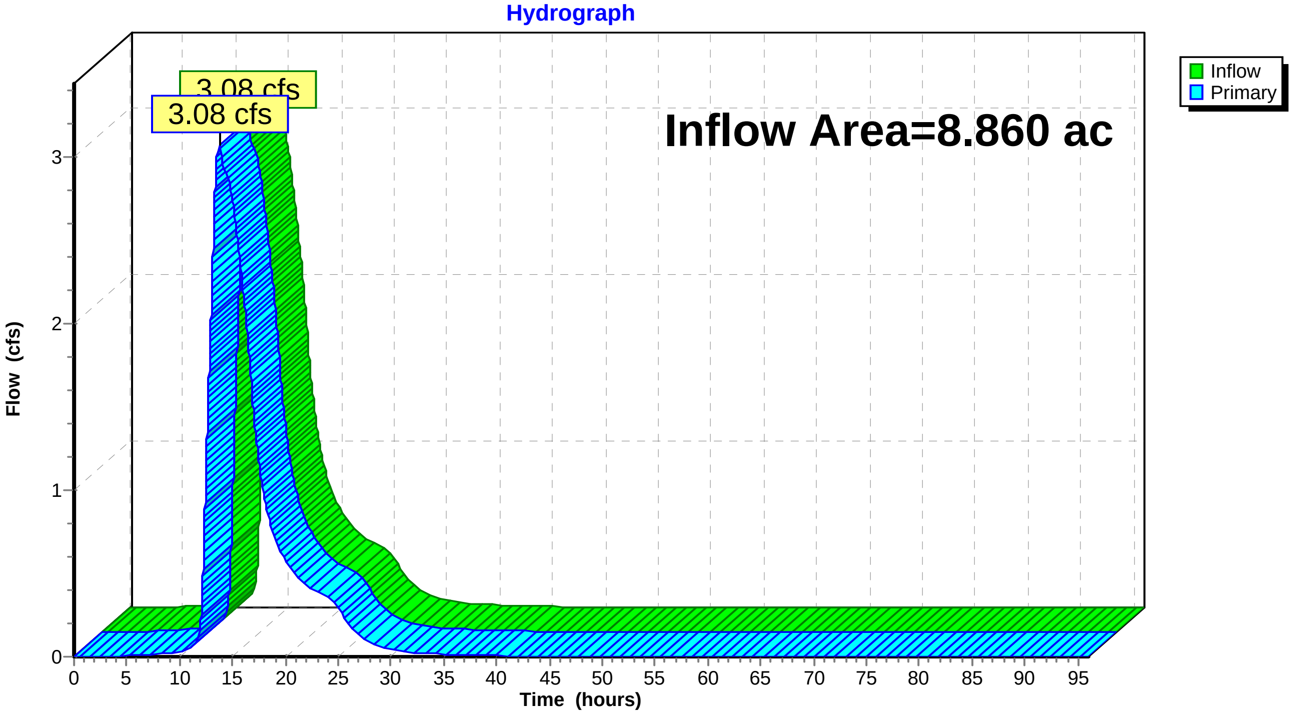


Summary for Link 55L: Sum of Outlet #1 Discharges to Round Lake

```
Inflow Area =        8.860 ac,   6.43% Impervious,  Inflow Depth =   1.90"    for  10-Year event
Inflow      =        3.08 cfs @   13.77 hrs,  Volume=           1.406 af
Primary     =        3.08 cfs @   13.77 hrs,  Volume=           1.406 af,  Atten= 0%,  Lag= 0.0 min
```

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 55L: Sum of Outlet #1 Discharges to Round Lake

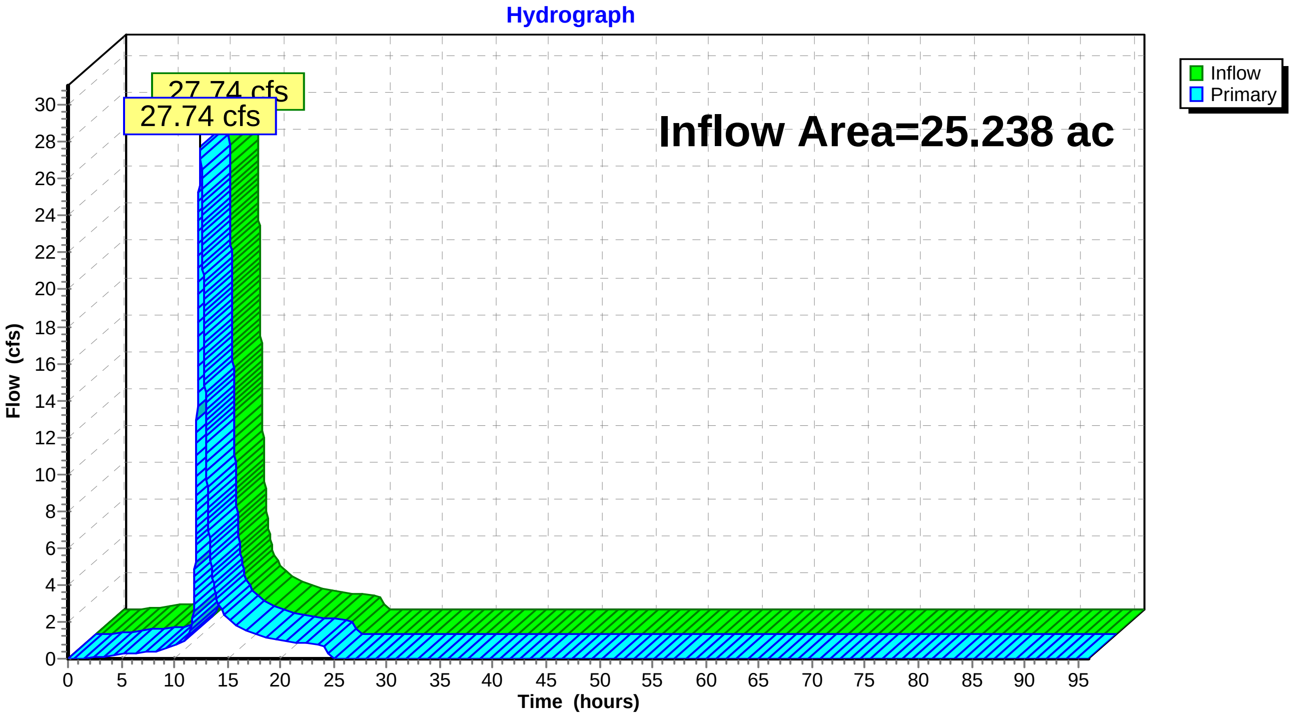


Summary for Link 57L: Outlet #3 Discharge to Round Lake

Inflow Area = 25.238 ac, 19.96% Impervious, Inflow Depth = 1.72" for 10-Year event
Inflow = 27.74 cfs @ 12.43 hrs, Volume= 3.622 af
Primary = 27.74 cfs @ 12.43 hrs, Volume= 3.622 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 57L: Outlet #3 Discharge to Round Lake



```
                 Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
         Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
        Reach routing by Dyn-Stor-Ind method  -  Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: To Rice Creek           Runoff Area=1.601 ac   31.98% Impervious   Runoff Depth=5.20"
                                               Tc=5.7 min   CN=74/98   Runoff=11.87 cfs  0.693 af

Subcatchment 47S: Offsite Subbasin 51   Runoff Area=25.238 ac   19.96% Impervious   Runoff Depth=4.09"
                                              Tc=32.8 min   CN=65/98   Runoff=70.31 cfs  8.599 af

Subcatchment SB 1: SB 1                  Runoff Area=52.150 ac   0.00% Impervious   Runoff Depth=4.31"
                                              Tc=53.1 min   CN=74/0   Runoff=125.09 cfs  18.747 af

Subcatchment SB 11: SB 11                Runoff Area=3.290 ac   36.78% Impervious   Runoff Depth=5.42"
                                              Tc=11.7 min   CN=74/100   Runoff=19.16 cfs  1.485 af

Subcatchment SB 12: SB 12                Runoff Area=1.390 ac   20.86% Impervious   Runoff Depth=4.89"
                                                Tc=9.5 min   CN=74/98   Runoff=8.27 cfs  0.566 af

Subcatchment SB 13: SB 13                Runoff Area=2.980 ac   26.17% Impervious   Runoff Depth=5.10"
                                               Tc=9.4 min   CN=74/100   Runoff=18.22 cfs  1.266 af

Subcatchment SB 14: SB 14               Runoff Area=10.230 ac   16.03% Impervious   Runoff Depth=4.76"
                                               Tc=4.3 min   CN=74/98   Runoff=76.19 cfs  4.054 af

Subcatchment SB 15: SB 15                Runoff Area=58.570 ac   0.05% Impervious   Runoff Depth=4.32"
                                             Tc=31.3 min   CN=74/98   Runoff=185.61 cfs  21.062 af

Subcatchment SB 16: SB 16                Runoff Area=32.440 ac   5.76% Impervious   Runoff Depth=4.47"
                                             Tc=12.1 min   CN=74/98   Runoff=163.65 cfs  12.092 af

Subcatchment SB 17: SB 17                Runoff Area=7.608 ac   48.41% Impervious   Runoff Depth=5.76"
                                               Tc=4.3 min   CN=74/100   Runoff=64.20 cfs  3.655 af

Subcatchment SB 18: SB 18                Runoff Area=52.790 ac   0.00% Impervious   Runoff Depth=4.31"
                                              Tc=33.5 min   CN=74/0   Runoff=161.15 cfs  18.977 af

Subcatchment SB 19: SB 19                Runoff Area=21.190 ac   0.00% Impervious   Runoff Depth=4.31"
                                               Tc=24.7 min   CN=74/0   Runoff=75.36 cfs  7.618 af

Subcatchment SB 2: SB 2                  Runoff Area=11.067 ac   0.33% Impervious   Runoff Depth=4.32"
                                              Tc=16.6 min   CN=74/98   Runoff=47.56 cfs  3.987 af

Subcatchment SB 22: SB 22                Runoff Area=41.910 ac   0.00% Impervious   Runoff Depth=1.75"
                                               Tc=41.0 min   CN=49/0   Runoff=40.68 cfs  6.106 af

Subcatchment SB 24: SB 24                Runoff Area=5.043 ac   97.56% Impervious   Runoff Depth=7.00"
                                               Tc=7.5 min   CN=74/98   Runoff=43.43 cfs  2.943 af

Subcatchment SB 25: SB 25                Runoff Area=5.136 ac   95.72% Impervious   Runoff Depth=6.95"
                                              Tc=10.7 min   CN=74/98   Runoff=38.17 cfs  2.976 af
```

Subcatchment SB 26: SB 26 Runoff Area=14.335 ac   98.27% Impervious   Runoff Depth=7.02"
Tc=25.4 min   CN=74/98   Runoff=73.07 cfs 8.390 af

Subcatchment SB 27: SB 27 (Thumb Road) Runoff Area=6.629 ac   83.33% Impervious   Runoff Depth=6.61"
Tc=27.6 min   CN=74/98   Runoff=30.89 cfs 3.652 af

Subcatchment SB 28: SB 28 Runoff Area=6.955 ac   46.76% Impervious   Runoff Depth=5.60"
Tc=14.6 min   CN=74/98   Runoff=38.37 cfs 3.247 af

Subcatchment SB 29: SB 29 Runoff Area=10.214 ac   37.73% Impervious   Runoff Depth=5.35"
Tc=19.1 min   CN=74/98   Runoff=48.13 cfs 4.557 af

Subcatchment SB 3: SB 3 Runoff Area=37.610 ac   7.68% Impervious   Runoff Depth=4.53"
Tc=15.3 min   CN=74/98   Runoff=173.90 cfs 14.184 af

Subcatchment SB 4: SB 4 Runoff Area=0.600 ac   43.33% Impervious   Runoff Depth=5.61"
Tc=5.9 min   CN=74/100   Runoff=4.61 cfs 0.281 af

Subcatchment SB 5: SB 5 Runoff Area=7.860 ac   5.98% Impervious   Runoff Depth=4.48"
Tc=59.3 min   CN=74/98   Runoff=18.03 cfs 2.934 af

Subcatchment SB 6: SB 6 Runoff Area=1.000 ac   10.00% Impervious   Runoff Depth=4.61"
Tc=20.3 min   CN=74/100   Runoff=4.09 cfs 0.384 af

Subcatchment SB 7: SB 7 Runoff Area=21.550 ac   0.00% Impervious   Runoff Depth=4.31"
Tc=5.7 min   CN=74/0   Runoff=140.12 cfs 7.747 af

Subcatchment SB 8: SB 8 Runoff Area=29.580 ac   5.51% Impervious   Runoff Depth=4.47"
Tc=47.1 min   CN=74/98   Runoff=77.55 cfs 11.008 af

Subcatchment SB 9: SB 9 Runoff Area=25.780 ac   0.12% Impervious   Runoff Depth=4.32"
Tc=30.0 min   CN=74/98   Runoff=83.43 cfs 9.275 af

Subcatchment SB10: SB 10 Runoff Area=6.390 ac   4.85% Impervious   Runoff Depth=4.45"
Tc=7.3 min   CN=74/98   Runoff=39.26 cfs 2.368 af

Pond 2 P: P-2 Peak Elev=925.48' Storage=1.347 af   Inflow=146.98 cfs 25.678 af
Outflow=146.30 cfs 25.678 af

Pond 4P: P-4 Peak Elev=917.34' Storage=1.444 af   Inflow=18.03 cfs 2.934 af
Primary=8.50 cfs 1.519 af   Secondary=3.10 cfs 1.415 af   Outflow=11.60 cfs 2.934 af

Pond 7P: P-7 Peak Elev=915.86' Storage=1.484 af   Inflow=77.55 cfs 11.008 af
Outflow=78.63 cfs 11.008 af

Pond 8P: P-8 Peak Elev=899.07' Storage=1.375 af   Inflow=39.26 cfs 2.368 af
24.0" Round Culvert n=0.013 L=380.0' S=0.0028 '/'   Outflow=10.88 cfs 2.363 af

Pond 9P: P-9 Peak Elev=915.78' Storage=0.576 af   Inflow=146.92 cfs 20.283 af
Outflow=146.74 cfs 20.283 af

Pond 10P: P-10 Lowered 1 ft Peak Elev=898.35' Storage=1.496 af   Inflow=139.63 cfs 21.209 af
Primary=15.29 cfs 10.343 af   Secondary=123.93 cfs 10.865 af   Outflow=139.22 cfs 21.208 af

Pond 11P: P-11 Peak Elev=912.68' Storage=8.867 af Inflow=153.04 cfs 21.768 af
Primary=130.96 cfs 18.280 af Secondary=4.94 cfs 3.486 af Outflow=135.90 cfs 21.766 af

Pond 12P: P-12 Peak Elev=895.49' Storage=9.562 af Inflow=148.48 cfs 29.994 af
Outflow=116.29 cfs 29.986 af

Pond 13P: P-13 Peak Elev=885.22' Storage=9.306 af Inflow=524.41 cfs 90.508 af
Primary=485.21 cfs 86.324 af Secondary=18.37 cfs 4.181 af Outflow=503.58 cfs 90.505 af

Pond 17P: W-2 Peak Elev=929.56' Storage=0.638 af Inflow=3.09 cfs 1.318 af
12.0" Round Culvert n=0.013 L=300.0' S=0.0437 '/' Outflow=1.02 cfs 1.173 af

Pond 36P: Culverts passing flow Peak Elev=888.46' Storage=0.003 af Inflow=161.15 cfs 18.977 af
Primary=127.00 cfs 18.235 af Secondary=34.15 cfs 0.742 af Outflow=161.15 cfs 18.977 af

Pond CRH-1: CRH-1 Peak Elev=878.81' Storage=0.760 af Inflow=38.37 cfs 3.247 af
Discarded=0.37 cfs 0.563 af Primary=25.16 cfs 2.685 af Outflow=25.53 cfs 3.247 af

Pond CRH-2: CRH-2 Peak Elev=883.78' Storage=1.468 af Inflow=48.13 cfs 4.557 af
Discarded=0.47 cfs 0.986 af Primary=27.38 cfs 3.571 af Outflow=27.85 cfs 4.557 af

Pond CRH-3: CRH-3 Peak Elev=879.83' Storage=0.769 af Inflow=30.15 cfs 4.265 af
Discarded=0.38 cfs 0.519 af Primary=25.52 cfs 3.745 af Outflow=25.90 cfs 4.265 af

Pond P-5/P-6: P-5/P-6 Peak Elev=931.48' Storage=10.663 af Inflow=208.93 cfs 17.441 af
Primary=109.91 cfs 16.116 af Secondary=3.09 cfs 1.318 af Outflow=112.99 cfs 17.434 af

Pond TI P: Thumb Infiltration (Thumb TP Peak Elev=903.80' Storage=3.804 af Inflow=62.42 cfs 9.759 af
Outflow=53.02 cfs 6.019 af

Pond W-1: W-1 Peak Elev=915.28' Storage=0.371 af Inflow=5.53 cfs 1.799 af
Outflow=2.75 cfs 1.799 af

Pond W-3: W-3 Peak Elev=915.31' Storage=1.173 af Inflow=1.02 cfs 1.173 af
Outflow=0.00 cfs 0.000 af

Pond W-4: W-4 Peak Elev=909.25' Storage=1.261 af Inflow=21.33 cfs 4.752 af
12.0" Round Culvert n=0.013 L=170.0' S=0.0235 '/' Outflow=4.11 cfs 4.732 af

Pond W-5: W-5 Peak Elev=883.30' Storage=6.307 af Inflow=73.62 cfs 7.835 af
Outflow=15.85 cfs 7.828 af

Link 53L: Sum of Outlet #2 Discharges to Round Lake Inflow=276.90 cfs 49.540 af
Primary=276.90 cfs 49.540 af

Link 54L: Sum of Discharges from P-13 and W-5 Inflow=498.50 cfs 94.152 af
Primary=498.50 cfs 94.152 af

Link 55L: Sum of Outlet #1 Discharges to Round Lake Inflow=11.11 cfs 3.318 af
Primary=11.11 cfs 3.318 af

Link 57L: Outlet #3 Discharge to Round Lake

Inflow=70.31 cfs 8.599 af
Primary=70.31 cfs 8.599 af

Total Runoff Area = 501.136 ac Runoff Volume = 182.855 af Average Runoff Depth = 4.38"
88.56% Pervious = 443.803 ac 11.44% Impervious = 57.333 ac

Summary for Subcatchment 1S: To Rice Creek

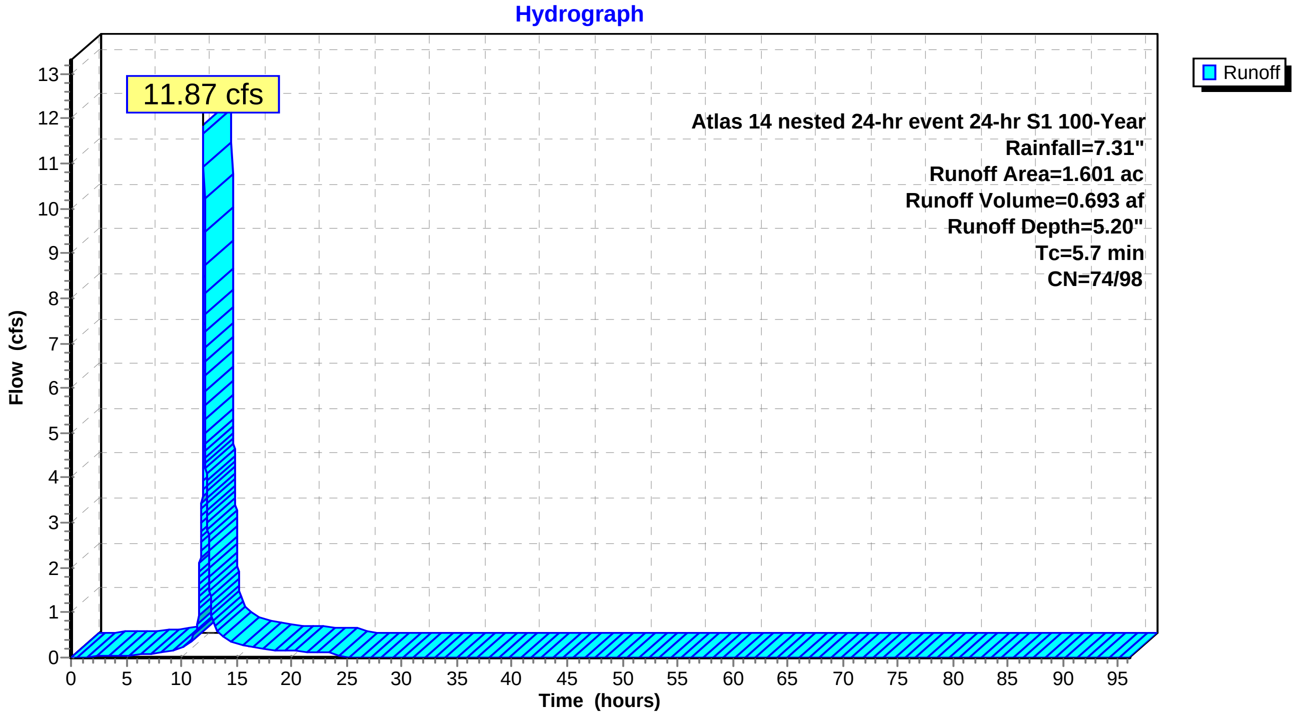
Runoff = 11.87 cfs @ 12.03 hrs, Volume= 0.693 af, Depth= 5.20"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.512	98	impervious
*	1.089	74	pervious
	1.601	82	Weighted Average
	1.089		68.02% Pervious Area
	0.512		31.98% Impervious Area

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

Subcatchment 1S: To Rice Creek



Summary for Subcatchment 47S: Offsite Subbasin 51

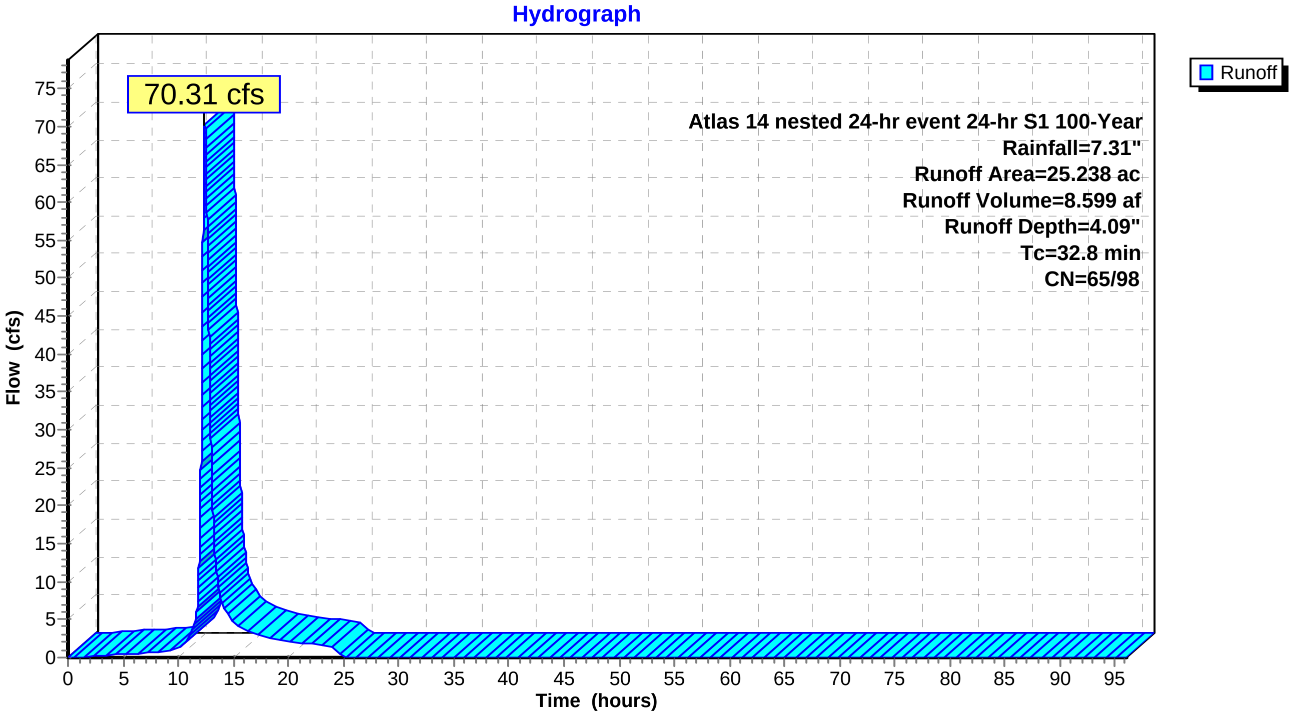
Runoff = 70.31 cfs @ 12.43 hrs, Volume= 8.599 af, Depth= 4.09"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	20.200	65	Offsite subbasin 51
*	5.038	98	
	25.238	72	Weighted Average
	20.200		80.04% Pervious Area
	5.038		19.96% Impervious Area

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

Subcatchment 47S: Offsite Subbasin 51



Summary for Subcatchment SB 1: SB 1

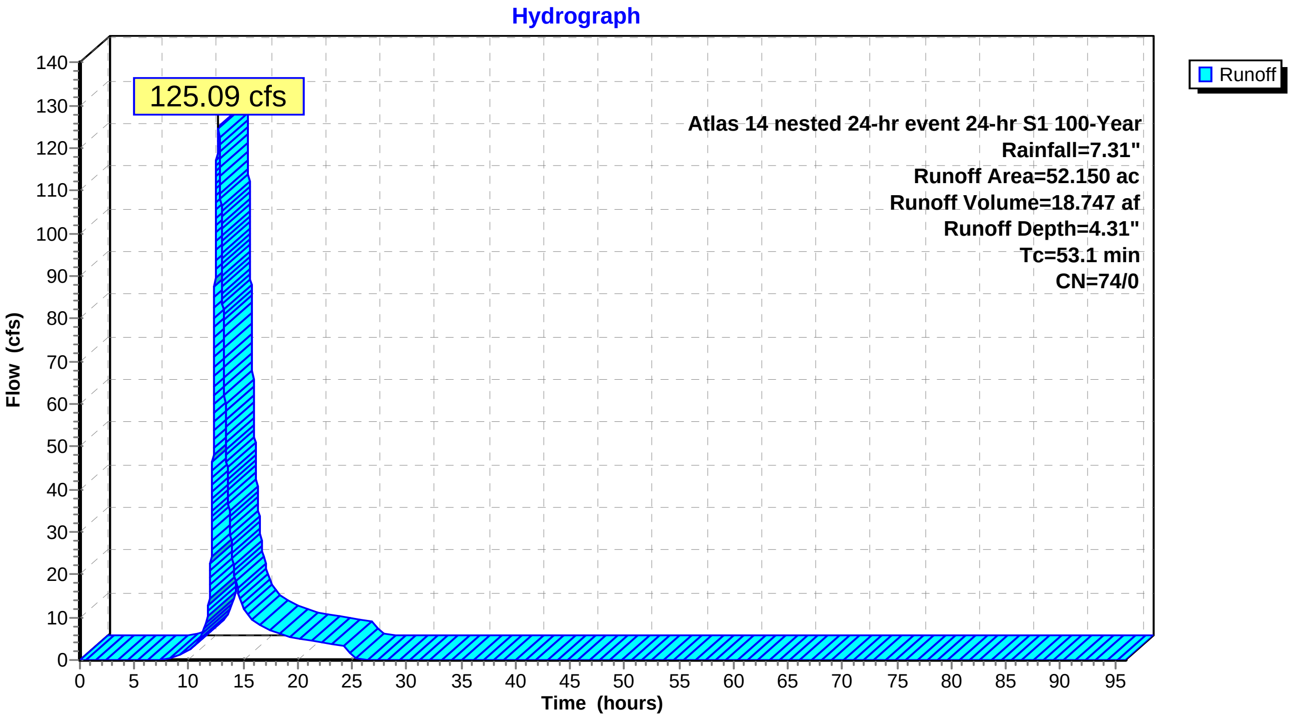
Runoff = 125.09 cfs @ 12.69 hrs, Volume= 18.747 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	52.150	74	pervious
*	0.000	98	impervious
	52.150	74	Weighted Average
	52.150		100.00% Pervious Area

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

Subcatchment SB 1: SB 1



Summary for Subcatchment SB 11: SB 11

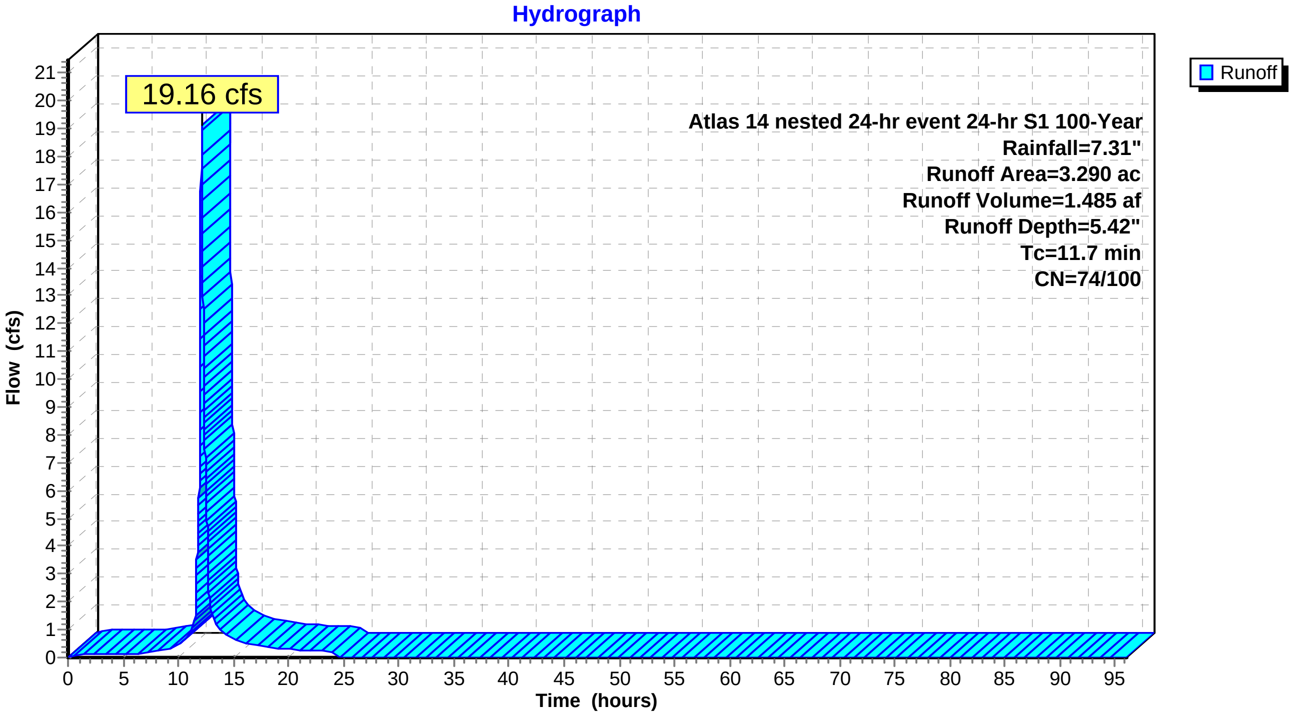
Runoff = 19.16 cfs @ 12.11 hrs, Volume= 1.485 af, Depth= 5.42"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.080	74	pervious
*	1.210	100	impervious
	3.290	84	Weighted Average
	2.080		63.22% Pervious Area
	1.210		36.78% Impervious Area

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

Subcatchment SB 11: SB 11



Summary for Subcatchment SB 12: SB 12

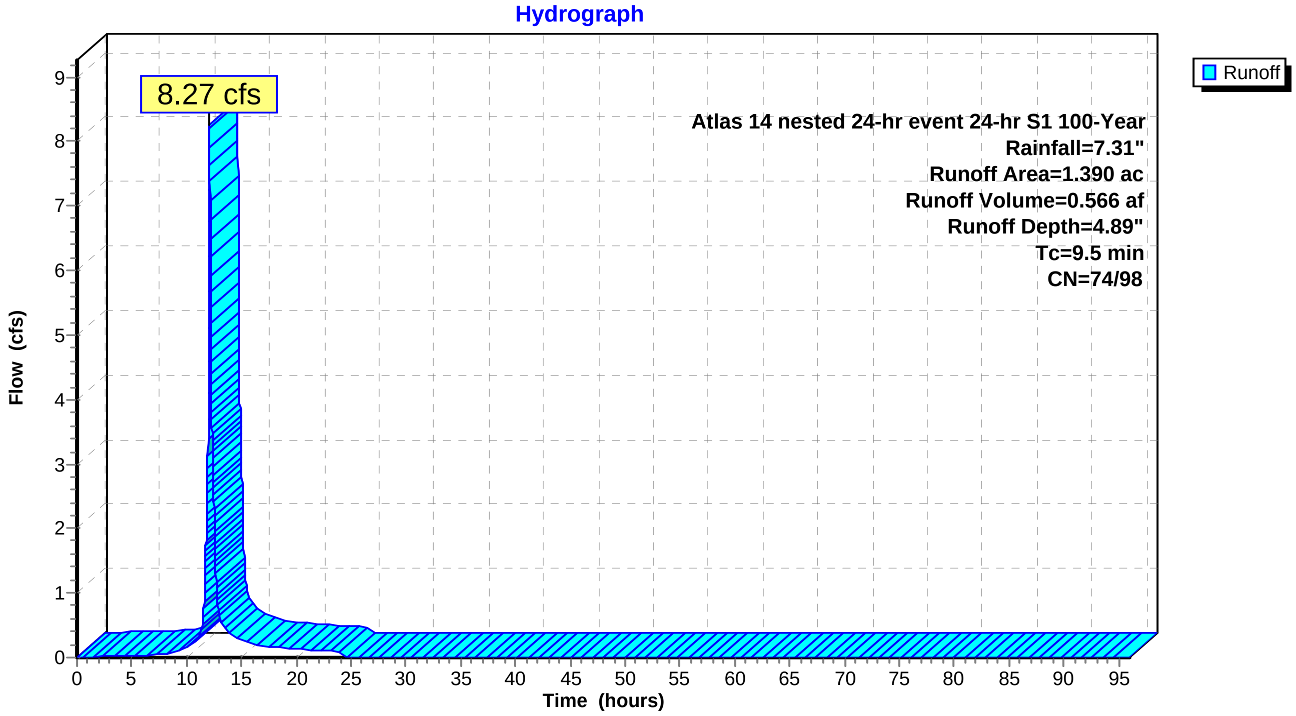
Runoff = 8.27 cfs @ 12.08 hrs, Volume= 0.566 af, Depth= 4.89"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	1.100	74	pervious
*	0.290	98	impervious
	1.390	79	Weighted Average
	1.100		79.14% Pervious Area
	0.290		20.86% Impervious Area

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

Subcatchment SB 12: SB 12



Summary for Subcatchment SB 13: SB 13

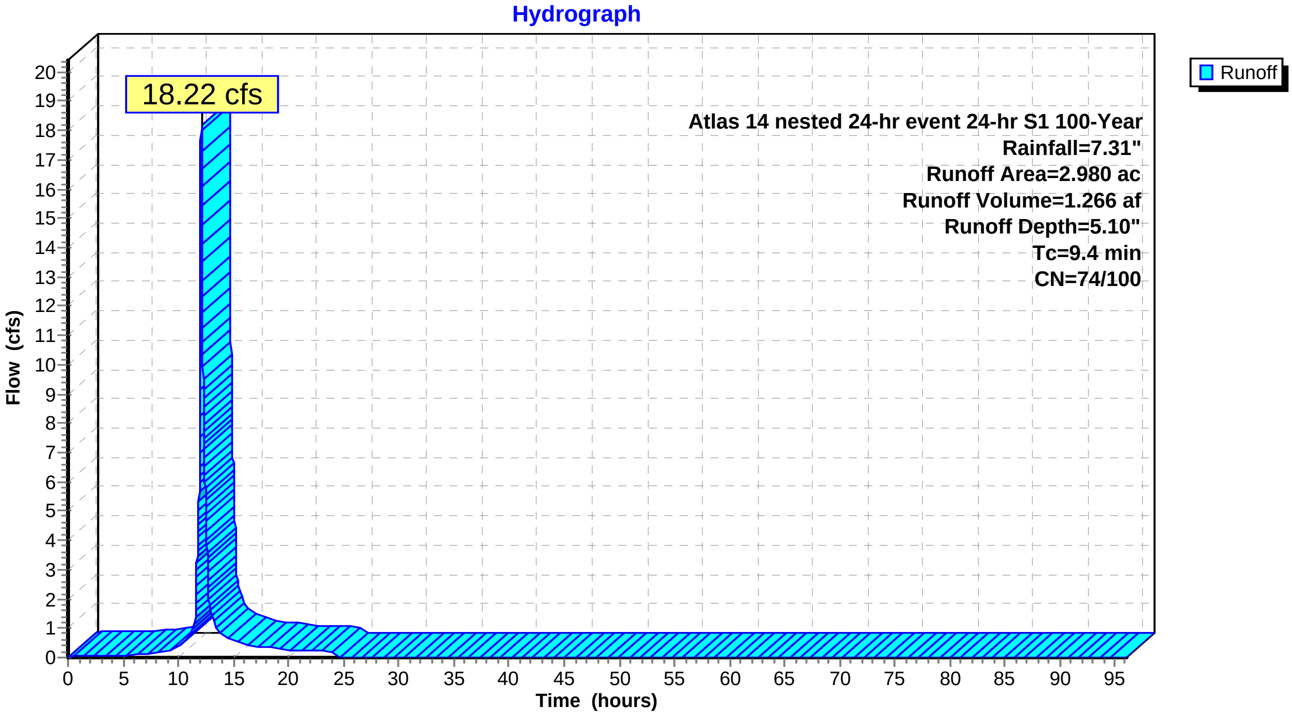
Runoff = 18.22 cfs @ 12.08 hrs, Volume= 1.266 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.200	74	pervious
*	0.780	100	impervious
	2.980	81	Weighted Average
	2.200		73.83% Pervious Area
	0.780		26.17% Impervious Area

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

Subcatchment SB 13: SB 13



Summary for Subcatchment SB 14: SB 14

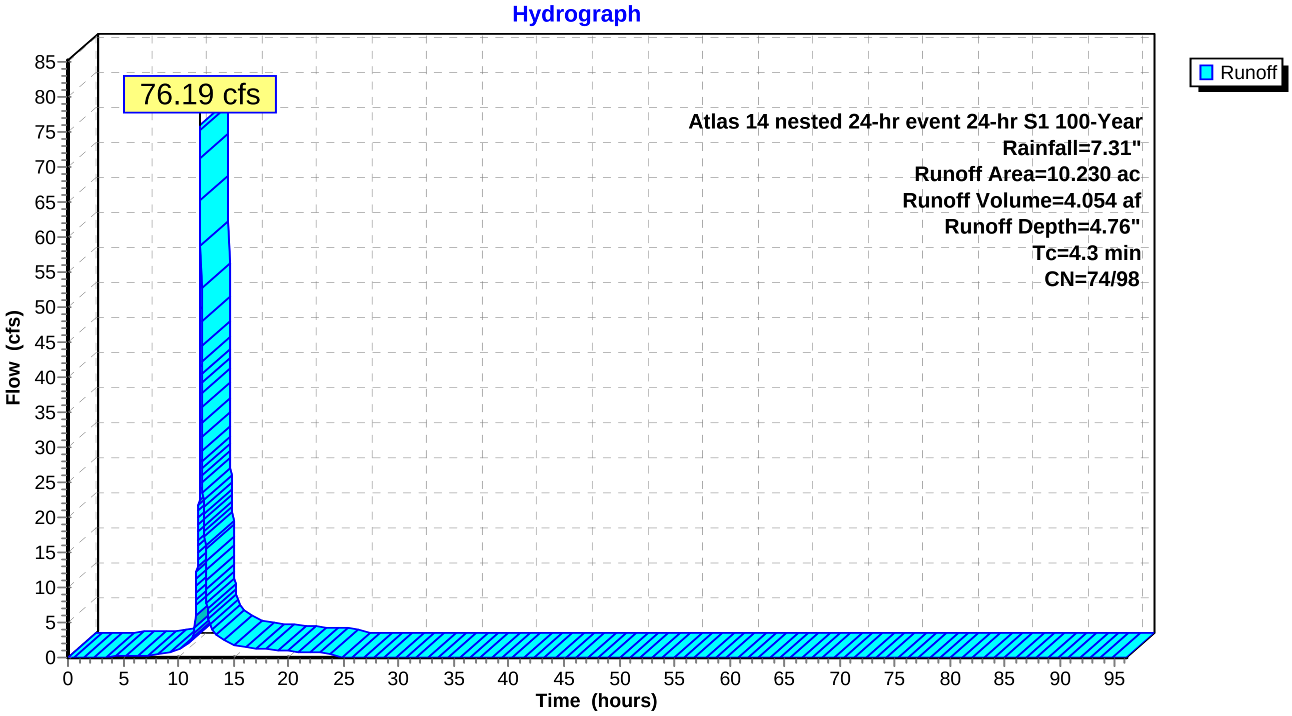
Runoff = 76.19 cfs @ 12.02 hrs, Volume= 4.054 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	8.590	74	pervious
*	1.640	98	impervious
	10.230	78	Weighted Average
	8.590		83.97% Pervious Area
	1.640		16.03% Impervious Area

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

Subcatchment SB 14: SB 14



Summary for Subcatchment SB 15: SB 15

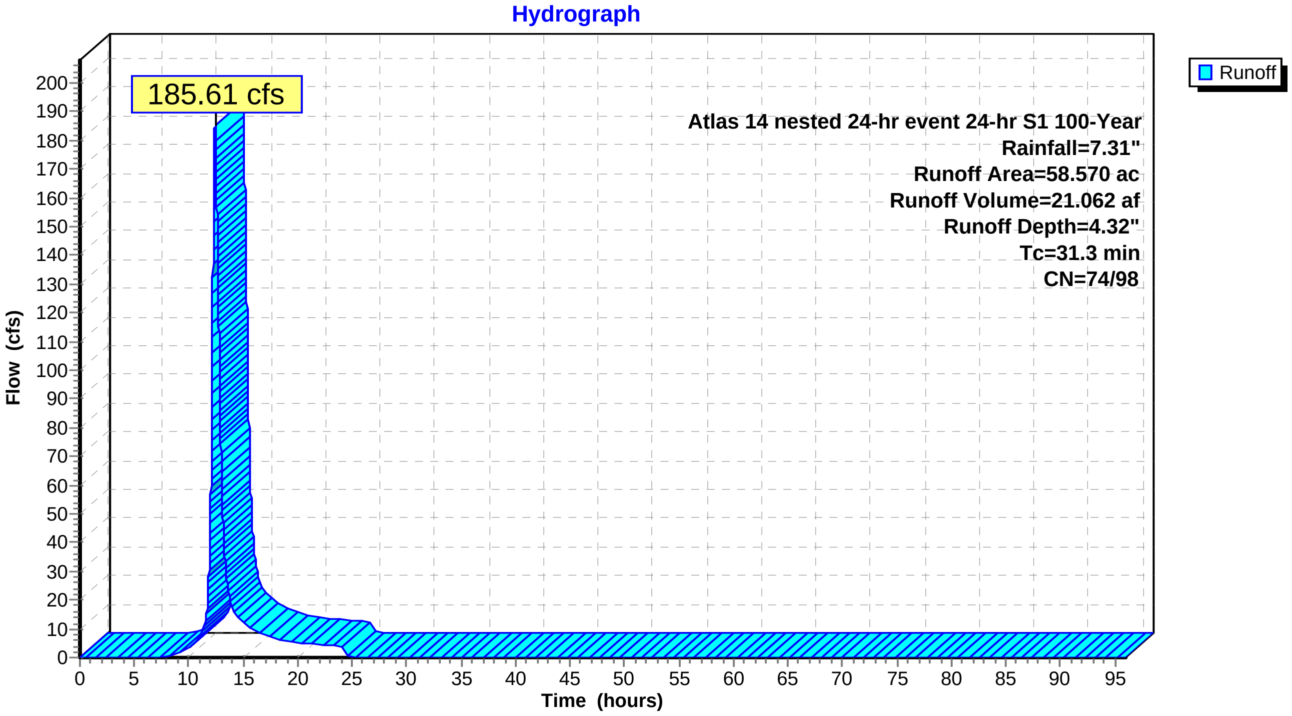
Runoff = 185.61 cfs @ 12.41 hrs, Volume= 21.062 af, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	58.540	74	pervious
*	0.030	98	impervious
	58.570	74	Weighted Average
	58.540		99.95% Pervious Area
	0.030		0.05% Impervious Area

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

Subcatchment SB 15: SB 15



Summary for Subcatchment SB 16: SB 16

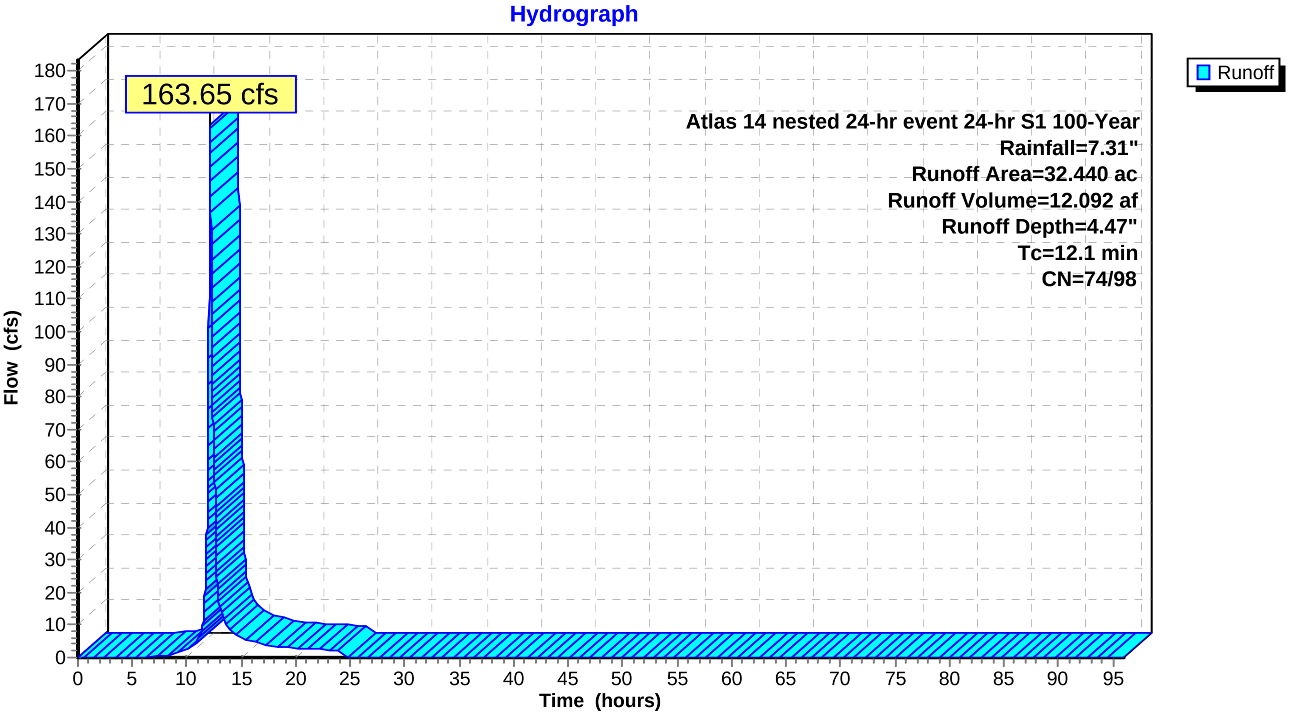
Runoff = 163.65 cfs @ 12.12 hrs, Volume= 12.092 af, Depth= 4.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	30.570	74	pervious
*	1.870	98	impervious
	32.440	75	Weighted Average
	30.570		94.24% Pervious Area
	1.870		5.76% Impervious Area

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

Subcatchment SB 16: SB 16



Summary for Subcatchment SB 17: SB 17

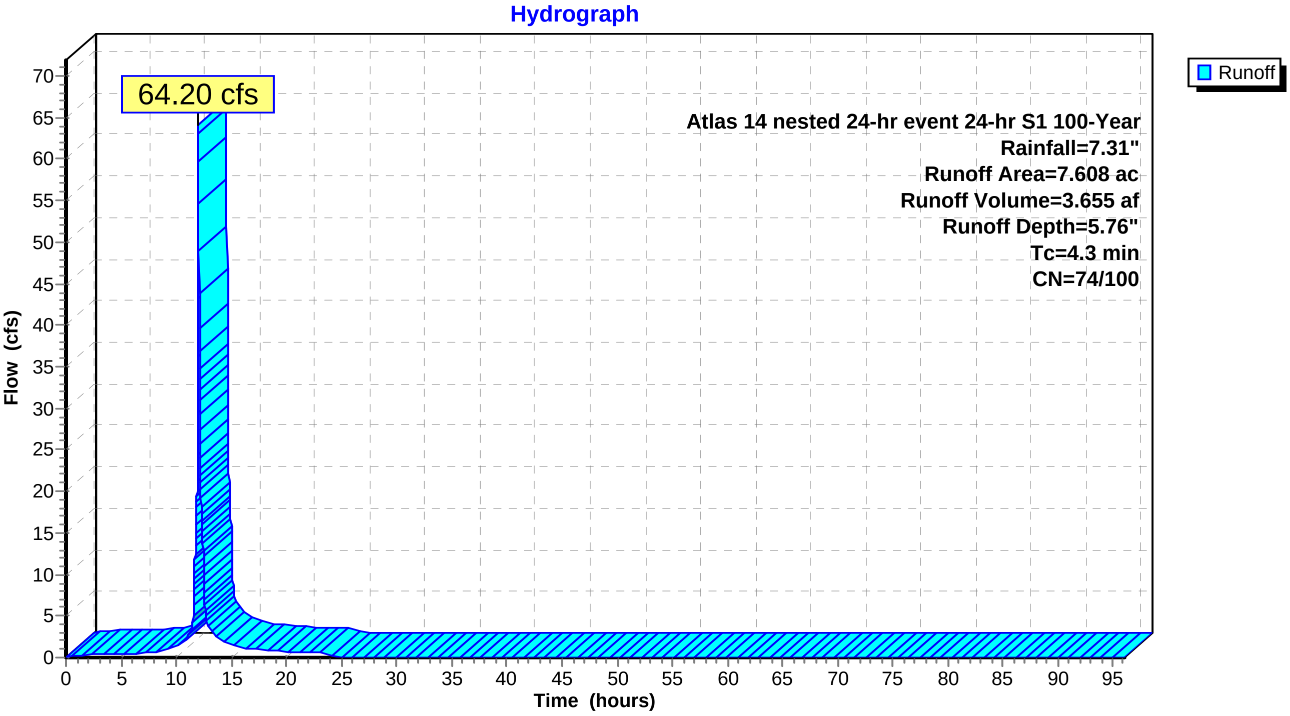
Runoff = 64.20 cfs @ 12.02 hrs, Volume= 3.655 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.925	74	pervious
*	3.683	100	impervious
	7.608	87	Weighted Average
	3.925		51.59% Pervious Area
	3.683		48.41% Impervious Area

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

Subcatchment SB 17: SB 17



Summary for Subcatchment SB 18: SB 18

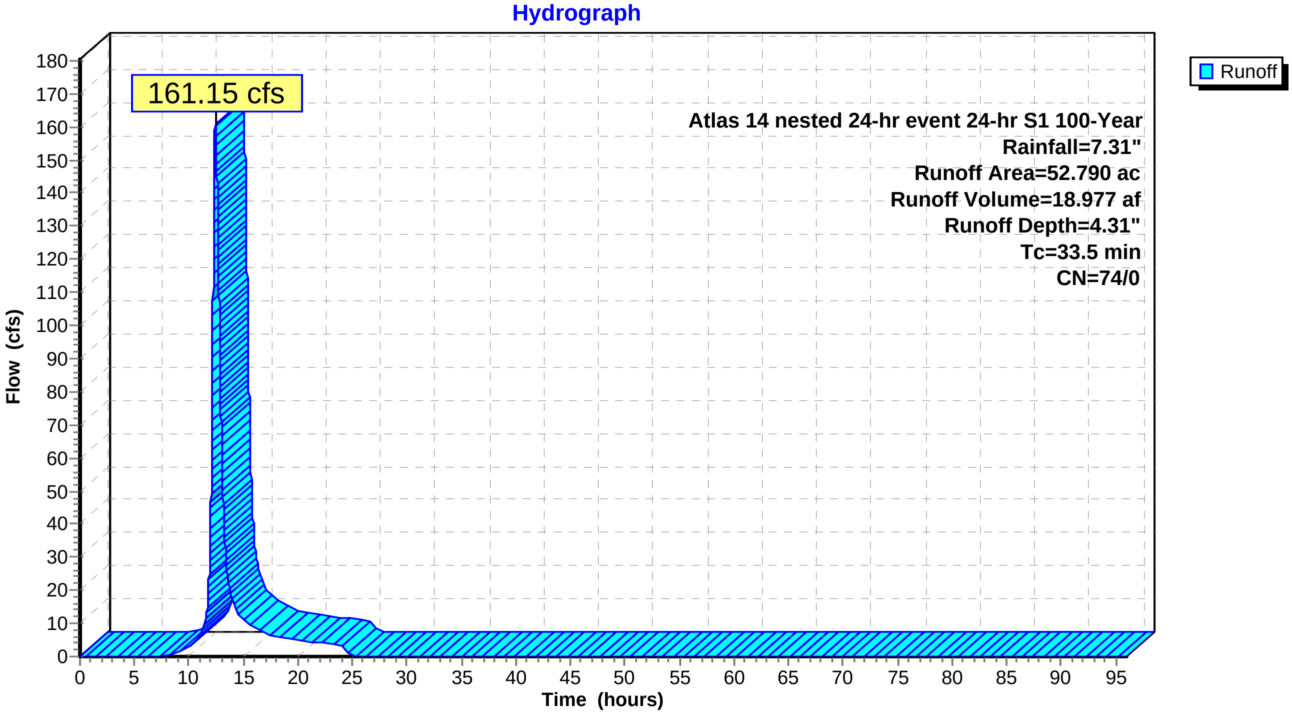
Runoff = 161.15 cfs @ 12.43 hrs, Volume= 18.977 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	52.790	74	pervious
*	0.000	98	impervious
	52.790	74	Weighted Average
	52.790		100.00% Pervious Area

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

Subcatchment SB 18: SB 18



Summary for Subcatchment SB 19: SB 19

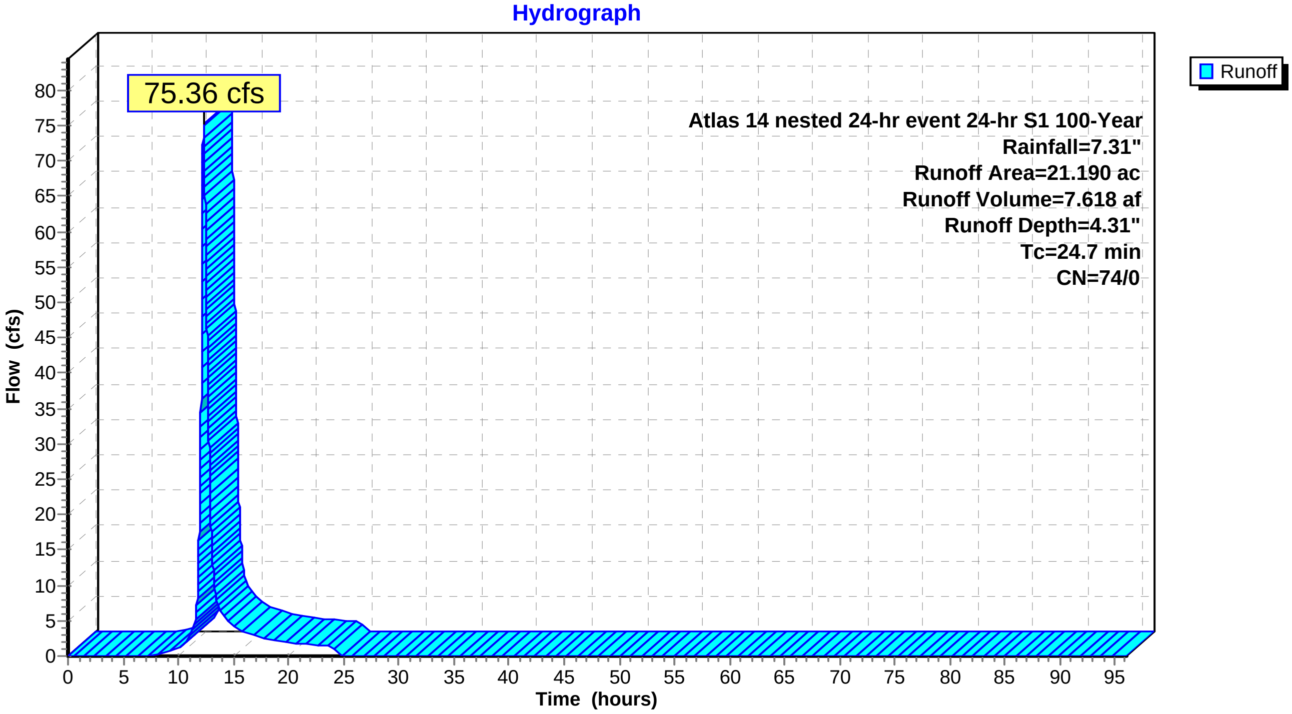
Runoff = 75.36 cfs @ 12.30 hrs, Volume= 7.618 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	21.190	74	pervious
*	0.000	98	impervious
	21.190	74	Weighted Average
	21.190		100.00% Pervious Area

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

Subcatchment SB 19: SB 19



Summary for Subcatchment SB 2: SB 2

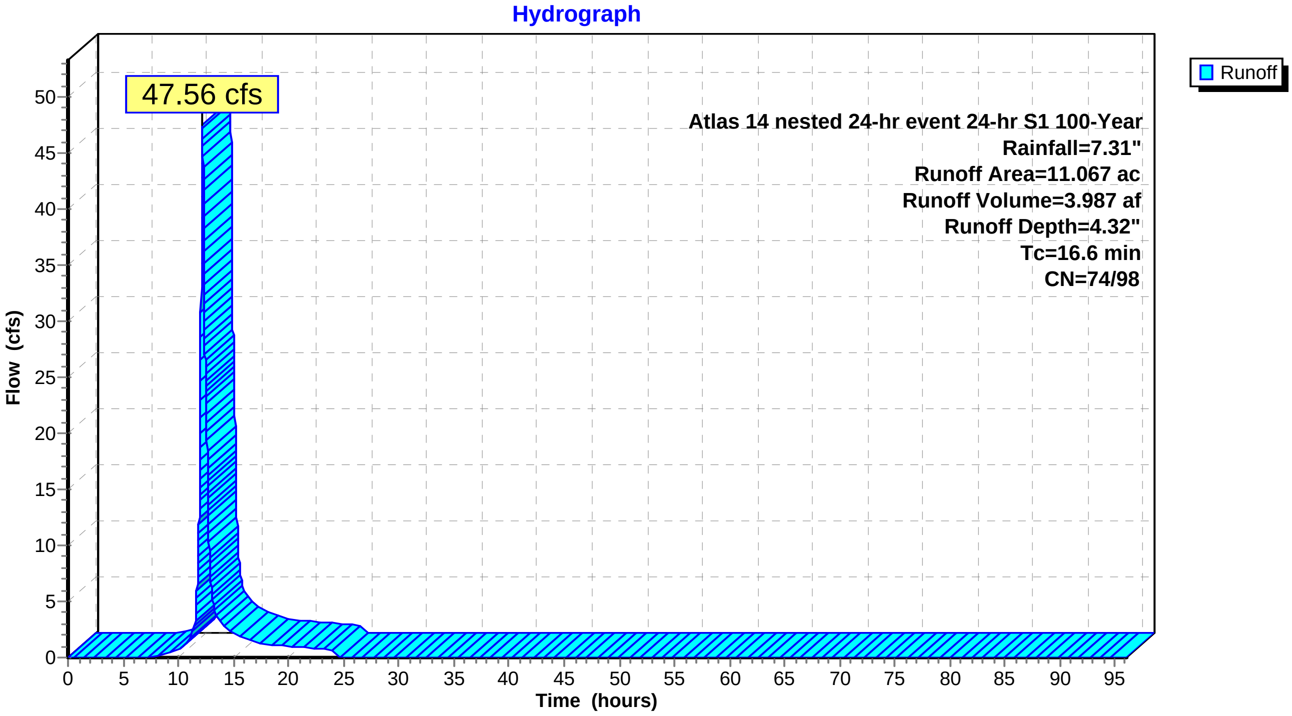
Runoff = 47.56 cfs @ 12.19 hrs, Volume= 3.987 af, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	11.030	74	pervious
*	0.037	98	impervious
	11.067	74	Weighted Average
	11.030		99.67% Pervious Area
	0.037		0.33% Impervious Area

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

Subcatchment SB 2: SB 2



Summary for Subcatchment SB 22: SB 22

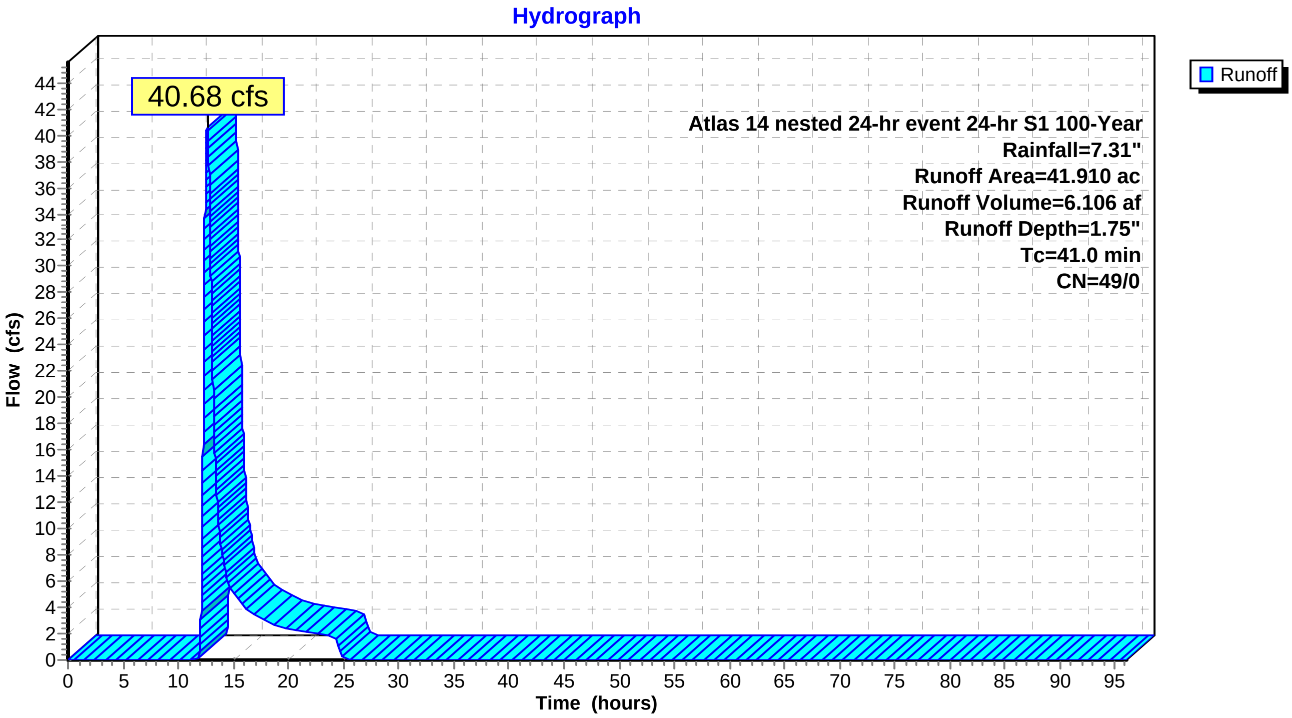
Runoff = 40.68 cfs @ 12.62 hrs, Volume= 6.106 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	41.910	49	Pervious
*	0.000	98	Impervious
	41.910	49	Weighted Average
	41.910		100.00% Pervious Area

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

Subcatchment SB 22: SB 22



Summary for Subcatchment SB 24: SB 24

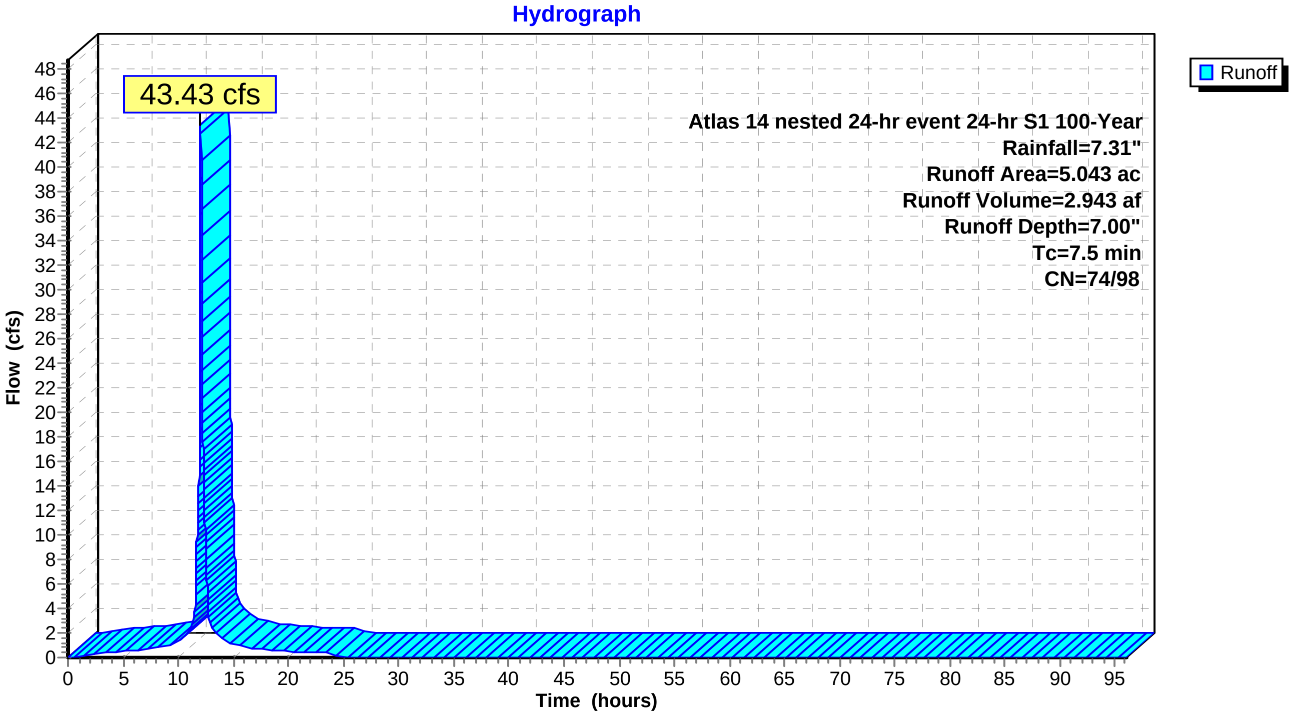
Runoff = 43.43 cfs @ 12.05 hrs, Volume= 2.943 af, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.123	74	permiable
*	4.920	98	impermiable
	5.043	97	Weighted Average
	0.123		2.44% Pervious Area
	4.920		97.56% Impervious Area

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

Subcatchment SB 24: SB 24



Summary for Subcatchment SB 25: SB 25

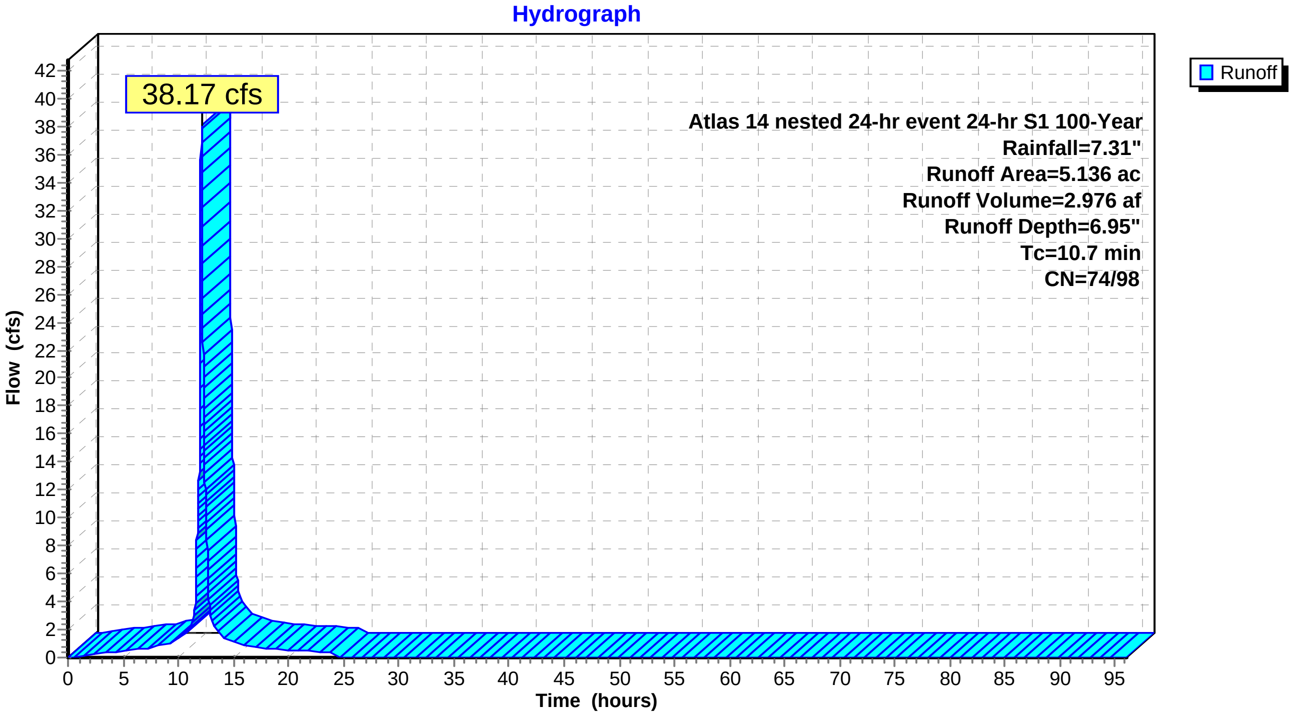
Runoff = 38.17 cfs @ 12.09 hrs, Volume= 2.976 af, Depth= 6.95"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.220	74	pervious
*	4.916	98	impervious
	5.136	97	Weighted Average
	0.220		4.28% Pervious Area
	4.916		95.72% Impervious Area

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

Subcatchment SB 25: SB 25



Summary for Subcatchment SB 26: SB 26

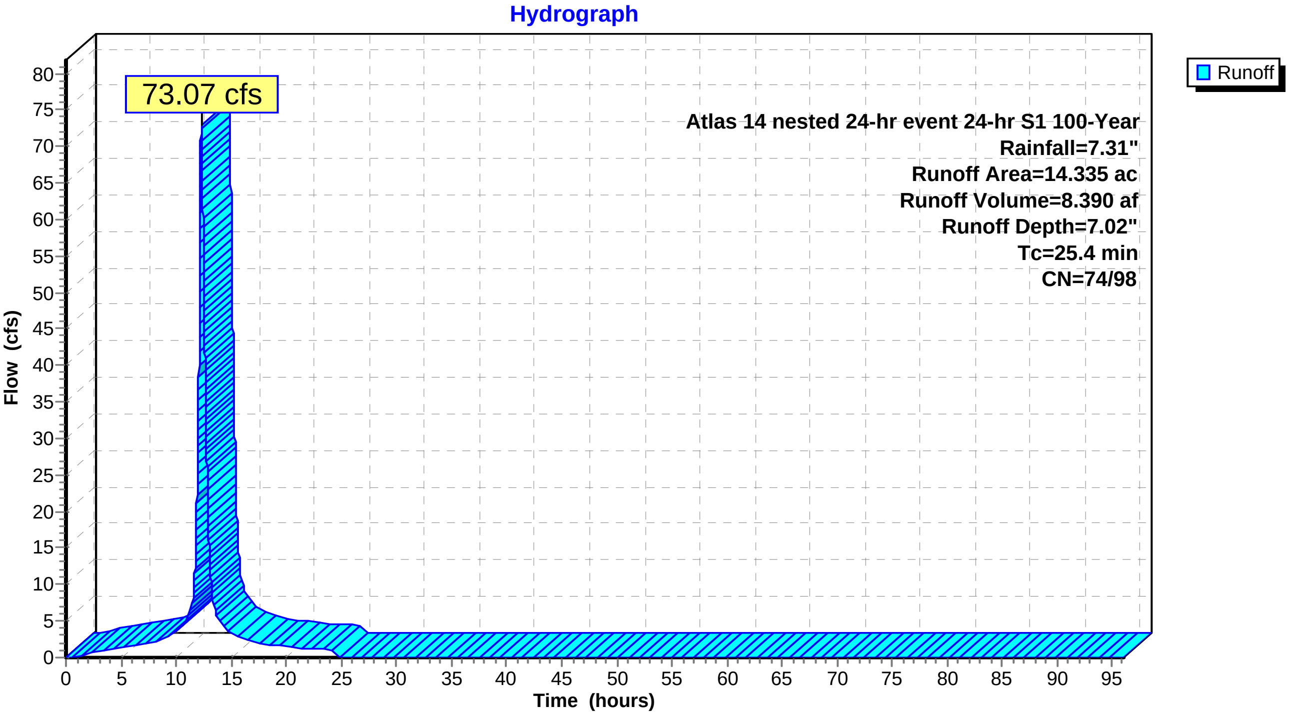
Runoff = 73.07 cfs @ 12.28 hrs, Volume= 8.390 af, Depth= 7.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.248	74	pervious
*	14.087	98	impervious
	14.335	98	Weighted Average
	0.248		1.73% Pervious Area
	14.087		98.27% Impervious Area

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

Subcatchment SB 26: SB 26



Summary for Subcatchment SB 27: SB 27 (Thumb Road)

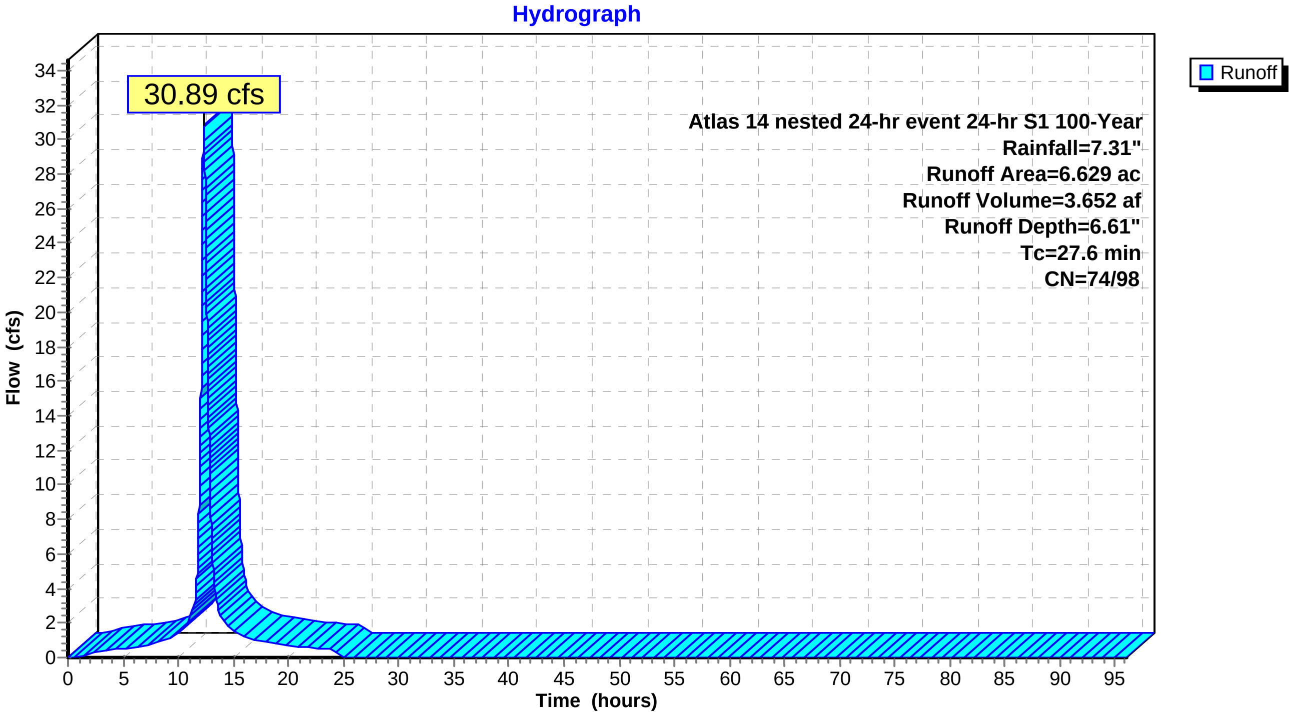
Runoff = 30.89 cfs @ 12.32 hrs, Volume= 3.652 af, Depth= 6.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	1.105	74	Pervious
*	5.524	98	Impervious
	6.629	94	Weighted Average
	1.105		16.67% Pervious Area
	5.524		83.33% Impervious Area

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

Subcatchment SB 27: SB 27 (Thumb Road)



Summary for Subcatchment SB 28: SB 28

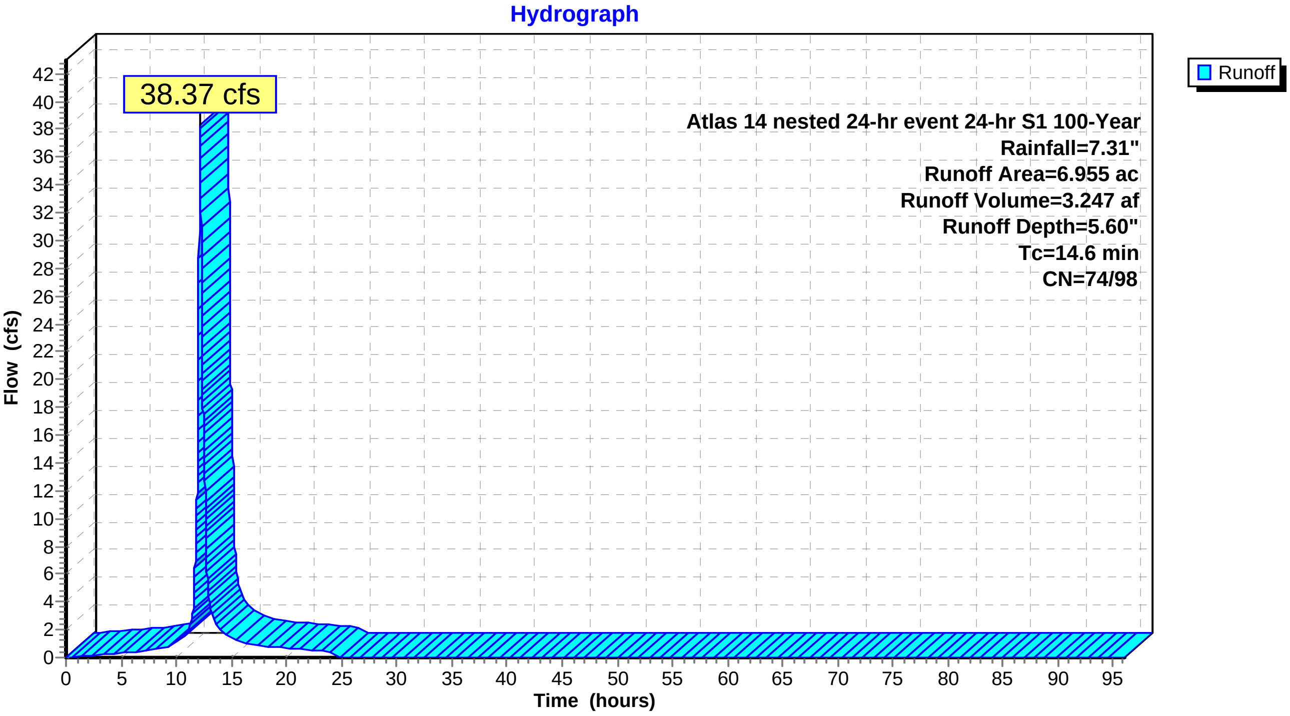
Runoff = 38.37 cfs @ 12.15 hrs, Volume= 3.247 af, Depth= 5.60"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.703	74	pervious
*	3.252	98	impervious
	6.955	85	Weighted Average
	3.703		53.24% Pervious Area
	3.252		46.76% Impervious Area

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

Subcatchment SB 28: SB 28



Summary for Subcatchment SB 29: SB 29

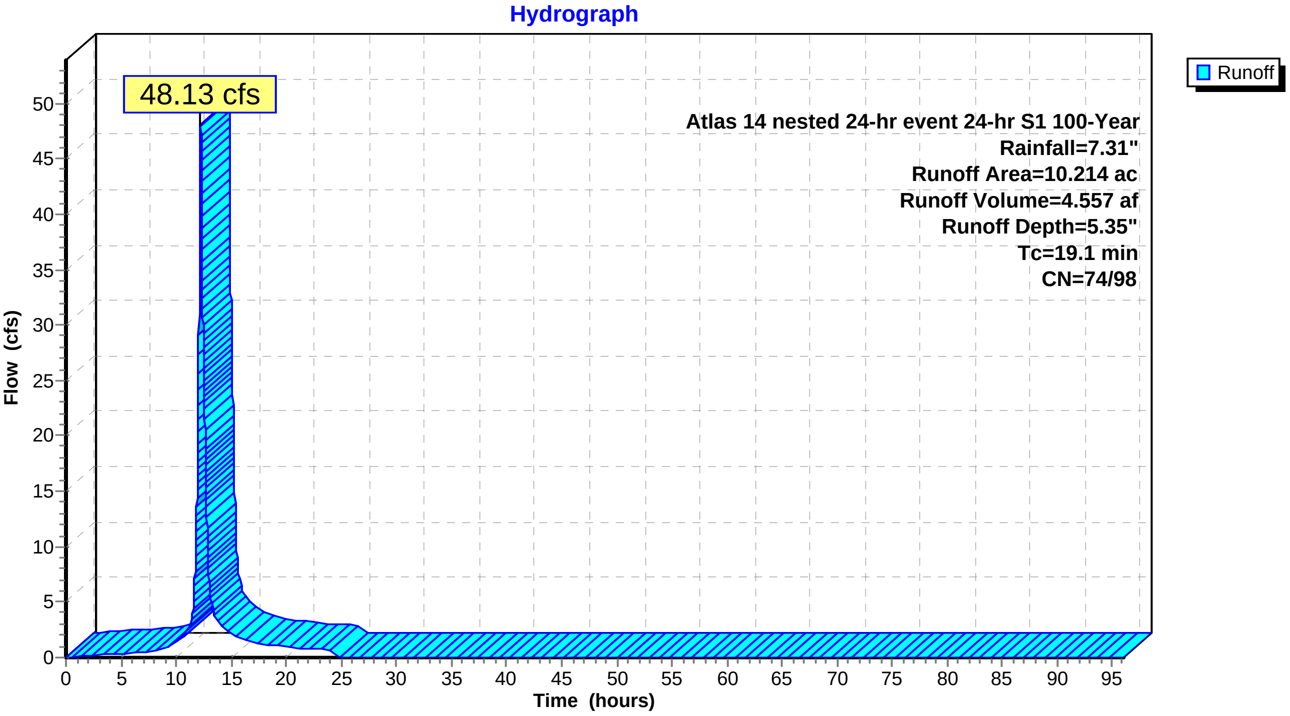
Runoff = 48.13 cfs @ 12.21 hrs, Volume= 4.557 af, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	6.360	74	pervious
*	3.854	98	impervious
	10.214	83	Weighted Average
	6.360		62.27% Pervious Area
	3.854		37.73% Impervious Area

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

Subcatchment SB 29: SB 29



Summary for Subcatchment SB 3: SB 3

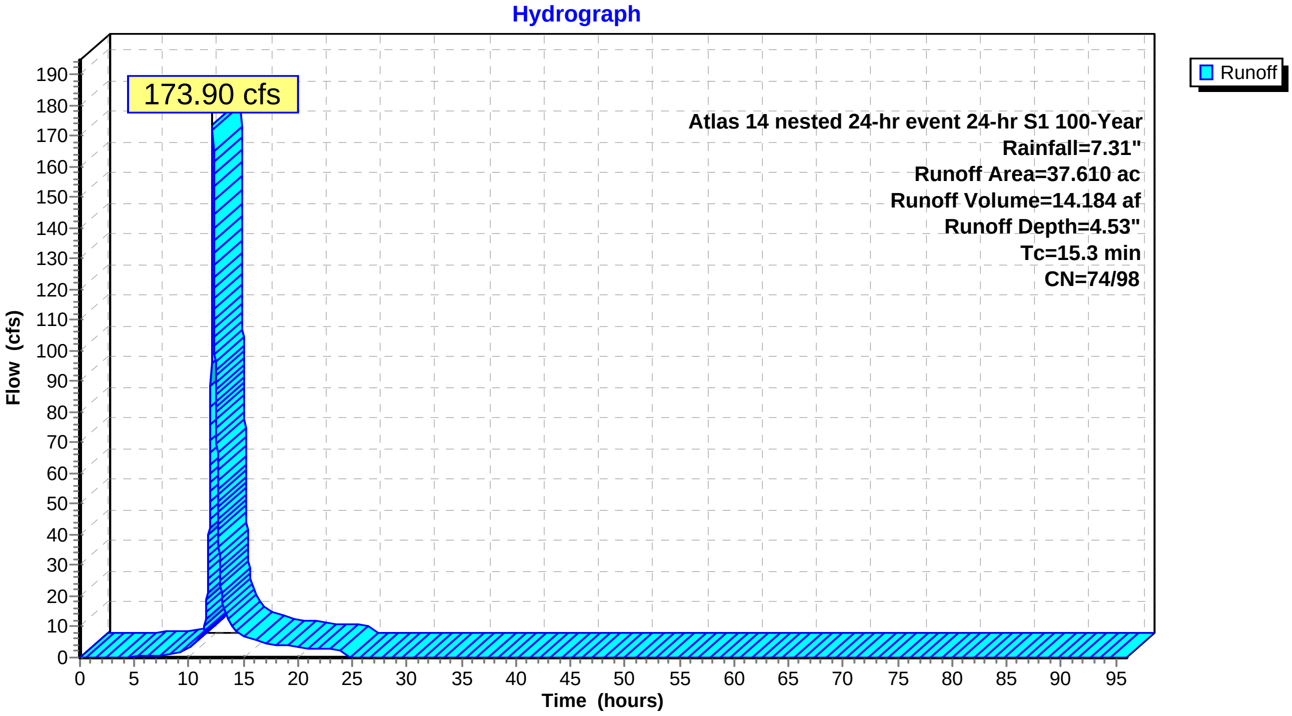
Runoff = 173.90 cfs @ 12.16 hrs, Volume= 14.184 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	34.720	74	Pervious
*	2.890	98	Impervious
	37.610	76	Weighted Average
	34.720		92.32% Pervious Area
	2.890		7.68% Impervious Area

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

Subcatchment SB 3: SB 3



Summary for Subcatchment SB 4: SB 4

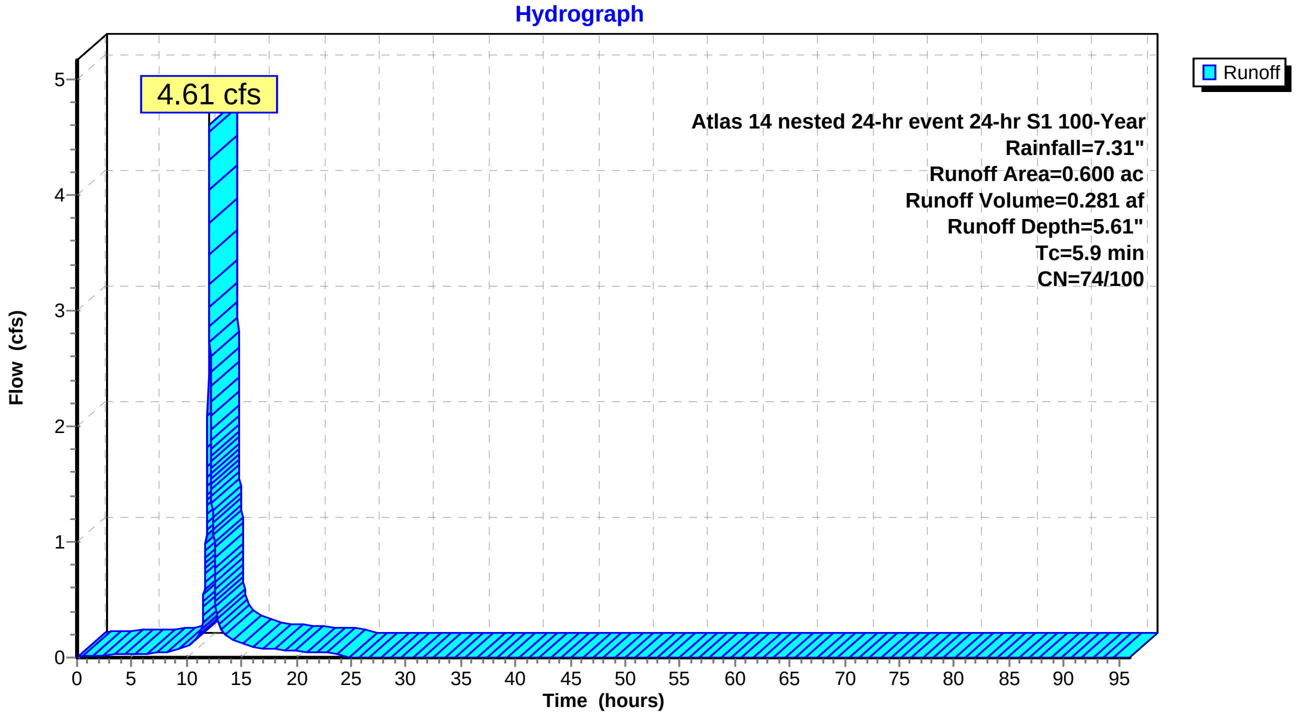
Runoff = 4.61 cfs @ 12.04 hrs, Volume= 0.281 af, Depth= 5.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.340	74	pervious
*	0.260	100	impervious
	0.600	85	Weighted Average
	0.340		56.67% Pervious Area
	0.260		43.33% Impervious Area

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

Subcatchment SB 4: SB 4



Summary for Subcatchment SB 5: SB 5

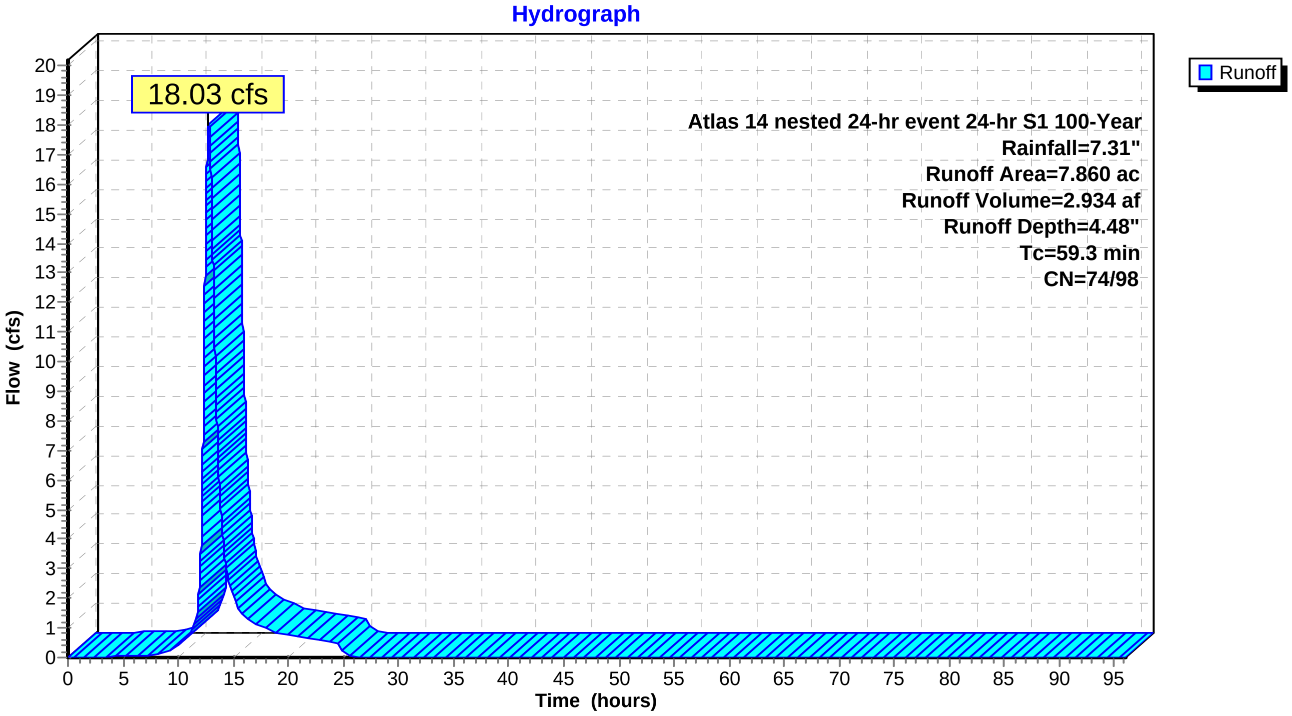
Runoff = 18.03 cfs @ 12.78 hrs, Volume= 2.934 af, Depth= 4.48"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	7.390	74	pervious
*	0.470	98	impervious
	7.860	75	Weighted Average
	7.390		94.02% Pervious Area
	0.470		5.98% Impervious Area

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

Subcatchment SB 5: SB 5



Summary for Subcatchment SB 6: SB 6

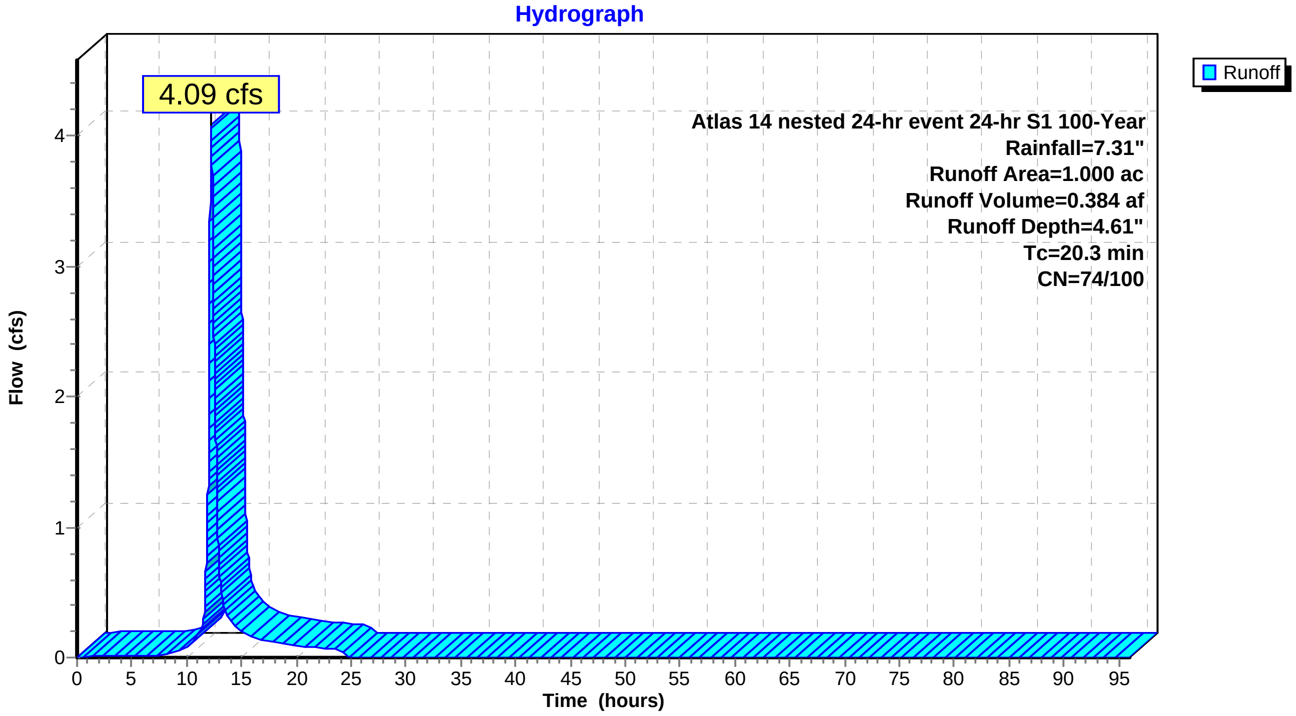
Runoff = 4.09 cfs @ 12.24 hrs, Volume= 0.384 af, Depth= 4.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.900	74	pervious
*	0.100	100	impervious
	1.000	77	Weighted Average
	0.900		90.00% Pervious Area
	0.100		10.00% Impervious Area

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

Subcatchment SB 6: SB 6



Summary for Subcatchment SB 7: SB 7

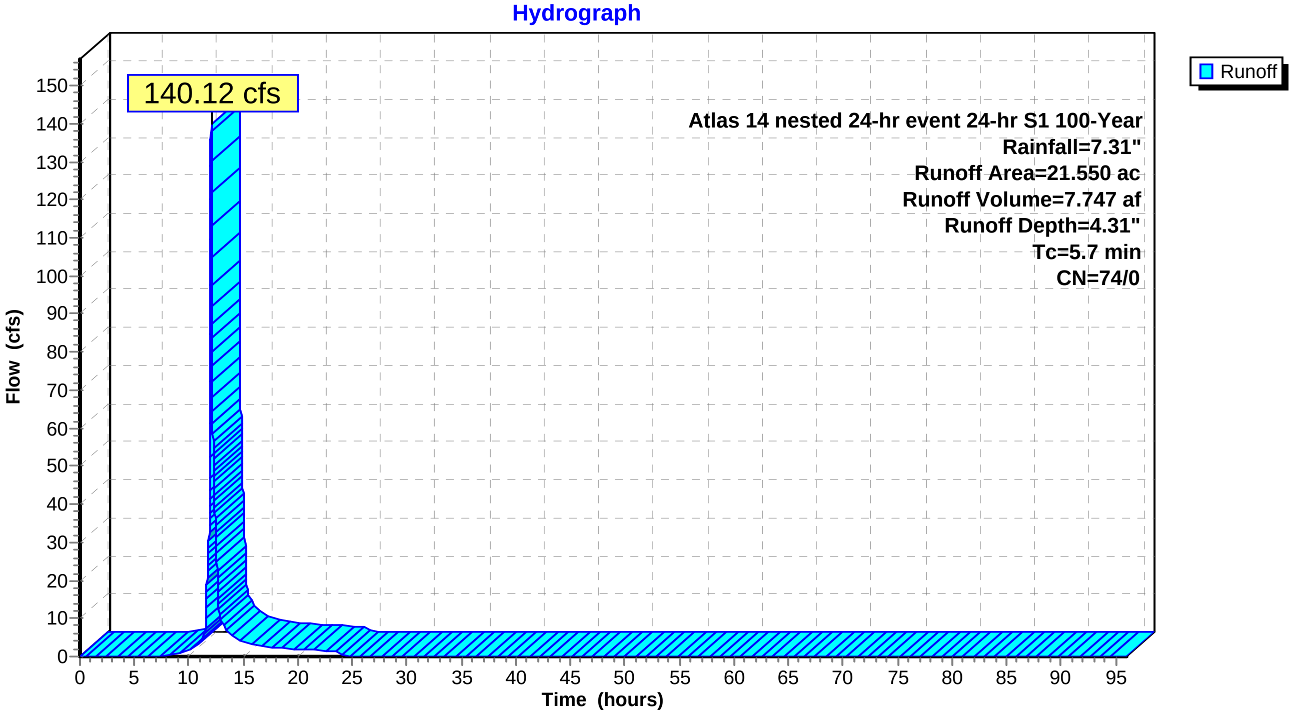
Runoff = 140.12 cfs @ 12.04 hrs, Volume= 7.747 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	21.550	74	pervious
*	0.000	98	impervious
	21.550	74	Weighted Average
	21.550		100.00% Pervious Area

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

Subcatchment SB 7: SB 7



Summary for Subcatchment SB 8: SB 8

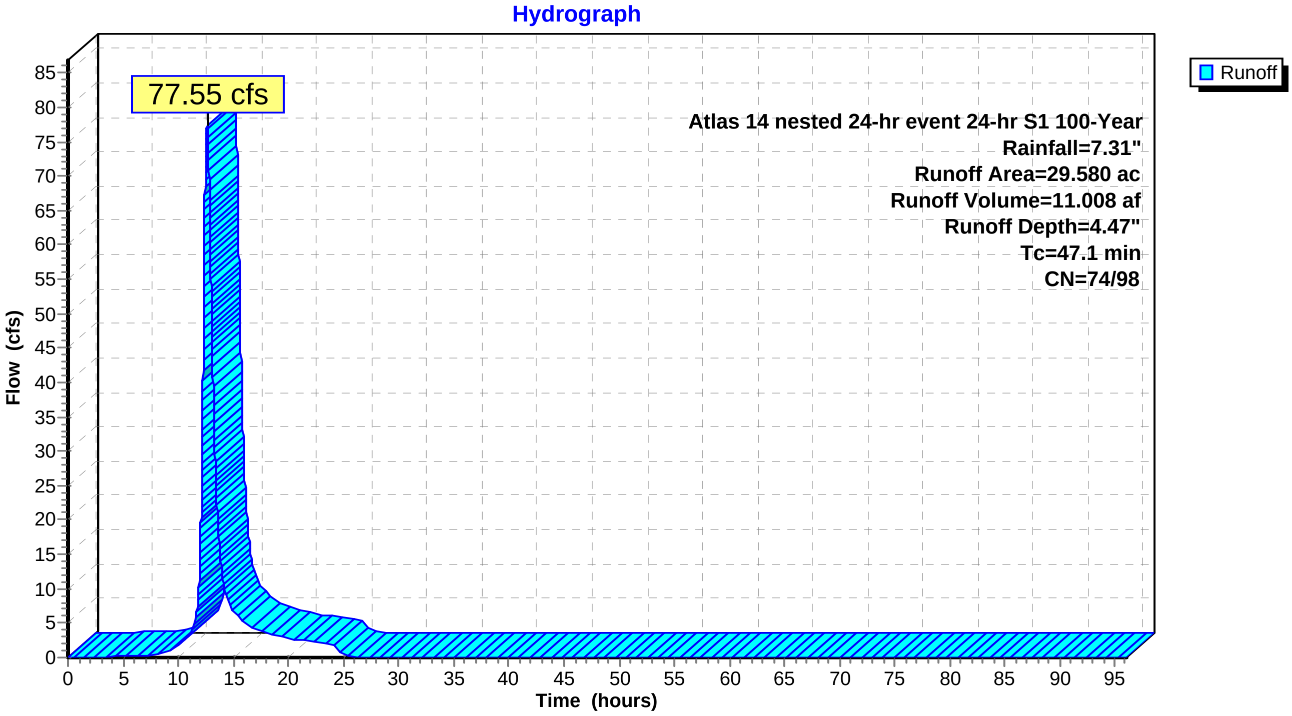
Runoff = 77.55 cfs @ 12.61 hrs, Volume= 11.008 af, Depth= 4.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	27.950	74	pervious
*	1.630	98	impervious
	29.580	75	Weighted Average
	27.950		94.49% Pervious Area
	1.630		5.51% Impervious Area

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

Subcatchment SB 8: SB 8



Summary for Subcatchment SB 9: SB 9

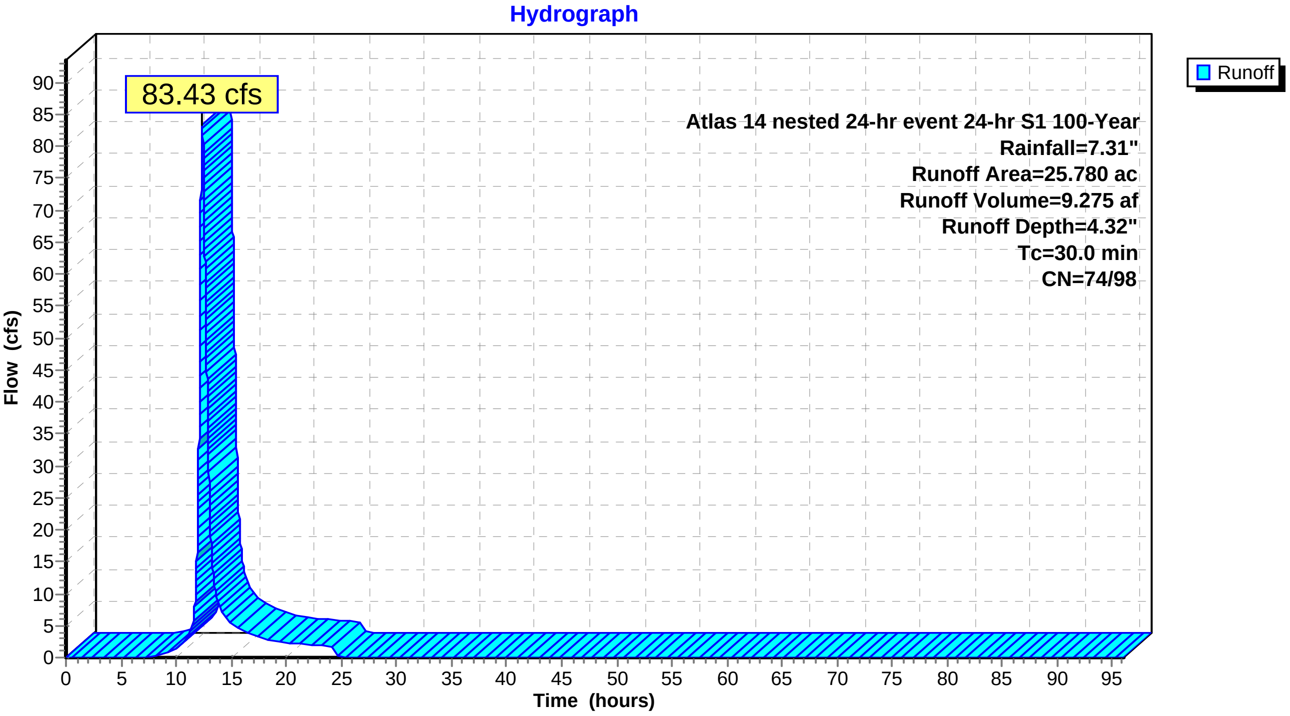
Runoff = 83.43 cfs @ 12.37 hrs, Volume= 9.275 af, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	25.750	74	permiable
*	0.030	98	impermiable
	25.780	74	Weighted Average
	25.750		99.88% Pervious Area
	0.030		0.12% Impervious Area

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

Subcatchment SB 9: SB 9



Summary for Subcatchment SB10: SB 10

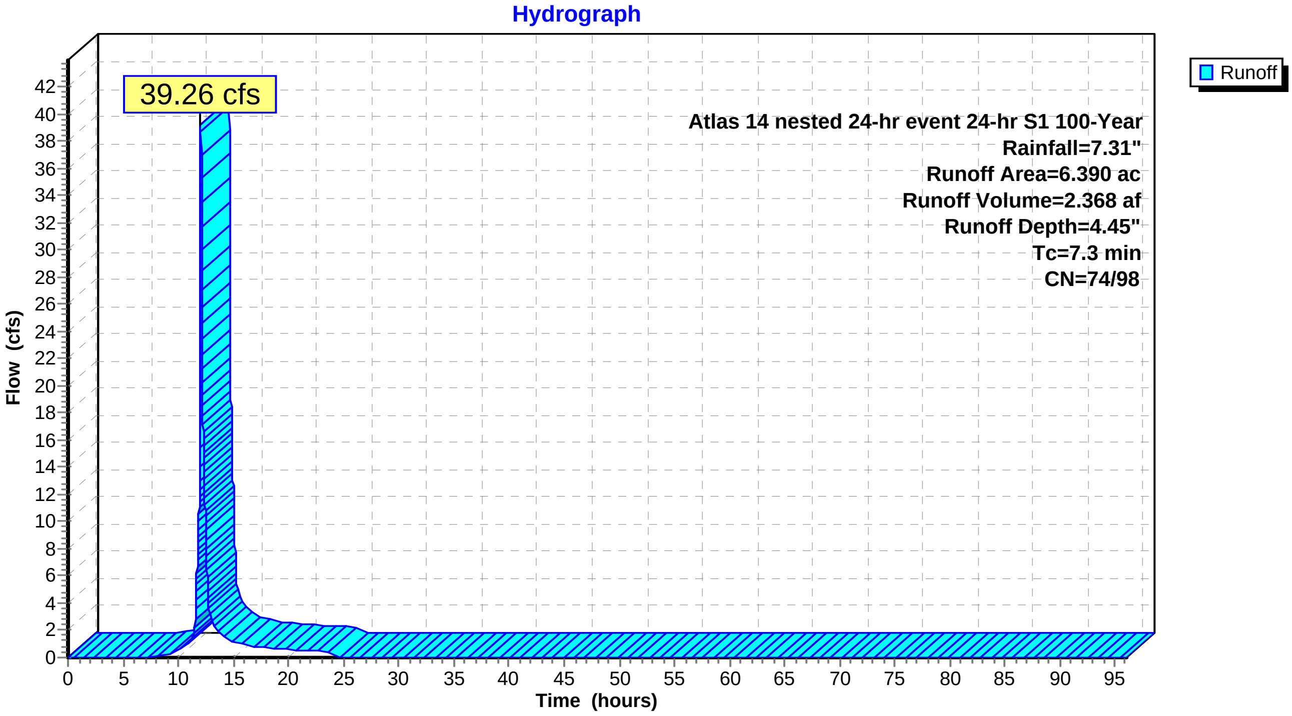
Runoff = 39.26 cfs @ 12.05 hrs, Volume= 2.368 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	6.080	74	pervious
*	0.310	98	impervious
	6.390	75	Weighted Average
	6.080		95.15% Pervious Area
	0.310		4.85% Impervious Area

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

Subcatchment SB10: SB 10



Summary for Pond 2 P: P-2

```
Inflow Area =        68.260 ac,    7.26% Impervious,  Inflow Depth =   4.51"    for  100-Year event
Inflow       =      146.98 cfs @   12.57 hrs,  Volume=          25.678 af
Outflow      =      146.30 cfs @   12.62 hrs,  Volume=          25.678 af,  Atten= 0%,  Lag= 2.6 min
Primary      =      146.30 cfs @   12.62 hrs,  Volume=          25.678 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 924.00'   Surf.Area= 0.370 ac   Storage= 0.730 af
Peak Elev= 925.48' @ 12.62 hrs   Surf.Area= 0.466 ac   Storage= 1.347 af   (0.617 af above start)

Plug-Flow detention time= 38.1 min calculated for 24.948 af (97% of inflow)
Center-of-Mass det. time= 11.7 min ( 855.2 - 843.5 )

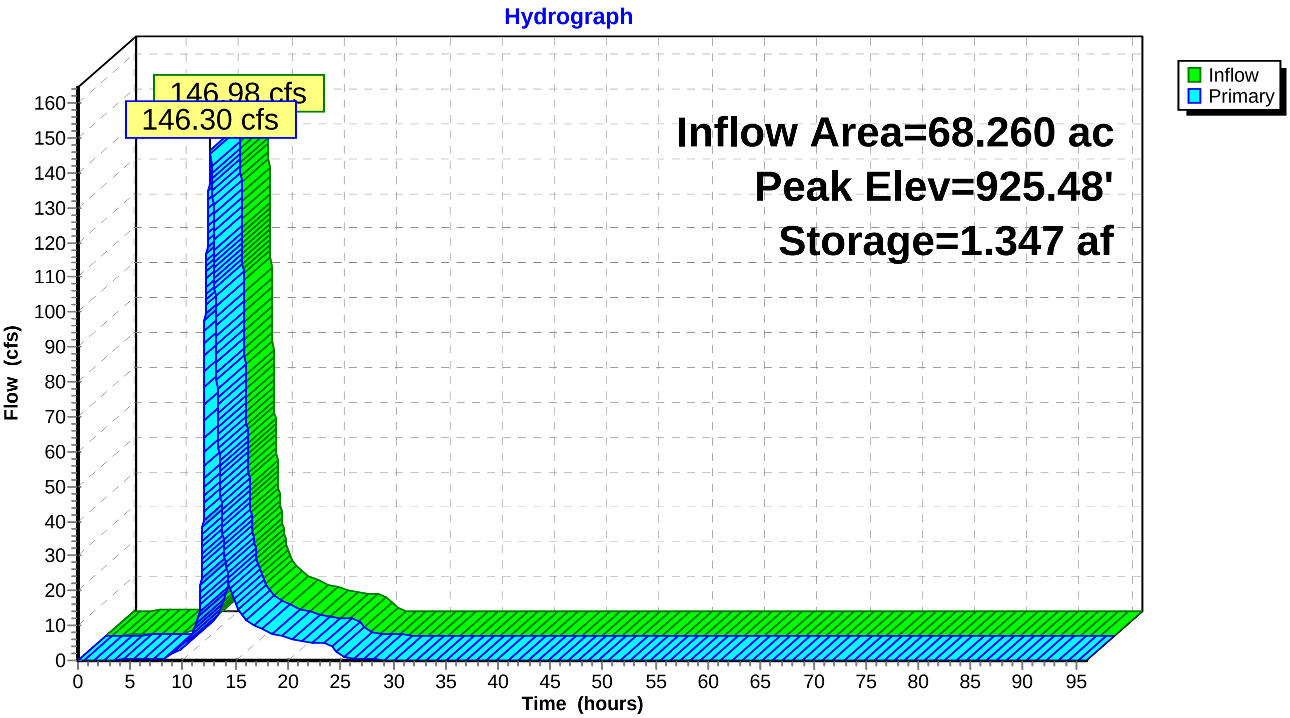
Volume         Invert    Avail.Storage    Storage Description
-------------------------------------------------------------------------------------------
   #1         920.00'         1.600 af    Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation       Surf.Area          Inc.Store          Cum.Store
    (feet)         (acres)        (acre-feet)        (acre-feet)
-----------------------------------------------------------------
    920.00           0.100              0.000              0.000
    922.00           0.130              0.230              0.230
    924.00           0.370              0.500              0.730
    926.00           0.500              0.870              1.600

Device    Routing            Invert    Outlet Devices
-------------------------------------------------------------------------------------------
   #1     Primary           924.40'    40.0' long Sharp-Crested Rectangular Weir  2 End Contraction(s)
   #2     Primary           924.00'    6.0" Horiz. Orifice/Grate   C= 0.600
                                       Limited to weir flow at low heads

Primary OutFlow  Max=146.30 cfs @ 12.62 hrs  HW=925.48'  TW=0.00'   (Dynamic Tailwater)
├─1=Sharp-Crested Rectangular Weir (Weir Controls 145.15 cfs @ 3.39 fps)
└─2=Orifice/Grate  (Orifice Controls 1.15 cfs @ 5.85 fps)
```

Pond 2 P: P-2


Hydrograph
146.98 cfs
146.30 cfs
Inflow Area=68.260 ac
Peak Elev=925.48'
Storage=1.347 af
Inflow
Primary
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 4P: P-4

Inflow Area = 7.860 ac, 5.98% Impervious, Inflow Depth = 4.48" for 100-Year event
Inflow = 18.03 cfs @ 12.78 hrs, Volume= 2.934 af
Outflow = 11.60 cfs @ 13.25 hrs, Volume= 2.934 af, Atten= 36%, Lag= 28.5 min
Primary = 8.50 cfs @ 13.26 hrs, Volume= 1.519 af
Secondary = 3.10 cfs @ 13.22 hrs, Volume= 1.415 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.275 ac Storage= 0.646 af
Peak Elev= 917.34' @ 13.26 hrs Surf.Area= 0.410 ac Storage= 1.444 af (0.798 af above start)

Plug-Flow detention time= 192.9 min calculated for 2.288 af (78% of inflow)
Center-of-Mass det. time= 57.0 min (917.8 - 860.7)

Volume	Invert	Avail.Storage	Storage Description
#1	910.90'	1.728 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

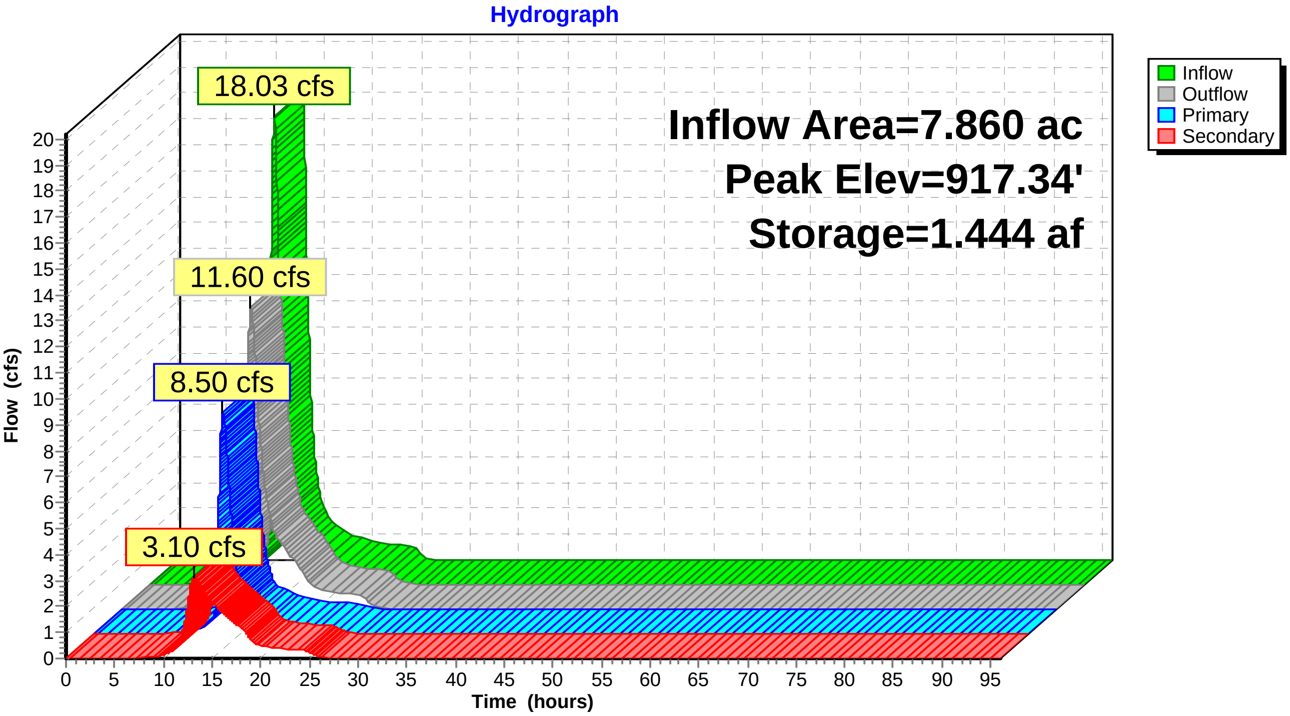
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.90	0.070	0.000	0.000
912.00	0.090	0.088	0.088
914.00	0.220	0.310	0.398
916.00	0.330	0.550	0.948
918.00	0.450	0.780	1.728

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	915.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	915.95'	**24.0" Round RCP_Round 24"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 915.80' / 915.95' S= -0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=8.50 cfs @ 13.26 hrs HW=917.34' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 1.45 cfs @ 7.36 fps)
└─**3=RCP_Round 24"** (Barrel Controls 7.06 cfs @ 3.76 fps)

Secondary OutFlow Max=3.10 cfs @ 13.22 hrs HW=917.34' TW=915.22' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 3.10 cfs @ 7.01 fps)

Pond 4P: P-4


Hydrograph
18.03 cfs
11.60 cfs
8.50 cfs
3.10 cfs
Inflow Area=7.860 ac
Peak Elev=917.34'
Storage=1.444 af
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

Summary for Pond 7P: P-7

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 29.580 ac, 5.51% Impervious, Inflow Depth = 4.47" for 100-Year event
Inflow = 77.55 cfs @ 12.61 hrs, Volume= 11.008 af
Outflow = 78.63 cfs @ 12.65 hrs, Volume= 11.008 af, Atten= 0%, Lag= 2.1 min
Primary = 78.63 cfs @ 12.65 hrs, Volume= 11.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.440 ac Storage= 1.062 af
Peak Elev= 915.86' @ 12.56 hrs Surf.Area= 0.543 ac Storage= 1.484 af (0.422 af above start)

Plug-Flow detention time= 77.7 min calculated for 9.945 af (90% of inflow)
Center-of-Mass det. time= 7.1 min (857.2 - 850.1)

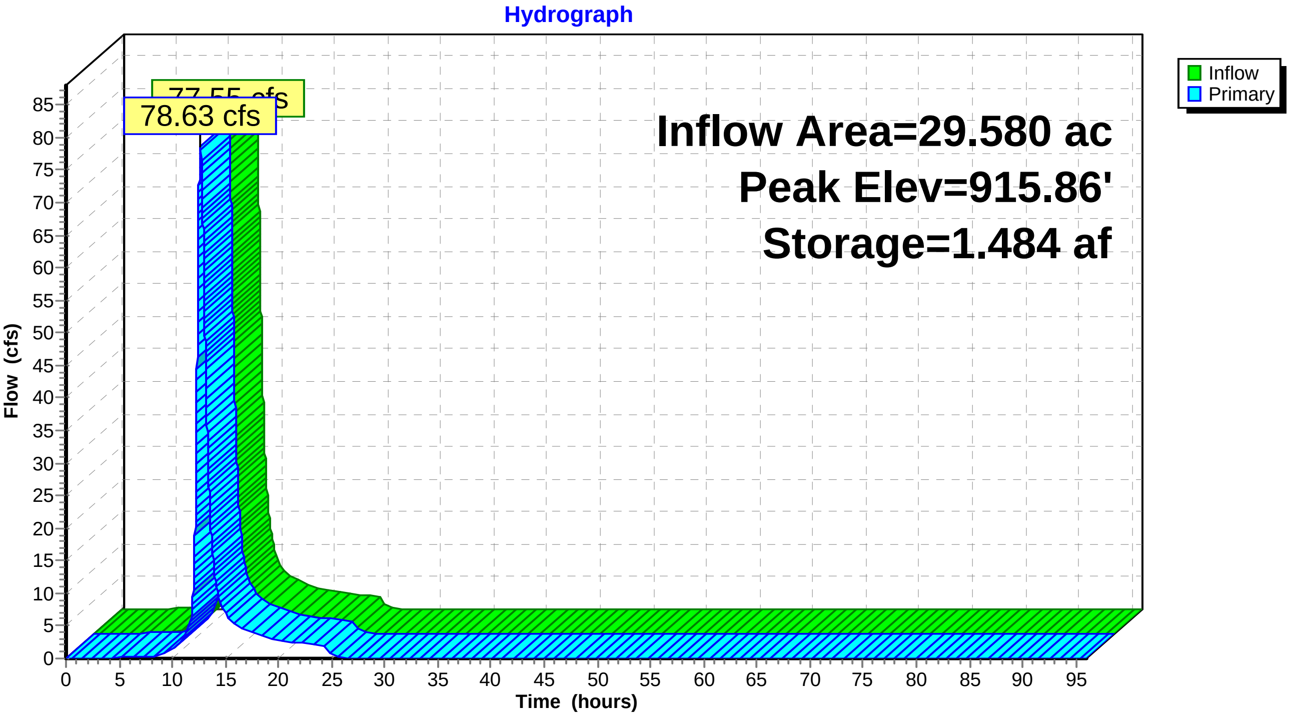
Volume	Invert	Avail.Storage	Storage Description
#1	910.95'	1.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.95	0.110	0.000	0.000
912.00	0.180	0.152	0.152
914.00	0.340	0.520	0.672
915.00	0.440	0.390	1.062
916.00	0.560	0.500	1.562

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**75.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=79.64 cfs @ 12.65 hrs HW=915.85' TW=915.75' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 79.64 cfs @ 1.25 fps)

Pond 7P: P-7


Hydrograph
77.55 cfs
78.63 cfs
Inflow Area=29.580 ac
Peak Elev=915.86'
Storage=1.484 af
Inflow
Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 8P: P-8

Inflow Area = 6.390 ac, 4.85% Impervious, Inflow Depth = 4.45" for 100-Year event
Inflow = 39.26 cfs @ 12.05 hrs, Volume= 2.368 af
Outflow = 10.88 cfs @ 12.31 hrs, Volume= 2.363 af, Atten= 72%, Lag= 15.5 min
Primary = 10.88 cfs @ 12.31 hrs, Volume= 2.363 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 897.00' Surf.Area= 0.300 ac Storage= 0.495 af
Peak Elev= 899.07' @ 12.55 hrs Surf.Area= 0.493 ac Storage= 1.375 af (0.880 af above start)

Plug-Flow detention time= 268.6 min calculated for 1.868 af (79% of inflow)
Center-of-Mass det. time= 127.9 min (941.9 - 813.9)

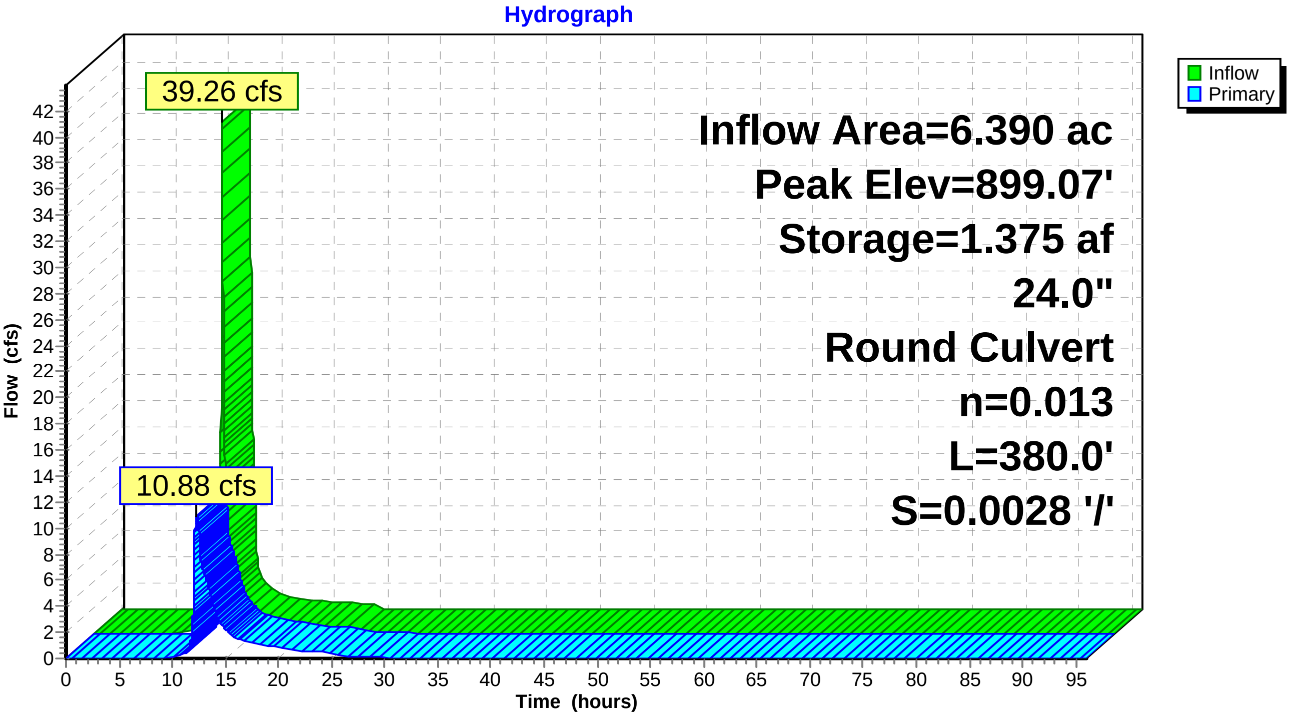
Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	1.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
893.00	0.030	0.000	0.000
894.00	0.070	0.050	0.050
896.00	0.150	0.220	0.270
897.00	0.300	0.225	0.495
898.00	0.450	0.375	0.870
900.00	0.530	0.980	1.850

Device	Routing	Invert	Outlet Devices
#1	Primary	897.00'	**24.0" Round RCP_Round 24"** L= 380.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 897.00' / 895.94' S= 0.0028 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=10.83 cfs @ 12.31 hrs HW=899.04' TW=897.70' (Dynamic Tailwater)
↑—**1=RCP_Round 24"** (Outlet Controls 10.83 cfs @ 4.20 fps)

Pond 8P: P-8


Hydrograph
39.26 cfs
10.88 cfs
Inflow
Primary
Inflow Area=6.390 ac
Peak Elev=899.07'
Storage=1.375 af
24.0"
Round Culvert
n=0.013
L=380.0'
S=0.0028 '/'
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 9P: P-9

```
Inflow Area =        55.360 ac,    3.00% Impervious,  Inflow Depth =   4.40"    for  100-Year event
Inflow      =      146.92 cfs @   12.50 hrs,  Volume=          20.283 af
Outflow     =      146.74 cfs @   12.51 hrs,  Volume=          20.283 af,  Atten= 0%,  Lag= 0.7 min
Primary     =      146.74 cfs @   12.51 hrs,  Volume=          20.283 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.210 ac Storage= 0.353 af
Peak Elev= 915.78' @ 12.51 hrs Surf.Area= 0.365 ac Storage= 0.576 af (0.223 af above start)

Plug-Flow detention time= 18.2 min calculated for 19.928 af (98% of inflow)
Center-of-Mass det. time= 1.8 min (851.5 - 849.7)

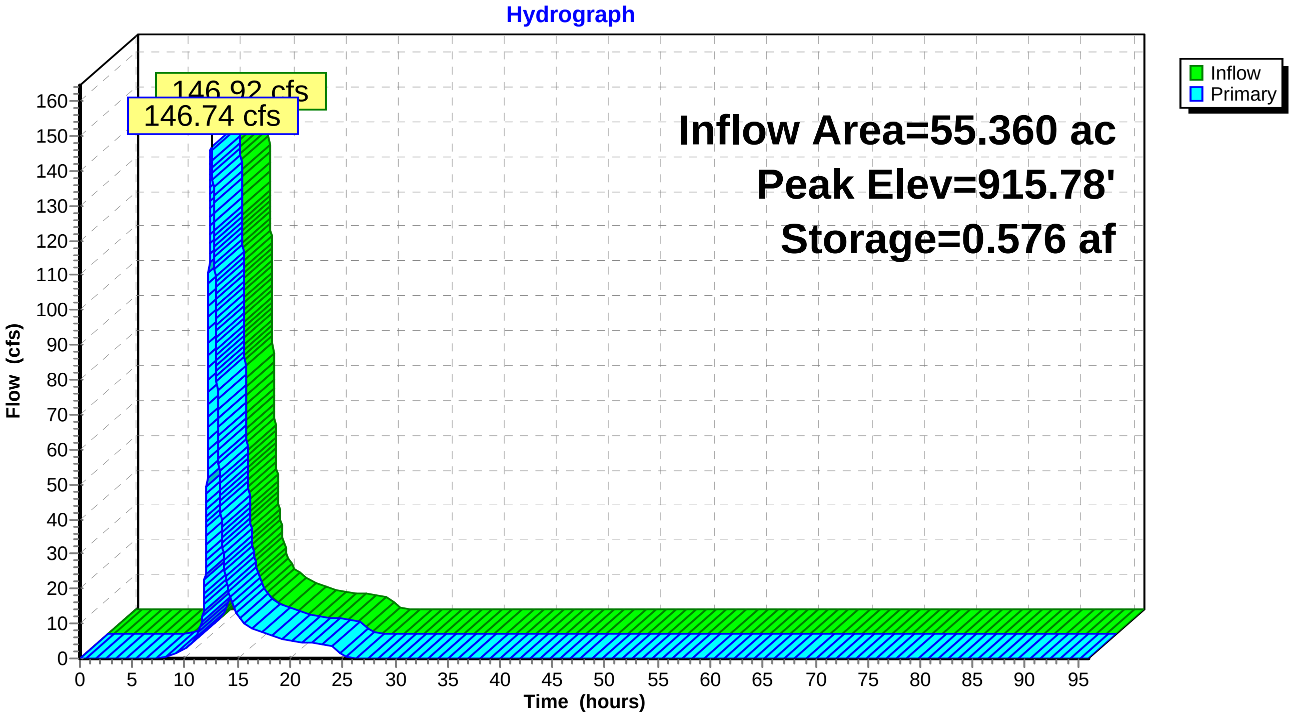
Volume	Invert	Avail.Storage	Storage Description
#1	910.50'	1.673 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.50	0.020	0.000	0.000
912.00	0.050	0.052	0.052
913.00	0.070	0.060	0.112
914.00	0.100	0.085	0.198
915.00	0.210	0.155	0.353
916.00	0.410	0.310	0.662
918.00	0.600	1.010	1.673

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**80.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=146.74 cfs @ 12.51 hrs HW=915.78' TW=912.45' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 146.74 cfs @ 2.36 fps)

Pond 9P: P-9


Hydrograph
146.92 cfs
146.74 cfs
Inflow Area=55.360 ac
Peak Elev=915.78'
Storage=0.576 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 10P: P-10 Lowered 1 ft

```
[95] Warning: Outlet Device #1 rise exceeded

Inflow Area =      66.430 ac,   5.22% Impervious,  Inflow Depth =   3.83"    for  100-Year event
Inflow      =     139.63 cfs @   12.70 hrs,  Volume=         21.209 af
Outflow     =     139.22 cfs @   12.72 hrs,  Volume=         21.208 af,  Atten= 0%,  Lag= 1.5 min
Primary     =      15.29 cfs @   12.72 hrs,  Volume=         10.343 af
Secondary =       123.93 cfs @   12.72 hrs,  Volume=         10.865 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 896.00'   Surf.Area= 0.290 ac   Storage= 0.700 af
Peak Elev= 898.35' @ 12.72 hrs   Surf.Area= 0.391 ac   Storage= 1.496 af   (0.796 af above start)

Plug-Flow detention time= 55.6 min calculated for 20.506 af (97% of inflow)
Center-of-Mass det. time= 17.3 min ( 930.7 - 913.4 )

Volume        Invert    Avail.Storage   Storage Description
   #1        892.00'         1.760 af   Custom Stage Data (Prismatic)Listed below (Recalc)

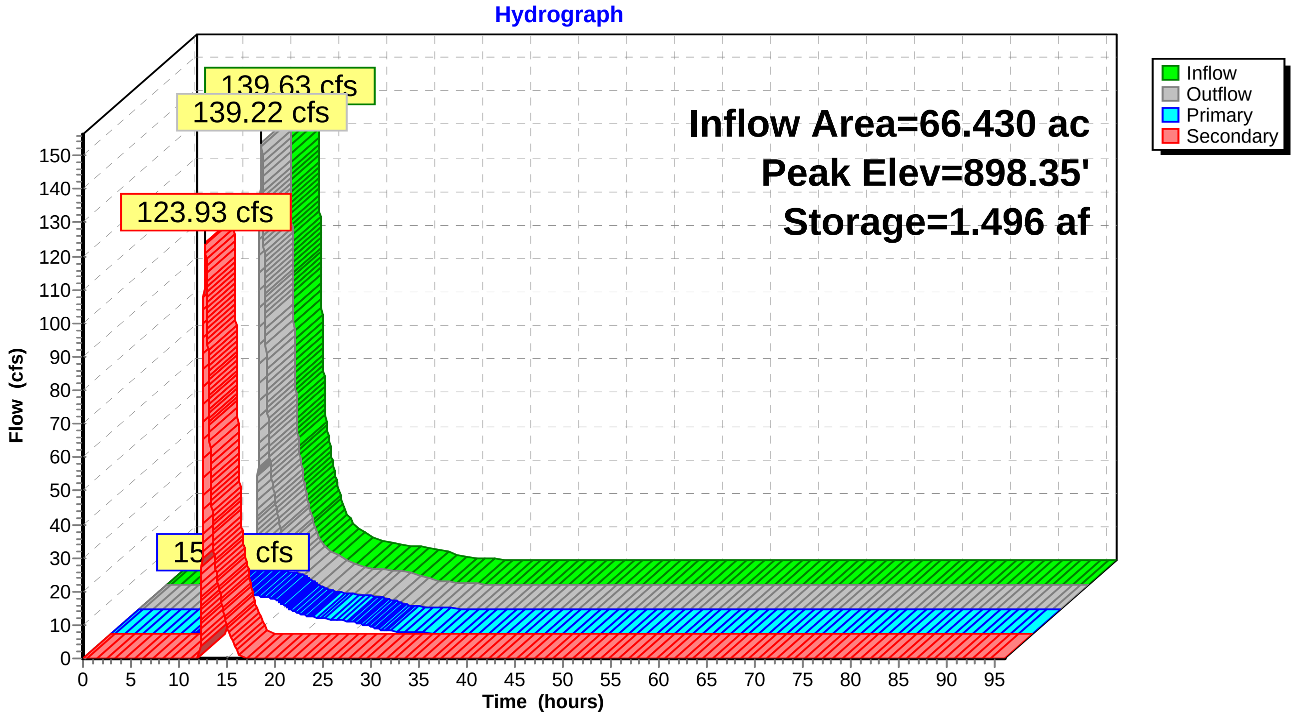
 Elevation      Surf.Area          Inc.Store        Cum.Store
    (feet)        (acres)        (acre-feet)      (acre-feet)
    892.00          0.120              0.000            0.000
    893.00          0.140              0.130            0.130
    895.00          0.190              0.330            0.460
    896.00          0.290              0.240            0.700
    897.00          0.330              0.310            1.010
    899.00          0.420              0.750            1.760

Device   Routing          Invert    Outlet Devices
    #1   Primary         896.00'    2.5' long x 1.00' rise Sharp-Crested Rectangular Weir
                                    2 End Contraction(s)
    #2   Secondary       897.40'    50.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                                    Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                                    2.50  3.00  3.50  4.00  4.50  5.00  5.50
                                    Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                                    2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88

Primary OutFlow  Max=15.29 cfs @ 12.72 hrs  HW=898.35'  TW=895.15'   (Dynamic Tailwater)
└─1=Sharp-Crested Rectangular Weir (Orifice Controls 15.29 cfs @ 6.65 fps)

Secondary OutFlow  Max=123.91 cfs @ 12.72 hrs  HW=898.35'  TW=895.15'   (Dynamic Tailwater)
└─2=Broad-Crested Rectangular Weir (Weir Controls 123.91 cfs @ 2.61 fps)
```

Pond 10P: P-10 Lowered 1 ft



Summary for Pond 11P: P-11

Inflow Area = 58.650 ac, 4.89% Impervious, Inflow Depth = 4.45" for 100-Year event
Inflow = 153.04 cfs @ 12.50 hrs, Volume= 21.768 af
Outflow = 135.90 cfs @ 12.71 hrs, Volume= 21.766 af, Atten= 11%, Lag= 12.3 min
Primary = 130.96 cfs @ 12.71 hrs, Volume= 18.280 af
Secondary = 4.94 cfs @ 12.67 hrs, Volume= 3.486 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 909.00' Surf.Area= 1.210 ac Storage= 3.640 af
Peak Elev= 912.68' @ 12.71 hrs Surf.Area= 1.641 ac Storage= 8.867 af (5.227 af above start)

Plug-Flow detention time= 203.7 min calculated for 18.124 af (83% of inflow)
Center-of-Mass det. time= 89.2 min (935.6 - 846.4)

Volume	Invert	Avail.Storage	Storage Description
#1	905.00'	9.405 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

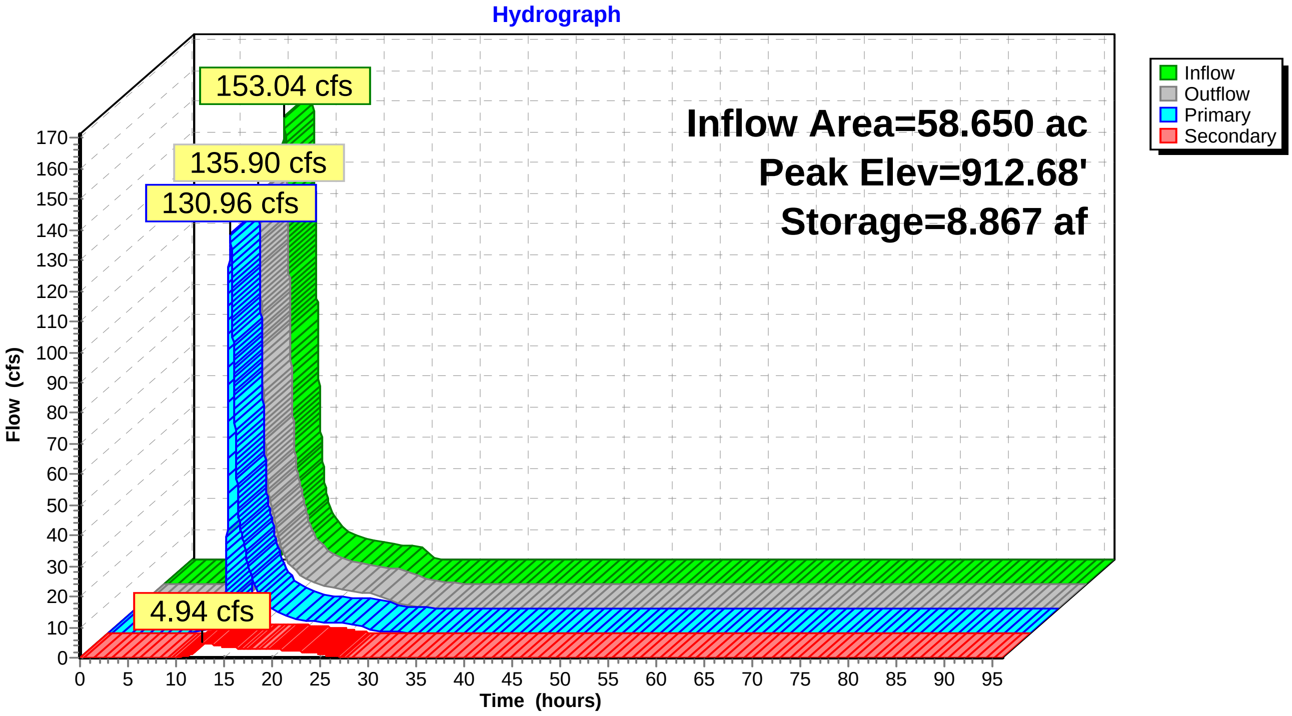
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
905.00	0.760	0.000	0.000
906.00	0.820	0.790	0.790
908.00	0.950	1.770	2.560
909.00	1.210	1.080	3.640
910.00	1.320	1.265	4.905
912.00	1.560	2.880	7.785
913.00	1.680	1.620	9.405

Device	Routing	Invert	Outlet Devices
#1	Primary	909.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#4	Primary	912.00'	**60.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#5	Secondary	909.00'	**12.0" Round RCP_Round 12"** L= 150.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 909.00' / 908.00' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=130.95 cfs @ 12.71 hrs HW=912.68' TW=898.35' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 7.25 cfs @ 9.23 fps)
- **2=RCP_Round 24"** (Barrel Controls 16.98 cfs @ 5.41 fps)
- **3=RCP_Round 24"** (Barrel Controls 16.98 cfs @ 5.41 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 89.73 cfs @ 2.21 fps)

Secondary OutFlow Max=4.94 cfs @ 12.67 hrs HW=912.67' TW=909.04' (Dynamic Tailwater)
- **5=RCP_Round 12"** (Outlet Controls 4.94 cfs @ 6.29 fps)

Pond 11P: P-11



Summary for Pond 12P: P-12

Inflow Area = 79.640 ac, 7.40% Impervious, Inflow Depth = 4.52" for 100-Year event
Inflow = 148.48 cfs @ 12.72 hrs, Volume= 29.994 af
Outflow = 116.29 cfs @ 13.01 hrs, Volume= 29.986 af, Atten= 22%, Lag= 17.3 min
Primary = 116.29 cfs @ 13.01 hrs, Volume= 29.986 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 893.00' Surf.Area= 1.640 ac Storage= 5.075 af
Peak Elev= 895.49' @ 13.01 hrs Surf.Area= 1.971 ac Storage= 9.562 af (4.487 af above start)

Plug-Flow detention time= 231.9 min calculated for 24.911 af (83% of inflow)
Center-of-Mass det. time= 62.7 min (1,021.9 - 959.1)

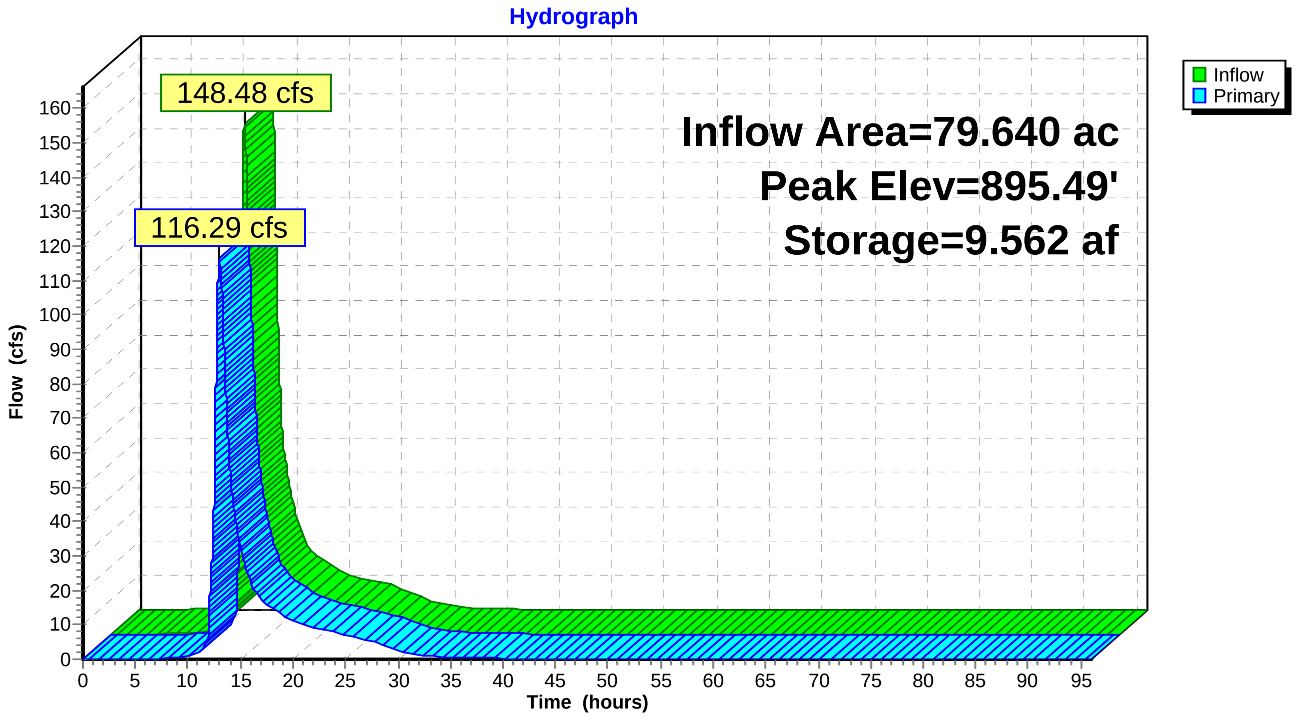
Volume	Invert	Avail.Storage	Storage Description
#1	889.00'	10.590 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
889.00	1.070	0.000	0.000
890.00	1.150	1.110	1.110
892.00	1.330	2.480	3.590
893.00	1.640	1.485	5.075
894.00	1.770	1.705	6.780
896.00	2.040	3.810	10.590

Device	Routing	Invert	Outlet Devices
#1	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#4	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#5	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#6	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf

Primary OutFlow Max=116.29 cfs @ 13.01 hrs HW=895.49' TW=884.60' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 5.96 cfs @ 7.59 fps)
- **2=Orifice/Grate** (Orifice Controls 5.96 cfs @ 7.59 fps)
- **3=RCP_Arch 44x27** (Barrel Controls 26.09 cfs @ 5.45 fps)
- **4=RCP_Arch 44x27** (Barrel Controls 26.09 cfs @ 5.45 fps)
- **5=RCP_Arch 44x27** (Barrel Controls 26.09 cfs @ 5.45 fps)
- **6=RCP_Arch 44x27** (Barrel Controls 26.09 cfs @ 5.45 fps)

Pond 12P: P-12



Summary for Pond 13P: P-13

Inflow Area = 237.775 ac, 9.20% Impervious, Inflow Depth = 4.57" for 100-Year event
Inflow = 524.41 cfs @ 12.35 hrs, Volume= 90.508 af
Outflow = 503.58 cfs @ 12.46 hrs, Volume= 90.505 af, Atten= 4%, Lag= 6.4 min
Primary = 485.21 cfs @ 12.46 hrs, Volume= 86.324 af
Secondary = 18.37 cfs @ 12.46 hrs, Volume= 4.181 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 883.00' Surf.Area= 1.870 ac Storage= 4.265 af
Peak Elev= 885.22' @ 12.46 hrs Surf.Area= 2.673 ac Storage= 9.306 af (5.041 af above start)

Plug-Flow detention time= 68.7 min calculated for 86.231 af (95% of inflow)
Center-of-Mass det. time= 12.6 min (903.8 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	11.490 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
878.00	0.000	0.000	0.000
879.00	0.630	0.315	0.315
880.00	0.730	0.680	0.995
882.00	1.070	1.800	2.795
883.00	1.870	1.470	4.265
884.00	2.220	2.045	6.310
886.00	2.960	5.180	11.490

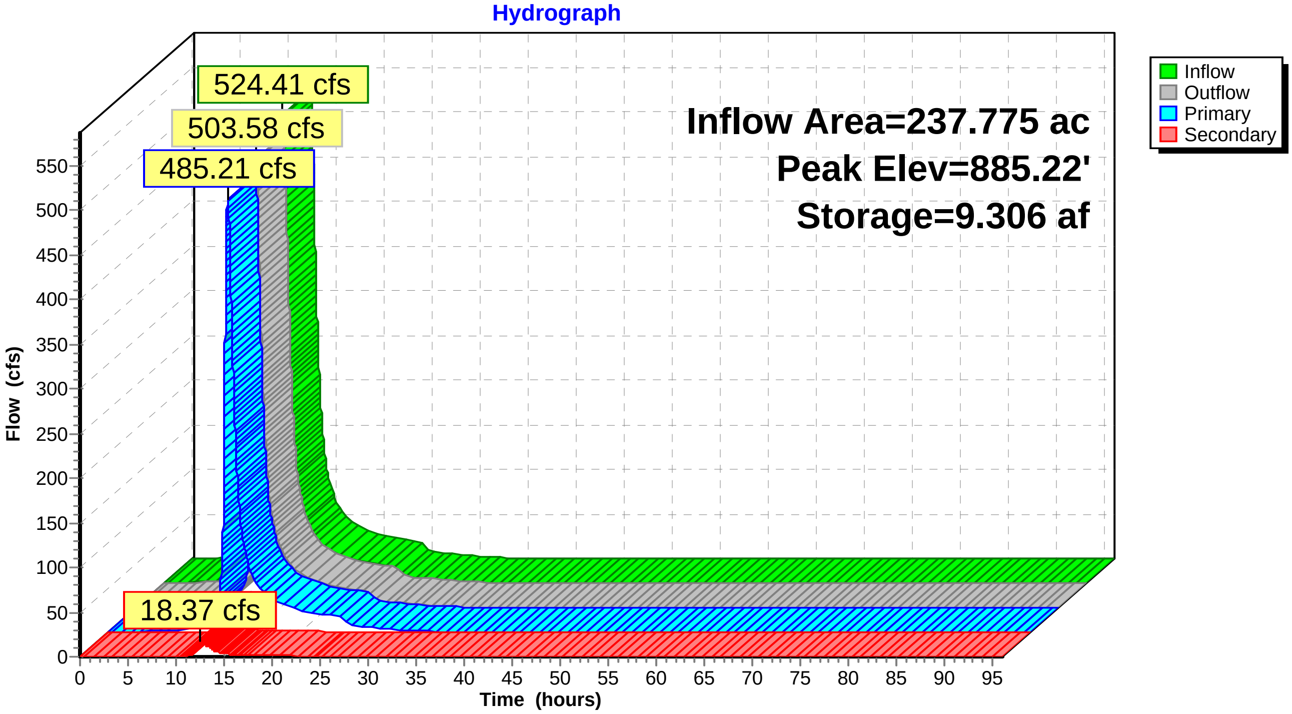
Device	Routing	Invert	Outlet Devices
#1	Primary	883.00'	**55.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#5	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#6	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200

Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=485.21 cfs @ 12.46 hrs HW=885.22' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 485.21 cfs @ 3.97 fps)

Secondary OutFlow Max=18.37 cfs @ 12.46 hrs HW=885.22' TW=883.24' (Dynamic Tailwater)
↑—**2=RCP_Round 12"** (Barrel Controls 3.67 cfs @ 4.68 fps)
—**3=RCP_Round 12"** (Barrel Controls 3.67 cfs @ 4.68 fps)
—**4=RCP_Round 12"** (Barrel Controls 3.67 cfs @ 4.68 fps)
—**5=RCP_Round 12"** (Barrel Controls 3.67 cfs @ 4.68 fps)
—**6=RCP_Round 12"** (Barrel Controls 3.67 cfs @ 4.68 fps)

Pond 13P: P-13



Summary for Pond 17P: W-2

[80] Warning: Exceeded Pond P-5/P-6 by 0.17' @ 36.12 hrs (0.20 cfs 0.727 af)

Inflow = 3.09 cfs @ 12.39 hrs, Volume= 1.318 af
Outflow = 1.02 cfs @ 16.83 hrs, Volume= 1.173 af, Atten= 67%, Lag= 266.4 min
Primary = 1.02 cfs @ 16.83 hrs, Volume= 1.173 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 929.56' @ 16.83 hrs Surf.Area= 1.185 ac Storage= 0.638 af

Plug-Flow detention time= 577.2 min calculated for 1.173 af (89% of inflow)
Center-of-Mass det. time= 523.1 min (1,453.9 - 930.9)

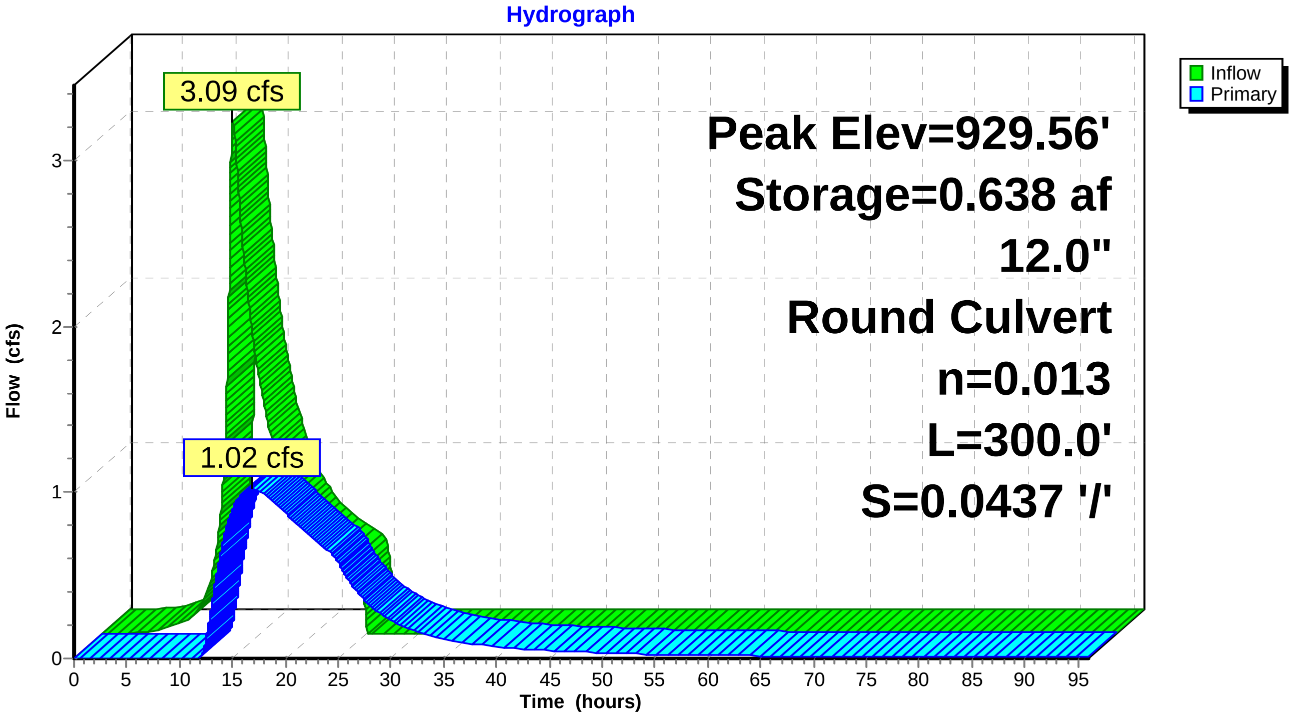
Volume	Invert	Avail.Storage	Storage Description
#1	929.00'	1.175 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
929.00	1.090	0.000	0.000
930.00	1.260	1.175	1.175

Device	Routing	Invert	Outlet Devices
#1	Primary	929.10'	**12.0" Round RCP_Round 12"** L= 300.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 929.10' / 916.00' S= 0.0437 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.02 cfs @ 16.83 hrs HW=929.56' TW=914.88' (Dynamic Tailwater)
↰**1=RCP_Round 12"** (Inlet Controls 1.02 cfs @ 2.89 fps)

Pond 17P: W-2


Hydrograph
3.09 cfs
1.02 cfs
Peak Elev=929.56'
Storage=0.638 af
12.0"
Round Culvert
n=0.013
L=300.0'
S=0.0437 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 36P: Culverts passing flow beneath Spine Road

Inflow Area = 52.790 ac, 0.00% Impervious, Inflow Depth = 4.31" for 100-Year event
Inflow = 161.15 cfs @ 12.43 hrs, Volume= 18.977 af
Outflow = 161.15 cfs @ 12.43 hrs, Volume= 18.977 af, Atten= 0%, Lag= 0.0 min
Primary = 127.00 cfs @ 12.25 hrs, Volume= 18.235 af
Secondary = 34.15 cfs @ 12.43 hrs, Volume= 0.742 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 888.46' @ 12.43 hrs Surf.Area= 0.004 ac Storage= 0.003 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (844.2 - 844.2)

Volume	Invert	Avail.Storage	Storage Description
#1	887.00'	0.026 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
887.00	0.000	0.000	0.000
887.50	0.002	0.001	0.001
890.50	0.007	0.014	0.014
892.00	0.009	0.012	0.026

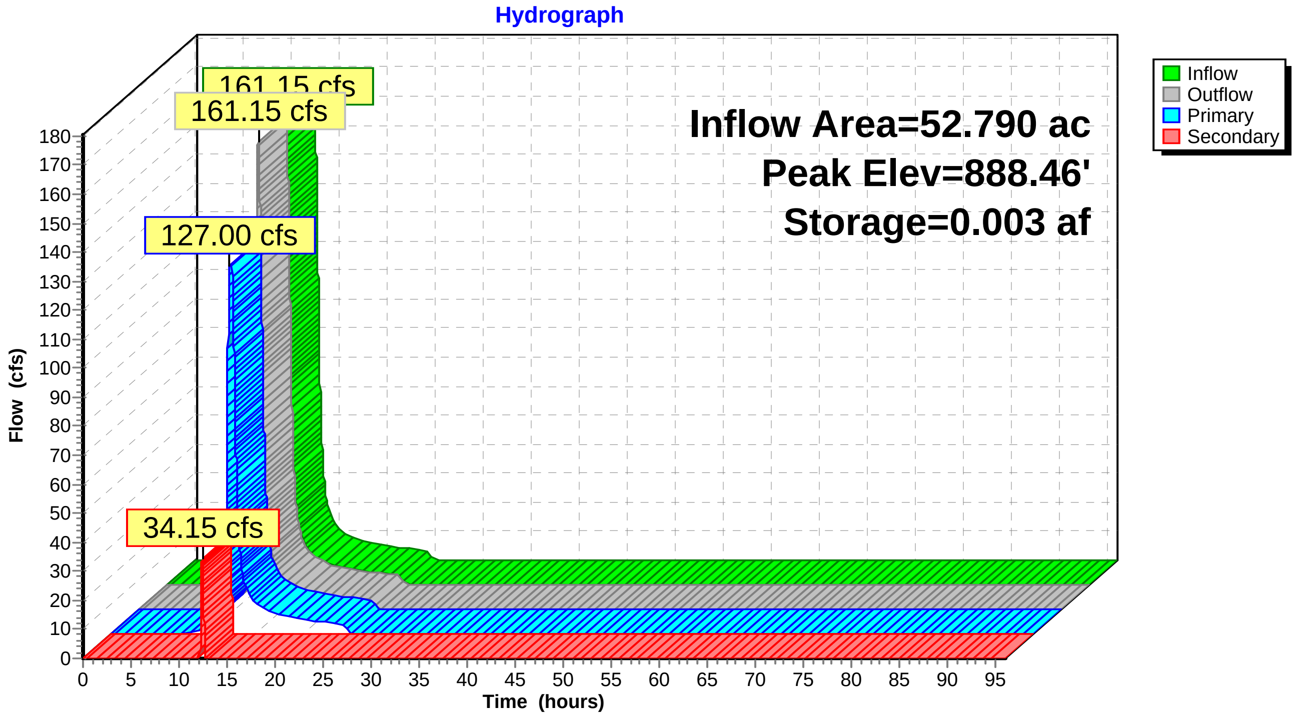
Device	Routing	Invert	Outlet Devices
#1	Primary	887.00'	**Special & User-Defined** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 5.00 Disch. (cfs) 0.000 25.000 50.000 75.000 100.000 127.000 127.000
#2	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#4	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#5	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#6	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#7	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900

			n= 0.013, Flow Area= 1.77 sf
#8	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#9	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=127.00 cfs @ 12.25 hrs HW=887.60' TW=884.93' (Dynamic Tailwater)
1=Special & User-Defined (Custom Controls 127.00 cfs)

Secondary OutFlow Max=34.12 cfs @ 12.43 hrs HW=888.46' TW=885.22' (Dynamic Tailwater)
2=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
3=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
4=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
5=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
6=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
7=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
8=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)
9=RCP_Round 18" (Barrel Controls 4.26 cfs @ 5.08 fps)

Pond 36P: Culverts passing flow beneath Spine Road



Summary for Pond CRH-1: CRH-1

```
Inflow Area =       6.955 ac,  46.76% Impervious,  Inflow Depth =   5.60"    for  100-Year event
Inflow      =      38.37 cfs @  12.15 hrs,  Volume=           3.247 af
Outflow     =      25.53 cfs @  12.31 hrs,  Volume=           3.247 af,  Atten= 33%,  Lag= 9.5 min
Discarded   =       0.37 cfs @  12.31 hrs,  Volume=           0.563 af
Primary     =      25.16 cfs @  12.31 hrs,  Volume=           2.685 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.81' @ 12.31 hrs   Surf.Area= 0.463 ac   Storage= 0.760 af

Plug-Flow detention time= 114.2 min calculated for 3.247 af (100% of inflow)
Center-of-Mass det. time= 114.3 min ( 895.5 - 781.2 )

Volume      Invert    Avail.Storage   Storage Description
   #1      876.00'         0.850 af   Custom Stage Data (Prismatic)Listed below (Recalc)

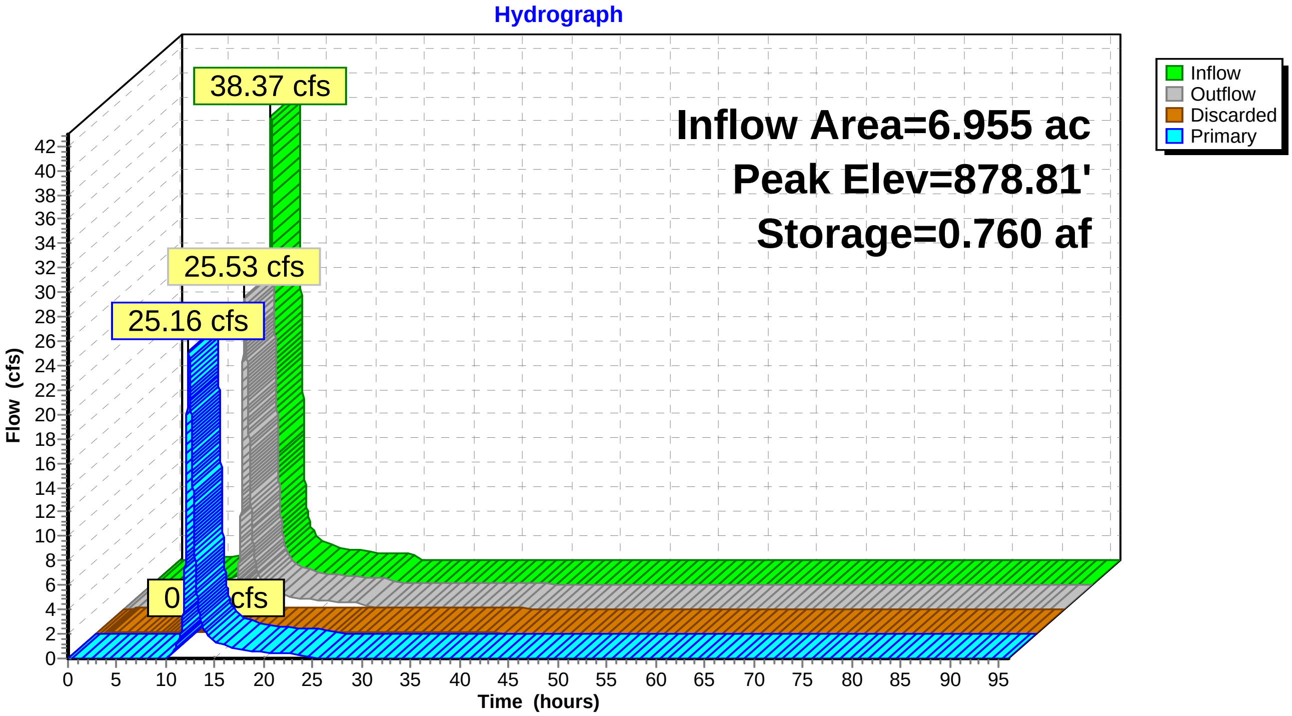
 Elevation     Surf.Area      Inc.Store      Cum.Store
    (feet)       (acres)    (acre-feet)    (acre-feet)
    876.00         0.150          0.000          0.000
    878.00         0.300          0.450          0.450
    879.00         0.500          0.400          0.850

Device  Routing        Invert   Outlet Devices
   #1   Discarded     876.00'   0.800 in/hr Exfiltration over Surface area
                                Conductivity to Groundwater Elevation = 0.00'
   #2   Primary       877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                n= 0.013,  Flow Area= 3.14 sf
   #3   Primary       877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                n= 0.013,  Flow Area= 3.14 sf

Discarded OutFlow  Max=0.37 cfs @ 12.31 hrs  HW=878.81'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.37 cfs)

Primary OutFlow  Max=25.15 cfs @ 12.31 hrs  HW=878.81'   (Free Discharge)
├─2=Culvert  (Barrel Controls 12.58 cfs @ 5.53 fps)
└─3=Culvert  (Barrel Controls 12.58 cfs @ 5.53 fps)
```

Pond CRH-1: CRH-1



Summary for Pond CRH-2: CRH-2

```
Inflow Area =        10.214 ac, 37.73% Impervious,  Inflow Depth =   5.35"    for  100-Year event
Inflow       =       48.13 cfs @   12.21 hrs,  Volume=            4.557 af
Outflow      =       27.85 cfs @   12.47 hrs,  Volume=            4.557 af,  Atten= 42%,  Lag= 15.7 min
Discarded  =          0.47 cfs @   12.47 hrs,  Volume=            0.986 af
Primary      =       27.38 cfs @   12.47 hrs,  Volume=            3.571 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 883.78' @ 12.47 hrs   Surf.Area= 0.578 ac   Storage= 1.468 af

Plug-Flow detention time= 190.2 min calculated for 4.557 af (100% of inflow)
Center-of-Mass det. time= 190.4 min ( 982.8 - 792.4 )

Volume          Invert    Avail.Storage    Storage Description
    #1          880.00'          1.600 af    Custom Stage Data (Prismatic)Listed below (Recalc)

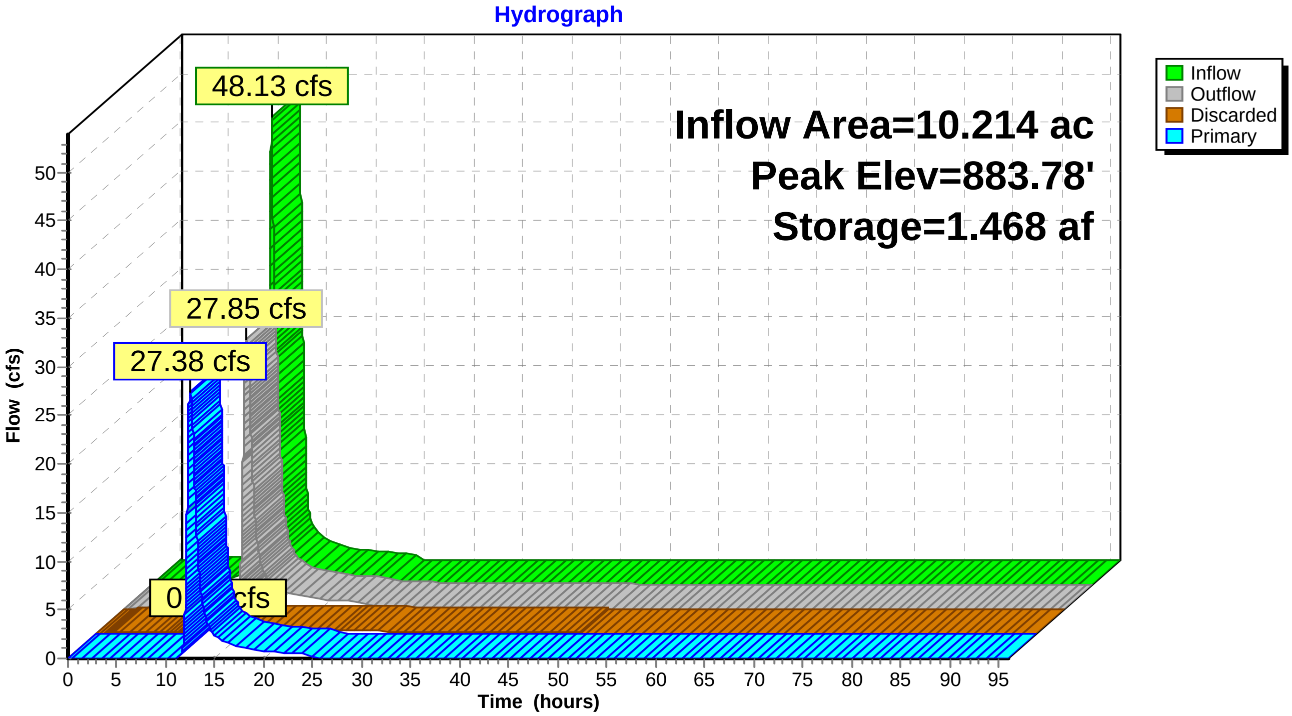
 Elevation      Surf.Area          Inc.Store          Cum.Store
       (feet)         (acres)        (acre-feet)        (acre-feet)
    880.00            0.200              0.000              0.000
    882.00            0.400              0.600              0.600
    884.00            0.600              1.000              1.600

Device   Routing             Invert   Outlet Devices
    #1     Primary            881.50'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                                 Inlet / Outlet Invert= 881.50' / 881.00'   S= 0.0032 '/'   Cc= 0.900
                                                 n= 0.013,  Flow Area= 3.14 sf
    #2     Primary            881.50'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                                 Inlet / Outlet Invert= 881.50' / 881.00'   S= 0.0032 '/'   Cc= 0.900
                                                 n= 0.013,  Flow Area= 3.14 sf
    #3     Discarded          880.00'   0.800 in/hr Exfiltration over Surface area
                                                 Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow  Max=0.47 cfs @ 12.47 hrs  HW=883.78'   (Free Discharge)
└─3=Exfiltration  ( Controls 0.47 cfs)

Primary OutFlow  Max=27.38 cfs @ 12.47 hrs  HW=883.78'  TW=879.69'   (Dynamic Tailwater)
├─1=Culvert  (Barrel Controls 13.69 cfs @ 4.79 fps)
└─2=Culvert  (Barrel Controls 13.69 cfs @ 4.79 fps)
```

Pond CRH-2: CRH-2



Summary for Pond CRH-3: CRH-3

```
Inflow Area =        11.815 ac,  36.95% Impervious,  Inflow Depth =   4.33"    for  100-Year event
Inflow      =       30.15 cfs @   12.44 hrs,  Volume=            4.265 af
Outflow     =       25.90 cfs @   12.71 hrs,  Volume=            4.265 af,  Atten= 14%,  Lag= 15.7 min
Discarded  =         0.38 cfs @   12.71 hrs,  Volume=            0.519 af
Primary     =       25.52 cfs @   12.71 hrs,  Volume=            3.745 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 879.83' @ 12.71 hrs   Surf.Area= 0.466 ac   Storage= 0.769 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 82.2 min ( 919.3 - 837.1 )

Volume          Invert    Avail.Storage    Storage Description
    #1          877.00'         0.850 af   Custom Stage Data (Prismatic)Listed below (Recalc)

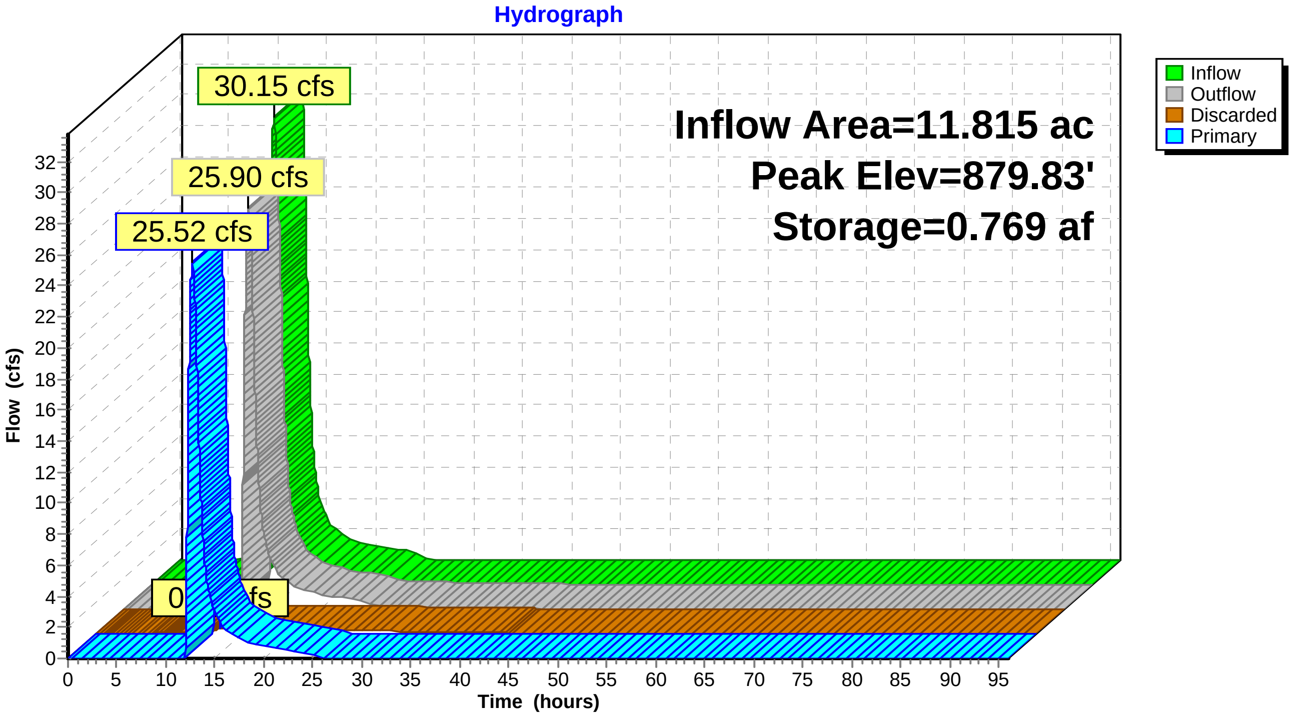
 Elevation        Surf.Area          Inc.Store          Cum.Store
      (feet)          (acres)        (acre-feet)        (acre-feet)
    877.00            0.150              0.000              0.000
    879.00            0.300              0.450              0.450
    880.00            0.500              0.400              0.850

Device   Routing              Invert   Outlet Devices
    #1     Discarded         877.00'   0.800 in/hr Exfiltration over Surface area
                                       Conductivity to Groundwater Elevation = 0.00'
    #2     Primary           878.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                       Inlet / Outlet Invert= 878.00' / 877.00'   S= 0.0065 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 3.14 sf
    #3     Primary           878.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                       Inlet / Outlet Invert= 878.00' / 877.00'   S= 0.0065 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 3.14 sf

Discarded OutFlow  Max=0.38 cfs @ 12.71 hrs  HW=879.83'   (Free Discharge)
└──1=Exfiltration  ( Controls 0.38 cfs)

Primary OutFlow  Max=25.52 cfs @ 12.71 hrs  HW=879.83'   (Free Discharge)
├──2=Culvert  (Barrel Controls 12.76 cfs @ 5.55 fps)
└──3=Culvert  (Barrel Controls 12.76 cfs @ 5.55 fps)
```

Pond CRH-3: CRH-3



Summary for Pond P-5/P-6: P-5/P-6

```
Inflow Area =        43.346 ac,  18.61% Impervious,  Inflow Depth =   4.83"    for  100-Year event
Inflow      =      208.93 cfs @   12.15 hrs,  Volume=          17.441 af
Outflow     =      112.99 cfs @   12.39 hrs,  Volume=          17.434 af,  Atten= 46%,  Lag= 14.5 min
Primary     =      109.91 cfs @   12.39 hrs,  Volume=          16.116 af
Secondary =          3.09 cfs @   12.39 hrs,  Volume=            1.318 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 929.00'   Surf.Area= 1.975 ac   Storage= 5.062 af
Peak Elev= 931.48' @ 12.39 hrs   Surf.Area= 2.486 ac   Storage= 10.663 af   (5.600 af above start)

Plug-Flow detention time= 294.2 min calculated for 12.371 af (71% of inflow)
Center-of-Mass det. time= 114.8 min ( 920.1 - 805.3 )

Volume         Invert    Avail.Storage    Storage Description
   #1          926.00'        14.650 af   Custom Stage Data (Prismatic)Listed below (Recalc)

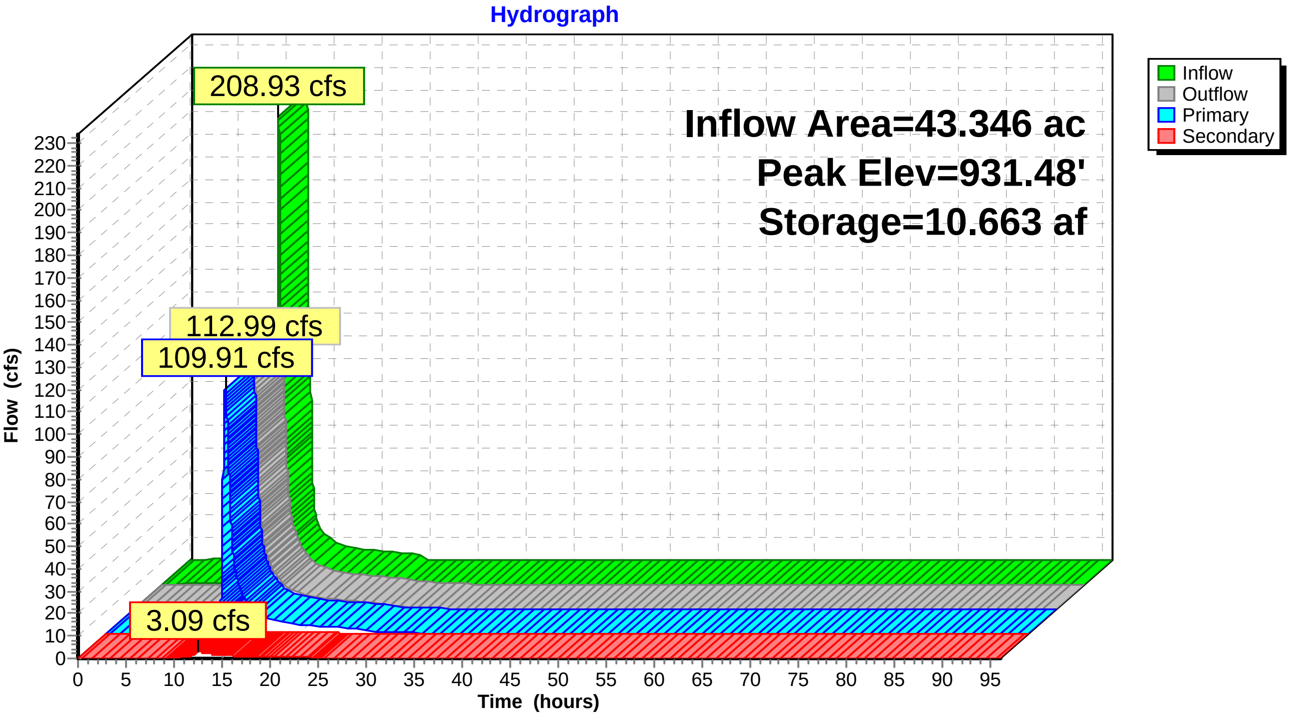
 Elevation       Surf.Area          Inc.Store           Cum.Store
     (feet)          (acres)        (acre-feet)         (acre-feet)
    926.00            1.510              0.000               0.000
    928.00            1.710              3.220               3.220
    930.00            2.240              3.950               7.170
    931.00            2.400              2.320               9.490
    933.00            2.760              5.160              14.650

Device   Routing            Invert   Outlet Devices
    #1    Primary            929.00'   12.0" Horiz. Orifice/Grate   C= 0.600
                                       Limited to weir flow at low heads
    #2    Primary            929.50'   7.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
    #3    Primary            930.50'   14.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
    #4    Secondary          929.00'   9.0" Vert. Orifice/Grate   C= 0.600

Primary OutFlow  Max=109.90 cfs @ 12.39 hrs  HW=931.48'  TW=0.00'   (Dynamic Tailwater)
↑─1=Orifice/Grate  (Orifice Controls 5.96 cfs @ 7.58 fps)
├─2=Sharp-Crested Rectangular Weir (Weir Controls 60.16 cfs @ 4.60 fps)
└─3=Sharp-Crested Rectangular Weir (Weir Controls 43.78 cfs @ 3.24 fps)

Secondary OutFlow Max=3.09 cfs @ 12.39 hrs  HW=931.48'  TW=929.22'   (Dynamic Tailwater)
↑─4=Orifice/Grate  (Orifice Controls 3.09 cfs @ 6.99 fps)
```

Pond P-5/P-6: P-5/P-6



Summary for Pond TI P: Thumb Infiltration (Thumb TP load only)

```
Inflow Area =        48.539 ac,  11.38% Impervious,  Inflow Depth =   2.41"    for  100-Year event
Inflow       =       62.42 cfs @   12.48 hrs,  Volume=            9.759 af
Outflow      =       53.02 cfs @   12.75 hrs,  Volume=            6.019 af,  Atten= 15%,  Lag= 16.2 min
Primary      =       53.02 cfs @   12.75 hrs,  Volume=            6.019 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.80' @ 12.75 hrs   Surf.Area= 1.000 ac   Storage= 3.804 af

Plug-Flow detention time= 229.2 min calculated for 6.018 af (62% of inflow)
Center-of-Mass det. time= 101.6 min ( 958.8 - 857.2 )

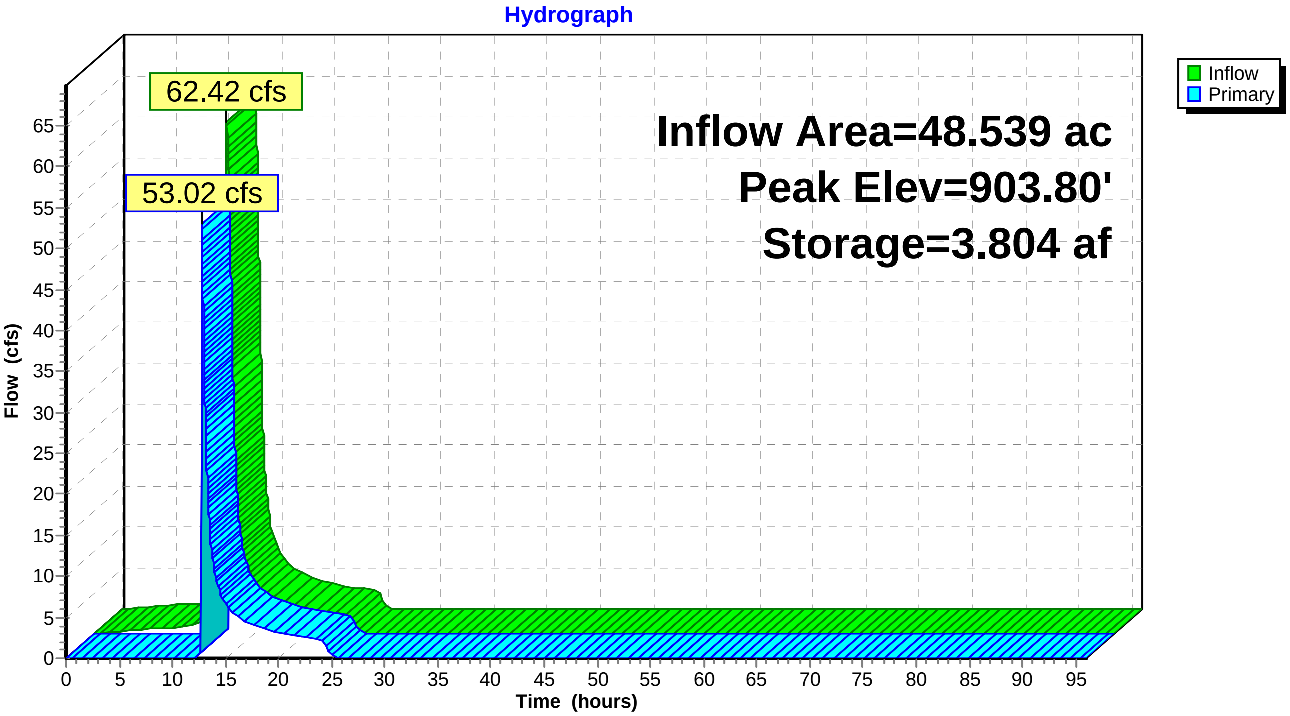
Volume         Invert     Avail.Storage    Storage Description
   #1         900.00'          5.000 af    Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation       Surf.Area         Inc.Store         Cum.Store
    (feet)         (acres)       (acre-feet)       (acre-feet)
    900.00           1.000             0.000             0.000
    901.00           1.000             1.000             1.000
    902.00           1.000             1.000             2.000
    903.00           1.000             1.000             3.000
    904.00           1.000             1.000             4.000
    905.00           1.000             1.000             5.000

Device    Routing            Invert    Outlet Devices
   #1     Primary           903.74'    1,000.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                       5.0' Crest Height

Primary OutFlow  Max=52.85 cfs @ 12.75 hrs  HW=903.80'   (Free Discharge)
└─1=Sharp-Crested Rectangular Weir (Weir Controls 52.85 cfs @ 0.83 fps)
```

Pond TI P: Thumb Infiltration (Thumb TP load only)



Summary for Pond W-1: W-1

```
Inflow Area =          1.000 ac,  10.00% Impervious,  Inflow Depth = 21.59"    for  100-Year event
Inflow      =          5.53 cfs @   12.25 hrs,  Volume=           1.799 af
Outflow     =          2.75 cfs @   14.34 hrs,  Volume=           1.799 af,  Atten= 50%,  Lag= 125.5 min
Primary     =          2.75 cfs @   14.34 hrs,  Volume=           1.799 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.28' @ 14.34 hrs   Surf.Area= 0.744 ac   Storage= 0.371 af

Plug-Flow detention time= 106.0 min calculated for 1.799 af (100% of inflow)
Center-of-Mass det. time= 106.0 min ( 1,026.7 - 920.7 )

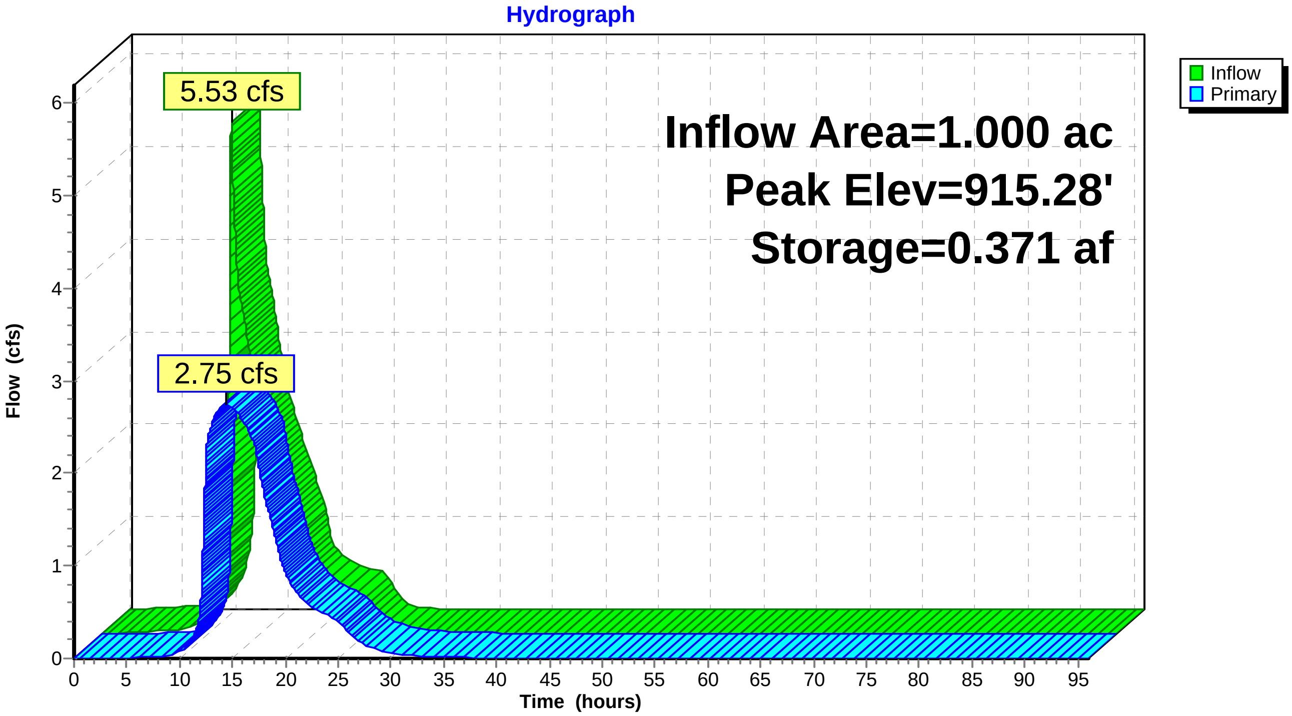
Volume        Invert    Avail.Storage   Storage Description
   #1        914.75'         0.950 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation       Surf.Area         Inc.Store        Cum.Store
      (feet)          (acres)      (acre-feet)      (acre-feet)
    914.75            0.660            0.000            0.000
    916.00            0.860            0.950            0.950

Device    Routing               Invert    Outlet Devices
    #1    Primary              914.75'    12.0" Horiz. Orifice/Grate   C= 0.600
                                          Limited to weir flow at low heads

Primary OutFlow  Max=2.75 cfs @ 14.34 hrs  HW=915.28'  TW=0.00'   (Dynamic Tailwater)
└─1=Orifice/Grate  (Orifice Controls 2.75 cfs @ 3.50 fps)
```

Pond W-1: W-1


Hydrograph
5.53 cfs
2.75 cfs
Inflow Area=1.000 ac
Peak Elev=915.28'
Storage=0.371 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
5
6
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-3: W-3

```
Inflow    =      1.02 cfs @   16.83 hrs,  Volume=          1.173 af
Outflow   =      0.00 cfs @    0.00 hrs,  Volume=          0.000 af,  Atten= 100%,  Lag= 0.0 min
```

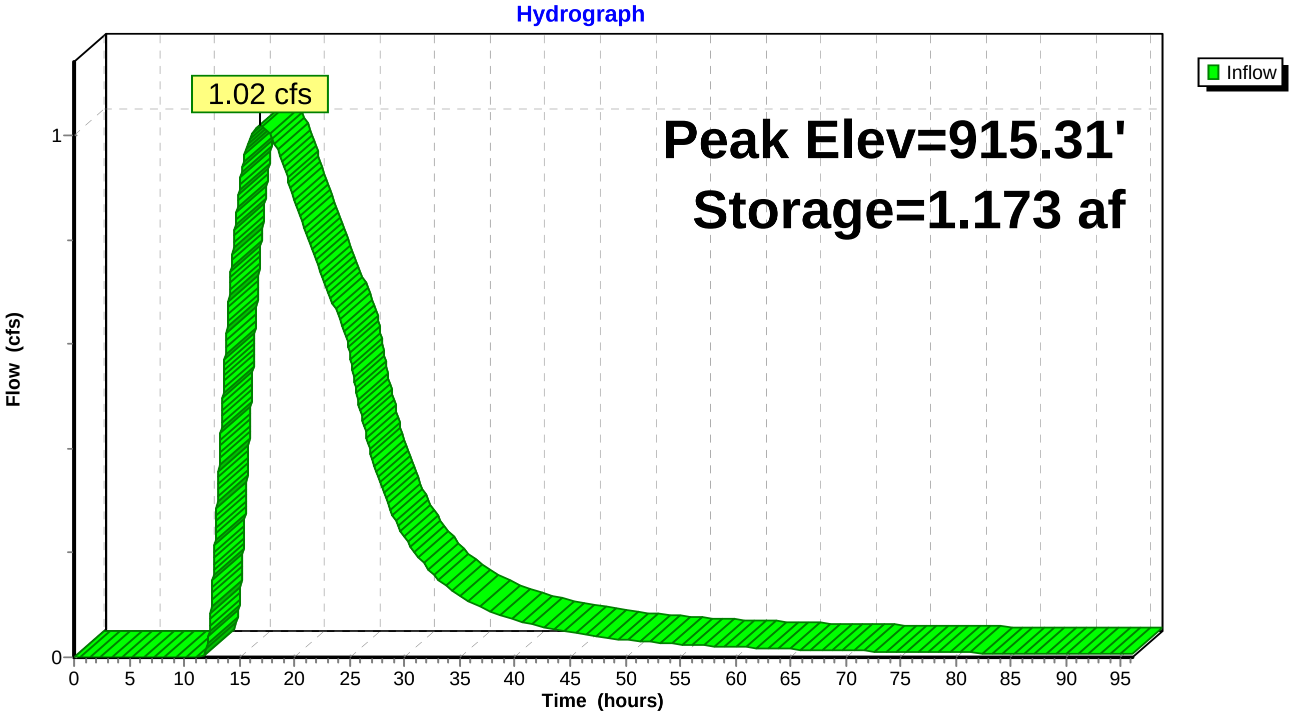
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.31' @ 96.00 hrs Surf.Area= 2.133 ac Storage= 1.173 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	2.680 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	2.040	0.000	0.000
915.00	2.080	0.515	0.515
916.00	2.250	2.165	2.680

Pond W-3: W-3



Summary for Pond W-4: W-4

Inflow Area = 2.980 ac, 26.17% Impervious, Inflow Depth = 19.14" for 100-Year event
Inflow = 21.33 cfs @ 12.08 hrs, Volume= 4.752 af
Outflow = 4.11 cfs @ 15.14 hrs, Volume= 4.732 af, Atten= 81%, Lag= 183.4 min
Primary = 4.11 cfs @ 15.14 hrs, Volume= 4.732 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 909.25' @ 15.14 hrs Surf.Area= 1.231 ac Storage= 1.261 af

Plug-Flow detention time= 245.8 min calculated for 4.732 af (100% of inflow)
Center-of-Mass det. time= 242.2 min (1,224.2 - 982.0)

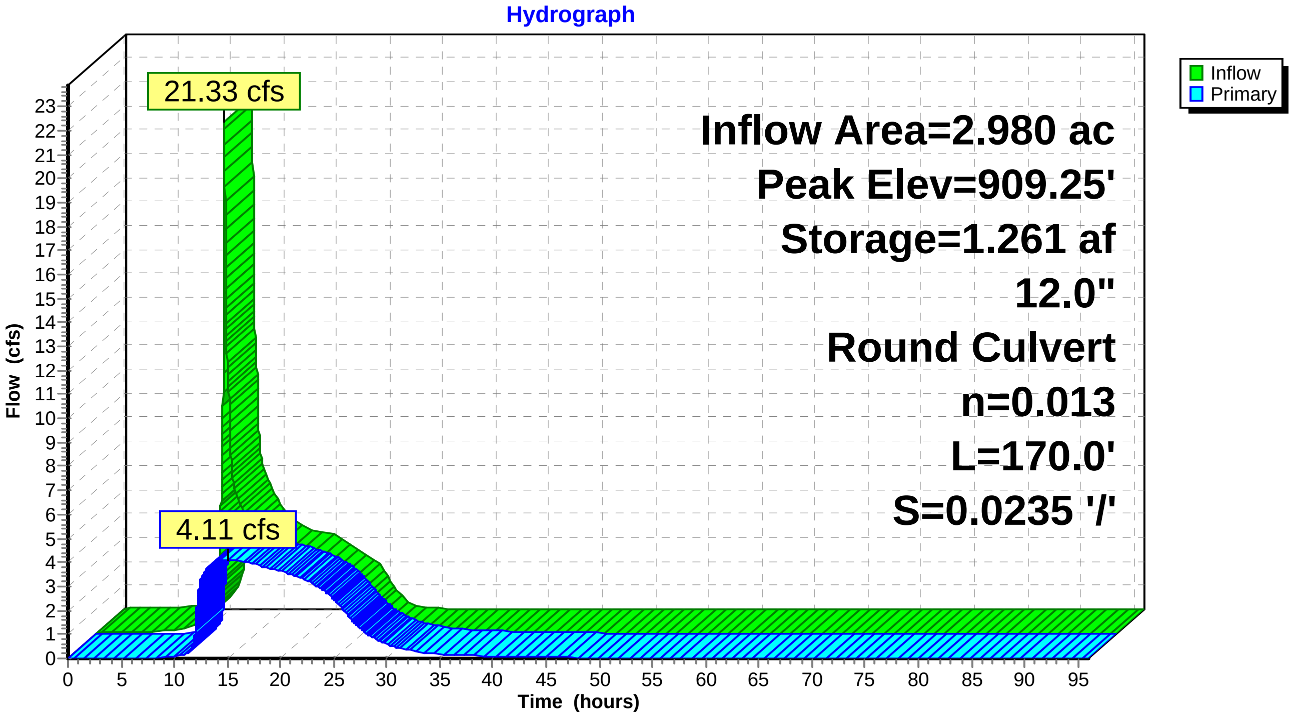
Volume	Invert	Avail.Storage	Storage Description
#1	908.00'	2.280 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
908.00	0.780	0.000	0.000
910.00	1.500	2.280	2.280

Device	Routing	Invert	Outlet Devices
#1	Primary	908.00'	**12.0" Round RCP_Round 12"** L= 170.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 908.00' / 904.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=4.11 cfs @ 15.14 hrs HW=909.25' TW=894.24' (Dynamic Tailwater)
⮤**1=RCP_Round 12"** (Inlet Controls 4.11 cfs @ 5.23 fps)

Pond W-4: W-4


Hydrograph
21.33 cfs
4.11 cfs
Inflow Area=2.980 ac
Peak Elev=909.25'
Storage=1.261 af
12.0"
Round Culvert
n=0.013
L=170.0'
S=0.0235 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-5: W-5

Inflow Area = 7.608 ac, 48.41% Impervious, Inflow Depth = 12.36" for 100-Year event
Inflow = 73.62 cfs @ 12.02 hrs, Volume= 7.835 af
Outflow = 15.85 cfs @ 13.13 hrs, Volume= 7.828 af, Atten= 78%, Lag= 66.4 min
Primary = 15.85 cfs @ 13.13 hrs, Volume= 7.828 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 882.75' Surf.Area= 4.910 ac Storage= 3.412 af
Peak Elev= 883.30' @ 13.13 hrs Surf.Area= 5.645 ac Storage= 6.307 af (2.894 af above start)

Plug-Flow detention time= 520.4 min calculated for 4.415 af (56% of inflow)
Center-of-Mass det. time= 194.5 min (1,024.1 - 829.7)

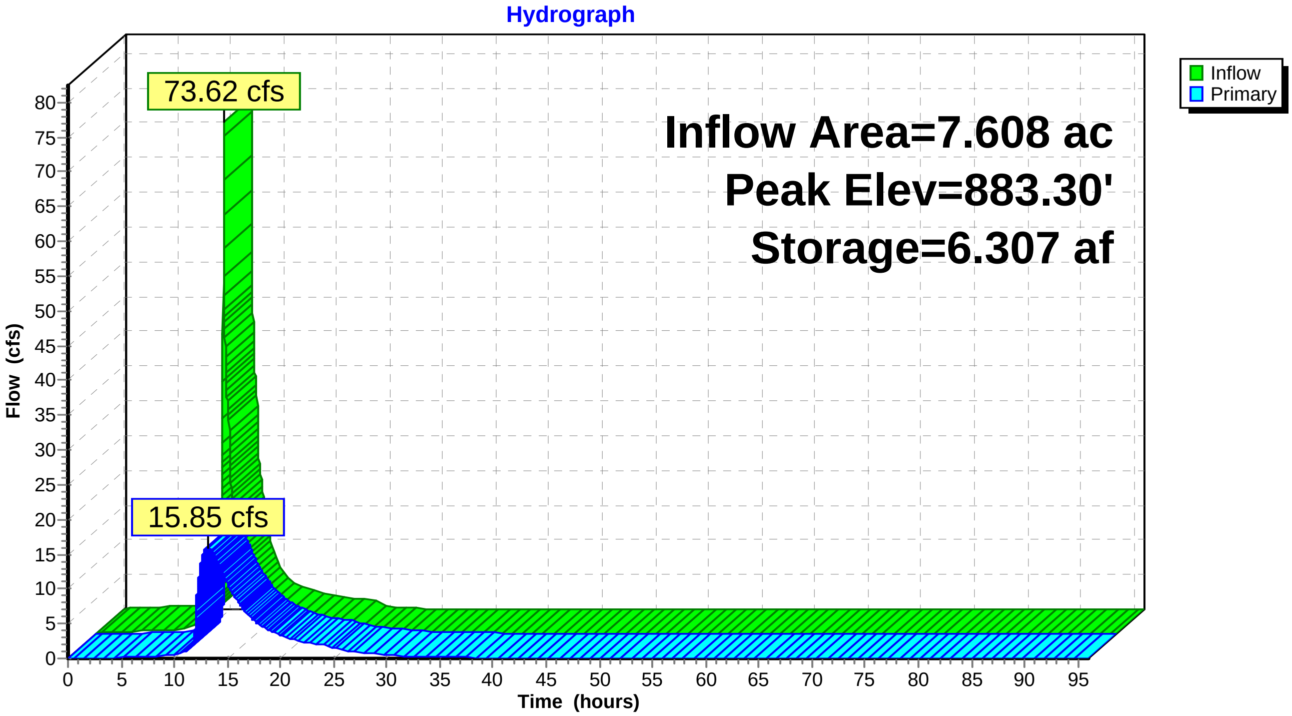
Volume	Invert	Avail.Storage	Storage Description
#1	882.00'	7.390 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
882.00	4.190	0.000	0.000
883.00	5.150	4.670	4.670
883.49	5.950	2.720	7.390

Device	Routing	Invert	Outlet Devices
#1	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=15.85 cfs @ 13.13 hrs HW=883.30' TW=0.00' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 7.92 cfs @ 2.43 fps)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 7.92 cfs @ 2.43 fps)

Pond W-5: W-5

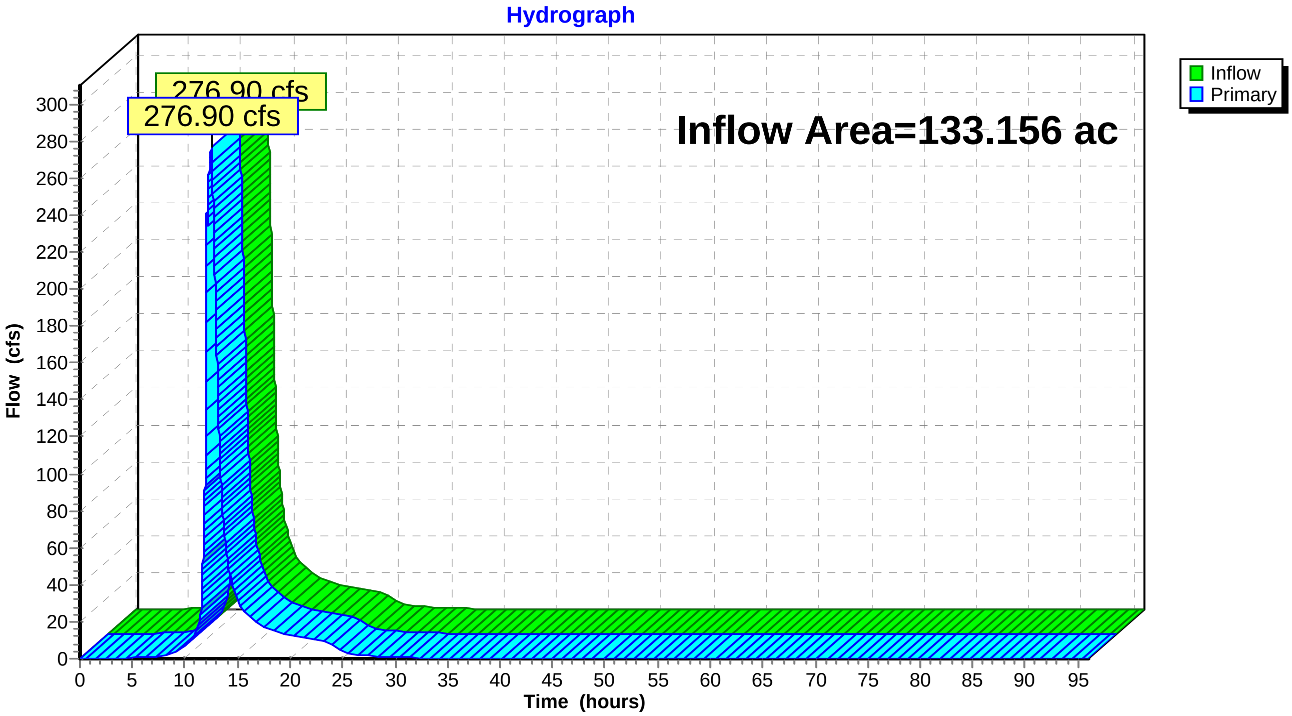

Hydrograph
73.62 cfs
15.85 cfs
Inflow Area=7.608 ac
Peak Elev=883.30'
Storage=6.307 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Link 53L: Sum of Outlet #2 Discharges to Round Lake

Inflow Area =	133.156 ac,	9.78% Impervious,	Inflow Depth = 4.46"	for 100-Year event	
Inflow =	276.90 cfs @	12.51 hrs,	Volume=	49.540 af	
Primary =	276.90 cfs @	12.51 hrs,	Volume=	49.540 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 53L: Sum of Outlet #2 Discharges to Round Lake

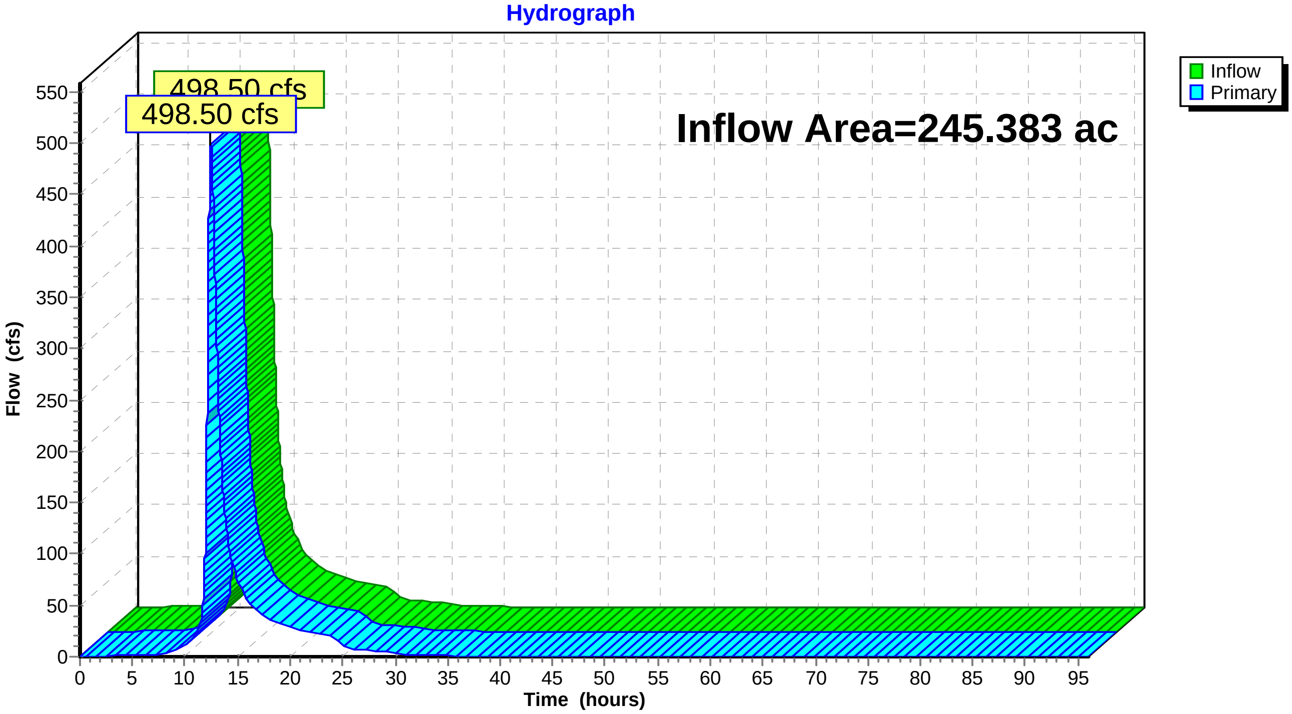


Summary for Link 54L: Sum of Discharges from P-13 and W-5

Inflow Area = 245.383 ac, 10.42% Impervious, Inflow Depth = 4.60" for 100-Year event
Inflow = 498.50 cfs @ 12.46 hrs, Volume= 94.152 af
Primary = 498.50 cfs @ 12.46 hrs, Volume= 94.152 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 54L: Sum of Discharges from P-13 and W-5

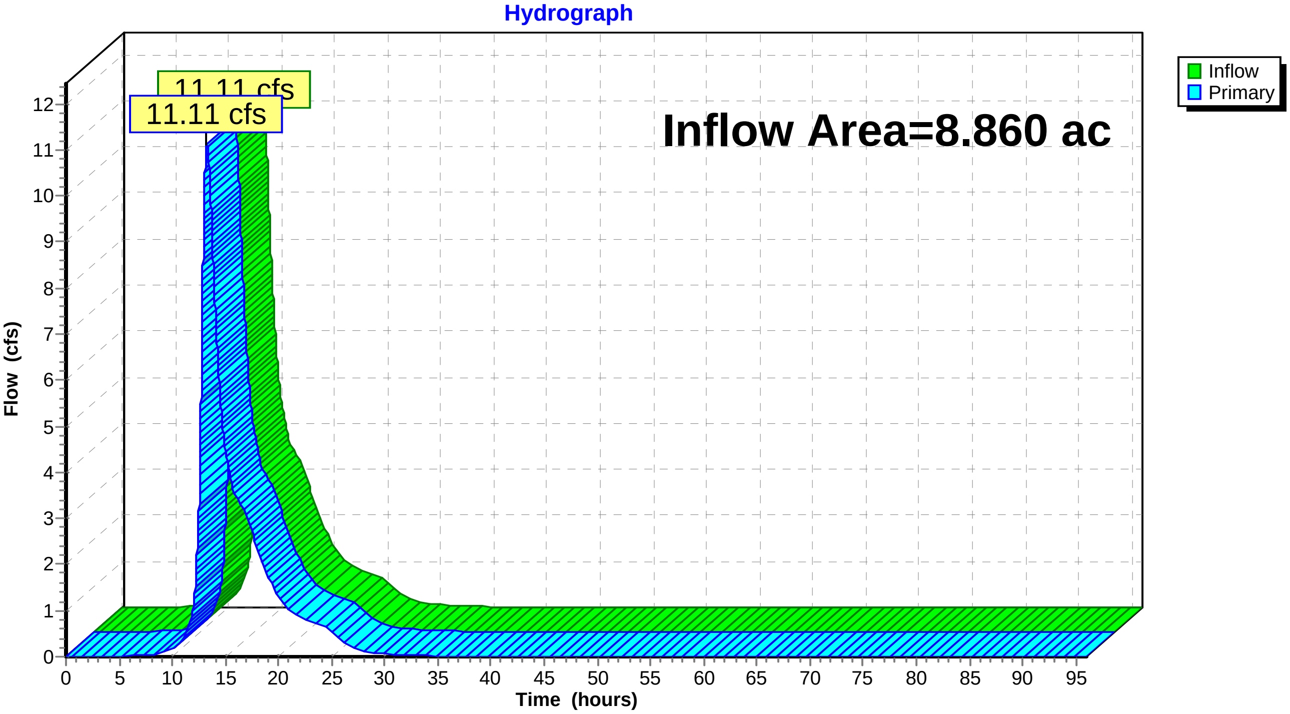


Summary for Link 55L: Sum of Outlet #1 Discharges to Round Lake

Inflow Area = 8.860 ac, 6.43% Impervious, Inflow Depth = 4.49" for 100-Year event
Inflow = 11.11 cfs @ 13.27 hrs, Volume= 3.318 af
Primary = 11.11 cfs @ 13.27 hrs, Volume= 3.318 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 55L: Sum of Outlet #1 Discharges to Round Lake

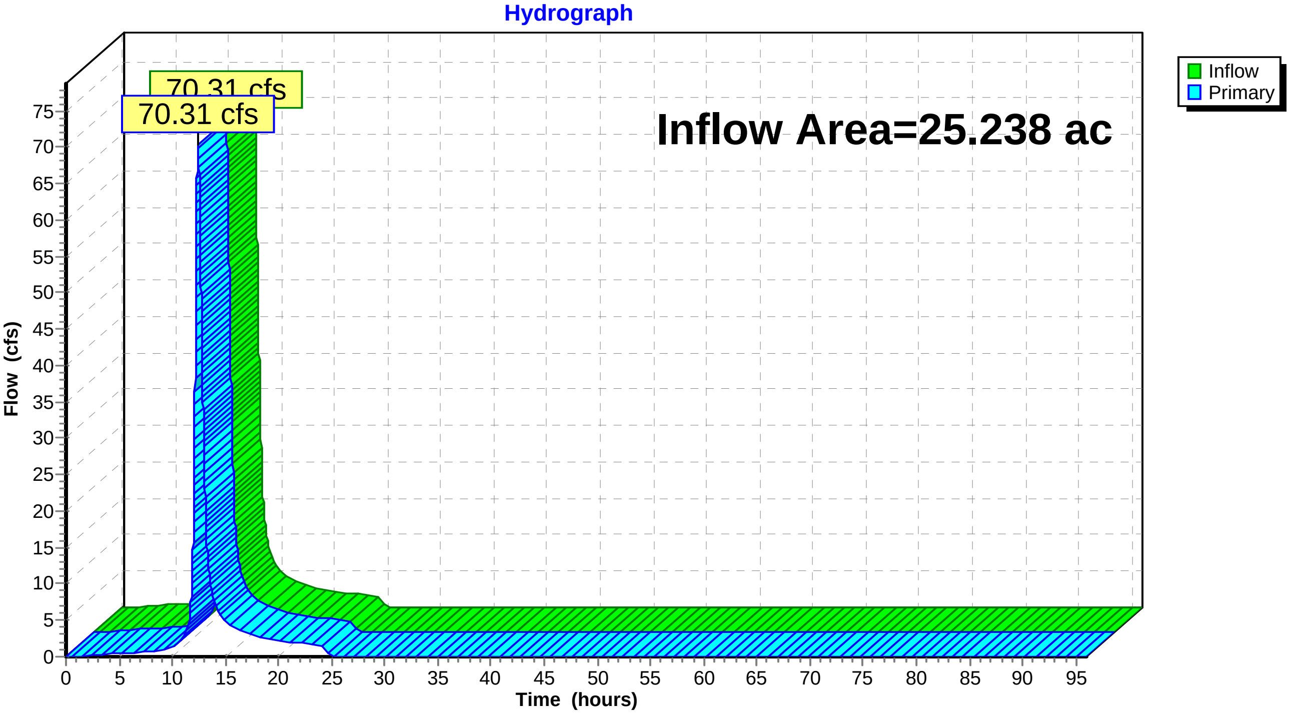


Summary for Link 57L: Outlet #3 Discharge to Round Lake

Inflow Area = 25.238 ac, 19.96% Impervious, Inflow Depth = 4.09" for 100-Year event
Inflow = 70.31 cfs @ 12.43 hrs, Volume= 8.599 af
Primary = 70.31 cfs @ 12.43 hrs, Volume= 8.599 af, Atten= 0%, Lag= 0.0 min

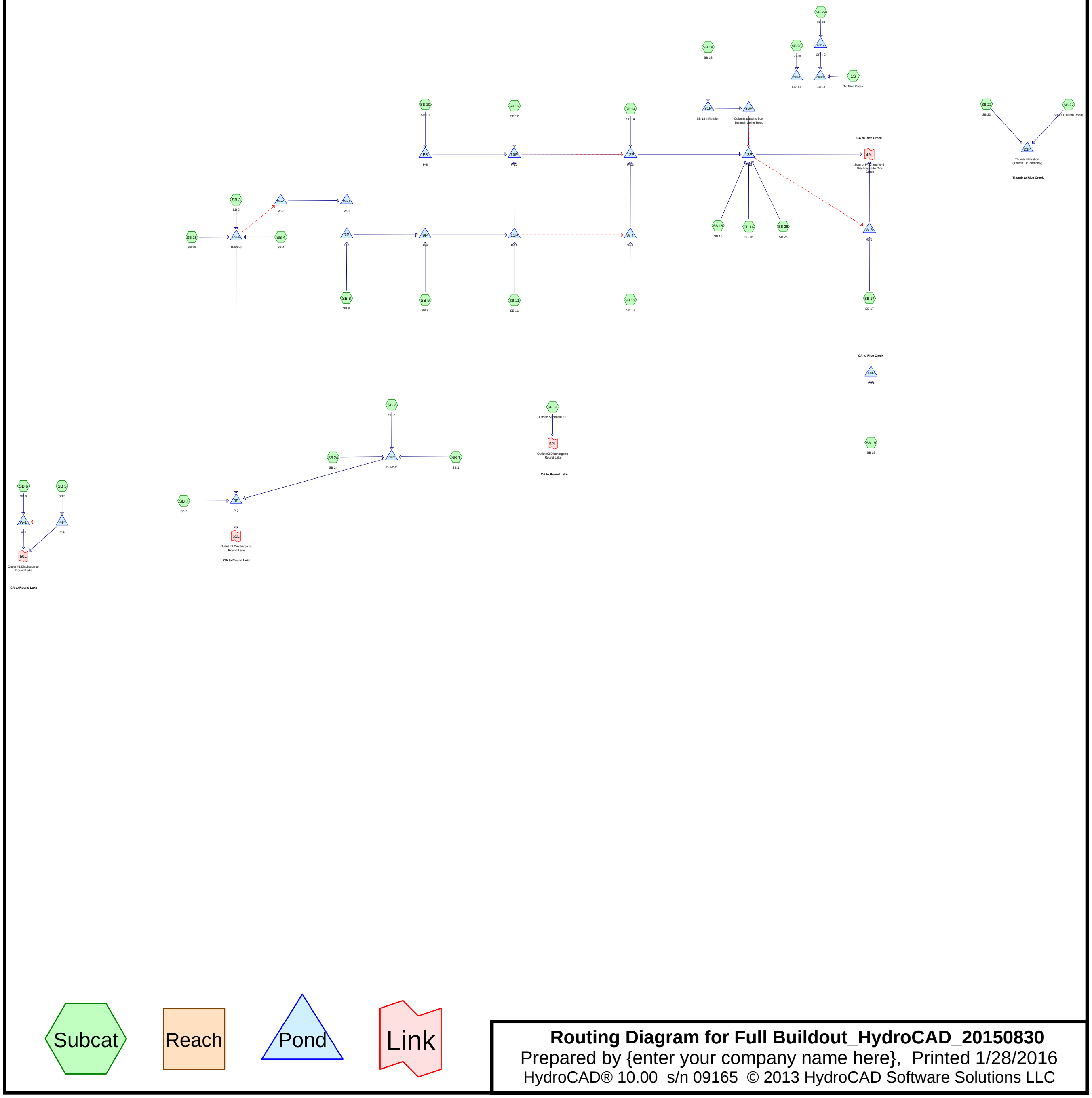
Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 57L: Outlet #3 Discharge to Round Lake



Appendix C

Fully Developed Conditions
Hydrology and Hydraulics Modeling (HydroCAD)



Routing Diagram for Full Buildout_HydroCAD_20150830
Prepared by {enter your company name here}, Printed 1/28/2016
HydroCAD® 10.00 s/n 09165 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.038	98	(SB 51)
56.502	98	Impervious (SB 22, SB 27, SB 3)
20.200	65	Offsite subbasin 51 (SB 51)
7.656	49	Pervious (SB 22, SB 27)
22.050	74	Pervious (SB 3)
13.406	98	impermiable (SB 24, SB 9)
191.729	98	impervious (1S, SB 1, SB 10, SB 12, SB 14, SB 15, SB 16, SB 18, SB 19, SB 2, SB 25, SB 26, SB 28, SB 29, SB 5, SB 7, SB 8)
6.029	100	impervious (SB 11, SB 13, SB 17, SB 4, SB 6)
17.322	74	permiable (SB 24, SB 9)
161.530	74	pervious (1S, SB 1, SB 10, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 25, SB 26, SB 28, SB 29, SB 4, SB 5, SB 6, SB 7, SB 8)
501.462	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
501.462	Other	1S, SB 1, SB 10, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 22, SB 24, SB 25, SB 26, SB 27, SB 28, SB 29, SB 3, SB 4, SB 5, SB 51, SB 6, SB 7, SB 8, SB 9
501.462		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	5.038	5.038		SB 51
0.000	0.000	0.000	0.000	56.502	56.502	Impervious	SB 22, SB 27, SB 3
0.000	0.000	0.000	0.000	20.200	20.200	Offsite subbasin 51	SB 51
0.000	0.000	0.000	0.000	29.706	29.706	Pervious	SB 22, SB 27, SB 3
0.000	0.000	0.000	0.000	13.406	13.406	impermiable	SB 24, SB 9
0.000	0.000	0.000	0.000	197.758	197.758	impervious	1S, SB 1, SB 10, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 25, SB 26, SB 28, SB 29, SB 4, SB 5, SB 6, SB 7, SB 8
0.000	0.000	0.000	0.000	17.322	17.322	permiable	SB 24, SB 9
0.000	0.000	0.000	0.000	161.530	161.530	pervious	1S, SB 1, SB 10, SB 11, SB 12, SB 13, SB 14, SB 15, SB 16, SB 17, SB 18, SB 19, SB 2, SB 25, SB 26, SB 28, SB 29, SB 4, SB 5, SB 6, SB 7, SB 8
0.000	**0.000**	**0.000**	**0.000**	**501.462**	**501.462**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	4P	915.80	915.95	50.0	-0.0030	0.013	24.0	0.0	0.0
2	11P	910.00	909.00	200.0	0.0050	0.013	24.0	0.0	0.0
3	11P	910.00	909.00	200.0	0.0050	0.013	24.0	0.0	0.0
4	11P	909.00	908.00	150.0	0.0067	0.013	12.0	0.0	0.0
5	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
6	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
7	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
8	12P	893.50	893.35	30.0	0.0050	0.013	43.8	26.6	0.0
9	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
10	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
11	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
12	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
13	13P	883.00	882.75	100.0	0.0025	0.013	12.0	0.0	0.0
14	14P	893.00	892.75	50.0	0.0050	0.013	18.0	0.0	0.0
15	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
16	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
17	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
18	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
19	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
20	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
21	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
22	36P	887.50	886.50	100.0	0.0100	0.013	18.0	0.0	0.0
23	CRH-1	877.00	876.00	155.0	0.0065	0.013	24.0	0.0	0.0
24	CRH-1	877.00	876.00	155.0	0.0065	0.013	24.0	0.0	0.0
25	CRH-2	881.50	881.00	155.0	0.0032	0.013	24.0	0.0	0.0
26	CRH-2	881.50	881.00	155.0	0.0032	0.013	24.0	0.0	0.0
27	CRH-3	878.00	877.00	155.0	0.0065	0.013	24.0	0.0	0.0
28	CRH-3	878.00	877.00	155.0	0.0065	0.013	24.0	0.0	0.0
29	P8	897.00	895.94	380.0	0.0028	0.013	24.0	0.0	0.0
30	W-2	929.10	916.00	300.0	0.0437	0.013	12.0	0.0	0.0
31	W-4	908.00	904.00	170.0	0.0235	0.013	12.0	0.0	0.0

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: To Rice Creek Runoff Area=1.601 ac 31.98% Impervious Runoff Depth=1.37"
Tc=5.7 min CN=74/98 Runoff=2.97 cfs 0.183 af

Subcatchment SB 1: SB 1 Runoff Area=52.192 ac 48.35% Impervious Runoff Depth=1.66"
Tc=53.1 min CN=74/98 Runoff=44.04 cfs 7.233 af

Subcatchment SB 10: SB 10 Runoff Area=6.389 ac 7.62% Impervious Runoff Depth=0.93"
Tc=7.3 min CN=74/98 Runoff=7.36 cfs 0.497 af

Subcatchment SB 11: SB 11 Runoff Area=3.293 ac 32.16% Impervious Runoff Depth=1.45"
Tc=11.7 min CN=74/100 Runoff=4.75 cfs 0.397 af

Subcatchment SB 12: SB 12 Runoff Area=1.382 ac 38.71% Impervious Runoff Depth=1.49"
Tc=9.5 min CN=74/98 Runoff=2.34 cfs 0.172 af

Subcatchment SB 13: SB 13 Runoff Area=2.985 ac 30.99% Impervious Runoff Depth=1.42"
Tc=9.4 min CN=74/100 Runoff=4.64 cfs 0.354 af

Subcatchment SB 14: SB 14 Runoff Area=10.225 ac 42.62% Impervious Runoff Depth=1.56"
Tc=4.3 min CN=74/98 Runoff=23.23 cfs 1.330 af

Subcatchment SB 15: SB 15 Runoff Area=58.564 ac 48.22% Impervious Runoff Depth=1.66"
Tc=31.3 min CN=74/98 Runoff=64.93 cfs 8.104 af

Subcatchment SB 16: SB 16 Runoff Area=32.428 ac 33.53% Impervious Runoff Depth=1.40"
Tc=12.1 min CN=74/98 Runoff=46.47 cfs 3.776 af

Subcatchment SB 17: SB 17 Runoff Area=7.608 ac 48.41% Impervious Runoff Depth=1.78"
Tc=4.3 min CN=74/100 Runoff=18.70 cfs 1.126 af

Subcatchment SB 18: SB 18 Runoff Area=52.908 ac 84.55% Impervious Runoff Depth=2.31"
Tc=33.5 min CN=74/98 Runoff=79.77 cfs 10.194 af

Subcatchment SB 19: SB 19 Runoff Area=21.198 ac 39.93% Impervious Runoff Depth=1.51"
Tc=24.7 min CN=74/98 Runoff=23.92 cfs 2.671 af

Subcatchment SB 2: SB 2 Runoff Area=11.400 ac 84.29% Impervious Runoff Depth=2.31"
Tc=16.6 min CN=74/98 Runoff=23.93 cfs 2.192 af

Subcatchment SB 22: SB 22 Runoff Area=41.911 ac 82.19% Impervious Runoff Depth=2.14"
Tc=41.0 min CN=49/98 Runoff=52.40 cfs 7.462 af

Subcatchment SB 24: SB 24 Runoff Area=4.939 ac 98.22% Impervious Runoff Depth=2.56"
Tc=7.5 min CN=74/98 Runoff=16.07 cfs 1.052 af

Subcatchment SB 25: SB 25 Runoff Area=5.012 ac 95.71% Impervious Runoff Depth=2.51"
Tc=10.7 min CN=74/98 Runoff=13.90 cfs 1.049 af

```
Subcatchment SB 26: SB 26                 Runoff Area=14.335 ac   98.27% Impervious   Runoff Depth=2.56"
                                                   Tc=25.4 min   CN=74/98   Runoff=27.53 cfs  3.056 af

Subcatchment SB 27: SB 27 (Thumb Road)    Runoff Area=6.629 ac   97.12% Impervious   Runoff Depth=2.52"
                                                   Tc=27.6 min   CN=49/98   Runoff=12.02 cfs  1.390 af

Subcatchment SB 28: SB 28                 Runoff Area=6.955 ac   46.76% Impervious   Runoff Depth=1.63"
                                                   Tc=14.6 min   CN=74/98   Runoff=10.87 cfs  0.947 af

Subcatchment SB 29: SB 29                 Runoff Area=10.214 ac   37.73% Impervious   Runoff Depth=1.47"
                                                   Tc=19.1 min   CN=74/98   Runoff=12.67 cfs  1.253 af

Subcatchment SB 3: SB 3                   Runoff Area=37.668 ac   41.46% Impervious   Runoff Depth=1.54"
                                                   Tc=15.3 min   CN=74/98   Runoff=54.30 cfs  4.833 af

Subcatchment SB 4: SB 4                   Runoff Area=0.599 ac   19.70% Impervious   Runoff Depth=1.19"
                                                   Tc=5.9 min   CN=74/100   Runoff=0.93 cfs  0.060 af

Subcatchment SB 5: SB 5                   Runoff Area=7.853 ac   70.37% Impervious   Runoff Depth=2.06"
                                                   Tc=59.3 min   CN=74/98   Runoff=7.70 cfs  1.347 af

Subcatchment SB 51: Offsite Subbasin 51   Runoff Area=25.238 ac   19.96% Impervious   Runoff Depth=0.86"
                                                   Tc=32.8 min   CN=65/98   Runoff=12.44 cfs  1.805 af

Subcatchment SB 6: SB 6                   Runoff Area=0.997 ac   24.47% Impervious   Runoff Depth=1.29"
                                                   Tc=20.3 min   CN=74/100   Runoff=1.01 cfs  0.107 af

Subcatchment SB 7: SB 7                   Runoff Area=21.555 ac   84.83% Impervious   Runoff Depth=2.32"
                                                   Tc=5.7 min   CN=74/98   Runoff=68.54 cfs  4.162 af

Subcatchment SB 8: SB 8                   Runoff Area=29.595 ac   30.01% Impervious   Runoff Depth=1.33"
                                                   Tc=47.1 min   CN=74/98   Runoff=21.21 cfs  3.290 af

Subcatchment SB 9: SB 9                   Runoff Area=25.789 ac   33.17% Impervious   Runoff Depth=1.39"
                                                   Tc=30.0 min   CN=74/98   Runoff=24.30 cfs  2.989 af

Pond 3P: P-3                       Peak Elev=916.51'  Storage=11.001 af   Inflow=90.72 cfs  17.776 af
                                                                        Outflow=46.80 cfs  17.759 af

Pond 4P: P-4                              Peak Elev=916.23'  Storage=1.025 af   Inflow=7.70 cfs  1.347 af
                    Primary=1.52 cfs  0.485 af   Secondary=2.32 cfs  0.862 af   Outflow=3.83 cfs  1.347 af

Pond 7P: P-7                              Peak Elev=915.39'  Storage=1.241 af   Inflow=21.21 cfs  3.290 af
                                                                          Outflow=21.61 cfs  3.290 af

Pond 9P: P-9                              Peak Elev=915.35'  Storage=0.439 af   Inflow=41.03 cfs  6.280 af
                                                                          Outflow=40.96 cfs  6.280 af

Pond 10P: P-10                            Peak Elev=897.48'  Storage=1.172 af   Inflow=14.23 cfs  5.606 af
                  Primary=11.01 cfs  5.505 af   Secondary=2.42 cfs  0.100 af   Outflow=13.43 cfs  5.605 af

Pond 11P: P-11                            Peak Elev=910.94'  Storage=6.202 af   Inflow=42.67 cfs  6.677 af
                  Primary=13.46 cfs  4.943 af   Secondary=3.61 cfs  1.732 af   Outflow=17.07 cfs  6.675 af
```

Pond 12P: P-12 Peak Elev=893.86' Storage=6.533 af Inflow=25.40 cfs 9.002 af
Outflow=12.77 cfs 8.994 af

Pond 13P: P-13 Peak Elev=884.08' Storage=6.493 af Inflow=197.71 cfs 30.805 af
Primary=165.33 cfs 29.381 af Secondary=10.39 cfs 1.421 af Outflow=175.72 cfs 30.802 af

Pond 14P: P-14 Peak Elev=892.95' Storage=5.837 af Inflow=23.92 cfs 2.671 af
Outflow=3.68 cfs 2.669 af

Pond 23P: Thumb Infiltration (Thumb TP Peak Elev=903.81' Storage=3.810 af Inflow=62.51 cfs 8.852 af
Outflow=61.16 cfs 5.112 af

Pond 31P: SB 18 Infiltration Peak Elev=903.40' Storage=3.403 af Inflow=79.77 cfs 10.194 af
Outflow=79.67 cfs 6.874 af

Pond 36P: Culverts passing flow beneath Peak Elev=887.32' Storage=0.000 af Inflow=79.67 cfs 6.874 af
Primary=79.68 cfs 6.874 af Secondary=0.00 cfs 0.000 af Outflow=79.68 cfs 6.874 af

Pond CRH-1: CRH-1 Peak Elev=877.67' Storage=0.354 af Inflow=10.87 cfs 0.947 af
Discarded=0.22 cfs 0.471 af Primary=4.58 cfs 0.476 af Outflow=4.80 cfs 0.947 af

Pond CRH-2: CRH-2 Peak Elev=882.04' Storage=0.617 af Inflow=12.67 cfs 1.253 af
Discarded=0.33 cfs 0.833 af Primary=2.29 cfs 0.420 af Outflow=2.62 cfs 1.254 af

Pond CRH-3: CRH-3 Peak Elev=878.30' Storage=0.259 af Inflow=2.97 cfs 0.603 af
Discarded=0.20 cfs 0.381 af Primary=0.97 cfs 0.222 af Outflow=1.17 cfs 0.603 af

Pond P1/P2: P-1/P-2 Peak Elev=924.94' Storage=4.760 af Inflow=54.34 cfs 10.477 af
Outflow=52.67 cfs 10.470 af

Pond P5/P6: P-5/P-6 Peak Elev=930.72' Storage=8.830 af Inflow=66.74 cfs 5.941 af
Primary=5.60 cfs 3.144 af Secondary=1.26 cfs 0.681 af Outflow=6.86 cfs 3.826 af

Pond P8: P-8 Peak Elev=897.62' Storage=0.712 af Inflow=7.36 cfs 0.497 af
24.0" Round Culvert n=0.013 L=380.0' S=0.0028 '/' Outflow=1.25 cfs 0.491 af

Pond W-1: W-1 Peak Elev=915.09' Storage=0.231 af Inflow=2.44 cfs 0.969 af
Outflow=2.00 cfs 0.969 af

Pond W-2: W-2 Peak Elev=929.37' Storage=0.413 af Inflow=1.26 cfs 0.681 af
12.0" Round Culvert n=0.013 L=300.0' S=0.0437 '/' Outflow=0.37 cfs 0.536 af

Pond W-3: W-3 Peak Elev=915.01' Storage=0.536 af Inflow=0.37 cfs 0.536 af
Outflow=0.00 cfs 0.000 af

Pond W-4: W-4 Peak Elev=908.83' Storage=0.769 af Inflow=5.28 cfs 2.086 af
12.0" Round Culvert n=0.013 L=170.0' S=0.0235 '/' Outflow=2.69 cfs 2.067 af

Pond W-5: W-5 Peak Elev=882.98' Storage=8.297 af Inflow=20.53 cfs 2.547 af
Outflow=4.37 cfs 2.540 af

Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek	Inflow=168.38 cfs 31.921 af Primary=168.38 cfs 31.921 af
Link 50L: Outlet #1 Discharge to Round Lake	Inflow=3.24 cfs 1.454 af Primary=3.24 cfs 1.454 af
Link 51L: Outlet #2 Discharge to Round Lake	Inflow=46.80 cfs 17.759 af Primary=46.80 cfs 17.759 af
Link 52L: Outlet #3 Discharge to Round Lake	Inflow=12.44 cfs 1.805 af Primary=12.44 cfs 1.805 af

Total Runoff Area = 501.462 ac Runoff Volume = 73.031 af Average Runoff Depth = 1.75"
45.62% Pervious = 228.758 ac 54.38% Impervious = 272.704 ac

Summary for Subcatchment 1S: To Rice Creek

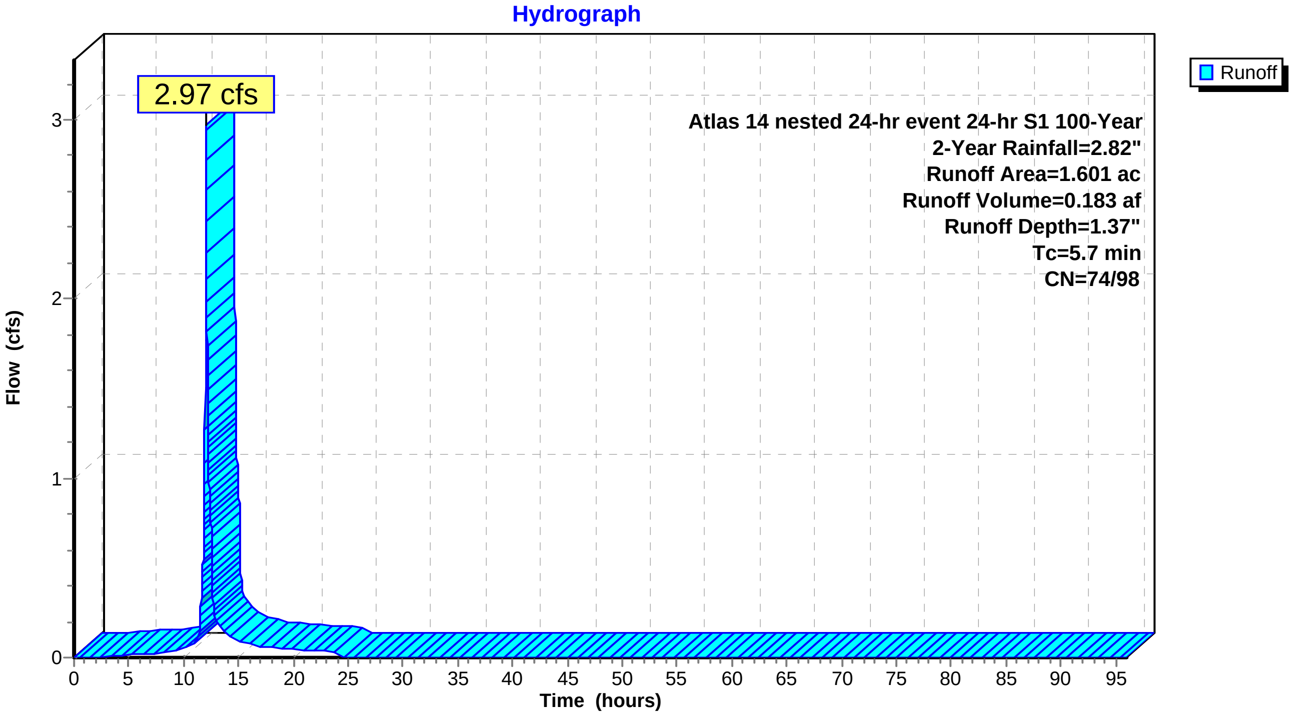
Runoff = 2.97 cfs @ 12.04 hrs, Volume= 0.183 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.512	98	impervious
*	1.089	74	pervious
	1.601	82	Weighted Average
	1.089		68.02% Pervious Area
	0.512		31.98% Impervious Area

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

Subcatchment 1S: To Rice Creek



Summary for Subcatchment SB 1: SB 1

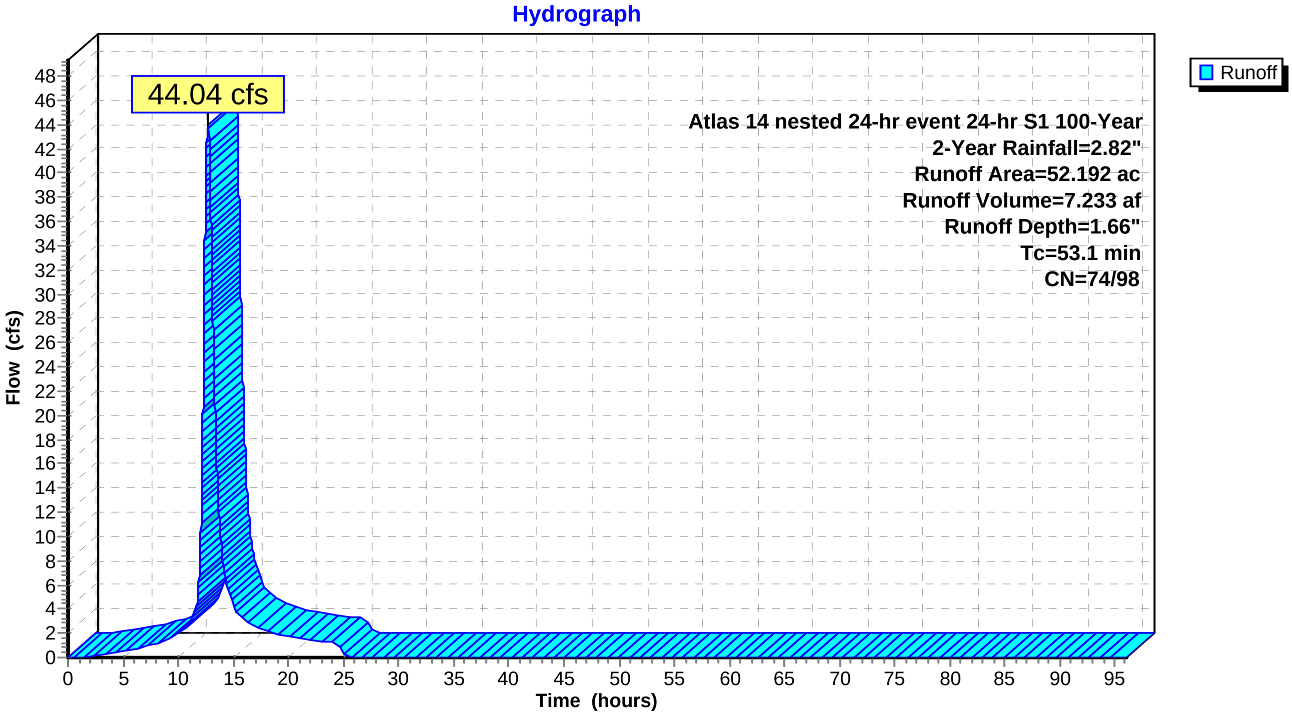
Runoff = 44.04 cfs @ 12.69 hrs, Volume= 7.233 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	26.958	74	pervious
*	25.234	98	impervious
	52.192	86	Weighted Average
	26.958		51.65% Pervious Area
	25.234		48.35% Impervious Area

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

Subcatchment SB 1: SB 1



Summary for Subcatchment SB 10: SB 10

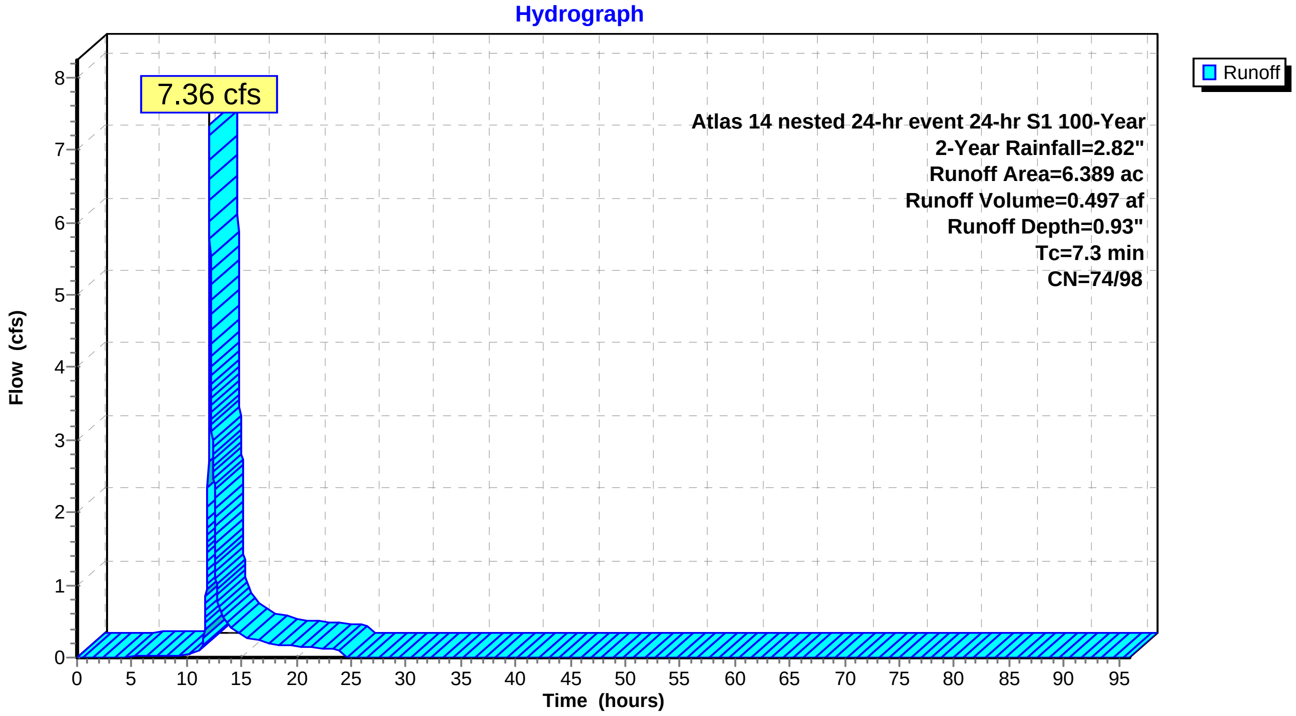
Runoff = 7.36 cfs @ 12.06 hrs, Volume= 0.497 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	5.902	74	pervious
*	0.487	98	impervious
	6.389	76	Weighted Average
	5.902		92.38% Pervious Area
	0.487		7.62% Impervious Area

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

Subcatchment SB 10: SB 10



Summary for Subcatchment SB 11: SB 11

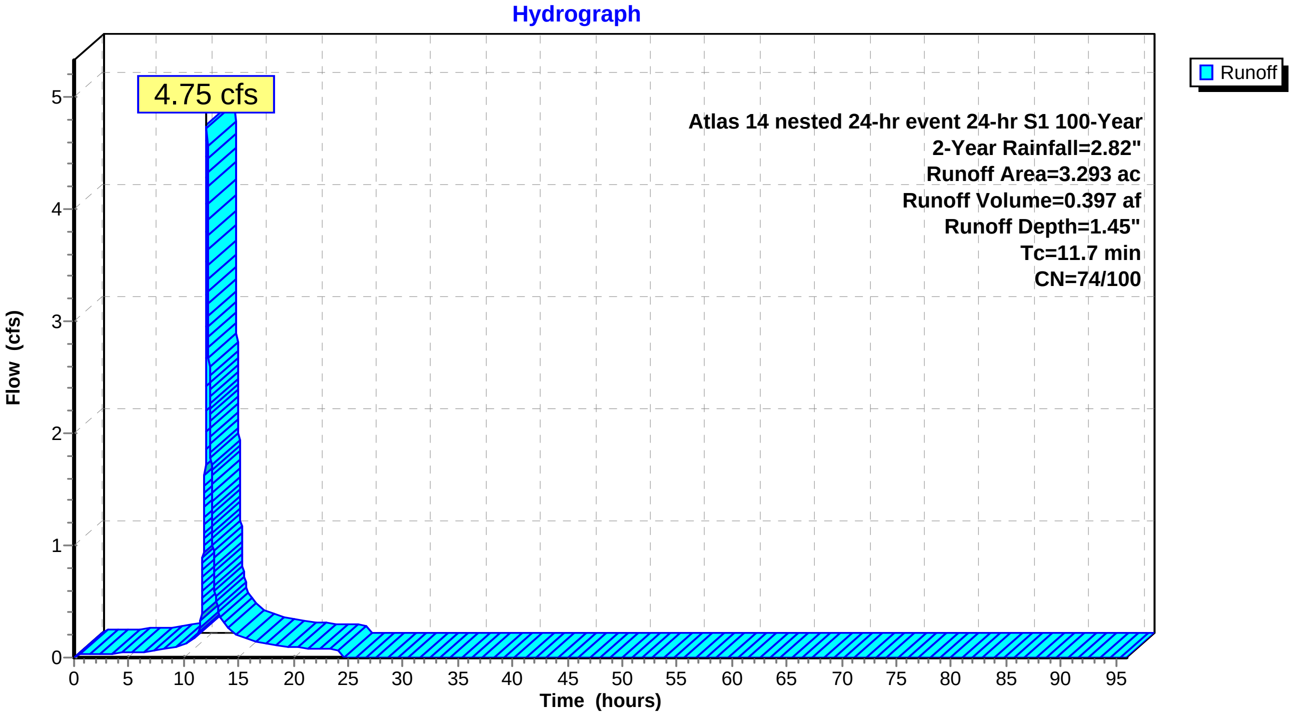
Runoff = 4.75 cfs @ 12.12 hrs, Volume= 0.397 af, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.234	74	pervious
*	1.059	100	impervious
	3.293	82	Weighted Average
	2.234		67.84% Pervious Area
	1.059		32.16% Impervious Area

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

Subcatchment SB 11: SB 11



Summary for Subcatchment SB 12: SB 12

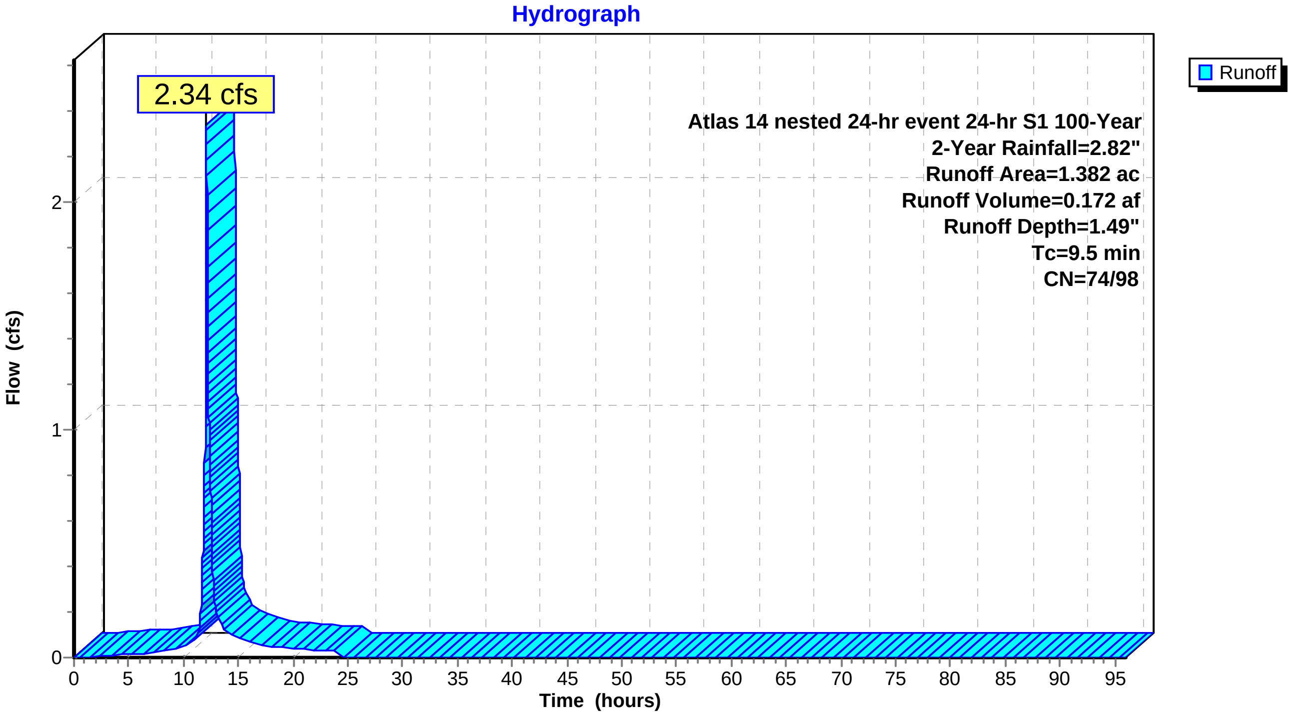
Runoff = 2.34 cfs @ 12.08 hrs, Volume= 0.172 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.847	74	pervious
*	0.535	98	impervious
	1.382	83	Weighted Average
	0.847		61.29% Pervious Area
	0.535		38.71% Impervious Area

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

Subcatchment SB 12: SB 12



Summary for Subcatchment SB 13: SB 13

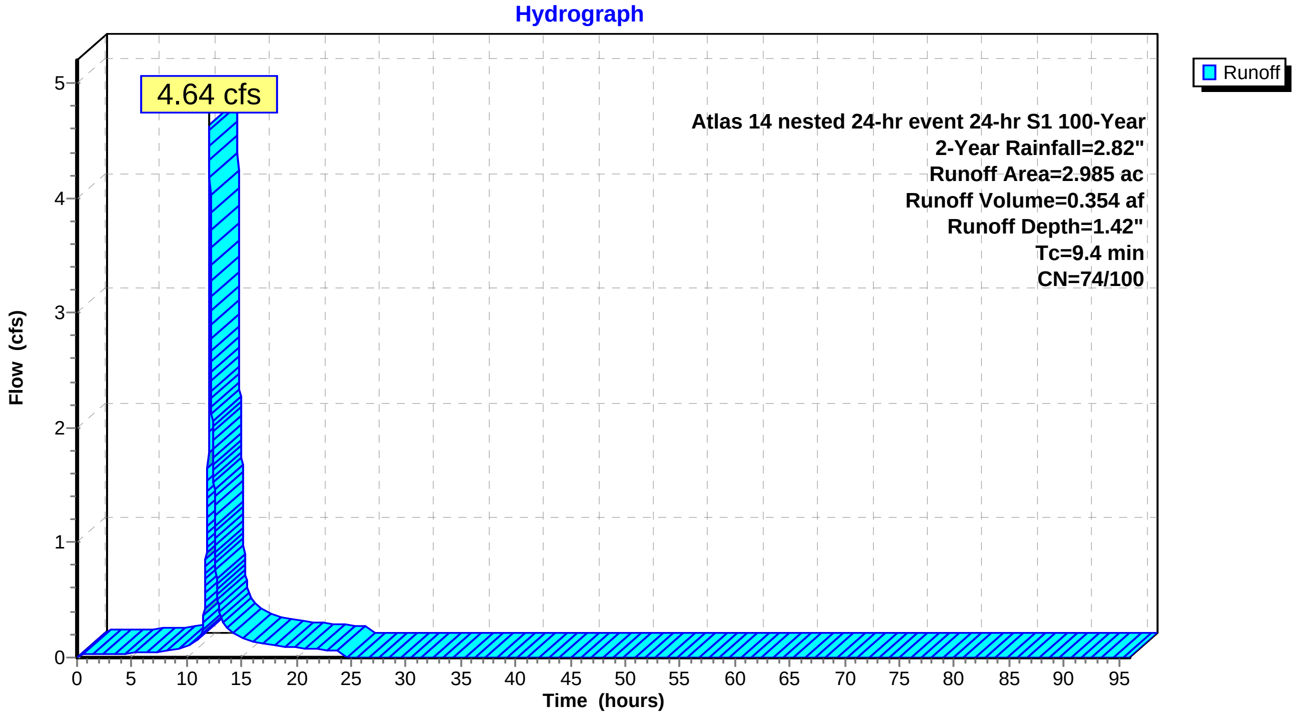
Runoff = 4.64 cfs @ 12.08 hrs, Volume= 0.354 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.060	74	pervious
*	0.925	100	impervious
	2.985	82	Weighted Average
	2.060		69.01% Pervious Area
	0.925		30.99% Impervious Area

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

Subcatchment SB 13: SB 13



Summary for Subcatchment SB 14: SB 14

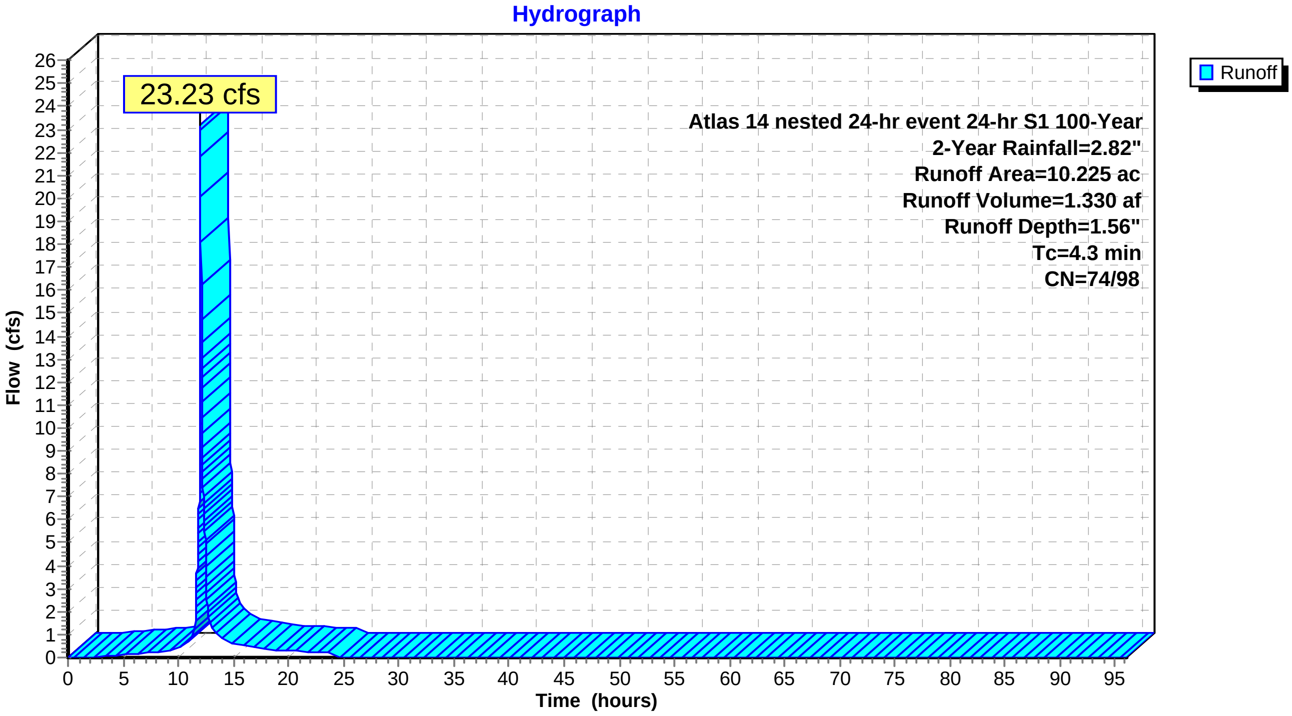
Runoff = 23.23 cfs @ 12.02 hrs, Volume= 1.330 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	5.867	74	pervious
*	4.358	98	impervious
	10.225	84	Weighted Average
	5.867		57.38% Pervious Area
	4.358		42.62% Impervious Area

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

Subcatchment SB 14: SB 14



Summary for Subcatchment SB 15: SB 15

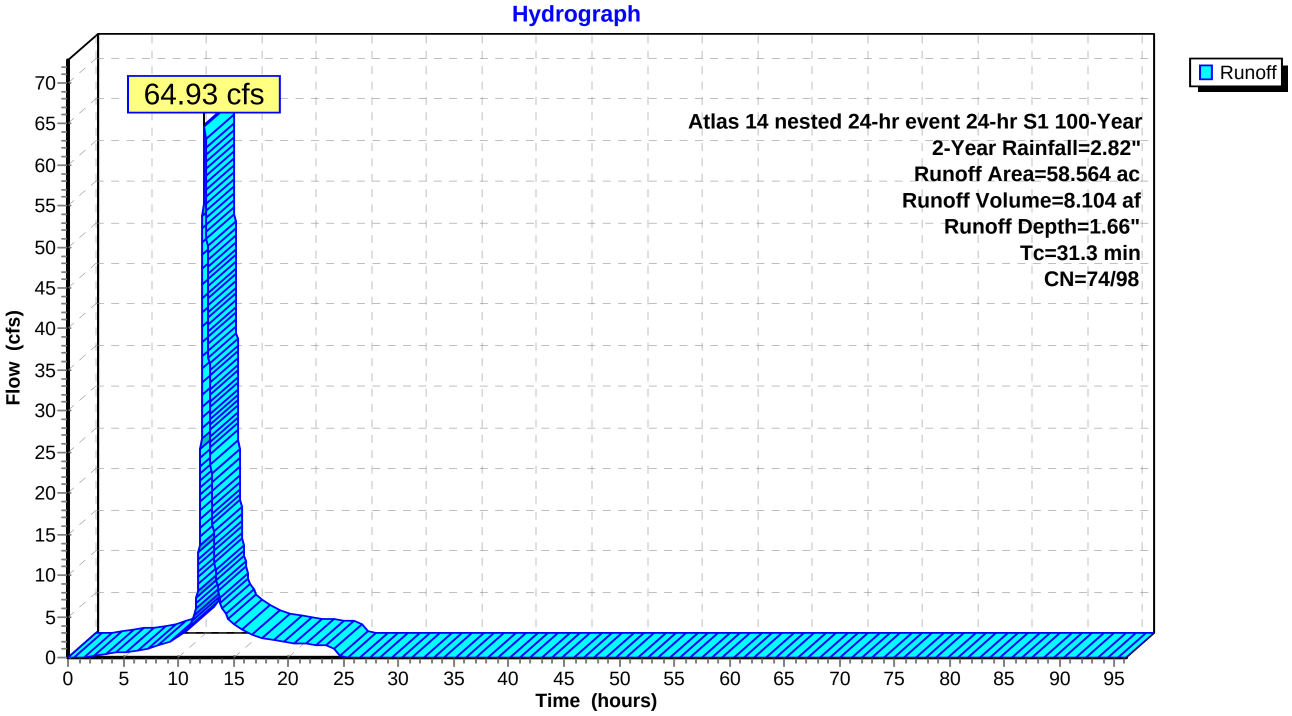
Runoff = 64.93 cfs @ 12.39 hrs, Volume= 8.104 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	30.326	74	pervious
*	28.238	98	impervious
	58.564	86	Weighted Average
	30.326		51.78% Pervious Area
	28.238		48.22% Impervious Area

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

Subcatchment SB 15: SB 15



Summary for Subcatchment SB 16: SB 16

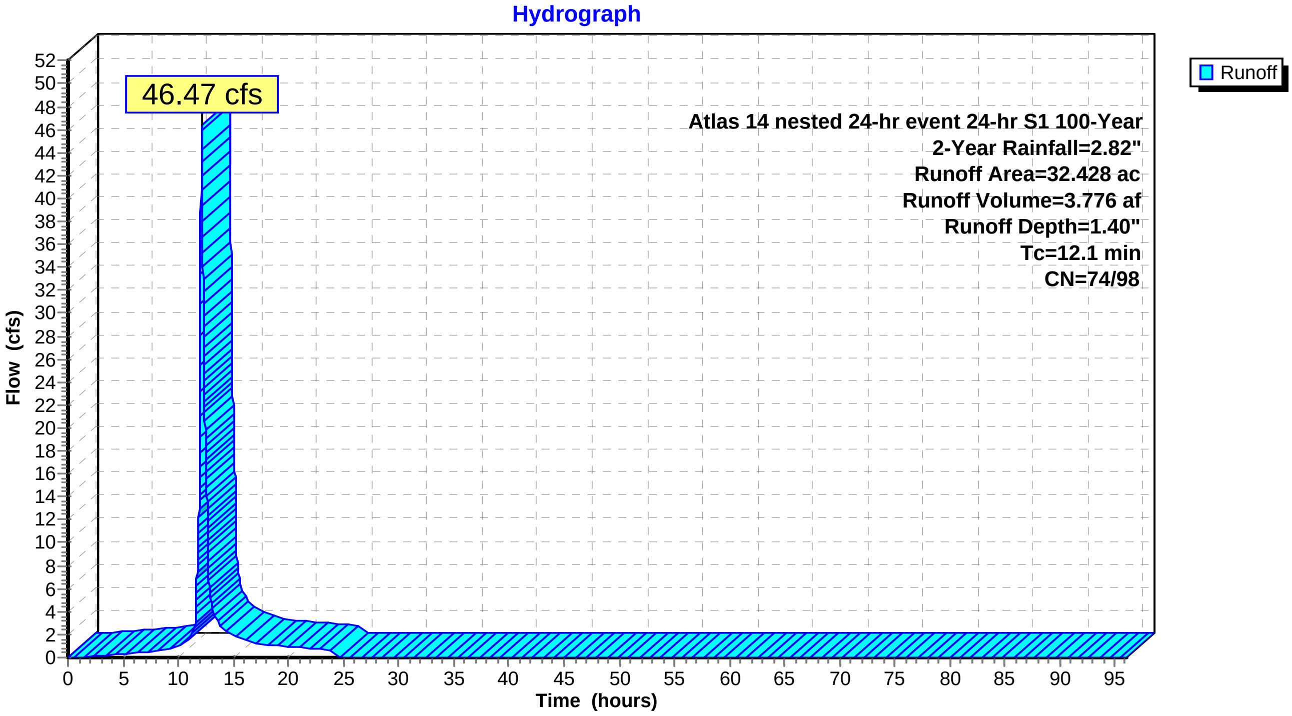
Runoff = 46.47 cfs @ 12.12 hrs, Volume= 3.776 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	21.555	74	pervious
*	10.873	98	impervious
	32.428	82	Weighted Average
	21.555		66.47% Pervious Area
	10.873		33.53% Impervious Area

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

Subcatchment SB 16: SB 16



Summary for Subcatchment SB 17: SB 17

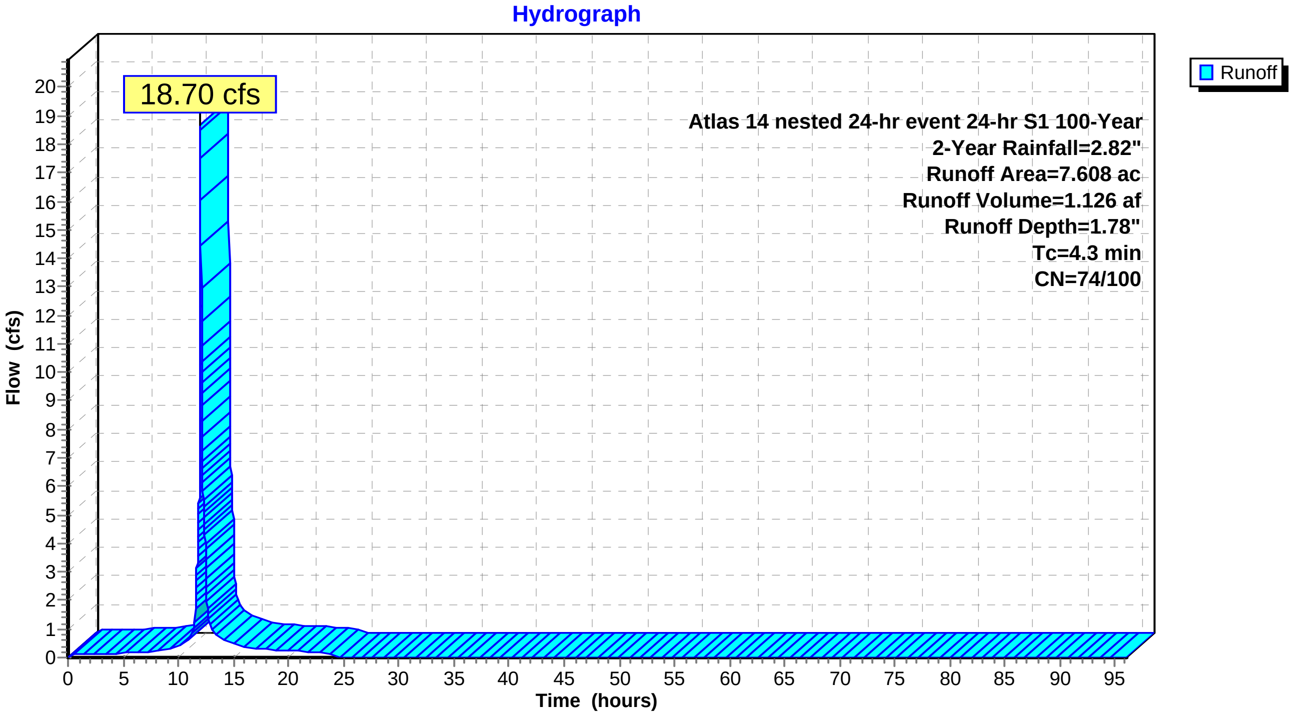
Runoff = 18.70 cfs @ 12.02 hrs, Volume= 1.126 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.925	74	pervious
*	3.683	100	impervious
	7.608	87	Weighted Average
	3.925		51.59% Pervious Area
	3.683		48.41% Impervious Area

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

Subcatchment SB 17: SB 17



Summary for Subcatchment SB 18: SB 18

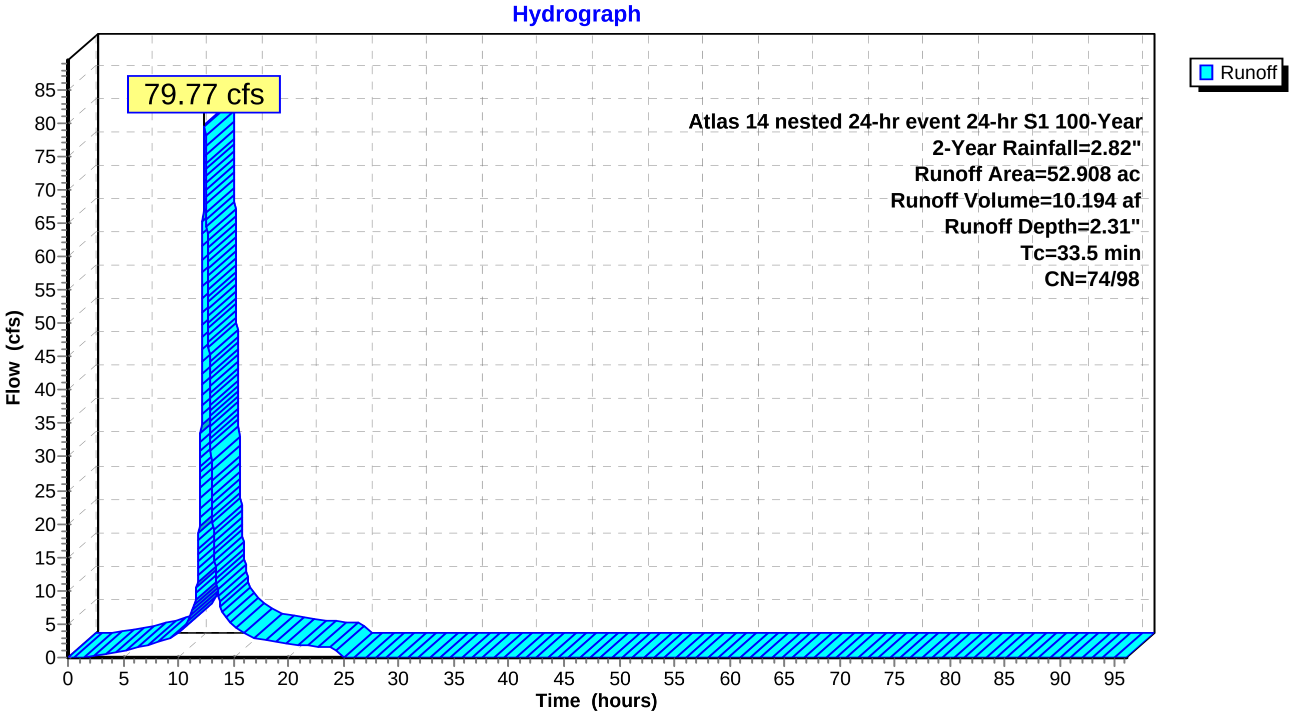
Runoff = 79.77 cfs @ 12.40 hrs, Volume= 10.194 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	8.172	74	pervious
*	44.736	98	impervious
	52.908	94	Weighted Average
	8.172		15.45% Pervious Area
	44.736		84.55% Impervious Area

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

Subcatchment SB 18: SB 18



Summary for Subcatchment SB 19: SB 19

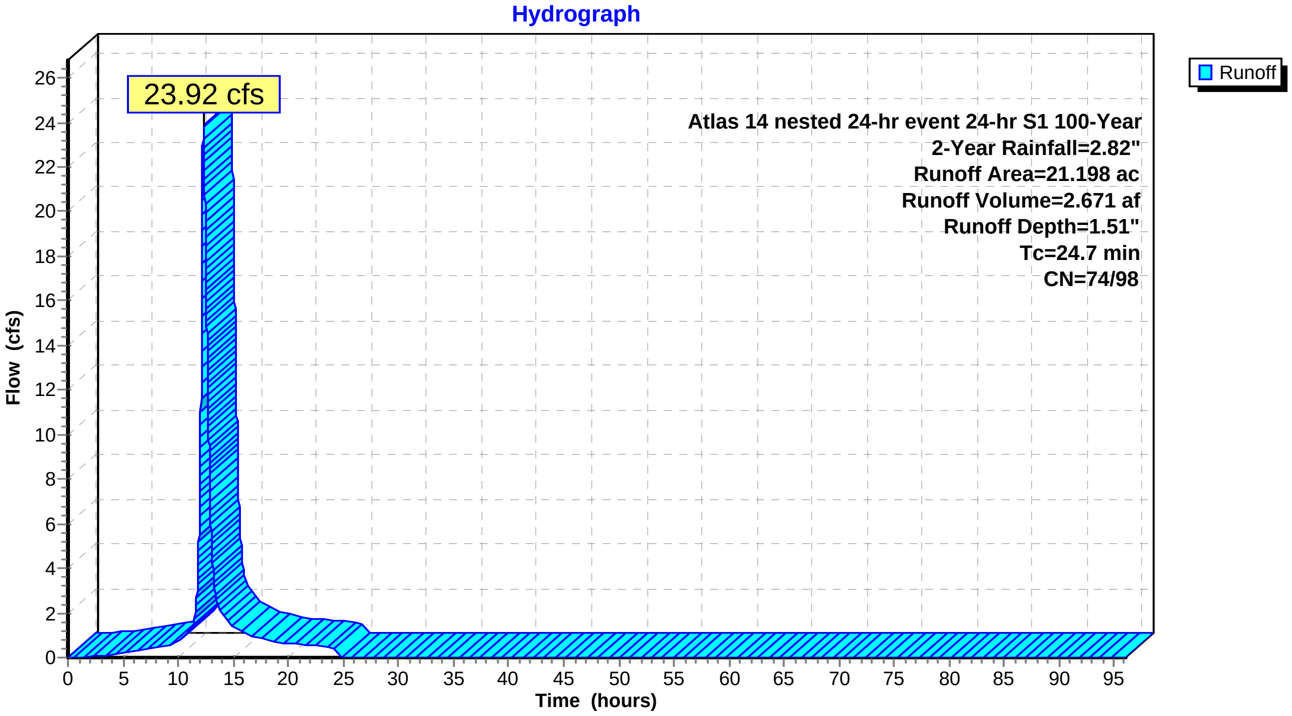
Runoff = 23.92 cfs @ 12.30 hrs, Volume= 2.671 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	12.734	74	pervious
*	8.464	98	impervious
	21.198	84	Weighted Average
	12.734		60.07% Pervious Area
	8.464		39.93% Impervious Area

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

Subcatchment SB 19: SB 19



Summary for Subcatchment SB 2: SB 2

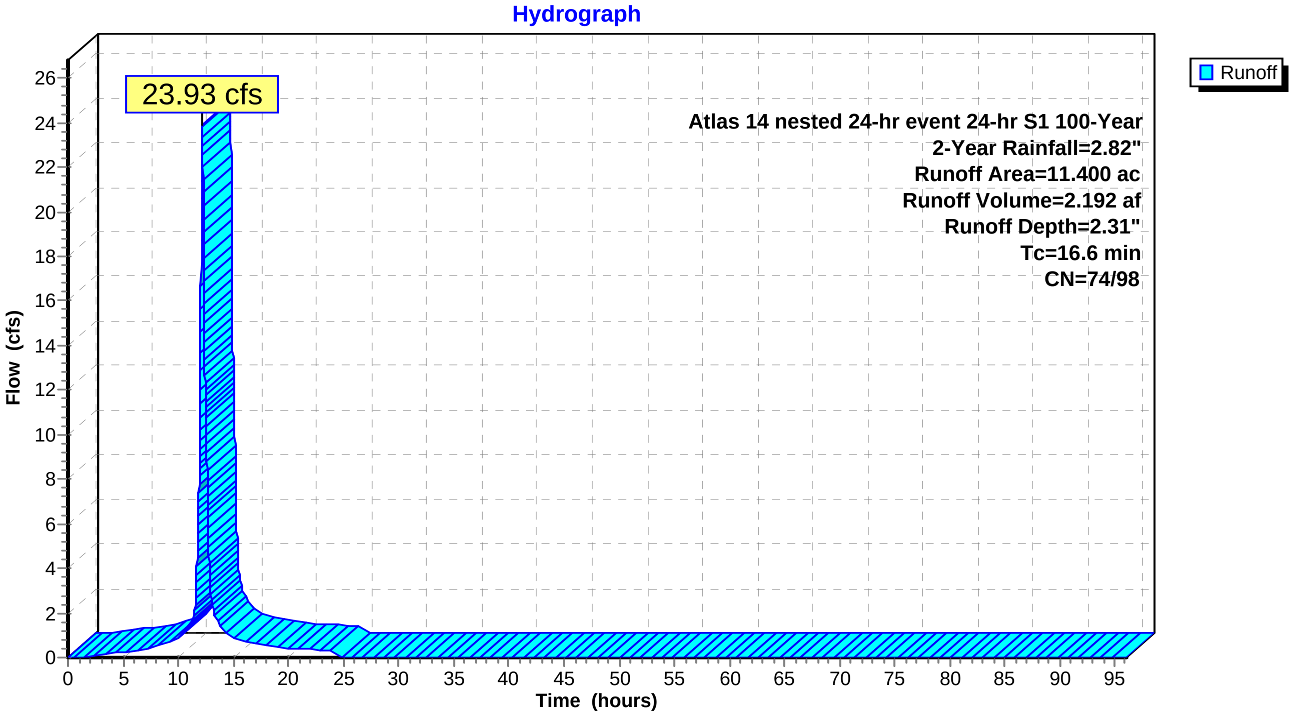
Runoff = 23.93 cfs @ 12.18 hrs, Volume= 2.192 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	1.791	74	pervious
*	9.609	98	impervious
	11.400	94	Weighted Average
	1.791		15.71% Pervious Area
	9.609		84.29% Impervious Area

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

Subcatchment SB 2: SB 2



Summary for Subcatchment SB 22: SB 22

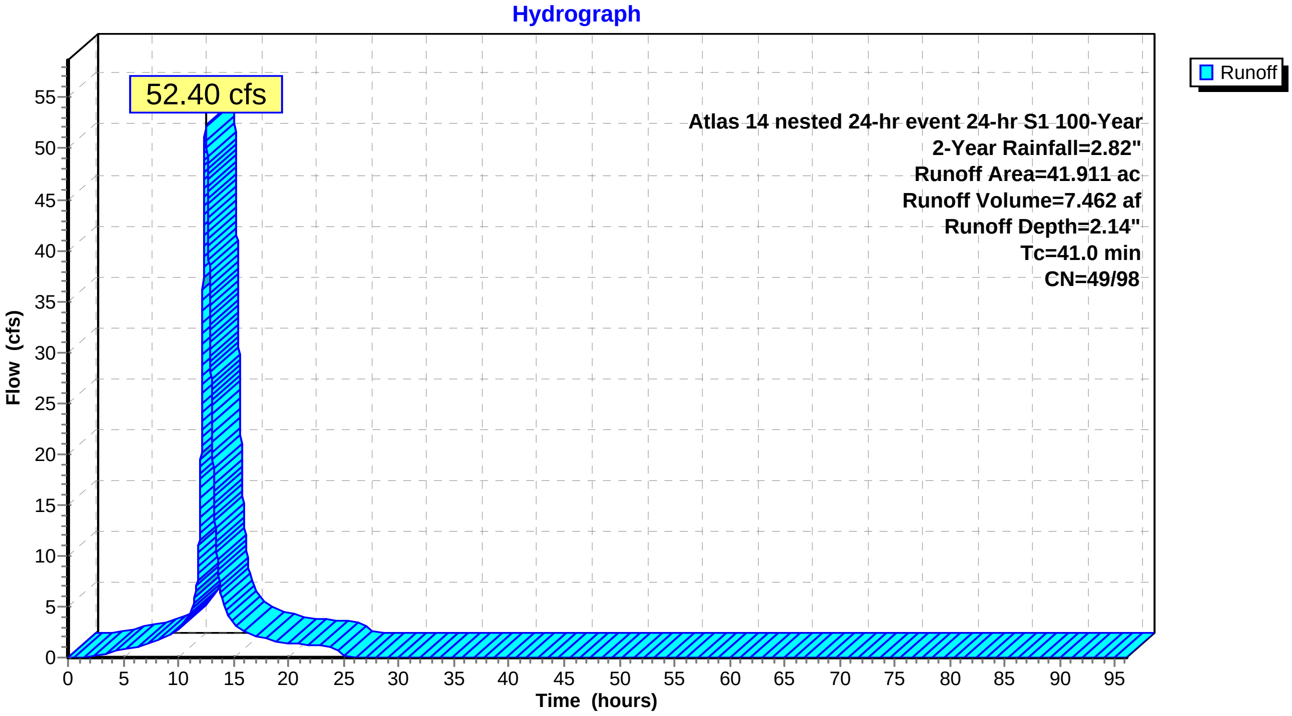
Runoff = 52.40 cfs @ 12.52 hrs, Volume= 7.462 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	7.465	49	Pervious
*	34.446	98	Impervious
	41.911	89	Weighted Average
	7.465		17.81% Pervious Area
	34.446		82.19% Impervious Area

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

Subcatchment SB 22: SB 22



Summary for Subcatchment SB 24: SB 24

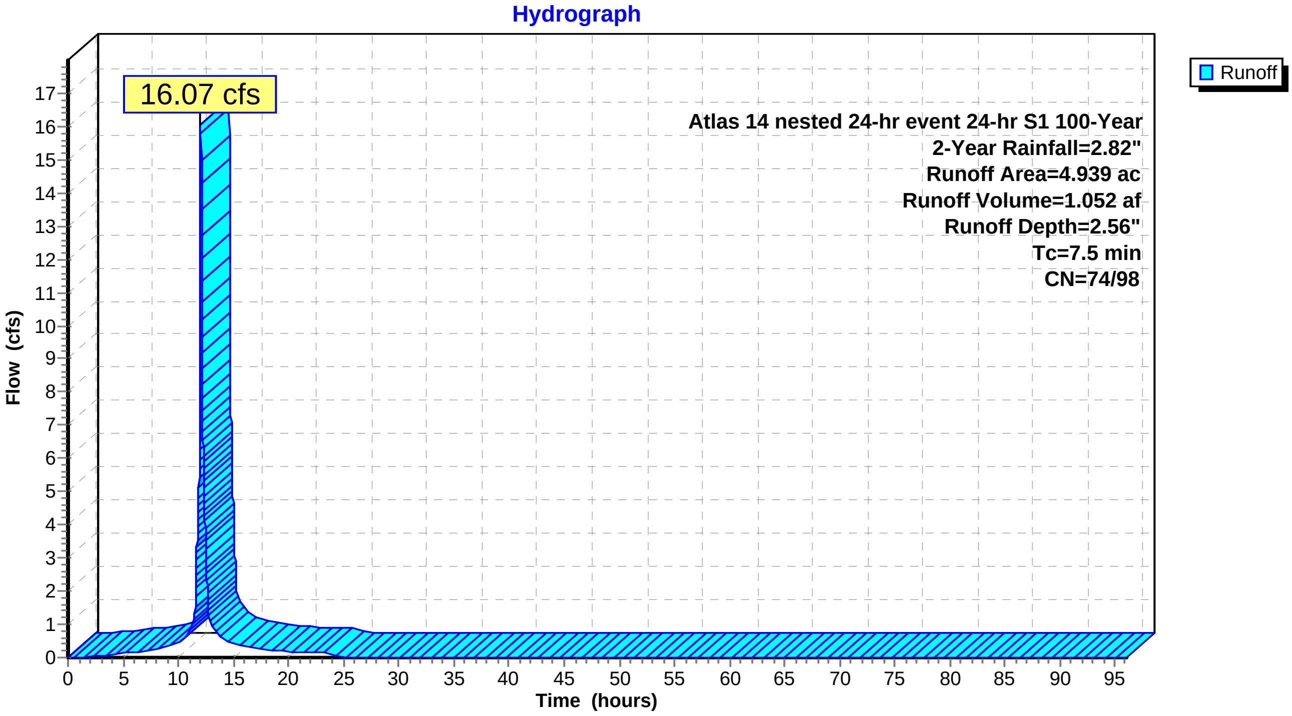
Runoff = 16.07 cfs @ 12.05 hrs, Volume= 1.052 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.088	74	permiable
*	4.851	98	impermiable
	4.939	98	Weighted Average
	0.088		1.78% Pervious Area
	4.851		98.22% Impervious Area

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

Subcatchment SB 24: SB 24



Summary for Subcatchment SB 25: SB 25

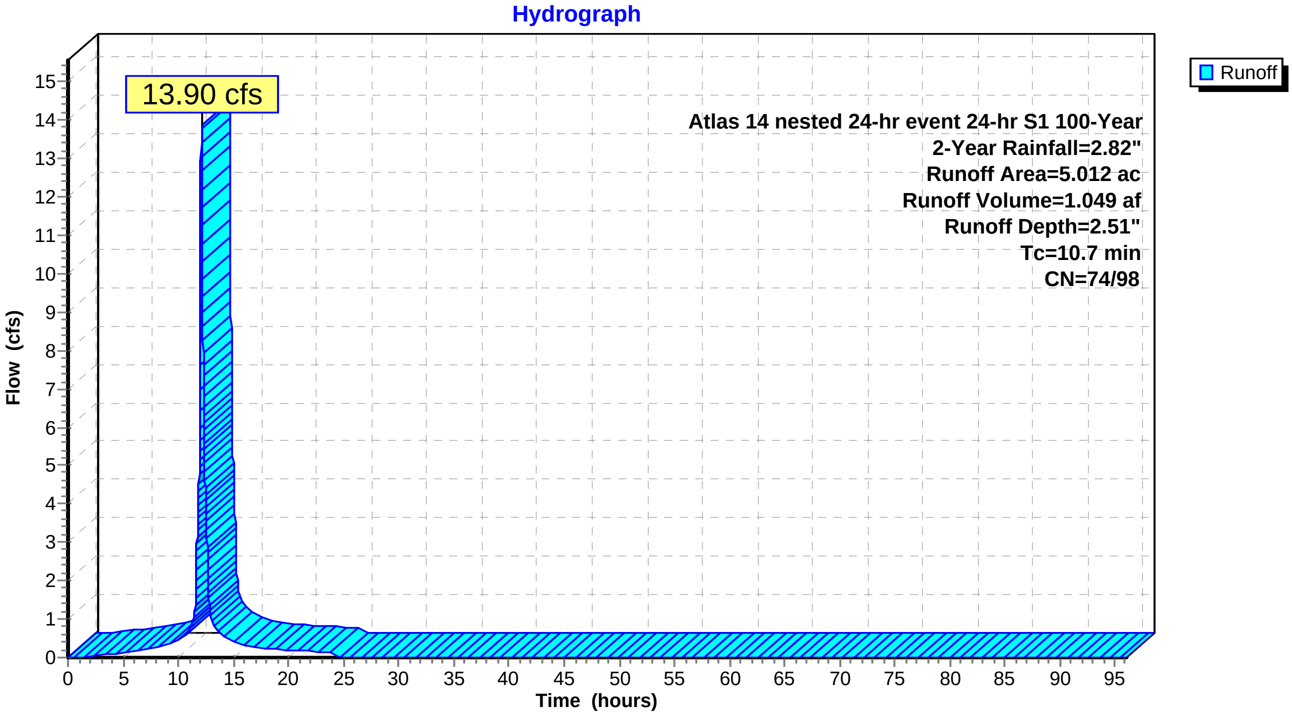
Runoff = 13.90 cfs @ 12.09 hrs, Volume= 1.049 af, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.215	74	pervious
*	4.797	98	impervious
	5.012	97	Weighted Average
	0.215		4.29% Pervious Area
	4.797		95.71% Impervious Area

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

Subcatchment SB 25: SB 25



Summary for Subcatchment SB 26: SB 26

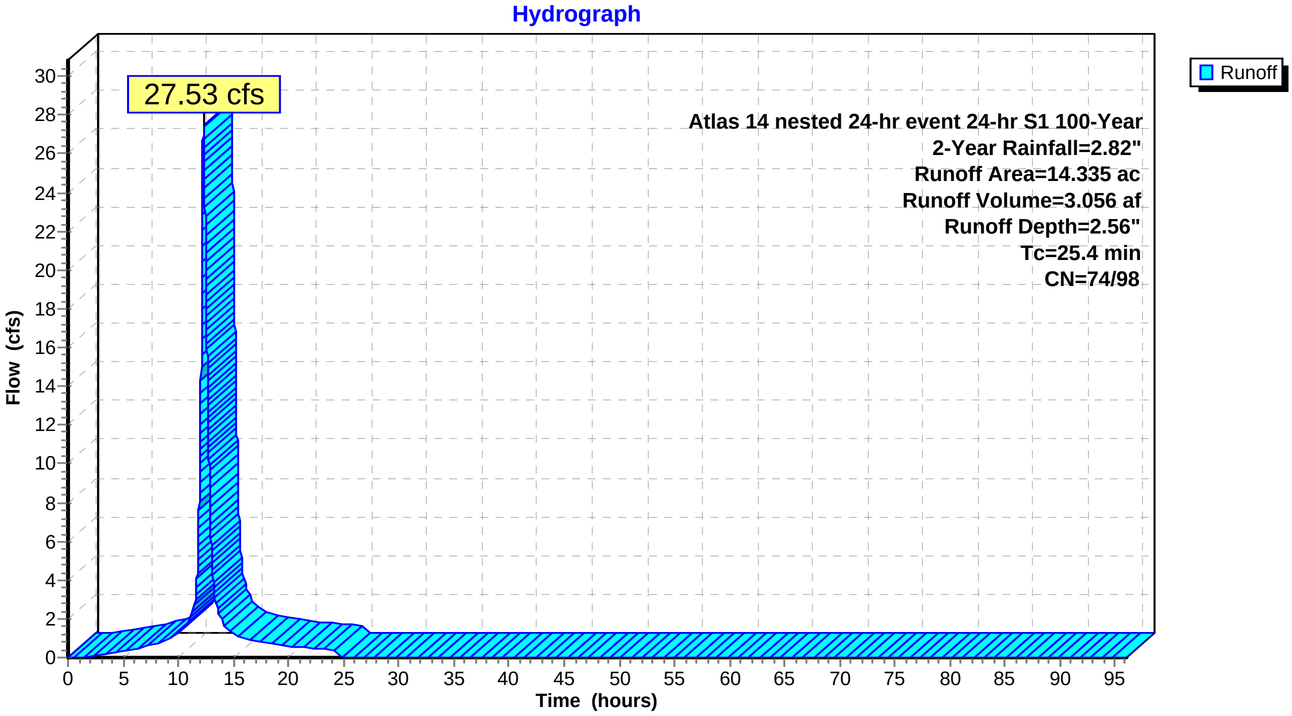
Runoff = 27.53 cfs @ 12.28 hrs, Volume= 3.056 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.248	74	pervious
*	14.087	98	impervious
	14.335	98	Weighted Average
	0.248		1.73% Pervious Area
	14.087		98.27% Impervious Area

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

Subcatchment SB 26: SB 26



Summary for Subcatchment SB 27: SB 27 (Thumb Road)

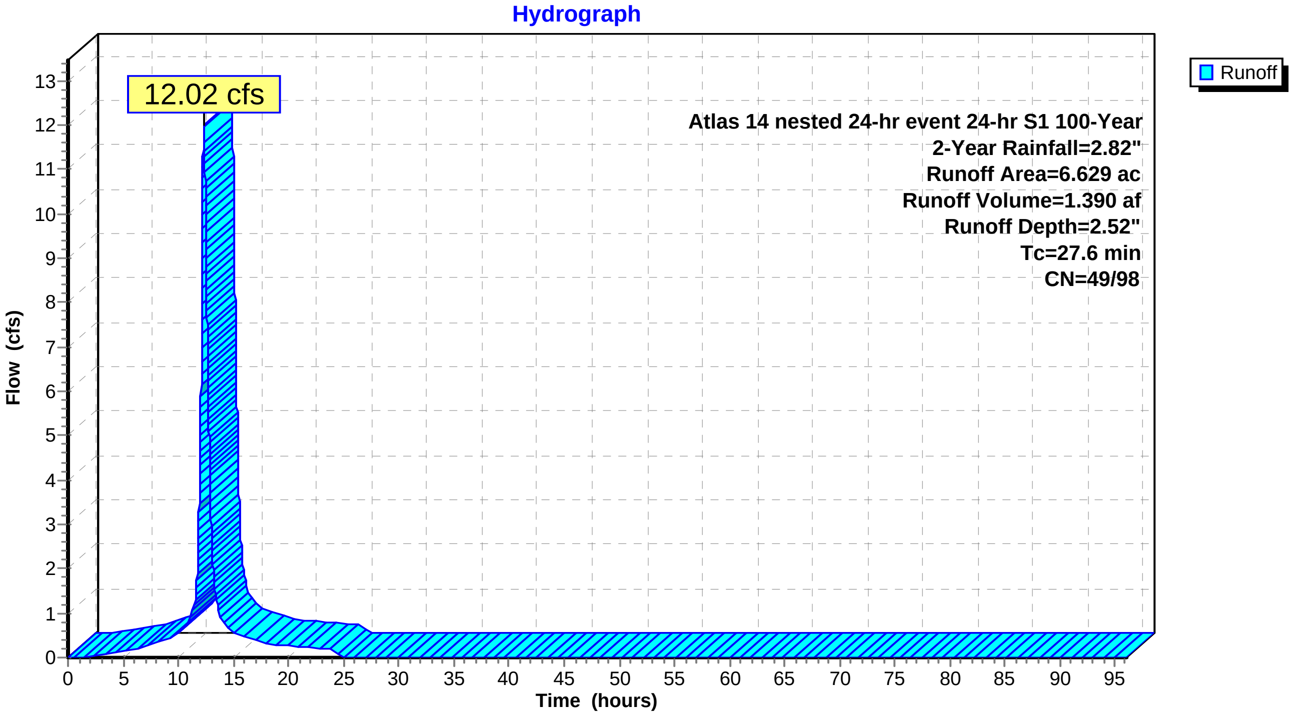
Runoff = 12.02 cfs @ 12.32 hrs, Volume= 1.390 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.191	49	Pervious
*	6.438	98	Impervious
	6.629	97	Weighted Average
	0.191		2.88% Pervious Area
	6.438		97.12% Impervious Area

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

Subcatchment SB 27: SB 27 (Thumb Road)



Summary for Subcatchment SB 28: SB 28

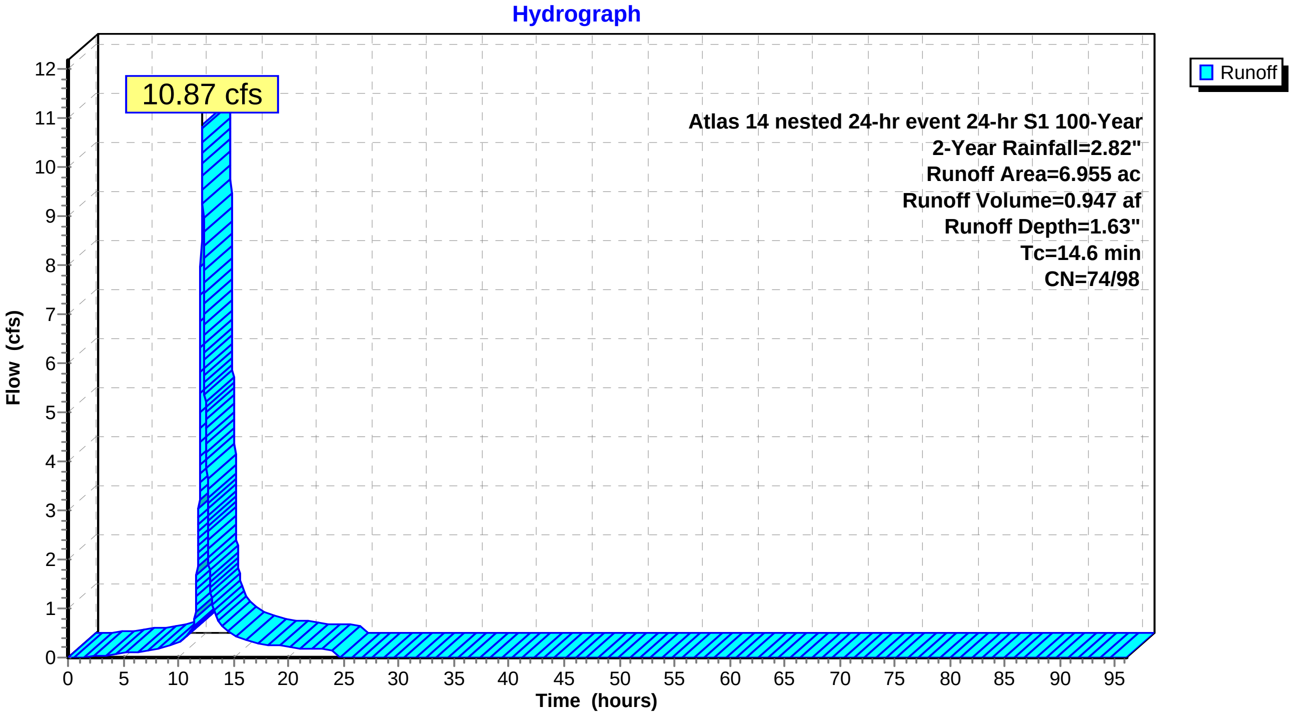
Runoff = 10.87 cfs @ 12.15 hrs, Volume= 0.947 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.703	74	pervious
*	3.252	98	impervious
	6.955	85	Weighted Average
	3.703		53.24% Pervious Area
	3.252		46.76% Impervious Area

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

Subcatchment SB 28: SB 28



Summary for Subcatchment SB 29: SB 29

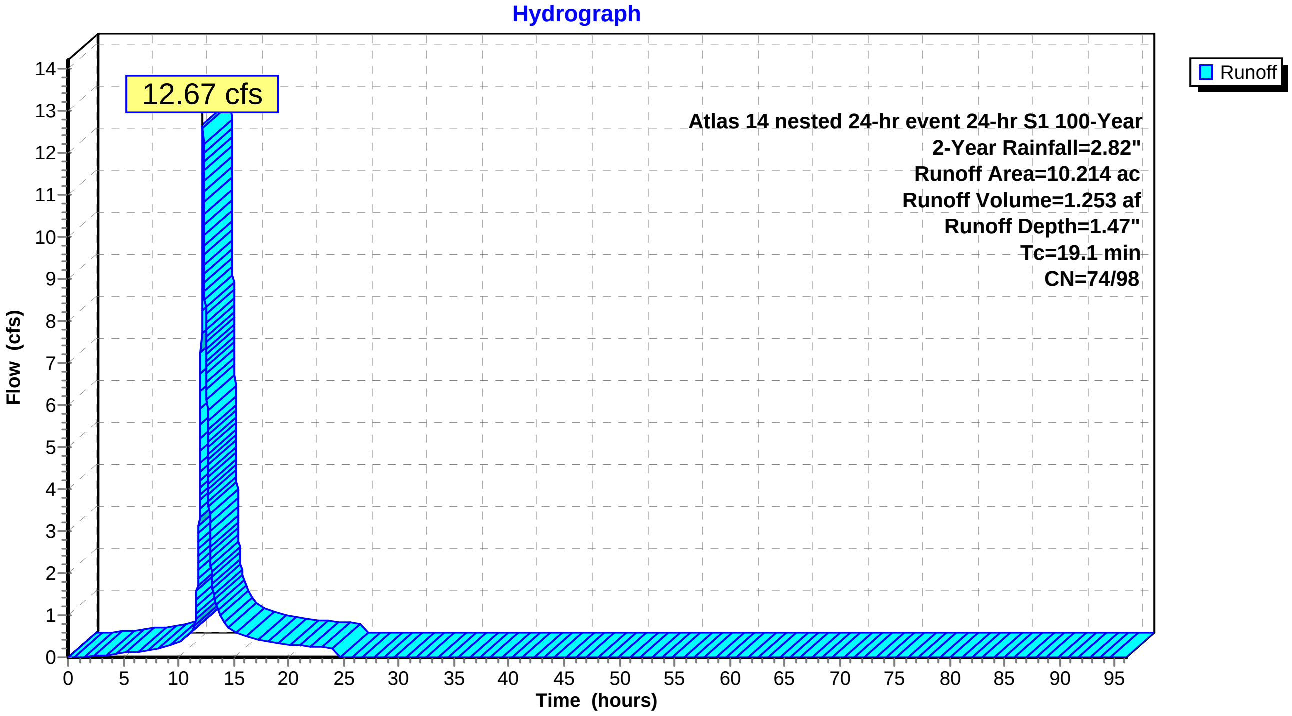
Runoff = 12.67 cfs @ 12.22 hrs, Volume= 1.253 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	6.360	74	pervious
*	3.854	98	impervious
	10.214	83	Weighted Average
	6.360		62.27% Pervious Area
	3.854		37.73% Impervious Area

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

Subcatchment SB 29: SB 29



Summary for Subcatchment SB 3: SB 3

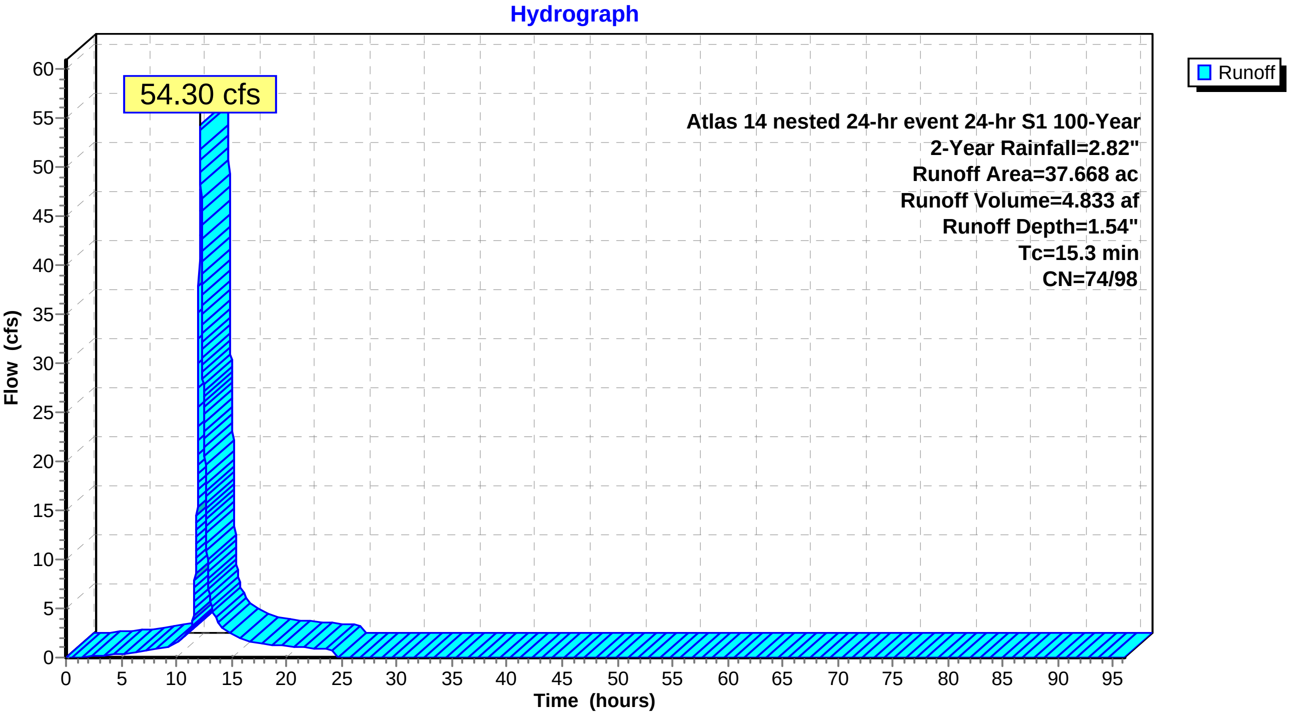
Runoff = 54.30 cfs @ 12.16 hrs, Volume= 4.833 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	22.050	74	Pervious
*	15.618	98	Impervious
	37.668	84	Weighted Average
	22.050		58.54% Pervious Area
	15.618		41.46% Impervious Area

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

Subcatchment SB 3: SB 3



Summary for Subcatchment SB 4: SB 4

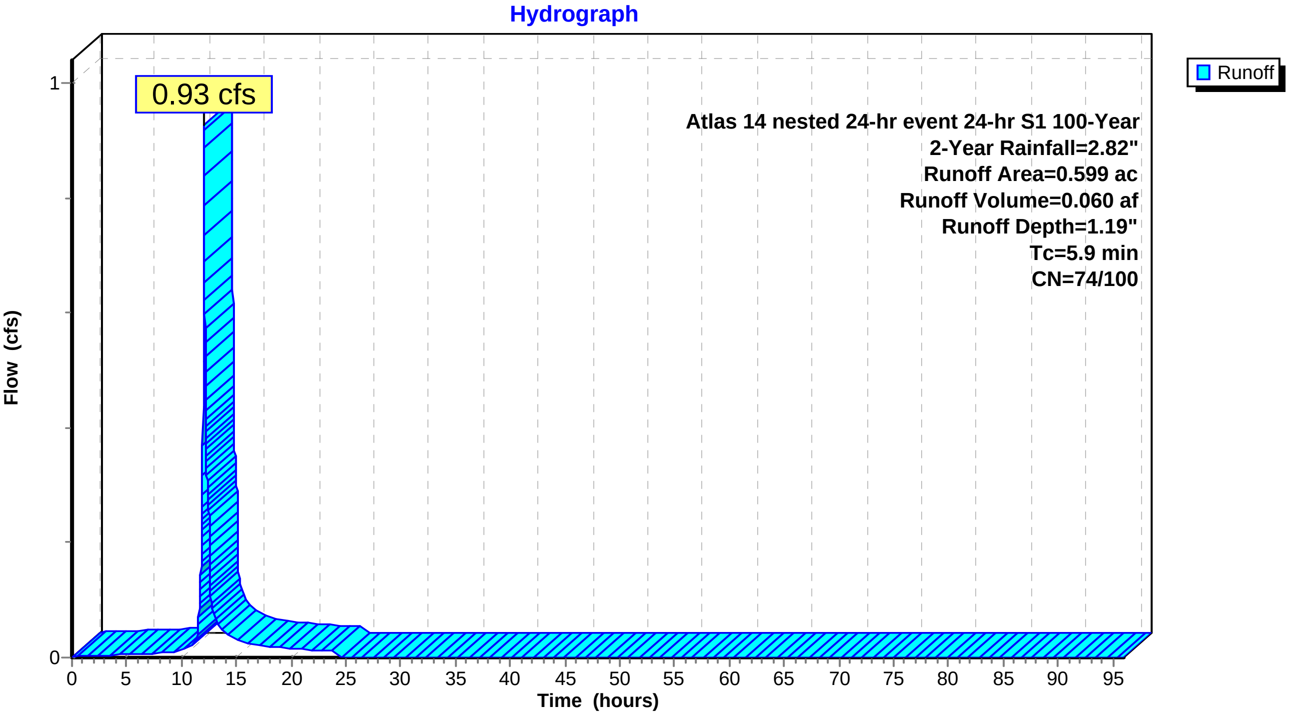
Runoff = 0.93 cfs @ 12.04 hrs, Volume= 0.060 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.481	74	pervious
*	0.118	100	impervious
	0.599	79	Weighted Average
	0.481		80.30% Pervious Area
	0.118		19.70% Impervious Area

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

Subcatchment SB 4: SB 4



Summary for Subcatchment SB 5: SB 5

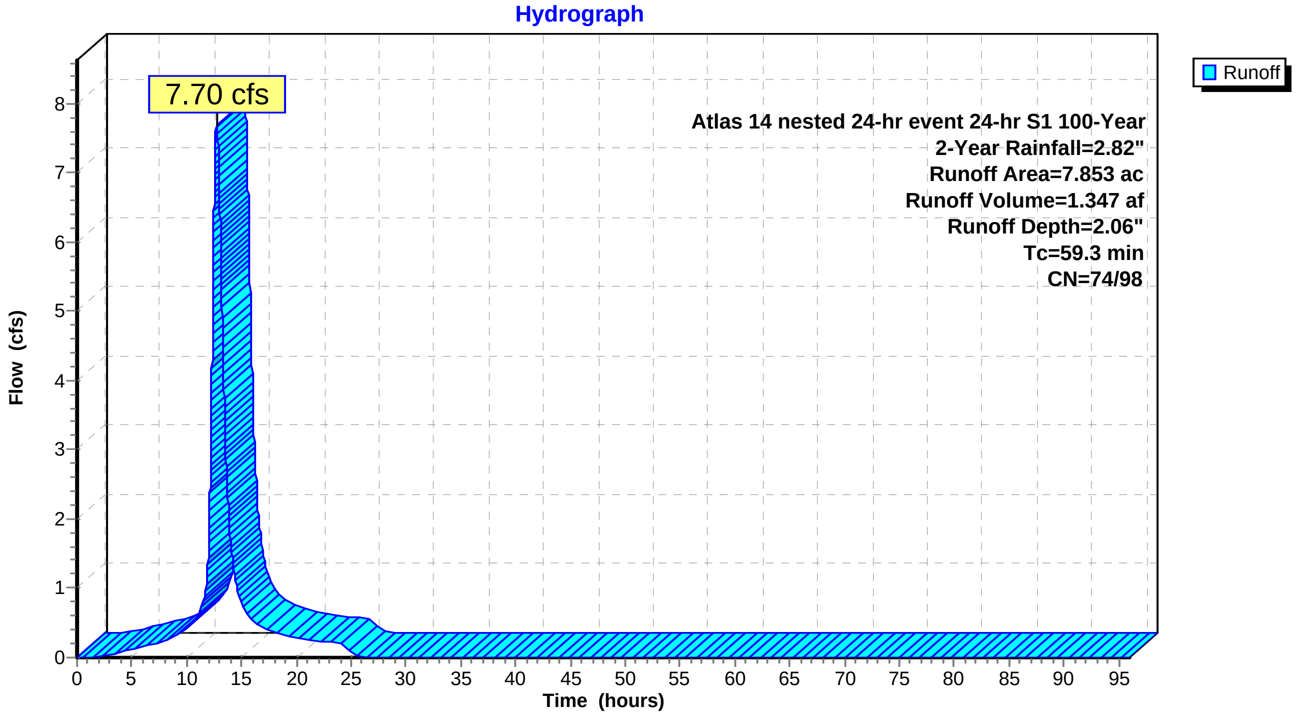
Runoff = 7.70 cfs @ 12.72 hrs, Volume= 1.347 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	2.327	74	pervious
*	5.526	98	impervious
	7.853	91	Weighted Average
	2.327		29.63% Pervious Area
	5.526		70.37% Impervious Area

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

Subcatchment SB 5: SB 5



Summary for Subcatchment SB 51: Offsite Subbasin 51

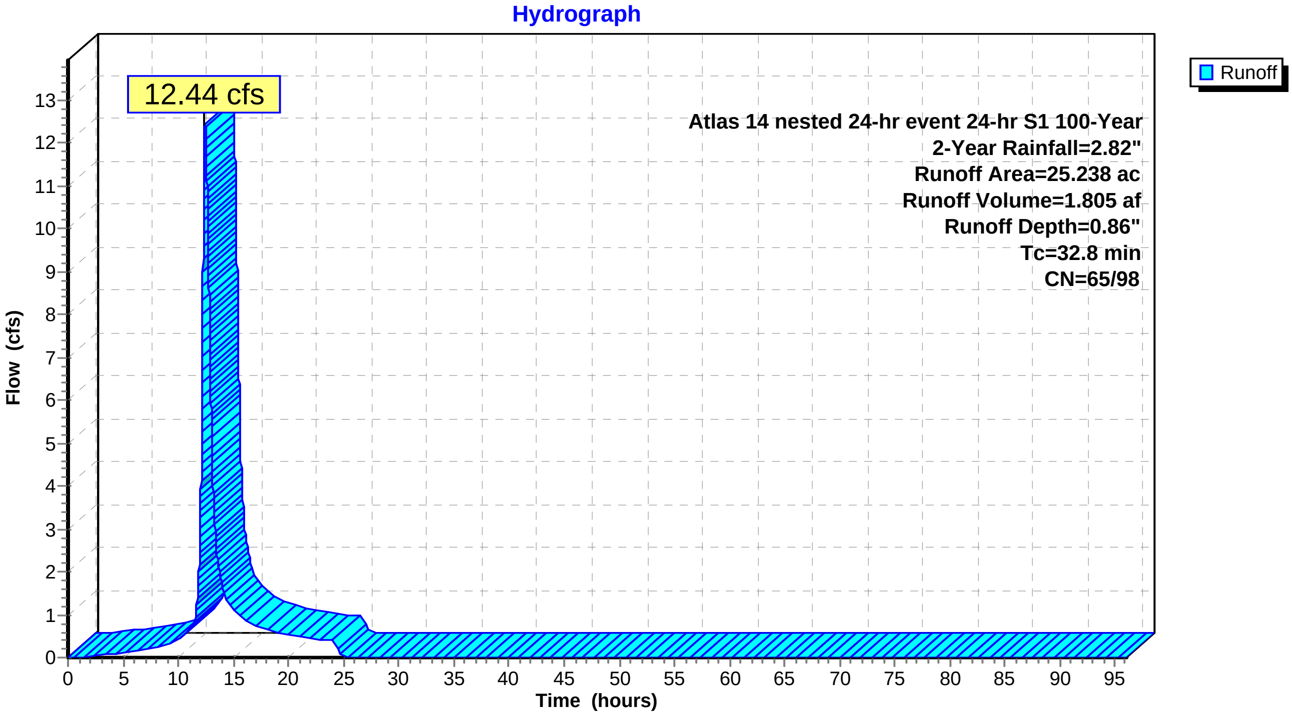
Runoff = 12.44 cfs @ 12.43 hrs, Volume= 1.805 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	20.200	65	Offsite subbasin 51
*	5.038	98	
	25.238	72	Weighted Average
	20.200		80.04% Pervious Area
	5.038		19.96% Impervious Area

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

Subcatchment SB 51: Offsite Subbasin 51



Summary for Subcatchment SB 6: SB 6

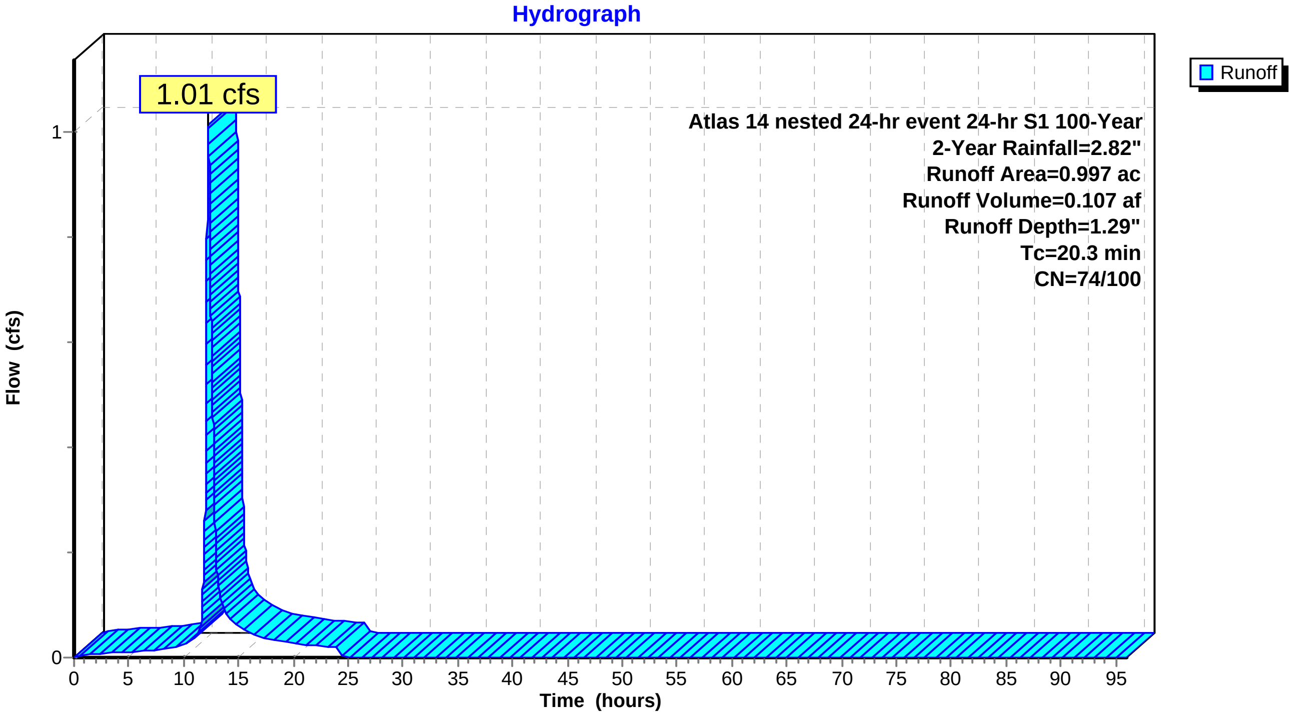
Runoff = 1.01 cfs @ 12.25 hrs, Volume= 0.107 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	0.753	74	pervious
*	0.244	100	impervious
	0.997	80	Weighted Average
	0.753		75.53% Pervious Area
	0.244		24.47% Impervious Area

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

Subcatchment SB 6: SB 6



Summary for Subcatchment SB 7: SB 7

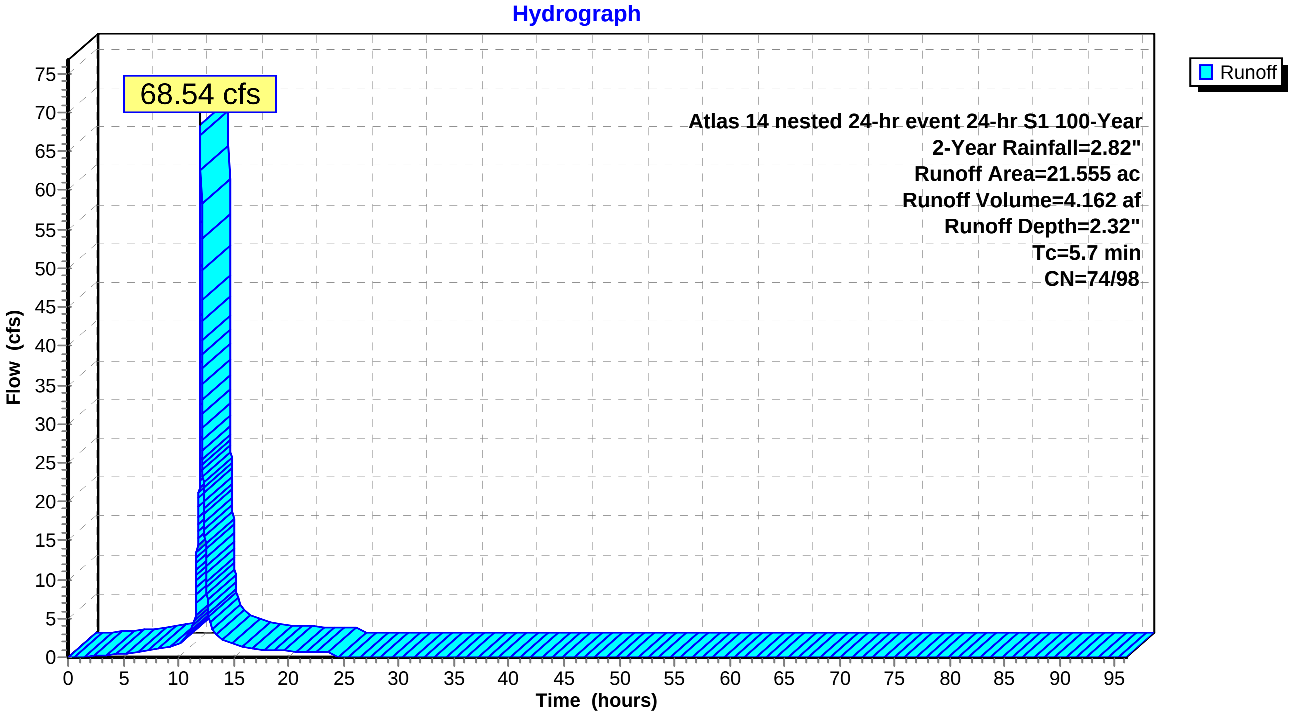
Runoff = 68.54 cfs @ 12.03 hrs, Volume= 4.162 af, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	3.269	74	pervious
*	18.286	98	impervious
	21.555	94	Weighted Average
	3.269		15.17% Pervious Area
	18.286		84.83% Impervious Area

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

Subcatchment SB 7: SB 7



Summary for Subcatchment SB 8: SB 8

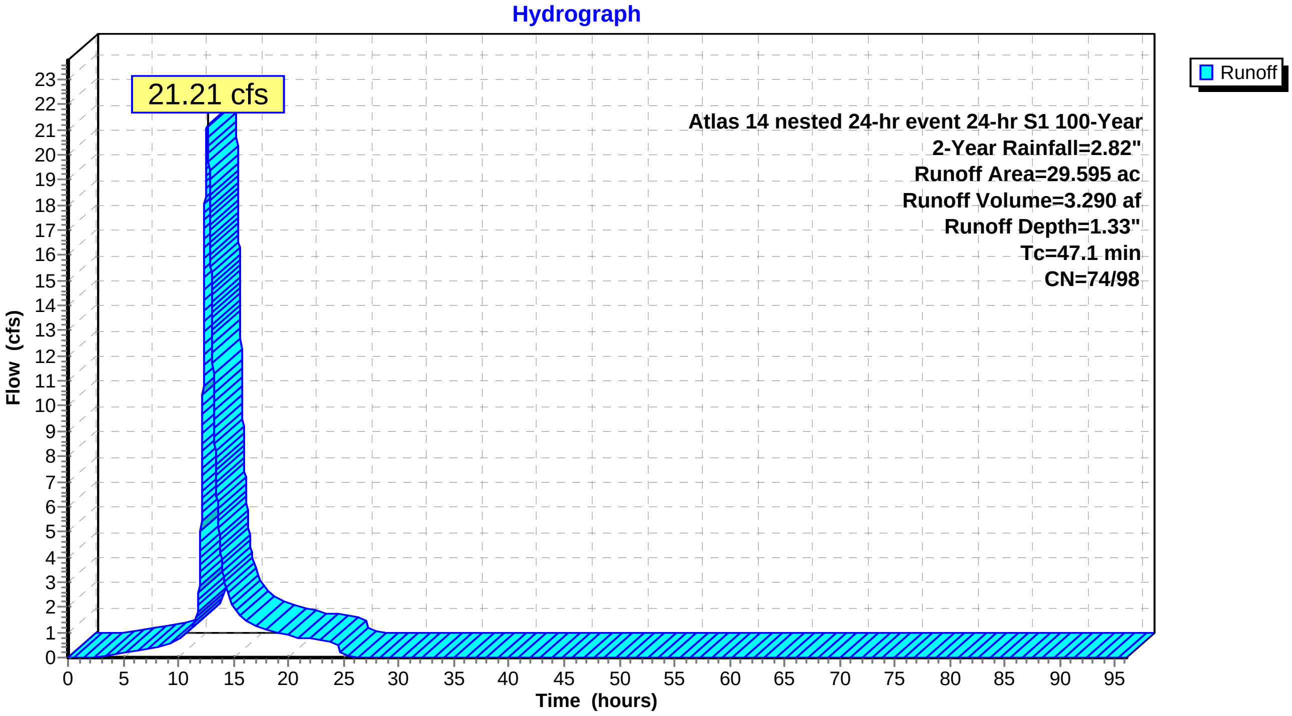
Runoff = 21.21 cfs @ 12.62 hrs, Volume= 3.290 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	20.714	74	pervious
*	8.881	98	impervious
	29.595	81	Weighted Average
	20.714		69.99% Pervious Area
	8.881		30.01% Impervious Area

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

Subcatchment SB 8: SB 8



Summary for Subcatchment SB 9: SB 9

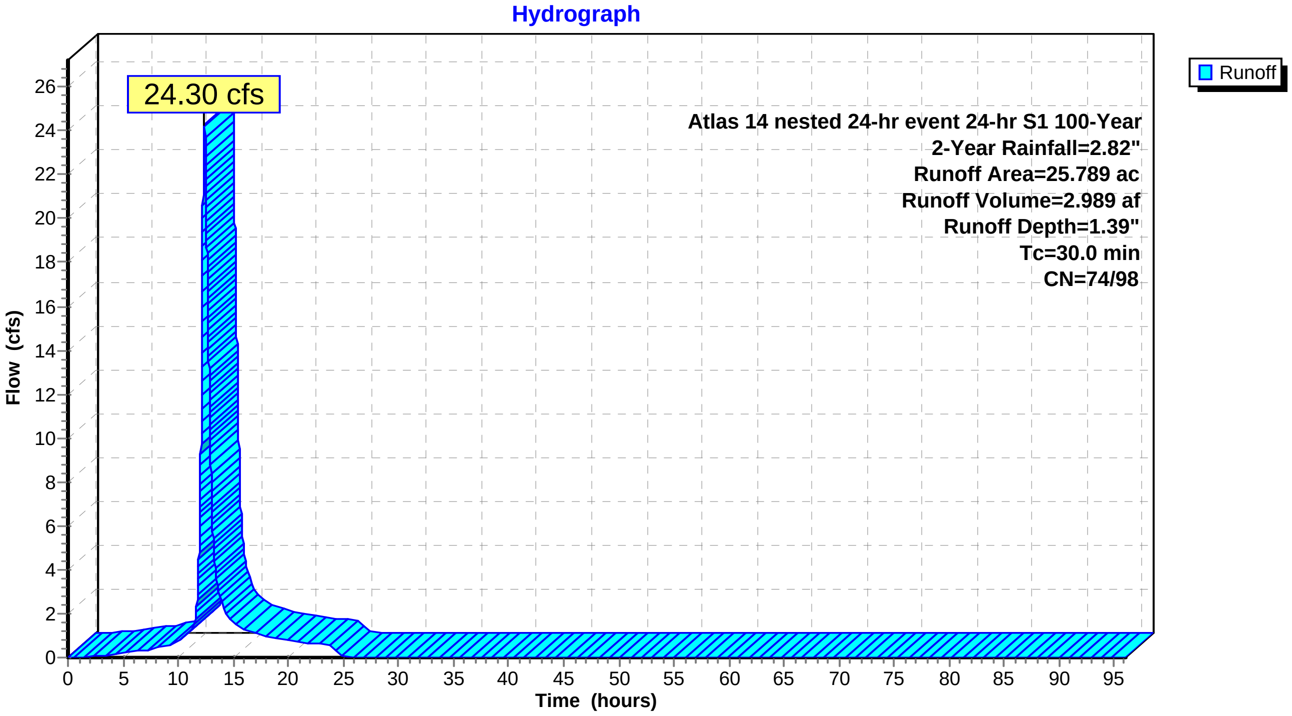
Runoff = 24.30 cfs @ 12.37 hrs, Volume= 2.989 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 2-Year Rainfall=2.82"

	Area (ac)	CN	Description
*	17.234	74	permiable
*	8.555	98	impermiable
	25.789	82	Weighted Average
	17.234		66.83% Pervious Area
	8.555		33.17% Impervious Area

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

Subcatchment SB 9: SB 9



Summary for Pond 3P: P-3

Inflow Area = 133.365 ac, 58.87% Impervious, Inflow Depth = 1.60" for 2-Year event
Inflow = 90.72 cfs @ 12.04 hrs, Volume= 17.776 af
Outflow = 46.80 cfs @ 13.14 hrs, Volume= 17.759 af, Atten= 48%, Lag= 65.7 min
Primary = 46.80 cfs @ 13.14 hrs, Volume= 17.759 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 914.00' Surf.Area= 1.790 ac Storage= 5.827 af
Peak Elev= 916.51' @ 13.14 hrs Surf.Area= 2.310 ac Storage= 11.001 af (5.175 af above start)

Plug-Flow detention time= 520.8 min calculated for 11.932 af (67% of inflow)
Center-of-Mass det. time= 182.4 min (1,098.7 - 916.3)

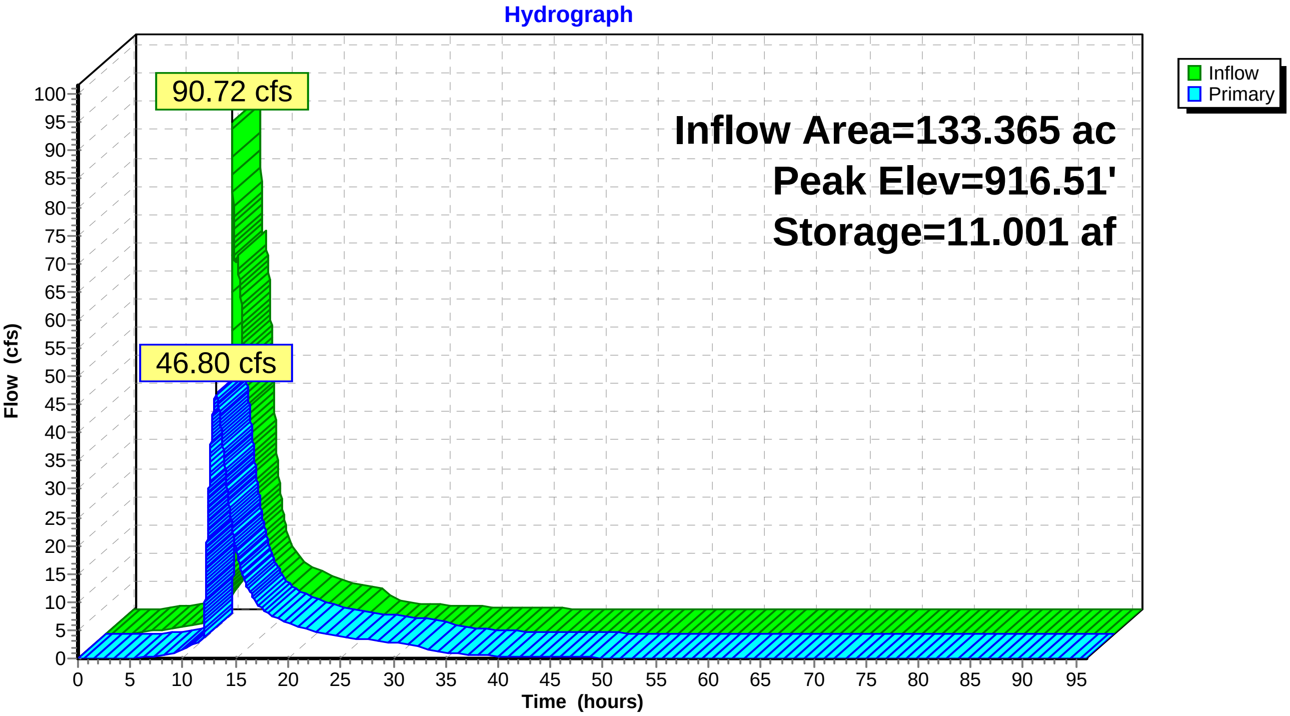
Volume	Invert	Avail.Storage	Storage Description
#1	909.85'	20.423 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
909.85	1.130	0.000	0.000
912.00	1.360	2.677	2.677
916.00	2.220	7.160	9.837
918.00	2.570	4.790	14.627
920.10	2.950	5.796	20.423

Device	Routing	Invert	Outlet Devices
#1	Primary	914.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	918.25'	**10.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	915.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=46.80 cfs @ 13.14 hrs HW=916.51' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 6.00 cfs @ 7.63 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
3=Sharp-Crested Rectangular Weir (Weir Controls 40.80 cfs @ 4.02 fps)

Pond 3P: P-3


Hydrograph
90.72 cfs
46.80 cfs
Inflow Area=133.365 ac
Peak Elev=916.51'
Storage=11.001 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 4P: P-4

Inflow Area = 7.853 ac, 70.37% Impervious, Inflow Depth = 2.06" for 2-Year event
Inflow = 7.70 cfs @ 12.72 hrs, Volume= 1.347 af
Outflow = 3.83 cfs @ 13.38 hrs, Volume= 1.347 af, Atten= 50%, Lag= 39.6 min
Primary = 1.52 cfs @ 13.40 hrs, Volume= 0.485 af
Secondary = 2.32 cfs @ 13.33 hrs, Volume= 0.862 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.275 ac Storage= 0.646 af
Peak Elev= 916.23' @ 13.40 hrs Surf.Area= 0.344 ac Storage= 1.025 af (0.379 af above start)

Plug-Flow detention time= 321.5 min calculated for 0.701 af (52% of inflow)
Center-of-Mass det. time= 59.9 min (880.2 - 820.3)

Volume	Invert	Avail.Storage	Storage Description
#1	910.90'	1.728 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

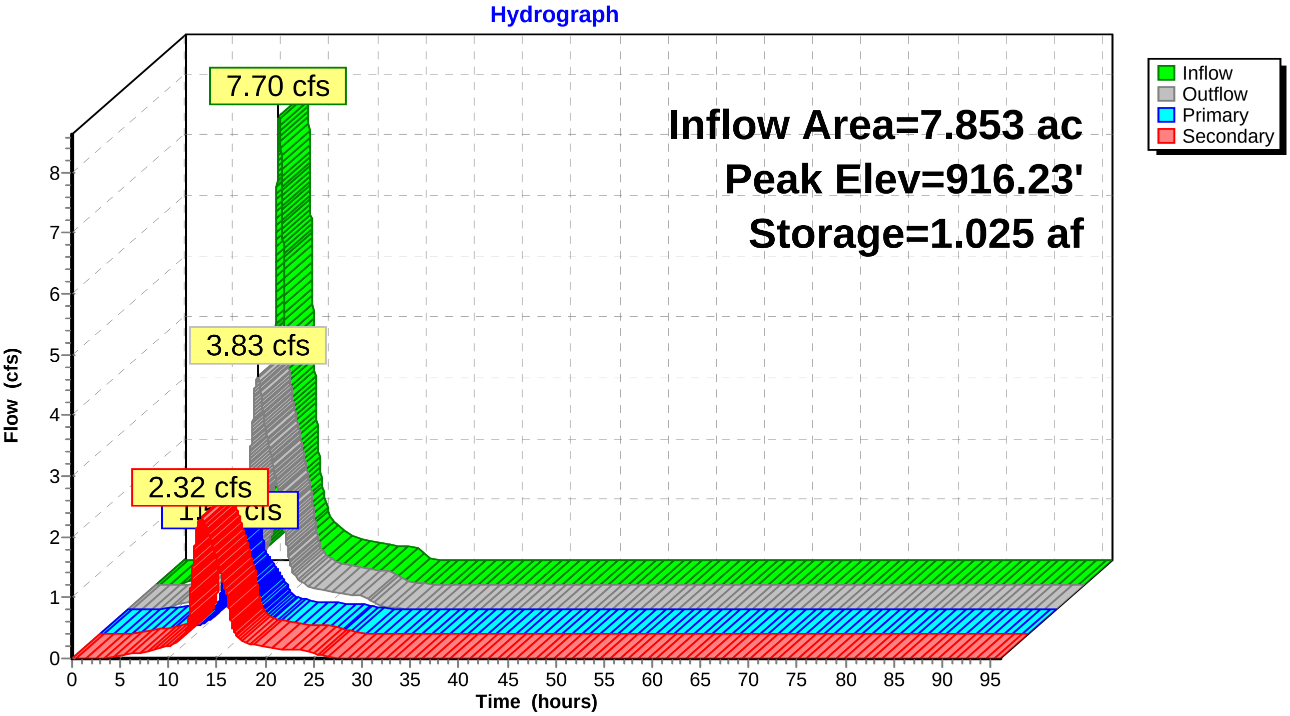
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.90	0.070	0.000	0.000
912.00	0.090	0.088	0.088
914.00	0.220	0.310	0.398
916.00	0.330	0.550	0.948
918.00	0.450	0.780	1.728

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	915.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	915.95'	**24.0" Round RCP_Round 24"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 915.80' / 915.95' S= -0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=1.52 cfs @ 13.40 hrs HW=916.23' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 1.05 cfs @ 5.34 fps)
└─**3=RCP_Round 24"** (Barrel Controls 0.47 cfs @ 1.43 fps)

Secondary OutFlow Max=2.32 cfs @ 13.33 hrs HW=916.22' TW=915.04' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 2.32 cfs @ 5.24 fps)

Pond 4P: P-4


Hydrograph
7.70 cfs
3.83 cfs
2.32 cfs
cfs
Inflow Area=7.853 ac
Peak Elev=916.23'
Storage=1.025 af
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
3
4
5
6
7
8
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond 7P: P-7

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 29.595 ac, 30.01% Impervious, Inflow Depth = 1.33" for 2-Year event
Inflow = 21.21 cfs @ 12.62 hrs, Volume= 3.290 af
Outflow = 21.61 cfs @ 12.68 hrs, Volume= 3.290 af, Atten= 0%, Lag= 3.6 min
Primary = 21.61 cfs @ 12.68 hrs, Volume= 3.290 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.440 ac Storage= 1.062 af
Peak Elev= 915.39' @ 12.60 hrs Surf.Area= 0.486 ac Storage= 1.241 af (0.179 af above start)

Plug-Flow detention time= 198.2 min calculated for 2.228 af (68% of inflow)
Center-of-Mass det. time= 11.5 min (853.5 - 842.0)

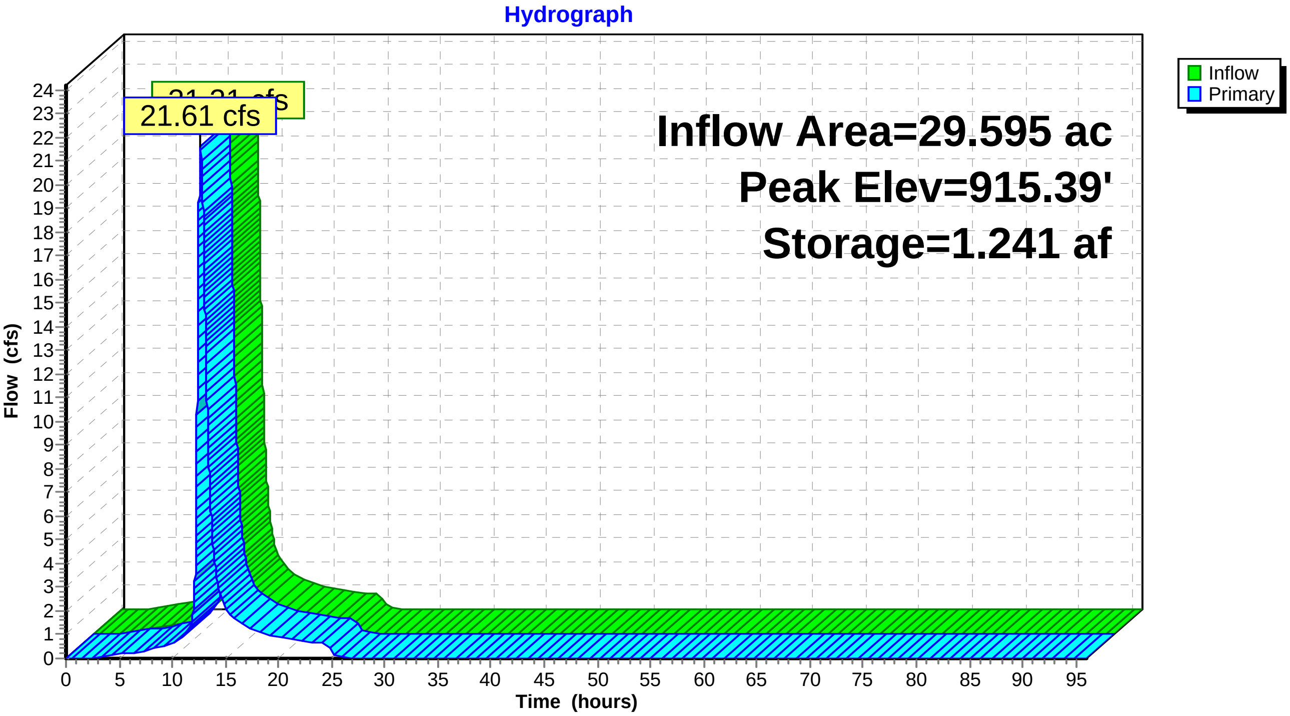
Volume	Invert	Avail.Storage	Storage Description
#1	910.95'	2.122 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.95	0.110	0.000	0.000
912.00	0.180	0.152	0.152
914.00	0.340	0.520	0.672
915.00	0.440	0.390	1.062
916.00	0.560	0.500	1.562
917.00	0.560	0.560	2.122

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**75.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=21.88 cfs @ 12.68 hrs HW=915.38' TW=915.34' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 21.88 cfs @ 0.76 fps)

Pond 7P: P-7


Hydrograph
21.31 cfs
21.61 cfs
Inflow Area=29.595 ac
Peak Elev=915.39'
Storage=1.241 af
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 9P: P-9

Inflow Area =	55.384 ac, 31.48% Impervious, Inflow Depth = 1.36" for 2-Year event			
Inflow =	41.03 cfs @	12.51 hrs, Volume=	6.280 af	
Outflow =	40.96 cfs @	12.53 hrs, Volume=	6.280 af,	Atten= 0%, Lag= 1.3 min
Primary =	40.96 cfs @	12.53 hrs, Volume=	6.280 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.210 ac Storage= 0.353 af
Peak Elev= 915.35' @ 12.53 hrs Surf.Area= 0.280 ac Storage= 0.439 af (0.086 af above start)

Plug-Flow detention time= 58.4 min calculated for 5.927 af (94% of inflow)
Center-of-Mass det. time= 2.7 min (841.3 - 838.6)

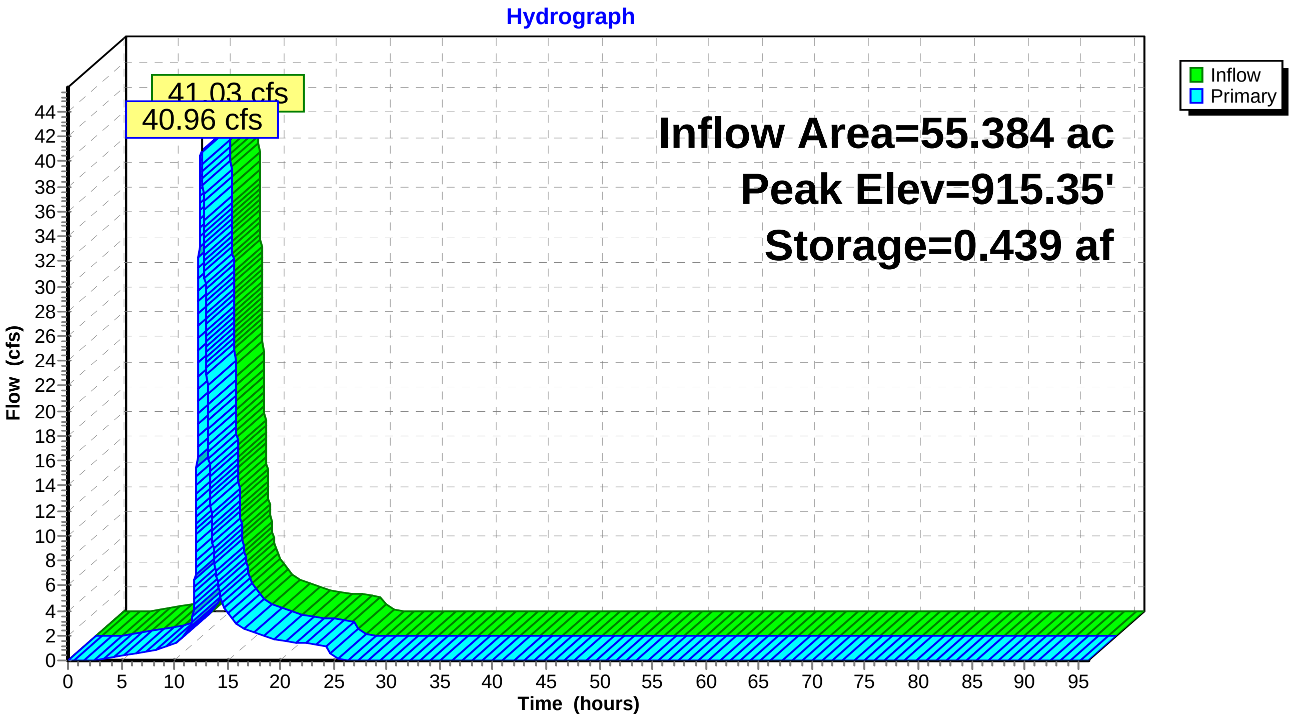
Volume	Invert	Avail.Storage	Storage Description
#1	910.50'	1.673 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.50	0.020	0.000	0.000
912.00	0.050	0.052	0.052
913.00	0.070	0.060	0.112
914.00	0.100	0.085	0.198
915.00	0.210	0.155	0.353
916.00	0.410	0.310	0.662
918.00	0.600	1.010	1.673

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**80.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=40.96 cfs @ 12.53 hrs HW=915.35' TW=910.20' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 40.96 cfs @ 1.46 fps)

Pond 9P: P-9


Hydrograph
41.03 cfs
40.96 cfs
Inflow Area=55.384 ac
Peak Elev=915.35'
Storage=0.439 af
Inflow
Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 10P: P-10

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 66.448 ac, 29.37% Impervious, Inflow Depth = 1.01" for 2-Year event
Inflow = 14.23 cfs @ 13.20 hrs, Volume= 5.606 af
Outflow = 13.43 cfs @ 13.49 hrs, Volume= 5.605 af, Atten= 6%, Lag= 17.0 min
Primary = 11.01 cfs @ 13.49 hrs, Volume= 5.505 af
Secondary = 2.42 cfs @ 13.49 hrs, Volume= 0.100 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 896.00' Surf.Area= 0.290 ac Storage= 0.700 af
Peak Elev= 897.48' @ 13.49 hrs Surf.Area= 0.351 ac Storage= 1.172 af (0.472 af above start)

Plug-Flow detention time= 174.3 min calculated for 4.905 af (87% of inflow)
Center-of-Mass det. time= 38.1 min (1,034.5 - 996.4)

Volume	Invert	Avail.Storage	Storage Description
#1	892.00'	1.760 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

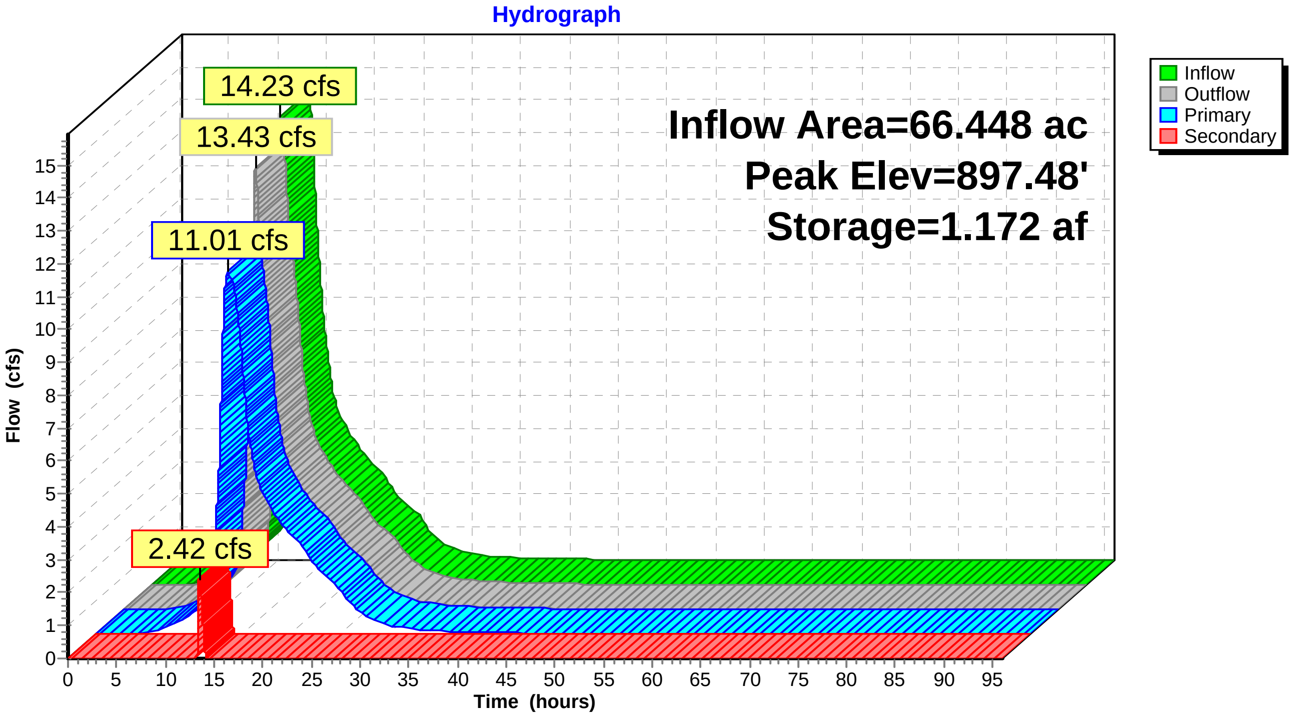
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
892.00	0.120	0.000	0.000
893.00	0.140	0.130	0.130
895.00	0.190	0.330	0.460
896.00	0.290	0.240	0.700
897.00	0.330	0.310	1.010
899.00	0.420	0.750	1.760

Device	Routing	Invert	Outlet Devices
#1	Primary	896.00'	**2.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	897.40'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=11.01 cfs @ 13.49 hrs HW=897.48' TW=893.73' (Dynamic Tailwater)
└─**1=Sharp-Crested Rectangular Weir** (Orifice Controls 11.01 cfs @ 4.79 fps)

Secondary OutFlow Max=2.42 cfs @ 13.49 hrs HW=897.48' TW=893.73' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.42 cfs @ 0.64 fps)

Pond 10P: P-10


Hydrograph
14.23 cfs
13.43 cfs
11.01 cfs
2.42 cfs
Inflow Area=66.448 ac
Peak Elev=897.48'
Storage=1.172 af
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 11P: P-11

Inflow Area = 58.677 ac, 31.52% Impervious, Inflow Depth = 1.37" for 2-Year event
Inflow = 42.67 cfs @ 12.52 hrs, Volume= 6.677 af
Outflow = 17.07 cfs @ 13.25 hrs, Volume= 6.675 af, Atten= 60%, Lag= 43.7 min
Primary = 13.46 cfs @ 13.25 hrs, Volume= 4.943 af
Secondary = 3.61 cfs @ 13.25 hrs, Volume= 1.732 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 909.00' Surf.Area= 1.210 ac Storage= 3.640 af
Peak Elev= 910.94' @ 13.25 hrs Surf.Area= 1.433 ac Storage= 6.202 af (2.562 af above start)

Plug-Flow detention time= 498.3 min calculated for 3.035 af (45% of inflow)
Center-of-Mass det. time= 141.9 min (979.8 - 837.9)

Volume	Invert	Avail.Storage	Storage Description
#1	905.00'	9.405 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

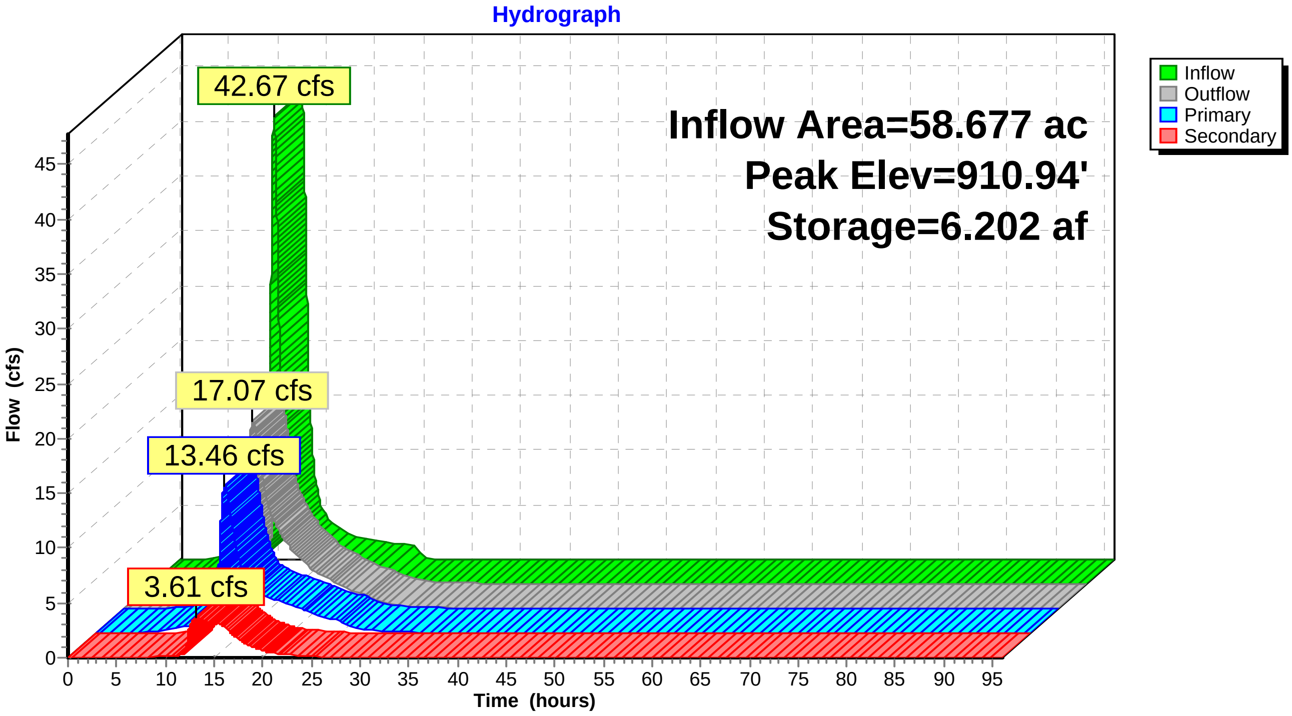
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
905.00	0.760	0.000	0.000
906.00	0.820	0.790	0.790
908.00	0.950	1.770	2.560
909.00	1.210	1.080	3.640
910.00	1.320	1.265	4.905
912.00	1.560	2.880	7.785
913.00	1.680	1.620	9.405

Device	Routing	Invert	Outlet Devices
#1	Primary	909.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#4	Primary	912.00'	**60.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#5	Secondary	909.00'	**12.0" Round RCP_Round 12"** L= 150.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 909.00' / 908.00' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=13.46 cfs @ 13.25 hrs HW=910.94' TW=897.39' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 5.27 cfs @ 6.71 fps)
2=RCP_Round 24" (Barrel Controls 4.09 cfs @ 4.13 fps)
3=RCP_Round 24" (Barrel Controls 4.09 cfs @ 4.13 fps)
4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=3.61 cfs @ 13.25 hrs HW=910.94' TW=908.55' (Dynamic Tailwater)
5=RCP_Round 12" (Barrel Controls 3.61 cfs @ 4.60 fps)

Pond 11P: P-11



Summary for Pond 12P: P-12

Inflow Area = 79.658 ac, 31.13% Impervious, Inflow Depth > 1.36" for 2-Year event
Inflow = 25.40 cfs @ 12.02 hrs, Volume= 9.002 af
Outflow = 12.77 cfs @ 14.53 hrs, Volume= 8.994 af, Atten= 50%, Lag= 150.3 min
Primary = 12.77 cfs @ 14.53 hrs, Volume= 8.994 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 893.00' Surf.Area= 1.640 ac Storage= 5.075 af
Peak Elev= 893.86' @ 14.53 hrs Surf.Area= 1.752 ac Storage= 6.533 af (1.458 af above start)

Plug-Flow detention time= 695.3 min calculated for 3.919 af (44% of inflow)
Center-of-Mass det. time= 112.9 min (1,150.3 - 1,037.3)

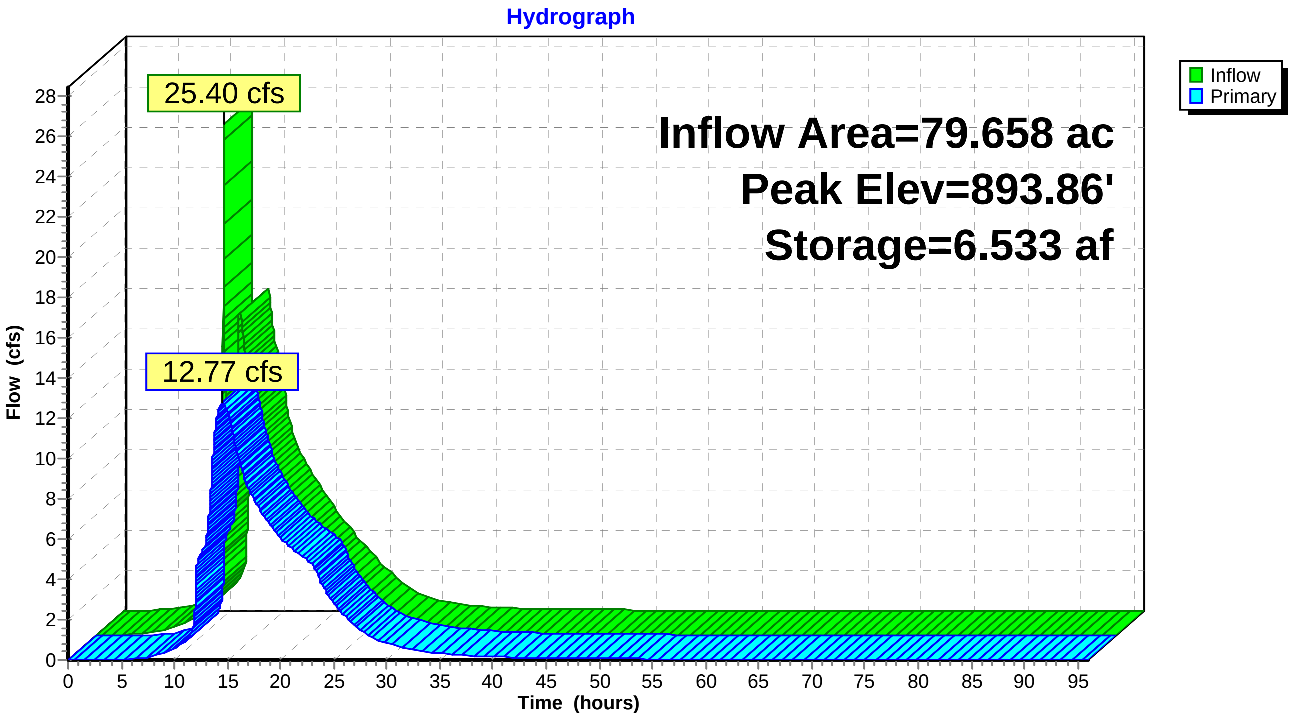
Volume	Invert	Avail.Storage	Storage Description
#1	889.00'	10.590 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
889.00	1.070	0.000	0.000
890.00	1.150	1.110	1.110
892.00	1.330	2.480	3.590
893.00	1.640	1.485	5.075
894.00	1.770	1.705	6.780
896.00	2.040	3.810	10.590

Device	Routing	Invert	Outlet Devices
#1	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#4	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#5	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#6	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf

Primary OutFlow Max=12.77 cfs @ 14.53 hrs HW=893.86' TW=883.34' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 3.51 cfs @ 4.47 fps)
- **2=Orifice/Grate** (Orifice Controls 3.51 cfs @ 4.47 fps)
- **3=RCP_Arch 44x27** (Barrel Controls 1.44 cfs @ 2.43 fps)
- **4=RCP_Arch 44x27** (Barrel Controls 1.44 cfs @ 2.43 fps)
- **5=RCP_Arch 44x27** (Barrel Controls 1.44 cfs @ 2.43 fps)
- **6=RCP_Arch 44x27** (Barrel Controls 1.44 cfs @ 2.43 fps)

Pond 12P: P-12



Summary for Pond 13P: P-13

```
Inflow Area =      237.893 ac, 51.59% Impervious, Inflow Depth =  1.55"   for 2-Year event
Inflow      =      197.71 cfs @  12.35 hrs, Volume=          30.805 af
Outflow     =      175.72 cfs @  12.52 hrs, Volume=          30.802 af, Atten= 11%, Lag= 9.9 min
Primary     =      165.33 cfs @  12.52 hrs, Volume=          29.381 af
Secondary =         10.39 cfs @  12.52 hrs, Volume=           1.421 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 883.00'  Surf.Area= 1.870 ac  Storage= 4.265 af
Peak Elev= 884.08' @ 12.52 hrs  Surf.Area= 2.250 ac  Storage= 6.493 af  (2.228 af above start)

Plug-Flow detention time= 160.9 min calculated for 26.537 af (86% of inflow)
Center-of-Mass det. time= 18.9 min ( 937.7 - 918.8 )

Volume      Invert   Avail.Storage  Storage Description
  #1       878.00'       11.490 af  Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation     Surf.Area       Inc.Store       Cum.Store
    (feet)       (acres)     (acre-feet)     (acre-feet)
    878.00         0.000           0.000           0.000
    879.00         0.630           0.315           0.315
    880.00         0.730           0.680           0.995
    882.00         1.070           1.800           2.795
    883.00         1.870           1.470           4.265
    884.00         2.220           2.045           6.310
    886.00         2.960           5.180          11.490

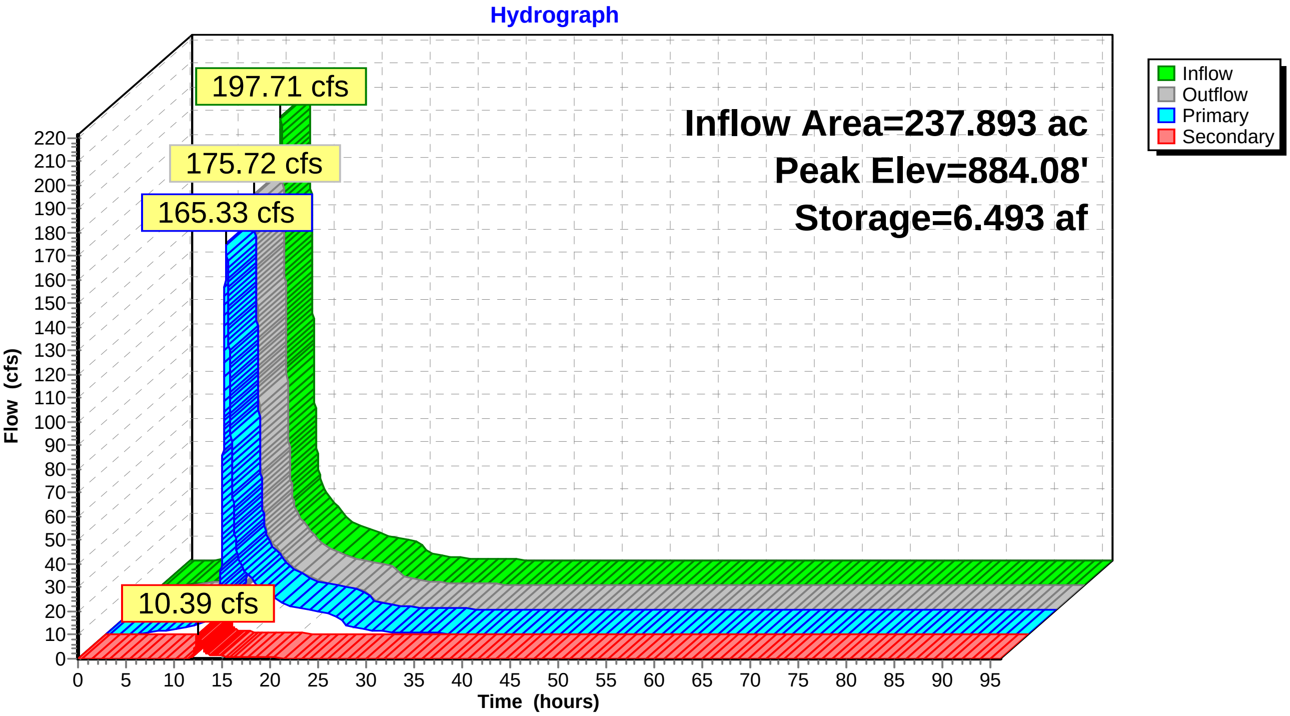
Device  Routing        Invert  Outlet Devices
   #1   Primary       883.00'  55.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                               Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                               2.50  3.00  3.50  4.00  4.50  5.00  5.50
                               Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                               2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88
   #2   Secondary     883.00'  12.0"  Round RCP_Round  12"
                               L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                               Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                               n= 0.013,  Flow Area= 0.79 sf
   #3   Secondary     883.00'  12.0"  Round RCP_Round  12"
                               L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                               Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                               n= 0.013,  Flow Area= 0.79 sf
   #4   Secondary     883.00'  12.0"  Round RCP_Round  12"
                               L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                               Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                               n= 0.013,  Flow Area= 0.79 sf
   #5   Secondary     883.00'  12.0"  Round RCP_Round  12"
                               L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                               Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                               n= 0.013,  Flow Area= 0.79 sf
   #6   Secondary     883.00'  12.0"  Round RCP_Round  12"
                               L= 100.0'   RCP, groove end projecting,  Ke= 0.200
```

Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=165.31 cfs @ 12.52 hrs HW=884.08' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 165.31 cfs @ 2.78 fps)

Secondary OutFlow Max=10.39 cfs @ 12.52 hrs HW=884.08' TW=882.93' (Dynamic Tailwater)
├─**2=RCP_Round 12"** (Barrel Controls 2.08 cfs @ 3.04 fps)
├─**3=RCP_Round 12"** (Barrel Controls 2.08 cfs @ 3.04 fps)
├─**4=RCP_Round 12"** (Barrel Controls 2.08 cfs @ 3.04 fps)
├─**5=RCP_Round 12"** (Barrel Controls 2.08 cfs @ 3.04 fps)
└─**6=RCP_Round 12"** (Barrel Controls 2.08 cfs @ 3.04 fps)

Pond 13P: P-13



Summary for Pond 14P: P-14

Inflow Area = 21.198 ac, 39.93% Impervious, Inflow Depth = 1.51" for 2-Year event
Inflow = 23.92 cfs @ 12.30 hrs, Volume= 2.671 af
Outflow = 3.68 cfs @ 13.21 hrs, Volume= 2.669 af, Atten= 85%, Lag= 54.4 min
Primary = 3.68 cfs @ 13.21 hrs, Volume= 2.669 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 892.00' Surf.Area= 1.380 ac Storage= 4.490 af
Peak Elev= 892.95' @ 13.21 hrs Surf.Area= 1.465 ac Storage= 5.837 af (1.347 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 239.6 min (1,049.8 - 810.2)

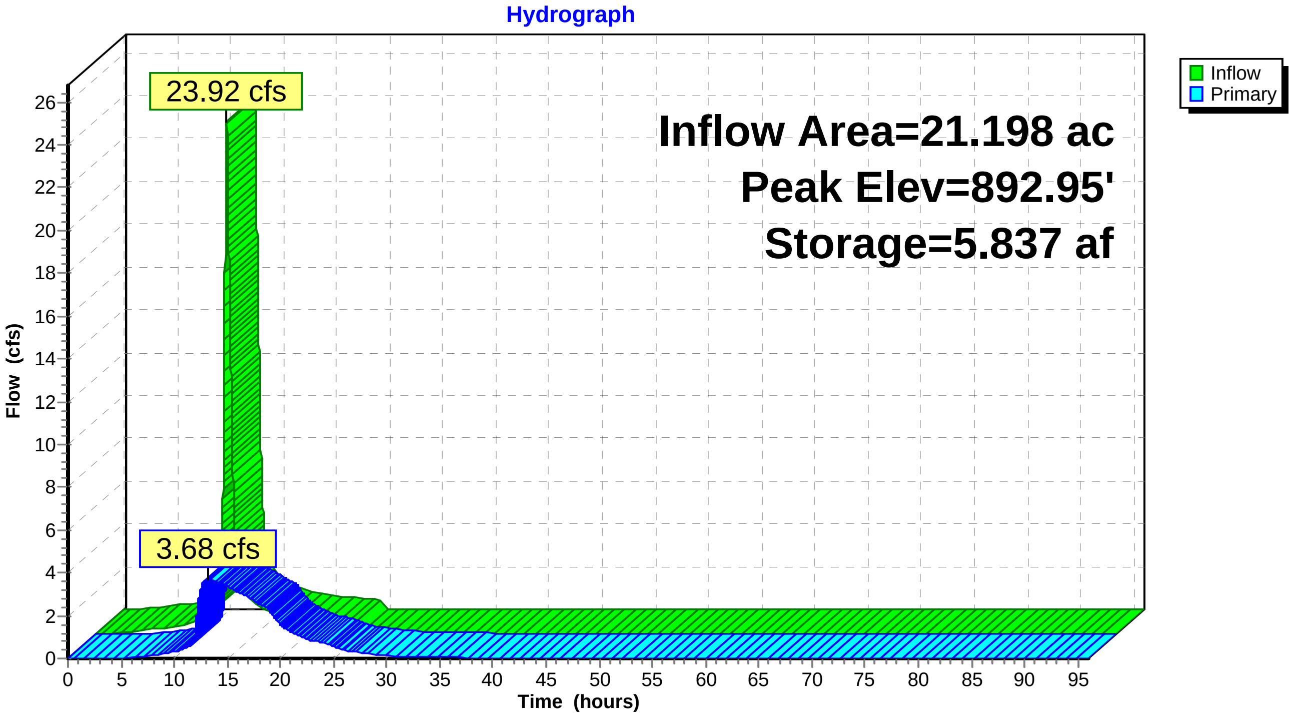
Volume	Invert	Avail.Storage	Storage Description
#1	888.00'	9.910 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
888.00	0.950	0.000	0.000
890.00	1.080	2.030	2.030
892.00	1.380	2.460	4.490
893.00	1.470	1.425	5.915
894.00	1.570	1.520	7.435
895.50	1.730	2.475	9.910

Device	Routing	Invert	Outlet Devices
#1	Primary	892.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 893.00' / 892.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=3.68 cfs @ 13.21 hrs HW=892.95' (Free Discharge)
1=Orifice/Grate (Orifice Controls 3.68 cfs @ 4.69 fps)
2=RCP_Round 18" (Controls 0.00 cfs)

Pond 14P: P-14


Hydrograph
23.92 cfs
3.68 cfs
Inflow Area=21.198 ac
Peak Elev=892.95'
Storage=5.837 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 23P: Thumb Infiltration (Thumb TP load only)

```
Inflow Area =        48.540 ac,  84.23% Impervious,  Inflow Depth =   2.19"    for  2-Year event
Inflow       =       62.51 cfs @   12.44 hrs,  Volume=           8.852 af
Outflow      =       61.16 cfs @   12.54 hrs,  Volume=           5.112 af,  Atten= 2%,  Lag= 5.6 min
Primary      =       61.16 cfs @   12.54 hrs,  Volume=           5.112 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.81' @ 12.54 hrs   Surf.Area= 1.000 ac   Storage= 3.810 af

Plug-Flow detention time= 214.4 min calculated for 5.112 af (58% of inflow)
Center-of-Mass det. time= 103.7 min (893.9 - 790.2)

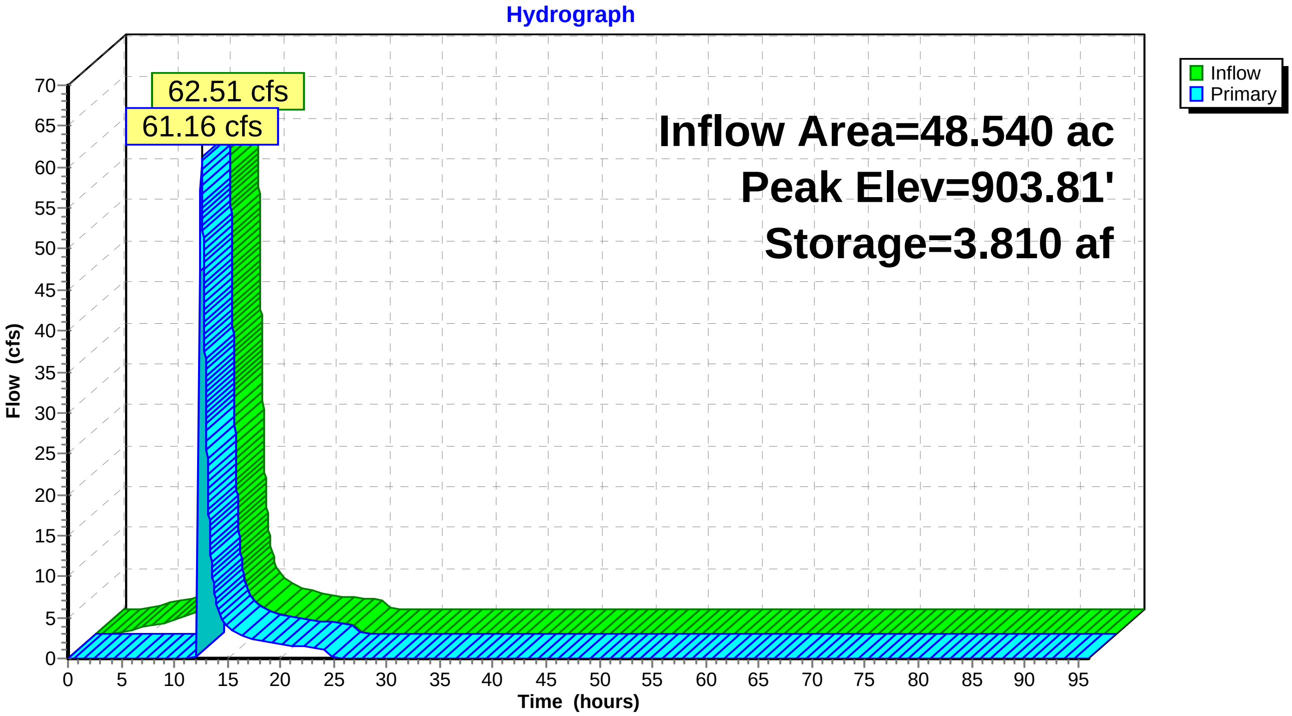
Volume	Invert	Avail.Storage	Storage Description
#1	900.00'	5.000 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
900.00	1.000	0.000	0.000
901.00	1.000	1.000	1.000
902.00	1.000	1.000	2.000
903.00	1.000	1.000	3.000
904.00	1.000	1.000	4.000
905.00	1.000	1.000	5.000

Device	Routing	Invert	Outlet Devices
#1	Primary	903.74'	**1,000.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=61.12 cfs @ 12.54 hrs HW=903.81'   (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Weir Controls 61.12 cfs @ 0.87 fps)

Pond 23P: Thumb Infiltration (Thumb TP load only)



Summary for Pond 31P: SB 18 Infiltration

Inflow Area = 52.908 ac, 84.55% Impervious, Inflow Depth = 2.31" for 2-Year event
Inflow = 79.77 cfs @ 12.40 hrs, Volume= 10.194 af
Outflow = 79.67 cfs @ 12.41 hrs, Volume= 6.874 af, Atten= 0%, Lag= 0.5 min
Primary = 79.67 cfs @ 12.41 hrs, Volume= 6.874 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.40' @ 12.41 hrs Surf.Area= 1.000 ac Storage= 3.403 af

Plug-Flow detention time= 178.8 min calculated for 6.873 af (67% of inflow)
Center-of-Mass det. time= 81.2 min (871.0 - 789.8)

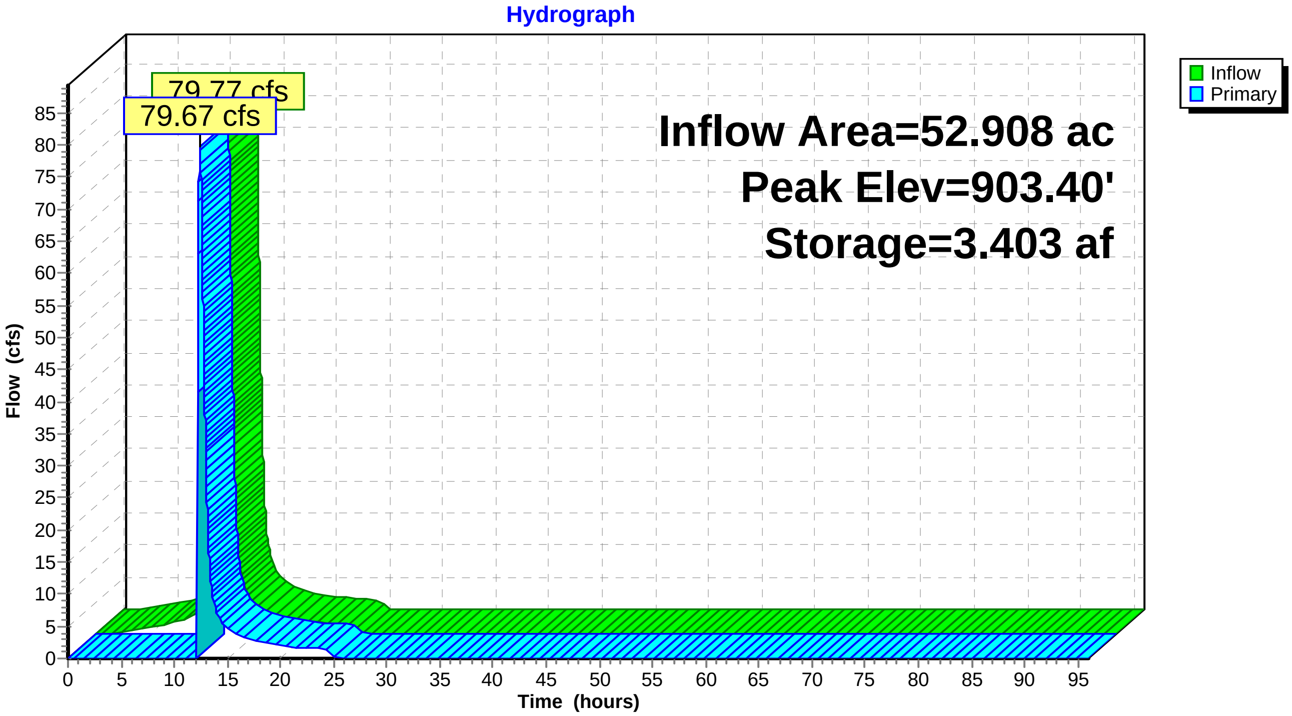
Volume	Invert	Avail.Storage	Storage Description
#1	900.00'	5.000 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
900.00	1.000	0.000	0.000
901.00	1.000	1.000	1.000
902.00	1.000	1.000	2.000
903.00	1.000	1.000	3.000
904.00	1.000	1.000	4.000
905.00	1.000	1.000	5.000

Device	Routing	Invert	Outlet Devices
#1	Primary	903.32'	**1,000.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.8' Crest Height

Primary OutFlow Max=79.65 cfs @ 12.41 hrs HW=903.40' TW=887.32' (Dynamic Tailwater)
└─**1=Sharp-Crested Rectangular Weir** (Weir Controls 79.65 cfs @ 0.96 fps)

Pond 31P: SB 18 Infiltration



Summary for Pond 36P: Culverts passing flow beneath Spine Road

```
[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =      52.908 ac, 84.55% Impervious, Inflow Depth =   1.56"   for  2-Year event
Inflow      =      79.67 cfs @  12.41 hrs, Volume=          6.874 af
Outflow     =      79.68 cfs @  12.40 hrs, Volume=          6.874 af, Atten= 0%, Lag= 0.0 min
Primary     =      79.68 cfs @  12.40 hrs, Volume=          6.874 af
Secondary =         0.00 cfs @   0.00 hrs, Volume=          0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 887.32' @ 12.40 hrs   Surf.Area= 0.002 ac   Storage= 0.000 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min ( 871.0 - 871.0 )

Volume       Invert    Avail.Storage   Storage Description
   #1       887.00'         0.025 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area         Inc.Store        Cum.Store
    (feet)        (acres)       (acre-feet)      (acre-feet)
    887.00          0.000             0.000            0.000
    887.50          0.003             0.001            0.001
    890.50          0.006             0.014            0.014
    892.00          0.009             0.011            0.025

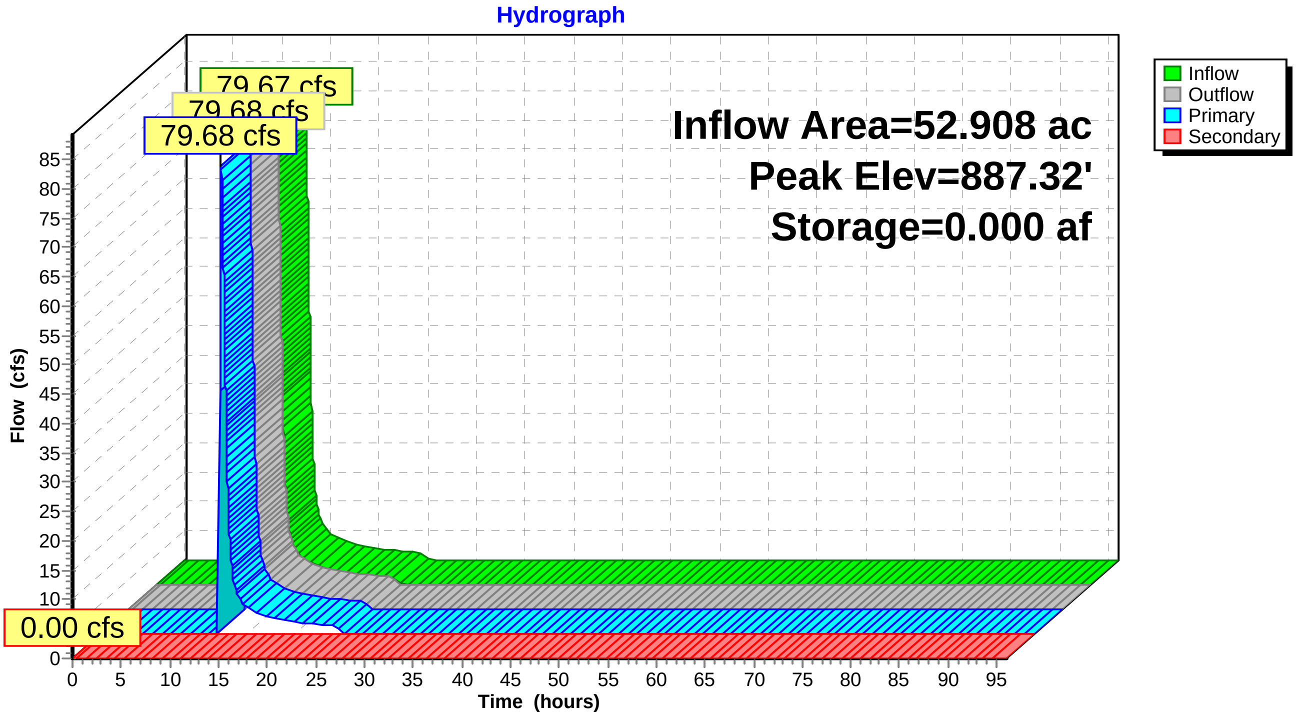
Device   Routing          Invert   Outlet Devices
   #1    Primary         887.00'   Special & User-Defined
                                   Head  (feet)  0.00  0.10  0.20  0.30  0.40  0.50  5.00
                                   Disch. (cfs)  0.000  25.000  50.000  75.000  100.000  125.000
                                   125.000
   #2    Secondary       887.50'   18.0"  Round RCP_Round  18"
                                   L= 100.0'   RCP, groove end w/headwall,  Ke= 0.200
                                   Inlet / Outlet Invert= 887.50' / 886.50'   S= 0.0100 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.77 sf
   #3    Secondary       887.50'   18.0"  Round RCP_Round  18"
                                   L= 100.0'   RCP, groove end w/headwall,  Ke= 0.200
                                   Inlet / Outlet Invert= 887.50' / 886.50'   S= 0.0100 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.77 sf
   #4    Secondary       887.50'   18.0"  Round RCP_Round  18"
                                   L= 100.0'   RCP, groove end w/headwall,  Ke= 0.200
                                   Inlet / Outlet Invert= 887.50' / 886.50'   S= 0.0100 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.77 sf
   #5    Secondary       887.50'   18.0"  Round RCP_Round  18"
                                   L= 100.0'   RCP, groove end w/headwall,  Ke= 0.200
                                   Inlet / Outlet Invert= 887.50' / 886.50'   S= 0.0100 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.77 sf
   #6    Secondary       887.50'   18.0"  Round RCP_Round  18"
                                   L= 100.0'   RCP, groove end w/headwall,  Ke= 0.200
                                   Inlet / Outlet Invert= 887.50' / 886.50'   S= 0.0100 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.77 sf
   #7    Secondary       887.50'   18.0"  Round RCP_Round  18"
```

			L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#8	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#9	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=79.65 cfs @ 12.40 hrs HW=887.32' TW=884.02' (Dynamic Tailwater)
└—**1=Special & User-Defined** (Custom Controls 79.65 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=887.00' TW=883.00' (Dynamic Tailwater)
├—**2=RCP_Round 18"** (Controls 0.00 cfs)
├—**3=RCP_Round 18"** (Controls 0.00 cfs)
├—**4=RCP_Round 18"** (Controls 0.00 cfs)
├—**5=RCP_Round 18"** (Controls 0.00 cfs)
├—**6=RCP_Round 18"** (Controls 0.00 cfs)
├—**7=RCP_Round 18"** (Controls 0.00 cfs)
├—**8=RCP_Round 18"** (Controls 0.00 cfs)
└—**9=RCP_Round 18"** (Controls 0.00 cfs)

Pond 36P: Culverts passing flow beneath Spine Road



Summary for Pond CRH-1: CRH-1

```
Inflow Area =        6.955 ac,  46.76% Impervious,  Inflow Depth =   1.63"    for  2-Year event
Inflow      =       10.87 cfs @   12.15 hrs,  Volume=            0.947 af
Outflow     =        4.80 cfs @   12.48 hrs,  Volume=            0.947 af,  Atten= 56%,  Lag= 19.6 min
Discarded   =        0.22 cfs @   12.48 hrs,  Volume=            0.471 af
Primary     =        4.58 cfs @   12.48 hrs,  Volume=            0.476 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 877.67' @ 12.48 hrs Surf.Area= 0.275 ac Storage= 0.354 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 270.2 min (1,064.9 - 794.7)

Volume	Invert	Avail.Storage	Storage Description
#1	876.00'	0.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

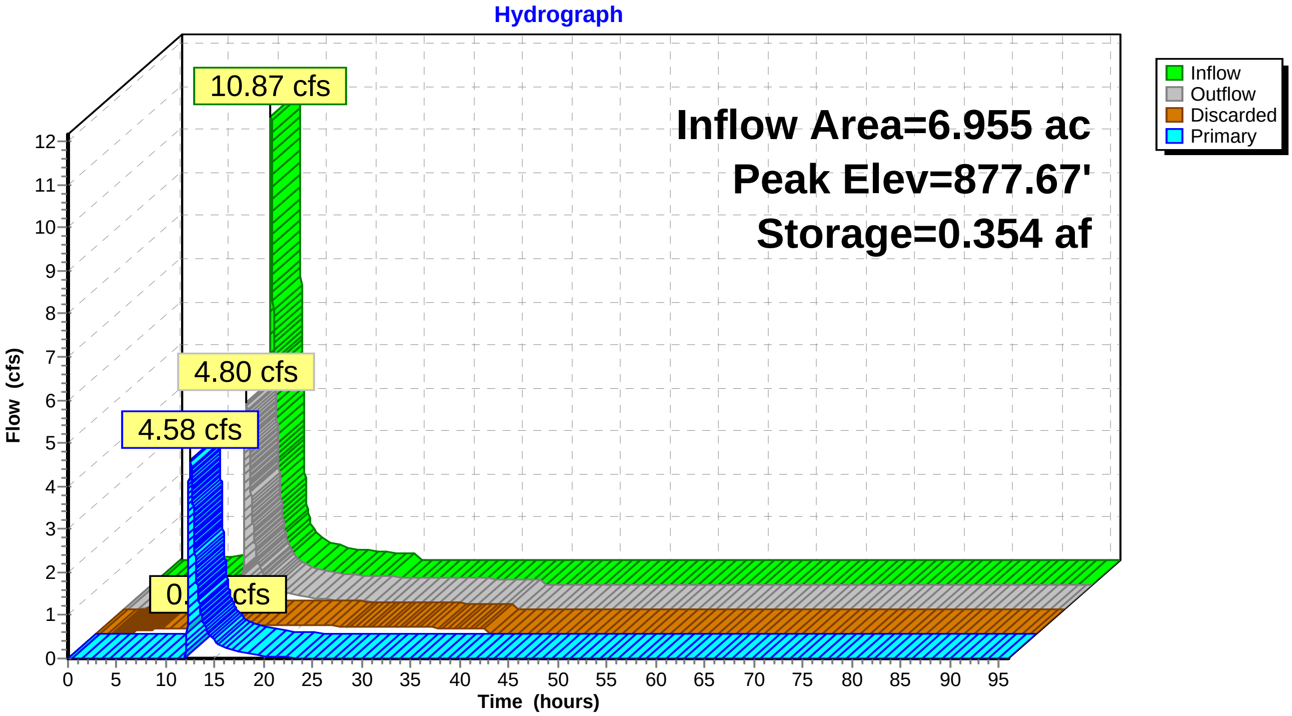
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
876.00	0.150	0.000	0.000
878.00	0.300	0.450	0.450
879.00	0.500	0.400	0.850

Device	Routing	Invert	Outlet Devices
#1	Discarded	876.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	877.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 877.00' / 876.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	877.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 877.00' / 876.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

```
Discarded OutFlow  Max=0.22 cfs @ 12.48 hrs  HW=877.67'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.22 cfs)

Primary OutFlow  Max=4.58 cfs @ 12.48 hrs  HW=877.67'   (Free Discharge)
├─2=Culvert  (Barrel Controls 2.29 cfs @ 3.72 fps)
└─3=Culvert  (Barrel Controls 2.29 cfs @ 3.72 fps)
```

Pond CRH-1: CRH-1



Summary for Pond CRH-2: CRH-2

Inflow Area =	10.214 ac,	37.73% Impervious,	Inflow Depth =	1.47"	for 2-Year event
Inflow =	12.67 cfs @	12.22 hrs,	Volume=	1.253 af	
Outflow =	2.62 cfs @	12.88 hrs,	Volume=	1.254 af,	Atten= 79%, Lag= 39.4 min
Discarded =	0.33 cfs @	12.88 hrs,	Volume=	0.833 af	
Primary =	2.29 cfs @	12.88 hrs,	Volume=	0.420 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 882.04' @ 12.88 hrs Surf.Area= 0.404 ac Storage= 0.617 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 500.6 min (1,307.9 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	1.600 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

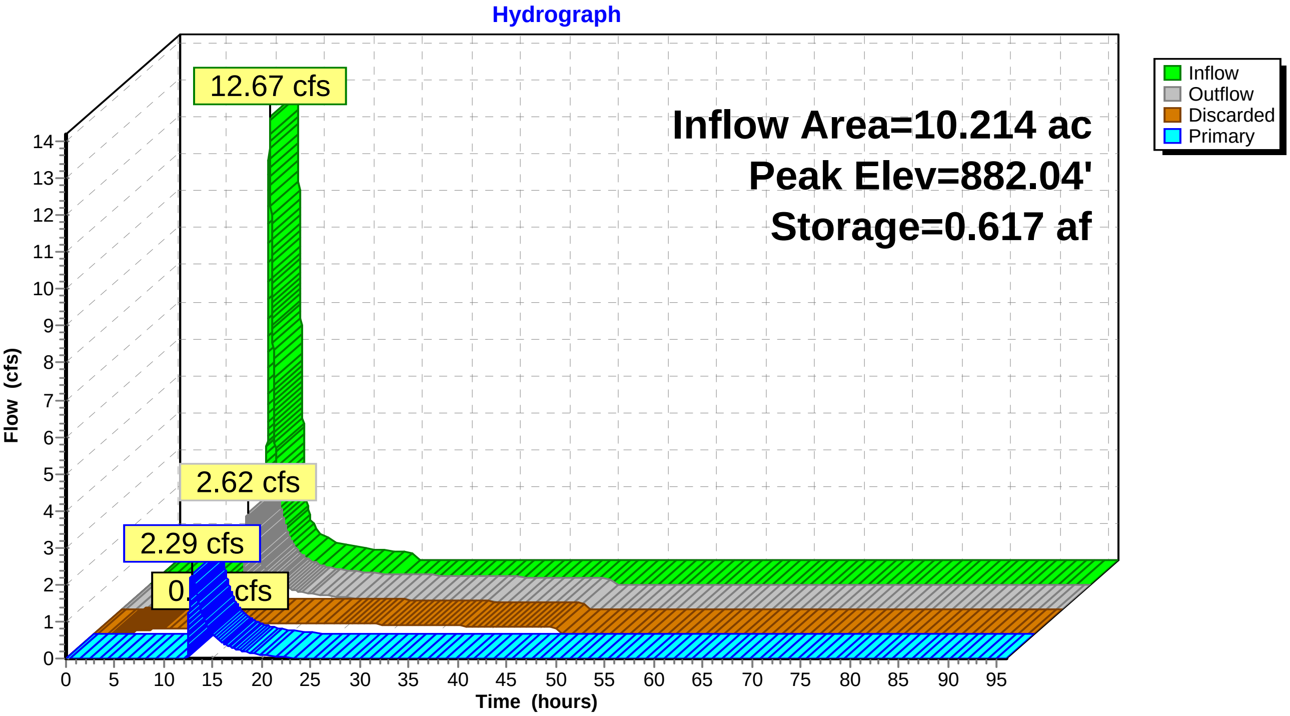
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
880.00	0.200	0.000	0.000
882.00	0.400	0.600	0.600
884.00	0.600	1.000	1.600

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.33 cfs @ 12.88 hrs HW=882.04' (Free Discharge)
└─**1=Exfiltration** (Controls 0.33 cfs)

Primary OutFlow Max=2.29 cfs @ 12.88 hrs HW=882.04' TW=877.79' (Dynamic Tailwater)
├─**2=Culvert** (Barrel Controls 1.15 cfs @ 2.51 fps)
└─**3=Culvert** (Barrel Controls 1.15 cfs @ 2.51 fps)

Pond CRH-2: CRH-2



Summary for Pond CRH-3: CRH-3

Inflow Area = 11.815 ac, 36.95% Impervious, Inflow Depth = 0.61" for 2-Year event
Inflow = 2.97 cfs @ 12.04 hrs, Volume= 0.603 af
Outflow = 1.17 cfs @ 14.13 hrs, Volume= 0.603 af, Atten= 61%, Lag= 125.4 min
Discarded = 0.20 cfs @ 14.13 hrs, Volume= 0.381 af
Primary = 0.97 cfs @ 14.13 hrs, Volume= 0.222 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.30' @ 14.13 hrs Surf.Area= 0.248 ac Storage= 0.259 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 351.8 min (1,209.1 - 857.3)

Volume	Invert	Avail.Storage	Storage Description
#1	877.00'	0.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

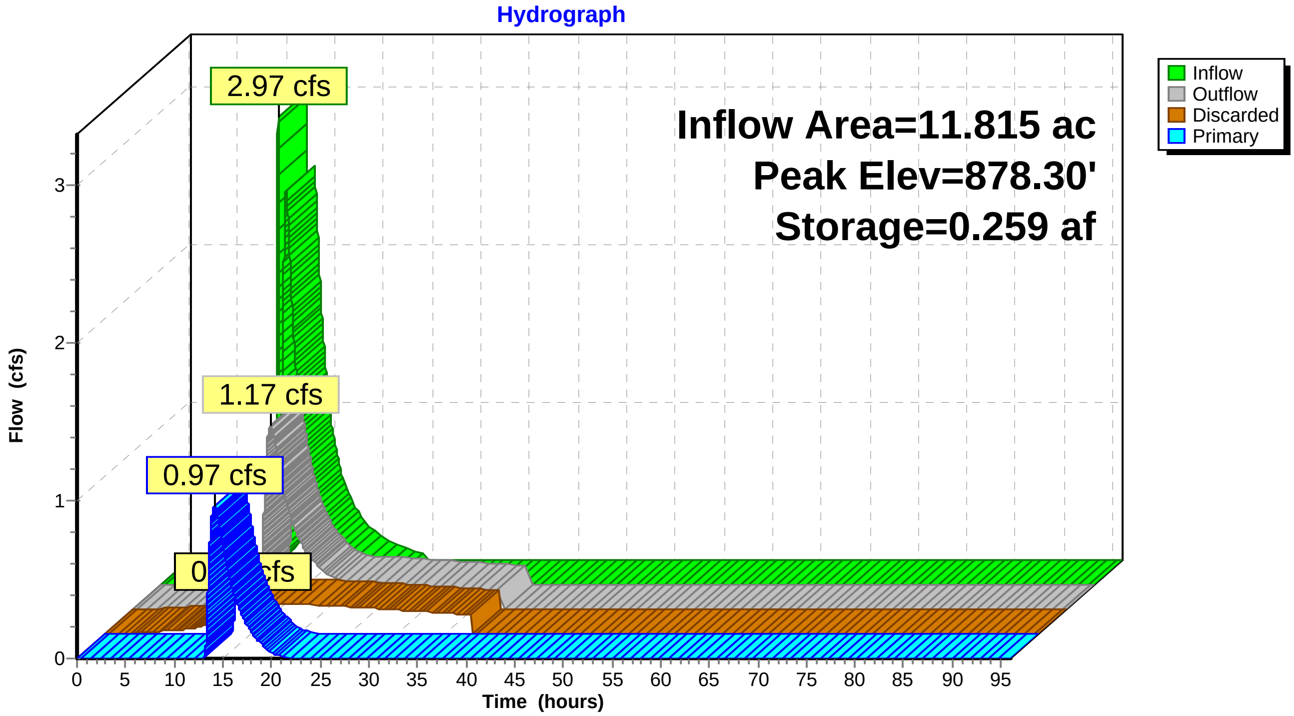
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
877.00	0.150	0.000	0.000
879.00	0.300	0.450	0.450
880.00	0.500	0.400	0.850

Device	Routing	Invert	Outlet Devices
#1	Discarded	877.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.20 cfs @ 14.13 hrs HW=878.30' (Free Discharge)
└─**1=Exfiltration** (Controls 0.20 cfs)

Primary OutFlow Max=0.97 cfs @ 14.13 hrs HW=878.30' (Free Discharge)
├─**2=Culvert** (Barrel Controls 0.48 cfs @ 2.44 fps)
└─**3=Culvert** (Barrel Controls 0.48 cfs @ 2.44 fps)

Pond CRH-3: CRH-3



Summary for Pond P1/P2: P-1/P-2

Inflow Area = 68.531 ac, 57.92% Impervious, Inflow Depth = 1.83" for 2-Year event
Inflow = 54.34 cfs @ 12.57 hrs, Volume= 10.477 af
Outflow = 52.67 cfs @ 12.67 hrs, Volume= 10.470 af, Atten= 3%, Lag= 6.2 min
Primary = 52.67 cfs @ 12.67 hrs, Volume= 10.470 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 924.00' Surf.Area= 1.270 ac Storage= 3.500 af
Peak Elev= 924.94' @ 12.67 hrs Surf.Area= 1.411 ac Storage= 4.760 af (1.260 af above start)

Plug-Flow detention time= 302.4 min calculated for 6.969 af (67% of inflow)
Center-of-Mass det. time= 96.8 min (907.5 - 810.7)

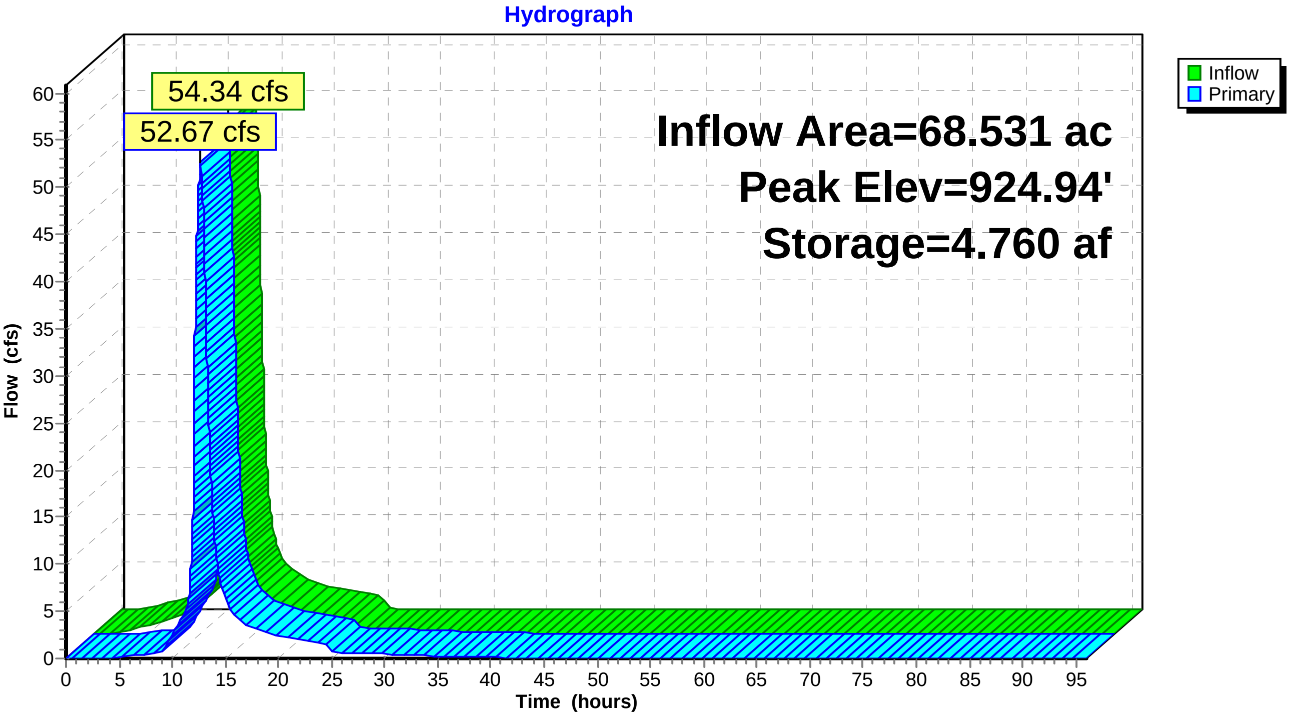
Volume	Invert	Avail.Storage	Storage Description
#1	920.00'	6.340 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
920.00	0.650	0.000	0.000
922.00	0.790	1.440	1.440
924.00	1.270	2.060	3.500
926.00	1.570	2.840	6.340

Device	Routing	Invert	Outlet Devices
#1	Primary	924.40'	**40.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	924.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=52.66 cfs @ 12.67 hrs HW=924.94' TW=916.30' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 51.75 cfs @ 2.40 fps)
└─**2=Orifice/Grate** (Orifice Controls 0.92 cfs @ 4.67 fps)

Pond P1/P2: P-1/P-2



Summary for Pond P5/P6: P-5/P-6

Inflow Area = 43.279 ac, 47.44% Impervious, Inflow Depth = 1.65" for 2-Year event
Inflow = 66.74 cfs @ 12.15 hrs, Volume= 5.941 af
Outflow = 6.86 cfs @ 13.07 hrs, Volume= 3.826 af, Atten= 90%, Lag= 55.4 min
Primary = 5.60 cfs @ 13.07 hrs, Volume= 3.144 af
Secondary = 1.26 cfs @ 13.07 hrs, Volume= 0.681 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 929.00' Surf.Area= 1.975 ac Storage= 5.062 af
Peak Elev= 930.72' @ 13.07 hrs Surf.Area= 2.356 ac Storage= 8.830 af (3.767 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 335.9 min (1,129.6 - 793.7)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	14.650 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

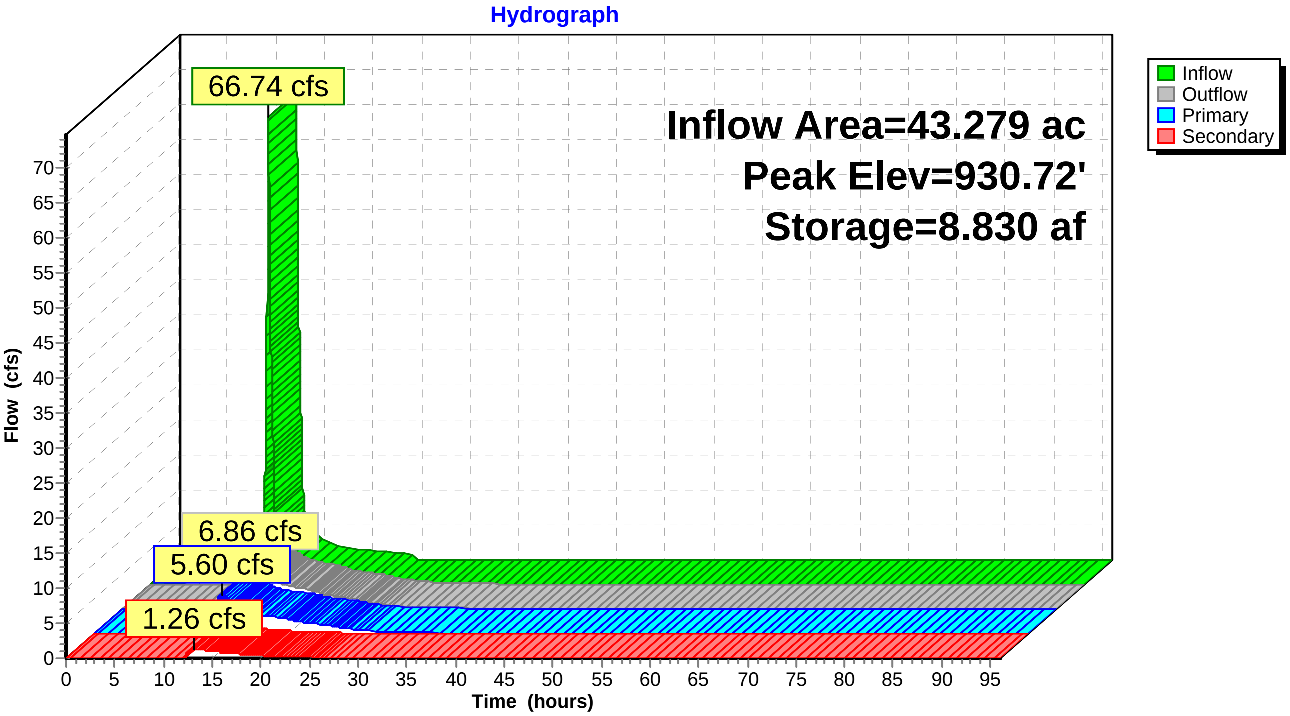
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
926.00	1.510	0.000	0.000
928.00	1.710	3.220	3.220
930.00	2.240	3.950	7.170
931.00	2.400	2.320	9.490
933.00	2.760	5.160	14.650

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	930.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	931.50'	**14.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	930.00'	**9.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=5.60 cfs @ 13.07 hrs HW=930.72' TW=916.51' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 3.21 cfs @ 4.09 fps)
├—**2=Sharp-Crested Rectangular Weir** (Weir Controls 2.38 cfs @ 1.54 fps)
└—**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=1.26 cfs @ 13.07 hrs HW=930.72' TW=929.06' (Dynamic Tailwater)
↑—**4=Orifice/Grate** (Orifice Controls 1.26 cfs @ 2.89 fps)

Pond P5/P6: P-5/P-6



Summary for Pond P8: P-8

Inflow Area = 6.389 ac, 7.62% Impervious, Inflow Depth = 0.93" for 2-Year event
Inflow = 7.36 cfs @ 12.06 hrs, Volume= 0.497 af
Outflow = 1.25 cfs @ 12.60 hrs, Volume= 0.491 af, Atten= 83%, Lag= 32.2 min
Primary = 1.25 cfs @ 12.60 hrs, Volume= 0.491 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 897.00' Surf.Area= 0.300 ac Storage= 0.495 af
Peak Elev= 897.62' @ 12.65 hrs Surf.Area= 0.394 ac Storage= 0.712 af (0.217 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 274.4 min (1,119.7 - 845.3)

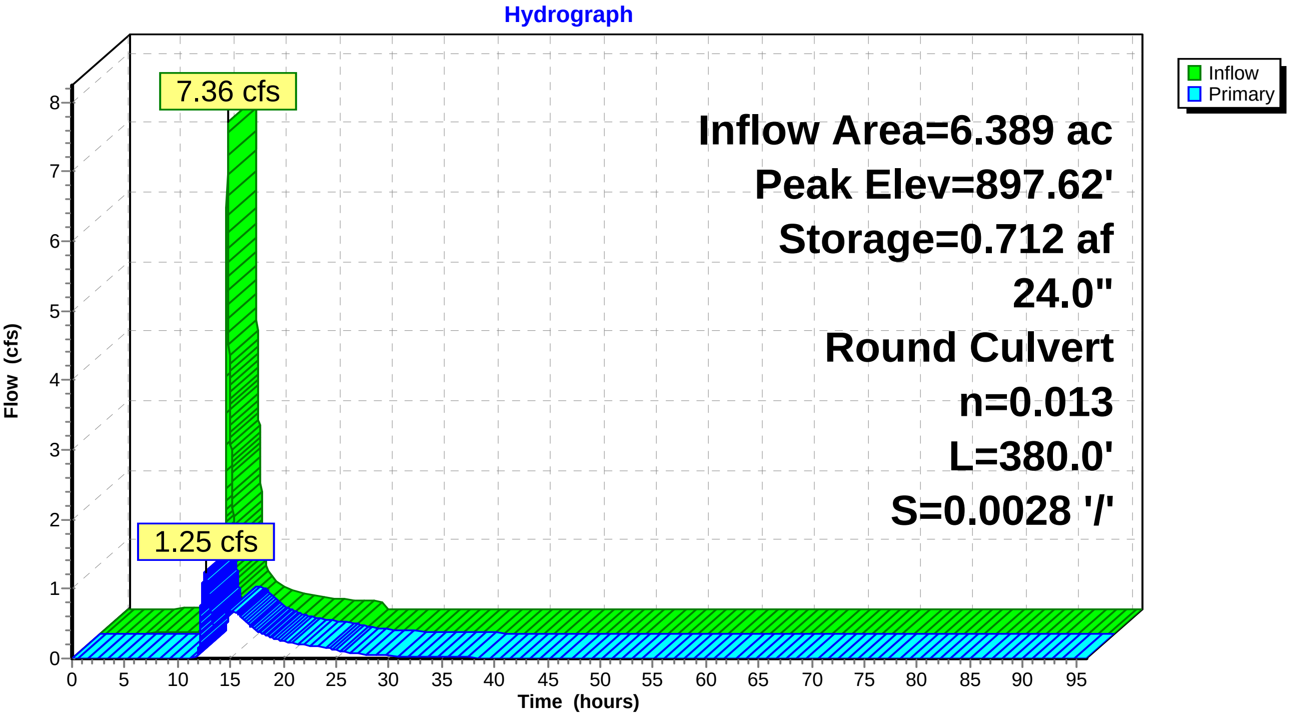
Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	1.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
893.00	0.030	0.000	0.000
894.00	0.070	0.050	0.050
896.00	0.150	0.220	0.270
897.00	0.300	0.225	0.495
898.00	0.450	0.375	0.870
900.00	0.530	0.980	1.850

Device	Routing	Invert	Outlet Devices
#1	Primary	897.00'	**24.0" Round RCP_Round 24"** L= 380.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 897.00' / 895.94' S= 0.0028 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=1.24 cfs @ 12.60 hrs HW=897.62' TW=896.73' (Dynamic Tailwater)
└─**1=RCP_Round 24"** (Outlet Controls 1.24 cfs @ 2.23 fps)

Pond P8: P-8


Hydrograph
7.36 cfs
1.25 cfs
Inflow Area=6.389 ac
Peak Elev=897.62'
Storage=0.712 af
24.0"
Round Culvert
n=0.013
L=380.0'
S=0.0028 '/'
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-1: W-1

Inflow Area = 0.997 ac, 24.47% Impervious, Inflow Depth = 11.67" for 2-Year event
Inflow = 2.44 cfs @ 13.25 hrs, Volume= 0.969 af
Outflow = 2.00 cfs @ 14.40 hrs, Volume= 0.969 af, Atten= 18%, Lag= 69.3 min
Primary = 2.00 cfs @ 14.40 hrs, Volume= 0.969 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.09' @ 14.40 hrs Surf.Area= 0.714 ac Storage= 0.231 af

Plug-Flow detention time= 121.0 min calculated for 0.969 af (100% of inflow)
Center-of-Mass det. time= 120.8 min (990.9 - 870.1)

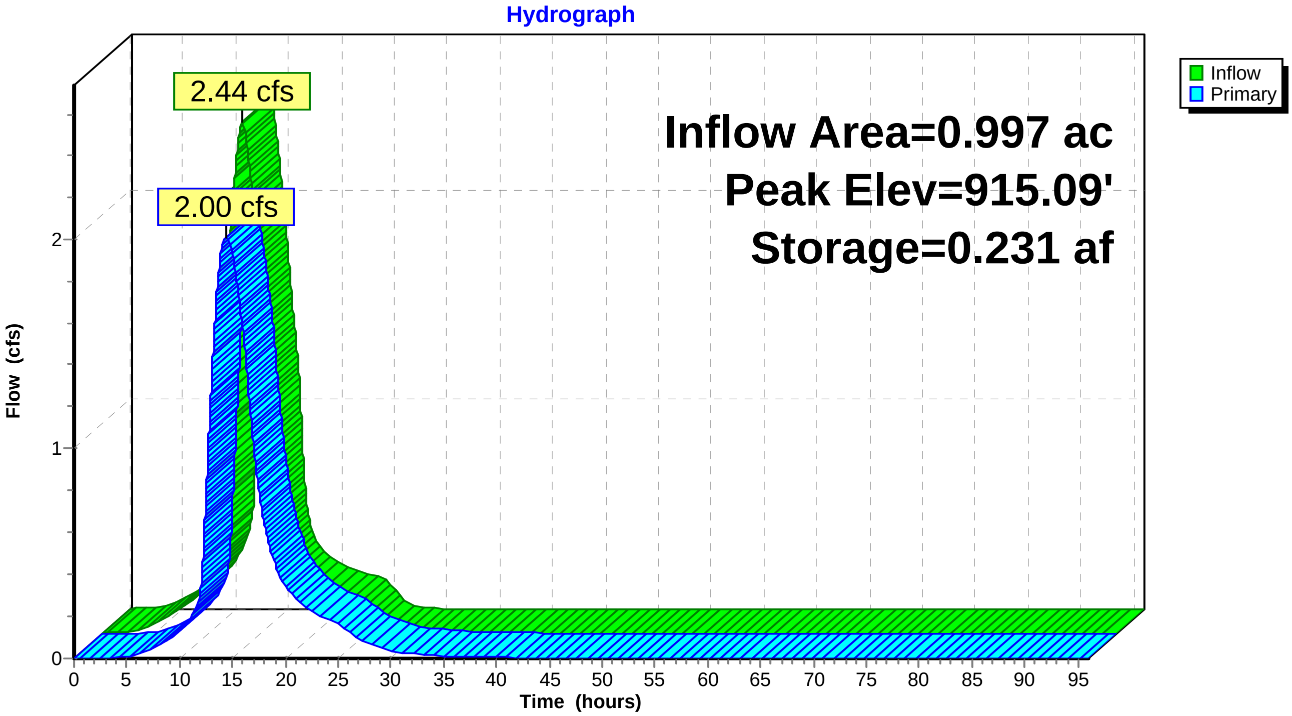
Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	0.950 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	0.660	0.000	0.000
916.00	0.860	0.950	0.950

Device	Routing	Invert	Outlet Devices
#1	Primary	914.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.00 cfs @ 14.40 hrs HW=915.09' TW=0.00' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 2.00 cfs @ 1.90 fps)

Pond W-1: W-1


Hydrograph
2.44 cfs
2.00 cfs
Inflow Area=0.997 ac
Peak Elev=915.09'
Storage=0.231 af
Inflow
Primary
Flow (cfs)
0
1
2
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond W-2: W-2

Inflow	=	1.26 cfs @	13.07 hrs,	Volume=	0.681 af
Outflow	=	0.37 cfs @	20.19 hrs,	Volume=	0.536 af, Atten= 70%, Lag= 426.8 min
Primary	=	0.37 cfs @	20.19 hrs,	Volume=	0.536 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 929.37' @ 20.19 hrs Surf.Area= 1.153 ac Storage= 0.413 af

Plug-Flow detention time= 878.1 min calculated for 0.536 af (79% of inflow)
Center-of-Mass det. time= 760.2 min (1,809.8 - 1,049.7)

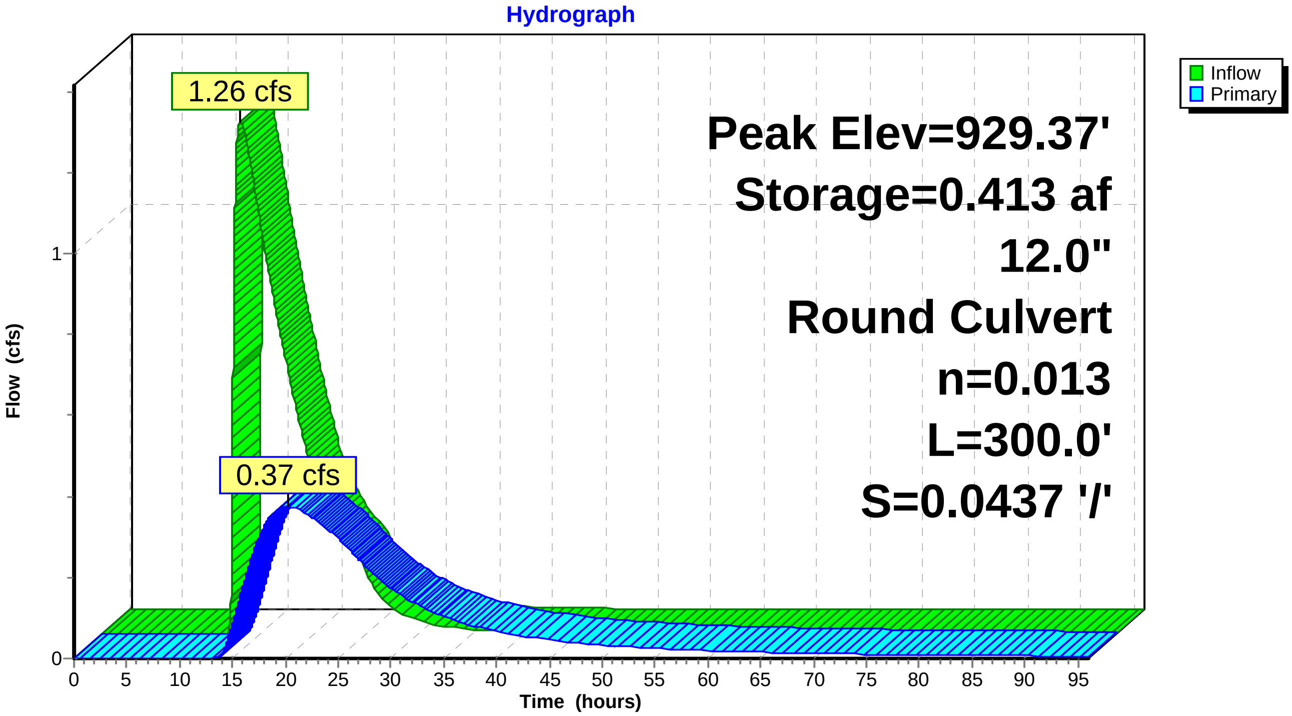
Volume	Invert	Avail.Storage	Storage Description
#1	929.00'	1.175 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
929.00	1.090	0.000	0.000
930.00	1.260	1.175	1.175

Device	Routing	Invert	Outlet Devices
#1	Primary	929.10'	**12.0" Round RCP_Round 12"** L= 300.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 929.10' / 916.00' S= 0.0437 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.37 cfs @ 20.19 hrs HW=929.37' TW=914.81' (Dynamic Tailwater)
↑—**1=RCP_Round 12"** (Inlet Controls 0.37 cfs @ 2.21 fps)

Pond W-2: W-2


Hydrograph
1.26 cfs
0.37 cfs
Peak Elev=929.37'
Storage=0.413 af
12.0"
Round Culvert
n=0.013
L=300.0'
S=0.0437 '/'
Inflow
Primary
Flow (cfs)
0
1
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

Summary for Pond W-3: W-3

Inflow	=	0.37 cfs @	20.19 hrs, Volume=	0.536 af	
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min

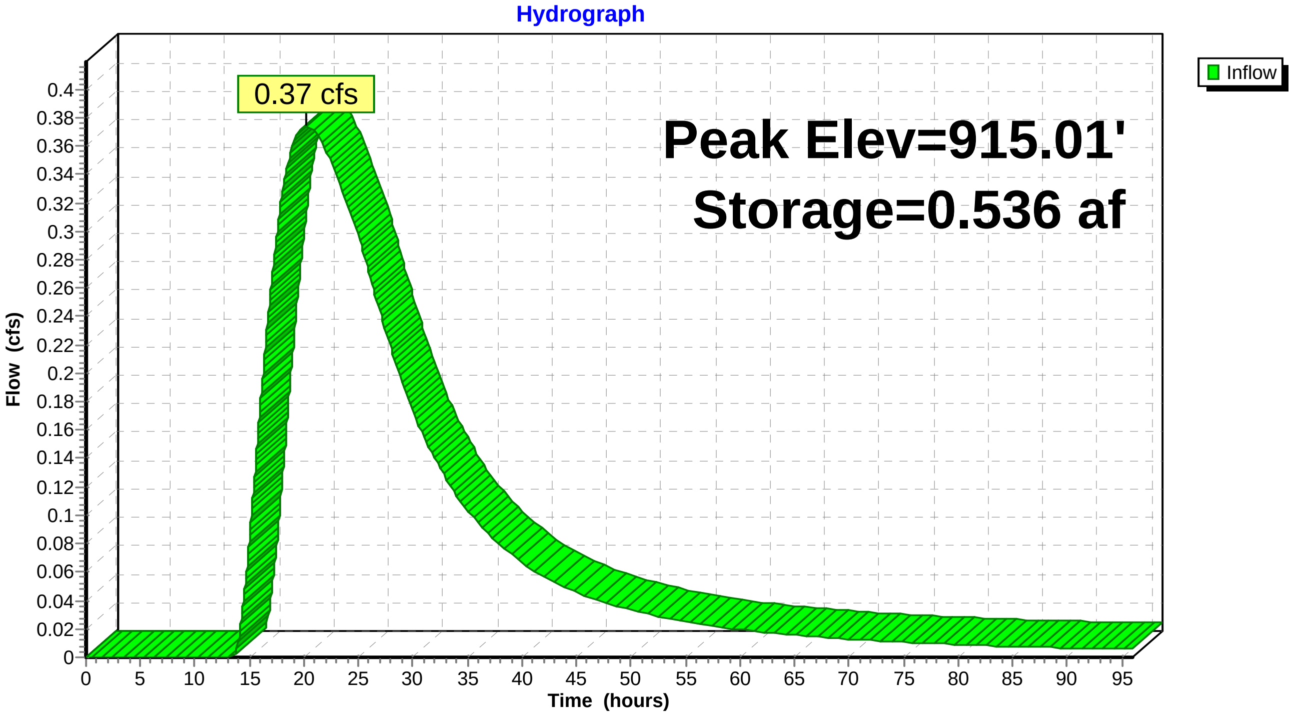
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.01' @ 96.00 hrs Surf.Area= 2.082 ac Storage= 0.536 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	2.680 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	2.040	0.000	0.000
915.00	2.080	0.515	0.515
916.00	2.250	2.165	2.680

Pond W-3: W-3



Summary for Pond W-4: W-4

Inflow Area = 2.985 ac, 30.99% Impervious, Inflow Depth = 8.39" for 2-Year event
Inflow = 5.28 cfs @ 12.09 hrs, Volume= 2.086 af
Outflow = 2.69 cfs @ 16.41 hrs, Volume= 2.067 af, Atten= 49%, Lag= 259.5 min
Primary = 2.69 cfs @ 16.41 hrs, Volume= 2.067 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 908.83' @ 16.41 hrs Surf.Area= 1.078 ac Storage= 0.769 af

Plug-Flow detention time= 292.4 min calculated for 2.067 af (99% of inflow)
Center-of-Mass det. time= 285.3 min (1,204.8 - 919.5)

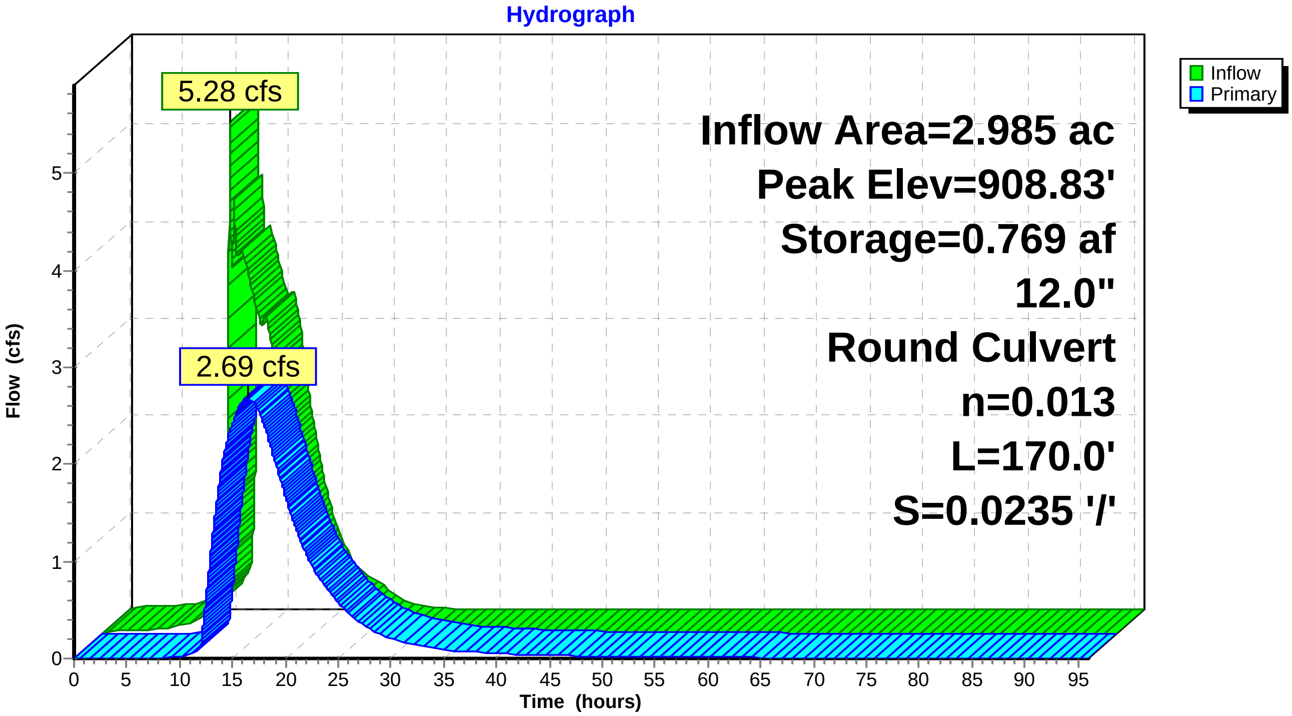
Volume	Invert	Avail.Storage	Storage Description
#1	908.00'	2.280 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
908.00	0.780	0.000	0.000
910.00	1.500	2.280	2.280

Device	Routing	Invert	Outlet Devices
#1	Primary	908.00'	**12.0" Round RCP_Round 12"** L= 170.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 908.00' / 904.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.69 cfs @ 16.41 hrs HW=908.83' TW=893.75' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Inlet Controls 2.69 cfs @ 3.87 fps)

Pond W-4: W-4


Hydrograph
5.28 cfs
2.69 cfs
Inflow Area=2.985 ac
Peak Elev=908.83'
Storage=0.769 af
12.0"
Round Culvert
n=0.013
L=170.0'
S=0.0235 '/'
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond W-5: W-5

Inflow Area = 7.608 ac, 48.41% Impervious, Inflow Depth = 4.02" for 2-Year event
Inflow = 20.53 cfs @ 12.02 hrs, Volume= 2.547 af
Outflow = 4.37 cfs @ 13.19 hrs, Volume= 2.540 af, Atten= 79%, Lag= 70.0 min
Primary = 4.37 cfs @ 13.19 hrs, Volume= 2.540 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 882.75' Surf.Area= 4.887 ac Storage= 7.134 af
Peak Elev= 882.98' @ 13.19 hrs Surf.Area= 5.104 ac Storage= 8.297 af (1.163 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 288.6 min (1,115.7 - 827.1)

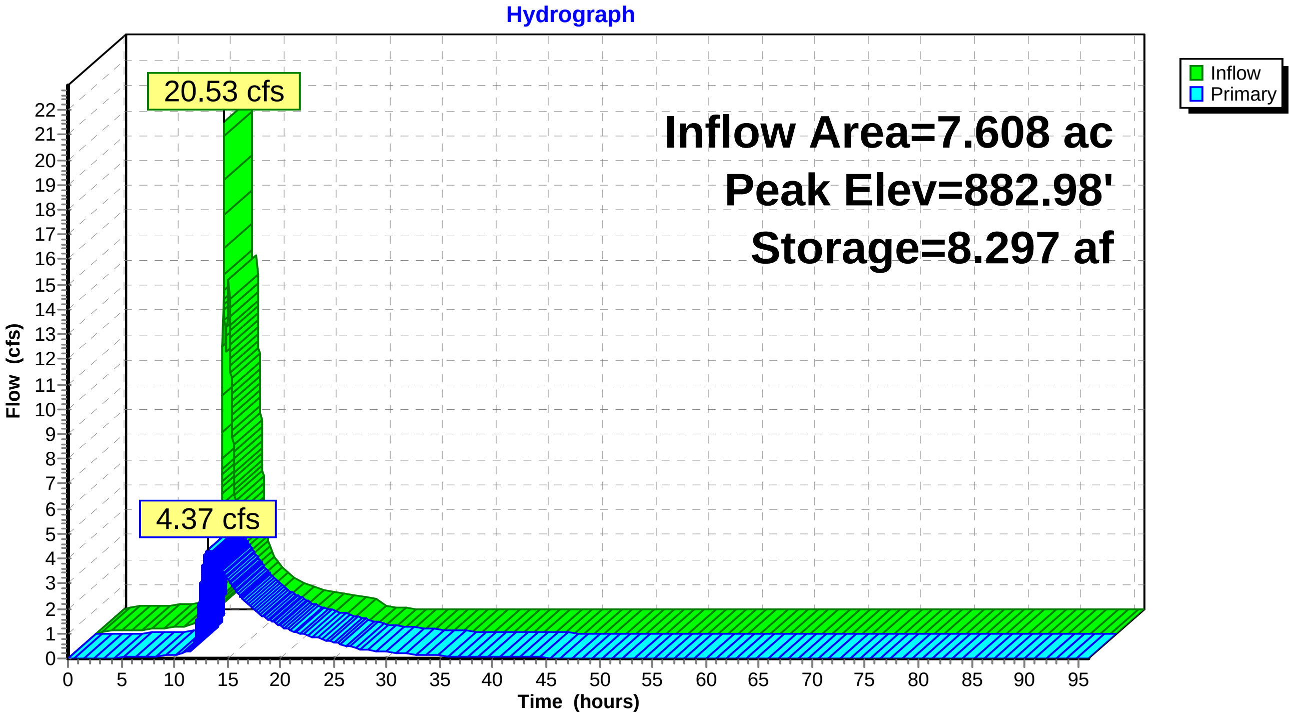
Volume	Invert	Avail.Storage	Storage Description
#1	881.00'	11.097 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
881.00	3.270	0.000	0.000
882.00	4.190	3.730	3.730
883.00	5.120	4.655	8.385
883.49	5.950	2.712	11.097

Device	Routing	Invert	Outlet Devices
#1	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=4.37 cfs @ 13.19 hrs HW=882.98' TW=0.00' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 2.19 cfs @ 1.58 fps)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 2.19 cfs @ 1.58 fps)

Pond W-5: W-5

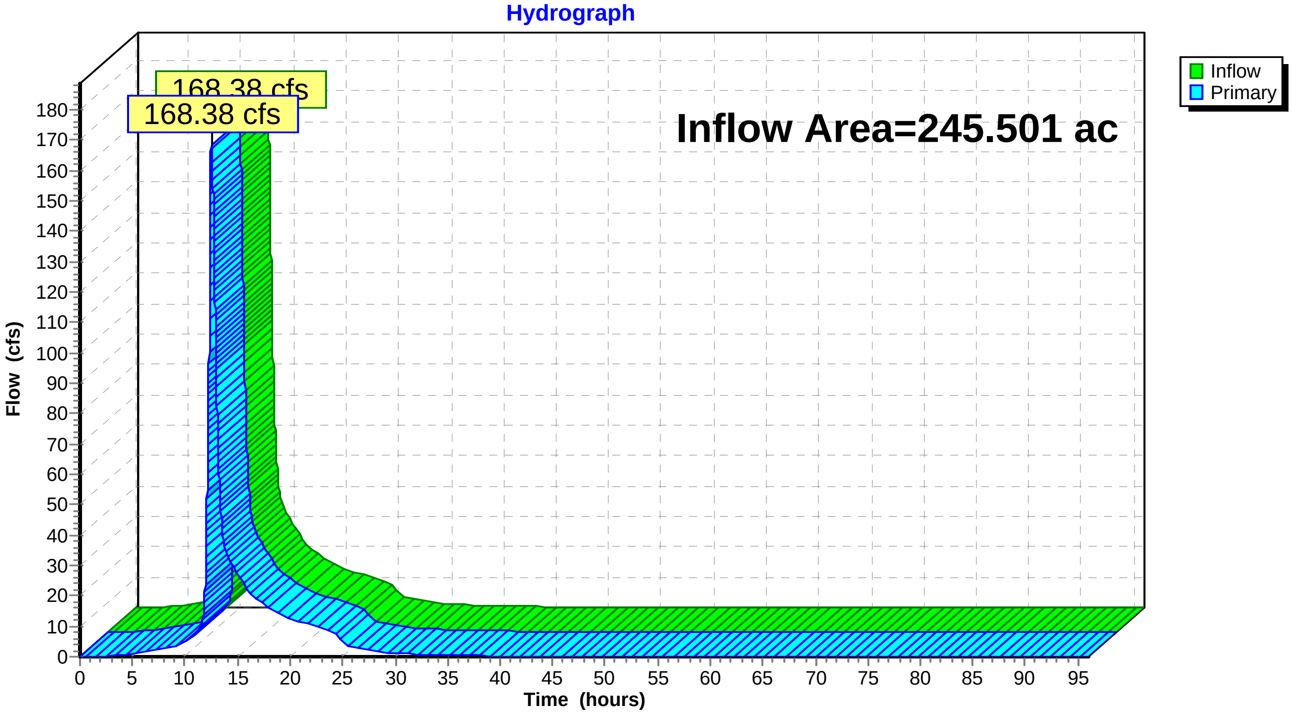

Hydrograph
20.53 cfs
4.37 cfs
Inflow Area=7.608 ac
Peak Elev=882.98'
Storage=8.297 af
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek

Inflow Area = 245.501 ac, 51.49% Impervious, Inflow Depth = 1.56" for 2-Year event
Inflow = 168.38 cfs @ 12.52 hrs, Volume= 31.921 af
Primary = 168.38 cfs @ 12.52 hrs, Volume= 31.921 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek

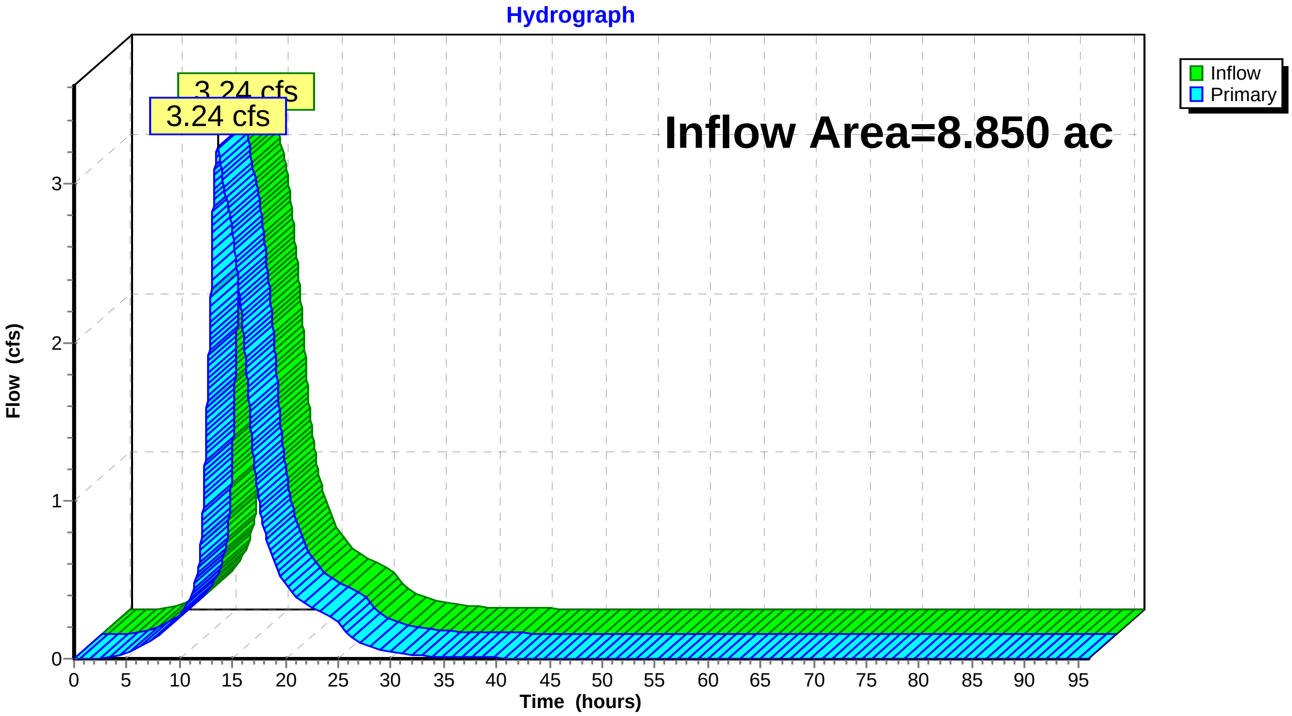


Summary for Link 50L: Outlet #1 Discharge to Round Lake

Inflow Area =	8.850 ac,	65.20% Impervious,	Inflow Depth = 1.97"	for 2-Year event	
Inflow =	3.24 cfs @	13.59 hrs,	Volume=	1.454 af	
Primary =	3.24 cfs @	13.59 hrs,	Volume=	1.454 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 50L: Outlet #1 Discharge to Round Lake

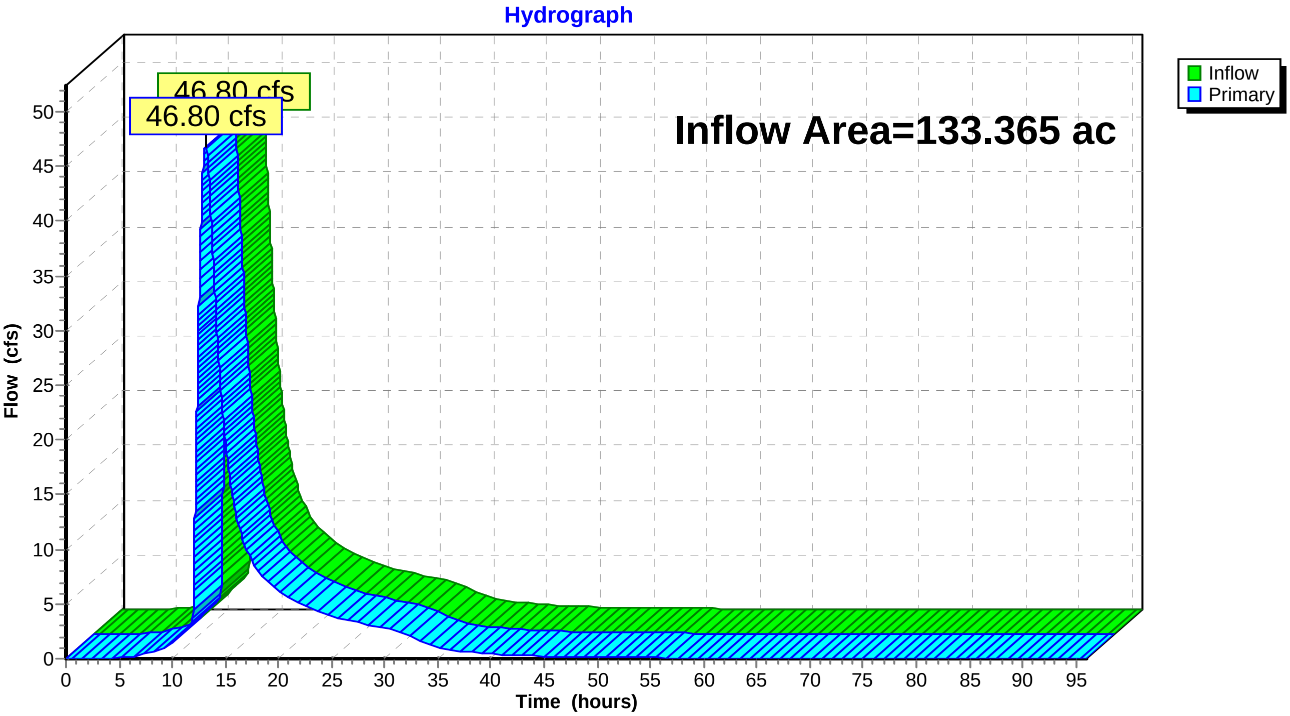


Summary for Link 51L: Outlet #2 Discharge to Round Lake

Inflow Area = 133.365 ac, 58.87% Impervious, Inflow Depth > 1.60" for 2-Year event
Inflow = 46.80 cfs @ 13.14 hrs, Volume= 17.759 af
Primary = 46.80 cfs @ 13.14 hrs, Volume= 17.759 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 51L: Outlet #2 Discharge to Round Lake

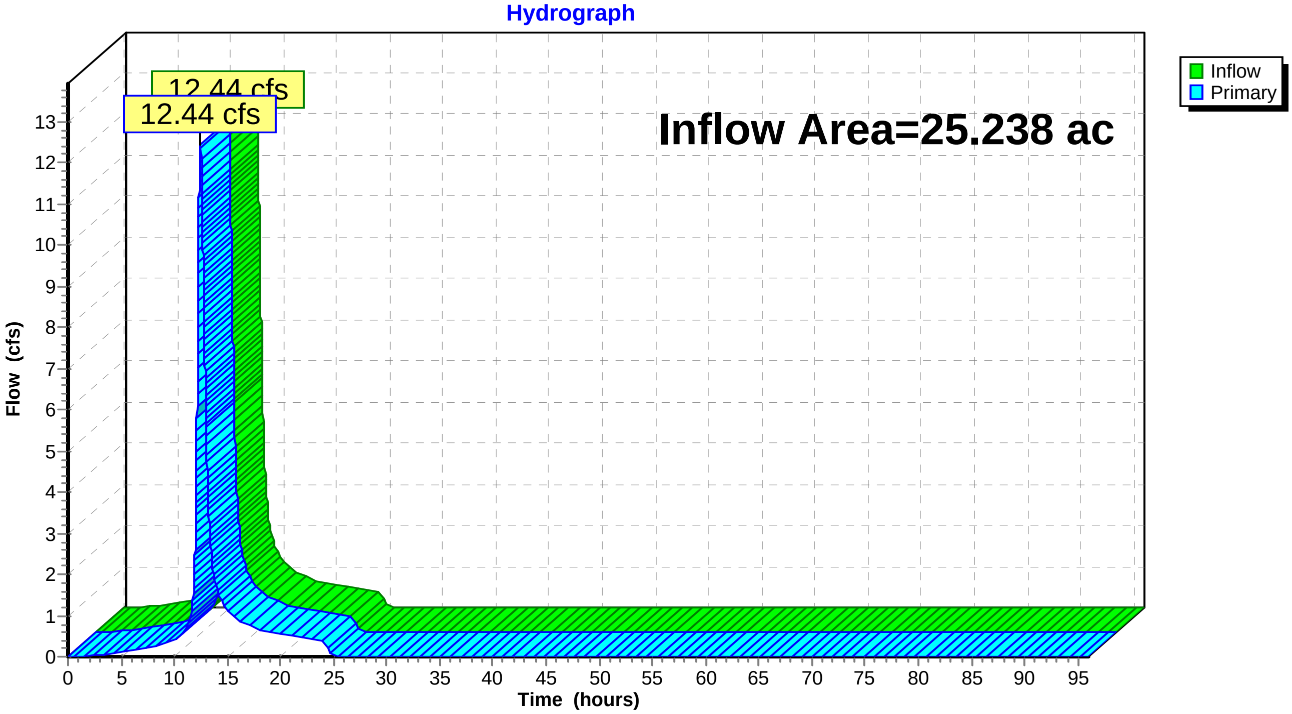


Summary for Link 52L: Outlet #3 Discharge to Round Lake

Inflow Area = 25.238 ac, 19.96% Impervious, Inflow Depth = 0.86" for 2-Year event
Inflow = 12.44 cfs @ 12.43 hrs, Volume= 1.805 af
Primary = 12.44 cfs @ 12.43 hrs, Volume= 1.805 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 52L: Outlet #3 Discharge to Round Lake



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: To Rice Creek Runoff Area=1.601 ac 31.98% Impervious Runoff Depth=2.47"
Tc=5.7 min CN=74/98 Runoff=5.55 cfs 0.330 af

Subcatchment SB 1: SB 1 Runoff Area=52.192 ac 48.35% Impervious Runoff Depth=2.83"
Tc=53.1 min CN=74/98 Runoff=76.21 cfs 12.329 af

Subcatchment SB 10: SB 10 Runoff Area=6.389 ac 7.62% Impervious Runoff Depth=1.93"
Tc=7.3 min CN=74/98 Runoff=16.44 cfs 1.027 af

Subcatchment SB 11: SB 11 Runoff Area=3.293 ac 32.16% Impervious Runoff Depth=2.55"
Tc=11.7 min CN=74/100 Runoff=8.82 cfs 0.700 af

Subcatchment SB 12: SB 12 Runoff Area=1.382 ac 38.71% Impervious Runoff Depth=2.62"
Tc=9.5 min CN=74/98 Runoff=4.23 cfs 0.302 af

Subcatchment SB 13: SB 13 Runoff Area=2.985 ac 30.99% Impervious Runoff Depth=2.52"
Tc=9.4 min CN=74/100 Runoff=8.67 cfs 0.627 af

Subcatchment SB 14: SB 14 Runoff Area=10.225 ac 42.62% Impervious Runoff Depth=2.71"
Tc=4.3 min CN=74/98 Runoff=41.19 cfs 2.307 af

Subcatchment SB 15: SB 15 Runoff Area=58.564 ac 48.22% Impervious Runoff Depth=2.83"
Tc=31.3 min CN=74/98 Runoff=112.62 cfs 13.820 af

Subcatchment SB 16: SB 16 Runoff Area=32.428 ac 33.53% Impervious Runoff Depth=2.50"
Tc=12.1 min CN=74/98 Runoff=86.24 cfs 6.769 af

Subcatchment SB 17: SB 17 Runoff Area=7.608 ac 48.41% Impervious Runoff Depth=2.95"
Tc=4.3 min CN=74/100 Runoff=32.13 cfs 1.870 af

Subcatchment SB 18: SB 18 Runoff Area=52.908 ac 84.55% Impervious Runoff Depth=3.64"
Tc=33.5 min CN=74/98 Runoff=124.38 cfs 16.050 af

Subcatchment SB 19: SB 19 Runoff Area=21.198 ac 39.93% Impervious Runoff Depth=2.65"
Tc=24.7 min CN=74/98 Runoff=42.96 cfs 4.676 af

Subcatchment SB 2: SB 2 Runoff Area=11.400 ac 84.29% Impervious Runoff Depth=3.63"
Tc=16.6 min CN=74/98 Runoff=37.33 cfs 3.453 af

Subcatchment SB 22: SB 22 Runoff Area=41.911 ac 82.19% Impervious Runoff Depth=3.34"
Tc=41.0 min CN=49/98 Runoff=79.81 cfs 11.662 af

Subcatchment SB 24: SB 24 Runoff Area=4.939 ac 98.22% Impervious Runoff Depth=3.94"
Tc=7.5 min CN=74/98 Runoff=24.36 cfs 1.623 af

Subcatchment SB 25: SB 25 Runoff Area=5.012 ac 95.71% Impervious Runoff Depth=3.89"
Tc=10.7 min CN=74/98 Runoff=21.17 cfs 1.624 af

Subcatchment SB 26: SB 26 Runoff Area=14.335 ac 98.27% Impervious Runoff Depth=3.95"
Tc=25.4 min CN=74/98 Runoff=41.75 cfs 4.713 af

Subcatchment SB 27: SB 27 (Thumb Road) Runoff Area=6.629 ac 97.12% Impervious Runoff Depth=3.88"
Tc=27.6 min CN=49/98 Runoff=18.18 cfs 2.143 af

Subcatchment SB 28: SB 28 Runoff Area=6.955 ac 46.76% Impervious Runoff Depth=2.80"
Tc=14.6 min CN=74/98 Runoff=18.97 cfs 1.622 af

Subcatchment SB 29: SB 29 Runoff Area=10.214 ac 37.73% Impervious Runoff Depth=2.60"
Tc=19.1 min CN=74/98 Runoff=23.01 cfs 2.212 af

Subcatchment SB 3: SB 3 Runoff Area=37.668 ac 41.46% Impervious Runoff Depth=2.68"
Tc=15.3 min CN=74/98 Runoff=96.96 cfs 8.417 af

Subcatchment SB 4: SB 4 Runoff Area=0.599 ac 19.70% Impervious Runoff Depth=2.24"
Tc=5.9 min CN=74/100 Runoff=1.86 cfs 0.112 af

Subcatchment SB 5: SB 5 Runoff Area=7.853 ac 70.37% Impervious Runoff Depth=3.32"
Tc=59.3 min CN=74/98 Runoff=12.43 cfs 2.176 af

Subcatchment SB 51: Offsite Subbasin 51 Runoff Area=25.238 ac 19.96% Impervious Runoff Depth=1.72"
Tc=32.8 min CN=65/98 Runoff=27.74 cfs 3.622 af

Subcatchment SB 6: SB 6 Runoff Area=0.997 ac 24.47% Impervious Runoff Depth=2.36"
Tc=20.3 min CN=74/100 Runoff=1.96 cfs 0.196 af

Subcatchment SB 7: SB 7 Runoff Area=21.555 ac 84.83% Impervious Runoff Depth=3.65"
Tc=5.7 min CN=74/98 Runoff=106.75 cfs 6.550 af

Subcatchment SB 8: SB 8 Runoff Area=29.595 ac 30.01% Impervious Runoff Depth=2.43"
Tc=47.1 min CN=74/98 Runoff=39.95 cfs 5.985 af

Subcatchment SB 9: SB 9 Runoff Area=25.789 ac 33.17% Impervious Runoff Depth=2.50"
Tc=30.0 min CN=74/98 Runoff=45.10 cfs 5.366 af

Pond 3P: P-3 Peak Elev=917.66' Storage=13.758 af Inflow=146.54 cfs 30.858 af
Outflow=98.88 cfs 30.840 af

Pond 4P: P-4 Peak Elev=916.82' Storage=1.241 af Inflow=12.43 cfs 2.176 af
Primary=4.47 cfs 0.953 af Secondary=2.78 cfs 1.223 af Outflow=7.25 cfs 2.176 af

Pond 7P: P-7 Peak Elev=915.56' Storage=1.330 af Inflow=39.95 cfs 5.985 af
Outflow=40.55 cfs 5.985 af

Pond 9P: P-9 Peak Elev=915.51' Storage=0.487 af Inflow=77.38 cfs 11.351 af
Outflow=77.30 cfs 11.351 af

Pond 10P: P-10 Peak Elev=897.75' Storage=1.270 af Inflow=38.10 cfs 10.812 af
Primary=12.53 cfs 7.912 af Secondary=25.45 cfs 2.899 af Outflow=37.98 cfs 10.811 af

Pond 11P: P-11 Peak Elev=912.03' Storage=7.830 af Inflow=80.40 cfs 12.051 af
Primary=35.82 cfs 9.489 af Secondary=4.51 cfs 2.560 af Outflow=40.33 cfs 12.049 af

Pond 12P: P-12 Peak Elev=894.35' Storage=7.405 af Inflow=45.31 cfs 16.286 af
Outflow=37.09 cfs 16.278 af

Pond 13P: P-13 Peak Elev=884.60' Storage=7.718 af Inflow=327.06 cfs 54.310 af
Primary=296.00 cfs 51.732 af Secondary=13.98 cfs 2.575 af Outflow=309.98 cfs 54.307 af

Pond 14P: P-14 Peak Elev=893.66' Storage=6.910 af Inflow=42.96 cfs 4.676 af
Outflow=6.52 cfs 4.674 af

Pond 23P: Thumb Infiltration (Thumb TP Peak Elev=903.83' Storage=3.834 af Inflow=95.01 cfs 13.805 af
Outflow=94.93 cfs 10.065 af

Pond 31P: SB 18 Infiltration Peak Elev=903.43' Storage=3.432 af Inflow=124.38 cfs 16.050 af
Outflow=124.27 cfs 12.730 af

Pond 36P: Culverts passing flow Peak Elev=887.50' Storage=0.001 af Inflow=124.27 cfs 12.730 af
Primary=124.27 cfs 12.730 af Secondary=0.00 cfs 0.000 af Outflow=124.27 cfs 12.730 af

Pond CRH-1: CRH-1 Peak Elev=878.12' Storage=0.489 af Inflow=18.97 cfs 1.622 af
Discarded=0.26 cfs 0.512 af Primary=11.80 cfs 1.110 af Outflow=12.06 cfs 1.622 af

Pond CRH-2: CRH-2 Peak Elev=882.67' Storage=0.888 af Inflow=23.01 cfs 2.212 af
Discarded=0.38 cfs 0.904 af Primary=9.82 cfs 1.308 af Outflow=10.19 cfs 2.212 af

Pond CRH-3: CRH-3 Peak Elev=878.90' Storage=0.421 af Inflow=10.84 cfs 1.637 af
Discarded=0.24 cfs 0.449 af Primary=7.98 cfs 1.188 af Outflow=8.22 cfs 1.637 af

Pond P1/P2: P-1/P-2 Peak Elev=925.17' Storage=5.093 af Inflow=92.00 cfs 17.405 af
Outflow=89.60 cfs 17.397 af

Pond P5/P6: P-5/P-6 Peak Elev=931.49' Storage=10.676 af Inflow=116.17 cfs 10.153 af
Primary=26.37 cfs 6.911 af Secondary=2.24 cfs 1.126 af Outflow=28.61 cfs 8.037 af

Pond P8: P-8 Peak Elev=898.11' Storage=0.922 af Inflow=16.44 cfs 1.027 af
24.0" Round Culvert n=0.013 L=380.0' S=0.0028 '/' Outflow=3.63 cfs 1.021 af

Pond W-1: W-1 Peak Elev=915.16' Storage=0.286 af Inflow=3.34 cfs 1.419 af
Outflow=2.43 cfs 1.419 af

Pond W-2: W-2 Peak Elev=929.49' Storage=0.559 af Inflow=2.24 cfs 1.126 af
12.0" Round Culvert n=0.013 L=300.0' S=0.0437 '/' Outflow=0.77 cfs 0.979 af

Pond W-3: W-3 Peak Elev=915.22' Storage=0.979 af Inflow=0.77 cfs 0.979 af
Outflow=0.00 cfs 0.000 af

Pond W-4: W-4 Peak Elev=908.99' Storage=0.949 af Inflow=10.44 cfs 3.187 af
12.0" Round Culvert n=0.013 L=170.0' S=0.0235 '/' Outflow=3.32 cfs 3.168 af

Pond W-5: W-5 Peak Elev=883.11' Storage=8.975 af Inflow=37.78 cfs 4.445 af
Outflow=8.48 cfs 4.438 af

Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek
Inflow=302.16 cfs 56.170 af
Primary=302.16 cfs 56.170 af

Link 50L: Outlet #1 Discharge to Round Lake
Inflow=6.78 cfs 2.372 af
Primary=6.78 cfs 2.372 af

Link 51L: Outlet #2 Discharge to Round Lake
Inflow=98.88 cfs 30.840 af
Primary=98.88 cfs 30.840 af

Link 52L: Outlet #3 Discharge to Round Lake
Inflow=27.74 cfs 3.622 af
Primary=27.74 cfs 3.622 af

Total Runoff Area = 501.462 ac Runoff Volume = 122.282 af Average Runoff Depth = 2.93"
45.62% Pervious = 228.758 ac 54.38% Impervious = 272.704 ac

Summary for Subcatchment 1S: To Rice Creek

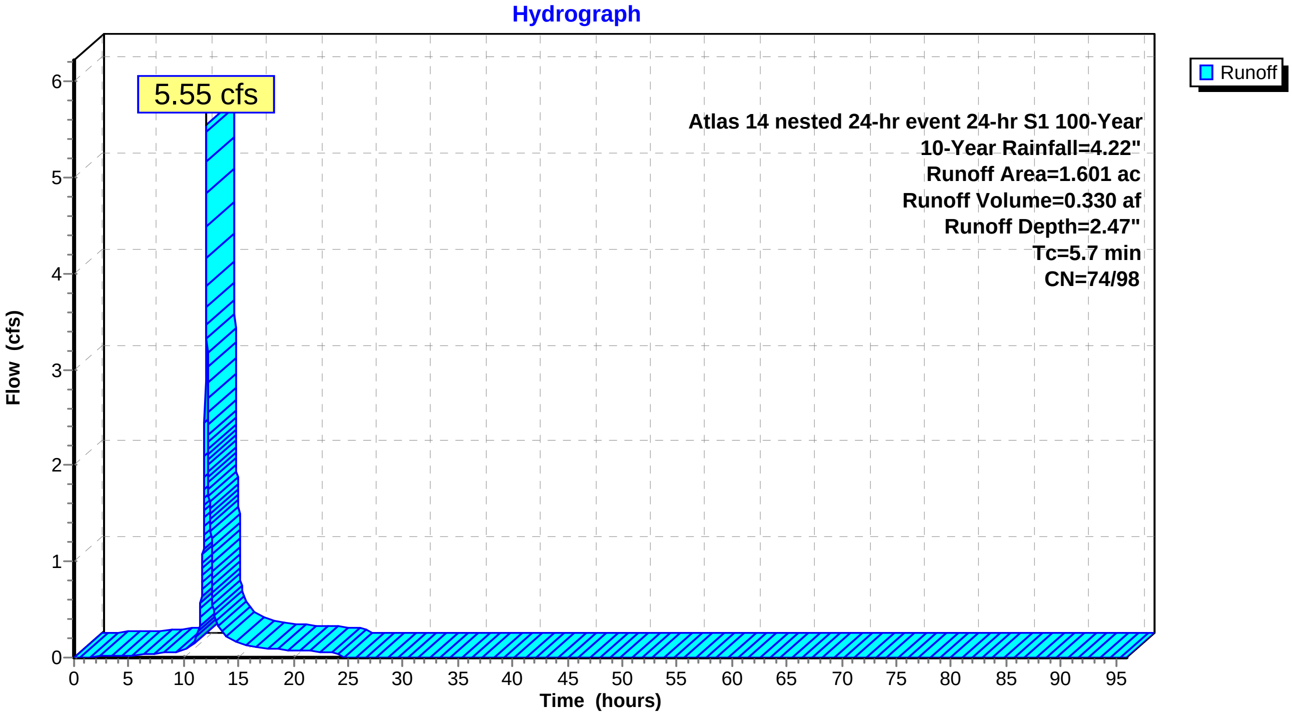
Runoff = 5.55 cfs @ 12.04 hrs, Volume= 0.330 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.512	98	impervious
*	1.089	74	pervious
	1.601	82	Weighted Average
	1.089		68.02% Pervious Area
	0.512		31.98% Impervious Area

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

Subcatchment 1S: To Rice Creek



Summary for Subcatchment SB 1: SB 1

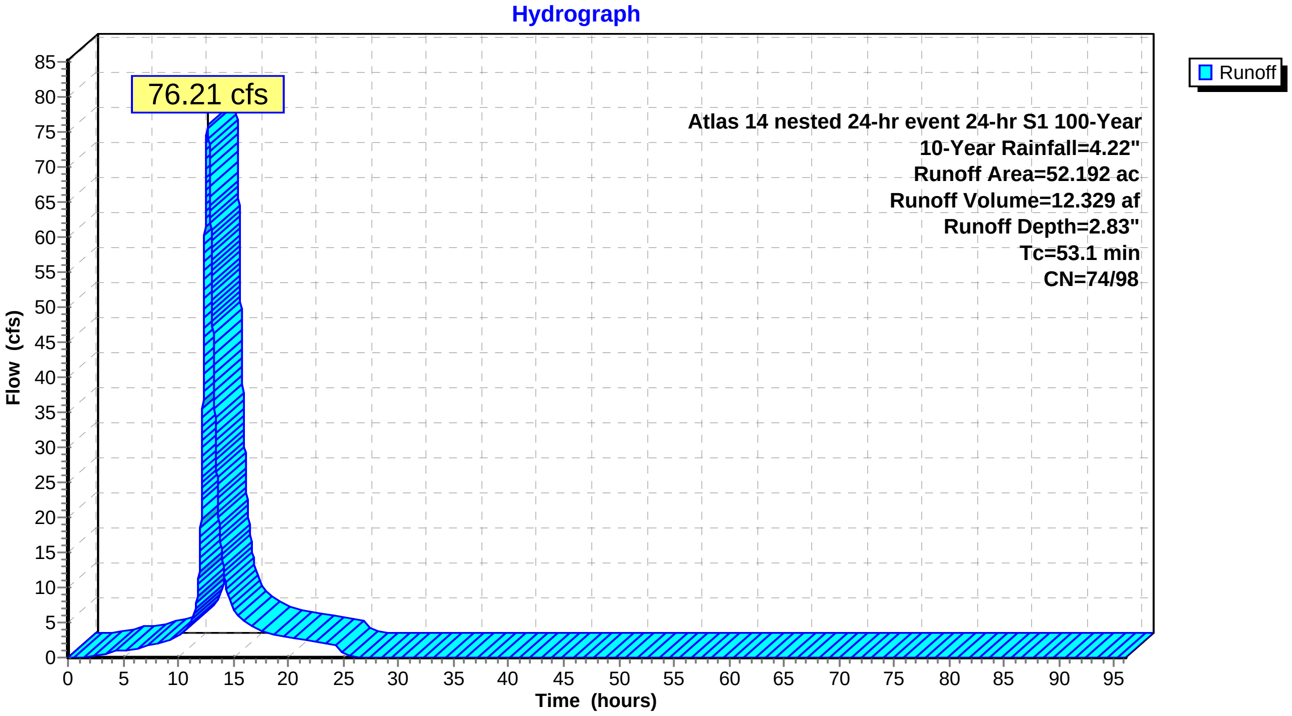
Runoff = 76.21 cfs @ 12.69 hrs, Volume= 12.329 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	26.958	74	pervious
*	25.234	98	impervious
	52.192	86	Weighted Average
	26.958		51.65% Pervious Area
	25.234		48.35% Impervious Area

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

Subcatchment SB 1: SB 1



Summary for Subcatchment SB 10: SB 10

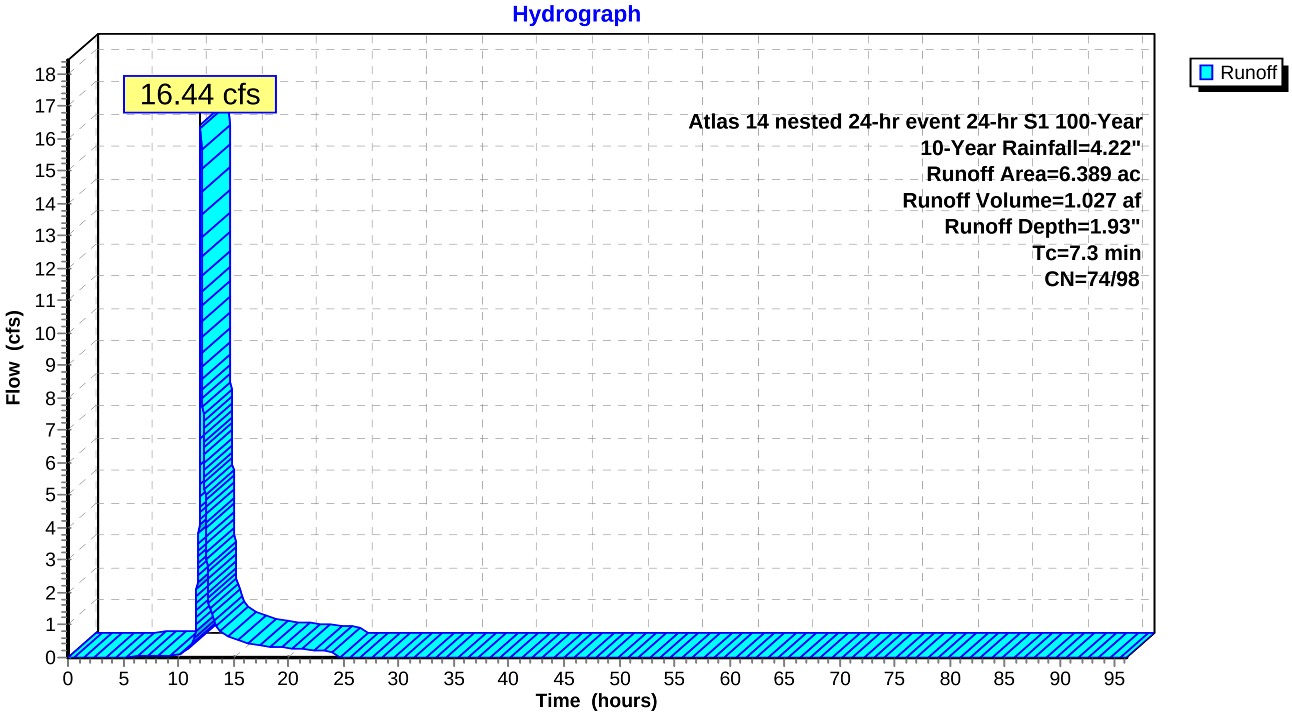
Runoff = 16.44 cfs @ 12.06 hrs, Volume= 1.027 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	5.902	74	pervious
*	0.487	98	impervious
	6.389	76	Weighted Average
	5.902		92.38% Pervious Area
	0.487		7.62% Impervious Area

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

Subcatchment SB 10: SB 10



Summary for Subcatchment SB 11: SB 11

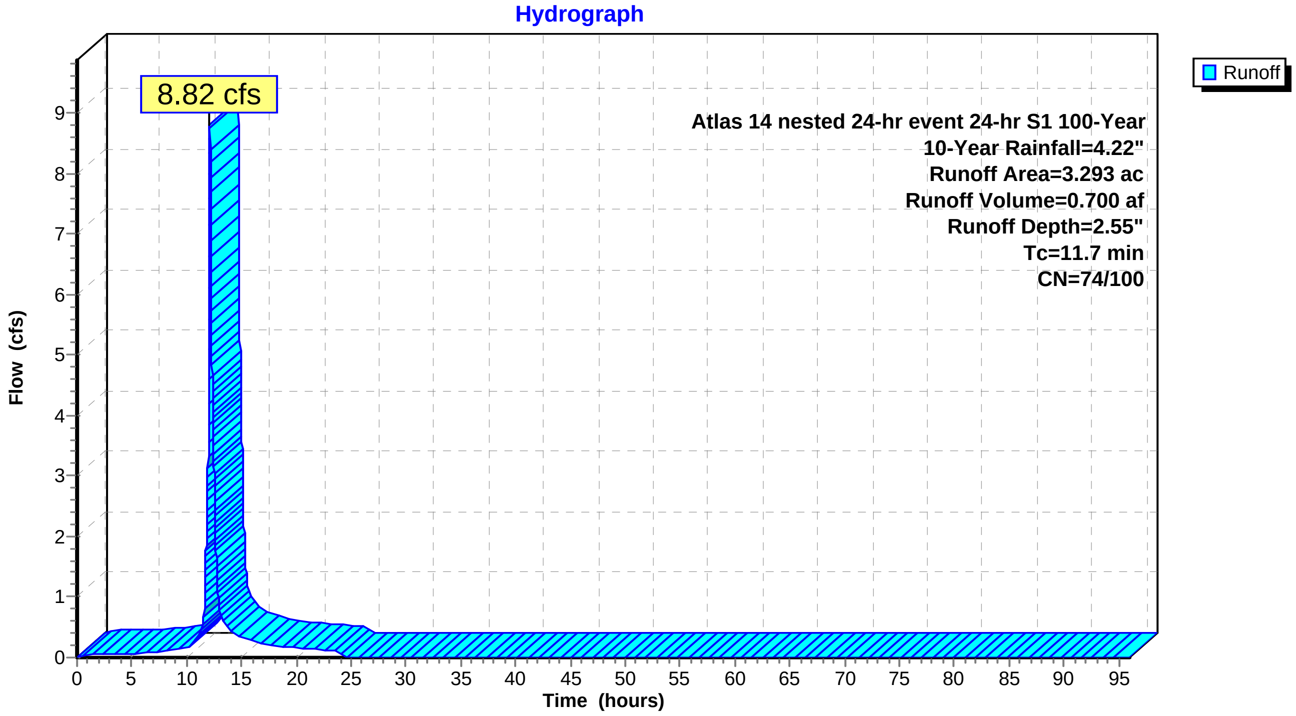
Runoff = 8.82 cfs @ 12.11 hrs, Volume= 0.700 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.234	74	pervious
*	1.059	100	impervious
	3.293	82	Weighted Average
	2.234		67.84% Pervious Area
	1.059		32.16% Impervious Area

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

Subcatchment SB 11: SB 11



Summary for Subcatchment SB 12: SB 12

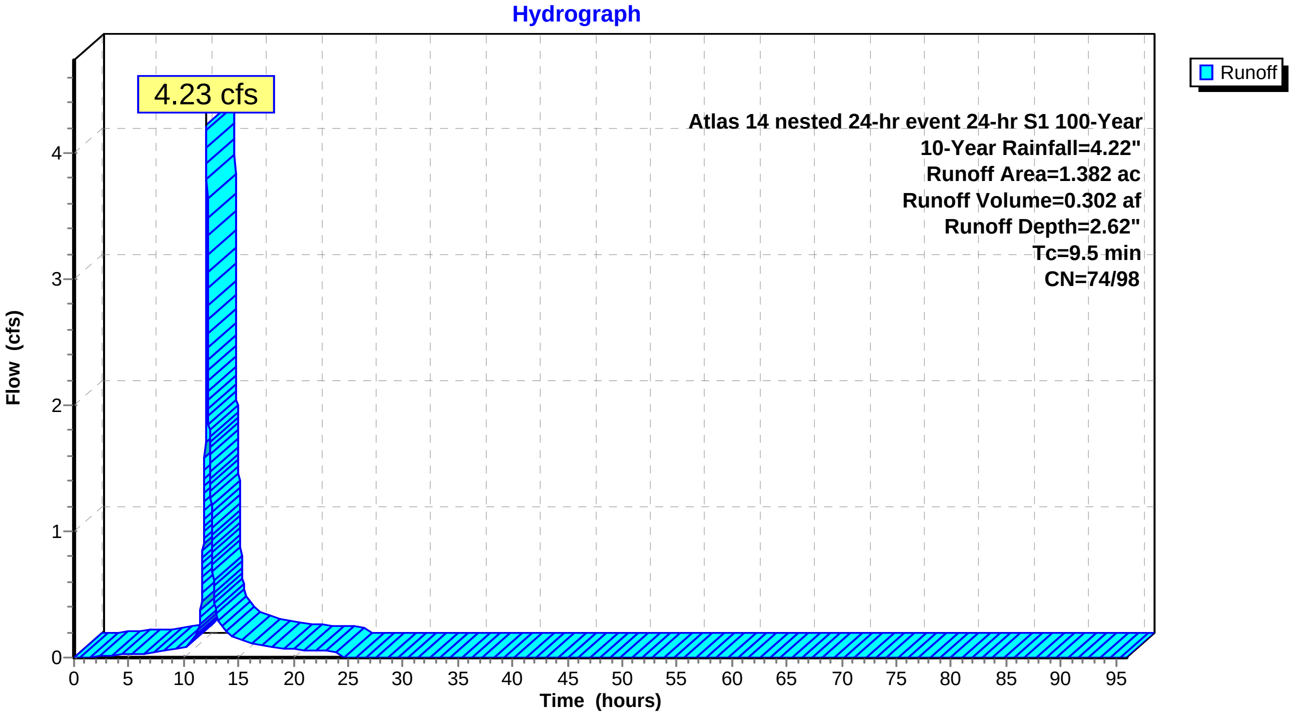
Runoff = 4.23 cfs @ 12.08 hrs, Volume= 0.302 af, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.847	74	pervious
*	0.535	98	impervious
	1.382	83	Weighted Average
	0.847		61.29% Pervious Area
	0.535		38.71% Impervious Area

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

Subcatchment SB 12: SB 12



Summary for Subcatchment SB 13: SB 13

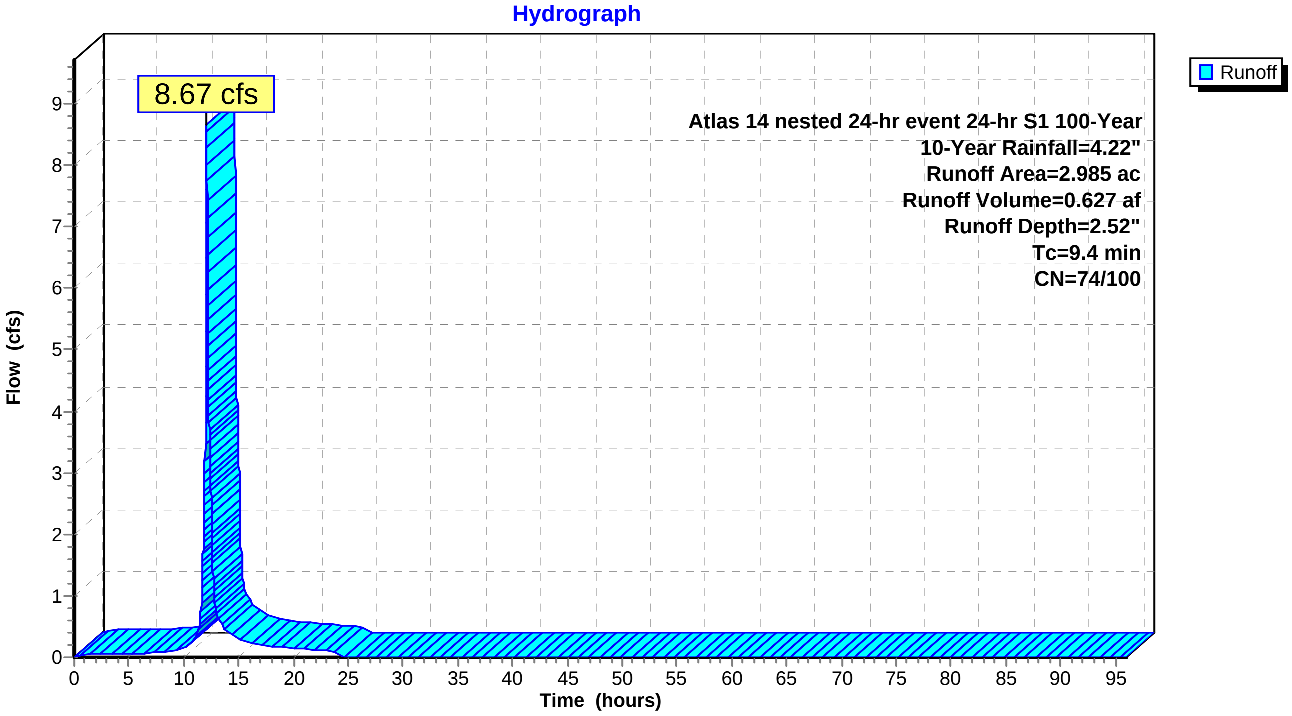
Runoff = 8.67 cfs @ 12.08 hrs, Volume= 0.627 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.060	74	pervious
*	0.925	100	impervious
	2.985	82	Weighted Average
	2.060		69.01% Pervious Area
	0.925		30.99% Impervious Area

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

Subcatchment SB 13: SB 13



Summary for Subcatchment SB 14: SB 14

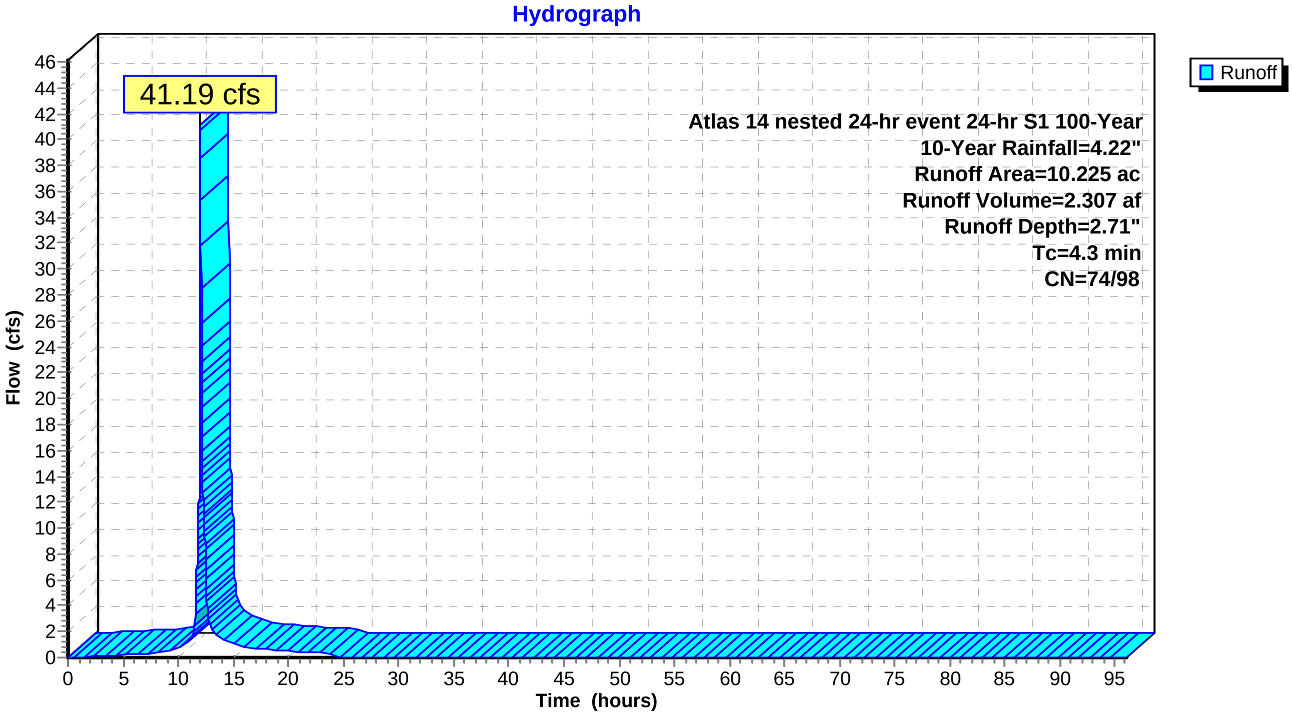
Runoff = 41.19 cfs @ 12.02 hrs, Volume= 2.307 af, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	5.867	74	pervious
*	4.358	98	impervious
	10.225	84	Weighted Average
	5.867		57.38% Pervious Area
	4.358		42.62% Impervious Area

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

Subcatchment SB 14: SB 14



Summary for Subcatchment SB 15: SB 15

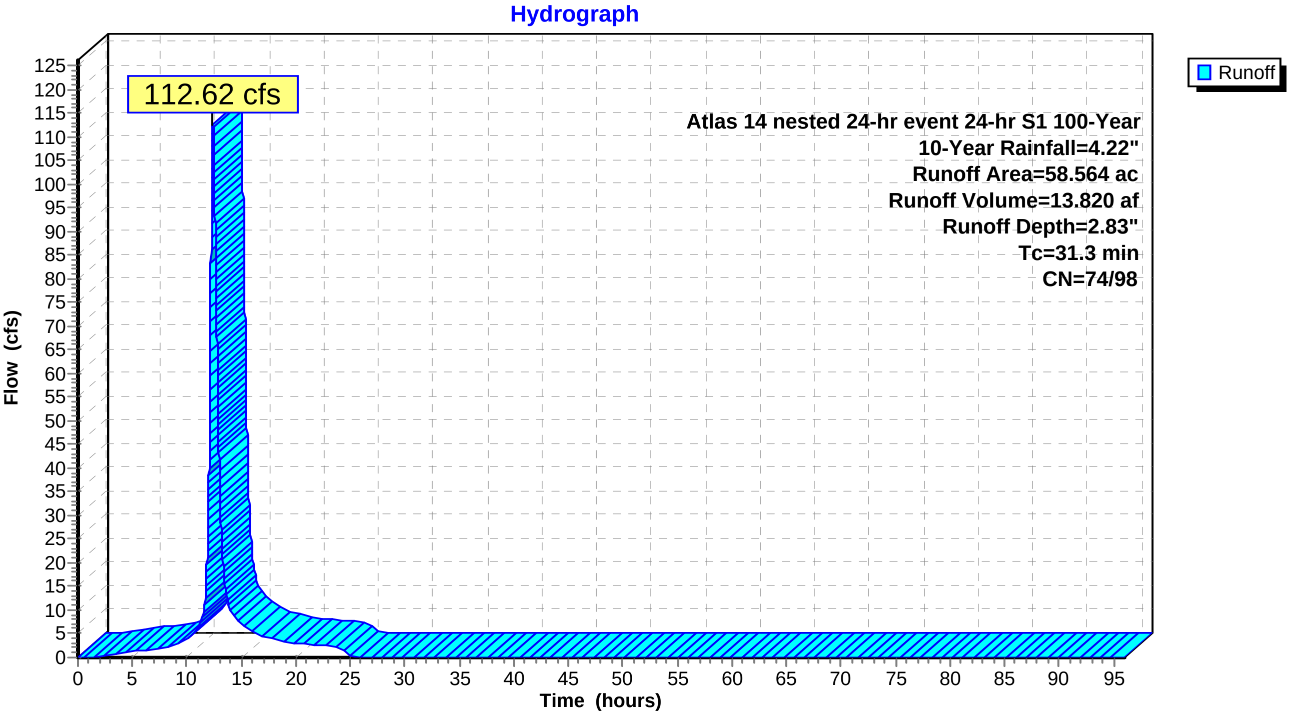
Runoff = 112.62 cfs @ 12.38 hrs, Volume= 13.820 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	30.326	74	pervious
*	28.238	98	impervious
	58.564	86	Weighted Average
	30.326		51.78% Pervious Area
	28.238		48.22% Impervious Area

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

Subcatchment SB 15: SB 15



Summary for Subcatchment SB 16: SB 16

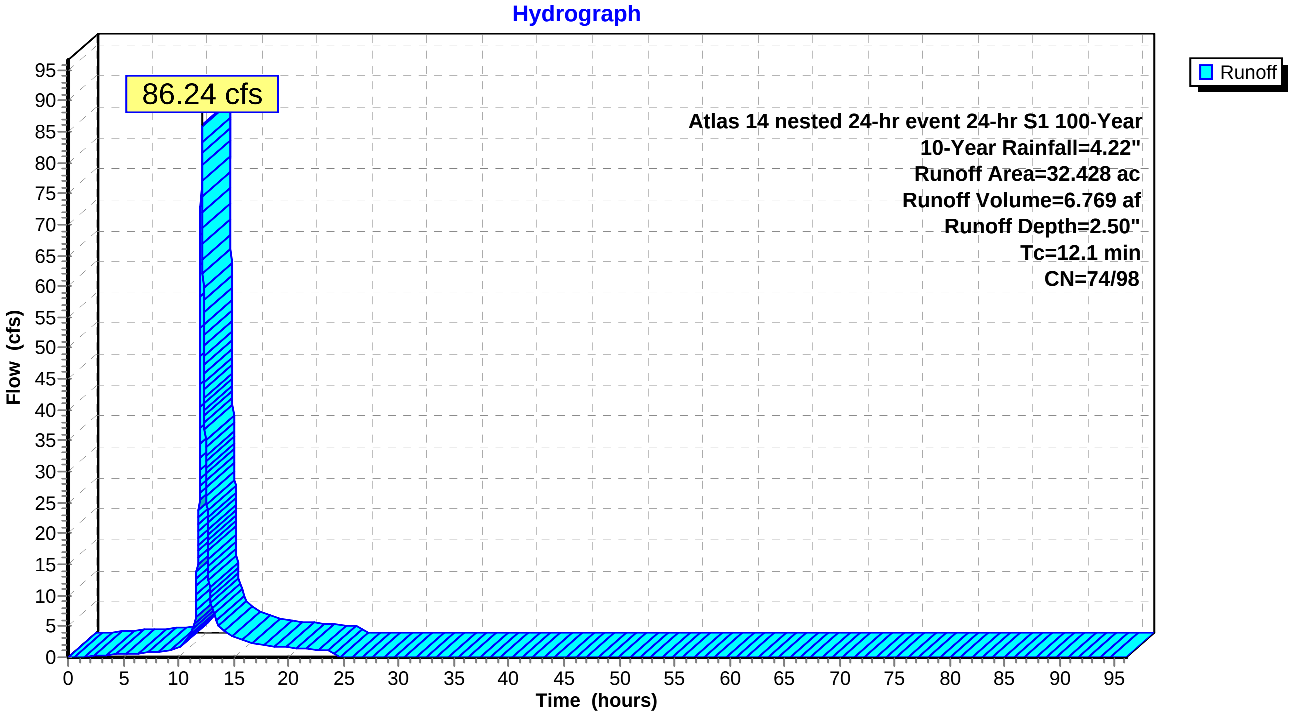
Runoff = 86.24 cfs @ 12.12 hrs, Volume= 6.769 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	21.555	74	pervious
*	10.873	98	impervious
	32.428	82	Weighted Average
	21.555		66.47% Pervious Area
	10.873		33.53% Impervious Area

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

Subcatchment SB 16: SB 16



Summary for Subcatchment SB 17: SB 17

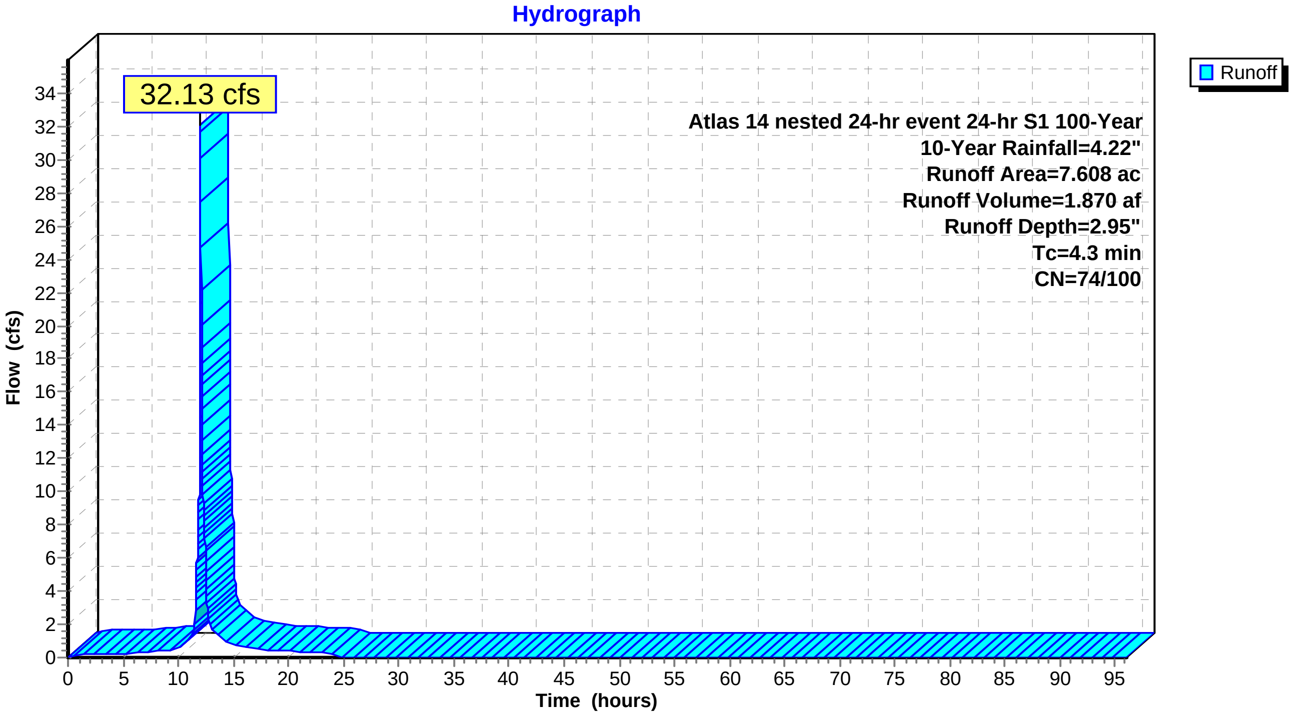
Runoff = 32.13 cfs @ 12.02 hrs, Volume= 1.870 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.925	74	pervious
*	3.683	100	impervious
	7.608	87	Weighted Average
	3.925		51.59% Pervious Area
	3.683		48.41% Impervious Area

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

Subcatchment SB 17: SB 17



Summary for Subcatchment SB 18: SB 18

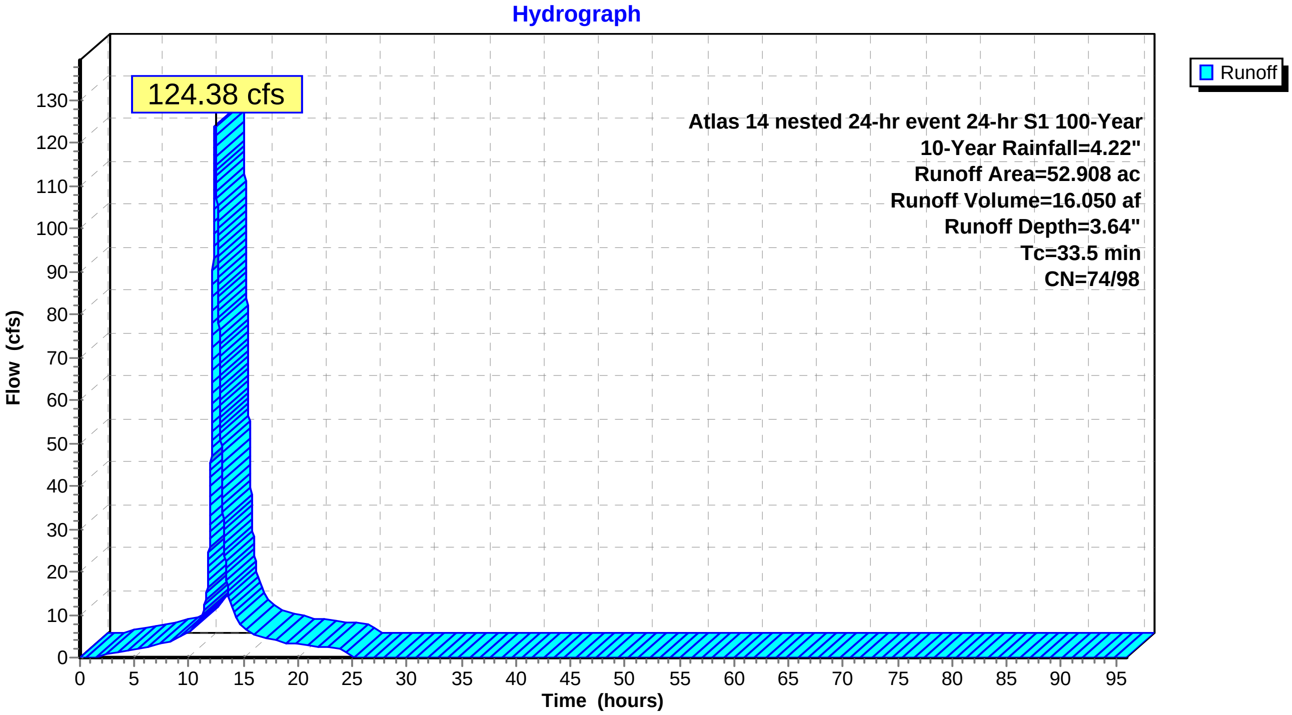
Runoff = 124.38 cfs @ 12.40 hrs, Volume= 16.050 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	8.172	74	pervious
*	44.736	98	impervious
	52.908	94	Weighted Average
	8.172		15.45% Pervious Area
	44.736		84.55% Impervious Area

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

Subcatchment SB 18: SB 18



Summary for Subcatchment SB 19: SB 19

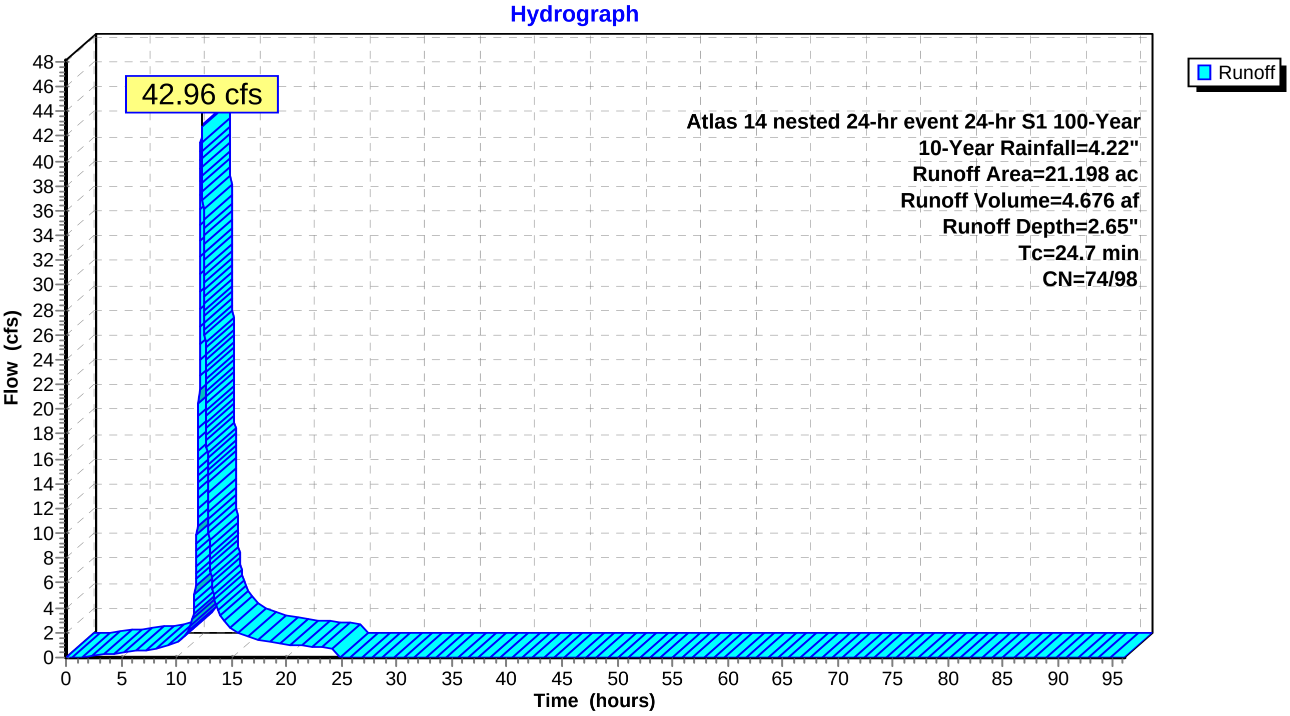
Runoff = 42.96 cfs @ 12.30 hrs, Volume= 4.676 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	12.734	74	pervious
*	8.464	98	impervious
	21.198	84	Weighted Average
	12.734		60.07% Pervious Area
	8.464		39.93% Impervious Area

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

Subcatchment SB 19: SB 19



Summary for Subcatchment SB 2: SB 2

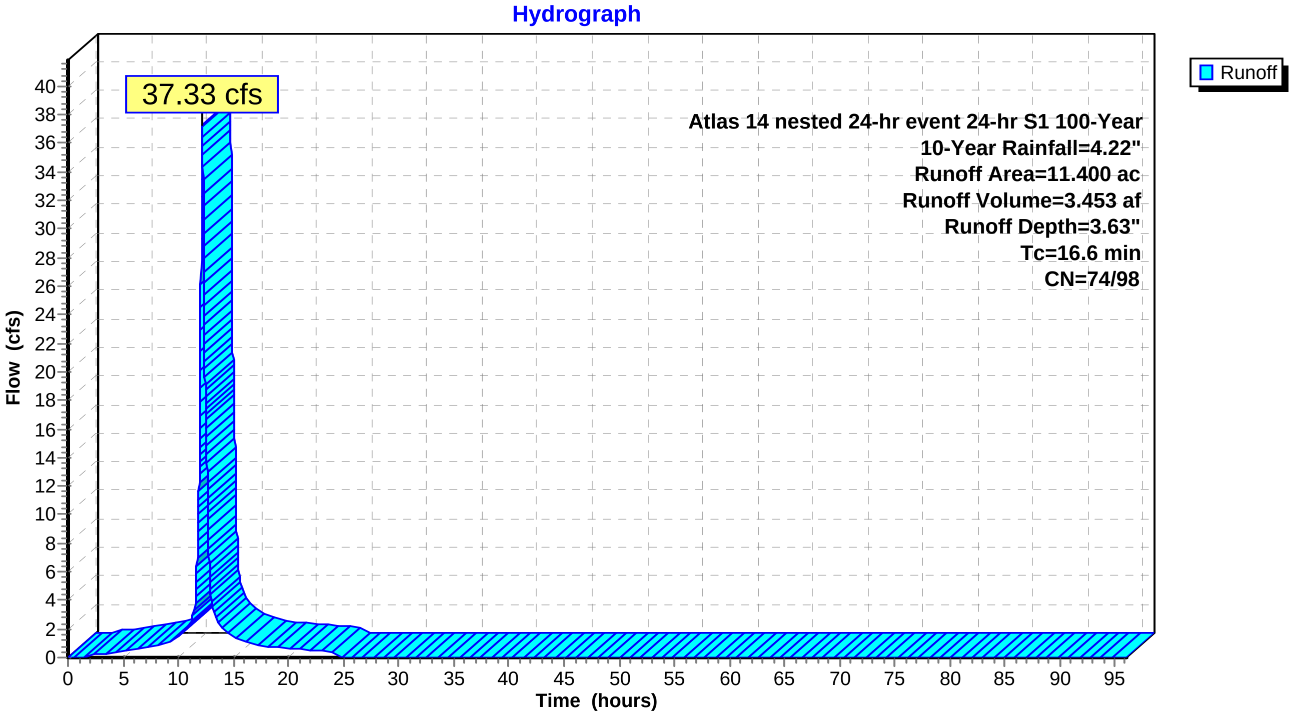
Runoff = 37.33 cfs @ 12.17 hrs, Volume= 3.453 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	1.791	74	pervious
*	9.609	98	impervious
	11.400	94	Weighted Average
	1.791		15.71% Pervious Area
	9.609		84.29% Impervious Area

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

Subcatchment SB 2: SB 2



Summary for Subcatchment SB 22: SB 22

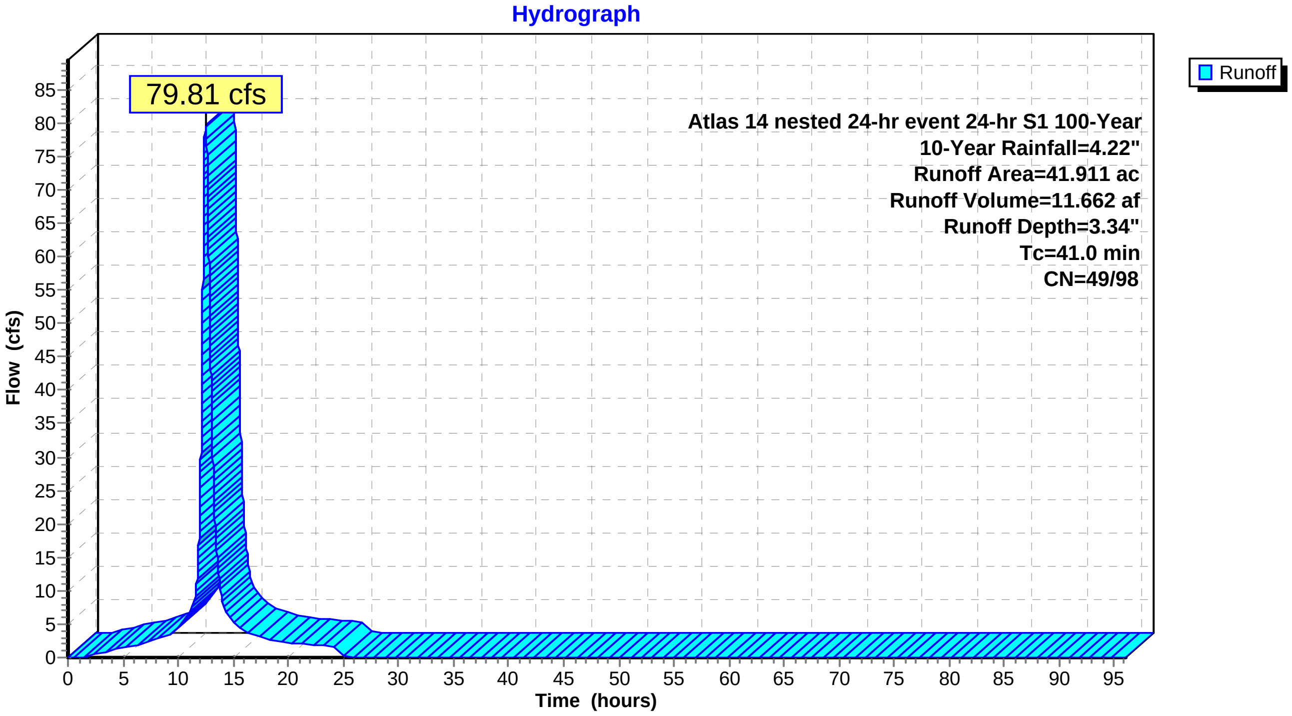
Runoff = 79.81 cfs @ 12.52 hrs, Volume= 11.662 af, Depth= 3.34"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	7.465	49	Pervious
*	34.446	98	Impervious
	41.911	89	Weighted Average
	7.465		17.81% Pervious Area
	34.446		82.19% Impervious Area

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

Subcatchment SB 22: SB 22



Summary for Subcatchment SB 24: SB 24

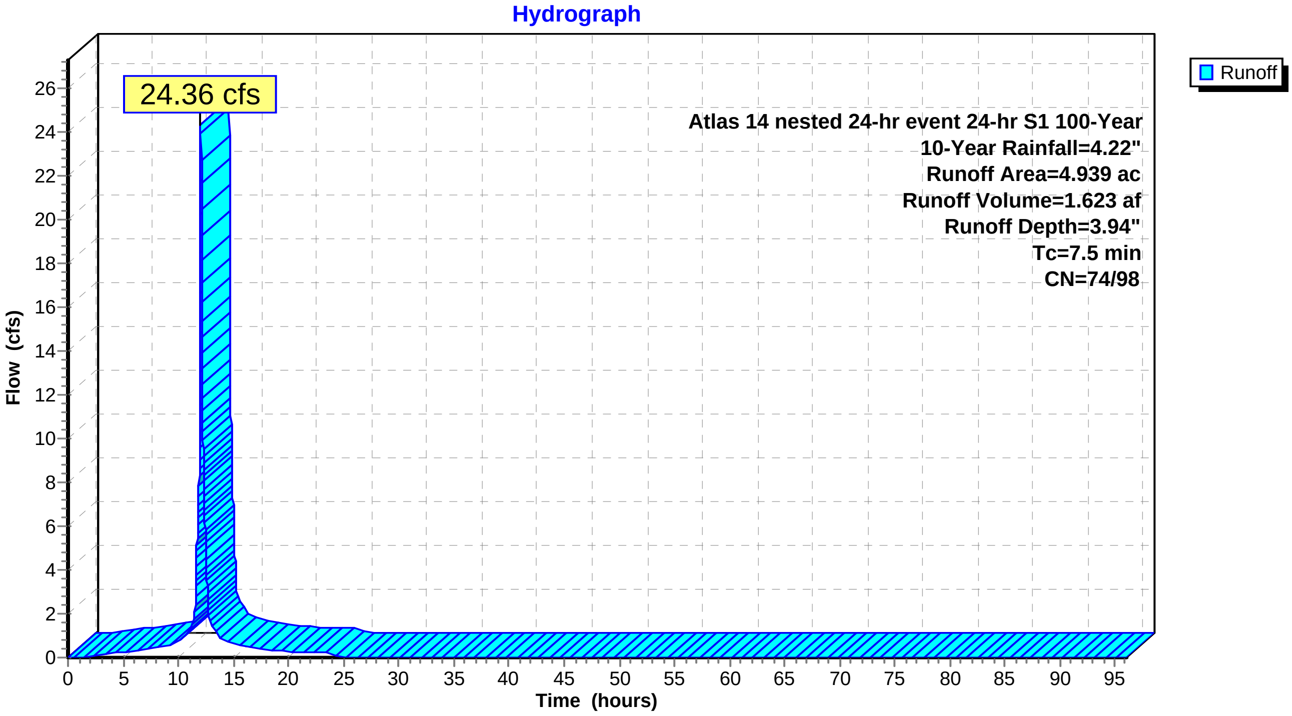
Runoff = 24.36 cfs @ 12.05 hrs, Volume= 1.623 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.088	74	permiable
*	4.851	98	impermiable
	4.939	98	Weighted Average
	0.088		1.78% Pervious Area
	4.851		98.22% Impervious Area

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

Subcatchment SB 24: SB 24



Summary for Subcatchment SB 25: SB 25

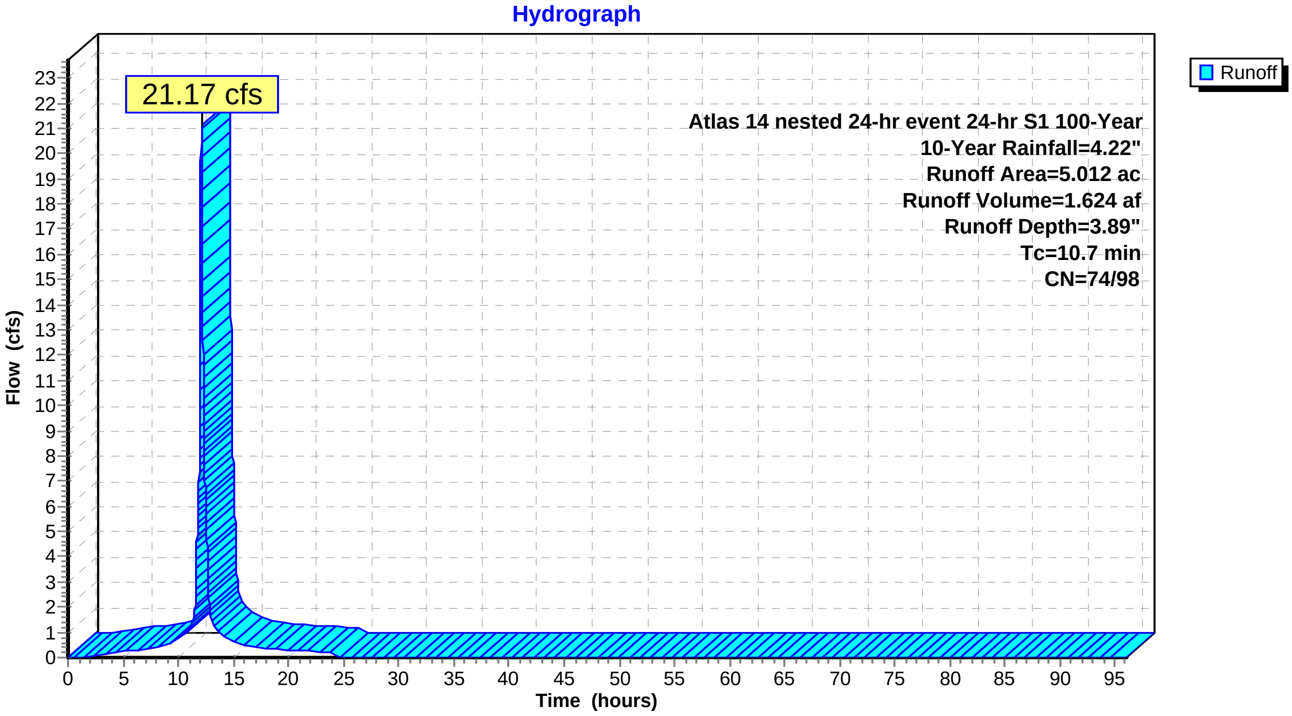
Runoff = 21.17 cfs @ 12.09 hrs, Volume= 1.624 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.215	74	pervious
*	4.797	98	impervious
	5.012	97	Weighted Average
	0.215		4.29% Pervious Area
	4.797		95.71% Impervious Area

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

Subcatchment SB 25: SB 25



Summary for Subcatchment SB 26: SB 26

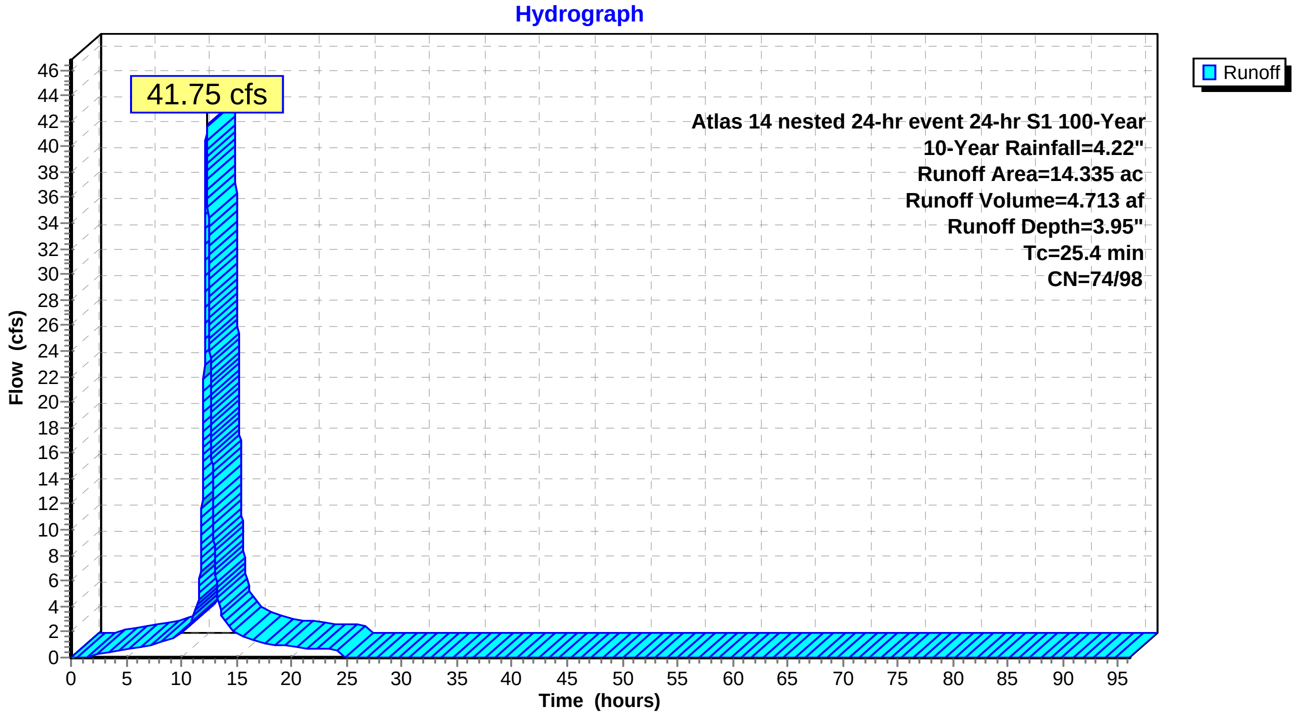
Runoff = 41.75 cfs @ 12.28 hrs, Volume= 4.713 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.248	74	pervious
*	14.087	98	impervious
	14.335	98	Weighted Average
	0.248		1.73% Pervious Area
	14.087		98.27% Impervious Area

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

Subcatchment SB 26: SB 26



Summary for Subcatchment SB 27: SB 27 (Thumb Road)

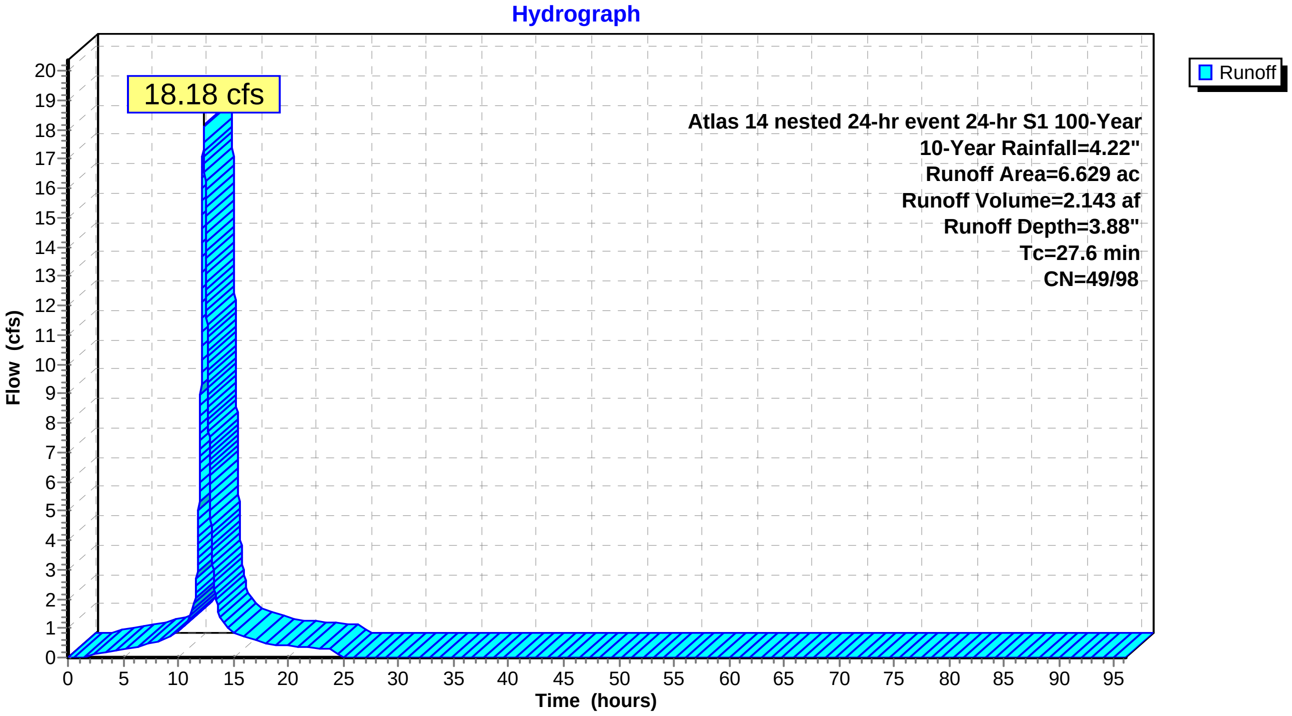
Runoff = 18.18 cfs @ 12.31 hrs, Volume= 2.143 af, Depth= 3.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.191	49	Pervious
*	6.438	98	Impervious
	6.629	97	Weighted Average
	0.191		2.88% Pervious Area
	6.438		97.12% Impervious Area

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

Subcatchment SB 27: SB 27 (Thumb Road)



Summary for Subcatchment SB 28: SB 28

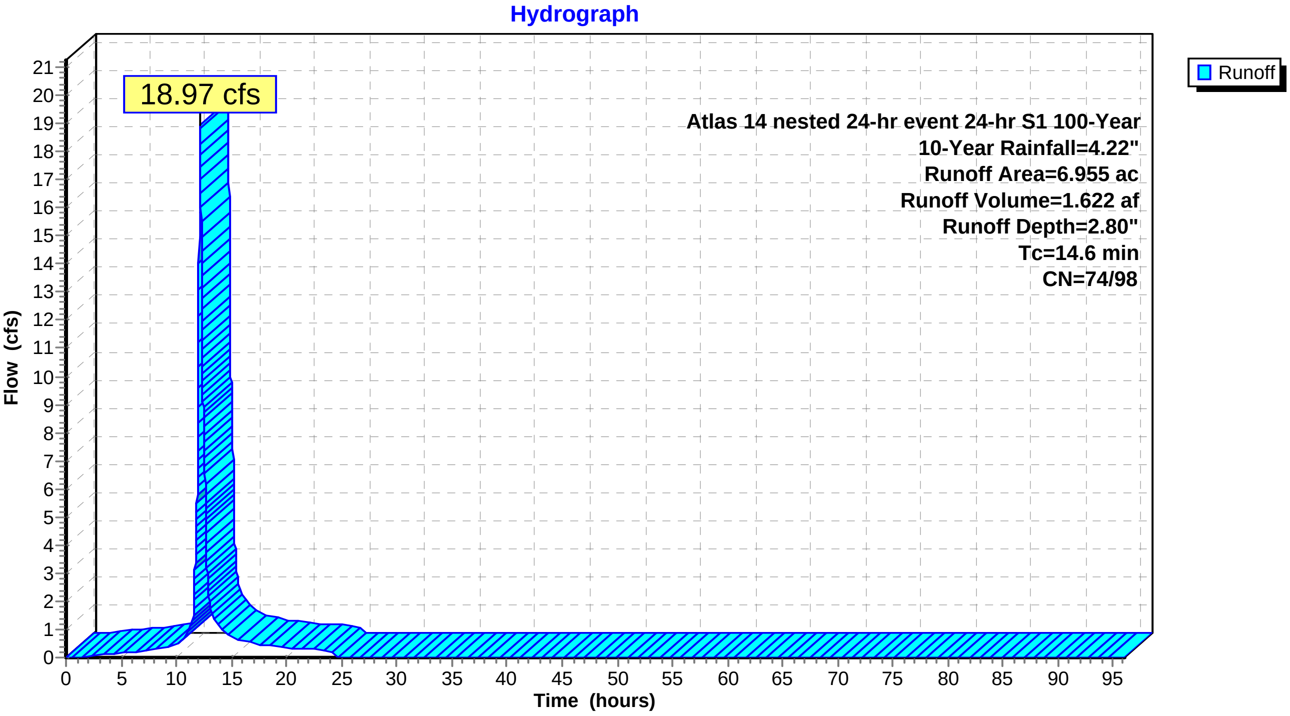
Runoff = 18.97 cfs @ 12.15 hrs, Volume= 1.622 af, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.703	74	pervious
*	3.252	98	impervious
	6.955	85	Weighted Average
	3.703		53.24% Pervious Area
	3.252		46.76% Impervious Area

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

Subcatchment SB 28: SB 28



Summary for Subcatchment SB 29: SB 29

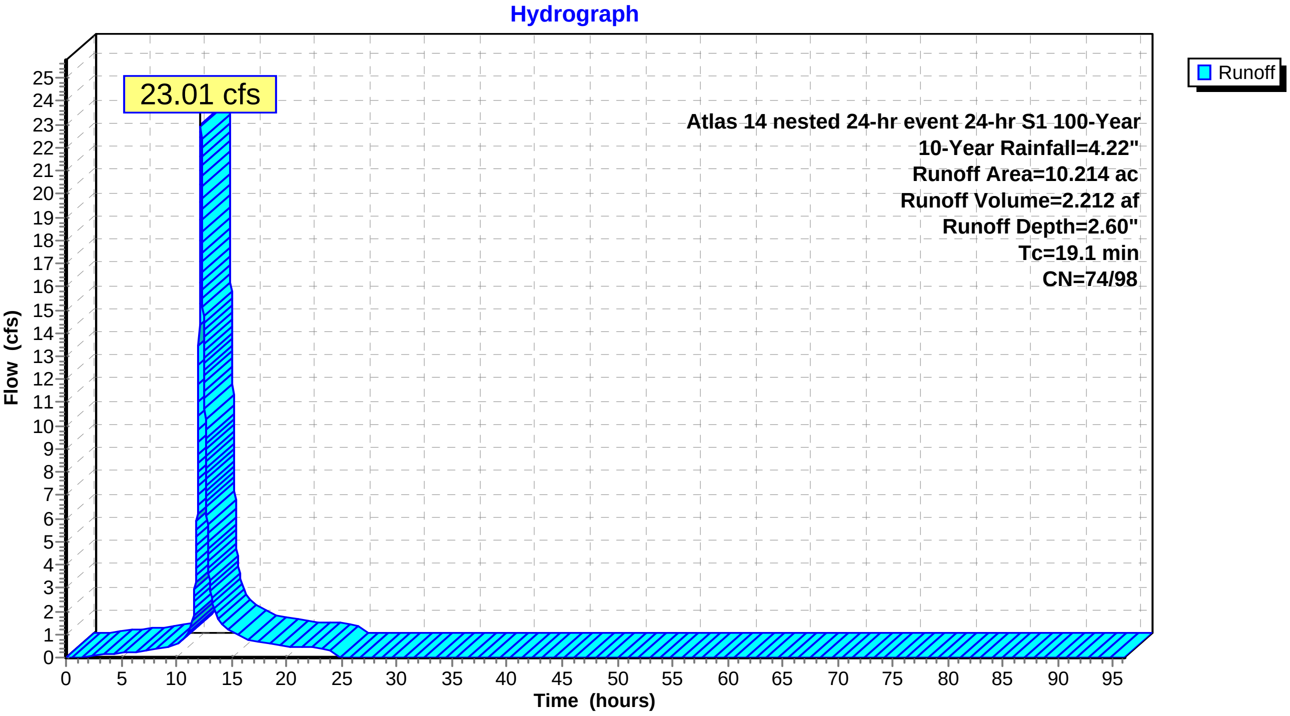
Runoff = 23.01 cfs @ 12.22 hrs, Volume= 2.212 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	6.360	74	pervious
*	3.854	98	impervious
	10.214	83	Weighted Average
	6.360		62.27% Pervious Area
	3.854		37.73% Impervious Area

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

Subcatchment SB 29: SB 29



Summary for Subcatchment SB 3: SB 3

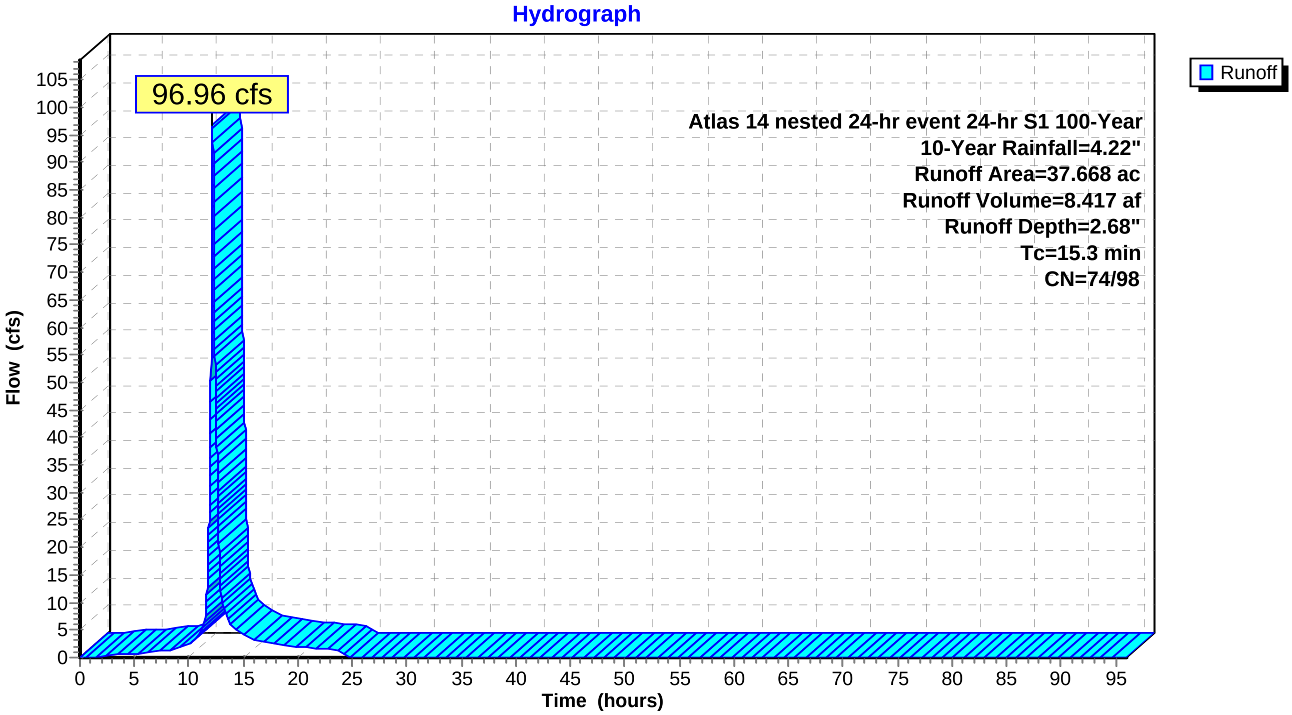
Runoff = 96.96 cfs @ 12.16 hrs, Volume= 8.417 af, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	22.050	74	Pervious
*	15.618	98	Impervious
	37.668	84	Weighted Average
	22.050		58.54% Pervious Area
	15.618		41.46% Impervious Area

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

Subcatchment SB 3: SB 3



Summary for Subcatchment SB 4: SB 4

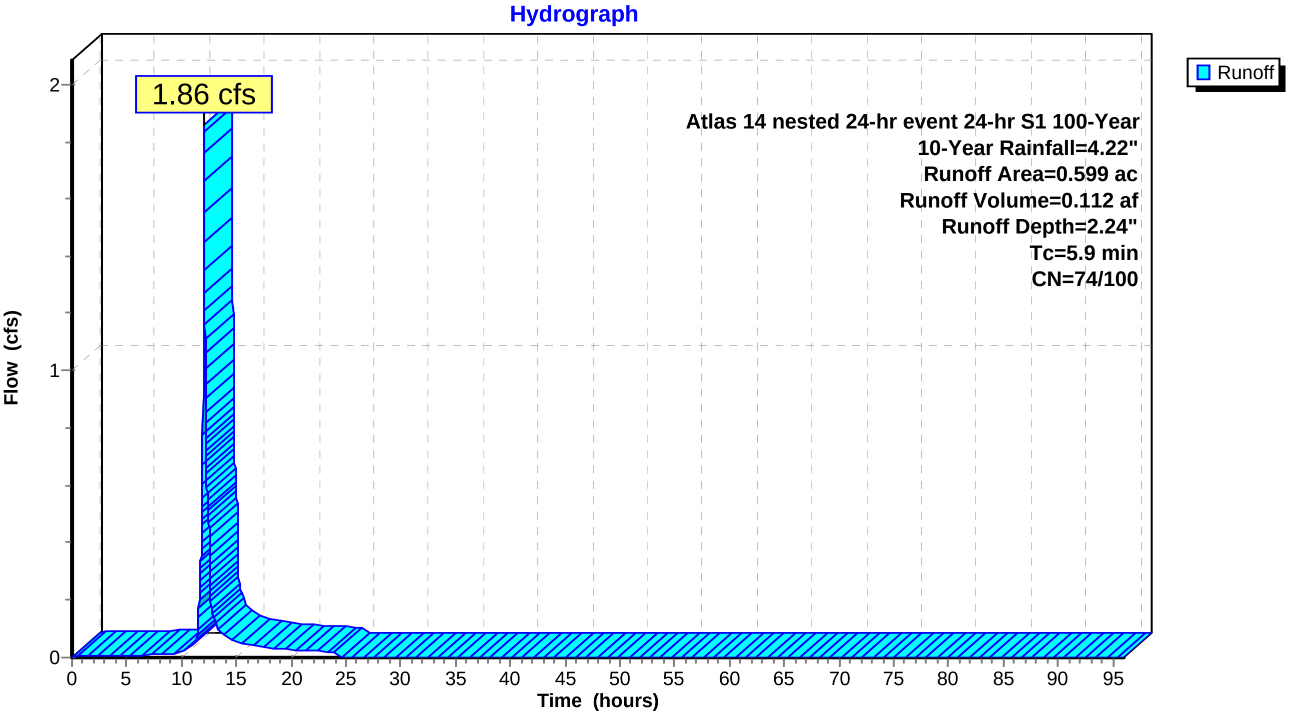
Runoff = 1.86 cfs @ 12.04 hrs, Volume= 0.112 af, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.481	74	pervious
*	0.118	100	impervious
	0.599	79	Weighted Average
	0.481		80.30% Pervious Area
	0.118		19.70% Impervious Area

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

Subcatchment SB 4: SB 4



Summary for Subcatchment SB 5: SB 5

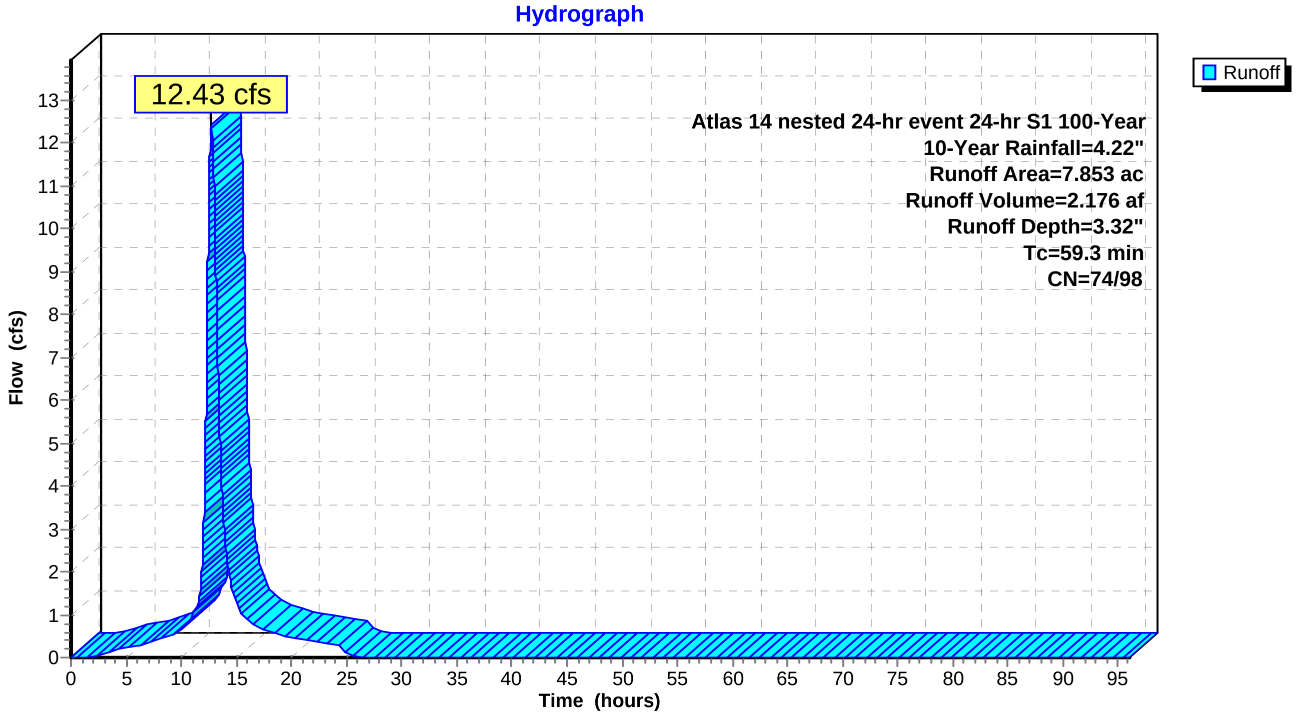
Runoff = 12.43 cfs @ 12.72 hrs, Volume= 2.176 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	2.327	74	pervious
*	5.526	98	impervious
	7.853	91	Weighted Average
	2.327		29.63% Pervious Area
	5.526		70.37% Impervious Area

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

Subcatchment SB 5: SB 5



Summary for Subcatchment SB 51: Offsite Subbasin 51

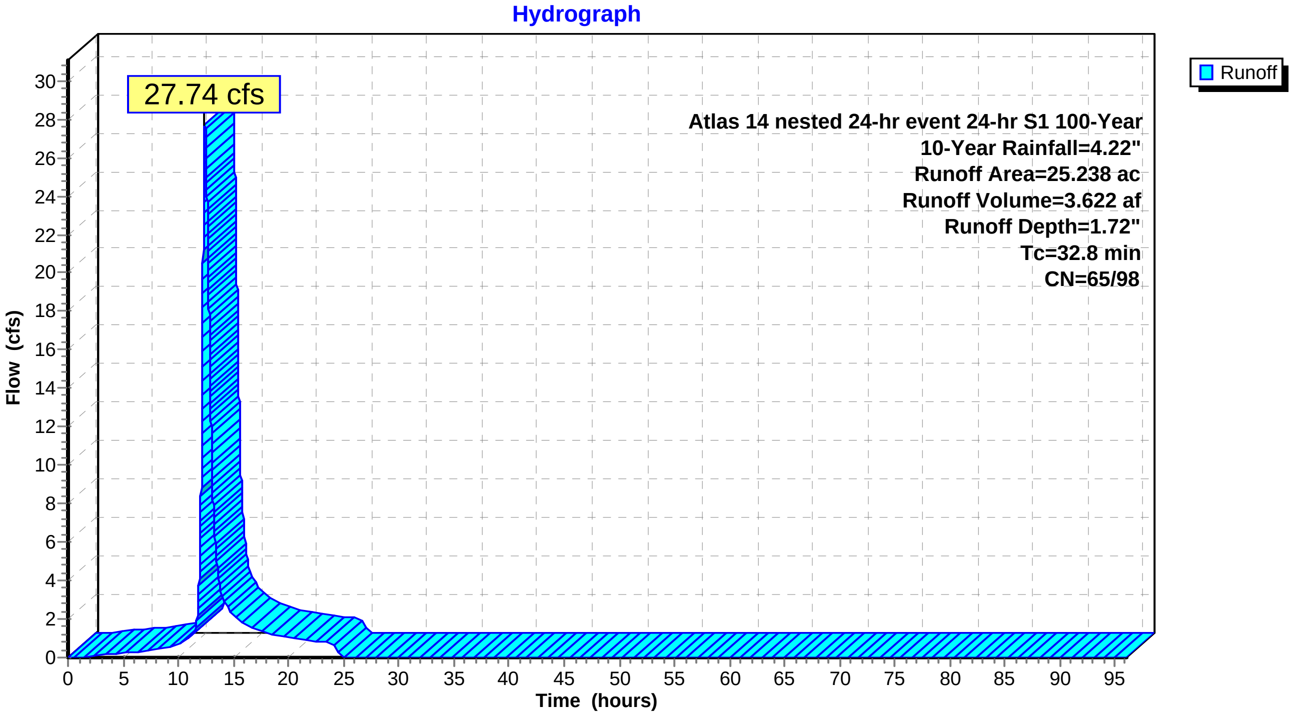
Runoff = 27.74 cfs @ 12.43 hrs, Volume= 3.622 af, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	20.200	65	Offsite subbasin 51
*	5.038	98	
	25.238	72	Weighted Average
	20.200		80.04% Pervious Area
	5.038		19.96% Impervious Area

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

Subcatchment SB 51: Offsite Subbasin 51



Summary for Subcatchment SB 6: SB 6

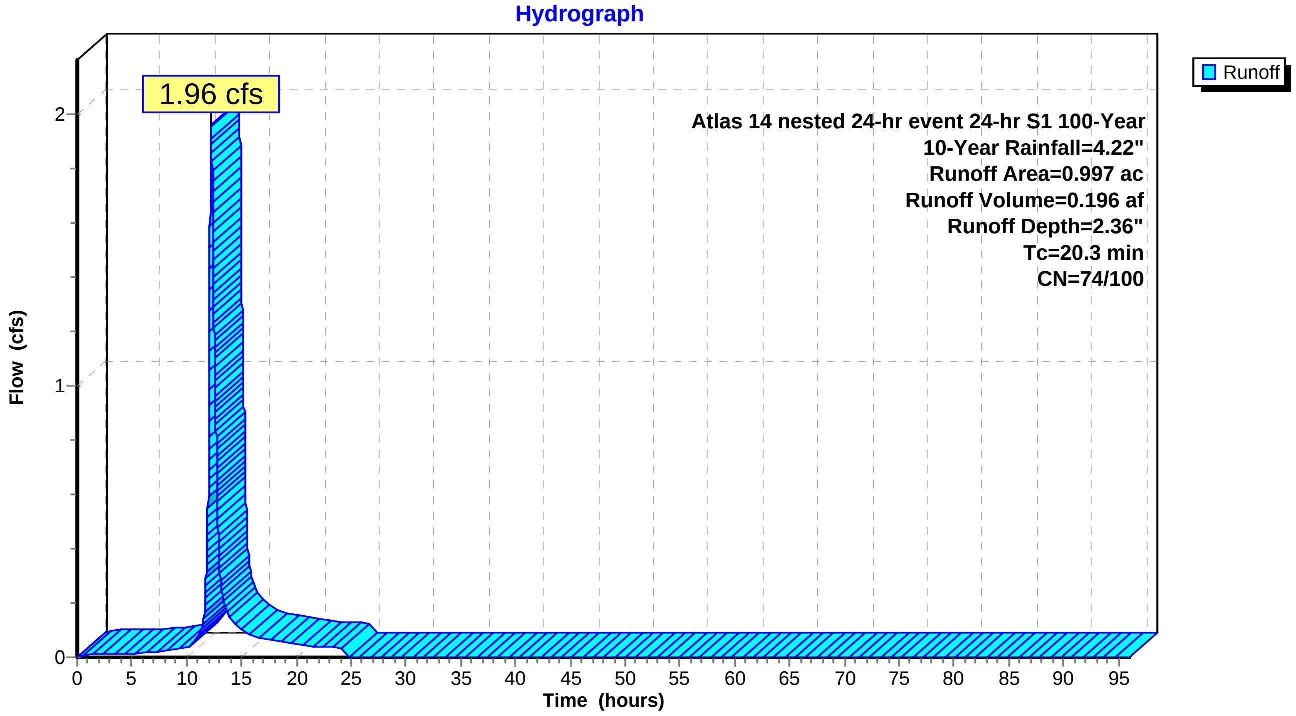
Runoff = 1.96 cfs @ 12.24 hrs, Volume= 0.196 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	0.753	74	pervious
*	0.244	100	impervious
	0.997	80	Weighted Average
	0.753		75.53% Pervious Area
	0.244		24.47% Impervious Area

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

Subcatchment SB 6: SB 6



Summary for Subcatchment SB 7: SB 7

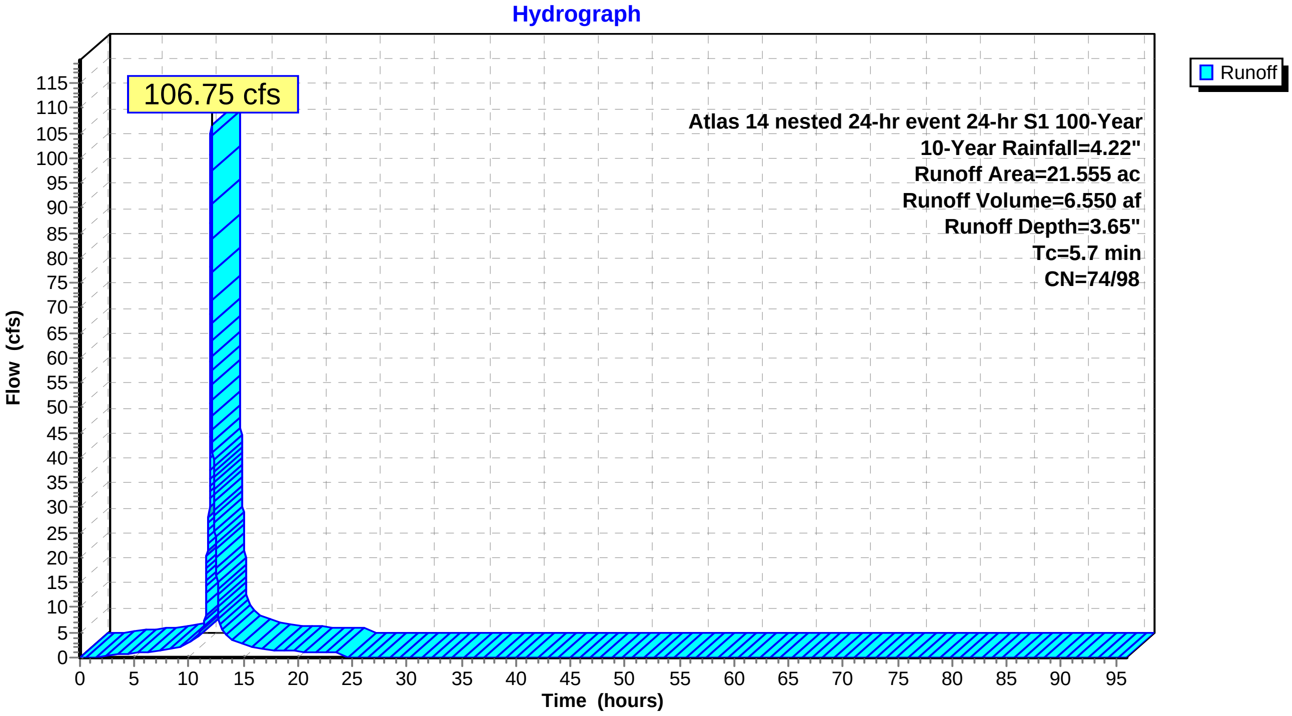
Runoff = 106.75 cfs @ 12.03 hrs, Volume= 6.550 af, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	3.269	74	pervious
*	18.286	98	impervious
	21.555	94	Weighted Average
	3.269		15.17% Pervious Area
	18.286		84.83% Impervious Area

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

Subcatchment SB 7: SB 7



Summary for Subcatchment SB 8: SB 8

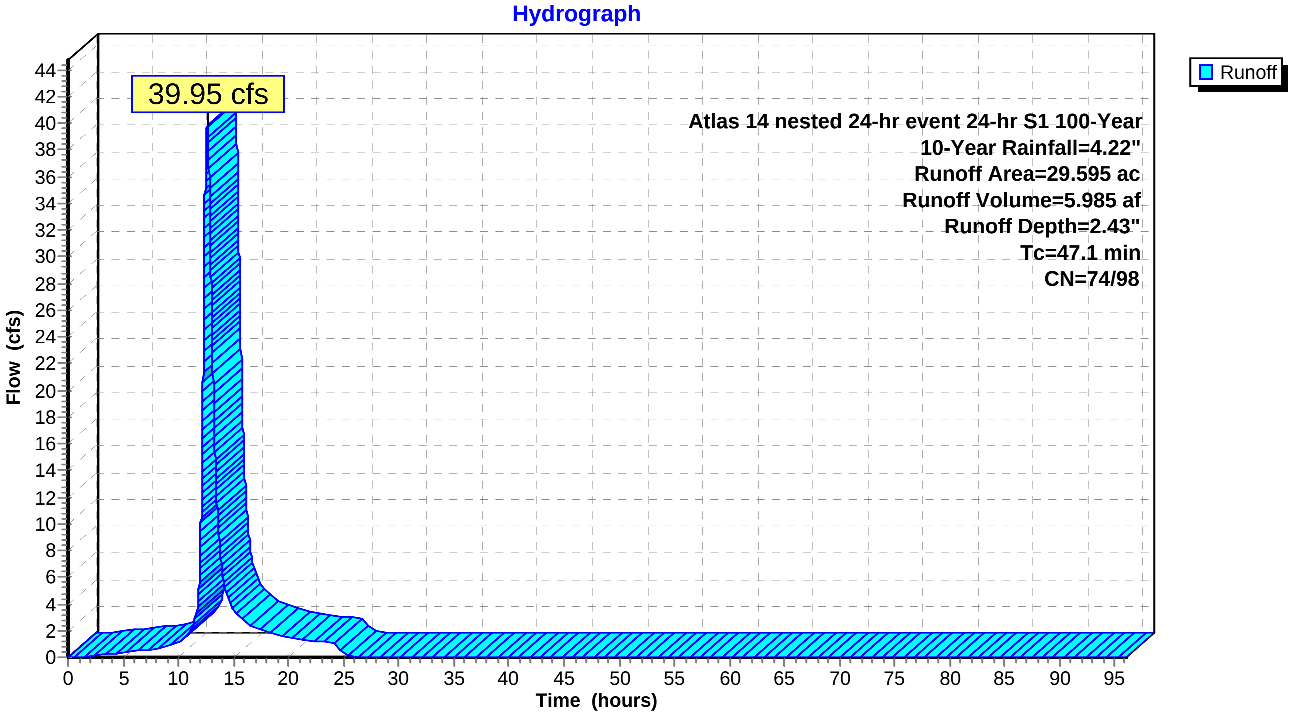
Runoff = 39.95 cfs @ 12.61 hrs, Volume= 5.985 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	20.714	74	pervious
*	8.881	98	impervious
	29.595	81	Weighted Average
	20.714		69.99% Pervious Area
	8.881		30.01% Impervious Area

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

Subcatchment SB 8: SB 8



Summary for Subcatchment SB 9: SB 9

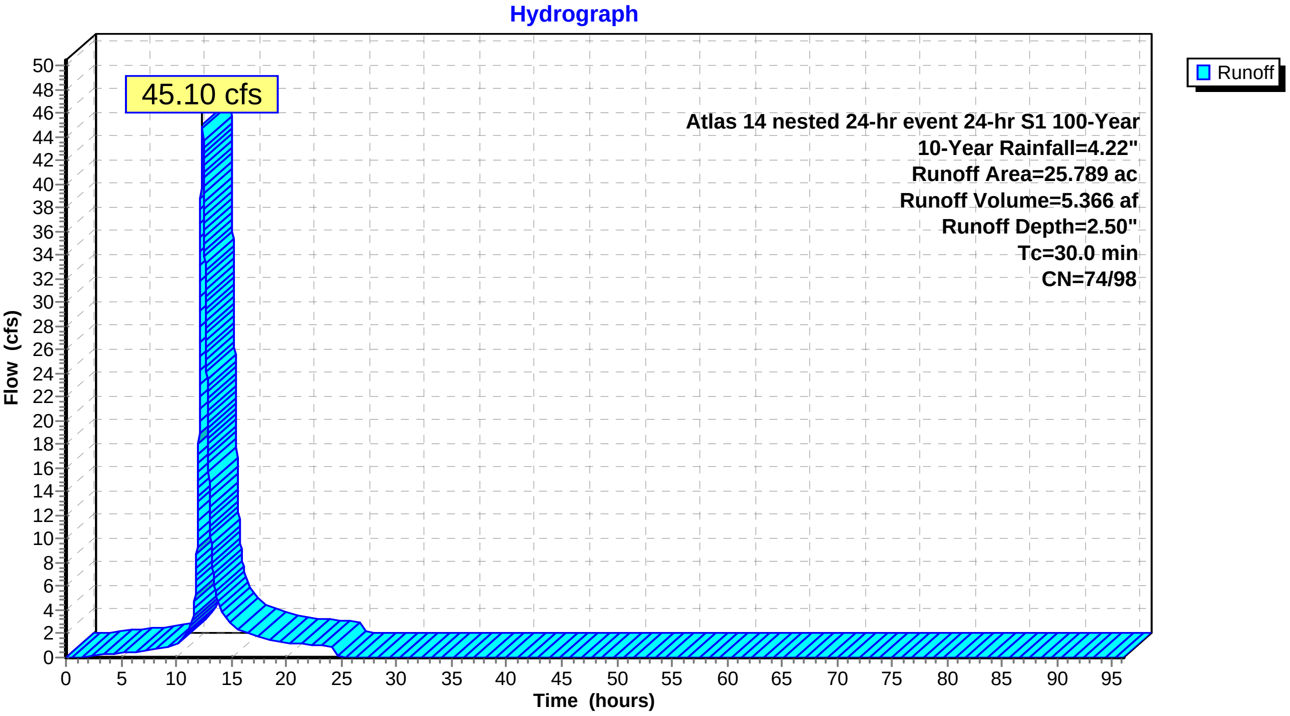
Runoff = 45.10 cfs @ 12.37 hrs, Volume= 5.366 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year 10-Year Rainfall=4.22"

	Area (ac)	CN	Description
*	17.234	74	permiable
*	8.555	98	impermiable
	25.789	82	Weighted Average
	17.234		66.83% Pervious Area
	8.555		33.17% Impervious Area

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

Subcatchment SB 9: SB 9



Summary for Pond 3P: P-3

```
Inflow Area =      133.365 ac,  58.87% Impervious,  Inflow Depth =   2.78"    for  10-Year event
Inflow       =     146.54 cfs @   12.04 hrs,  Volume=          30.858 af
Outflow      =      98.88 cfs @   13.04 hrs,  Volume=          30.840 af,  Atten= 33%,  Lag= 60.0 min
Primary      =      98.88 cfs @   13.04 hrs,  Volume=          30.840 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 914.00' Surf.Area= 1.790 ac Storage= 5.827 af
Peak Elev= 917.66' @ 13.04 hrs Surf.Area= 2.510 ac Storage= 13.758 af (7.931 af above start)

Plug-Flow detention time= 319.6 min calculated for 25.011 af (81% of inflow)
Center-of-Mass det. time= 134.6 min (1,014.4 - 879.8)

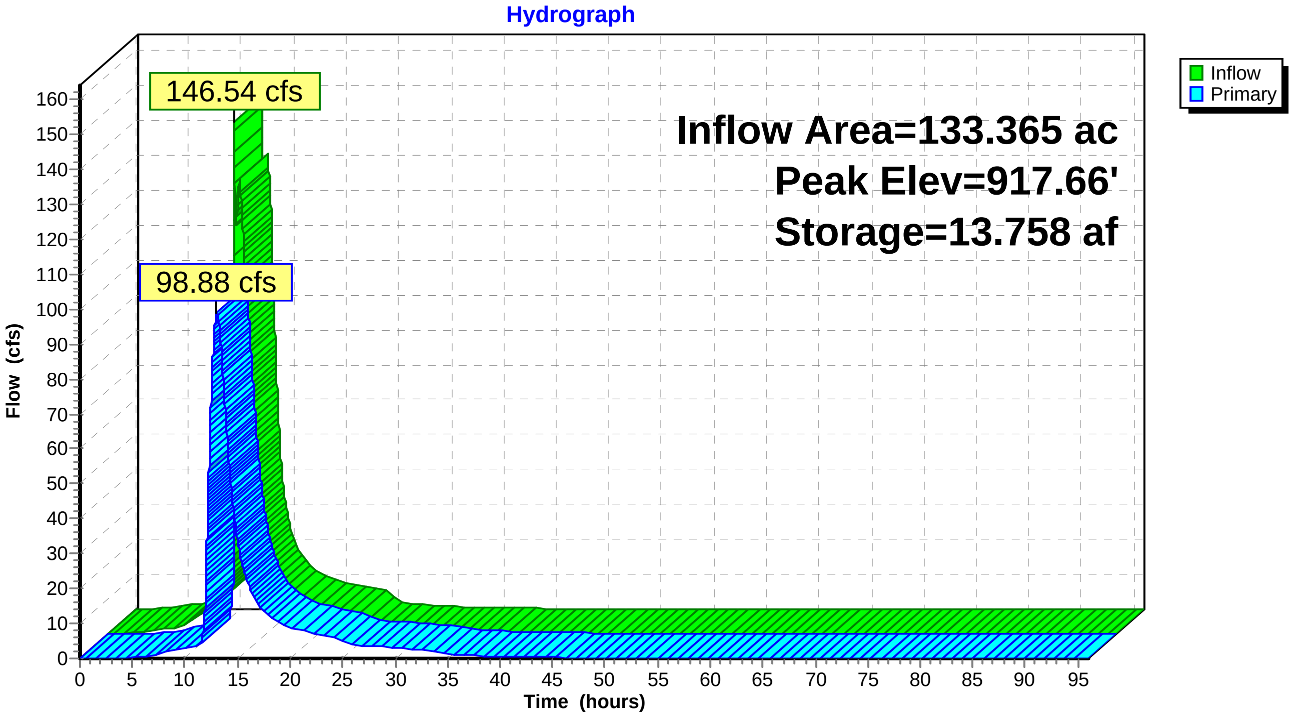
Volume	Invert	Avail.Storage	Storage Description
#1	909.85'	20.423 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
909.85	1.130	0.000	0.000
912.00	1.360	2.677	2.677
916.00	2.220	7.160	9.837
918.00	2.570	4.790	14.627
920.10	2.950	5.796	20.423

Device	Routing	Invert	Outlet Devices
#1	Primary	914.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	918.25'	**10.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	915.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=98.88 cfs @ 13.04 hrs HW=917.66' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 7.23 cfs @ 9.21 fps)
├─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 91.65 cfs @ 5.33 fps)

Pond 3P: P-3


Hydrograph
146.54 cfs
98.88 cfs
Inflow Area=133.365 ac
Peak Elev=917.66'
Storage=13.758 af
Inflow
Primary
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 4P: P-4

Inflow Area = 7.853 ac, 70.37% Impervious, Inflow Depth = 3.32" for 10-Year event
Inflow = 12.43 cfs @ 12.72 hrs, Volume= 2.176 af
Outflow = 7.25 cfs @ 13.29 hrs, Volume= 2.176 af, Atten= 42%, Lag= 33.8 min
Primary = 4.47 cfs @ 13.29 hrs, Volume= 0.953 af
Secondary = 2.78 cfs @ 13.26 hrs, Volume= 1.223 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.275 ac Storage= 0.646 af
Peak Elev= 916.82' @ 13.29 hrs Surf.Area= 0.379 ac Storage= 1.241 af (0.595 af above start)

Plug-Flow detention time= 243.0 min calculated for 1.530 af (70% of inflow)
Center-of-Mass det. time= 58.7 min (873.0 - 814.3)

Volume	Invert	Avail.Storage	Storage Description
#1	910.90'	1.728 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

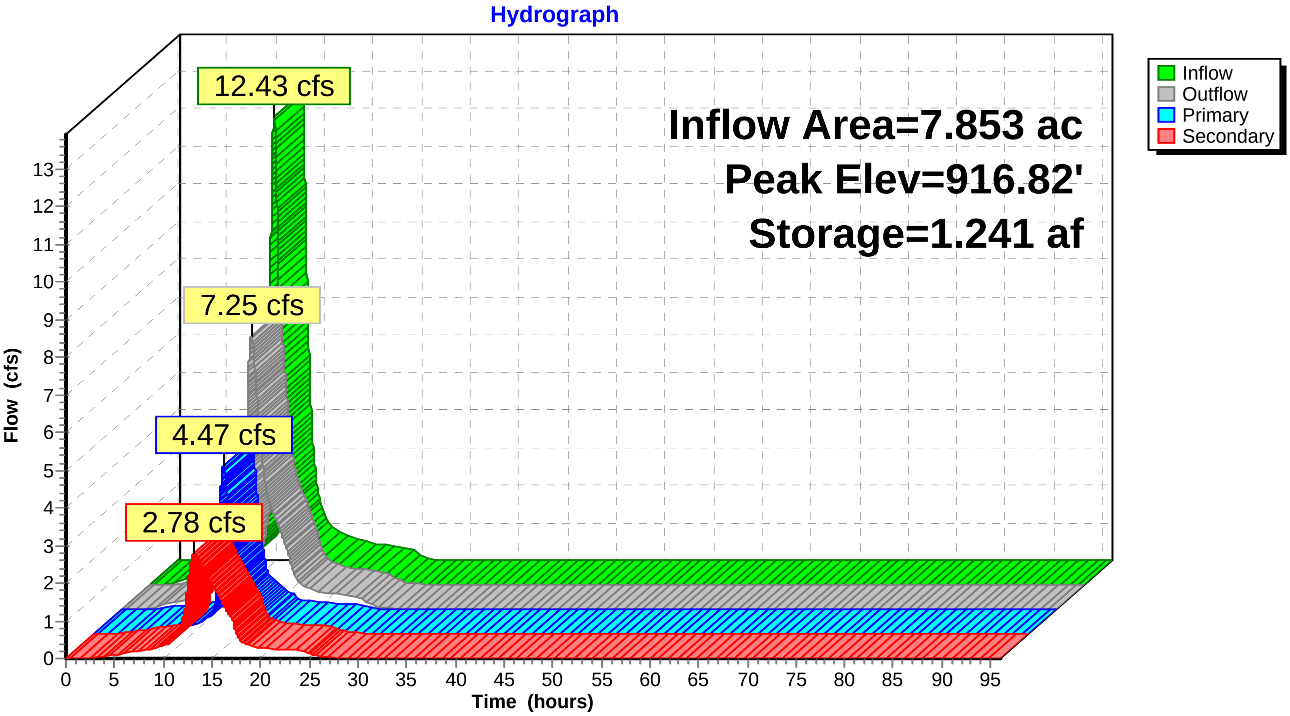
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.90	0.070	0.000	0.000
912.00	0.090	0.088	0.088
914.00	0.220	0.310	0.398
916.00	0.330	0.550	0.948
918.00	0.450	0.780	1.728

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	915.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	915.95'	**24.0" Round RCP_Round 24"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 915.80' / 915.95' S= -0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=4.47 cfs @ 13.29 hrs HW=916.82' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 1.28 cfs @ 6.50 fps)
└─**3=RCP_Round 24"** (Barrel Controls 3.20 cfs @ 2.87 fps)

Secondary OutFlow Max=2.78 cfs @ 13.26 hrs HW=916.82' TW=915.12' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 2.78 cfs @ 6.29 fps)

Pond 4P: P-4


Hydrograph
12.43 cfs
7.25 cfs
4.47 cfs
2.78 cfs
Inflow Area=7.853 ac
Peak Elev=916.82'
Storage=1.241 af
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 7P: P-7

```
[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =       29.595 ac,  30.01% Impervious,  Inflow Depth =   2.43"    for  10-Year event
Inflow      =       39.95 cfs @   12.61 hrs,  Volume=           5.985 af
Outflow     =       40.55 cfs @   12.66 hrs,  Volume=           5.985 af,  Atten= 0%,  Lag= 2.6 min
Primary     =       40.55 cfs @   12.66 hrs,  Volume=           5.985 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00'   Surf.Area= 0.440 ac   Storage= 1.062 af
Peak Elev= 915.56' @ 12.56 hrs   Surf.Area= 0.508 ac   Storage= 1.330 af   (0.268 af above start)

Plug-Flow detention time= 132.8 min calculated for 4.922 af (82% of inflow)
Center-of-Mass det. time= 9.3 min ( 845.0 - 835.7 )

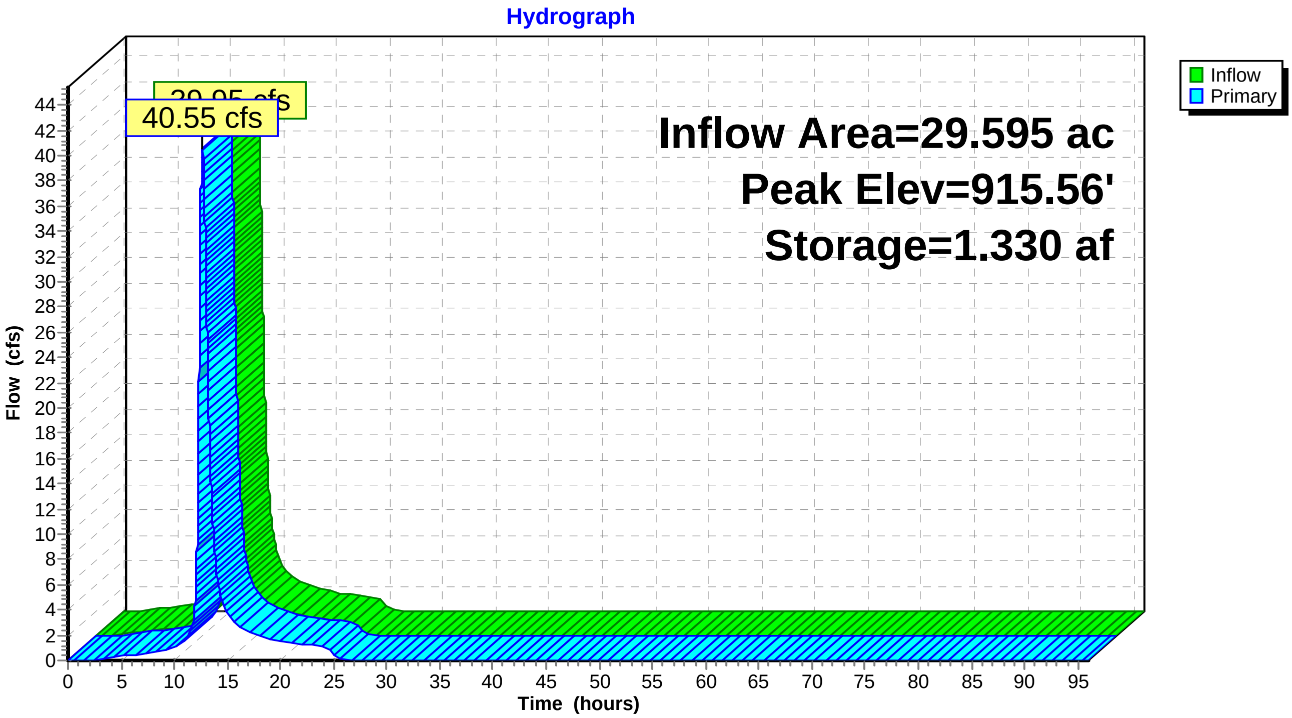
Volume        Invert    Avail.Storage   Storage Description
   #1         910.95'        2.122 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area         Inc.Store        Cum.Store
    (feet)        (acres)       (acre-feet)      (acre-feet)
    910.95          0.110             0.000            0.000
    912.00          0.180             0.152            0.152
    914.00          0.340             0.520            0.672
    915.00          0.440             0.390            1.062
    916.00          0.560             0.500            1.562
    917.00          0.560             0.560            2.122

Device   Routing            Invert   Outlet Devices
   #1    Primary           915.00'   75.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                                     Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                                     2.50  3.00  3.50  4.00  4.50  5.00  5.50
                                     Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                                     2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88

Primary OutFlow  Max=41.07 cfs @ 12.66 hrs  HW=915.56'  TW=915.50'   (Dynamic Tailwater)
└─1=Broad-Crested Rectangular Weir (Weir Controls 41.07 cfs @ 0.98 fps)
```

Pond 7P: P-7


Hydrograph
Inflow Area=29.595 ac
Peak Elev=915.56'
Storage=1.330 af
39.95 cfs
40.55 cfs
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 9P: P-9

```
Inflow Area =        55.384 ac,  31.48% Impervious,  Inflow Depth =   2.46"    for  10-Year event
Inflow      =       77.38 cfs @   12.50 hrs,  Volume=          11.351 af
Outflow     =       77.30 cfs @   12.51 hrs,  Volume=          11.351 af,  Atten= 0%,  Lag= 0.6 min
Primary     =       77.30 cfs @   12.51 hrs,  Volume=          11.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00'   Surf.Area= 0.210 ac   Storage= 0.353 af
Peak Elev= 915.51' @ 12.51 hrs   Surf.Area= 0.313 ac   Storage= 0.487 af   (0.135 af above start)

Plug-Flow detention time= 36.8 min calculated for 10.998 af (97% of inflow)
Center-of-Mass det. time= 2.2 min ( 833.7 - 831.5 )

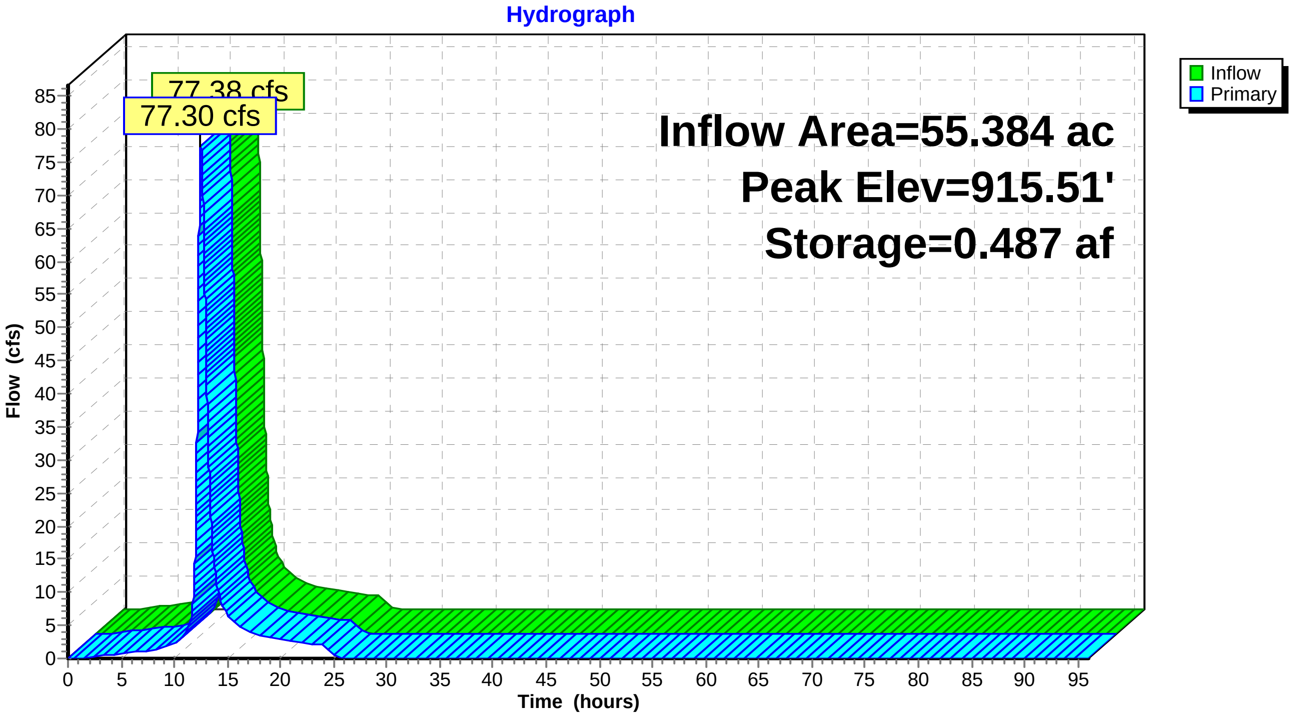
Volume        Invert    Avail.Storage    Storage Description
   #1        910.50'         1.673 af    Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area          Inc.Store          Cum.Store
    (feet)        (acres)        (acre-feet)        (acre-feet)
    910.50          0.020              0.000              0.000
    912.00          0.050              0.052              0.052
    913.00          0.070              0.060              0.112
    914.00          0.100              0.085              0.198
    915.00          0.210              0.155              0.353
    916.00          0.410              0.310              0.662
    918.00          0.600              1.010              1.673

Device    Routing            Invert    Outlet Devices
  #1      Primary           915.00'    80.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                                       Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                                       2.50  3.00  3.50  4.00  4.50  5.00  5.50
                                       Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                                       2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88

Primary OutFlow  Max=77.29 cfs @ 12.51 hrs  HW=915.51'  TW=911.10'   (Dynamic Tailwater)
└─1=Broad-Crested Rectangular Weir (Weir Controls 77.29 cfs @ 1.88 fps)
```

Pond 9P: P-9


Hydrograph
77.38 cfs
77.30 cfs
Inflow Area=55.384 ac
Peak Elev=915.51'
Storage=0.487 af
Inflow
Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 10P: P-10

```
[95] Warning: Outlet Device #1 rise exceeded

Inflow Area =       66.448 ac,  29.37% Impervious,  Inflow Depth =   1.95"    for  10-Year event
Inflow      =       38.10 cfs @   13.07 hrs,  Volume=          10.812 af
Outflow     =       37.98 cfs @   13.11 hrs,  Volume=          10.811 af,  Atten= 0%,  Lag= 2.1 min
Primary     =       12.53 cfs @   13.11 hrs,  Volume=           7.912 af
Secondary =         25.45 cfs @   13.11 hrs,  Volume=           2.899 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 896.00'   Surf.Area= 0.290 ac   Storage= 0.700 af
Peak Elev= 897.75' @ 13.11 hrs   Surf.Area= 0.364 ac   Storage= 1.270 af   (0.570 af above start)

Plug-Flow detention time= 102.7 min calculated for 10.110 af (94% of inflow)
Center-of-Mass det. time= 26.9 min ( 971.5 - 944.5 )

Volume       Invert    Avail.Storage   Storage Description
   #1       892.00'         1.760 af   Custom Stage Data (Prismatic)Listed below (Recalc)

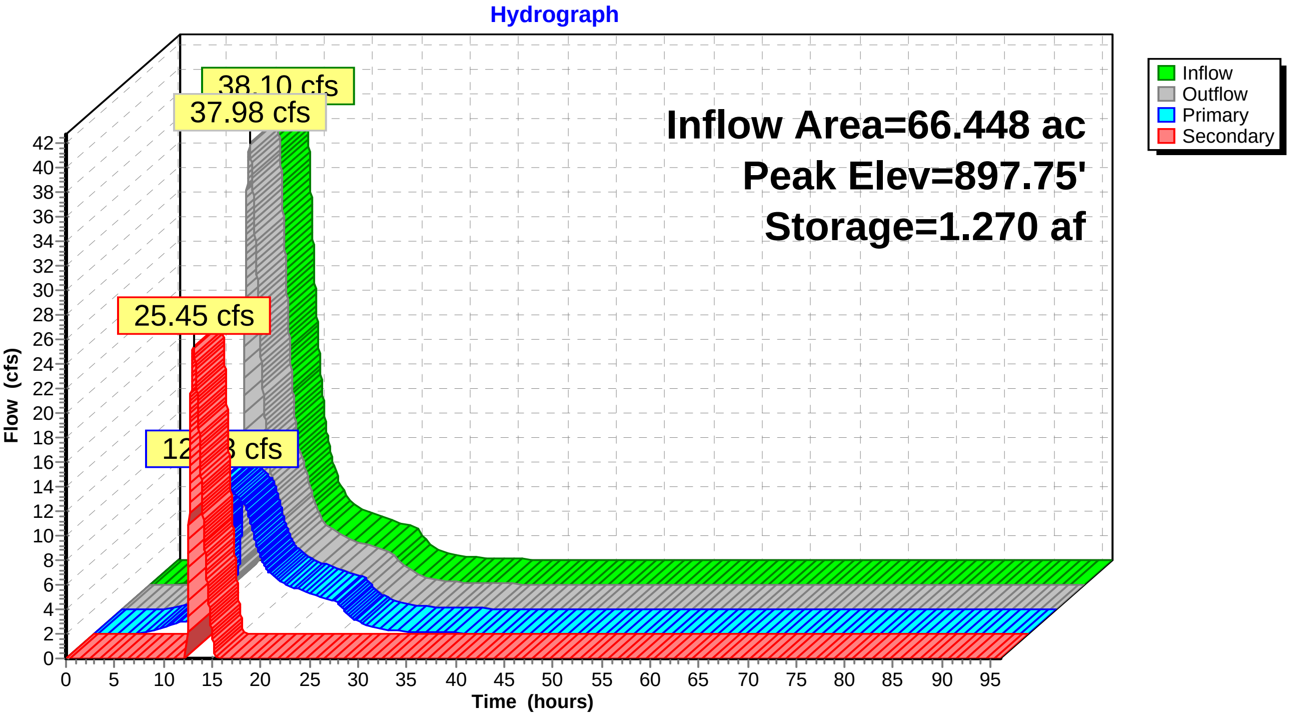
 Elevation       Surf.Area          Inc.Store         Cum.Store
    (feet)         (acres)        (acre-feet)       (acre-feet)
    892.00           0.120              0.000             0.000
    893.00           0.140              0.130             0.130
    895.00           0.190              0.330             0.460
    896.00           0.290              0.240             0.700
    897.00           0.330              0.310             1.010
    899.00           0.420              0.750             1.760

Device   Routing            Invert   Outlet Devices
   #1    Primary           896.00'   2.5' long x 1.00' rise Sharp-Crested Rectangular Weir
                                     2 End Contraction(s)
   #2    Secondary         897.40'   50.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                                     Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                                     2.50  3.00  3.50  4.00  4.50  5.00  5.50
                                     Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                                     2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88

Primary OutFlow  Max=12.53 cfs @ 13.11 hrs  HW=897.75'  TW=894.24'   (Dynamic Tailwater)
└─1=Sharp-Crested Rectangular Weir (Orifice Controls 12.53 cfs @ 5.45 fps)

Secondary OutFlow  Max=25.45 cfs @ 13.11 hrs  HW=897.75'  TW=894.24'   (Dynamic Tailwater)
└─2=Broad-Crested Rectangular Weir (Weir Controls 25.45 cfs @ 1.46 fps)
```

Pond 10P: P-10


Hydrograph
38.10 cfs
37.98 cfs
25.45 cfs
12
3 cfs
Inflow Area=66.448 ac
Peak Elev=897.75'
Storage=1.270 af
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 11P: P-11

Inflow Area = 58.677 ac, 31.52% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 80.40 cfs @ 12.50 hrs, Volume= 12.051 af
Outflow = 40.33 cfs @ 13.08 hrs, Volume= 12.049 af, Atten= 50%, Lag= 34.7 min
Primary = 35.82 cfs @ 13.08 hrs, Volume= 9.489 af
Secondary = 4.51 cfs @ 13.08 hrs, Volume= 2.560 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 909.00' Surf.Area= 1.210 ac Storage= 3.640 af
Peak Elev= 912.03' @ 13.08 hrs Surf.Area= 1.563 ac Storage= 7.830 af (4.190 af above start)

Plug-Flow detention time= 315.8 min calculated for 8.408 af (70% of inflow)
Center-of-Mass det. time= 118.1 min (949.0 - 830.9)

Volume	Invert	Avail.Storage	Storage Description
#1	905.00'	9.405 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

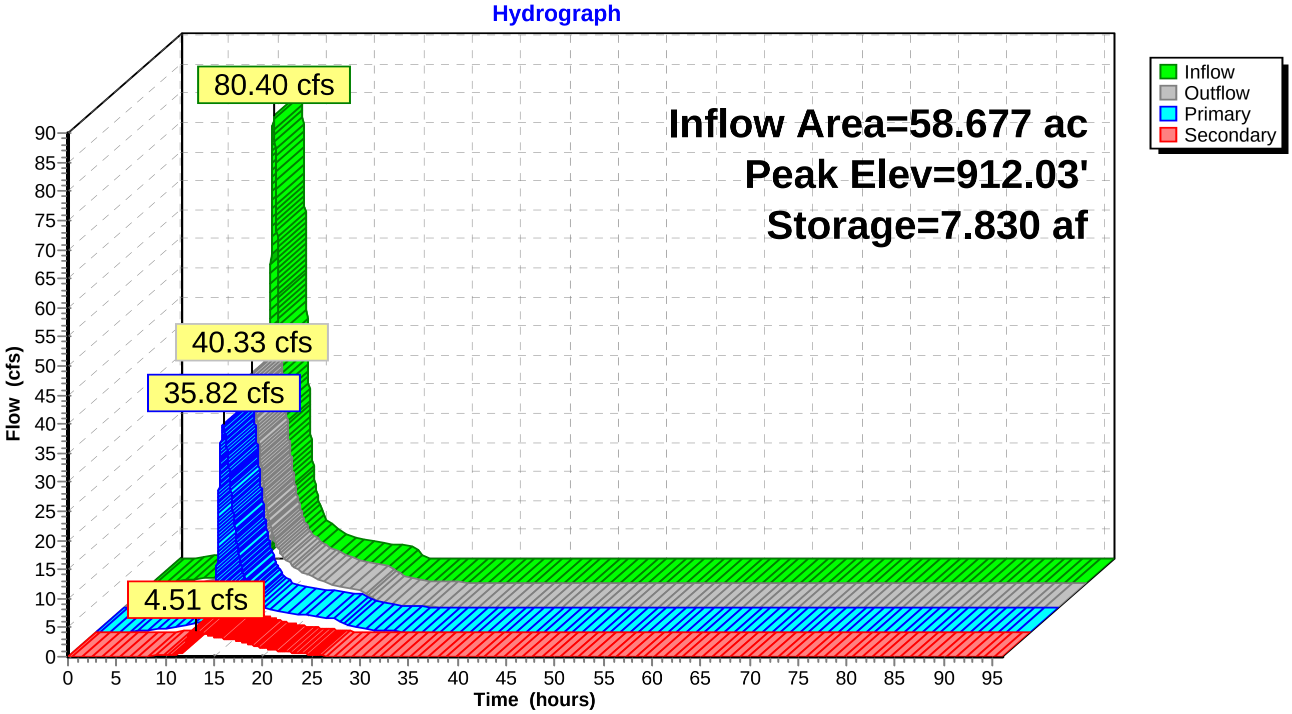
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
905.00	0.760	0.000	0.000
906.00	0.820	0.790	0.790
908.00	0.950	1.770	2.560
909.00	1.210	1.080	3.640
910.00	1.320	1.265	4.905
912.00	1.560	2.880	7.785
913.00	1.680	1.620	9.405

Device	Routing	Invert	Outlet Devices
#1	Primary	909.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#4	Primary	912.00'	**60.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#5	Secondary	909.00'	**12.0" Round RCP_Round 12"** L= 150.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 909.00' / 908.00' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=35.82 cfs @ 13.08 hrs HW=912.03' TW=897.75' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 6.58 cfs @ 8.38 fps)
2=RCP_Round 24" (Barrel Controls 14.27 cfs @ 5.57 fps)
3=RCP_Round 24" (Barrel Controls 14.27 cfs @ 5.57 fps)
4=Broad-Crested Rectangular Weir (Weir Controls 0.69 cfs @ 0.40 fps)

Secondary OutFlow Max=4.51 cfs @ 13.08 hrs HW=912.03' TW=908.76' (Dynamic Tailwater)
5=RCP_Round 12" (Barrel Controls 4.51 cfs @ 5.75 fps)

Pond 11P: P-11



Summary for Pond 12P: P-12

Inflow Area = 79.658 ac, 31.13% Impervious, Inflow Depth > 2.45" for 10-Year event
Inflow = 45.31 cfs @ 12.02 hrs, Volume= 16.286 af
Outflow = 37.09 cfs @ 13.56 hrs, Volume= 16.278 af, Atten= 18%, Lag= 92.1 min
Primary = 37.09 cfs @ 13.56 hrs, Volume= 16.278 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 893.00' Surf.Area= 1.640 ac Storage= 5.075 af
Peak Elev= 894.35' @ 13.56 hrs Surf.Area= 1.817 ac Storage= 7.405 af (2.330 af above start)

Plug-Flow detention time= 392.1 min calculated for 11.202 af (69% of inflow)
Center-of-Mass det. time= 86.6 min (1,075.0 - 988.5)

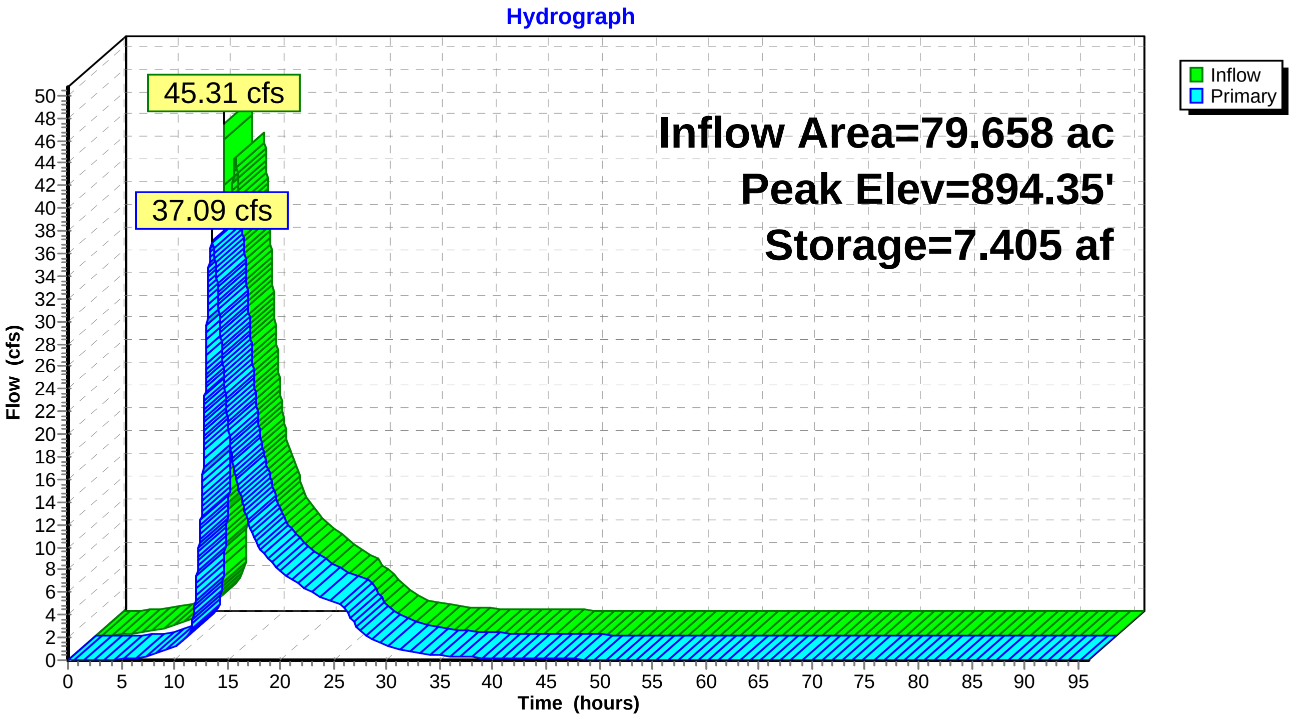
Volume	Invert	Avail.Storage	Storage Description
#1	889.00'	10.590 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
889.00	1.070	0.000	0.000
890.00	1.150	1.110	1.110
892.00	1.330	2.480	3.590
893.00	1.640	1.485	5.075
894.00	1.770	1.705	6.780
896.00	2.040	3.810	10.590

Device	Routing	Invert	Outlet Devices
#1	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#4	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#5	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf
#6	Primary	893.50'	**43.8" W x 26.6" H, R=22.5"/62.0" Pipe Arch RCP_Arch 44x27** L= 30.0' Box, 30-75° wingwalls, rounded crown, Ke= 0.200 Inlet / Outlet Invert= 893.50' / 893.35' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 6.29 sf

Primary OutFlow Max=37.09 cfs @ 13.56 hrs HW=894.35' TW=883.66' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 4.39 cfs @ 5.59 fps)
- **2=Orifice/Grate** (Orifice Controls 4.39 cfs @ 5.59 fps)
- **3=RCP_Arch 44x27** (Barrel Controls 7.08 cfs @ 3.78 fps)
- **4=RCP_Arch 44x27** (Barrel Controls 7.08 cfs @ 3.78 fps)
- **5=RCP_Arch 44x27** (Barrel Controls 7.08 cfs @ 3.78 fps)
- **6=RCP_Arch 44x27** (Barrel Controls 7.08 cfs @ 3.78 fps)

Pond 12P: P-12



Summary for Pond 13P: P-13

```
Inflow Area =      237.893 ac, 51.59% Impervious, Inflow Depth =  2.74"   for 10-Year event
Inflow      =      327.06 cfs @  12.35 hrs, Volume=        54.310 af
Outflow     =      309.98 cfs @  12.46 hrs, Volume=        54.307 af, Atten= 5%, Lag= 6.5 min
Primary     =      296.00 cfs @  12.46 hrs, Volume=        51.732 af
Secondary =         13.98 cfs @  12.46 hrs, Volume=         2.575 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 883.00'  Surf.Area= 1.870 ac  Storage= 4.265 af
Peak Elev= 884.60' @ 12.46 hrs  Surf.Area= 2.443 ac  Storage= 7.718 af  (3.453 af above start)

Plug-Flow detention time= 104.7 min calculated for 50.037 af (92% of inflow)
Center-of-Mass det. time= 15.3 min ( 906.8 - 891.6 )
```

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	11.490 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
878.00	0.000	0.000	0.000
879.00	0.630	0.315	0.315
880.00	0.730	0.680	0.995
882.00	1.070	1.800	2.795
883.00	1.870	1.470	4.265
884.00	2.220	2.045	6.310
886.00	2.960	5.180	11.490

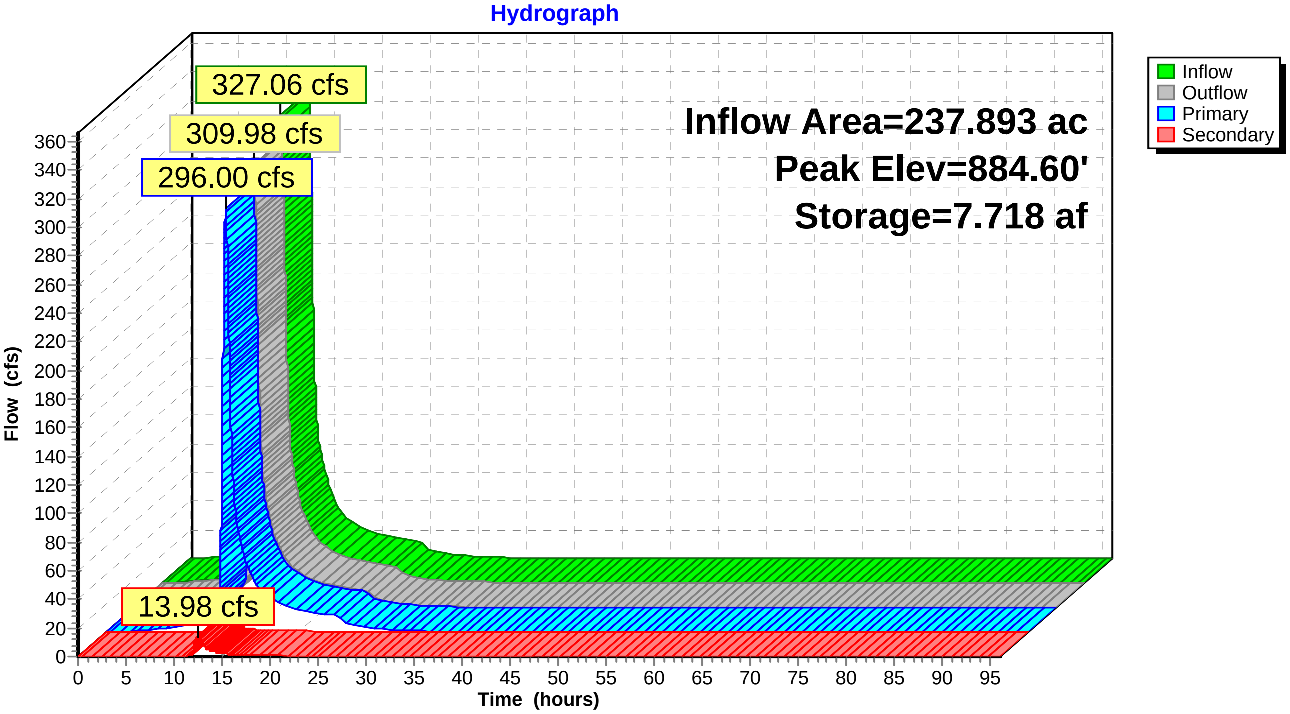
Device	Routing	Invert	Outlet Devices
#1	Primary	883.00'	**55.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#5	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#6	Secondary	883.00'	**12.0" Round RCP_Round 12"** L= 100.0' RCP, groove end projecting, Ke= 0.200

Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=295.98 cfs @ 12.46 hrs HW=884.60' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 295.98 cfs @ 3.36 fps)

Secondary OutFlow Max=13.98 cfs @ 12.46 hrs HW=884.60' TW=883.04' (Dynamic Tailwater)
↑—**2=RCP_Round 12"** (Barrel Controls 2.80 cfs @ 3.56 fps)
—**3=RCP_Round 12"** (Barrel Controls 2.80 cfs @ 3.56 fps)
—**4=RCP_Round 12"** (Barrel Controls 2.80 cfs @ 3.56 fps)
—**5=RCP_Round 12"** (Barrel Controls 2.80 cfs @ 3.56 fps)
—**6=RCP_Round 12"** (Barrel Controls 2.80 cfs @ 3.56 fps)

Pond 13P: P-13



Summary for Pond 14P: P-14

Inflow Area = 21.198 ac, 39.93% Impervious, Inflow Depth = 2.65" for 10-Year event
Inflow = 42.96 cfs @ 12.30 hrs, Volume= 4.676 af
Outflow = 6.52 cfs @ 13.18 hrs, Volume= 4.674 af, Atten= 85%, Lag= 53.4 min
Primary = 6.52 cfs @ 13.18 hrs, Volume= 4.674 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 892.00' Surf.Area= 1.380 ac Storage= 4.490 af
Peak Elev= 893.66' @ 13.18 hrs Surf.Area= 1.536 ac Storage= 6.910 af (2.420 af above start)

Plug-Flow detention time= 1,732.7 min calculated for 0.184 af (4% of inflow)
Center-of-Mass det. time= 259.6 min (1,064.4 - 804.9)

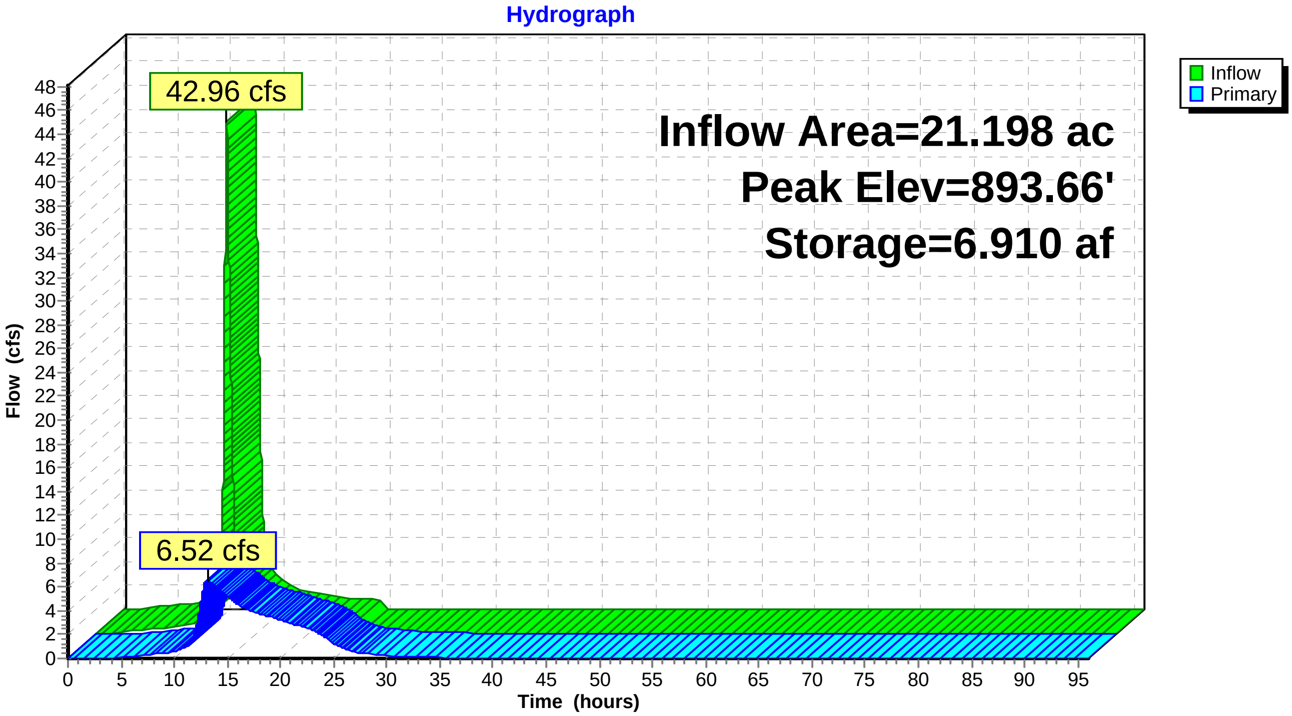
Volume	Invert	Avail.Storage	Storage Description
#1	888.00'	9.910 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
888.00	0.950	0.000	0.000
890.00	1.080	2.030	2.030
892.00	1.380	2.460	4.490
893.00	1.470	1.425	5.915
894.00	1.570	1.520	7.435
895.50	1.730	2.475	9.910

Device	Routing	Invert	Outlet Devices
#1	Primary	892.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 893.00' / 892.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=6.52 cfs @ 13.18 hrs HW=893.66' (Free Discharge)
├**1=Orifice/Grate** (Orifice Controls 4.88 cfs @ 6.21 fps)
└**2=RCP_Round 18"** (Barrel Controls 1.65 cfs @ 3.23 fps)

Pond 14P: P-14


Hydrograph
42.96 cfs
6.52 cfs
Inflow Area=21.198 ac
Peak Elev=893.66'
Storage=6.910 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 23P: Thumb Infiltration (Thumb TP load only)

```
Inflow Area =         48.540 ac,  84.23% Impervious,  Inflow Depth =   3.41"    for  10-Year event
Inflow       =        95.01 cfs @   12.44 hrs,  Volume=          13.805 af
Outflow      =        94.93 cfs @   12.45 hrs,  Volume=          10.065 af,  Atten= 0%,  Lag= 0.7 min
Primary      =        94.93 cfs @   12.45 hrs,  Volume=          10.065 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.83' @ 12.45 hrs   Surf.Area= 1.000 ac   Storage= 3.834 af

Plug-Flow detention time= 168.5 min calculated for 10.065 af (73% of inflow)
Center-of-Mass det. time= 77.0 min ( 861.0 - 784.1 )

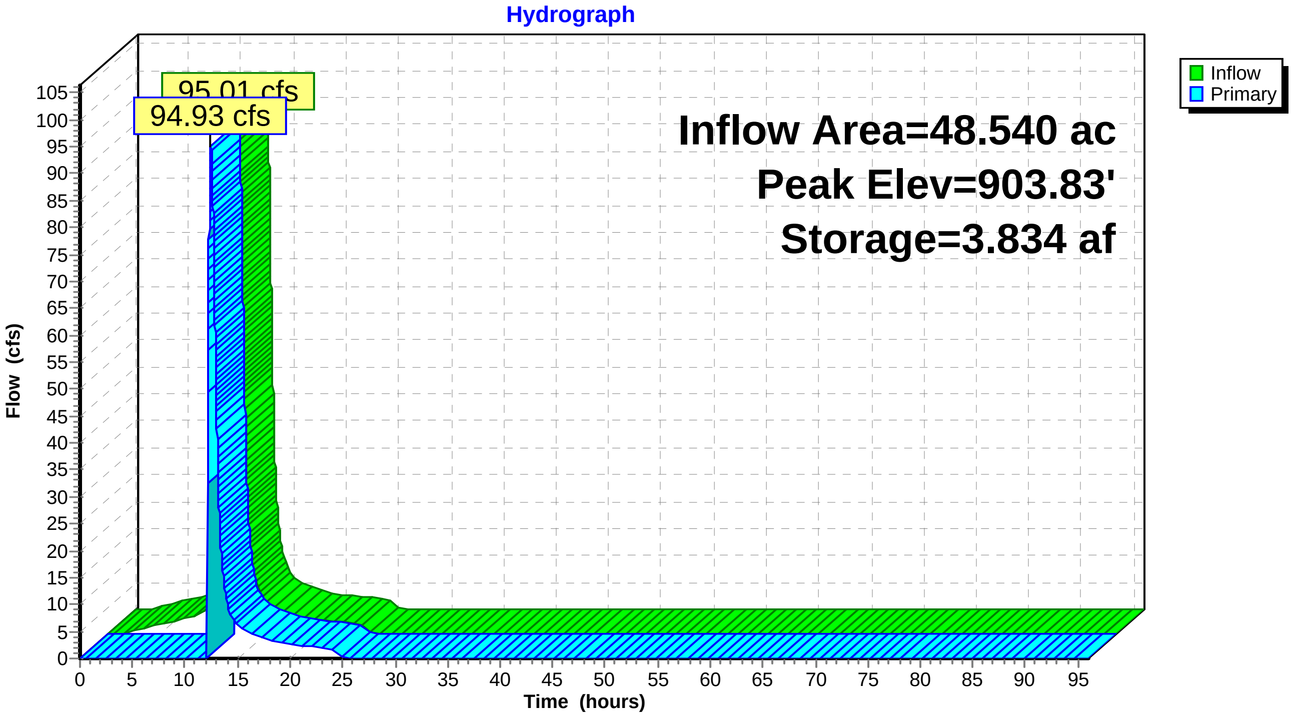
Volume          Invert     Avail.Storage    Storage Description
   #1          900.00'          5.000 af    Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation        Surf.Area           Inc.Store          Cum.Store
      (feet)          (acres)         (acre-feet)        (acre-feet)
    900.00            1.000               0.000              0.000
    901.00            1.000               1.000              1.000
    902.00            1.000               1.000              2.000
    903.00            1.000               1.000              3.000
    904.00            1.000               1.000              4.000
    905.00            1.000               1.000              5.000

Device    Routing              Invert    Outlet Devices
    #1    Primary             903.74'    1,000.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                         5.0' Crest Height

Primary OutFlow  Max=94.91 cfs @ 12.45 hrs  HW=903.83'   (Free Discharge)
└─1=Sharp-Crested Rectangular Weir (Weir Controls 94.91 cfs @ 1.01 fps)
```

Pond 23P: Thumb Infiltration (Thumb TP load only)



Summary for Pond 31P: SB 18 Infiltration

```
Inflow Area =       52.908 ac,  84.55% Impervious,  Inflow Depth =   3.64"    for  10-Year event
Inflow      =      124.38 cfs @   12.40 hrs,  Volume=          16.050 af
Outflow     =      124.27 cfs @   12.40 hrs,  Volume=          12.730 af,  Atten= 0%,  Lag= 0.4 min
Primary     =      124.27 cfs @   12.40 hrs,  Volume=          12.730 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.43' @ 12.40 hrs   Surf.Area= 1.000 ac   Storage= 3.432 af

Plug-Flow detention time= 144.2 min calculated for 12.730 af (79% of inflow)
Center-of-Mass det. time= 63.9 min ( 846.6 - 782.8 )

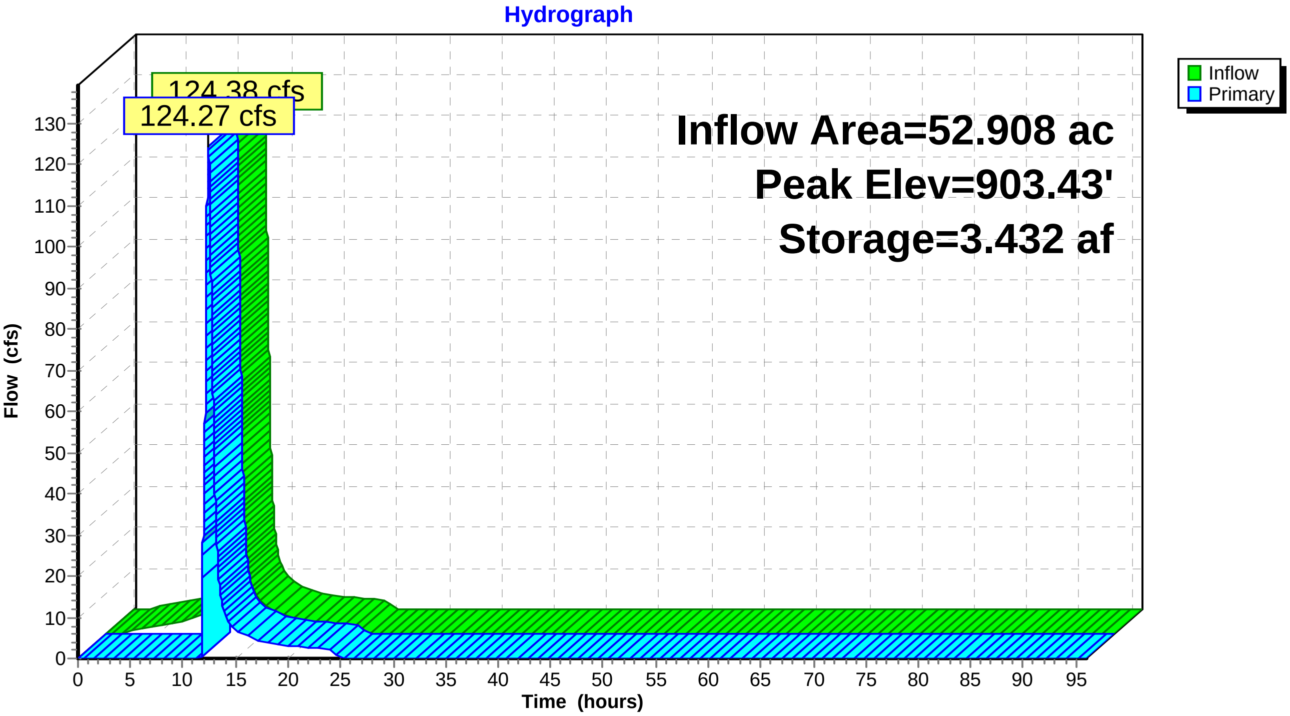
Volume       Invert    Avail.Storage   Storage Description
   #1       900.00'         5.000 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area        Inc.Store       Cum.Store
    (feet)        (acres)      (acre-feet)     (acre-feet)
    900.00          1.000            0.000           0.000
    901.00          1.000            1.000           1.000
    902.00          1.000            1.000           2.000
    903.00          1.000            1.000           3.000
    904.00          1.000            1.000           4.000
    905.00          1.000            1.000           5.000

Device    Routing          Invert    Outlet Devices
   #1     Primary         903.32'    1,000.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                     0.8' Crest Height

Primary OutFlow  Max=124.22 cfs @ 12.40 hrs  HW=903.43'  TW=887.50'   (Dynamic Tailwater)
↑—1=Sharp-Crested Rectangular Weir (Weir Controls 124.22 cfs @ 1.11 fps)
```

Pond 31P: SB 18 Infiltration



Summary for Pond 36P: Culverts passing flow beneath Spine Road

Inflow Area = 52.908 ac, 84.55% Impervious, Inflow Depth = 2.89" for 10-Year event
Inflow = 124.27 cfs @ 12.40 hrs, Volume= 12.730 af
Outflow = 124.27 cfs @ 12.40 hrs, Volume= 12.730 af, Atten= 0%, Lag= 0.0 min
Primary = 124.27 cfs @ 12.40 hrs, Volume= 12.730 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 887.50' @ 12.40 hrs Surf.Area= 0.003 ac Storage= 0.001 af

Plug-Flow detention time= 0.0 min calculated for 12.728 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (846.6 - 846.6)

Volume	Invert	Avail.Storage	Storage Description
#1	887.00'	0.025 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
887.00	0.000	0.000	0.000
887.50	0.003	0.001	0.001
890.50	0.006	0.014	0.014
892.00	0.009	0.011	0.025

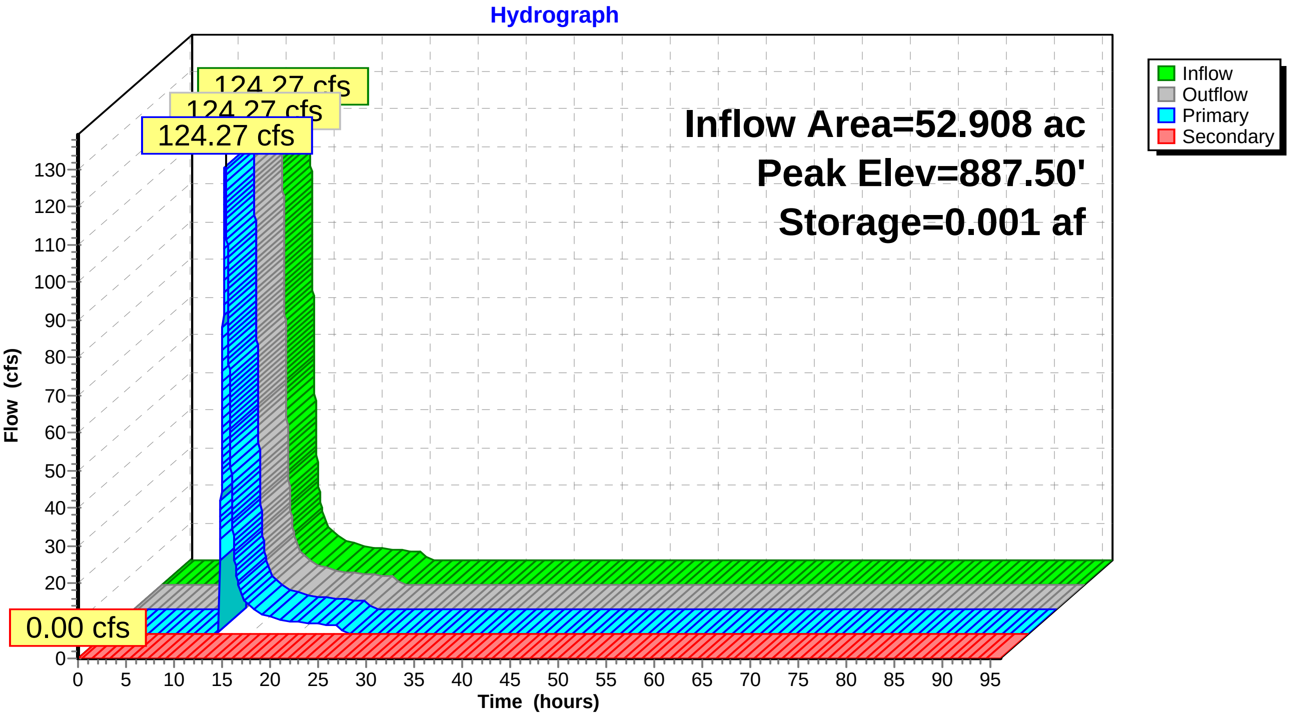
Device	Routing	Invert	Outlet Devices
#1	Primary	887.00'	**Special & User-Defined** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 5.00 Disch. (cfs) 0.000 25.000 50.000 75.000 100.000 125.000 125.000
#2	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#4	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#5	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#6	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#7	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900

			n= 0.013, Flow Area= 1.77 sf
#8	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#9	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=124.22 cfs @ 12.40 hrs HW=887.50' TW=884.59' (Dynamic Tailwater)
└─**1=Special & User-Defined** (Custom Controls 124.22 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=887.00' TW=883.00' (Dynamic Tailwater)
├─**2=RCP_Round 18"** (Controls 0.00 cfs)
├─**3=RCP_Round 18"** (Controls 0.00 cfs)
├─**4=RCP_Round 18"** (Controls 0.00 cfs)
├─**5=RCP_Round 18"** (Controls 0.00 cfs)
├─**6=RCP_Round 18"** (Controls 0.00 cfs)
├─**7=RCP_Round 18"** (Controls 0.00 cfs)
├─**8=RCP_Round 18"** (Controls 0.00 cfs)
└─**9=RCP_Round 18"** (Controls 0.00 cfs)

Pond 36P: Culverts passing flow beneath Spine Road



Summary for Pond CRH-1: CRH-1

```
Inflow Area =         6.955 ac,  46.76% Impervious,  Inflow Depth =   2.80"    for  10-Year event
Inflow      =        18.97 cfs @   12.15 hrs,  Volume=           1.622 af
Outflow     =        12.06 cfs @   12.33 hrs,  Volume=           1.622 af,  Atten= 36%,  Lag= 10.6 min
Discarded  =          0.26 cfs @   12.33 hrs,  Volume=           0.512 af
Primary     =        11.80 cfs @   12.33 hrs,  Volume=           1.110 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.12' @ 12.33 hrs   Surf.Area= 0.325 ac   Storage= 0.489 af

Plug-Flow detention time= 182.4 min calculated for 1.622 af (100% of inflow)
Center-of-Mass det. time= 182.5 min ( 971.9 - 789.5 )

Volume         Invert    Avail.Storage    Storage Description
   #1         876.00'         0.850 af    Custom Stage Data (Prismatic)Listed below (Recalc)

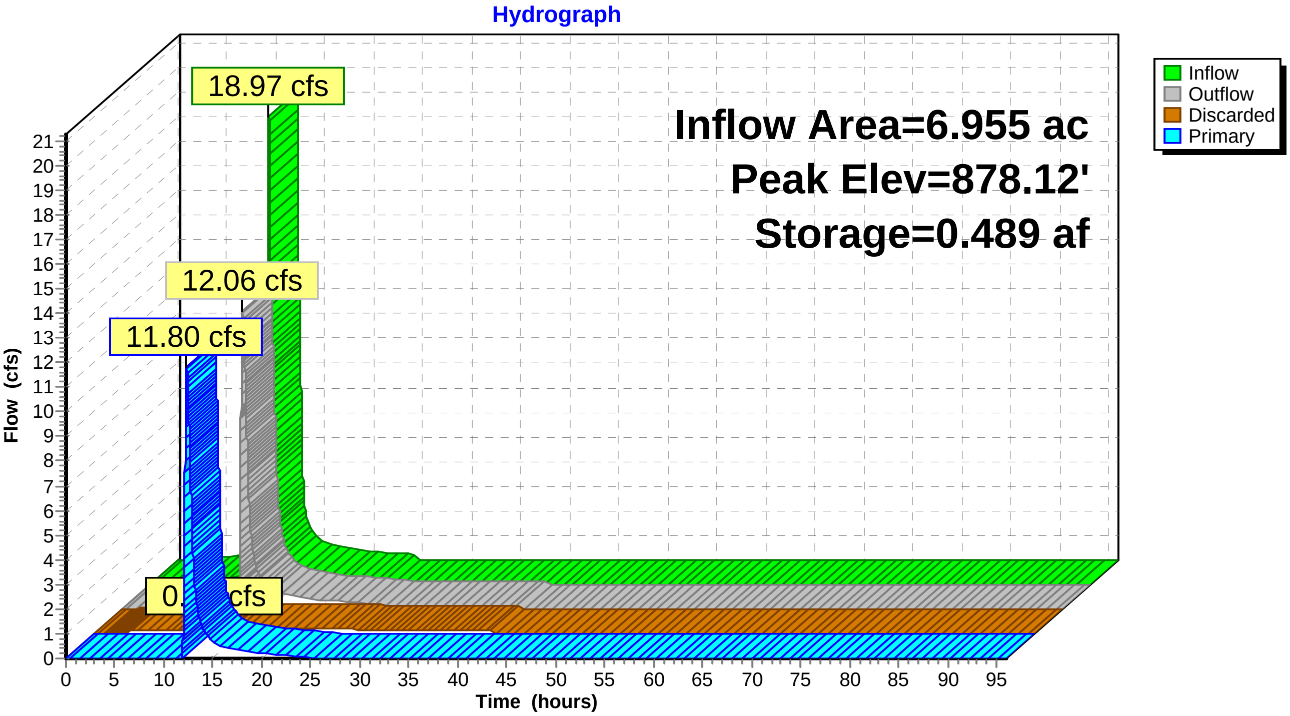
 Elevation       Surf.Area         Inc.Store        Cum.Store
     (feet)         (acres)       (acre-feet)      (acre-feet)
    876.00           0.150             0.000            0.000
    878.00           0.300             0.450            0.450
    879.00           0.500             0.400            0.850

Device   Routing             Invert   Outlet Devices
    #1   Discarded          876.00'   0.800 in/hr Exfiltration over Surface area
                                      Conductivity to Groundwater Elevation = 0.00'
    #2   Primary            877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                      Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                      n= 0.013,  Flow Area= 3.14 sf
    #3   Primary            877.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                      Inlet / Outlet Invert= 877.00' / 876.00'   S= 0.0065 '/'   Cc= 0.900
                                      n= 0.013,  Flow Area= 3.14 sf

Discarded OutFlow  Max=0.26 cfs @ 12.33 hrs  HW=878.12'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.26 cfs)

Primary OutFlow  Max=11.80 cfs @ 12.33 hrs  HW=878.12'   (Free Discharge)
├─2=Culvert  (Barrel Controls 5.90 cfs @ 4.69 fps)
└─3=Culvert  (Barrel Controls 5.90 cfs @ 4.69 fps)
```

Pond CRH-1: CRH-1



Summary for Pond CRH-2: CRH-2

Inflow Area = 10.214 ac, 37.73% Impervious, Inflow Depth = 2.60" for 10-Year event
Inflow = 23.01 cfs @ 12.22 hrs, Volume= 2.212 af
Outflow = 10.19 cfs @ 12.62 hrs, Volume= 2.212 af, Atten= 56%, Lag= 24.1 min
Discarded = 0.38 cfs @ 12.62 hrs, Volume= 0.904 af
Primary = 9.82 cfs @ 12.62 hrs, Volume= 1.308 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 882.67' @ 12.62 hrs Surf.Area= 0.467 ac Storage= 0.888 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 323.8 min (1,125.6 - 801.7)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	1.600 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

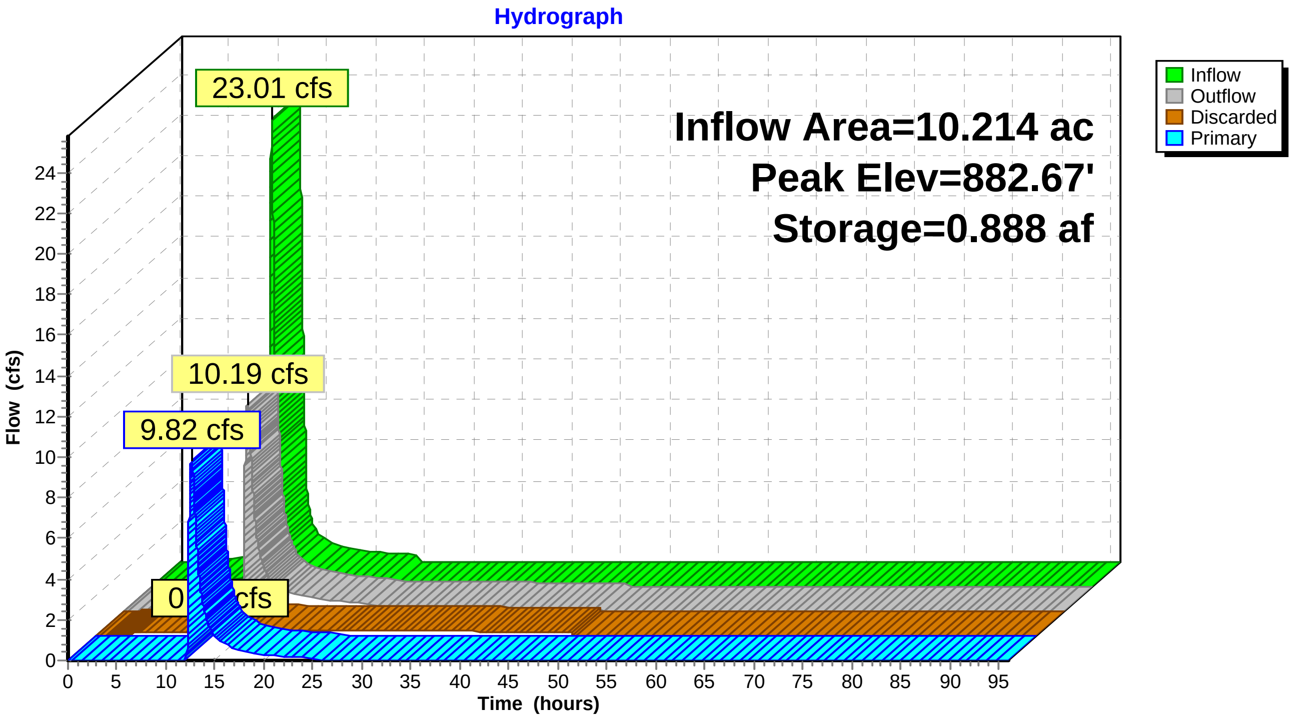
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
880.00	0.200	0.000	0.000
882.00	0.400	0.600	0.600
884.00	0.600	1.000	1.600

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.38 cfs @ 12.62 hrs HW=882.67' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.38 cfs)

Primary OutFlow Max=9.82 cfs @ 12.62 hrs HW=882.67' TW=878.71' (Dynamic Tailwater)
↑—**2=Culvert** (Barrel Controls 4.91 cfs @ 3.72 fps)
└—**3=Culvert** (Barrel Controls 4.91 cfs @ 3.72 fps)

Pond CRH-2: CRH-2



Summary for Pond CRH-3: CRH-3

Inflow Area =	11.815 ac, 36.95% Impervious,	Inflow Depth = 1.66"	for 10-Year event	
Inflow =	10.84 cfs @	12.54 hrs, Volume=	1.637 af	
Outflow =	8.22 cfs @	12.91 hrs, Volume=	1.637 af,	Atten= 24%, Lag= 22.1 min
Discarded =	0.24 cfs @	12.91 hrs, Volume=	0.449 af	
Primary =	7.98 cfs @	12.91 hrs, Volume=	1.188 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.90' @ 12.91 hrs Surf.Area= 0.293 ac Storage= 0.421 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 170.2 min (1,018.1 - 847.9)

Volume	Invert	Avail.Storage	Storage Description
#1	877.00'	0.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

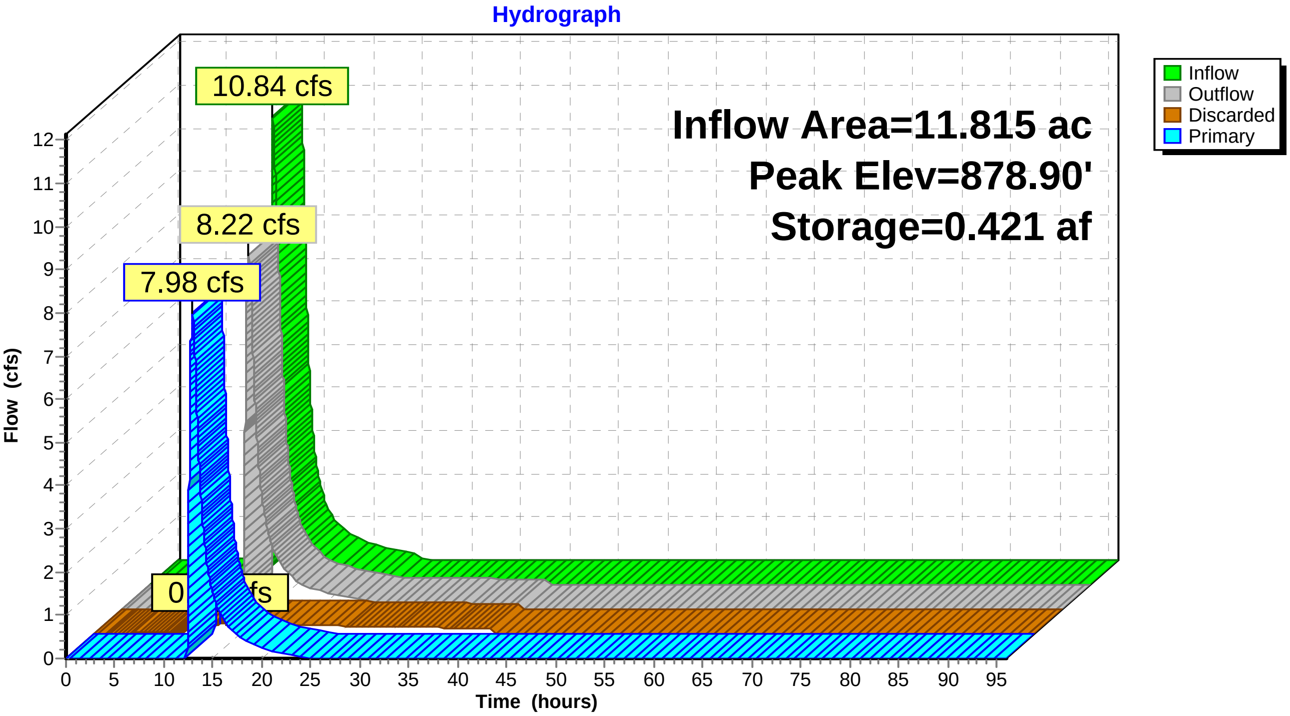
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
877.00	0.150	0.000	0.000
879.00	0.300	0.450	0.450
880.00	0.500	0.400	0.850

Device	Routing	Invert	Outlet Devices
#1	Discarded	877.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	878.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 878.00' / 877.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.24 cfs @ 12.91 hrs HW=878.90' (Free Discharge)
└─**1=Exfiltration** (Controls 0.24 cfs)

Primary OutFlow Max=7.98 cfs @ 12.91 hrs HW=878.90' (Free Discharge)
├─**2=Culvert** (Barrel Controls 3.99 cfs @ 4.27 fps)
└─**3=Culvert** (Barrel Controls 3.99 cfs @ 4.27 fps)

Pond CRH-3: CRH-3



Summary for Pond P1/P2: P-1/P-2

Inflow Area = 68.531 ac, 57.92% Impervious, Inflow Depth = 3.05" for 10-Year event
Inflow = 92.00 cfs @ 12.57 hrs, Volume= 17.405 af
Outflow = 89.60 cfs @ 12.67 hrs, Volume= 17.397 af, Atten= 3%, Lag= 5.9 min
Primary = 89.60 cfs @ 12.67 hrs, Volume= 17.397 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 924.00' Surf.Area= 1.270 ac Storage= 3.500 af
Peak Elev= 925.17' @ 12.67 hrs Surf.Area= 1.446 ac Storage= 5.093 af (1.593 af above start)

Plug-Flow detention time= 203.9 min calculated for 13.896 af (80% of inflow)
Center-of-Mass det. time= 66.2 min (872.2 - 806.0)

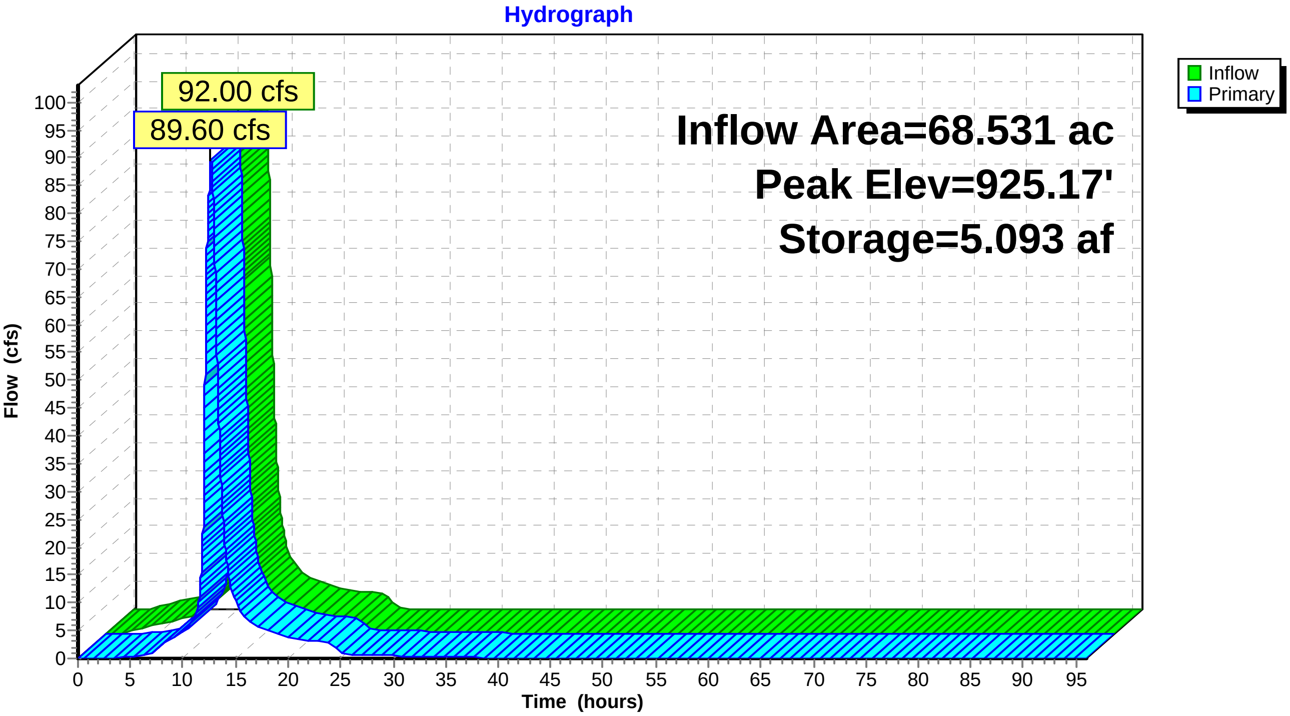
Volume	Invert	Avail.Storage	Storage Description
#1	920.00'	6.340 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
920.00	0.650	0.000	0.000
922.00	0.790	1.440	1.440
924.00	1.270	2.060	3.500
926.00	1.570	2.840	6.340

Device	Routing	Invert	Outlet Devices
#1	Primary	924.40'	**40.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	924.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=89.60 cfs @ 12.67 hrs HW=925.17' TW=917.41' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 88.57 cfs @ 2.88 fps)
└─**2=Orifice/Grate** (Orifice Controls 1.02 cfs @ 5.22 fps)

Pond P1/P2: P-1/P-2



Summary for Pond P5/P6: P-5/P-6

Inflow Area = 43.279 ac, 47.44% Impervious, Inflow Depth = 2.82" for 10-Year event
Inflow = 116.17 cfs @ 12.15 hrs, Volume= 10.153 af
Outflow = 28.61 cfs @ 12.70 hrs, Volume= 8.037 af, Atten= 75%, Lag= 32.8 min
Primary = 26.37 cfs @ 12.70 hrs, Volume= 6.911 af
Secondary = 2.24 cfs @ 12.70 hrs, Volume= 1.126 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 929.00' Surf.Area= 1.975 ac Storage= 5.062 af
Peak Elev= 931.49' @ 12.70 hrs Surf.Area= 2.487 ac Storage= 10.676 af (5.614 af above start)

Plug-Flow detention time= 735.4 min calculated for 2.974 af (29% of inflow)
Center-of-Mass det. time= 230.7 min (1,019.3 - 788.7)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	14.650 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

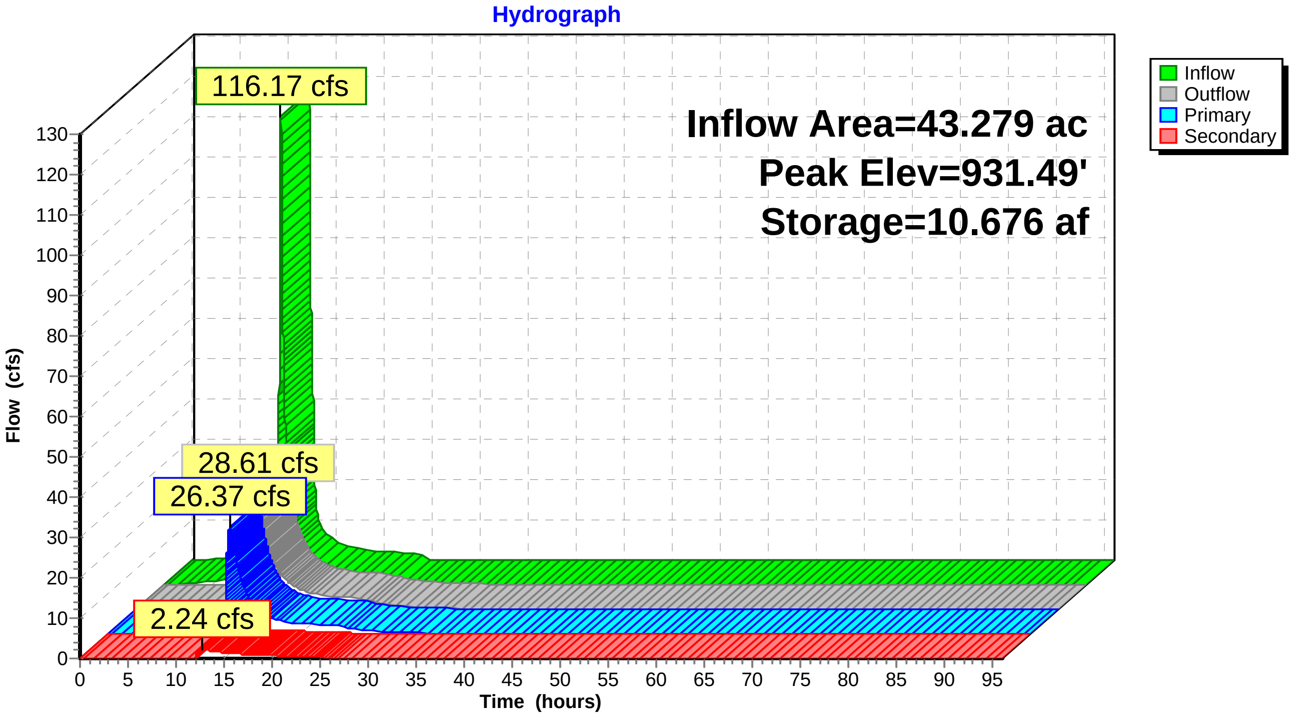
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
926.00	1.510	0.000	0.000
928.00	1.710	3.220	3.220
930.00	2.240	3.950	7.170
931.00	2.400	2.320	9.490
933.00	2.760	5.160	14.650

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	930.50'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	931.50'	**14.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	930.00'	**9.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=26.37 cfs @ 12.70 hrs HW=931.49' TW=917.45' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 4.61 cfs @ 5.87 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 21.76 cfs @ 3.25 fps)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=2.24 cfs @ 12.70 hrs HW=931.49' TW=929.09' (Dynamic Tailwater)
4=Orifice/Grate (Orifice Controls 2.24 cfs @ 5.07 fps)

Pond P5/P6: P-5/P-6



Summary for Pond P8: P-8

```
Inflow Area =         6.389 ac,    7.62% Impervious,  Inflow Depth =   1.93"    for  10-Year event
Inflow      =        16.44 cfs @   12.06 hrs,  Volume=            1.027 af
Outflow     =         3.63 cfs @   12.39 hrs,  Volume=            1.021 af,  Atten= 78%,  Lag= 19.7 min
Primary     =         3.63 cfs @   12.39 hrs,  Volume=            1.021 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 897.00' Surf.Area= 0.300 ac Storage= 0.495 af
Peak Elev= 898.11' @ 12.62 hrs Surf.Area= 0.455 ac Storage= 0.922 af (0.427 af above start)

Plug-Flow detention time= 533.7 min calculated for 0.526 af (51% of inflow)
Center-of-Mass det. time= 193.8 min (1,023.9 - 830.1)

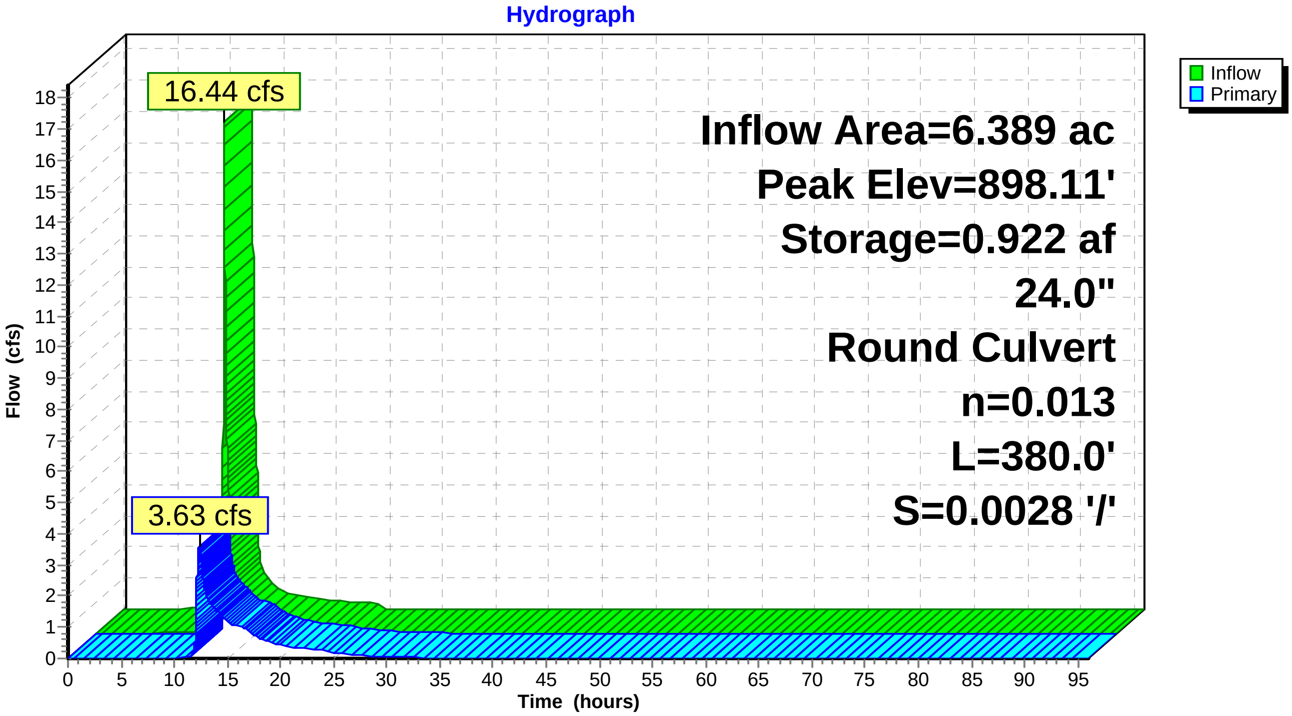
Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	1.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
893.00	0.030	0.000	0.000
894.00	0.070	0.050	0.050
896.00	0.150	0.220	0.270
897.00	0.300	0.225	0.495
898.00	0.450	0.375	0.870
900.00	0.530	0.980	1.850

Device	Routing	Invert	Outlet Devices
#1	Primary	897.00'	**24.0" Round RCP_Round 24"** L= 380.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 897.00' / 895.94' S= 0.0028 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=3.60 cfs @ 12.39 hrs HW=898.06' TW=897.03' (Dynamic Tailwater)
↑—**1=RCP_Round 24"** (Outlet Controls 3.60 cfs @ 3.08 fps)

Pond P8: P-8


Hydrograph
16.44 cfs
3.63 cfs
Inflow Area=6.389 ac
Peak Elev=898.11'
Storage=0.922 af
24.0"
Round Culvert
n=0.013
L=380.0'
S=0.0028 '/'
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-1: W-1

Inflow Area = 0.997 ac, 24.47% Impervious, Inflow Depth = 17.08" for 10-Year event
Inflow = 3.34 cfs @ 12.27 hrs, Volume= 1.419 af
Outflow = 2.43 cfs @ 14.34 hrs, Volume= 1.419 af, Atten= 27%, Lag= 124.1 min
Primary = 2.43 cfs @ 14.34 hrs, Volume= 1.419 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.16' @ 14.34 hrs Surf.Area= 0.726 ac Storage= 0.286 af

Plug-Flow detention time= 110.1 min calculated for 1.418 af (100% of inflow)
Center-of-Mass det. time= 110.1 min (980.3 - 870.2)

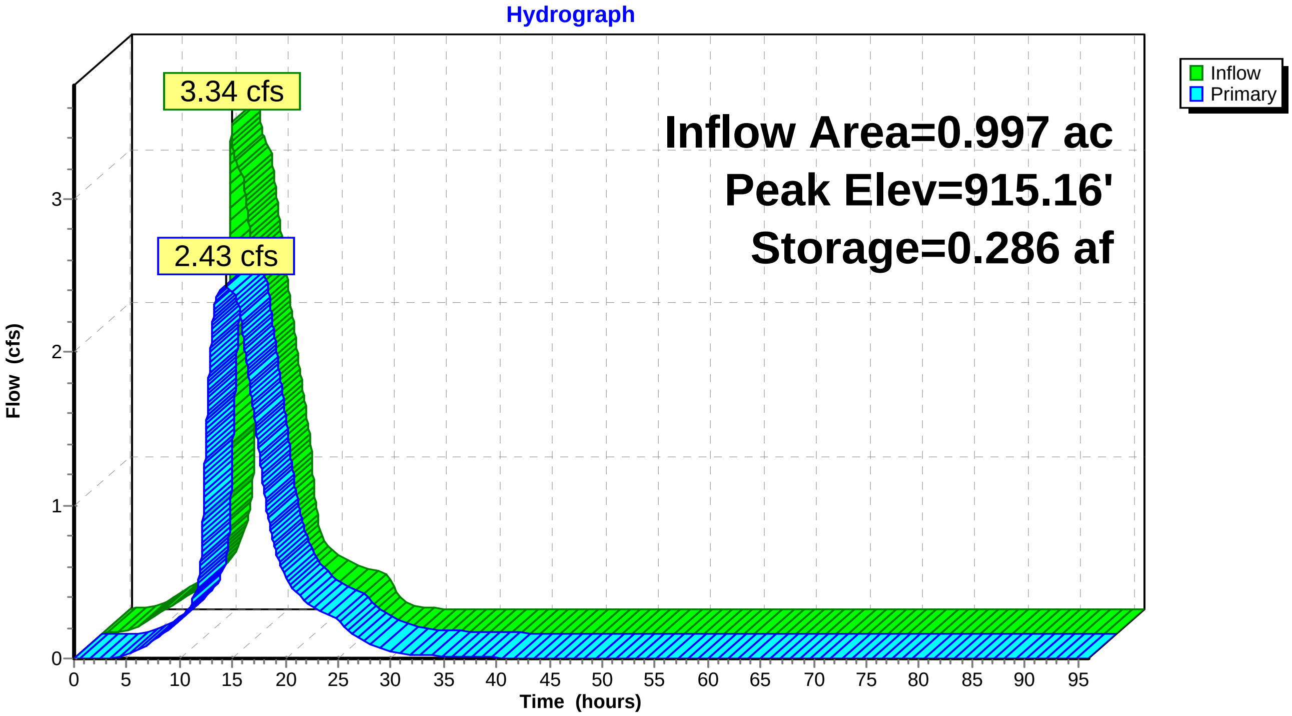
Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	0.950 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	0.660	0.000	0.000
916.00	0.860	0.950	0.950

Device	Routing	Invert	Outlet Devices
#1	Primary	914.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.43 cfs @ 14.34 hrs HW=915.16' TW=0.00' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 2.43 cfs @ 3.09 fps)

Pond W-1: W-1


Hydrograph
3.34 cfs
2.43 cfs
Inflow Area=0.997 ac
Peak Elev=915.16'
Storage=0.286 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-2: W-2

Inflow	=	2.24 cfs @	12.70 hrs,	Volume=	1.126 af
Outflow	=	0.77 cfs @	19.38 hrs,	Volume=	0.979 af, Atten= 66%, Lag= 401.0 min
Primary	=	0.77 cfs @	19.38 hrs,	Volume=	0.979 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 929.49' @ 19.38 hrs Surf.Area= 1.174 ac Storage= 0.559 af

Plug-Flow detention time= 656.6 min calculated for 0.979 af (87% of inflow)
Center-of-Mass det. time= 576.0 min (1,617.9 - 1,042.0)

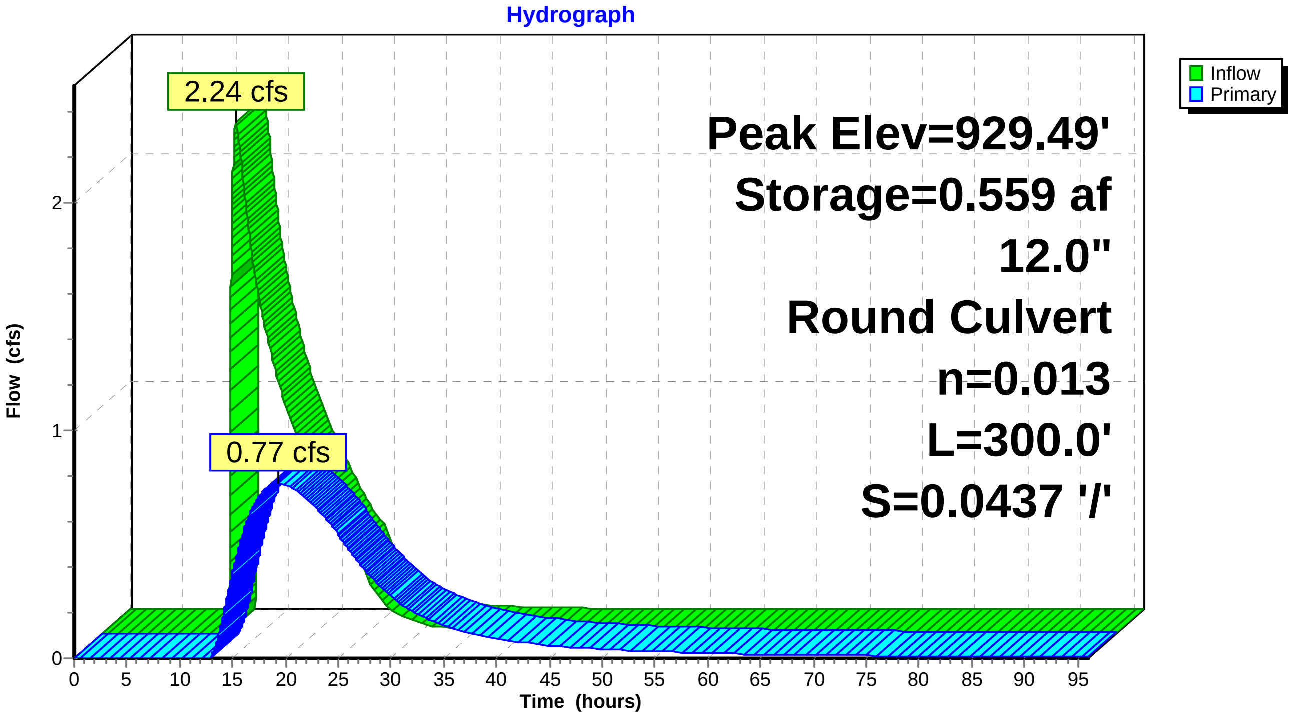
Volume	Invert	Avail.Storage	Storage Description
#1	929.00'	1.175 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
929.00	1.090	0.000	0.000
930.00	1.260	1.175	1.175

Device	Routing	Invert	Outlet Devices
#1	Primary	929.10'	**12.0" Round RCP_Round 12"** L= 300.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 929.10' / 916.00' S= 0.0437 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.77 cfs @ 19.38 hrs HW=929.49' TW=914.88' (Dynamic Tailwater)
└─**1=RCP_Round 12"** (Inlet Controls 0.77 cfs @ 2.67 fps)

Pond W-2: W-2


Hydrograph
2.24 cfs
0.77 cfs
Peak Elev=929.49'
Storage=0.559 af
12.0"
Round Culvert
n=0.013
L=300.0'
S=0.0437 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-3: W-3

```
Inflow    =     0.77 cfs @   19.38 hrs,  Volume=          0.979 af
Outflow   =     0.00 cfs @    0.00 hrs,  Volume=          0.000 af,  Atten= 100%,  Lag= 0.0 min
```

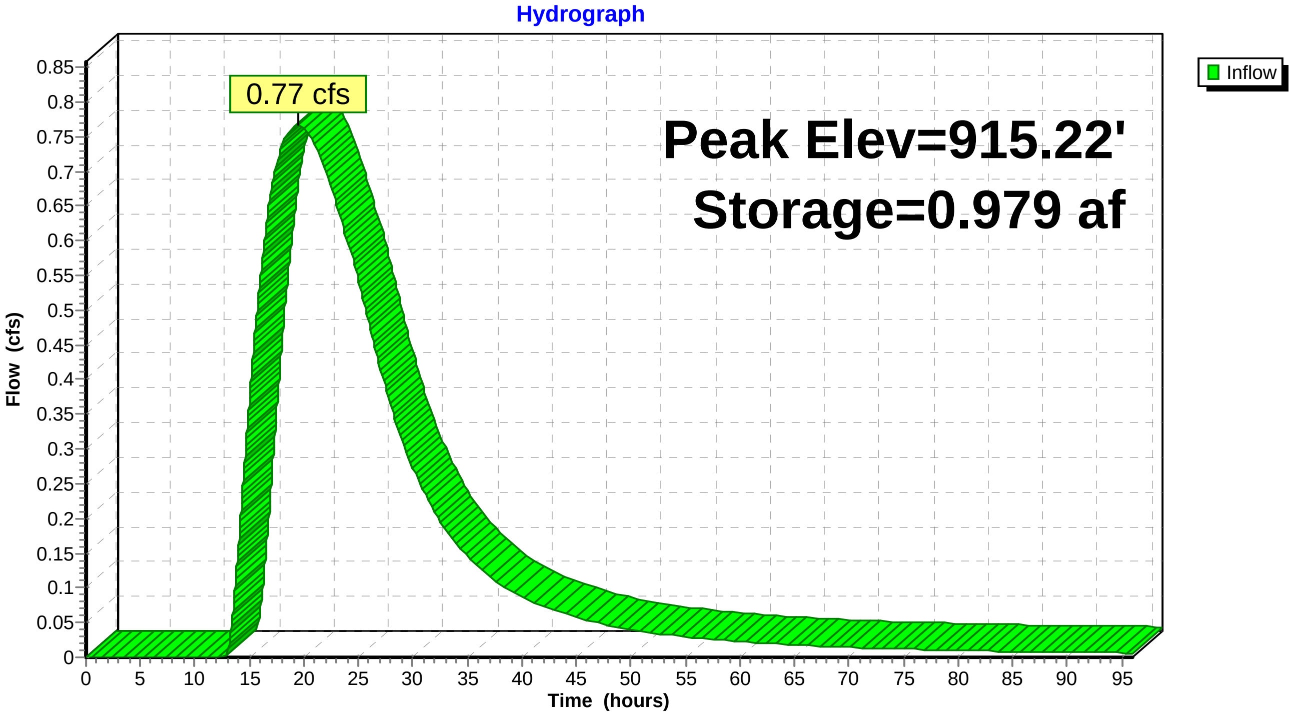
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.22' @ 96.00 hrs Surf.Area= 2.118 ac Storage= 0.979 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	2.680 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	2.040	0.000	0.000
915.00	2.080	0.515	0.515
916.00	2.250	2.165	2.680

Pond W-3: W-3



Summary for Pond W-4: W-4

Inflow Area = 2.985 ac, 30.99% Impervious, Inflow Depth = 12.81" for 10-Year event
Inflow = 10.44 cfs @ 12.09 hrs, Volume= 3.187 af
Outflow = 3.32 cfs @ 16.14 hrs, Volume= 3.168 af, Atten= 68%, Lag= 243.0 min
Primary = 3.32 cfs @ 16.14 hrs, Volume= 3.168 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 908.99' @ 16.14 hrs Surf.Area= 1.137 ac Storage= 0.949 af

Plug-Flow detention time= 259.4 min calculated for 3.168 af (99% of inflow)
Center-of-Mass det. time= 254.5 min (1,195.6 - 941.1)

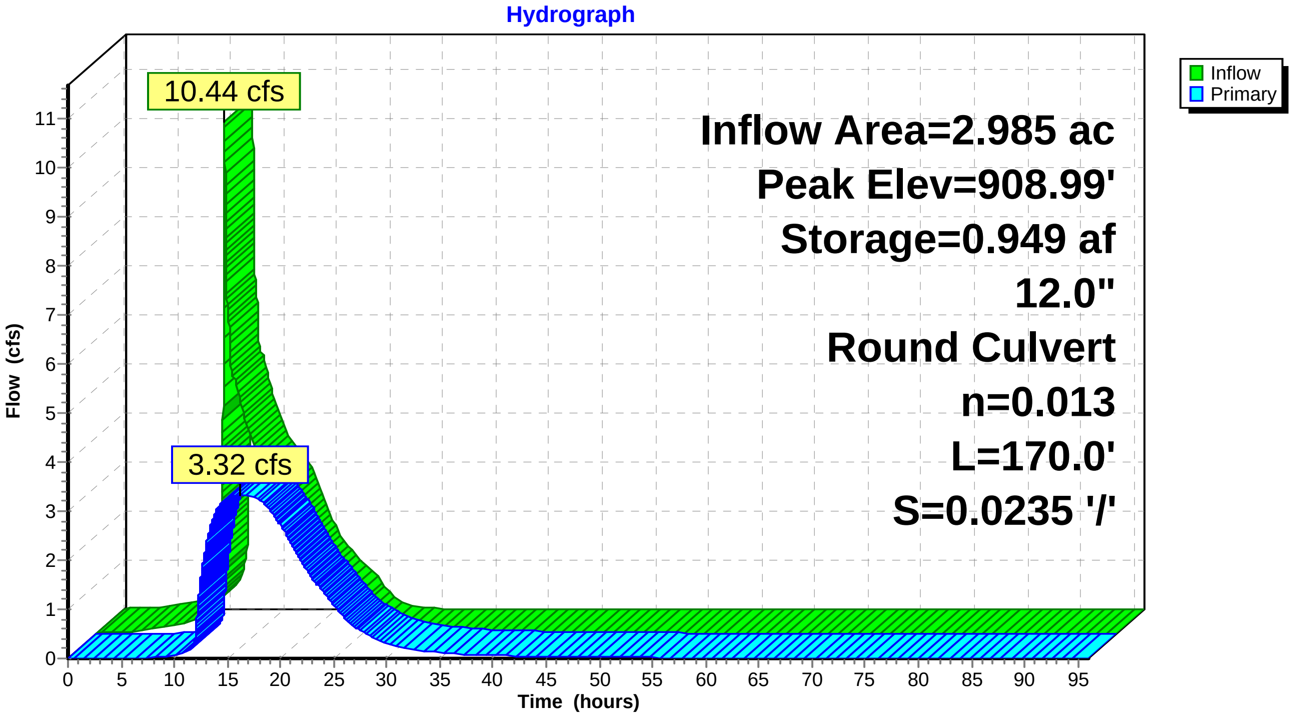
Volume	Invert	Avail.Storage	Storage Description
#1	908.00'	2.280 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
908.00	0.780	0.000	0.000
910.00	1.500	2.280	2.280

Device	Routing	Invert	Outlet Devices
#1	Primary	908.00'	**12.0" Round RCP_Round 12"** L= 170.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 908.00' / 904.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=3.32 cfs @ 16.14 hrs HW=908.99' TW=893.91' (Dynamic Tailwater)
↑**1=RCP_Round 12"** (Inlet Controls 3.32 cfs @ 4.24 fps)

Pond W-4: W-4


Hydrograph
10.44 cfs
3.32 cfs
Inflow Area=2.985 ac
Peak Elev=908.99'
Storage=0.949 af
12.0"
Round Culvert
n=0.013
L=170.0'
S=0.0235 '/'
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-5: W-5

```
Inflow Area =        7.608 ac,  48.41% Impervious,  Inflow Depth =   7.01"    for  10-Year event
Inflow      =       37.78 cfs @   12.02 hrs,  Volume=           4.445 af
Outflow     =        8.48 cfs @   13.20 hrs,  Volume=           4.438 af,  Atten= 78%,  Lag= 70.8 min
Primary     =        8.48 cfs @   13.20 hrs,  Volume=           4.438 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 882.75'   Surf.Area= 4.887 ac   Storage= 7.134 af
Peak Elev= 883.11' @ 13.20 hrs   Surf.Area= 5.311 ac   Storage= 8.975 af   (1.841 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 235.1 min (1,062.3 - 827.2)

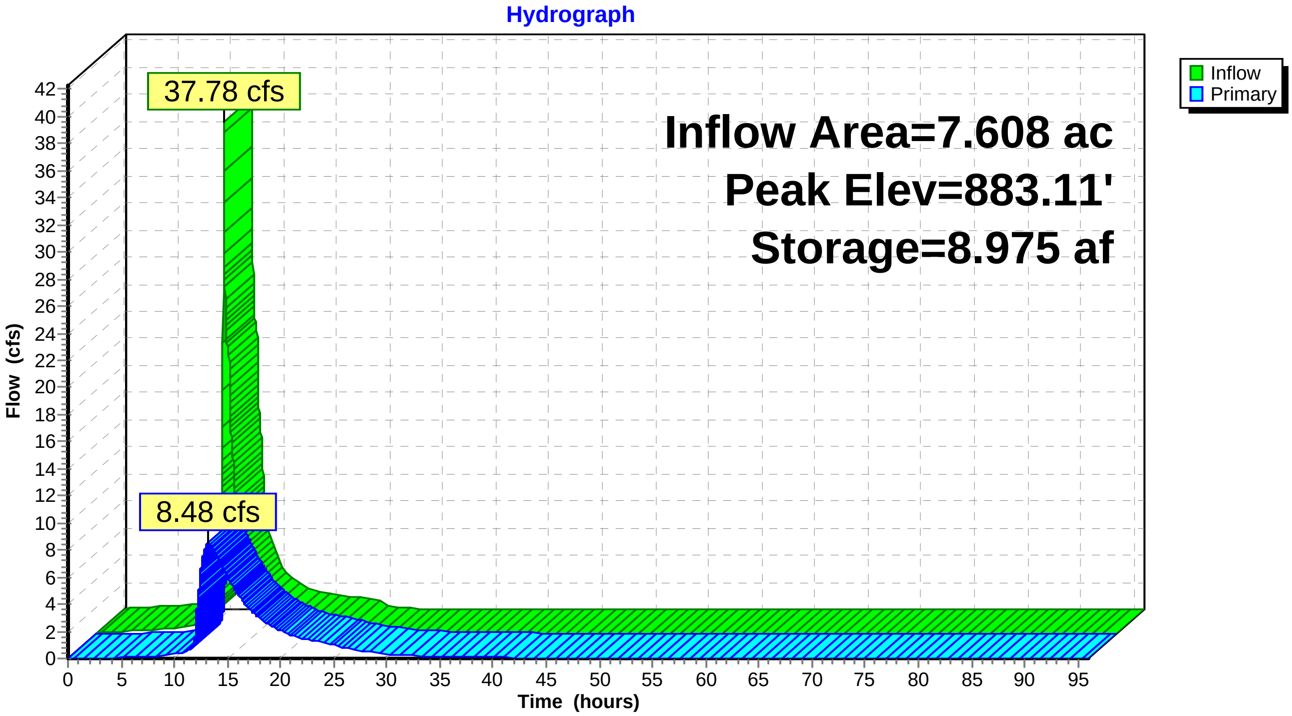
Volume	Invert	Avail.Storage	Storage Description
#1	881.00'	11.097 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
881.00	3.270	0.000	0.000
882.00	4.190	3.730	3.730
883.00	5.120	4.655	8.385
883.49	5.950	2.712	11.097

Device	Routing	Invert	Outlet Devices
#1	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	882.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=8.48 cfs @ 13.20 hrs HW=883.11' TW=0.00'   (Dynamic Tailwater)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 4.24 cfs @ 1.97 fps)
└—**2=Sharp-Crested Rectangular Weir** (Weir Controls 4.24 cfs @ 1.97 fps)

Pond W-5: W-5

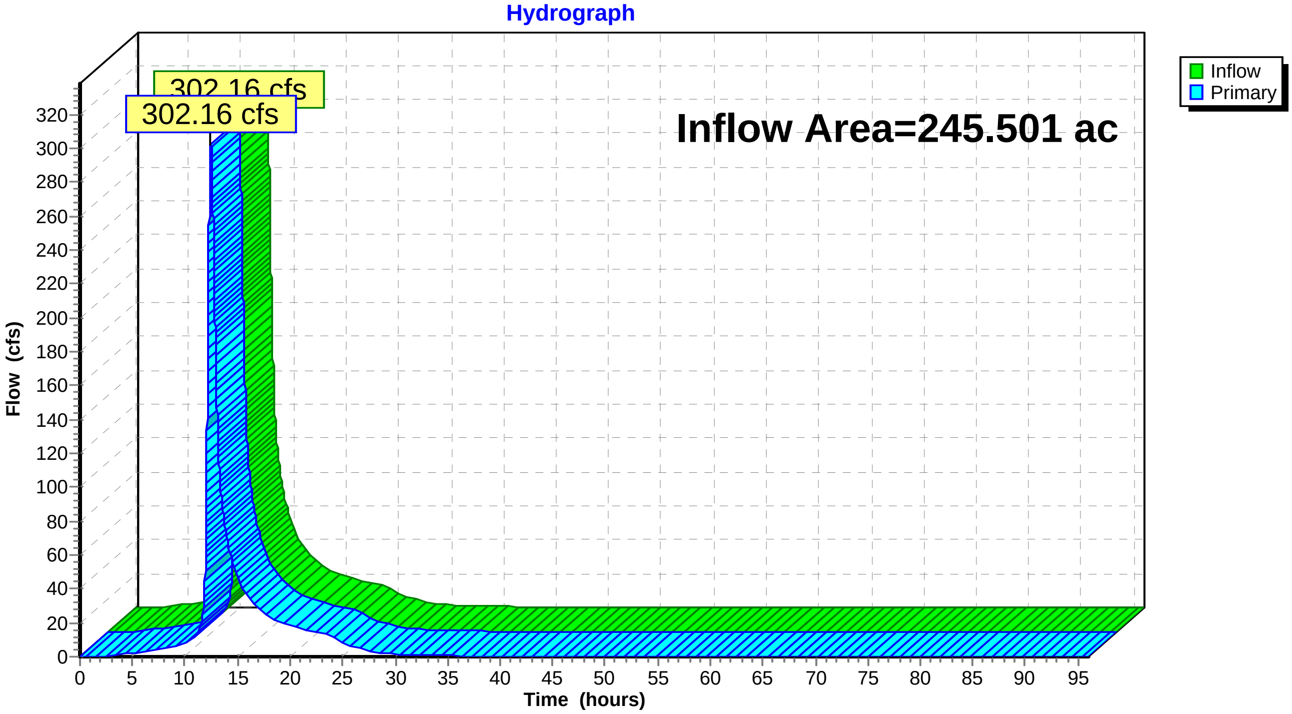

Hydrograph
37.78 cfs
8.48 cfs
Inflow Area=7.608 ac
Peak Elev=883.11'
Storage=8.975 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek

Inflow Area = 245.501 ac, 51.49% Impervious, Inflow Depth = 2.75" for 10-Year event
Inflow = 302.16 cfs @ 12.46 hrs, Volume= 56.170 af
Primary = 302.16 cfs @ 12.46 hrs, Volume= 56.170 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek

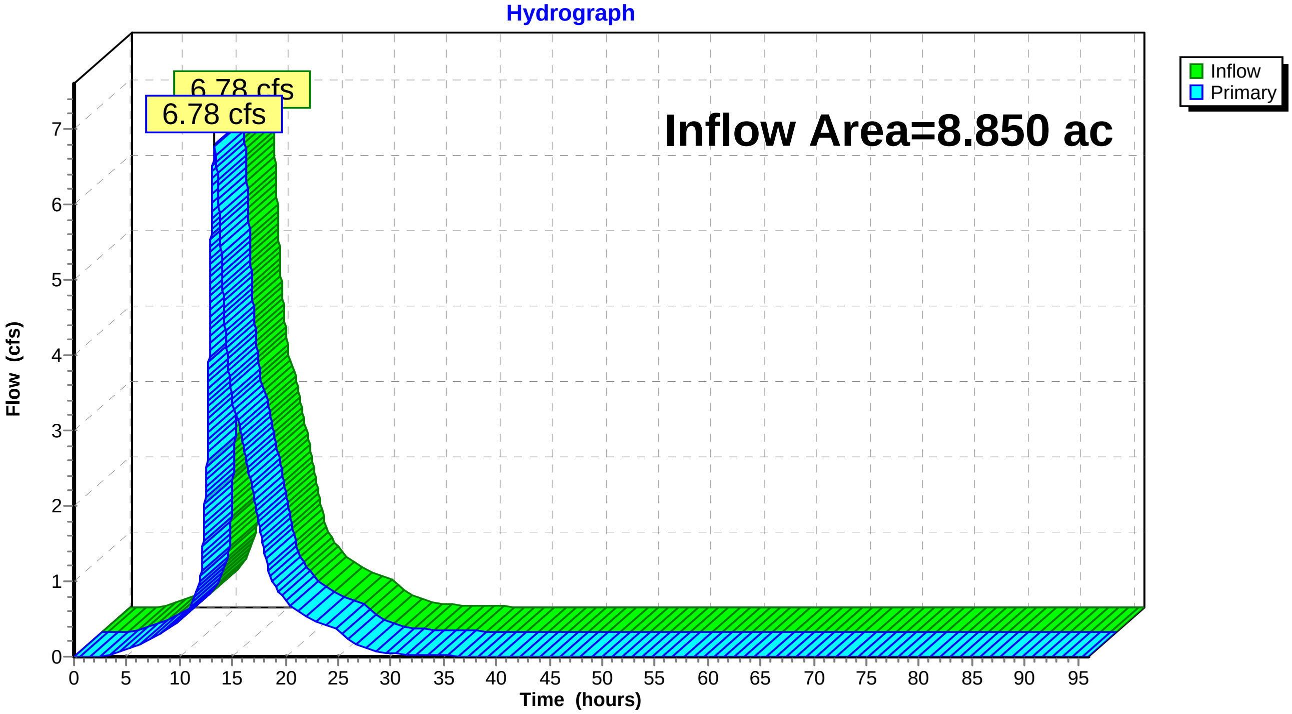


Summary for Link 50L: Outlet #1 Discharge to Round Lake

Inflow Area = 8.850 ac, 65.20% Impervious, Inflow Depth = 3.22" for 10-Year event
Inflow = 6.78 cfs @ 13.30 hrs, Volume= 2.372 af
Primary = 6.78 cfs @ 13.30 hrs, Volume= 2.372 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 50L: Outlet #1 Discharge to Round Lake

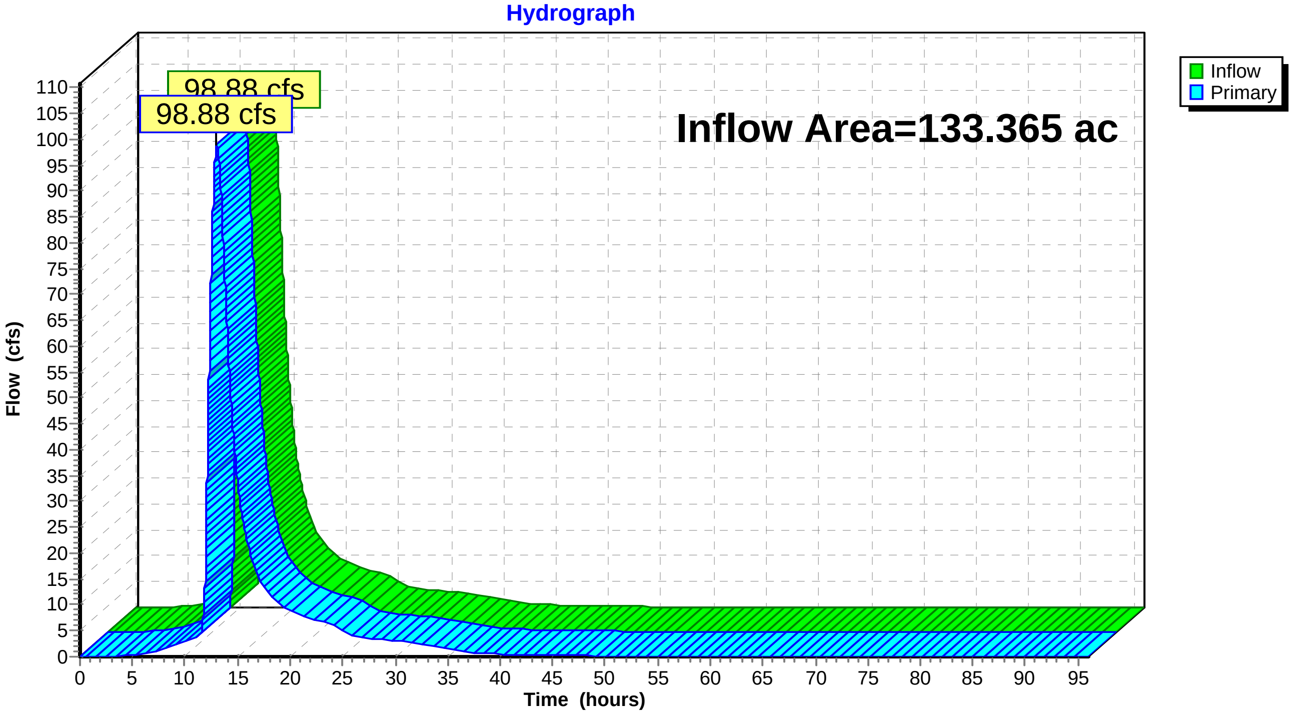


Summary for Link 51L: Outlet #2 Discharge to Round Lake

Inflow Area =	133.365 ac,	58.87% Impervious,	Inflow Depth > 2.77"	for 10-Year event	
Inflow =	98.88 cfs @	13.04 hrs,	Volume=	30.840 af	
Primary =	98.88 cfs @	13.04 hrs,	Volume=	30.840 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 51L: Outlet #2 Discharge to Round Lake

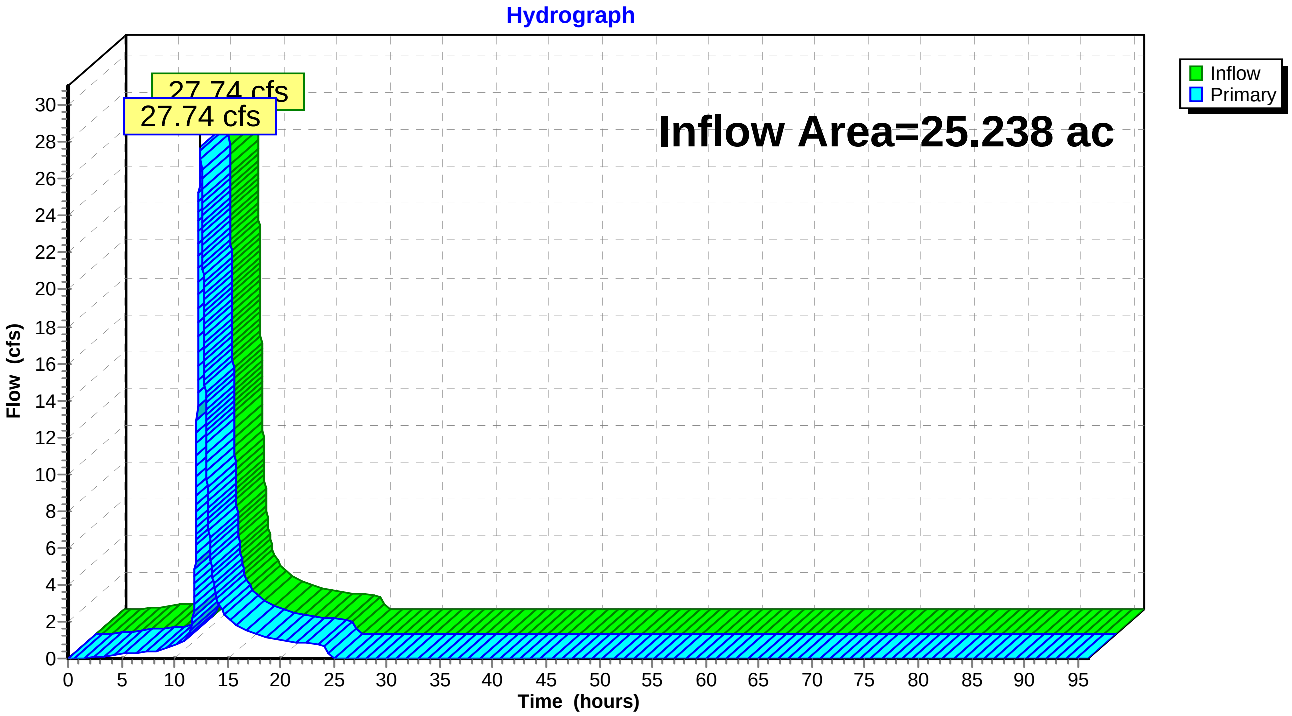


Summary for Link 52L: Outlet #3 Discharge to Round Lake

Inflow Area = 25.238 ac, 19.96% Impervious, Inflow Depth = 1.72" for 10-Year event
Inflow = 27.74 cfs @ 12.43 hrs, Volume= 3.622 af
Primary = 27.74 cfs @ 12.43 hrs, Volume= 3.622 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 52L: Outlet #3 Discharge to Round Lake



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: To Rice Creek Runoff Area=1.601 ac 31.98% Impervious Runoff Depth=5.20"
Tc=5.7 min CN=74/98 Runoff=11.87 cfs 0.693 af

Subcatchment SB 1: SB 1 Runoff Area=52.192 ac 48.35% Impervious Runoff Depth=5.65"
Tc=53.1 min CN=74/98 Runoff=152.90 cfs 24.560 af

Subcatchment SB 10: SB 10 Runoff Area=6.389 ac 7.62% Impervious Runoff Depth=4.52"
Tc=7.3 min CN=74/98 Runoff=39.72 cfs 2.409 af

Subcatchment SB 11: SB 11 Runoff Area=3.293 ac 32.16% Impervious Runoff Depth=5.28"
Tc=11.7 min CN=74/100 Runoff=18.83 cfs 1.448 af

Subcatchment SB 12: SB 12 Runoff Area=1.382 ac 38.71% Impervious Runoff Depth=5.38"
Tc=9.5 min CN=74/98 Runoff=8.83 cfs 0.620 af

Subcatchment SB 13: SB 13 Runoff Area=2.985 ac 30.99% Impervious Runoff Depth=5.24"
Tc=9.4 min CN=74/100 Runoff=18.60 cfs 1.304 af

Subcatchment SB 14: SB 14 Runoff Area=10.225 ac 42.62% Impervious Runoff Depth=5.49"
Tc=4.3 min CN=74/98 Runoff=84.34 cfs 4.677 af

Subcatchment SB 15: SB 15 Runoff Area=58.564 ac 48.22% Impervious Runoff Depth=5.64"
Tc=31.3 min CN=74/98 Runoff=226.38 cfs 27.541 af

Subcatchment SB 16: SB 16 Runoff Area=32.428 ac 33.53% Impervious Runoff Depth=5.24"
Tc=12.1 min CN=74/98 Runoff=183.61 cfs 14.156 af

Subcatchment SB 17: SB 17 Runoff Area=7.608 ac 48.41% Impervious Runoff Depth=5.76"
Tc=4.3 min CN=74/100 Runoff=64.20 cfs 3.655 af

Subcatchment SB 18: SB 18 Runoff Area=52.908 ac 84.55% Impervious Runoff Depth=6.65"
Tc=33.5 min CN=74/98 Runoff=224.72 cfs 29.299 af

Subcatchment SB 19: SB 19 Runoff Area=21.198 ac 39.93% Impervious Runoff Depth=5.41"
Tc=24.7 min CN=74/98 Runoff=89.07 cfs 9.565 af

Subcatchment SB 2: SB 2 Runoff Area=11.400 ac 84.29% Impervious Runoff Depth=6.64"
Tc=16.6 min CN=74/98 Runoff=67.49 cfs 6.306 af

Subcatchment SB 22: SB 22 Runoff Area=41.911 ac 82.19% Impervious Runoff Depth=6.12"
Tc=41.0 min CN=49/98 Runoff=144.97 cfs 21.385 af

Subcatchment SB 24: SB 24 Runoff Area=4.939 ac 98.22% Impervious Runoff Depth=7.02"
Tc=7.5 min CN=74/98 Runoff=42.62 cfs 2.890 af

Subcatchment SB 25: SB 25 Runoff Area=5.012 ac 95.71% Impervious Runoff Depth=6.95"
Tc=10.7 min CN=74/98 Runoff=37.25 cfs 2.904 af

Subcatchment SB 26: SB 26 Runoff Area=14.335 ac 98.27% Impervious Runoff Depth=7.02"
Tc=25.4 min CN=74/98 Runoff=73.07 cfs 8.390 af

Subcatchment SB 27: SB 27 (Thumb Road) Runoff Area=6.629 ac 97.12% Impervious Runoff Depth=6.92"
Tc=27.6 min CN=49/98 Runoff=31.89 cfs 3.821 af

Subcatchment SB 28: SB 28 Runoff Area=6.955 ac 46.76% Impervious Runoff Depth=5.60"
Tc=14.6 min CN=74/98 Runoff=38.37 cfs 3.247 af

Subcatchment SB 29: SB 29 Runoff Area=10.214 ac 37.73% Impervious Runoff Depth=5.35"
Tc=19.1 min CN=74/98 Runoff=48.13 cfs 4.557 af

Subcatchment SB 3: SB 3 Runoff Area=37.668 ac 41.46% Impervious Runoff Depth=5.46"
Tc=15.3 min CN=74/98 Runoff=199.96 cfs 17.130 af

Subcatchment SB 4: SB 4 Runoff Area=0.599 ac 19.70% Impervious Runoff Depth=4.90"
Tc=5.9 min CN=74/100 Runoff=4.20 cfs 0.245 af

Subcatchment SB 5: SB 5 Runoff Area=7.853 ac 70.37% Impervious Runoff Depth=6.25"
Tc=59.3 min CN=74/98 Runoff=23.32 cfs 4.093 af

Subcatchment SB 51: Offsite Subbasin 51 Runoff Area=25.238 ac 19.96% Impervious Runoff Depth=4.09"
Tc=32.8 min CN=65/98 Runoff=70.31 cfs 8.599 af

Subcatchment SB 6: SB 6 Runoff Area=0.997 ac 24.47% Impervious Runoff Depth=5.05"
Tc=20.3 min CN=74/100 Runoff=4.33 cfs 0.419 af

Subcatchment SB 7: SB 7 Runoff Area=21.555 ac 84.83% Impervious Runoff Depth=6.65"
Tc=5.7 min CN=74/98 Runoff=192.64 cfs 11.950 af

Subcatchment SB 8: SB 8 Runoff Area=29.595 ac 30.01% Impervious Runoff Depth=5.14"
Tc=47.1 min CN=74/98 Runoff=86.02 cfs 12.680 af

Subcatchment SB 9: SB 9 Runoff Area=25.789 ac 33.17% Impervious Runoff Depth=5.23"
Tc=30.0 min CN=74/98 Runoff=96.02 cfs 11.237 af

Pond 3P: P-3 Peak Elev=919.71' Storage=19.292 af Inflow=321.63 cfs 62.160 af
Outflow=267.75 cfs 62.142 af

Pond 4P: P-4 Peak Elev=917.80' Storage=1.640 af Inflow=23.32 cfs 4.093 af
Primary=12.66 cfs 2.270 af Secondary=3.35 cfs 1.823 af Outflow=16.01 cfs 4.093 af

Pond 7P: P-7 Peak Elev=915.93' Storage=1.523 af Inflow=86.02 cfs 12.680 af
Outflow=87.44 cfs 12.680 af

Pond 9P: P-9 Peak Elev=915.84' Storage=0.601 af Inflow=166.30 cfs 23.916 af
Outflow=166.11 cfs 23.916 af

Pond 10P: P-10 Peak Elev=898.47' Storage=1.545 af Inflow=164.99 cfs 24.555 af
Primary=15.81 cfs 11.415 af Secondary=148.71 cfs 13.140 af Outflow=164.52 cfs 24.555 af

Pond 11P: P-11 Peak Elev=912.79' Storage=9.054 af Inflow=172.55 cfs 25.364 af
Primary=155.34 cfs 21.533 af Secondary=4.92 cfs 3.830 af Outflow=160.26 cfs 25.363 af

Pond 12P: P-12 Peak Elev=895.80' Storage=10.192 af Inflow=175.25 cfs 34.346 af
Outflow=138.66 cfs 34.338 af

Pond 13P: P-13 Peak Elev=885.58' Storage=10.282 af Inflow=652.01 cfs 110.403 af
Primary=608.53 cfs 105.483 af Secondary=20.47 cfs 4.917 af Outflow=629.00 cfs 110.401 af

Pond 14P: P-14 Peak Elev=895.17' Storage=9.341 af Inflow=89.07 cfs 9.565 af
Outflow=16.07 cfs 9.563 af

Pond 23P: Thumb Infiltration (Thumb TP Peak Elev=903.88' Storage=3.880 af Inflow=171.27 cfs 25.207 af
Outflow=171.19 cfs 21.467 af

Pond 31P: SB 18 Infiltration Peak Elev=903.48' Storage=3.485 af Inflow=224.72 cfs 29.299 af
Outflow=224.59 cfs 25.979 af

Pond 36P: Culverts passing flow Peak Elev=890.33' Storage=0.013 af Inflow=224.59 cfs 25.979 af
Primary=125.00 cfs 22.689 af Secondary=99.53 cfs 3.290 af Outflow=224.53 cfs 25.979 af

Pond CRH-1: CRH-1 Peak Elev=878.81' Storage=0.760 af Inflow=38.37 cfs 3.247 af
Discarded=0.37 cfs 0.563 af Primary=25.16 cfs 2.685 af Outflow=25.53 cfs 3.247 af

Pond CRH-2: CRH-2 Peak Elev=883.78' Storage=1.468 af Inflow=48.13 cfs 4.557 af
Discarded=0.47 cfs 0.986 af Primary=27.38 cfs 3.571 af Outflow=27.85 cfs 4.557 af

Pond CRH-3: CRH-3 Peak Elev=879.83' Storage=0.769 af Inflow=30.15 cfs 4.265 af
Discarded=0.38 cfs 0.519 af Primary=25.52 cfs 3.745 af Outflow=25.90 cfs 4.265 af

Pond P1/P2: P-1/P-2 Peak Elev=925.63' Storage=5.762 af Inflow=181.28 cfs 33.757 af
Outflow=177.47 cfs 33.749 af

Pond P5/P6: P-5/P-6 Peak Elev=932.56' Storage=13.463 af Inflow=234.37 cfs 20.279 af
Primary=119.36 cfs 16.461 af Secondary=3.15 cfs 1.701 af Outflow=122.50 cfs 18.162 af

Pond P8: P-8 Peak Elev=899.15' Storage=1.415 af Inflow=39.72 cfs 2.409 af
24.0" Round Culvert n=0.013 L=380.0' S=0.0028 '/' Outflow=11.00 cfs 2.403 af

Pond W-1: W-1 Peak Elev=915.37' Storage=0.443 af Inflow=6.17 cfs 2.242 af
Outflow=2.99 cfs 2.242 af

Pond W-2: W-2 Peak Elev=929.60' Storage=0.681 af Inflow=3.15 cfs 1.701 af
12.0" Round Culvert n=0.013 L=300.0' S=0.0437 '/' Outflow=1.17 cfs 1.553 af

Pond W-3: W-3 Peak Elev=915.49' Storage=1.553 af Inflow=1.17 cfs 1.553 af
Outflow=0.00 cfs 0.000 af

Pond W-4: W-4 Peak Elev=909.35' Storage=1.383 af Inflow=22.11 cfs 5.134 af
12.0" Round Culvert n=0.013 L=170.0' S=0.0235 '/' Outflow=4.36 cfs 5.114 af

Pond W-5: W-5 Peak Elev=883.35' Storage=10.267 af Inflow=76.11 cfs 8.572 af
Outflow=17.76 cfs 8.565 af

Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek	Inflow=623.69 cfs 114.048 af Primary=623.69 cfs 114.048 af
Link 50L: Outlet #1 Discharge to Round Lake	Inflow=15.52 cfs 4.512 af Primary=15.52 cfs 4.512 af
Link 51L: Outlet #2 Discharge to Round Lake	Inflow=267.75 cfs 62.142 af Primary=267.75 cfs 62.142 af
Link 52L: Outlet #3 Discharge to Round Lake	Inflow=70.31 cfs 8.599 af Primary=70.31 cfs 8.599 af

Total Runoff Area = 501.462 ac Runoff Volume = 239.780 af Average Runoff Depth = 5.74"
45.62% Pervious = 228.758 ac 54.38% Impervious = 272.704 ac

Summary for Subcatchment 1S: To Rice Creek

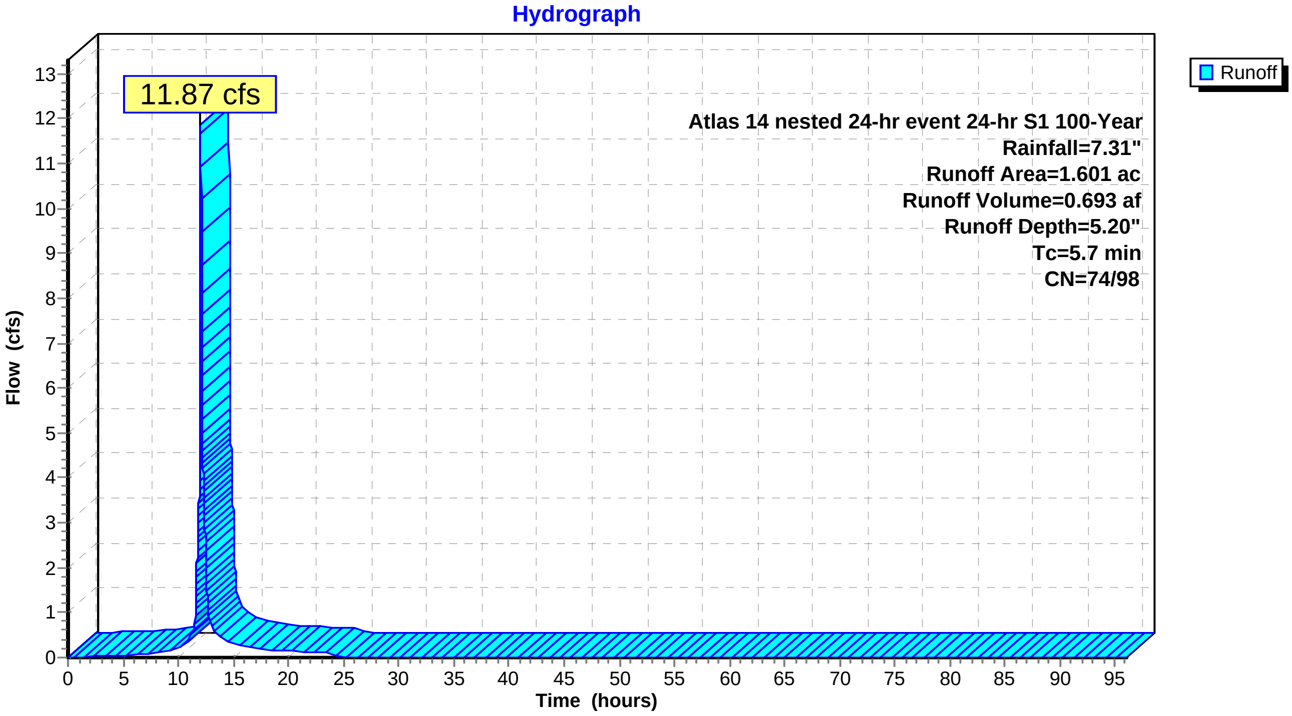
Runoff = 11.87 cfs @ 12.03 hrs, Volume= 0.693 af, Depth= 5.20"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.512	98	impervious
*	1.089	74	pervious
	1.601	82	Weighted Average
	1.089		68.02% Pervious Area
	0.512		31.98% Impervious Area

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

Subcatchment 1S: To Rice Creek



Summary for Subcatchment SB 1: SB 1

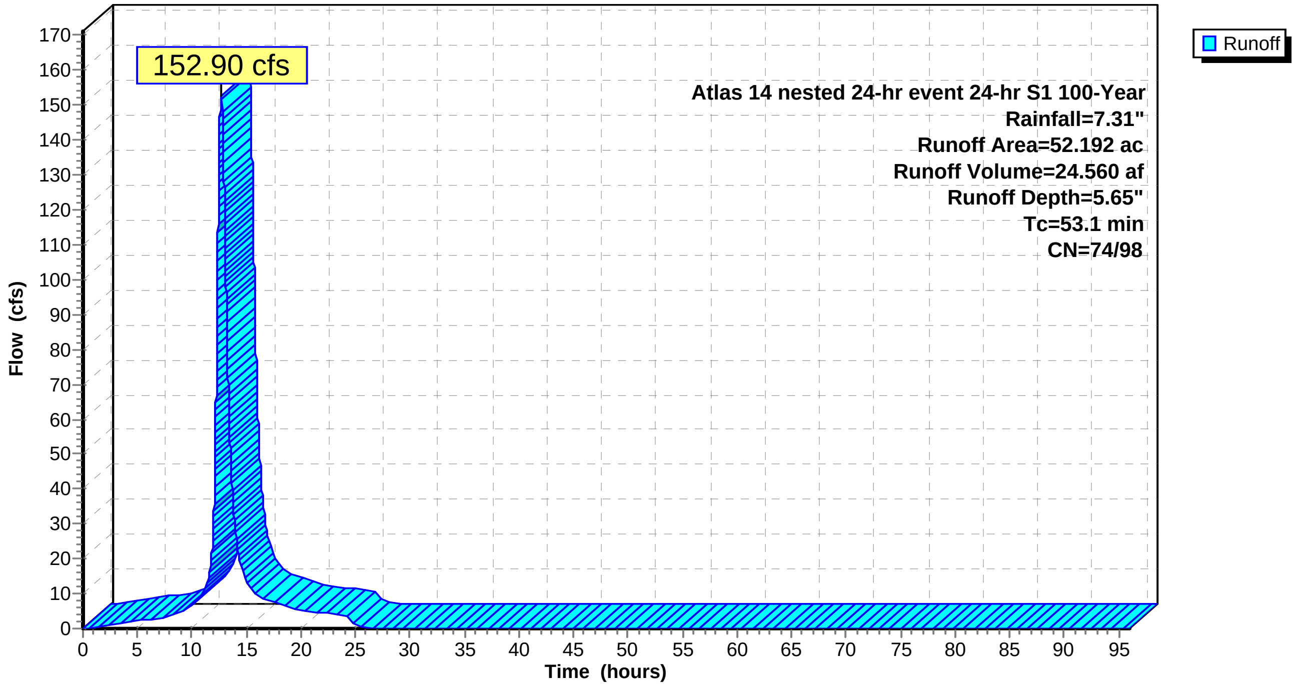
Runoff = 152.90 cfs @ 12.68 hrs, Volume= 24.560 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	26.958	74	pervious
*	25.234	98	impervious
	52.192	86	Weighted Average
	26.958		51.65% Pervious Area
	25.234		48.35% Impervious Area

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

Subcatchment SB 1: SB 1



Summary for Subcatchment SB 10: SB 10

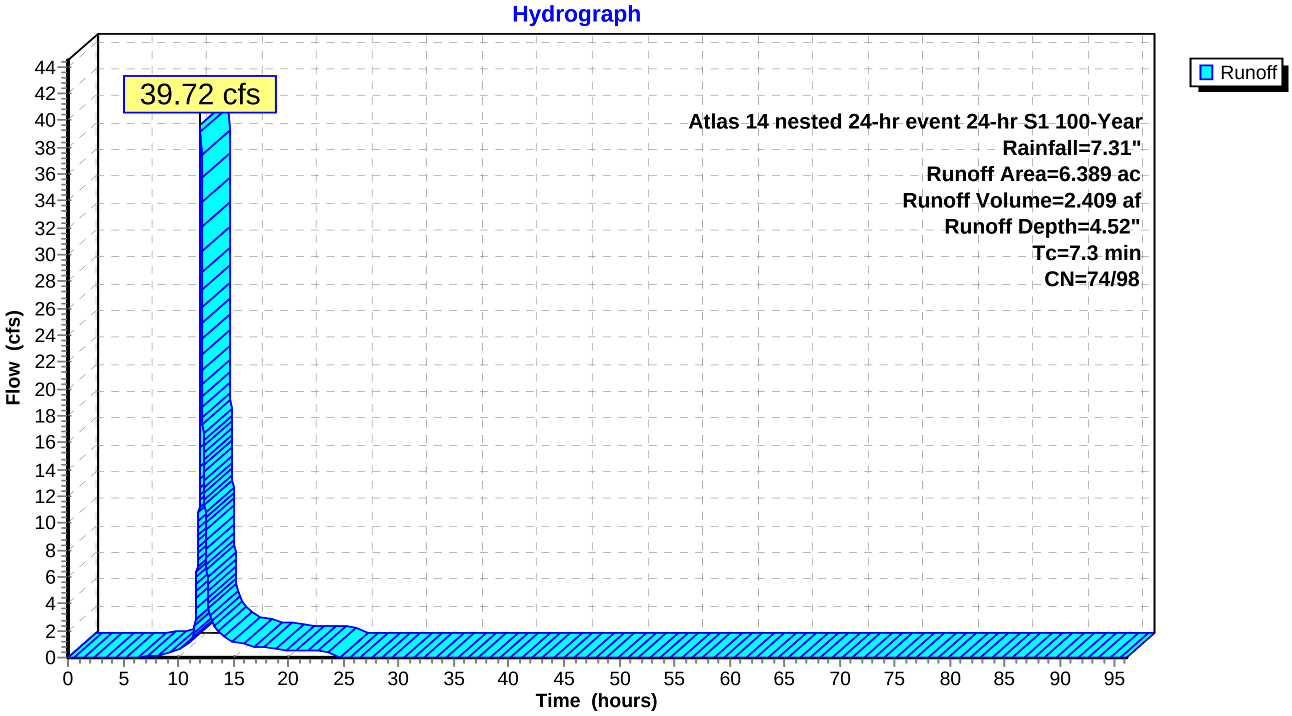
Runoff = 39.72 cfs @ 12.05 hrs, Volume= 2.409 af, Depth= 4.52"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	5.902	74	pervious
*	0.487	98	impervious
	6.389	76	Weighted Average
	5.902		92.38% Pervious Area
	0.487		7.62% Impervious Area

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

Subcatchment SB 10: SB 10



Summary for Subcatchment SB 11: SB 11

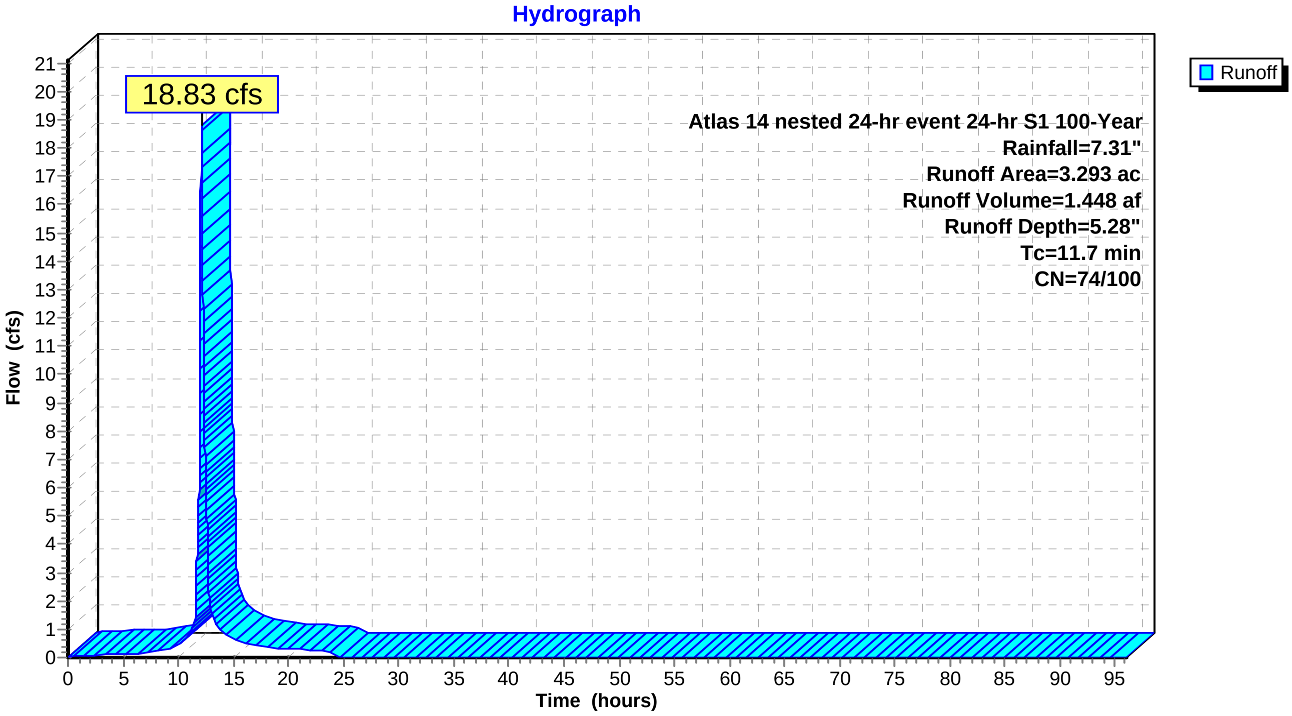
Runoff = 18.83 cfs @ 12.11 hrs, Volume= 1.448 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.234	74	pervious
*	1.059	100	impervious
	3.293	82	Weighted Average
	2.234		67.84% Pervious Area
	1.059		32.16% Impervious Area

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

Subcatchment SB 11: SB 11



Summary for Subcatchment SB 12: SB 12

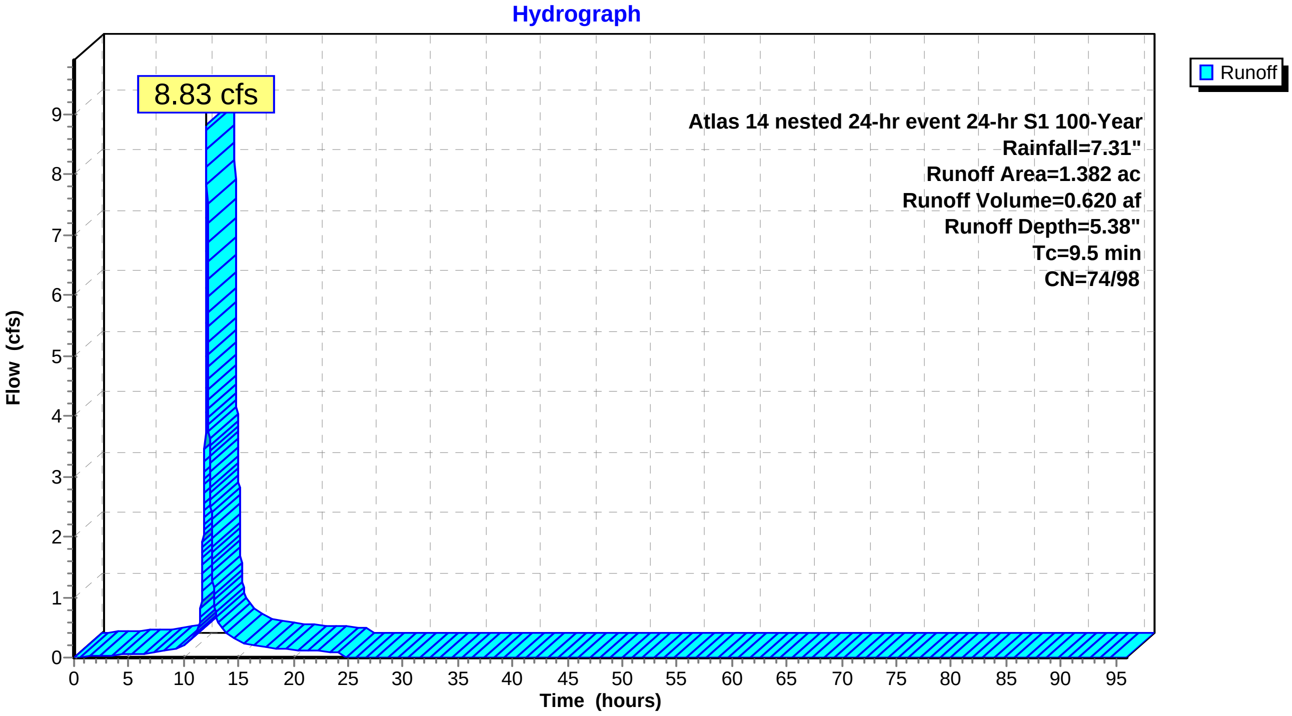
Runoff = 8.83 cfs @ 12.08 hrs, Volume= 0.620 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.847	74	pervious
*	0.535	98	impervious
	1.382	83	Weighted Average
	0.847		61.29% Pervious Area
	0.535		38.71% Impervious Area

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

Subcatchment SB 12: SB 12



Summary for Subcatchment SB 13: SB 13

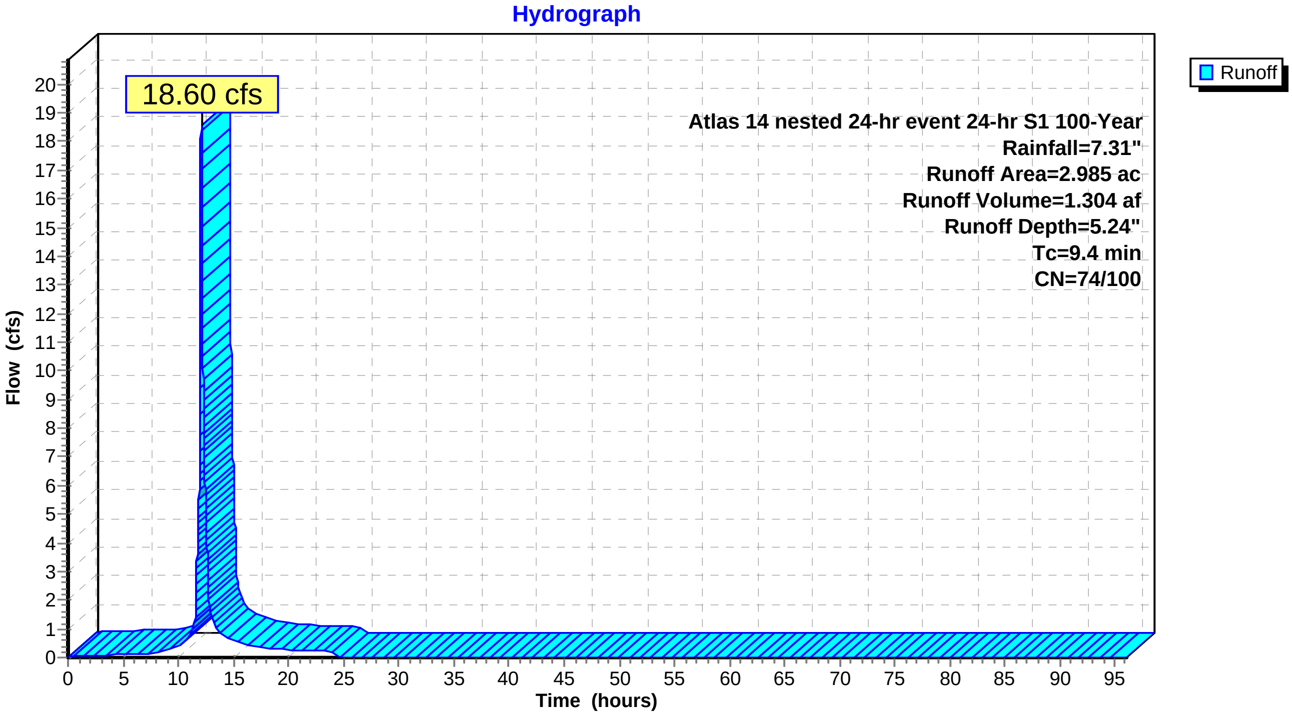
Runoff = 18.60 cfs @ 12.08 hrs, Volume= 1.304 af, Depth= 5.24"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.060	74	pervious
*	0.925	100	impervious
	2.985	82	Weighted Average
	2.060		69.01% Pervious Area
	0.925		30.99% Impervious Area

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

Subcatchment SB 13: SB 13



Summary for Subcatchment SB 14: SB 14

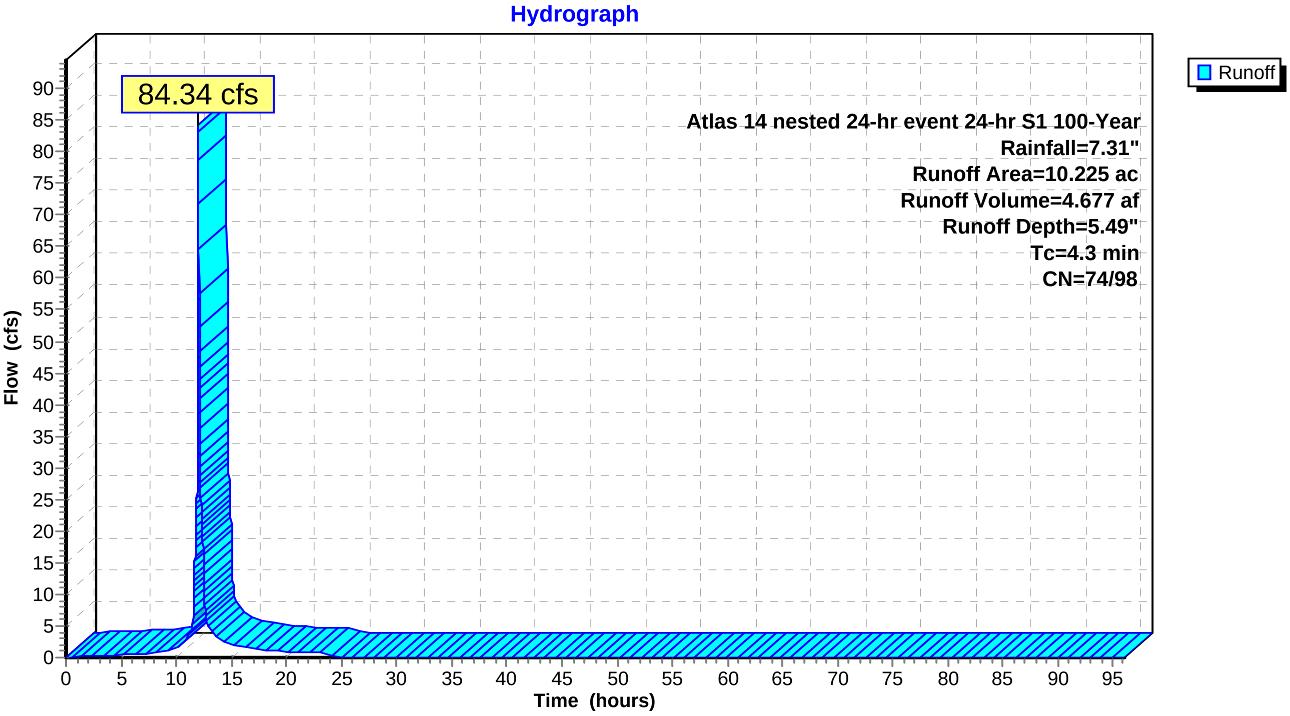
Runoff = 84.34 cfs @ 12.02 hrs, Volume= 4.677 af, Depth= 5.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	5.867	74	pervious
*	4.358	98	impervious
	10.225	84	Weighted Average
	5.867		57.38% Pervious Area
	4.358		42.62% Impervious Area

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

Subcatchment SB 14: SB 14



Summary for Subcatchment SB 15: SB 15

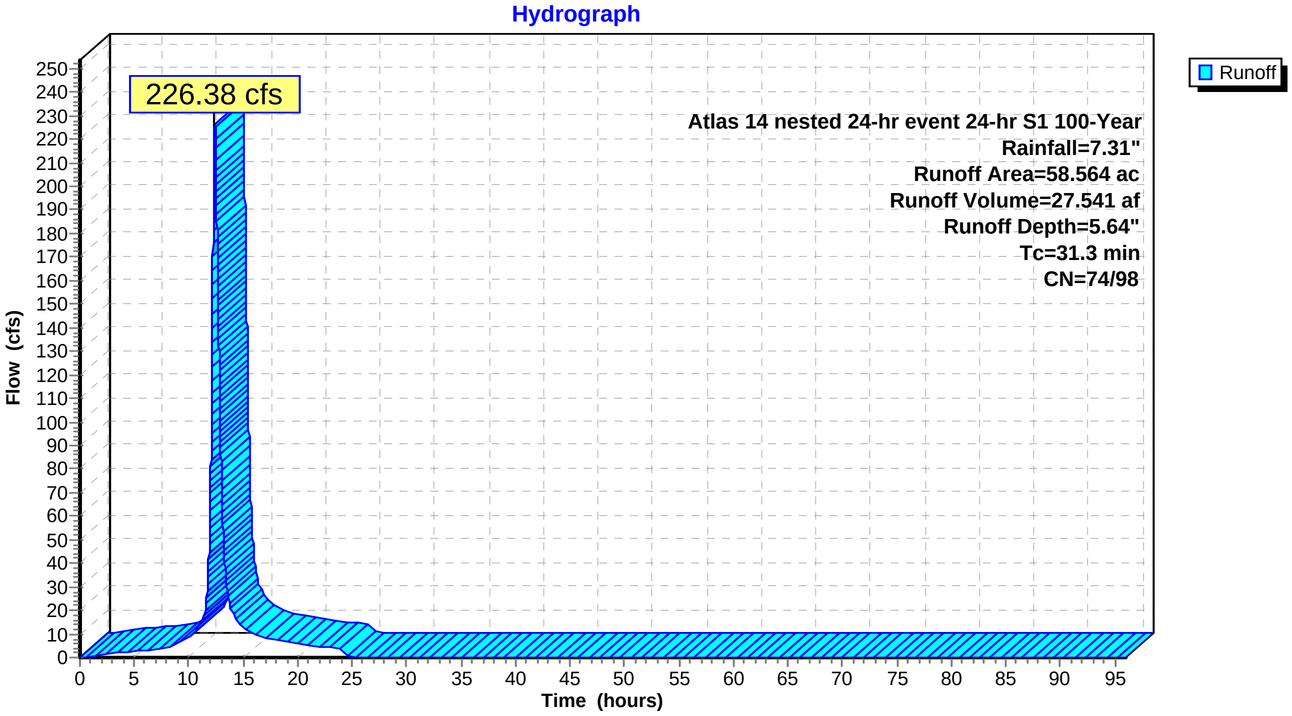
Runoff = 226.38 cfs @ 12.38 hrs, Volume= 27.541 af, Depth= 5.64"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	30.326	74	pervious
*	28.238	98	impervious
	58.564	86	Weighted Average
	30.326		51.78% Pervious Area
	28.238		48.22% Impervious Area

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

Subcatchment SB 15: SB 15



Summary for Subcatchment SB 16: SB 16

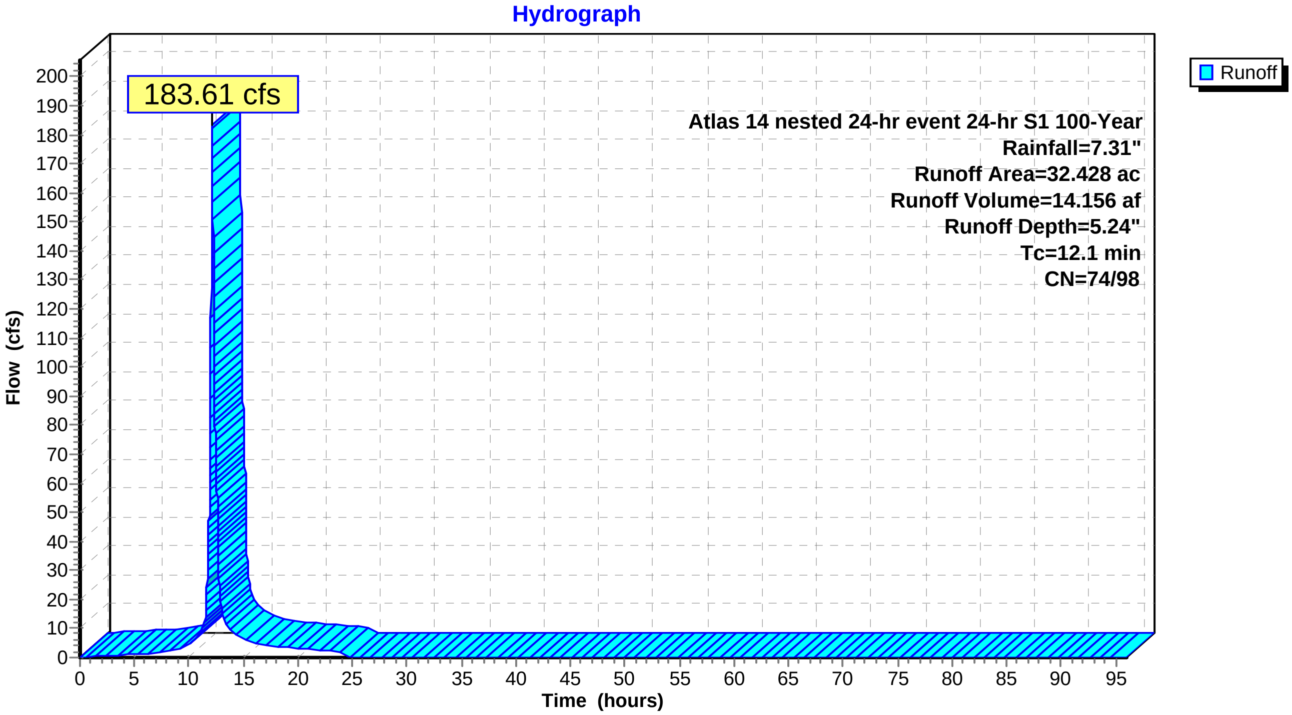
Runoff = 183.61 cfs @ 12.12 hrs, Volume= 14.156 af, Depth= 5.24"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	21.555	74	pervious
*	10.873	98	impervious
	32.428	82	Weighted Average
	21.555		66.47% Pervious Area
	10.873		33.53% Impervious Area

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

Subcatchment SB 16: SB 16



Summary for Subcatchment SB 17: SB 17

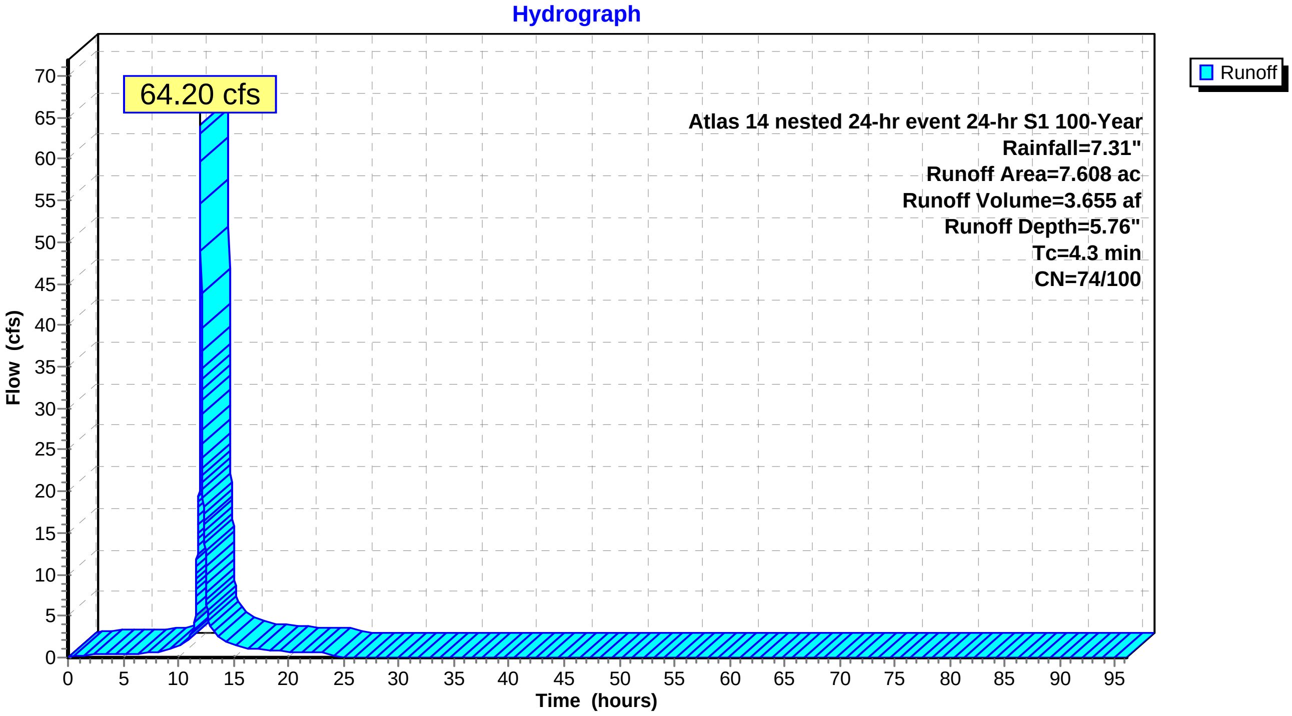
Runoff = 64.20 cfs @ 12.02 hrs, Volume= 3.655 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.925	74	pervious
*	3.683	100	impervious
	7.608	87	Weighted Average
	3.925		51.59% Pervious Area
	3.683		48.41% Impervious Area

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

Subcatchment SB 17: SB 17



Summary for Subcatchment SB 18: SB 18

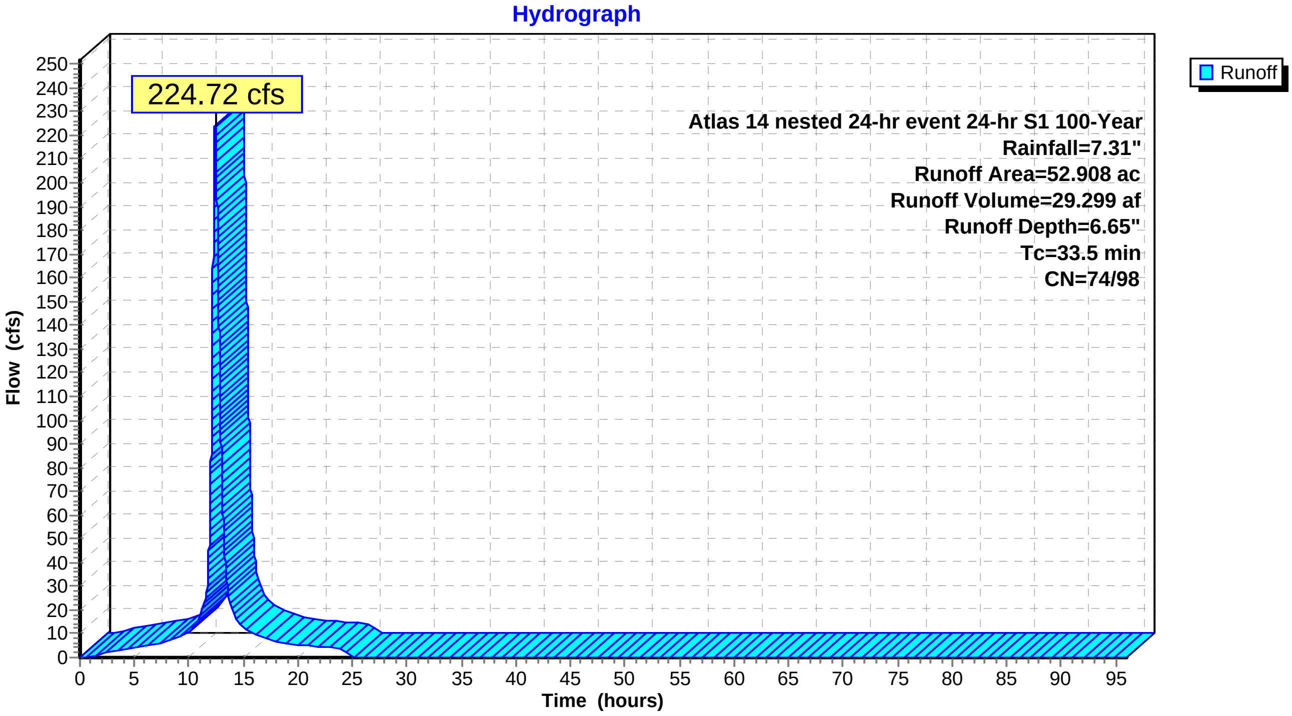
Runoff = 224.72 cfs @ 12.40 hrs, Volume= 29.299 af, Depth= 6.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	8.172	74	pervious
*	44.736	98	impervious
	52.908	94	Weighted Average
	8.172		15.45% Pervious Area
	44.736		84.55% Impervious Area

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

Subcatchment SB 18: SB 18



Summary for Subcatchment SB 19: SB 19

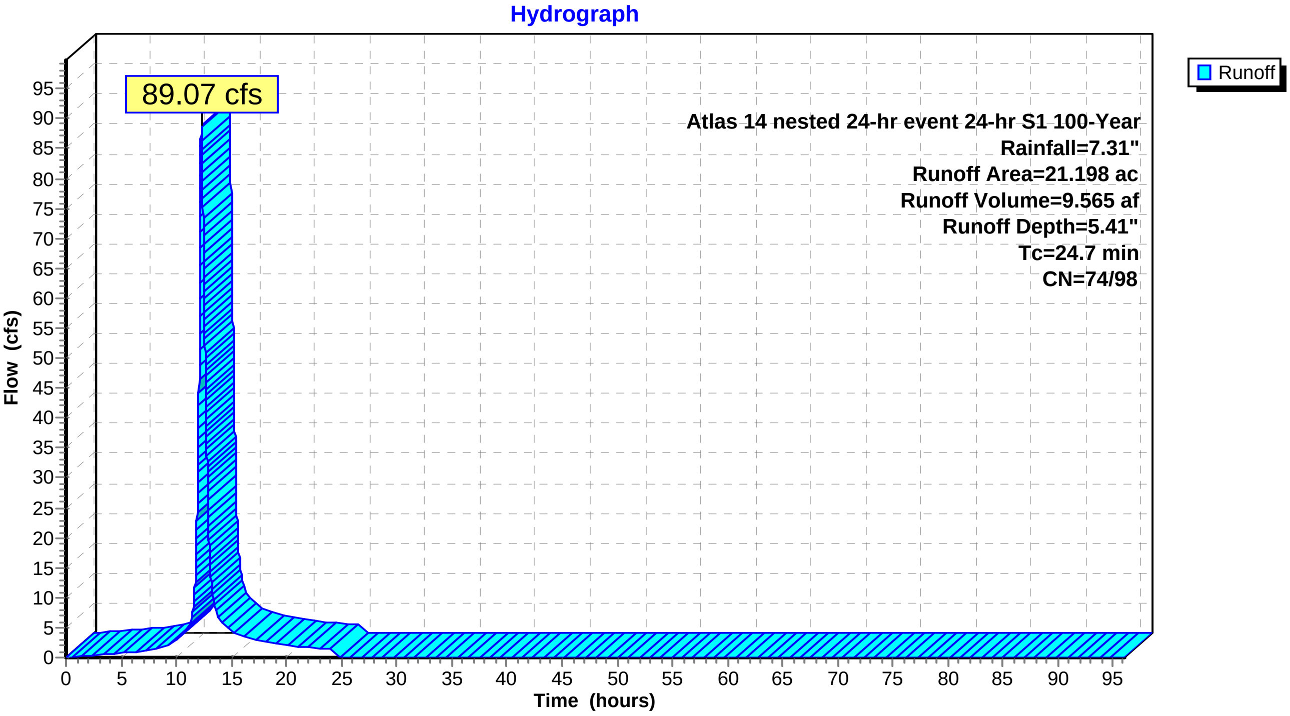
Runoff = 89.07 cfs @ 12.29 hrs, Volume= 9.565 af, Depth= 5.41"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	12.734	74	pervious
*	8.464	98	impervious
	21.198	84	Weighted Average
	12.734		60.07% Pervious Area
	8.464		39.93% Impervious Area

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

Subcatchment SB 19: SB 19



Summary for Subcatchment SB 2: SB 2

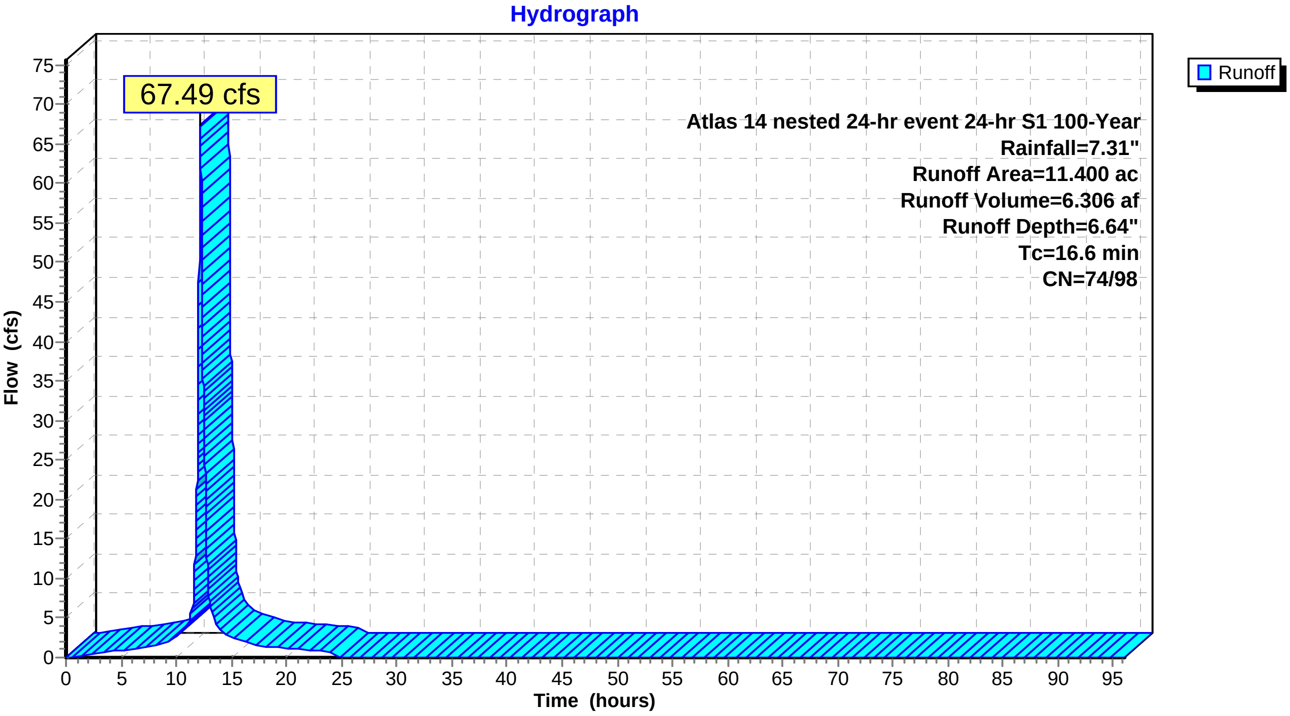
Runoff = 67.49 cfs @ 12.17 hrs, Volume= 6.306 af, Depth= 6.64"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	1.791	74	pervious
*	9.609	98	impervious
	11.400	94	Weighted Average
	1.791		15.71% Pervious Area
	9.609		84.29% Impervious Area

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

Subcatchment SB 2: SB 2



Summary for Subcatchment SB 22: SB 22

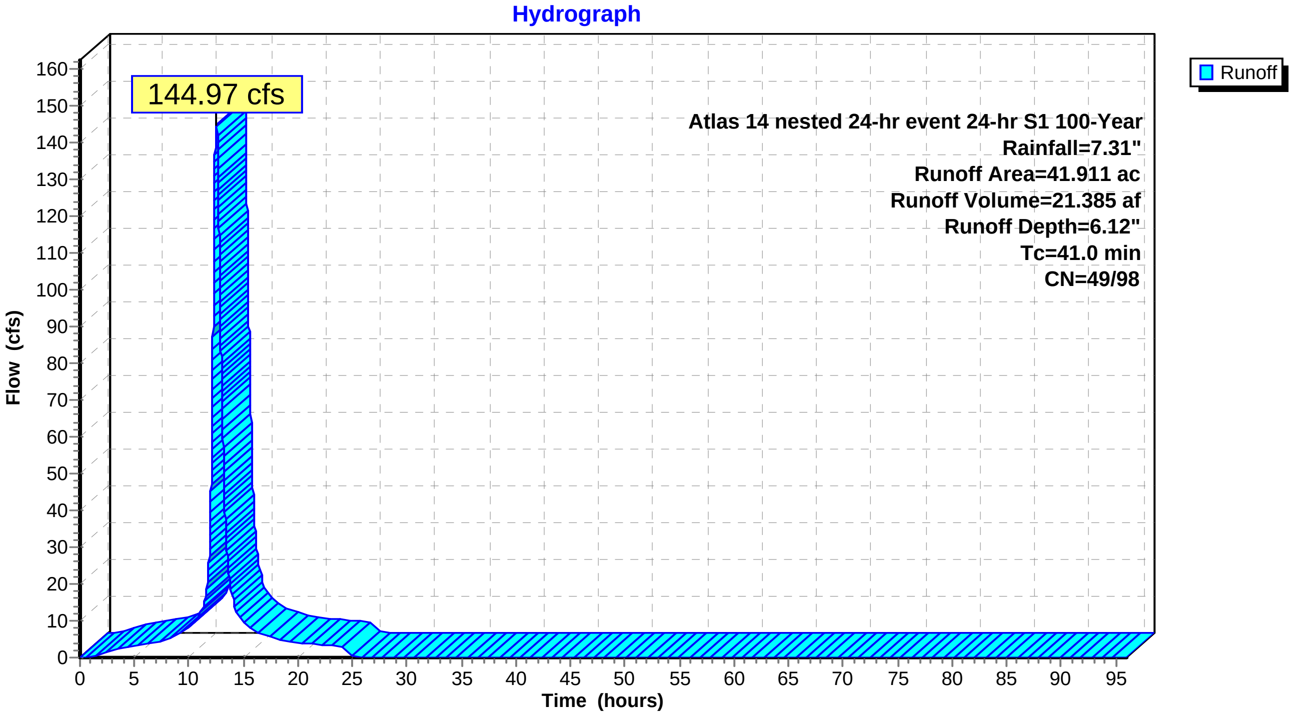
Runoff = 144.97 cfs @ 12.52 hrs, Volume= 21.385 af, Depth= 6.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	7.465	49	Pervious
*	34.446	98	Impervious
	41.911	89	Weighted Average
	7.465		17.81% Pervious Area
	34.446		82.19% Impervious Area

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

Subcatchment SB 22: SB 22



Summary for Subcatchment SB 24: SB 24

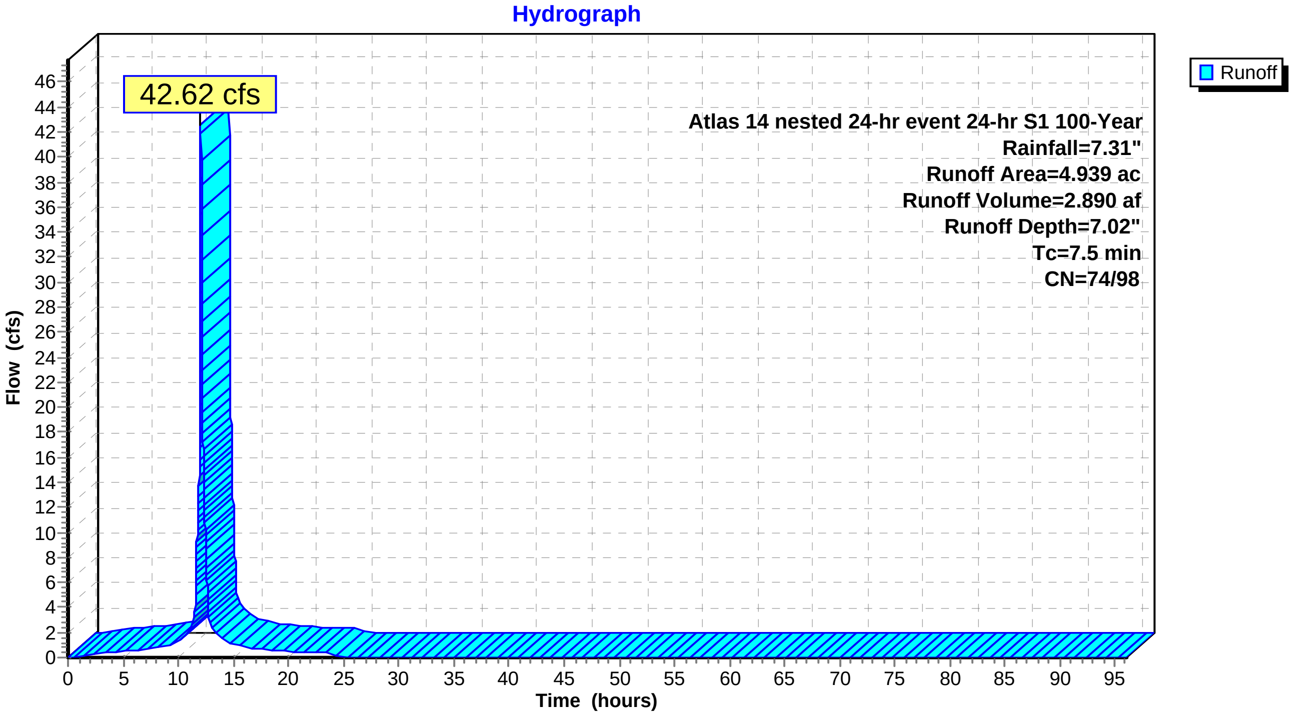
Runoff = 42.62 cfs @ 12.05 hrs, Volume= 2.890 af, Depth= 7.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.088	74	permiable
*	4.851	98	impermiable
	4.939	98	Weighted Average
	0.088		1.78% Pervious Area
	4.851		98.22% Impervious Area

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

Subcatchment SB 24: SB 24



Summary for Subcatchment SB 25: SB 25

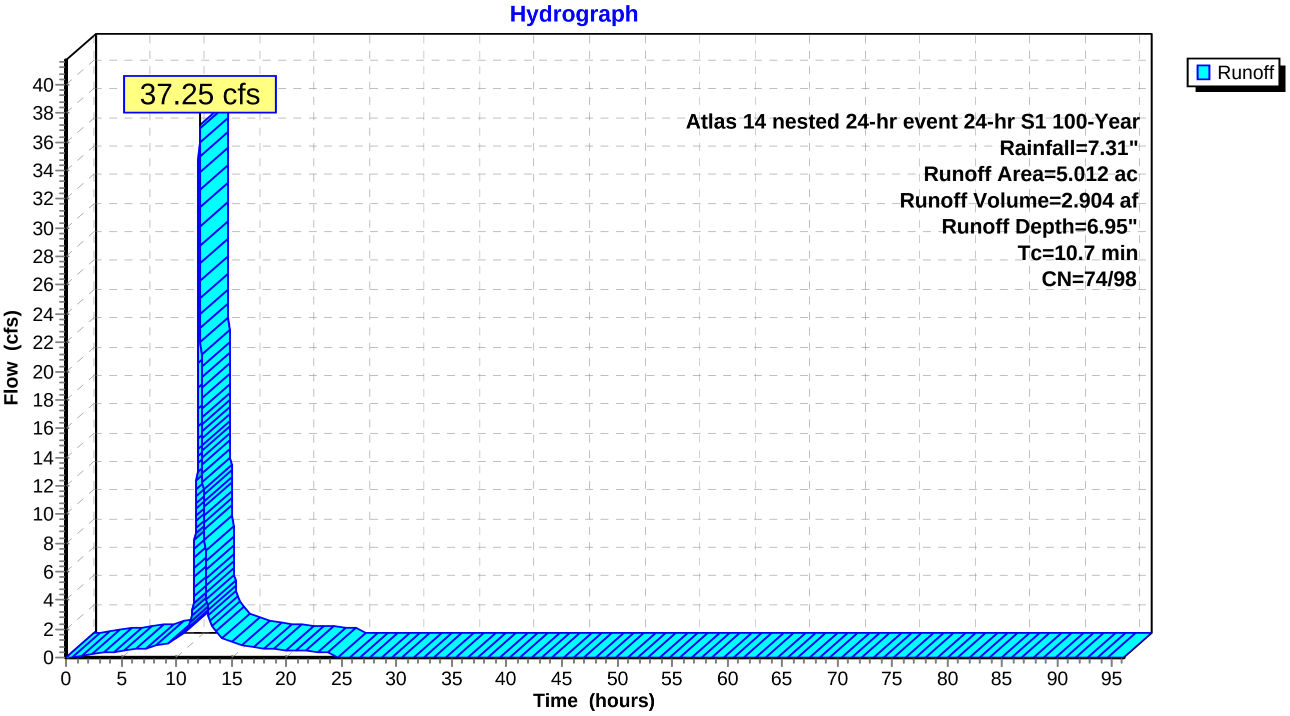
Runoff = 37.25 cfs @ 12.09 hrs, Volume= 2.904 af, Depth= 6.95"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.215	74	pervious
*	4.797	98	impervious
	5.012	97	Weighted Average
	0.215		4.29% Pervious Area
	4.797		95.71% Impervious Area

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

Subcatchment SB 25: SB 25



Summary for Subcatchment SB 26: SB 26

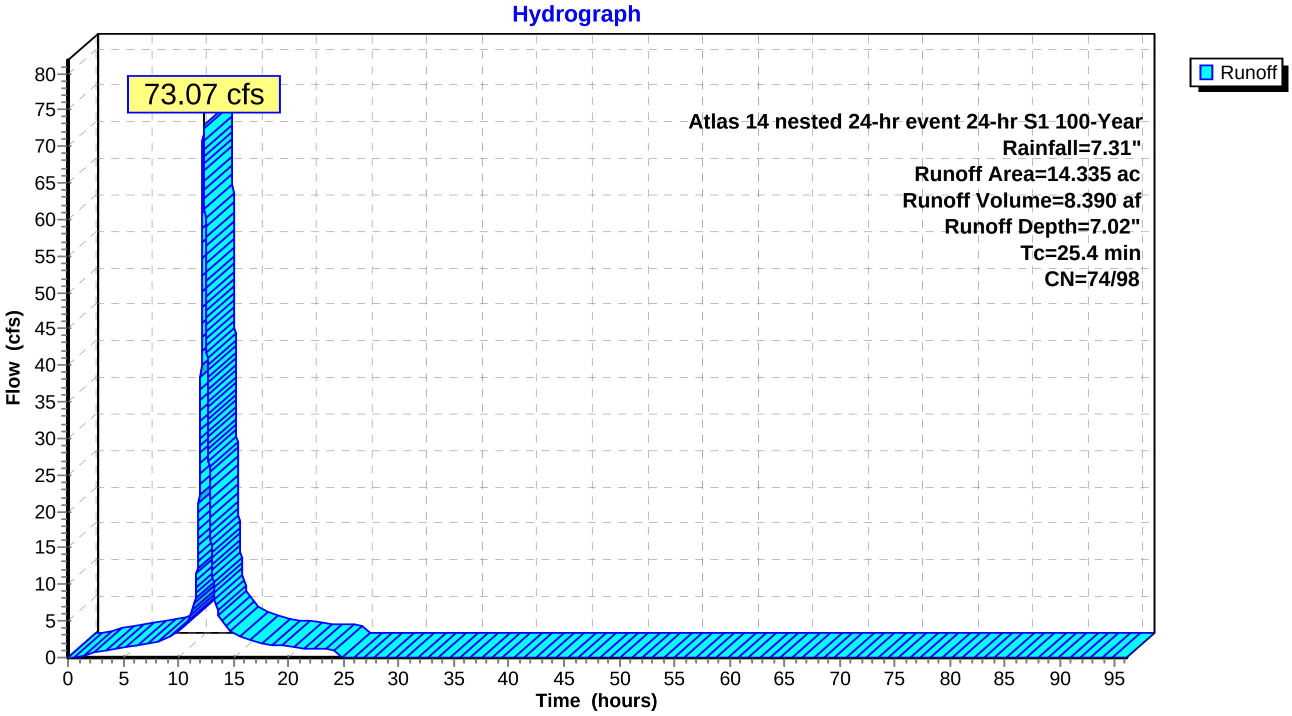
Runoff = 73.07 cfs @ 12.28 hrs, Volume= 8.390 af, Depth= 7.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.248	74	pervious
*	14.087	98	impervious
	14.335	98	Weighted Average
	0.248		1.73% Pervious Area
	14.087		98.27% Impervious Area

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

Subcatchment SB 26: SB 26



Summary for Subcatchment SB 27: SB 27 (Thumb Road)

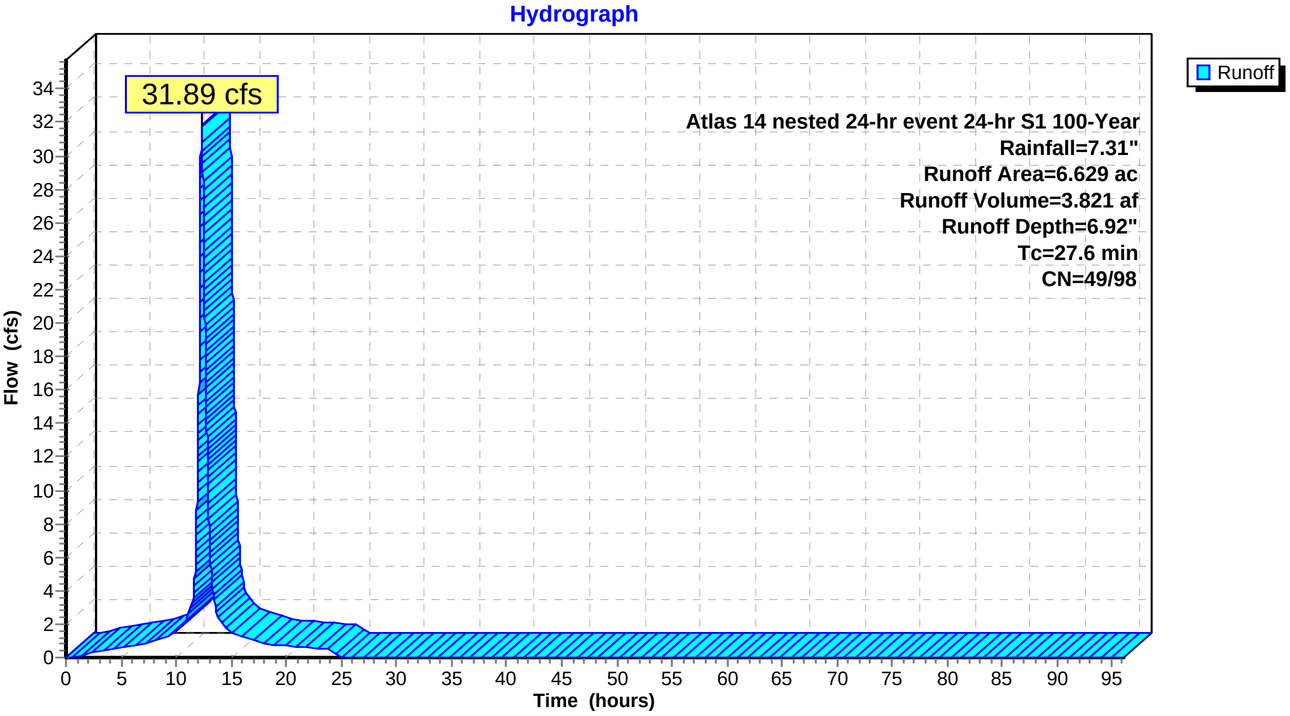
Runoff = 31.89 cfs @ 12.31 hrs, Volume= 3.821 af, Depth= 6.92"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.191	49	Pervious
*	6.438	98	Impervious
	6.629	97	Weighted Average
	0.191		2.88% Pervious Area
	6.438		97.12% Impervious Area

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

Subcatchment SB 27: SB 27 (Thumb Road)



Summary for Subcatchment SB 28: SB 28

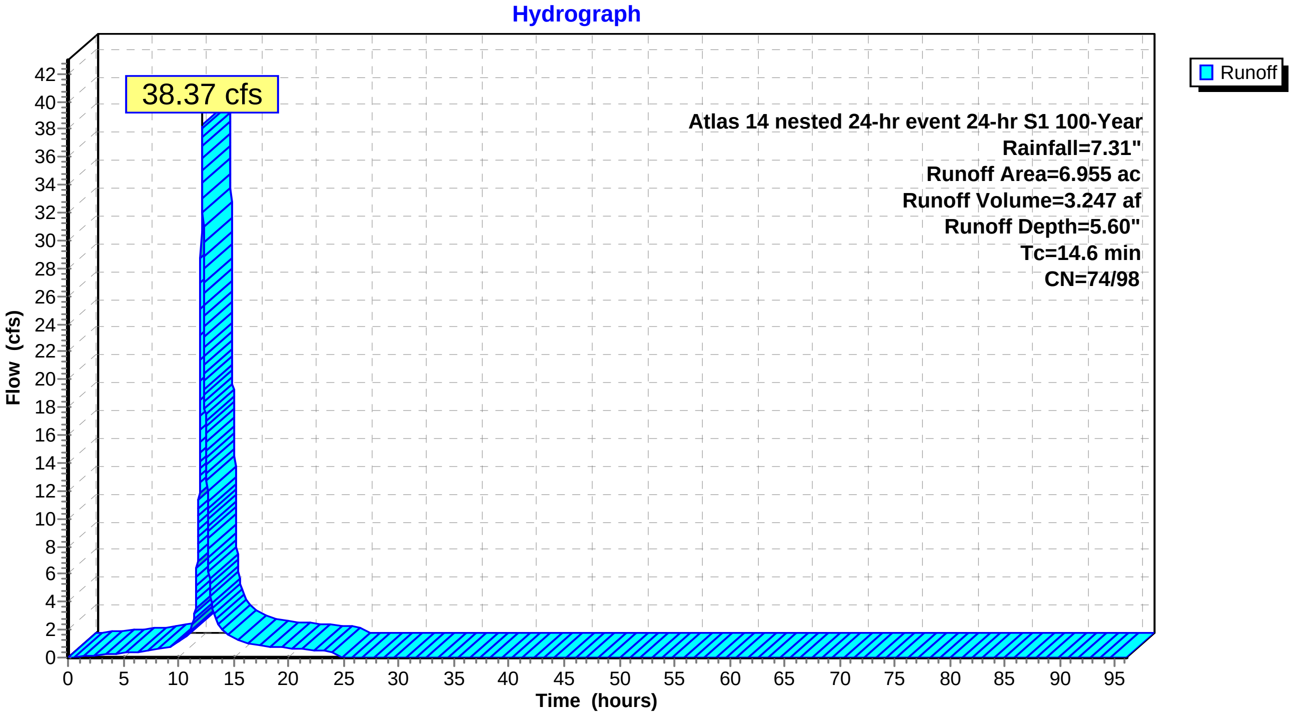
Runoff = 38.37 cfs @ 12.15 hrs, Volume= 3.247 af, Depth= 5.60"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.703	74	pervious
*	3.252	98	impervious
	6.955	85	Weighted Average
	3.703		53.24% Pervious Area
	3.252		46.76% Impervious Area

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

Subcatchment SB 28: SB 28



Summary for Subcatchment SB 29: SB 29

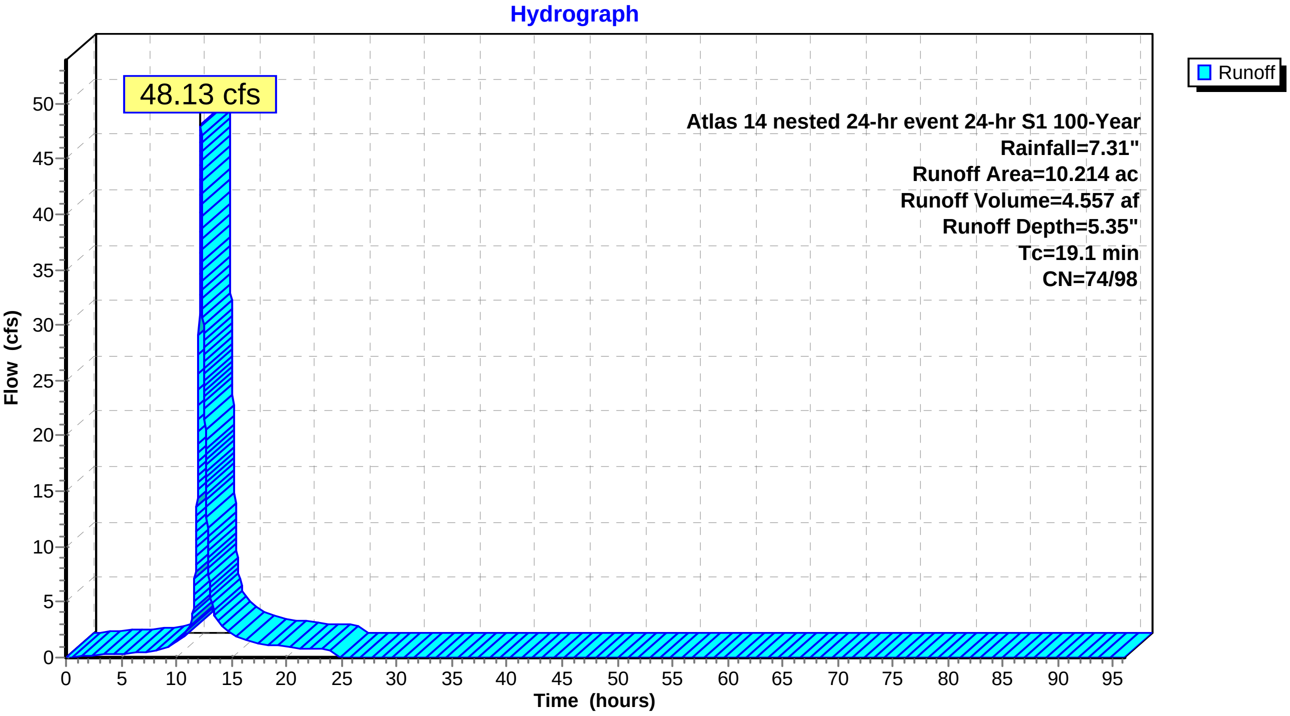
Runoff = 48.13 cfs @ 12.21 hrs, Volume= 4.557 af, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	6.360	74	pervious
*	3.854	98	impervious
	10.214	83	Weighted Average
	6.360		62.27% Pervious Area
	3.854		37.73% Impervious Area

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

Subcatchment SB 29: SB 29



Summary for Subcatchment SB 3: SB 3

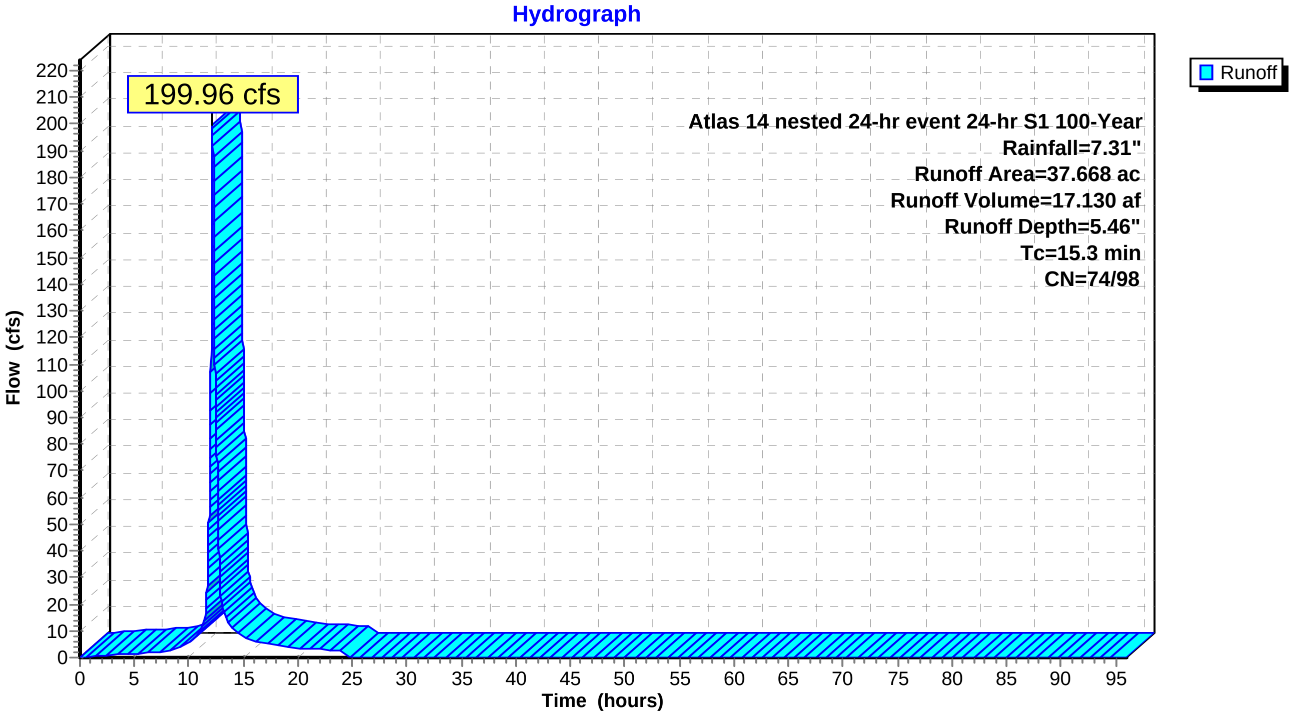
Runoff = 199.96 cfs @ 12.16 hrs, Volume= 17.130 af, Depth= 5.46"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	22.050	74	Pervious
*	15.618	98	Impervious
	37.668	84	Weighted Average
	22.050		58.54% Pervious Area
	15.618		41.46% Impervious Area

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

Subcatchment SB 3: SB 3



Summary for Subcatchment SB 4: SB 4

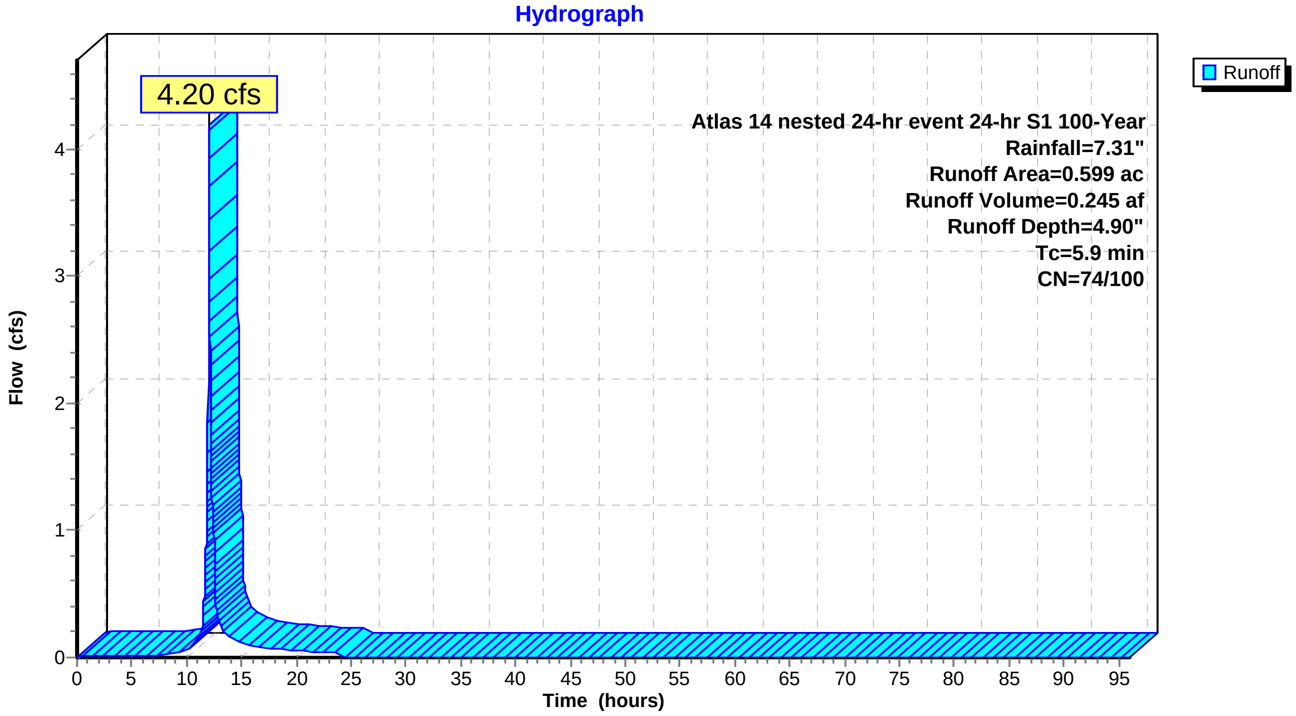
Runoff = 4.20 cfs @ 12.04 hrs, Volume= 0.245 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.481	74	pervious
*	0.118	100	impervious
	0.599	79	Weighted Average
	0.481		80.30% Pervious Area
	0.118		19.70% Impervious Area

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

Subcatchment SB 4: SB 4



Summary for Subcatchment SB 5: SB 5

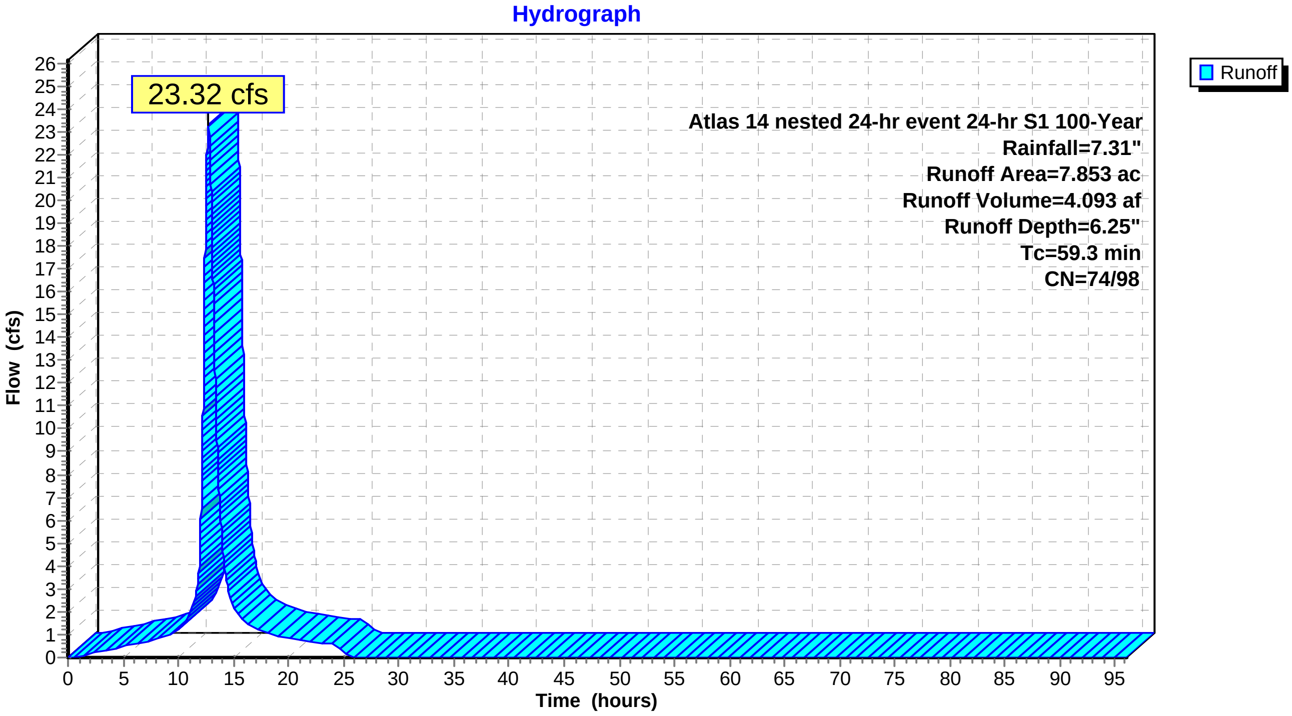
Runoff = 23.32 cfs @ 12.72 hrs, Volume= 4.093 af, Depth= 6.25"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	2.327	74	pervious
*	5.526	98	impervious
	7.853	91	Weighted Average
	2.327		29.63% Pervious Area
	5.526		70.37% Impervious Area

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

Subcatchment SB 5: SB 5



Summary for Subcatchment SB 51: Offsite Subbasin 51

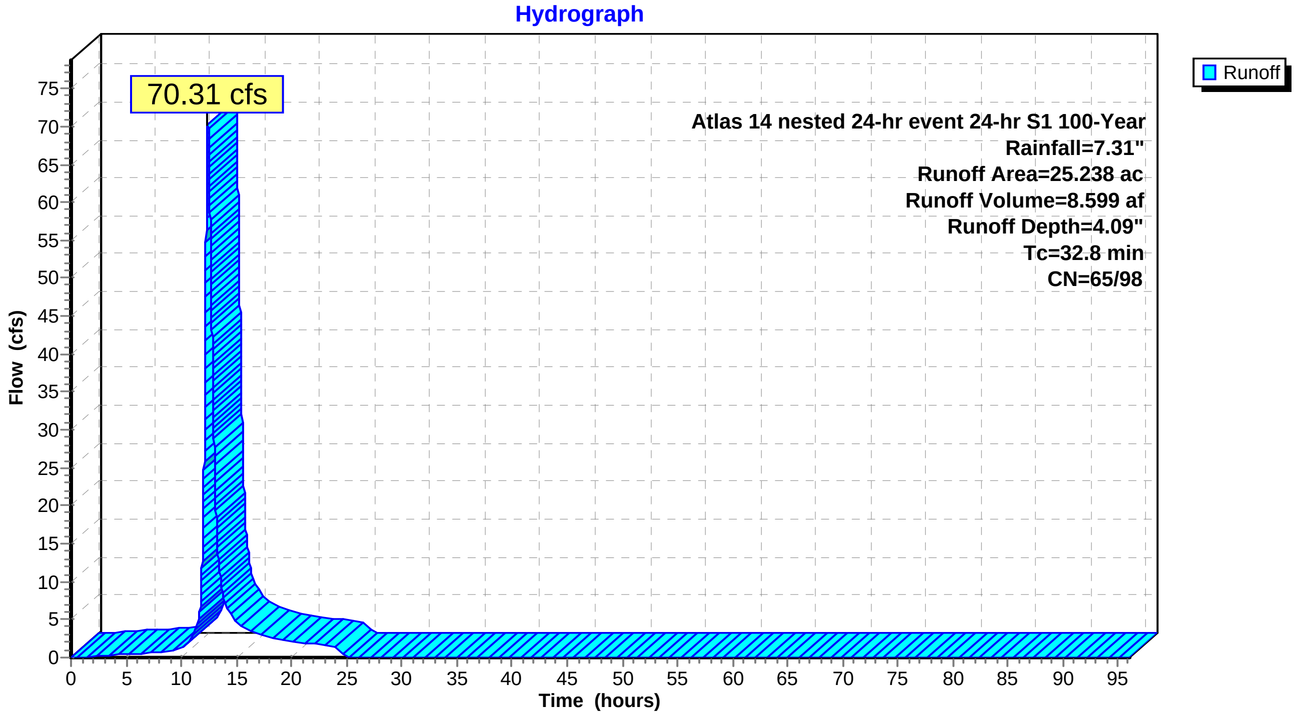
Runoff = 70.31 cfs @ 12.43 hrs, Volume= 8.599 af, Depth= 4.09"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	20.200	65	Offsite subbasin 51
*	5.038	98	
	25.238	72	Weighted Average
	20.200		80.04% Pervious Area
	5.038		19.96% Impervious Area

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

Subcatchment SB 51: Offsite Subbasin 51



Summary for Subcatchment SB 6: SB 6

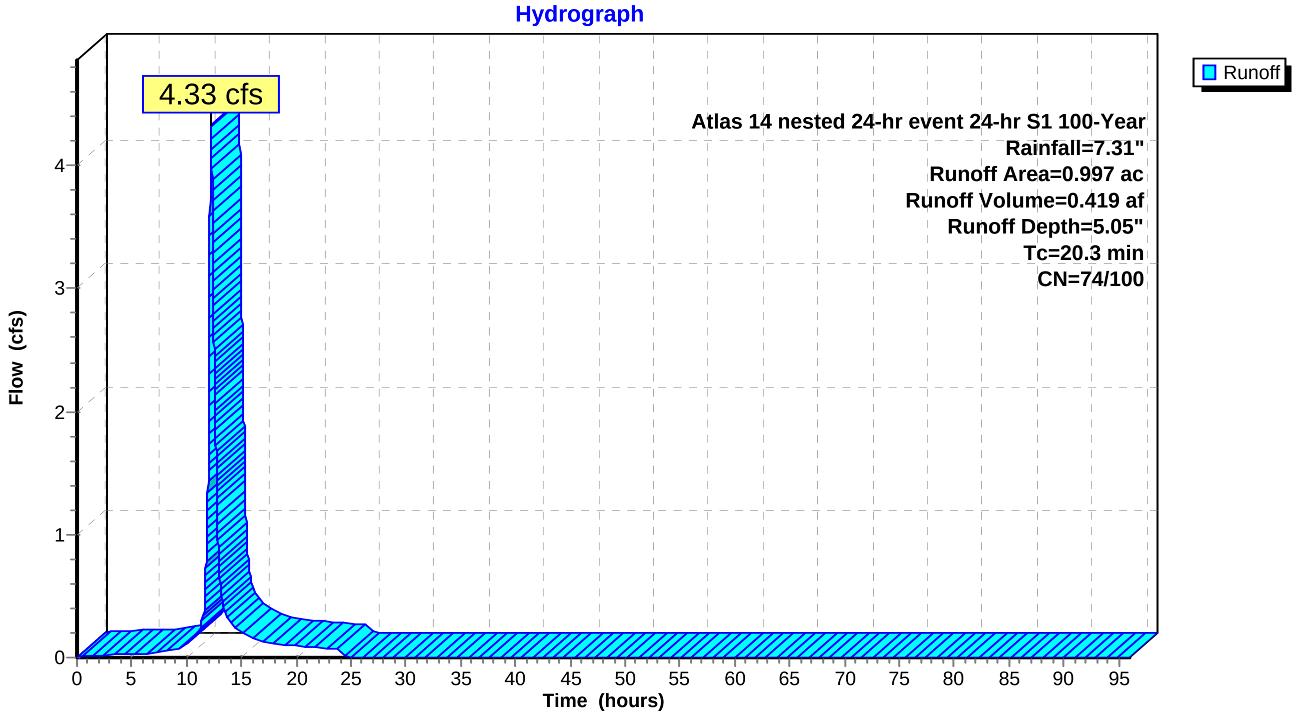
Runoff = 4.33 cfs @ 12.23 hrs, Volume= 0.419 af, Depth= 5.05"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	0.753	74	pervious
*	0.244	100	impervious
	0.997	80	Weighted Average
	0.753		75.53% Pervious Area
	0.244		24.47% Impervious Area

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

Subcatchment SB 6: SB 6



Summary for Subcatchment SB 7: SB 7

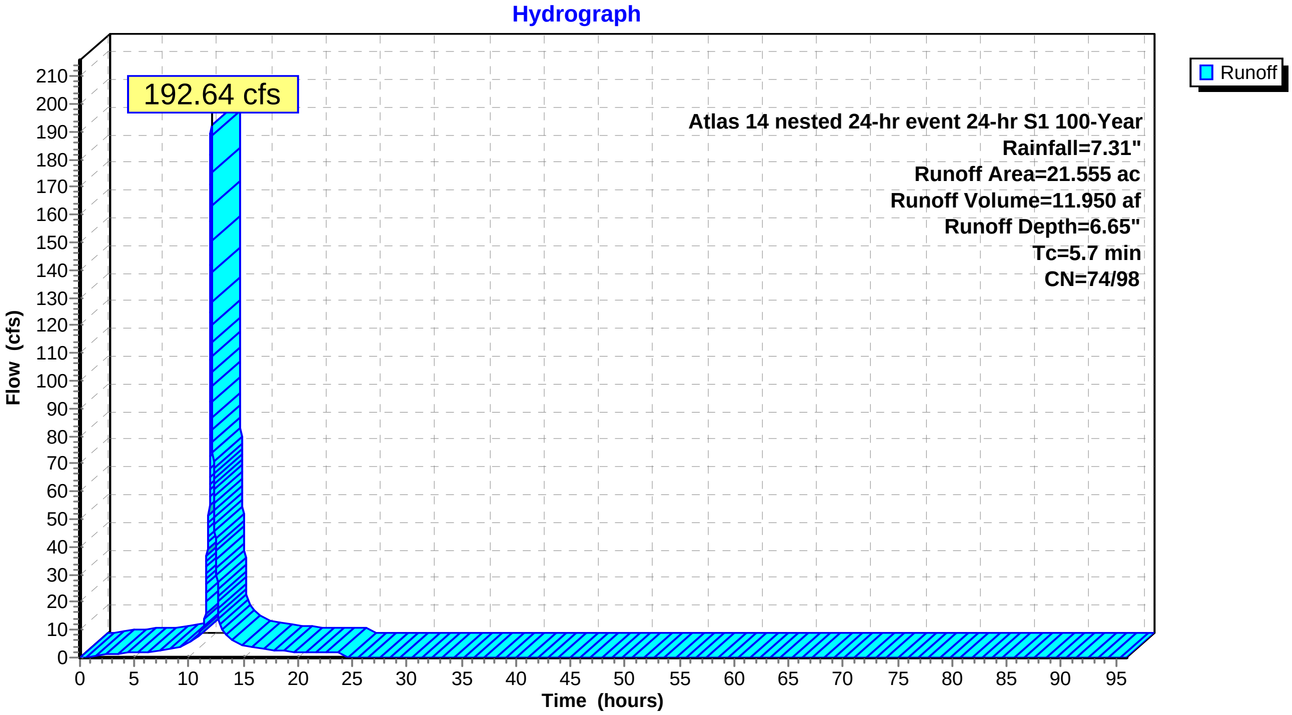
Runoff = 192.64 cfs @ 12.03 hrs, Volume= 11.950 af, Depth= 6.65"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	3.269	74	pervious
*	18.286	98	impervious
	21.555	94	Weighted Average
	3.269		15.17% Pervious Area
	18.286		84.83% Impervious Area

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

Subcatchment SB 7: SB 7



Summary for Subcatchment SB 8: SB 8

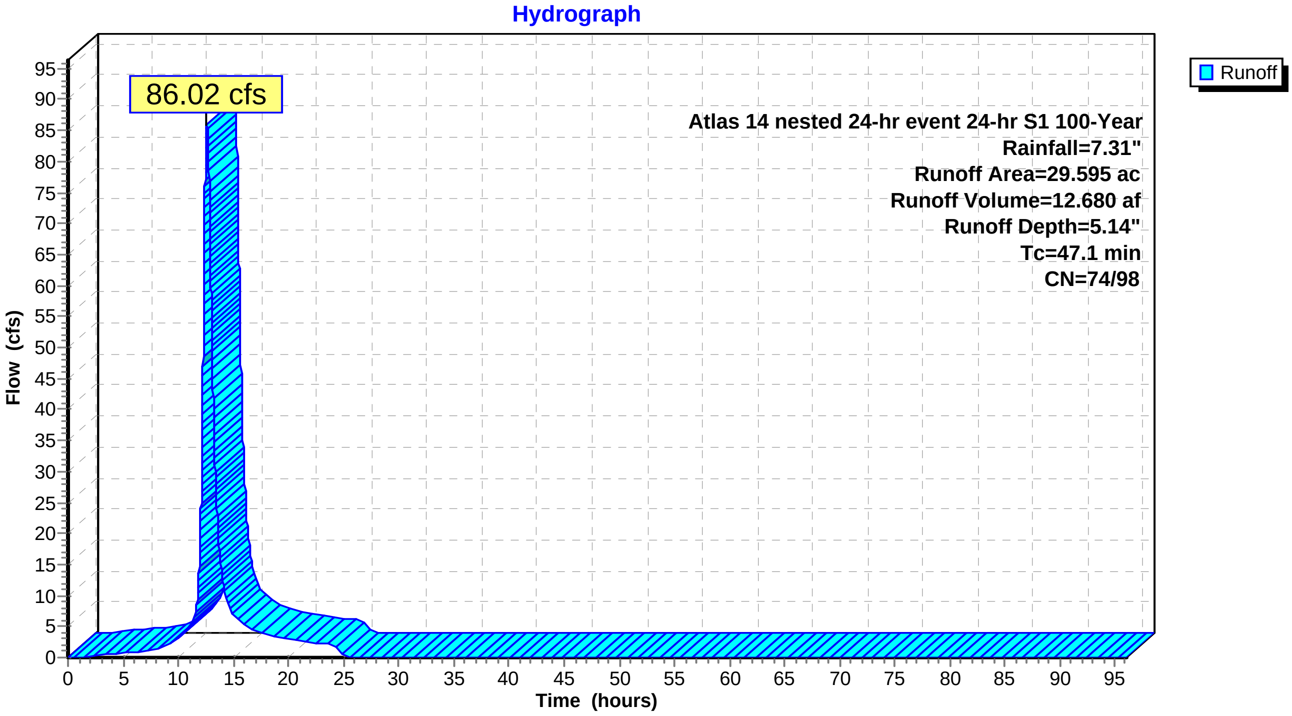
Runoff = 86.02 cfs @ 12.61 hrs, Volume= 12.680 af, Depth= 5.14"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	20.714	74	pervious
*	8.881	98	impervious
	29.595	81	Weighted Average
	20.714		69.99% Pervious Area
	8.881		30.01% Impervious Area

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

Subcatchment SB 8: SB 8



Summary for Subcatchment SB 9: SB 9

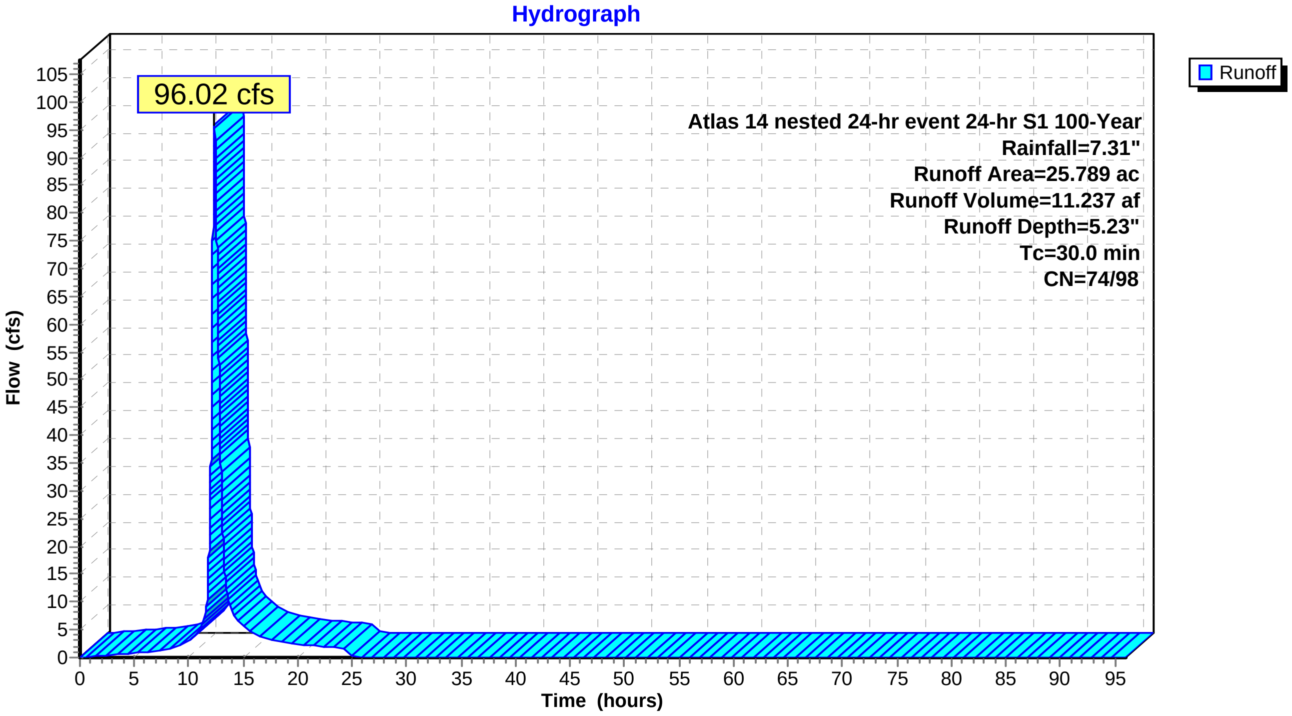
Runoff = 96.02 cfs @ 12.37 hrs, Volume= 11.237 af, Depth= 5.23"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-96.00 hrs, dt= 0.01
Atlas 14 nested 24-hr event 24-hr S1 100-Year Rainfall=7.31"

	Area (ac)	CN	Description
*	17.234	74	permiable
*	8.555	98	impermiable
	25.789	82	Weighted Average
	17.234		66.83% Pervious Area
	8.555		33.17% Impervious Area

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

Subcatchment SB 9: SB 9



Summary for Pond 3P: P-3

Inflow Area = 133.365 ac, 58.87% Impervious, Inflow Depth = 5.59" for 100-Year event
Inflow = 321.63 cfs @ 12.46 hrs, Volume= 62.160 af
Outflow = 267.75 cfs @ 12.78 hrs, Volume= 62.142 af, Atten= 17%, Lag= 19.2 min
Primary = 267.75 cfs @ 12.78 hrs, Volume= 62.142 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 914.00' Surf.Area= 1.790 ac Storage= 5.827 af
Peak Elev= 919.71' @ 12.78 hrs Surf.Area= 2.880 ac Storage= 19.292 af (13.465 af above start)

Plug-Flow detention time= 190.2 min calculated for 56.315 af (91% of inflow)
Center-of-Mass det. time= 93.0 min (936.3 - 843.3)

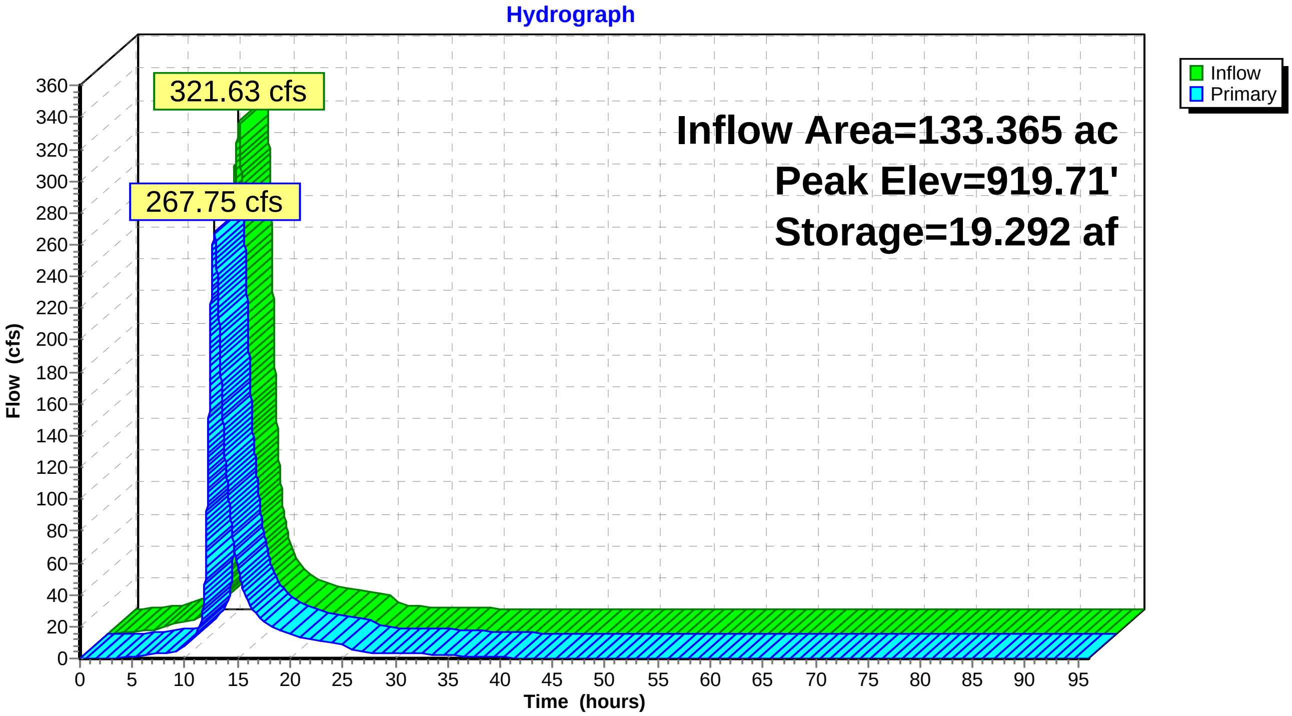
Volume	Invert	Avail.Storage	Storage Description
#1	909.85'	20.423 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
909.85	1.130	0.000	0.000
912.00	1.360	2.677	2.677
916.00	2.220	7.160	9.837
918.00	2.570	4.790	14.627
920.10	2.950	5.796	20.423

Device	Routing	Invert	Outlet Devices
#1	Primary	914.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	918.25'	**10.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	915.00'	**7.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=267.74 cfs @ 12.78 hrs HW=919.71' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 9.04 cfs @ 11.51 fps)
├─**2=Sharp-Crested Rectangular Weir** (Weir Controls 56.11 cfs @ 3.95 fps)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 202.60 cfs @ 7.10 fps)

Pond 3P: P-3


Hydrograph
321.63 cfs
267.75 cfs
Inflow Area=133.365 ac
Peak Elev=919.71'
Storage=19.292 af
Inflow
Primary
Flow (cfs)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond 4P: P-4

Inflow Area = 7.853 ac, 70.37% Impervious, Inflow Depth = 6.25" for 100-Year event
Inflow = 23.32 cfs @ 12.72 hrs, Volume= 4.093 af
Outflow = 16.01 cfs @ 13.17 hrs, Volume= 4.093 af, Atten= 31%, Lag= 26.9 min
Primary = 12.66 cfs @ 13.17 hrs, Volume= 2.270 af
Secondary = 3.35 cfs @ 13.15 hrs, Volume= 1.823 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.275 ac Storage= 0.646 af
Peak Elev= 917.80' @ 13.17 hrs Surf.Area= 0.438 ac Storage= 1.640 af (0.995 af above start)

Plug-Flow detention time= 181.5 min calculated for 3.447 af (84% of inflow)
Center-of-Mass det. time= 53.0 min (859.7 - 806.7)

Volume	Invert	Avail.Storage	Storage Description
#1	910.90'	1.728 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

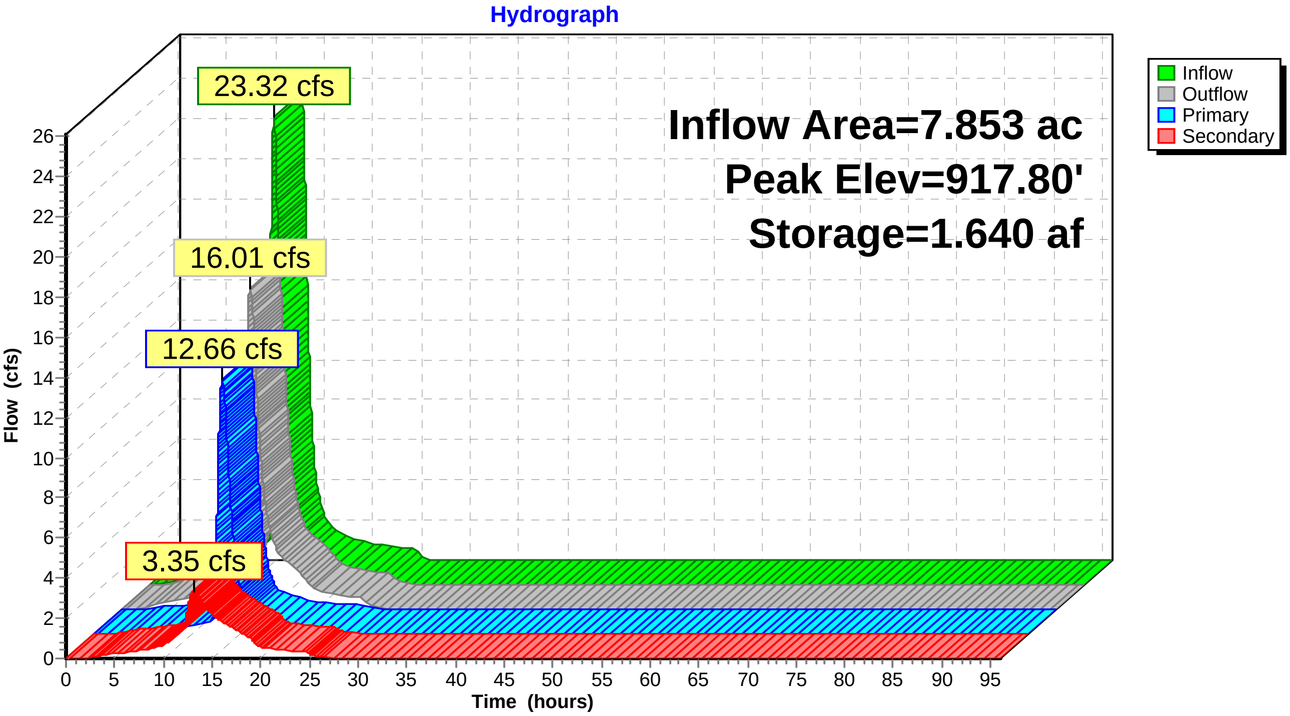
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.90	0.070	0.000	0.000
912.00	0.090	0.088	0.088
914.00	0.220	0.310	0.398
916.00	0.330	0.550	0.948
918.00	0.450	0.780	1.728

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	915.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	915.95'	**24.0" Round RCP_Round 24"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 915.80' / 915.95' S= -0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=12.66 cfs @ 13.17 hrs HW=917.80' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 1.58 cfs @ 8.06 fps)
└─**3=RCP_Round 24"** (Barrel Controls 11.07 cfs @ 4.37 fps)

Secondary OutFlow Max=3.35 cfs @ 13.15 hrs HW=917.80' TW=915.32' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 3.35 cfs @ 7.58 fps)

Pond 4P: P-4


Hydrograph
23.32 cfs
16.01 cfs
12.66 cfs
3.35 cfs
Inflow Area=7.853 ac
Peak Elev=917.80'
Storage=1.640 af
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 7P: P-7

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 29.595 ac, 30.01% Impervious, Inflow Depth = 5.14" for 100-Year event
Inflow = 86.02 cfs @ 12.61 hrs, Volume= 12.680 af
Outflow = 87.44 cfs @ 12.62 hrs, Volume= 12.680 af, Atten= 0%, Lag= 0.9 min
Primary = 87.44 cfs @ 12.62 hrs, Volume= 12.680 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.440 ac Storage= 1.062 af
Peak Elev= 915.93' @ 12.54 hrs Surf.Area= 0.551 ac Storage= 1.523 af (0.461 af above start)

Plug-Flow detention time= 81.8 min calculated for 11.617 af (92% of inflow)
Center-of-Mass det. time= 7.2 min (832.2 - 825.0)

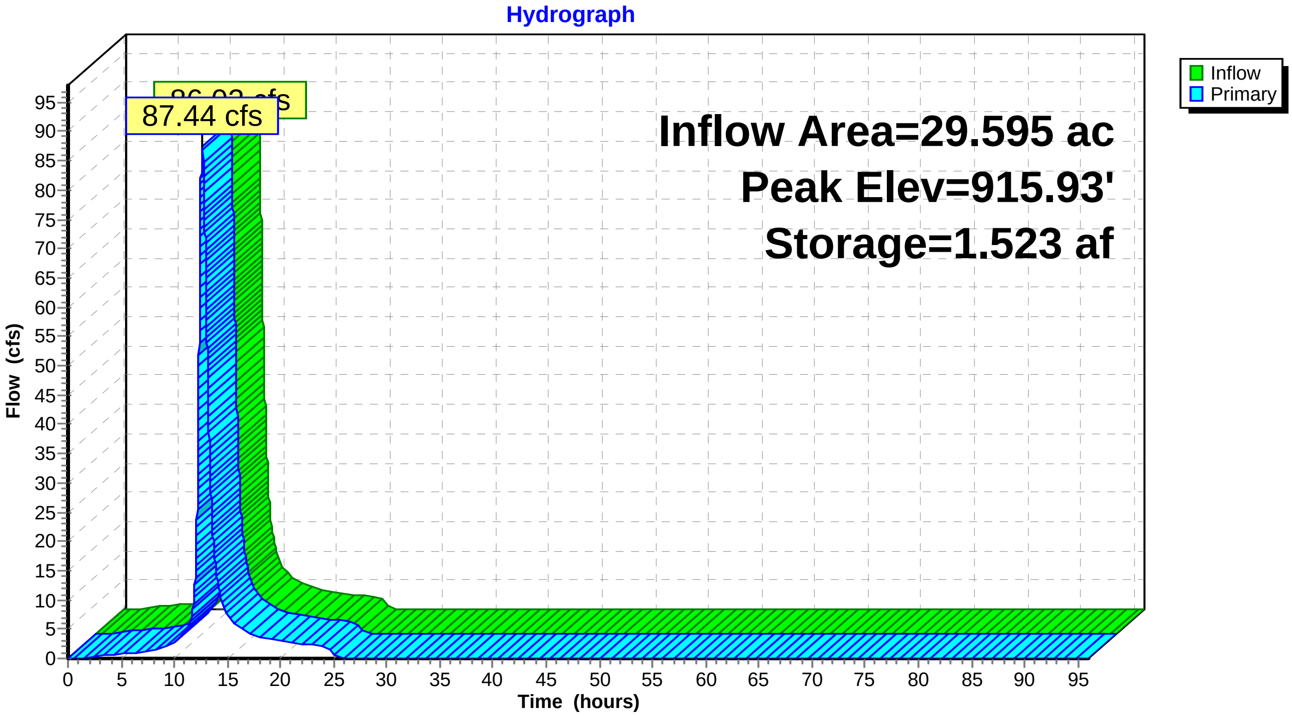
Volume	Invert	Avail.Storage	Storage Description
#1	910.95'	2.122 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.95	0.110	0.000	0.000
912.00	0.180	0.152	0.152
914.00	0.340	0.520	0.672
915.00	0.440	0.390	1.062
916.00	0.560	0.500	1.562
917.00	0.560	0.560	2.122

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**75.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=88.53 cfs @ 12.62 hrs HW=915.92' TW=915.81' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 88.53 cfs @ 1.29 fps)

Pond 7P: P-7


Hydrograph
87.44 cfs
Inflow Area=29.595 ac
Peak Elev=915.93'
Storage=1.523 af
🟩 Inflow
🟦 Primary
Flow (cfs)
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond 9P: P-9

Inflow Area = 55.384 ac, 31.48% Impervious, Inflow Depth = 5.18" for 100-Year event
Inflow = 166.30 cfs @ 12.47 hrs, Volume= 23.916 af
Outflow = 166.11 cfs @ 12.49 hrs, Volume= 23.916 af, Atten= 0%, Lag= 1.3 min
Primary = 166.11 cfs @ 12.49 hrs, Volume= 23.916 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 915.00' Surf.Area= 0.210 ac Storage= 0.353 af
Peak Elev= 915.84' @ 12.49 hrs Surf.Area= 0.379 ac Storage= 0.601 af (0.248 af above start)

Plug-Flow detention time= 20.1 min calculated for 23.564 af (99% of inflow)
Center-of-Mass det. time= 1.8 min (821.8 - 820.1)

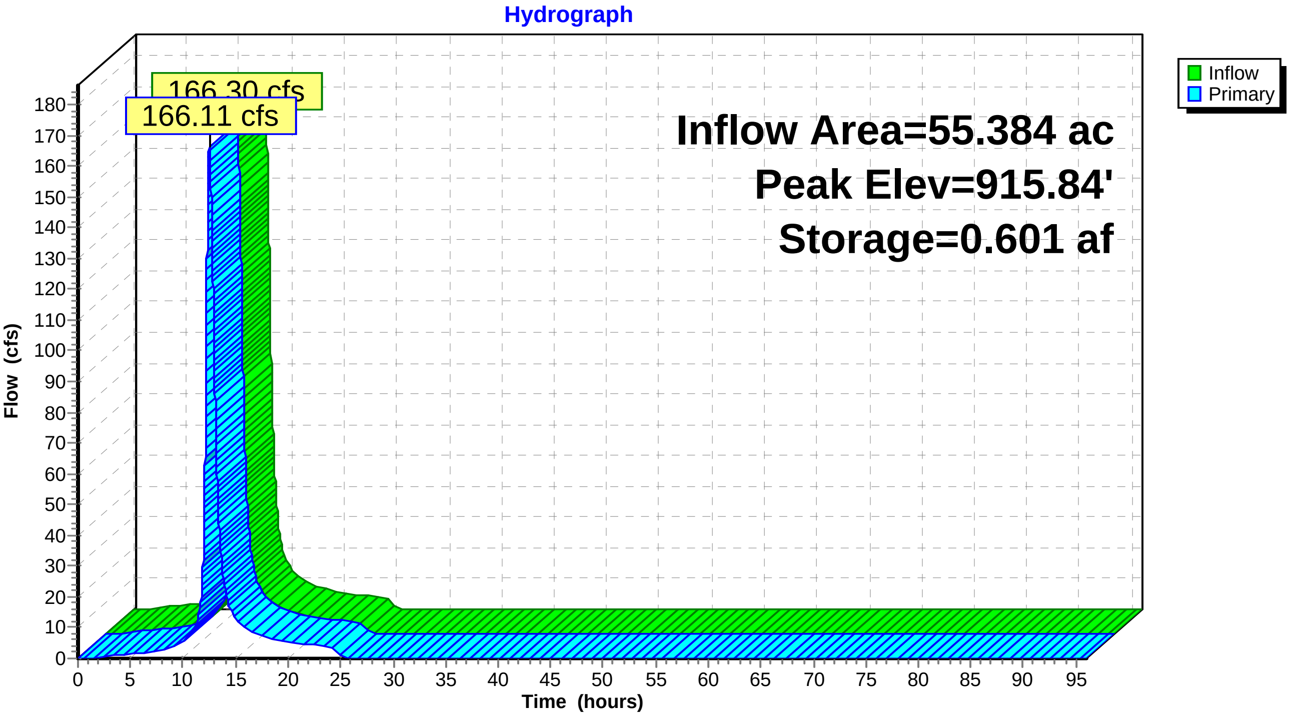
Volume	Invert	Avail.Storage	Storage Description
#1	910.50'	1.673 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
910.50	0.020	0.000	0.000
912.00	0.050	0.052	0.052
913.00	0.070	0.060	0.112
914.00	0.100	0.085	0.198
915.00	0.210	0.155	0.353
916.00	0.410	0.310	0.662
918.00	0.600	1.010	1.673

Device	Routing	Invert	Outlet Devices
#1	Primary	915.00'	**80.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=166.10 cfs @ 12.49 hrs HW=915.84' TW=912.69' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 166.10 cfs @ 2.46 fps)

Pond 9P: P-9


Hydrograph
166.30 cfs
166.11 cfs
Inflow Area=55.384 ac
Peak Elev=915.84'
Storage=0.601 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)

Summary for Pond 10P: P-10

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 66.448 ac, 29.37% Impervious, Inflow Depth = 4.43" for 100-Year event
Inflow = 164.99 cfs @ 12.63 hrs, Volume= 24.555 af
Outflow = 164.52 cfs @ 12.65 hrs, Volume= 24.555 af, Atten= 0%, Lag= 1.5 min
Primary = 15.81 cfs @ 12.65 hrs, Volume= 11.415 af
Secondary = 148.71 cfs @ 12.65 hrs, Volume= 13.140 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 896.00' Surf.Area= 0.290 ac Storage= 0.700 af
Peak Elev= 898.47' @ 12.65 hrs Surf.Area= 0.396 ac Storage= 1.545 af (0.845 af above start)

Plug-Flow detention time= 55.6 min calculated for 23.855 af (97% of inflow)
Center-of-Mass det. time= 16.6 min (903.8 - 887.2)

Volume	Invert	Avail.Storage	Storage Description
#1	892.00'	1.760 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

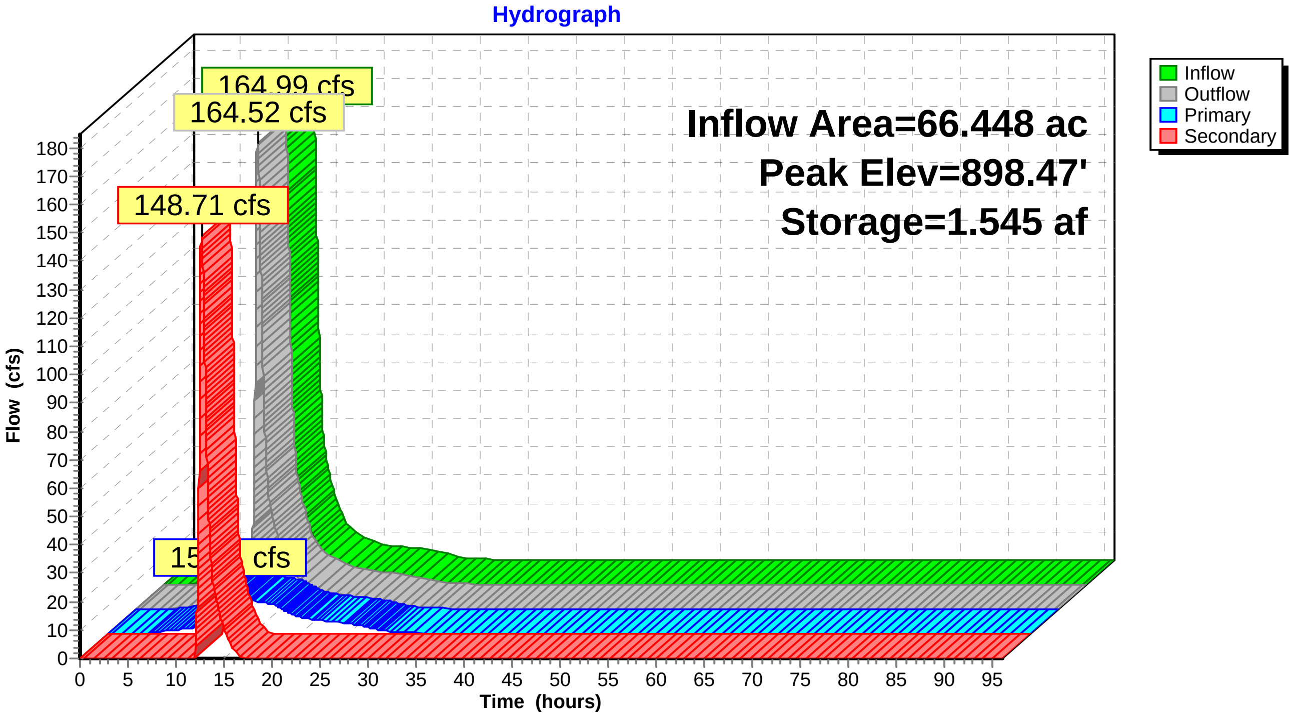
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
892.00	0.120	0.000	0.000
893.00	0.140	0.130	0.130
895.00	0.190	0.330	0.460
896.00	0.290	0.240	0.700
897.00	0.330	0.310	1.010
899.00	0.420	0.750	1.760

Device	Routing	Invert	Outlet Devices
#1	Primary	896.00'	**2.5' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	897.40'	**50.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=15.81 cfs @ 12.65 hrs HW=898.47' TW=895.43' (Dynamic Tailwater)
└─**1=Sharp-Crested Rectangular Weir** (Orifice Controls 15.81 cfs @ 6.87 fps)

Secondary OutFlow Max=148.69 cfs @ 12.65 hrs HW=898.47' TW=895.43' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 148.69 cfs @ 2.77 fps)

Pond 10P: P-10


Hydrograph
164.99 cfs
164.52 cfs
148.71 cfs
15
cfs
Inflow Area=66.448 ac
Peak Elev=898.47'
Storage=1.545 af
🟩 Inflow
⬜ Outflow
🟦 Primary
🟥 Secondary
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 11P: P-11

Inflow Area = 58.677 ac, 31.52% Impervious, Inflow Depth = 5.19" for 100-Year event
Inflow = 172.55 cfs @ 12.48 hrs, Volume= 25.364 af
Outflow = 160.26 cfs @ 12.64 hrs, Volume= 25.363 af, Atten= 7%, Lag= 9.3 min
Primary = 155.34 cfs @ 12.64 hrs, Volume= 21.533 af
Secondary = 4.92 cfs @ 12.59 hrs, Volume= 3.830 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 909.00' Surf.Area= 1.210 ac Storage= 3.640 af
Peak Elev= 912.79' @ 12.64 hrs Surf.Area= 1.655 ac Storage= 9.054 af (5.414 af above start)

Plug-Flow detention time= 194.6 min calculated for 21.723 af (86% of inflow)
Center-of-Mass det. time= 85.1 min (904.7 - 819.6)

Volume	Invert	Avail.Storage	Storage Description
#1	905.00'	9.405 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

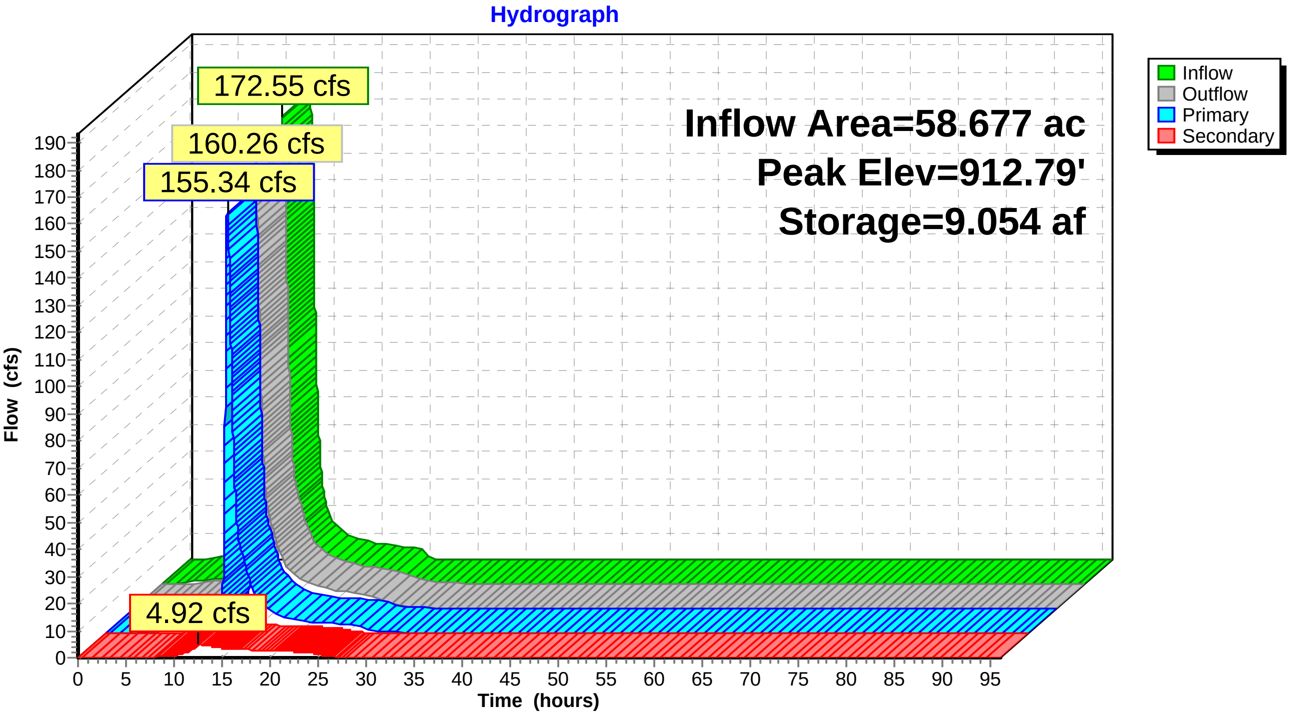
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
905.00	0.760	0.000	0.000
906.00	0.820	0.790	0.790
908.00	0.950	1.770	2.560
909.00	1.210	1.080	3.640
910.00	1.320	1.265	4.905
912.00	1.560	2.880	7.785
913.00	1.680	1.620	9.405

Device	Routing	Invert	Outlet Devices
#1	Primary	909.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	910.00'	**24.0" Round RCP_Round 24"** L= 200.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 910.00' / 909.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#4	Primary	912.00'	**60.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#5	Secondary	909.00'	**12.0" Round RCP_Round 12"** L= 150.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 909.00' / 908.00' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=155.33 cfs @ 12.64 hrs HW=912.79' TW=898.47' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 7.36 cfs @ 9.37 fps)
- **2=RCP_Round 24"** (Barrel Controls 17.55 cfs @ 5.59 fps)
- **3=RCP_Round 24"** (Barrel Controls 17.55 cfs @ 5.59 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 112.86 cfs @ 2.38 fps)

Secondary OutFlow Max=4.92 cfs @ 12.59 hrs HW=912.78' TW=909.18' (Dynamic Tailwater)
- **5=RCP_Round 12"** (Outlet Controls 4.92 cfs @ 6.27 fps)

Pond 11P: P-11



Summary for Pond 12P: P-12

```
Inflow Area =        79.658 ac,  31.13% Impervious,  Inflow Depth =   5.17"    for  100-Year event
Inflow       =      175.25 cfs @   12.64 hrs,  Volume=          34.346 af
Outflow      =      138.66 cfs @   12.95 hrs,  Volume=          34.338 af,  Atten= 21%,  Lag= 18.7 min
Primary      =      138.66 cfs @   12.95 hrs,  Volume=          34.338 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 893.00'   Surf.Area= 1.640 ac   Storage= 5.075 af
Peak Elev= 895.80' @ 12.95 hrs   Surf.Area= 2.014 ac   Storage= 10.192 af   (5.117 af above start)

Plug-Flow detention time= 213.2 min calculated for 29.263 af (85% of inflow)
Center-of-Mass det. time= 60.1 min ( 991.0 - 930.9 )

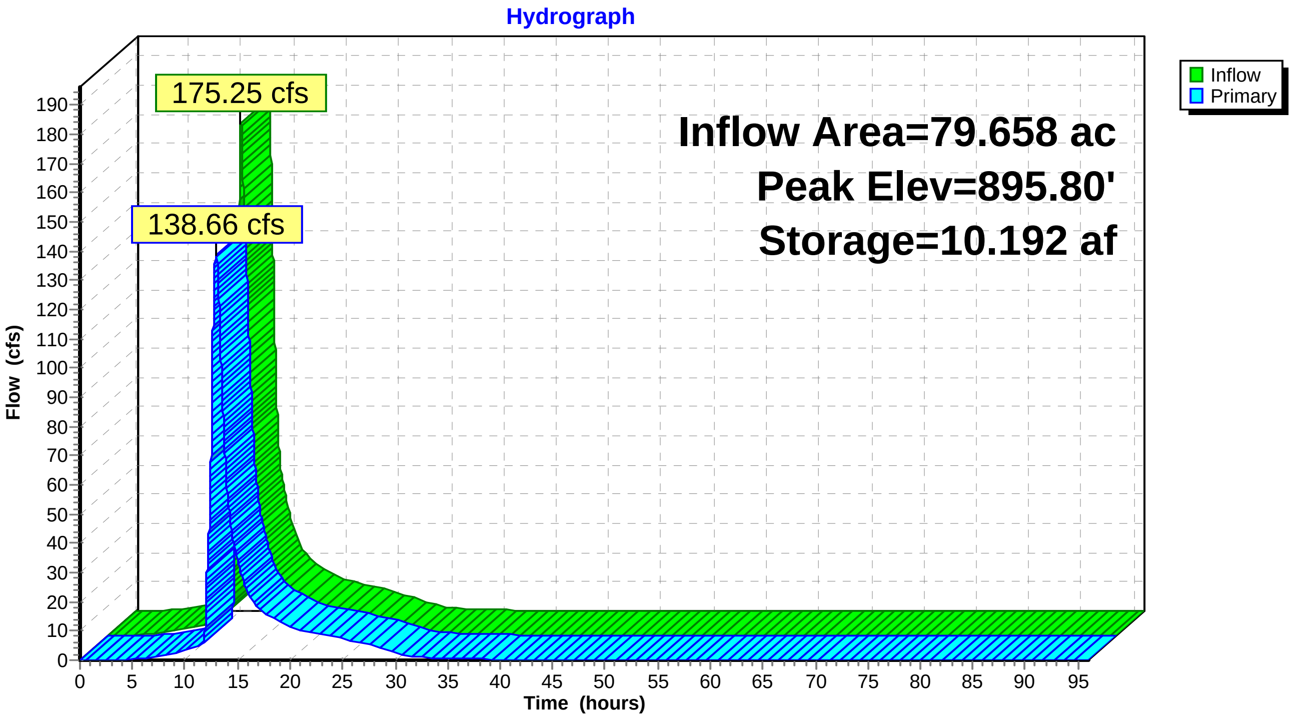
Volume       Invert    Avail.Storage    Storage Description
    #1       889.00'        10.590 af    Custom Stage Data (Prismatic)Listed below (Recalc)

  Elevation       Surf.Area          Inc.Store          Cum.Store
      (feet)         (acres)        (acre-feet)        (acre-feet)
      889.00           1.070              0.000              0.000
      890.00           1.150              1.110              1.110
      892.00           1.330              2.480              3.590
      893.00           1.640              1.485              5.075
      894.00           1.770              1.705              6.780
      896.00           2.040              3.810             10.590

Device    Routing            Invert    Outlet Devices
    #1    Primary           893.00'    12.0" Horiz. Orifice/Grate   C= 0.600
                                       Limited to weir flow at low heads
    #2    Primary           893.00'    12.0" Horiz. Orifice/Grate   C= 0.600
                                       Limited to weir flow at low heads
    #3    Primary           893.50'    43.8" W x 26.6" H, R=22.5"/62.0"  Pipe Arch RCP_Arch  44x27
                                       L= 30.0'   Box, 30-75° wingwalls, rounded crown,  Ke= 0.200
                                       Inlet / Outlet Invert= 893.50' / 893.35'   S= 0.0050 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 6.29 sf
    #4    Primary           893.50'    43.8" W x 26.6" H, R=22.5"/62.0"  Pipe Arch RCP_Arch  44x27
                                       L= 30.0'   Box, 30-75° wingwalls, rounded crown,  Ke= 0.200
                                       Inlet / Outlet Invert= 893.50' / 893.35'   S= 0.0050 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 6.29 sf
    #5    Primary           893.50'    43.8" W x 26.6" H, R=22.5"/62.0"  Pipe Arch RCP_Arch  44x27
                                       L= 30.0'   Box, 30-75° wingwalls, rounded crown,  Ke= 0.200
                                       Inlet / Outlet Invert= 893.50' / 893.35'   S= 0.0050 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 6.29 sf
    #6    Primary           893.50'    43.8" W x 26.6" H, R=22.5"/62.0"  Pipe Arch RCP_Arch  44x27
                                       L= 30.0'   Box, 30-75° wingwalls, rounded crown,  Ke= 0.200
                                       Inlet / Outlet Invert= 893.50' / 893.35'   S= 0.0050 '/'   Cc= 0.900
                                       n= 0.013,  Flow Area= 6.29 sf
```

Primary OutFlow Max=138.65 cfs @ 12.95 hrs HW=895.80' TW=884.90' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 6.33 cfs @ 8.06 fps)
2=Orifice/Grate (Orifice Controls 6.33 cfs @ 8.06 fps)
3=RCP_Arch 44x27 (Barrel Controls 31.50 cfs @ 5.79 fps)
4=RCP_Arch 44x27 (Barrel Controls 31.50 cfs @ 5.79 fps)
5=RCP_Arch 44x27 (Barrel Controls 31.50 cfs @ 5.79 fps)
6=RCP_Arch 44x27 (Barrel Controls 31.50 cfs @ 5.79 fps)

Pond 12P: P-12



Summary for Pond 13P: P-13

```
Inflow Area =      237.893 ac,  51.59% Impervious,  Inflow Depth =   5.57"    for  100-Year event
Inflow      =      652.01 cfs @   12.35 hrs,  Volume=        110.403 af
Outflow     =      629.00 cfs @   12.46 hrs,  Volume=        110.401 af,  Atten= 4%,  Lag= 6.6 min
Primary     =      608.53 cfs @   12.46 hrs,  Volume=        105.483 af
Secondary =         20.47 cfs @   12.46 hrs,  Volume=          4.917 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 883.00'   Surf.Area= 1.870 ac   Storage= 4.265 af
Peak Elev= 885.58' @ 12.46 hrs   Surf.Area= 2.805 ac   Storage= 10.282 af   (6.017 af above start)

Plug-Flow detention time= 64.3 min calculated for 106.125 af (96% of inflow)
Center-of-Mass det. time= 12.0 min ( 871.5 - 859.5 )

Volume        Invert    Avail.Storage   Storage Description
   #1        878.00'        11.490 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area        Inc.Store        Cum.Store
    (feet)        (acres)      (acre-feet)      (acre-feet)
    878.00          0.000            0.000            0.000
    879.00          0.630            0.315            0.315
    880.00          0.730            0.680            0.995
    882.00          1.070            1.800            2.795
    883.00          1.870            1.470            4.265
    884.00          2.220            2.045            6.310
    886.00          2.960            5.180           11.490

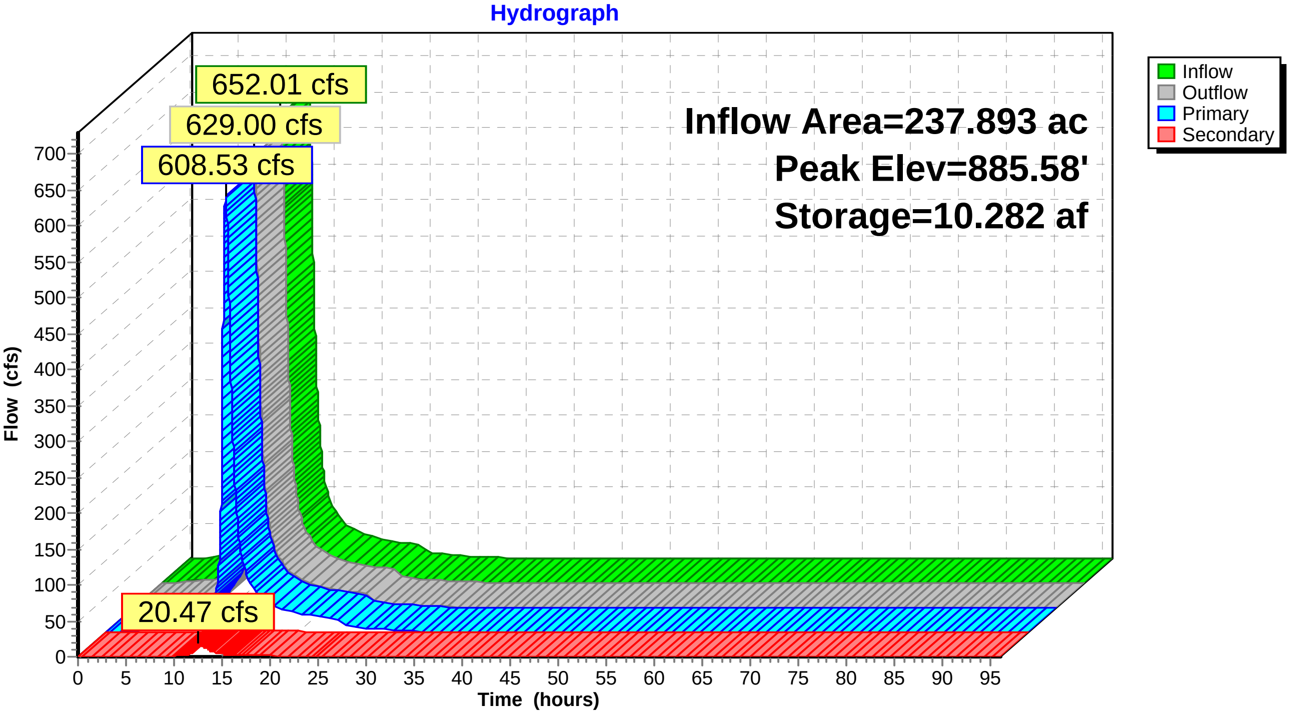
Device   Routing           Invert   Outlet Devices
    #1   Primary          883.00'   55.0' long  x 5.0' breadth Broad-Crested Rectangular Weir
                                    Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60  1.80  2.00
                                    2.50  3.00  3.50  4.00  4.50  5.00  5.50
                                    Coef. (English)  2.34  2.50  2.70  2.68  2.68  2.66  2.65  2.65  2.65
                                    2.65  2.67  2.66  2.68  2.70  2.74  2.79  2.88
    #2   Secondary        883.00'   12.0"  Round RCP_Round  12"
                                    L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                    Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                    n= 0.013,  Flow Area= 0.79 sf
    #3   Secondary        883.00'   12.0"  Round RCP_Round  12"
                                    L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                    Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                    n= 0.013,  Flow Area= 0.79 sf
    #4   Secondary        883.00'   12.0"  Round RCP_Round  12"
                                    L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                    Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                    n= 0.013,  Flow Area= 0.79 sf
    #5   Secondary        883.00'   12.0"  Round RCP_Round  12"
                                    L= 100.0'   RCP, groove end projecting,  Ke= 0.200
                                    Inlet / Outlet Invert= 883.00' / 882.75'   S= 0.0025 '/'   Cc= 0.900
                                    n= 0.013,  Flow Area= 0.79 sf
    #6   Secondary        883.00'   12.0"  Round RCP_Round  12"
                                    L= 100.0'   RCP, groove end projecting,  Ke= 0.200
```

Inlet / Outlet Invert= 883.00' / 882.75' S= 0.0025 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=608.52 cfs @ 12.46 hrs HW=885.58' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 608.52 cfs @ 4.29 fps)

Secondary OutFlow Max=20.47 cfs @ 12.46 hrs HW=885.58' TW=883.29' (Dynamic Tailwater)
├**2=RCP_Round 12"** (Barrel Controls 4.09 cfs @ 5.21 fps)
├**3=RCP_Round 12"** (Barrel Controls 4.09 cfs @ 5.21 fps)
├**4=RCP_Round 12"** (Barrel Controls 4.09 cfs @ 5.21 fps)
├**5=RCP_Round 12"** (Barrel Controls 4.09 cfs @ 5.21 fps)
└**6=RCP_Round 12"** (Barrel Controls 4.09 cfs @ 5.21 fps)

Pond 13P: P-13



Summary for Pond 14P: P-14

Inflow Area = 21.198 ac, 39.93% Impervious, Inflow Depth = 5.41" for 100-Year event
Inflow = 89.07 cfs @ 12.29 hrs, Volume= 9.565 af
Outflow = 16.07 cfs @ 13.06 hrs, Volume= 9.563 af, Atten= 82%, Lag= 46.4 min
Primary = 16.07 cfs @ 13.06 hrs, Volume= 9.563 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 892.00' Surf.Area= 1.380 ac Storage= 4.490 af
Peak Elev= 895.17' @ 13.06 hrs Surf.Area= 1.695 ac Storage= 9.341 af (4.851 af above start)

Plug-Flow detention time= 580.1 min calculated for 5.073 af (53% of inflow)
Center-of-Mass det. time= 239.8 min (1,035.6 - 795.8)

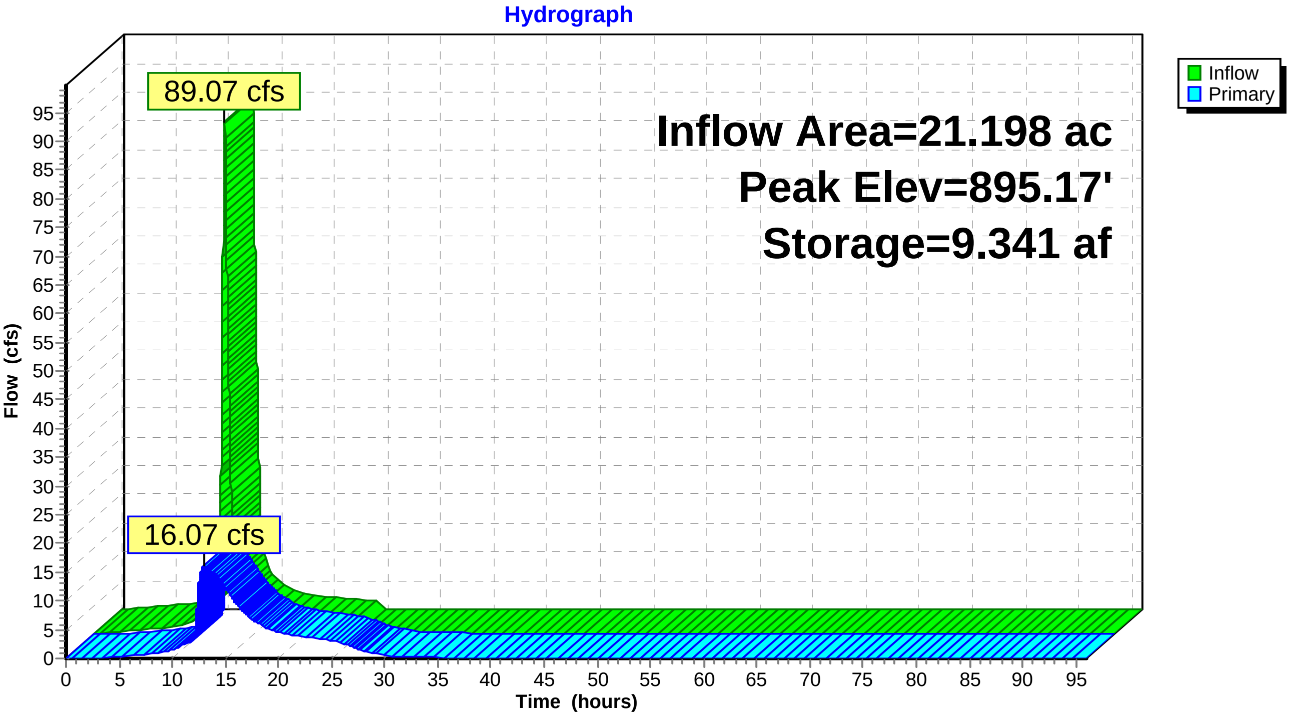
Volume	Invert	Avail.Storage	Storage Description
#1	888.00'	9.910 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
888.00	0.950	0.000	0.000
890.00	1.080	2.030	2.030
892.00	1.380	2.460	4.490
893.00	1.470	1.425	5.915
894.00	1.570	1.520	7.435
895.50	1.730	2.475	9.910

Device	Routing	Invert	Outlet Devices
#1	Primary	892.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	893.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 893.00' / 892.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=16.07 cfs @ 13.06 hrs HW=895.17' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 6.73 cfs @ 8.57 fps)
└—**2=RCP_Round 18"** (Barrel Controls 9.34 cfs @ 5.29 fps)

Pond 14P: P-14


Hydrograph
89.07 cfs
16.07 cfs
Inflow Area=21.198 ac
Peak Elev=895.17'
Storage=9.341 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond 23P: Thumb Infiltration (Thumb TP load only)

```
Inflow Area =       48.540 ac,  84.23% Impervious,  Inflow Depth =   6.23"    for  100-Year event
Inflow      =      171.27 cfs @   12.44 hrs,  Volume=          25.207 af
Outflow     =      171.19 cfs @   12.45 hrs,  Volume=          21.467 af,  Atten= 0%,  Lag= 0.6 min
Primary     =      171.19 cfs @   12.45 hrs,  Volume=          21.467 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.88' @ 12.45 hrs Surf.Area= 1.000 ac Storage= 3.880 af

Plug-Flow detention time= 126.7 min calculated for 21.467 af (85% of inflow)
Center-of-Mass det. time= 58.7 min (836.9 - 778.1)

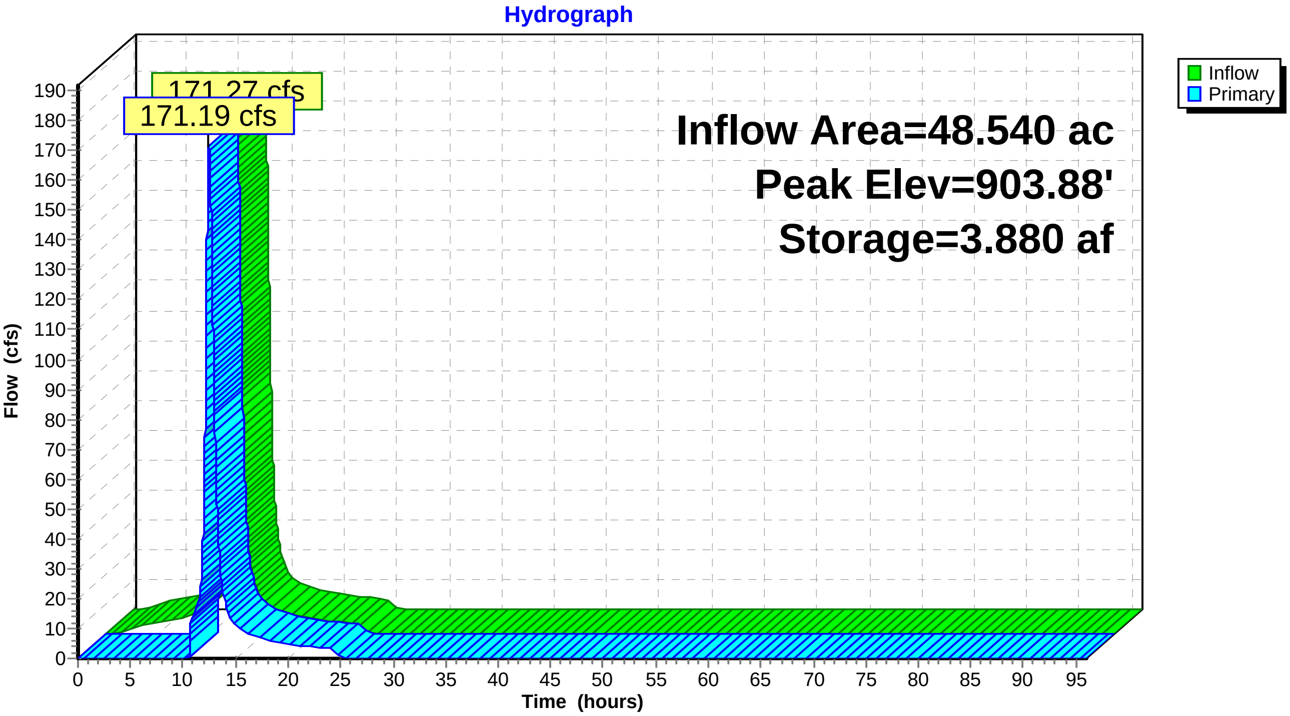
Volume	Invert	Avail.Storage	Storage Description
#1	900.00'	5.000 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
900.00	1.000	0.000	0.000
901.00	1.000	1.000	1.000
902.00	1.000	1.000	2.000
903.00	1.000	1.000	3.000
904.00	1.000	1.000	4.000
905.00	1.000	1.000	5.000

Device	Routing	Invert	Outlet Devices
#1	Primary	903.74'	**1,000.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=171.15 cfs @ 12.45 hrs HW=903.88' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Weir Controls 171.15 cfs @ 1.23 fps)

Pond 23P: Thumb Infiltration (Thumb TP load only)



Summary for Pond 31P: SB 18 Infiltration

Inflow Area = 52.908 ac, 84.55% Impervious, Inflow Depth = 6.65" for 100-Year event
Inflow = 224.72 cfs @ 12.40 hrs, Volume= 29.299 af
Outflow = 224.59 cfs @ 12.40 hrs, Volume= 25.979 af, Atten= 0%, Lag= 0.3 min
Primary = 224.59 cfs @ 12.40 hrs, Volume= 25.979 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 903.48' @ 12.40 hrs Surf.Area= 1.000 ac Storage= 3.485 af

Plug-Flow detention time= 105.3 min calculated for 25.979 af (89% of inflow)
Center-of-Mass det. time= 48.6 min (823.5 - 774.8)

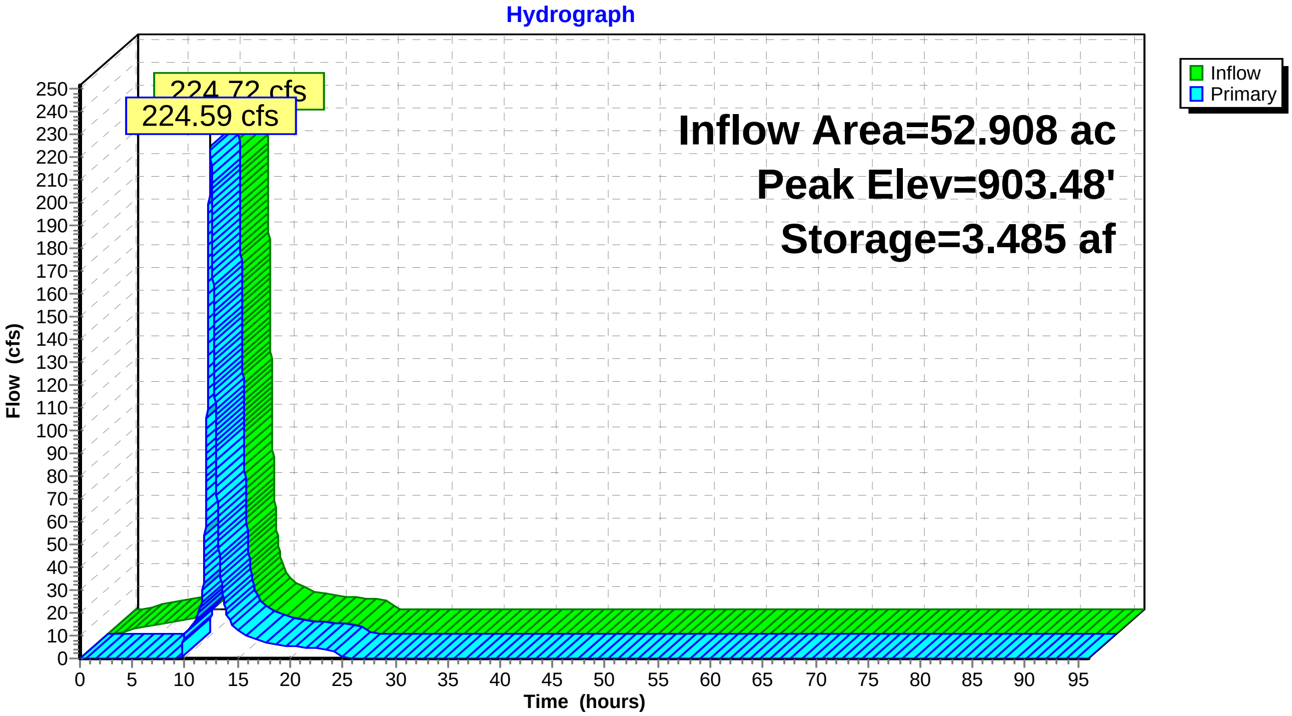
Volume	Invert	Avail.Storage	Storage Description
#1	900.00'	5.000 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
900.00	1.000	0.000	0.000
901.00	1.000	1.000	1.000
902.00	1.000	1.000	2.000
903.00	1.000	1.000	3.000
904.00	1.000	1.000	4.000
905.00	1.000	1.000	5.000

Device	Routing	Invert	Outlet Devices
#1	Primary	903.32'	**1,000.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.8' Crest Height

Primary OutFlow Max=224.52 cfs @ 12.40 hrs HW=903.48' TW=890.33' (Dynamic Tailwater)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 224.52 cfs @ 1.36 fps)

Pond 31P: SB 18 Infiltration



Summary for Pond 36P: Culverts passing flow beneath Spine Road

Inflow Area =	52.908 ac,	84.55% Impervious,	Inflow Depth =	5.89"	for 100-Year event	
Inflow =	224.59 cfs @	12.40 hrs,	Volume=	25.979 af		
Outflow =	224.53 cfs @	12.41 hrs,	Volume=	25.979 af,	Atten= 0%,	Lag= 0.2 min
Primary =	125.00 cfs @	12.14 hrs,	Volume=	22.689 af		
Secondary =	99.53 cfs @	12.41 hrs,	Volume=	3.290 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 890.33' @ 12.41 hrs Surf.Area= 0.006 ac Storage= 0.013 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (823.5 - 823.5)

Volume	Invert	Avail.Storage	Storage Description
#1	887.00'	0.025 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
887.00	0.000	0.000	0.000
887.50	0.003	0.001	0.001
890.50	0.006	0.014	0.014
892.00	0.009	0.011	0.025

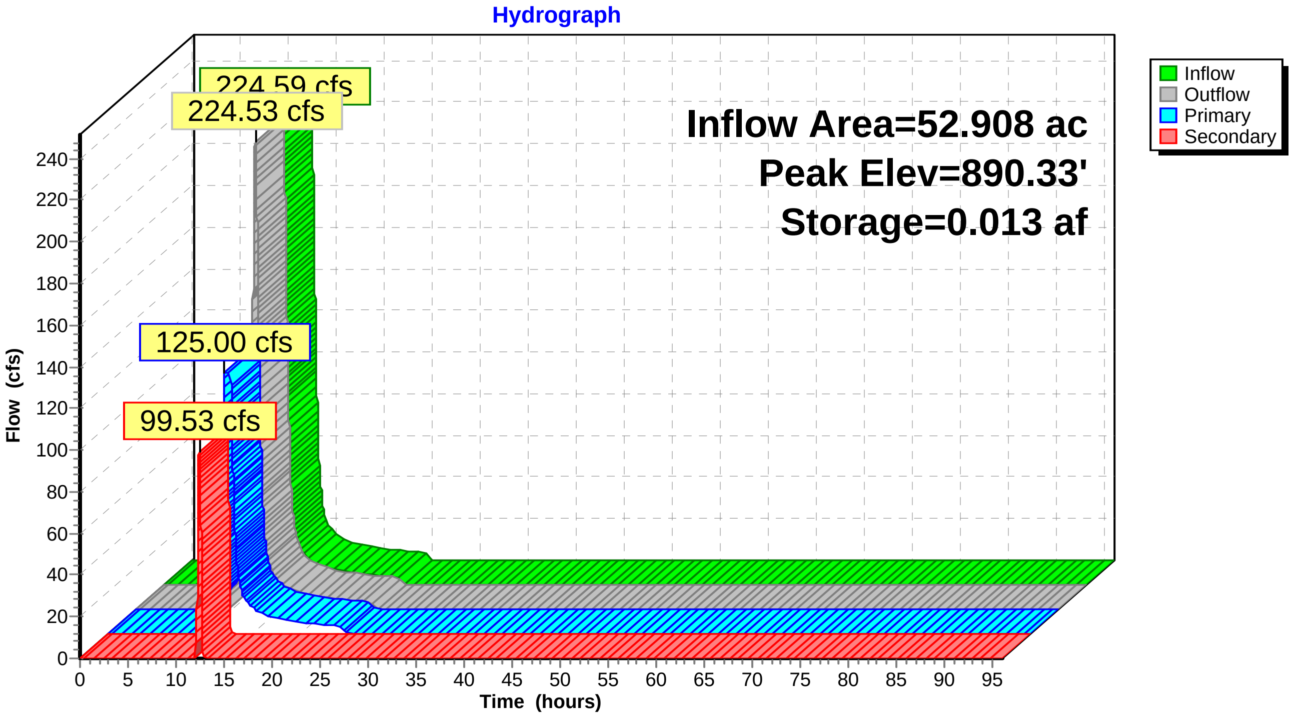
Device	Routing	Invert	Outlet Devices
#1	Primary	887.00'	**Special & User-Defined** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 5.00 Disch. (cfs) 0.000 25.000 50.000 75.000 100.000 125.000 125.000
#2	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#4	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#5	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#6	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#7	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900

			n= 0.013, Flow Area= 1.77 sf
#8	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#9	Secondary	887.50'	**18.0" Round RCP_Round 18"** L= 100.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 887.50' / 886.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=125.00 cfs @ 12.14 hrs HW=887.69' TW=884.86' (Dynamic Tailwater)
└─**1=Special & User-Defined** (Custom Controls 125.00 cfs)

Secondary OutFlow Max=99.47 cfs @ 12.41 hrs HW=890.33' TW=885.56' (Dynamic Tailwater)
├─**2=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
├─**3=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
├─**4=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
├─**5=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
├─**6=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
├─**7=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
├─**8=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)
└─**9=RCP_Round 18"** (Barrel Controls 12.43 cfs @ 7.04 fps)

Pond 36P: Culverts passing flow beneath Spine Road



Summary for Pond CRH-1: CRH-1

Inflow Area = 6.955 ac, 46.76% Impervious, Inflow Depth = 5.60" for 100-Year event
Inflow = 38.37 cfs @ 12.15 hrs, Volume= 3.247 af
Outflow = 25.53 cfs @ 12.31 hrs, Volume= 3.247 af, Atten= 33%, Lag= 9.5 min
Discarded = 0.37 cfs @ 12.31 hrs, Volume= 0.563 af
Primary = 25.16 cfs @ 12.31 hrs, Volume= 2.685 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 878.81' @ 12.31 hrs Surf.Area= 0.463 ac Storage= 0.760 af

Plug-Flow detention time= 114.2 min calculated for 3.247 af (100% of inflow)
Center-of-Mass det. time= 114.3 min (895.5 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1	876.00'	0.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

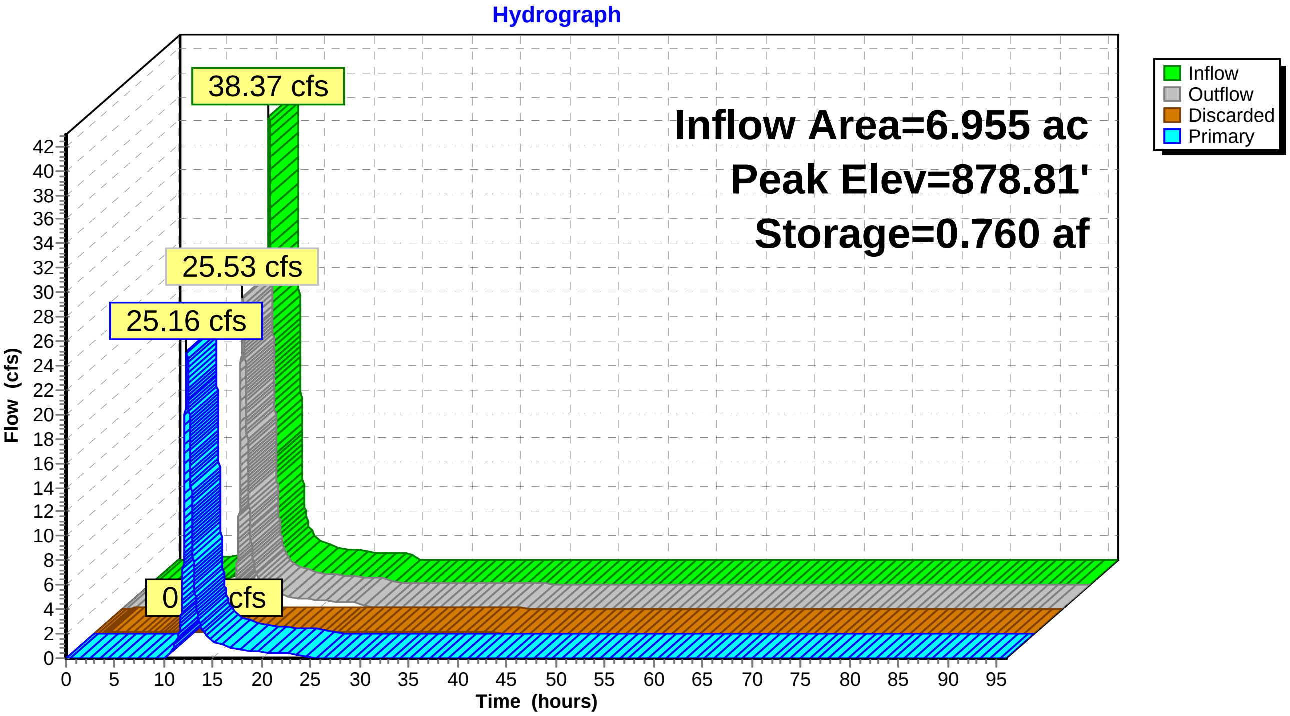
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
876.00	0.150	0.000	0.000
878.00	0.300	0.450	0.450
879.00	0.500	0.400	0.850

Device	Routing	Invert	Outlet Devices
#1	Discarded	876.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	877.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 877.00' / 876.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	877.00'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 877.00' / 876.00' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.37 cfs @ 12.31 hrs HW=878.81' (Free Discharge)
└─**1=Exfiltration** (Controls 0.37 cfs)

Primary OutFlow Max=25.15 cfs @ 12.31 hrs HW=878.81' (Free Discharge)
├─**2=Culvert** (Barrel Controls 12.58 cfs @ 5.53 fps)
└─**3=Culvert** (Barrel Controls 12.58 cfs @ 5.53 fps)

Pond CRH-1: CRH-1



Summary for Pond CRH-2: CRH-2

Inflow Area = 10.214 ac, 37.73% Impervious, Inflow Depth = 5.35" for 100-Year event
Inflow = 48.13 cfs @ 12.21 hrs, Volume= 4.557 af
Outflow = 27.85 cfs @ 12.47 hrs, Volume= 4.557 af, Atten= 42%, Lag= 15.7 min
Discarded = 0.47 cfs @ 12.47 hrs, Volume= 0.986 af
Primary = 27.38 cfs @ 12.47 hrs, Volume= 3.571 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 883.78' @ 12.47 hrs Surf.Area= 0.578 ac Storage= 1.468 af

Plug-Flow detention time= 190.2 min calculated for 4.557 af (100% of inflow)
Center-of-Mass det. time= 190.4 min (982.8 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	1.600 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

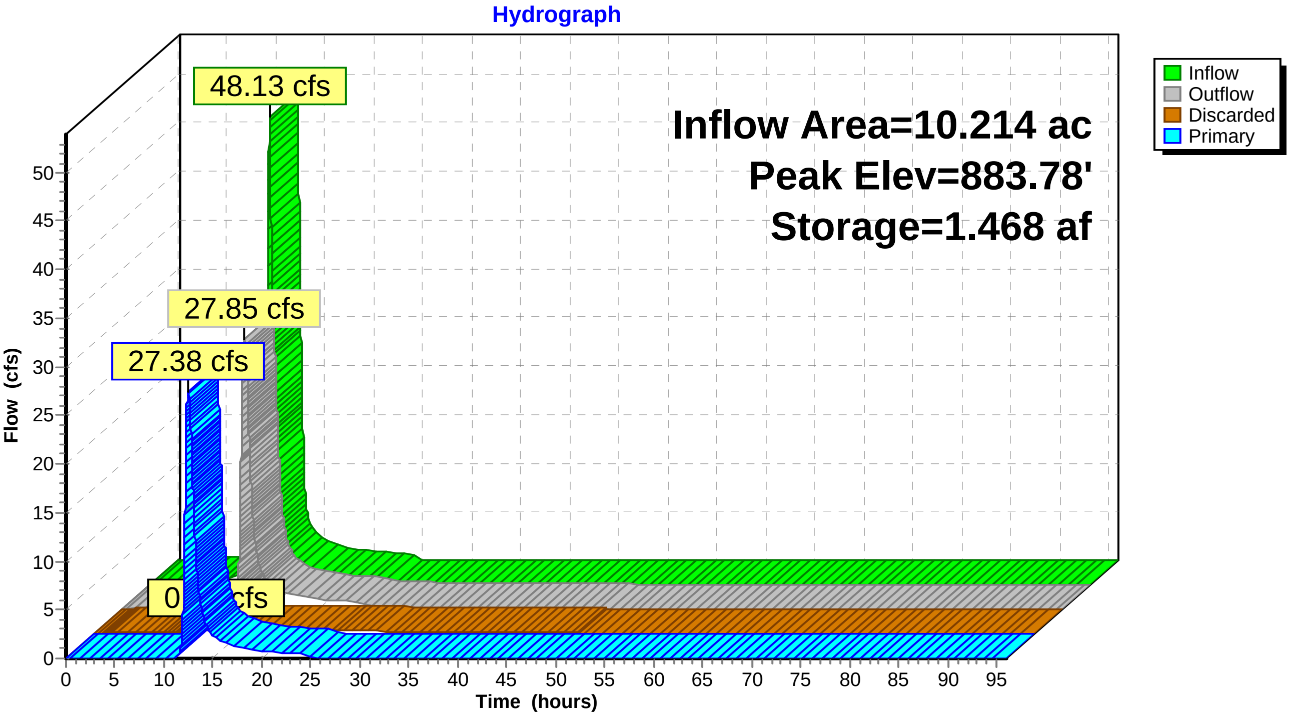
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
880.00	0.200	0.000	0.000
882.00	0.400	0.600	0.600
884.00	0.600	1.000	1.600

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Primary	881.50'	**24.0" Round Culvert** L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 881.50' / 881.00' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Discarded OutFlow Max=0.47 cfs @ 12.47 hrs HW=883.78' (Free Discharge)
└─**1=Exfiltration** (Controls 0.47 cfs)

Primary OutFlow Max=27.38 cfs @ 12.47 hrs HW=883.78' TW=879.69' (Dynamic Tailwater)
├─**2=Culvert** (Barrel Controls 13.69 cfs @ 4.79 fps)
└─**3=Culvert** (Barrel Controls 13.69 cfs @ 4.79 fps)

Pond CRH-2: CRH-2



Summary for Pond CRH-3: CRH-3

```
Inflow Area =       11.815 ac, 36.95% Impervious, Inflow Depth =  4.33"   for 100-Year event
Inflow      =       30.15 cfs @  12.44 hrs, Volume=          4.265 af
Outflow     =       25.90 cfs @  12.71 hrs, Volume=          4.265 af, Atten= 14%, Lag= 15.7 min
Discarded   =        0.38 cfs @  12.71 hrs, Volume=          0.519 af
Primary     =       25.52 cfs @  12.71 hrs, Volume=          3.745 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 879.83' @ 12.71 hrs   Surf.Area= 0.466 ac   Storage= 0.769 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 82.2 min ( 919.3 - 837.1 )

Volume       Invert    Avail.Storage   Storage Description
   #1       877.00'        0.850 af    Custom Stage Data (Prismatic)Listed below (Recalc)

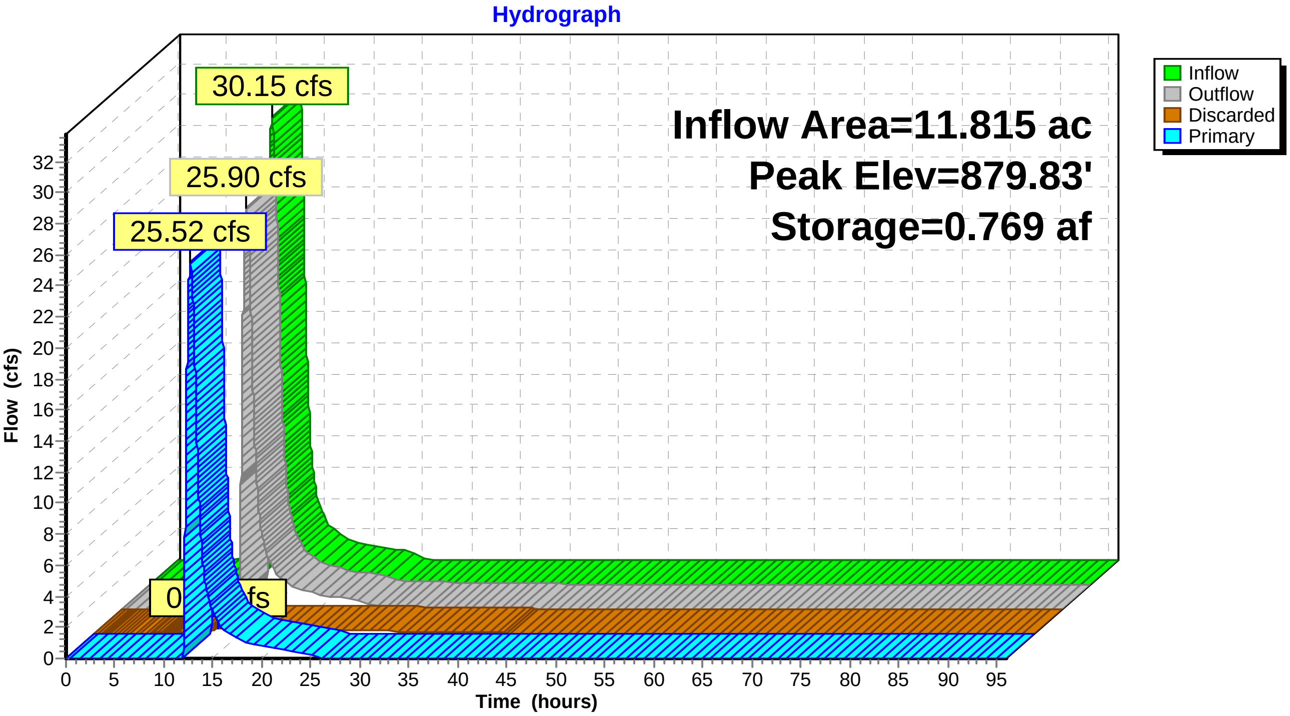
 Elevation      Surf.Area        Inc.Store        Cum.Store
    (feet)        (acres)      (acre-feet)      (acre-feet)
    877.00          0.150            0.000            0.000
    879.00          0.300            0.450            0.450
    880.00          0.500            0.400            0.850

Device   Routing        Invert   Outlet Devices
   #1    Discarded     877.00'   0.800 in/hr Exfiltration over Surface area
                                 Conductivity to Groundwater Elevation = 0.00'
   #2    Primary       878.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                 Inlet / Outlet Invert= 878.00' / 877.00'   S= 0.0065 '/'   Cc= 0.900
                                 n= 0.013,  Flow Area= 3.14 sf
   #3    Primary       878.00'   24.0"  Round Culvert  L= 155.0'   Ke= 0.500
                                 Inlet / Outlet Invert= 878.00' / 877.00'   S= 0.0065 '/'   Cc= 0.900
                                 n= 0.013,  Flow Area= 3.14 sf

Discarded OutFlow  Max=0.38 cfs @ 12.71 hrs  HW=879.83'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.38 cfs)

Primary OutFlow  Max=25.52 cfs @ 12.71 hrs  HW=879.83'   (Free Discharge)
├─2=Culvert  (Barrel Controls 12.76 cfs @ 5.55 fps)
└─3=Culvert  (Barrel Controls 12.76 cfs @ 5.55 fps)
```

Pond CRH-3: CRH-3



Summary for Pond P1/P2: P-1/P-2

Inflow Area = 68.531 ac, 57.92% Impervious, Inflow Depth = 5.91" for 100-Year event
Inflow = 181.28 cfs @ 12.57 hrs, Volume= 33.757 af
Outflow = 177.47 cfs @ 12.65 hrs, Volume= 33.749 af, Atten= 2%, Lag= 5.2 min
Primary = 177.47 cfs @ 12.65 hrs, Volume= 33.749 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 924.00' Surf.Area= 1.270 ac Storage= 3.500 af
Peak Elev= 925.63' @ 12.65 hrs Surf.Area= 1.514 ac Storage= 5.762 af (2.262 af above start)

Plug-Flow detention time= 130.6 min calculated for 30.246 af (90% of inflow)
Center-of-Mass det. time= 40.6 min (839.6 - 799.0)

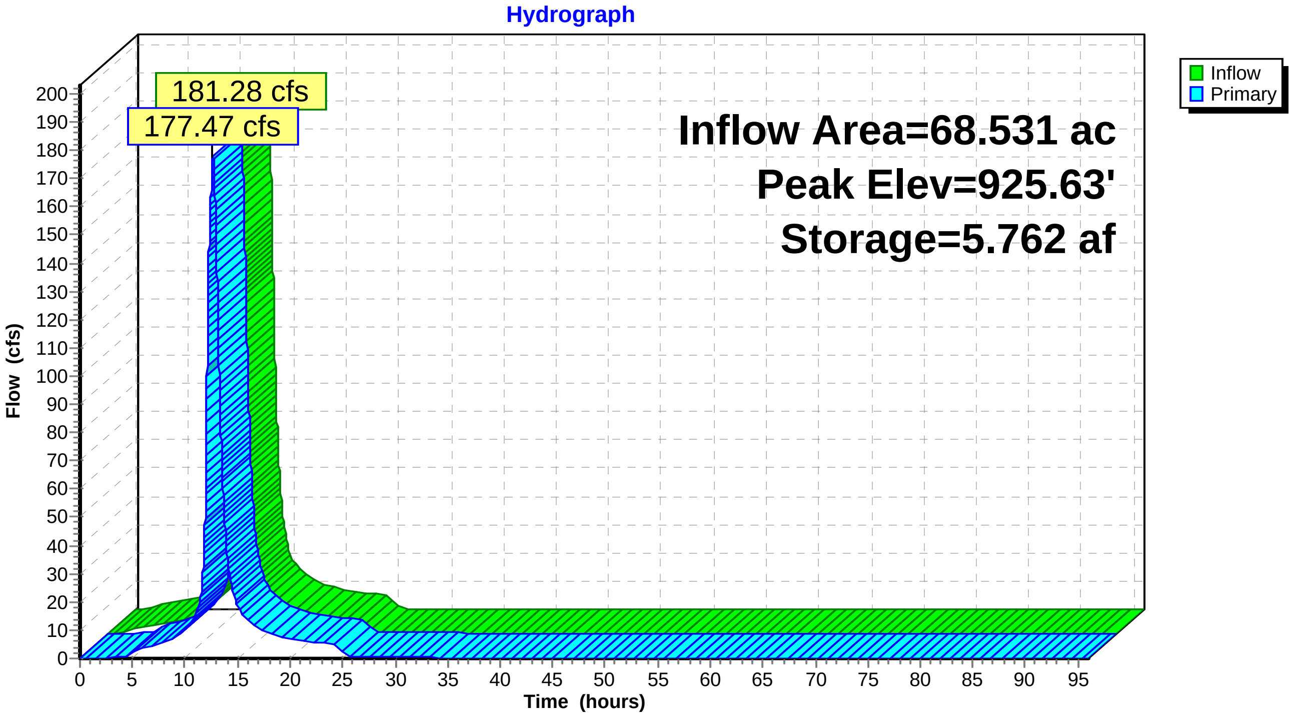
Volume	Invert	Avail.Storage	Storage Description
#1	920.00'	6.340 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
920.00	0.650	0.000	0.000
922.00	0.790	1.440	1.440
924.00	1.270	2.060	3.500
926.00	1.570	2.840	6.340

Device	Routing	Invert	Outlet Devices
#1	Primary	924.40'	**40.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	924.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=177.46 cfs @ 12.65 hrs HW=925.62' TW=919.66' (Dynamic Tailwater)
↑
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 176.25 cfs @ 3.62 fps)
└─**2=Orifice/Grate** (Orifice Controls 1.21 cfs @ 6.14 fps)

Pond P1/P2: P-1/P-2



Summary for Pond P5/P6: P-5/P-6

```
Inflow Area =       43.279 ac, 47.44% Impervious, Inflow Depth =  5.62"   for 100-Year event
Inflow      =     234.37 cfs @  12.15 hrs, Volume=        20.279 af
Outflow     =     122.50 cfs @  12.39 hrs, Volume=        18.162 af, Atten= 48%, Lag= 14.7 min
Primary     =     119.36 cfs @  12.39 hrs, Volume=        16.461 af
Secondary =         3.15 cfs @  12.39 hrs, Volume=         1.701 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 929.00'  Surf.Area= 1.975 ac  Storage= 5.062 af
Peak Elev= 932.56' @ 12.39 hrs  Surf.Area= 2.681 ac  Storage= 13.463 af  (8.400 af above start)

Plug-Flow detention time= 329.8 min calculated for 13.098 af (65% of inflow)
Center-of-Mass det. time= 152.1 min ( 932.6 - 780.5 )

Volume      Invert   Avail.Storage   Storage Description
   #1      926.00'       14.650 af   Custom Stage Data (Prismatic)Listed below (Recalc)

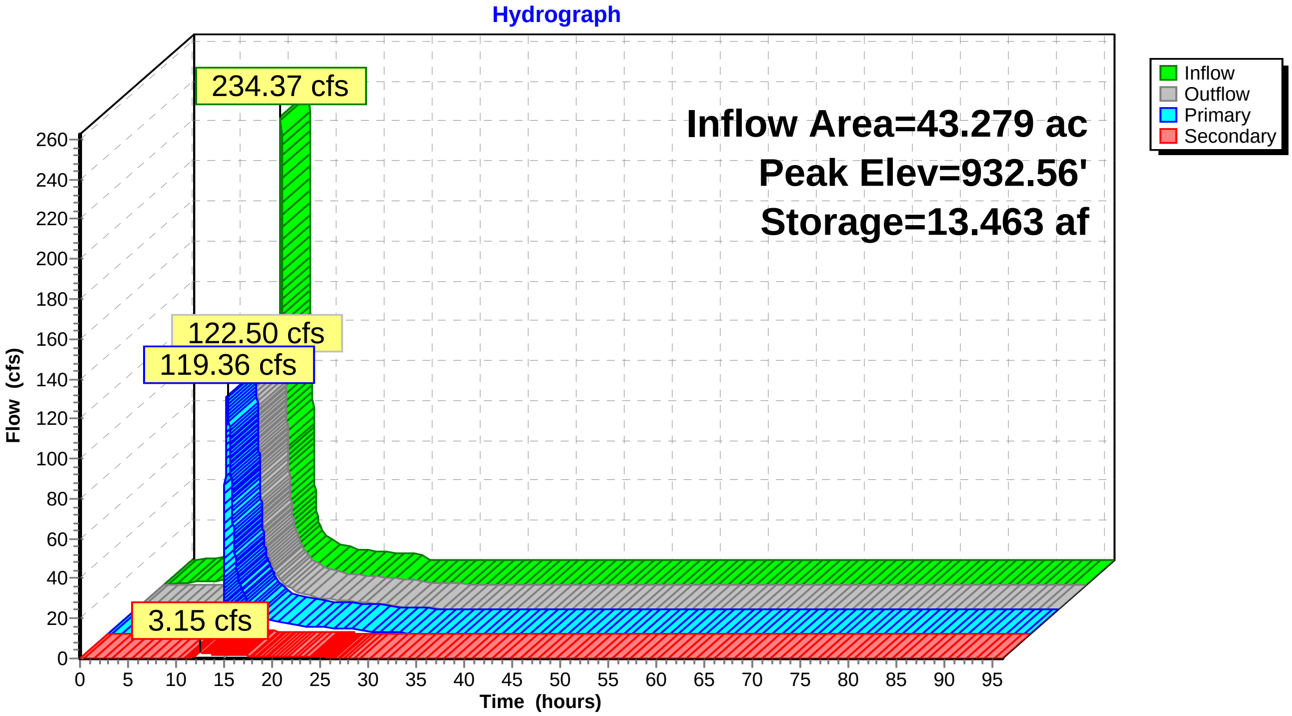
Elevation     Surf.Area      Inc.Store      Cum.Store
   (feet)       (acres)    (acre-feet)    (acre-feet)
   926.00         1.510          0.000          0.000
   928.00         1.710          3.220          3.220
   930.00         2.240          3.950          7.170
   931.00         2.400          2.320          9.490
   933.00         2.760          5.160         14.650

Device   Routing        Invert   Outlet Devices
   #1    Primary       930.00'   12.0" Horiz. Orifice/Grate  C= 0.600
                                 Limited to weir flow at low heads
   #2    Primary       930.50'   7.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
   #3    Primary       931.50'   14.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
   #4    Secondary     930.00'   9.0" Vert. Orifice/Grate  C= 0.600

Primary OutFlow  Max=119.34 cfs @ 12.39 hrs  HW=932.56'  TW=919.05'  (Dynamic Tailwater)
├─1=Orifice/Grate  (Orifice Controls 6.05 cfs @ 7.71 fps)
├─2=Sharp-Crested Rectangular Weir (Weir Controls 63.85 cfs @ 4.70 fps)
└─3=Sharp-Crested Rectangular Weir (Weir Controls 49.44 cfs @ 3.37 fps)

Secondary OutFlow  Max=3.15 cfs @ 12.39 hrs  HW=932.56'  TW=929.14'  (Dynamic Tailwater)
└─4=Orifice/Grate  (Orifice Controls 3.15 cfs @ 7.12 fps)
```

Pond P5/P6: P-5/P-6



Summary for Pond P8: P-8

Inflow Area = 6.389 ac, 7.62% Impervious, Inflow Depth = 4.52" for 100-Year event
Inflow = 39.72 cfs @ 12.05 hrs, Volume= 2.409 af
Outflow = 11.00 cfs @ 12.33 hrs, Volume= 2.403 af, Atten= 72%, Lag= 16.4 min
Primary = 11.00 cfs @ 12.33 hrs, Volume= 2.403 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 897.00' Surf.Area= 0.300 ac Storage= 0.495 af
Peak Elev= 899.15' @ 12.57 hrs Surf.Area= 0.496 ac Storage= 1.415 af (0.920 af above start)

Plug-Flow detention time= 268.2 min calculated for 1.908 af (79% of inflow)
Center-of-Mass det. time= 129.7 min (940.4 - 810.7)

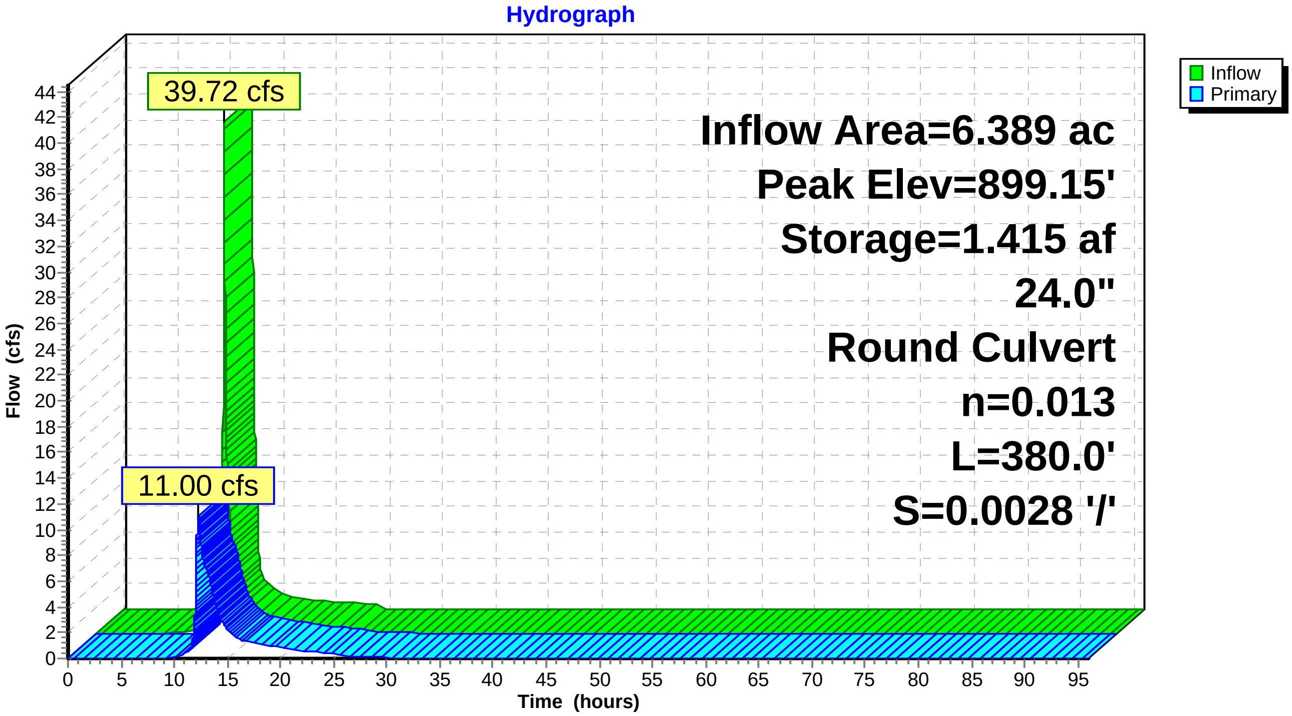
Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	1.850 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
893.00	0.030	0.000	0.000
894.00	0.070	0.050	0.050
896.00	0.150	0.220	0.270
897.00	0.300	0.225	0.495
898.00	0.450	0.375	0.870
900.00	0.530	0.980	1.850

Device	Routing	Invert	Outlet Devices
#1	Primary	897.00'	**24.0" Round RCP_Round 24"** L= 380.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 897.00' / 895.94' S= 0.0028 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=10.95 cfs @ 12.33 hrs HW=899.10' TW=897.82' (Dynamic Tailwater)
↑—**1=RCP_Round 24"** (Outlet Controls 10.95 cfs @ 4.12 fps)

Pond P8: P-8


Hydrograph
39.72 cfs
11.00 cfs
Inflow Area=6.389 ac
Peak Elev=899.15'
Storage=1.415 af
24.0"
Round Culvert
n=0.013
L=380.0'
S=0.0028 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-1: W-1

Inflow Area = 0.997 ac, 24.47% Impervious, Inflow Depth = 26.99" for 100-Year event
Inflow = 6.17 cfs @ 12.25 hrs, Volume= 2.242 af
Outflow = 2.99 cfs @ 14.14 hrs, Volume= 2.242 af, Atten= 52%, Lag= 113.3 min
Primary = 2.99 cfs @ 14.14 hrs, Volume= 2.242 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.37' @ 14.14 hrs Surf.Area= 0.760 ac Storage= 0.443 af

Plug-Flow detention time= 109.6 min calculated for 2.242 af (100% of inflow)
Center-of-Mass det. time= 109.3 min (974.6 - 865.3)

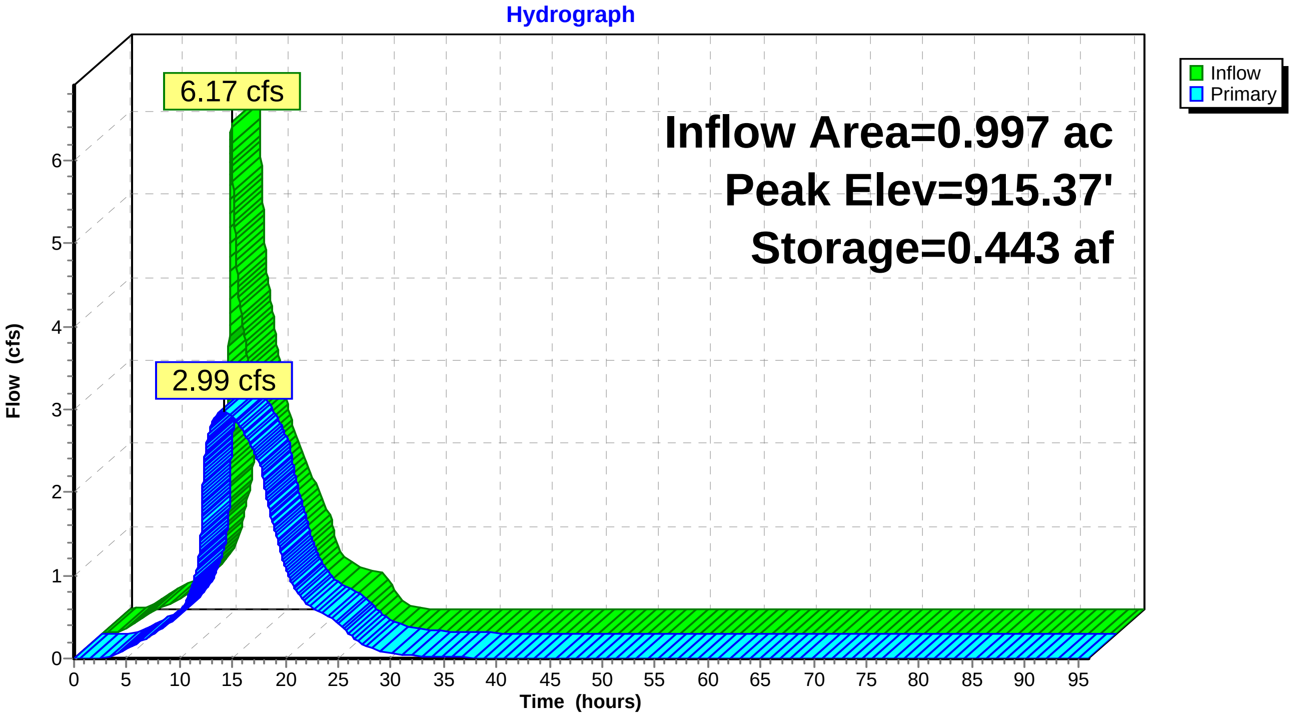
Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	0.950 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	0.660	0.000	0.000
916.00	0.860	0.950	0.950

Device	Routing	Invert	Outlet Devices
#1	Primary	914.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.99 cfs @ 14.14 hrs HW=915.37' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 2.99 cfs @ 3.80 fps)

Pond W-1: W-1


Hydrograph
6.17 cfs
2.99 cfs
Inflow Area=0.997 ac
Peak Elev=915.37'
Storage=0.443 af
Inflow
Primary
Flow (cfs)
0
1
2
3
4
5
6
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-2: W-2

```
Inflow    =     3.15 cfs @  12.39 hrs,  Volume=         1.701 af
Outflow   =     1.17 cfs @  18.92 hrs,  Volume=         1.553 af,  Atten= 63%,  Lag= 391.6 min
Primary   =     1.17 cfs @  18.92 hrs,  Volume=         1.553 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 929.60' @ 18.92 hrs   Surf.Area= 1.191 ac   Storage= 0.681 af

Plug-Flow detention time= 533.4 min calculated for 1.553 af (91% of inflow)
Center-of-Mass det. time= 473.2 min ( 1,532.2 - 1,059.1 )

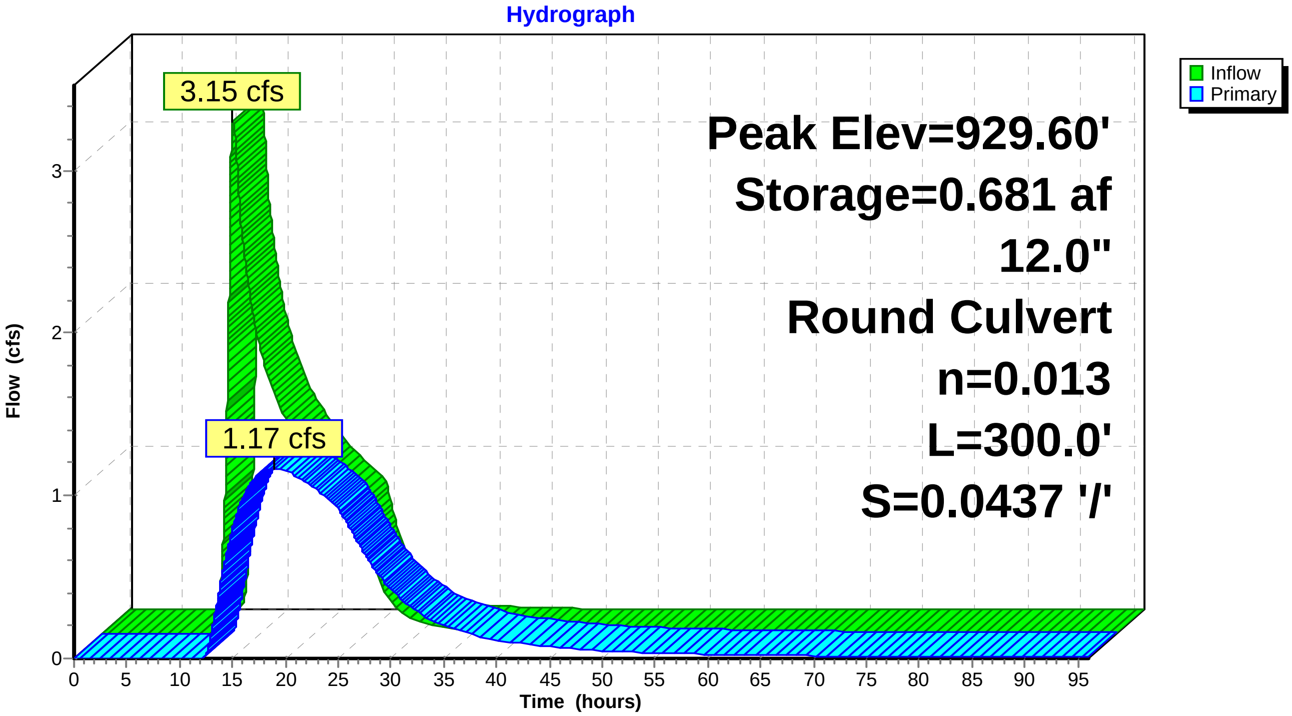
Volume      Invert    Avail.Storage   Storage Description
   #1      929.00'        1.175 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area       Inc.Store       Cum.Store
    (feet)        (acres)     (acre-feet)     (acre-feet)
    929.00          1.090           0.000           0.000
    930.00          1.260           1.175           1.175

Device   Routing          Invert   Outlet Devices
   #1    Primary         929.10'   12.0"  Round RCP_Round  12"
                                   L= 300.0'   RCP, groove end projecting,  Ke= 0.200
                                   Inlet / Outlet Invert= 929.10' / 916.00'   S= 0.0437 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 0.79 sf

Primary OutFlow  Max=1.17 cfs @ 18.92 hrs  HW=929.60'  TW=914.96'   (Dynamic Tailwater)
└─1=RCP_Round  12"  (Inlet Controls 1.17 cfs @ 3.00 fps)
```

Pond W-2: W-2


Hydrograph
3.15 cfs
1.17 cfs
Peak Elev=929.60'
Storage=0.681 af
12.0"
Round Culvert
n=0.013
L=300.0'
S=0.0437 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-3: W-3

Inflow	=	1.17 cfs @ 18.92 hrs,	Volume=	1.553 af
Outflow	=	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af, Atten= 100%, Lag= 0.0 min

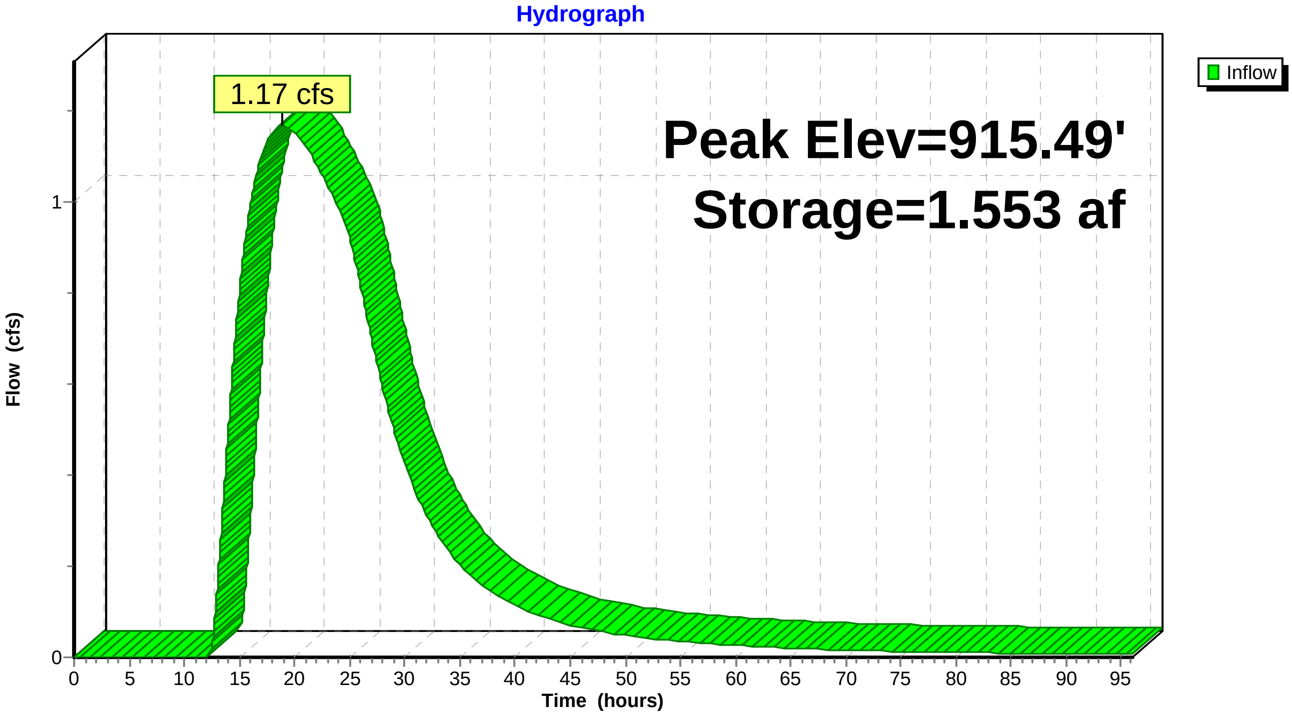
Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 915.49' @ 96.00 hrs Surf.Area= 2.163 ac Storage= 1.553 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	914.75'	2.680 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
914.75	2.040	0.000	0.000
915.00	2.080	0.515	0.515
916.00	2.250	2.165	2.680

Pond W-3: W-3



Summary for Pond W-4: W-4

Inflow Area = 2.985 ac, 30.99% Impervious, Inflow Depth = 20.64" for 100-Year event
Inflow = 22.11 cfs @ 12.08 hrs, Volume= 5.134 af
Outflow = 4.36 cfs @ 14.67 hrs, Volume= 5.114 af, Atten= 80%, Lag= 155.4 min
Primary = 4.36 cfs @ 14.67 hrs, Volume= 5.114 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Peak Elev= 909.35' @ 14.67 hrs Surf.Area= 1.266 ac Storage= 1.383 af

Plug-Flow detention time= 248.3 min calculated for 5.114 af (100% of inflow)
Center-of-Mass det. time= 244.9 min (1,203.6 - 958.7)

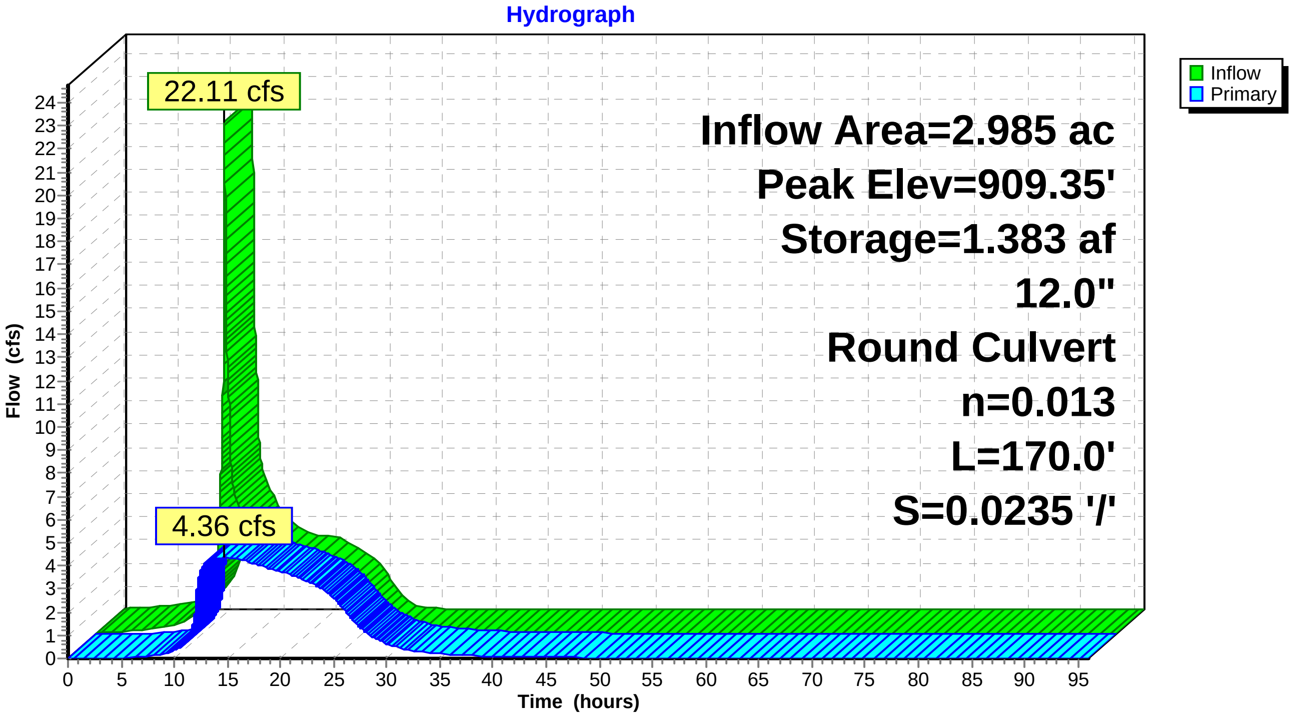
Volume	Invert	Avail.Storage	Storage Description
#1	908.00'	2.280 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
908.00	0.780	0.000	0.000
910.00	1.500	2.280	2.280

Device	Routing	Invert	Outlet Devices
#1	Primary	908.00'	**12.0" Round RCP_Round 12"** L= 170.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 908.00' / 904.00' S= 0.0235 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=4.36 cfs @ 14.67 hrs HW=909.35' TW=894.39' (Dynamic Tailwater)
↑—**1=RCP_Round 12"** (Inlet Controls 4.36 cfs @ 5.55 fps)

Pond W-4: W-4


Hydrograph
22.11 cfs
4.36 cfs
Inflow Area=2.985 ac
Peak Elev=909.35'
Storage=1.383 af
12.0"
Round Culvert
n=0.013
L=170.0'
S=0.0235 '/'
🟩 Inflow
🟦 Primary
Flow (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Pond W-5: W-5

```
Inflow Area =        7.608 ac,  48.41% Impervious,  Inflow Depth = 13.52"    for  100-Year event
Inflow      =       76.11 cfs @   12.02 hrs,  Volume=          8.572 af
Outflow     =       17.76 cfs @   13.09 hrs,  Volume=          8.565 af,  Atten= 77%,  Lag= 64.3 min
Primary     =       17.76 cfs @   13.09 hrs,  Volume=          8.565 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Starting Elev= 882.75'   Surf.Area= 4.887 ac   Storage= 7.134 af
Peak Elev= 883.35' @ 13.09 hrs   Surf.Area= 5.709 ac   Storage= 10.267 af   (3.132 af above start)

Plug-Flow detention time= 1,065.0 min calculated for 1.430 af (17% of inflow)
Center-of-Mass det. time= 188.1 min ( 1,009.6 - 821.6 )

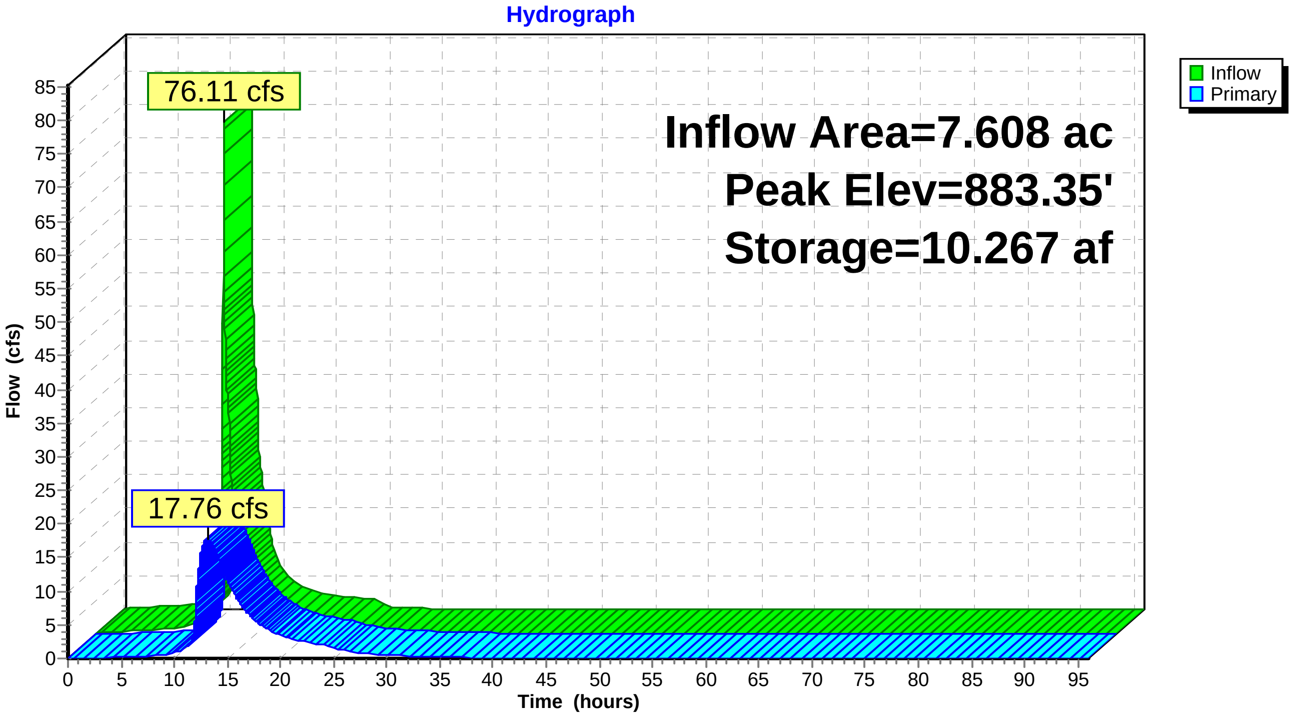
Volume        Invert    Avail.Storage   Storage Description
   #1        881.00'        11.097 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area       Inc.Store       Cum.Store
    (feet)        (acres)     (acre-feet)     (acre-feet)
    881.00          3.270           0.000           0.000
    882.00          4.190           3.730           3.730
    883.00          5.120           4.655           8.385
    883.49          5.950           2.712          11.097

Device  Routing           Invert   Outlet Devices
    #1  Primary          882.75'   6.0' long Sharp-Crested Rectangular Weir  2 End Contraction(s)
    #2  Primary          882.75'   6.0' long Sharp-Crested Rectangular Weir  2 End Contraction(s)

Primary OutFlow  Max=17.76 cfs @ 13.09 hrs  HW=883.35'  TW=0.00'   (Dynamic Tailwater)
├─1=Sharp-Crested Rectangular Weir (Weir Controls 8.88 cfs @ 2.53 fps)
└─2=Sharp-Crested Rectangular Weir (Weir Controls 8.88 cfs @ 2.53 fps)
```

Pond W-5: W-5

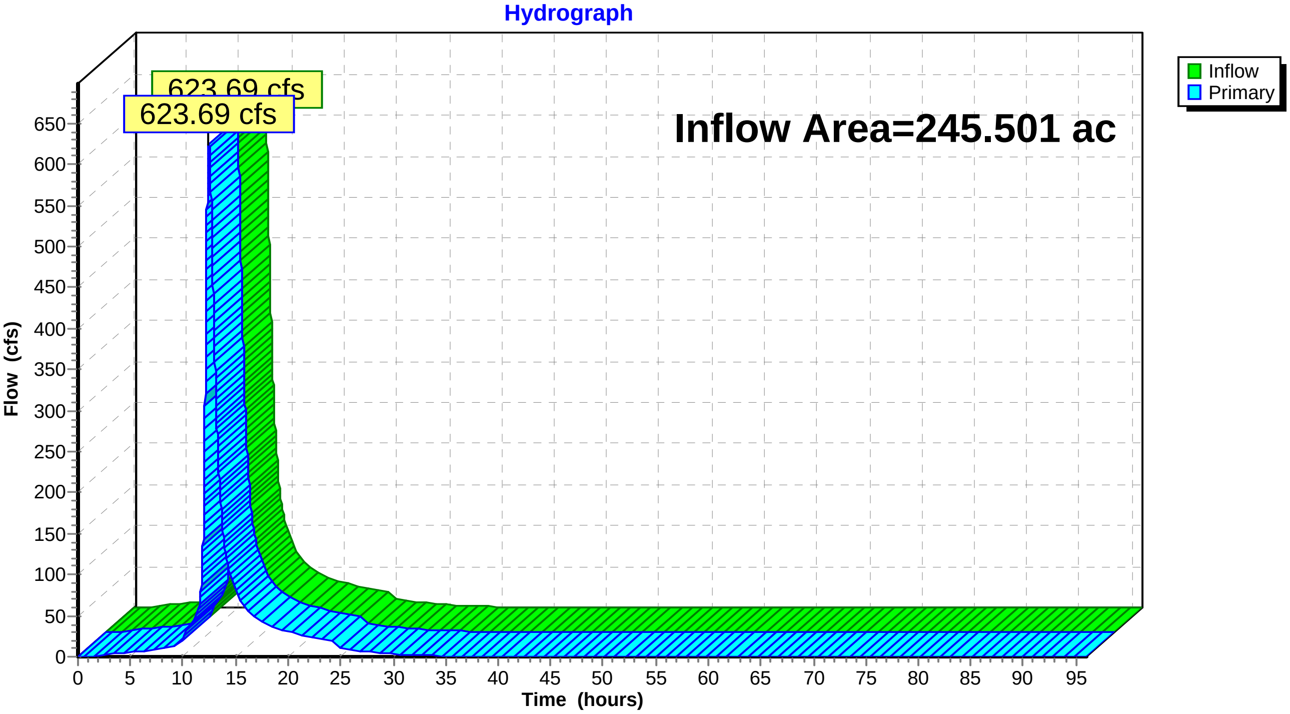

Hydrograph
76.11 cfs
17.76 cfs
Inflow Area=7.608 ac
Peak Elev=883.35'
Storage=10.267 af
🟩 Inflow
🟦 Primary
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Summary for Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek

Inflow Area = 245.501 ac, 51.49% Impervious, Inflow Depth = 5.57" for 100-Year event
Inflow = 623.69 cfs @ 12.46 hrs, Volume= 114.048 af
Primary = 623.69 cfs @ 12.46 hrs, Volume= 114.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 49L: Sum of P-13 and W-5 Discharges to Rice Creek

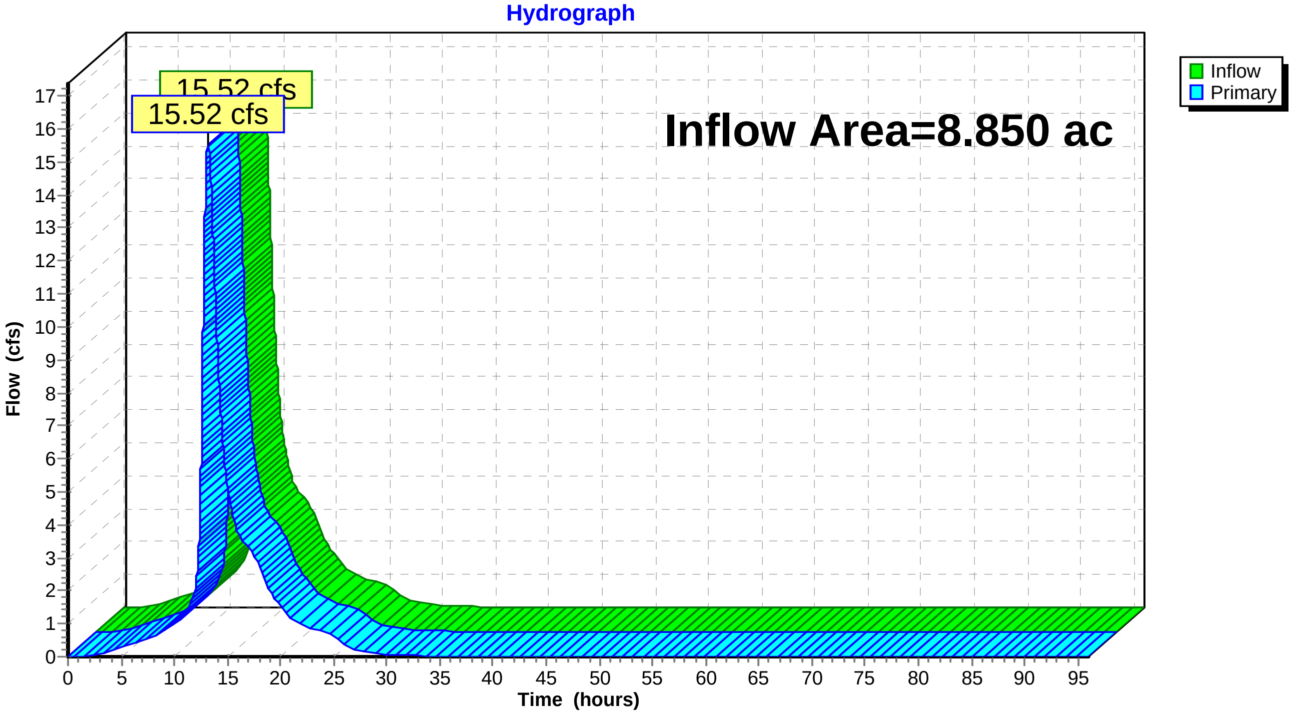


Summary for Link 50L: Outlet #1 Discharge to Round Lake

Inflow Area = 8.850 ac, 65.20% Impervious, Inflow Depth = 6.12" for 100-Year event
Inflow = 15.52 cfs @ 13.18 hrs, Volume= 4.512 af
Primary = 15.52 cfs @ 13.18 hrs, Volume= 4.512 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 50L: Outlet #1 Discharge to Round Lake

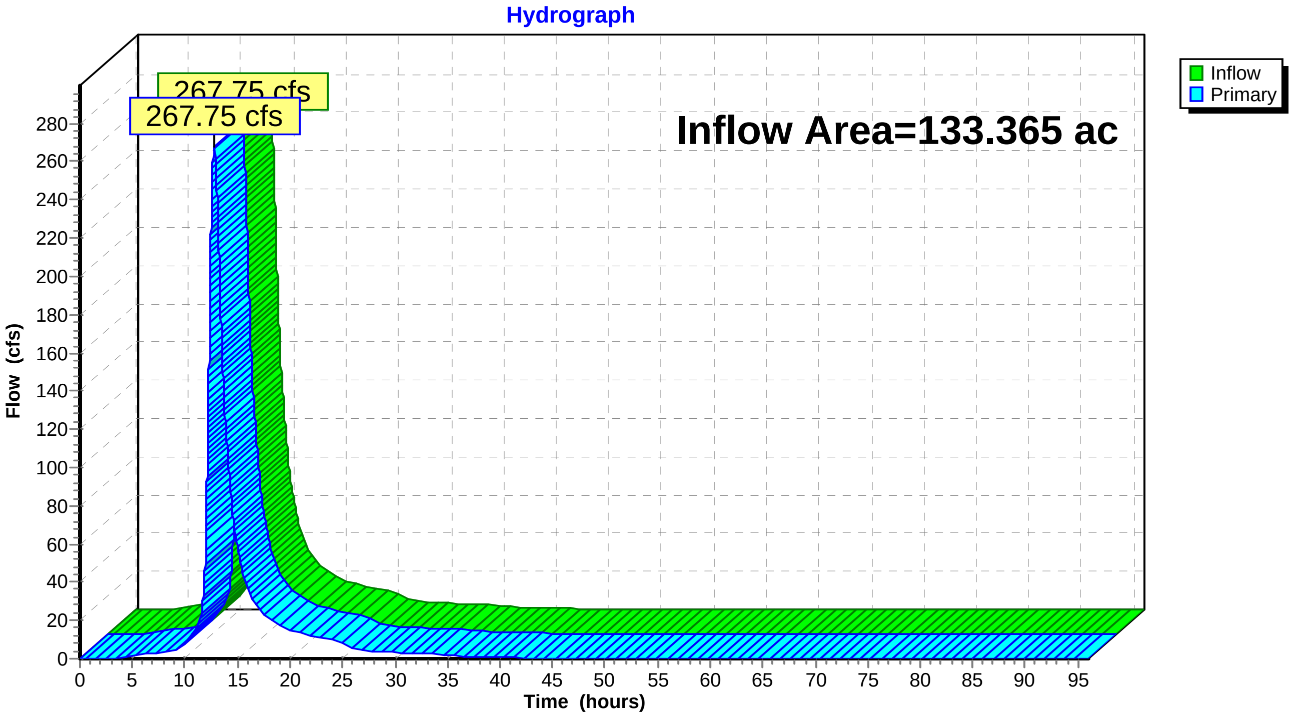


Summary for Link 51L: Outlet #2 Discharge to Round Lake

Inflow Area = 133.365 ac, 58.87% Impervious, Inflow Depth = 5.59" for 100-Year event
Inflow = 267.75 cfs @ 12.78 hrs, Volume= 62.142 af
Primary = 267.75 cfs @ 12.78 hrs, Volume= 62.142 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 51L: Outlet #2 Discharge to Round Lake

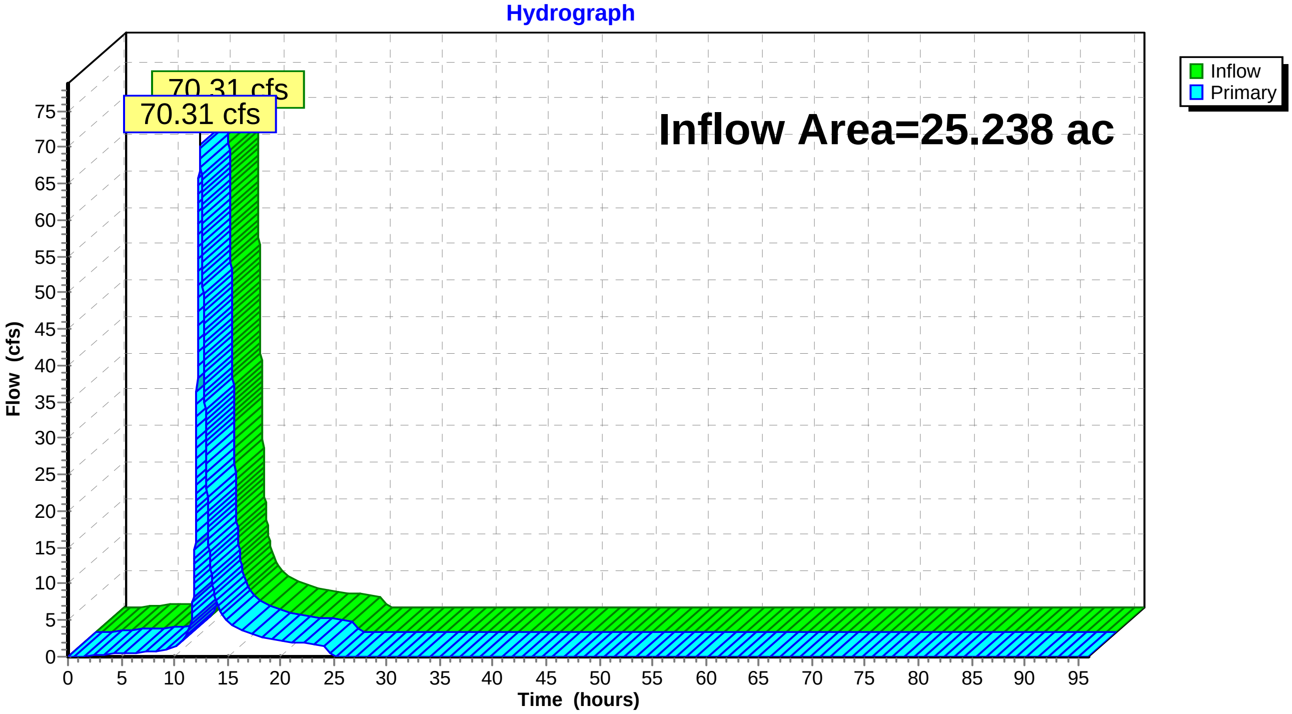


Summary for Link 52L: Outlet #3 Discharge to Round Lake

Inflow Area = 25.238 ac, 19.96% Impervious, Inflow Depth = 4.09" for 100-Year event
Inflow = 70.31 cfs @ 12.43 hrs, Volume= 8.599 af
Primary = 70.31 cfs @ 12.43 hrs, Volume= 8.599 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 52L: Outlet #3 Discharge to Round Lake



Technical Memo

WENCK
ASSOCIATES
Responsive partner.
Exceptional outcomes.

To: Beth Kunkel, Kimley-Horn

From: Pamela Massaro, PE, Wenck Associates, Inc.
Mary Pate-Holt, EIT, Wenck Associates, Inc.
Adam Marsh, EIT, Wenck Associates, Inc.

Date: July 30, 2015

Subject: P8 Water Quality Modeling

1.1 Introduction

The purpose of this technical memorandum is to summarize the stormwater water quality modeling completed using the P8 model as presented in the Comprehensive Stormwater Management Plan (CSMP) submitted to the Rice Creek Watershed District (RCWD) for the portion of the former Twin Cities Army Ammunition Plant (TCAAP) Site being redeveloped by Ramsey County (County), the City of Arden Hills (City), the County's consultants (Kimley Horn, Wenck Associates Inc.), and future Developers. The Site, under 2012 existing conditions, provides few stormwater control structures to reduce discharge rate and just grassy swales as best management practices (BMPs) to improve water quality treatment before stormwater leaves the Site.

1.2 Project Location

The 427-acre site is located in the Ramsey County, Minnesota in the cities of Arden Hills and New Brighton, the Twin Cities Army Ammunitions Plant (TCAAP) is bounded by U.S. Interstate Highway 35 on the west, Minnesota Highway 96 to the south and US Highway 10 to the Southwest (**CSMP Figure 2-1**).

Rice Creek divides the Site into two sections: the portion south of Rice Creek, and the portion north of Rice Creek. The Site drains to both Rice Creek and Round Lake (**CSMP Figure 2-2**). The portion north of Rice Creek is north of County Road H and drains to Rice Creek, the northern two-thirds of the Site south of Rice Creek drains to Rice Creek, and the southern third of the Site south of Rice Creek drains south to Round Lake.

1.3 Water Quality Modeling Scenarios

The Site, under proposed fully developed conditions, will meet RCWD's water quality treatment requirements through a combination of onsite infiltration and wet detention ponds. Hydrology and Hydraulics results are summarized in a separate HydroCAD Modeling technical memorandum. This technical memorandum summarizes the evaluation of phosphorous removal using the P8 water quality model for interim and fully developed conditions at the Site. Wet detention ponds (stand alone and connected in series) hydraulically connected to wetlands (both mitigation and existing), a vegetated swale, and "to be designed" infiltration practices are planned to provide the water quality treatment to reduce the total phosphorous (TP) load from stormwater before discharging to the Resource of Concern (ROC). Dead storage volume, of the wet detention pond, is the most important design parameter influencing the pollutant removal efficiency as it provides runoff storage and water quality treatment between storms. Phosphorous removals were evaluated for several stages of development and various treatment trains by discharge point; Table 1 describes the different model scenarios evaluated by ROC.

Table 1: P8 Modeling Scenarios

Resource of Concern	Development Stage
Round Lake	
Interim Scenario 1	Construction of Spine Road, mitigation wetlands (W-1, W-2), stormwater ponds (P-2, P-4, P-5, P-6), 60" RCP and 36" RCP to Outfall #2 (60" under Hwy 10), and connections to Outfall #1 (24" under Hwy 10) (as shown in CSMP Figure 4-5) The Site's open space is undeveloped and vegetated (CN 74).
Scenario 2	Fully Developed Conditions (CSMP Figure 4-5 with landuse per CSMP Figure 3-1)
Rice Creek	
Interim Scenario 1	Construction of Spine Road, County Road H/I-35W Interchange, remeander of Rice Creek, Old Highway 8 extension Road, mitigation wetlands (W-3, W-4, W-5), stormwater ponds (P-7, P-8, P-9, P-10, P-11, P-12, and P-13), MnDOT ponds (CRH-1, CRH-2, and CRH-3), and vegetated swale (SB-18) connected to P-13 under Spine Road. The Site's open space is undeveloped and vegetated (CN 74).
Interim Scenario 2	Interim Scenario 1 plus stormwater pond (P-14), development east of Spine Road (landuse per CSMP Figure 3-1). Assume there is no development or infiltration device in SB-18 (CSMP Figure 4-7).
Scenario 3	Fully Developed Conditions (CSMP Figure 4-5 with landuse per CSMP Figure 3-1)

Many figures referenced in this technical memorandum are from the CSMP document and referenced as "CSMP Figure X-X".

2.1 P8 Computer Model

P8 (Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds, IEP, Inc., 1990) is a computer model used for predicting the generation and transport of stormwater runoff pollutants in urban watersheds. P8 is a useful diagnostic tool for evaluating and designing watershed improvements like green infrastructure. The model requires user input on watershed characteristics, green infrastructure dimensions, local precipitation and temperature, and water quality parameters.

P8 calculates runoff separately from pervious and impervious areas. Calculations for pervious areas use the Soil Conservation Service (SCS) Curve Number (CN) method. The

CN for pervious areas was 74 and the impervious area CNs was assigned 98 for all scenarios tested. To represent changes in development, the percent impervious was adjusted for the modeling scenarios presented in Table 1.

The percent impervious of scenario 1 (for both resources of concern) was calculated using Table 2 of the HydroCAD Technical Memorandum. In the fully developed conditions (for both resources of concern), the percent impervious was calculated using Table 3 of the HydroCAD Technical Memorandum. The Rice Creek interim scenario 2 model uses the interim percent impervious for subwatershed 18 (Table 2 of the HydroCAD Technical Memorandum) and the full development percent impervious for the rest of the site (Table 3 of the HydroCAD Technical Memorandum). The surface areas of the ponds and wetlands were included in the tributary area directly contributing runoff into each pond (see the Stormwater Pond Data Summary Tables included in the Appendix of the HydroCAD Technical Memorandum). This provides a conservative estimate for the amount of TP removed. Runoff from impervious areas begins once the cumulative storm rainfall exceeds the specified depression storage, with the runoff rate equal to the rainfall intensity.

The ponds in P8 were built using area, volume, and outlet information from HydroCAD. Surface areas were inputted for each pond's bottom, permanent pool, and flood pool. The permanent pool was calculated as the surface area at the primary outlet. The flood pool surface area was calculated at the top contour of the pond. Permanent and flood pool storage for each pond are shown in the Stormwater Pond Data Summary Tables included in the Appendix of the HydroCAD Technical Memorandum. Outlet devices are shown in the Stormwater Pond Data Summary Tables included in the Appendix of the HydroCAD Technical Memorandum

The P8 model uses an hourly precipitation record (rain and snowfall) and daily temperature record. Precipitation and temperature data were obtained from the Minneapolis-St. Paul International Airport. Records from 2001 to 2010 were used for this study. Model results summarized herein are annual averages reported by weight (pounds of TP per year).

Wenck selected the $NURP_{50}$ particle file for the TCAAP study. The component concentrations in the $NURP_{50}$ file represent the 50th percentile (median) values compiled in the US EPA's Nationwide Urban Runoff Program (NURP).

2.2 Proposed Stormwater Treatment

Wenck evaluated the proposed TP loads, by weight, for runoff into Round Lake and Rice Creek/Long Lake at each discharge point were evaluated individually (**CSMP Figures 4-6 and 4-7**). P8, under fully developed conditions, predicts runoff loading from subwatersheds that are directed to stormwater BMPs (e.g., ponds) for treatment. The proposed ponds P-1, P-2, P-3, P-4, P-5, P-6, and wetlands W-1 and W-2 discharge to Round Lake. While proposed ponds P-7, P-8, P-9, P-10, P-11, P-12, P-13, P-14, CRH-1, CHR-2, CHR-3, and wetlands Wi, W-3, W-4, and W-5 discharge to Rice Creek/Long Lake.

2.2.1 Infiltration BMPs

Runoff from the west side of the site (subwatershed 18) and the thumb will be treated by infiltration once the site is fully developed (**CSMP Figure 5-1**, *Areas 3 and 4*). This was modeled in P8, under fully developed conditions, by creating an infiltration basin sized to infiltrate the runoff from the proposed impervious surfaces. For Area 3 on **CSMP Figure 5-1**, the infiltration basin was sized to infiltrate 3.32 acre-ft (1.1 inches) of runoff. For Area 4 on **CSMP Figure 5-1**, the infiltration basin was sized to infiltrate 3.74 acre-ft (1.1 inches) of runoff. The modeled removal efficiency for the proposed ponds reflect the least effective BMP that will be installed. Under interim scenarios 1 and 2, a grassy swale was used as an infiltration treatment device in subwatershed 18. The grassy swale provides 6.15 acre-feet of infiltration volume. The P8 input details for the swale are shown in Table 2.

Table 2: Swale Details

Parameter	Measurement
Flow Path Length	3,400 feet
Flow Path Slope	1%
Bottom Width	4 feet
Side Slope	0.33 ft/ft
Maximum Depth	4.5 feet
Infiltration Rate	0.45 in/hour
Manning’s n	0.15
Infiltration Volume	6.15 acre-feet

2.3 Pollutant Reduction

The Rice Creek Watershed District (RCWD) recommended TP loads (lbs/year) are reduced by at least 50%.

2.3.1 ROC: Rice Creek TP Reductions

The proposed ponding systems will reduce the annual TP load to Rice Creek by 65% under the public infrastructure improvement conditions, aka interim scenario 1 (**Table 3**, total), 55% in worst case, aka interim scenario 2 (**Table 4**, total), and 64% in fully developed conditions, aka scenario 3 (**Table 5**, total). TP load reductions at each discharge point are shown in **Tables 3-5**. The outfall locations and tributary areas are shown in **CSMP Figure 6-5**. Ponds CRH-1 and CRH-3 are not meeting the 50% reduction in annual TP load because they are only 30% designed; these ponds are required to have infiltration if the soil borings indicate infiltration is possible. Results from P8 are provided in **Appendix A**.

Table 3: TP Load Reductions to Rice Creek (Interim Scenario 1: Public Infrastructure Improvements)

Discharge Point	Total TP Inflow Load* (lbs./year)	Total Outflow Load (lbs./year)	% Reduction
Outfall #5 (Pond P-13)	75.3	28.9	62%
Outfall #4 (CRH-1)**	7.1	3.8	46%
Outfall #8 (CRH-3)**	5.4	4.2	22%
Outfall #9 (Thumb with Infiltration BMP)	19.0	1.0	95%
Total	106.8	37.9	**65%**

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for CRH-3 = TP load from CRH-2 + TP load from CRH-3).
** Ponds CRH-1 and CHR-3 are 30% designed.

Table 4: TP Load Reductions to Rice Creek (Interim Scenario 2: Worst Case)

Discharge Point	Total TP Inflow Load* (lbs./year)	Total Outflow Load (lbs./year)	% Reduction
Outfall #5 (Pond P-13)	189.6	91	52%
Outfall #10 (Pond P-14)	18.8	7.1	62%
Outfall #4 (CRH-1)**	8.6	4.9	43%
Outfall #8 (CRH-3)**	4.5	3.4	24%
Outfall #9 (Thumb with Infiltration BMP)	16.8	0.8	95%
Total	238.3	107.2	**55%**

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for CRH-3 = TP load from CRH-2 + TP load from CRH-3).
** Ponds CRH-1 and CHR-3 are 30% designed.

Table 5: TP Load Reductions to Rice Creek (Scenario 3: Fully Developed Conditions)

Discharge Point	Watershed Inflow (lbs./year)	Total Outflow (lbs./year)	% Reduction
Outfall #5 (Pond P-13)	279	99.9	64%
Outfall #10 (Pond P-14)	18.8	7.1	62%
Outfall #4 (CRH-1)**	7.1	3.8	46%
Outfall #8 (CRH-3)**	5.4	4.2	22%
Outfall #9 (Thumb with Infiltration BMP)	13.6	0.4	97%
Total	323.9	115.4	**64%**

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for CRH-3 = TP load from CRH-2 + TP load from CRH-3).
** Ponds CRH-1 and CHR-3 are 30% designed, see text above.

2.3.1 ROC: Round Lake TP Reductions

The proposed ponding systems will reduce the annual TP load to Round Lake by 53% in under the public infrastructure improvement conditions, aka interim scenario 1 (**Table 6**, total) and 60% in fully developed conditions, aka scenario 2 (**Tables 7**, total). TP load reductions at each discharge point are shown in **Tables 6-7**. The outfall locations and tributary areas are shown in **CSMP Figure 6-5**. Results from P8 are provided in **Appendix A**.

Table 6: TP Load Reductions to Round Lake (Interim Scenario 1: Public Infrastructure Improvements)

Discharge Point	Total TP Inflow Load* (lbs./year)	Total Outflow Load (lbs./year)	% Reduction
Outfall #2 (Pond P-3)	36.2	17	53%
Outfall #1 (Pond P-4)	1.7	0.8	53%
Total	37.9	17.8	**53%**

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for Outfall #1 = TP load from Pond 4 + TP load from Wetland 1).

Table 7: TP Load Reductions to Round Lake (Scenario 2: Fully Developed Conditions)

Discharge Point	Total TP Inflow Load* (lbs./year)	Total Outflow Load (lbs./year)	% Reduction
Outfall #2 (Pond P-3)	168.8	66.3	61%
Outfall #1 (Pond P-4)	12.4	6.1	51%
Total	181.2	72.4	**60%**

*The total TP inflow load for each discharge point was calculated by summing the TP loads from each contributing watershed (i.e. total TP inflow load for Outfall #1 = TP load from Pond 4 + TP load from Wetland 1)

3.1 Conclusion

The proposed ponding systems will reduce TP loads from the proposed site conditions by more than 50%, meeting RCWD standards. For runoff into Rice Creek, the TP load is 65% in interim scenario 1, 55% in interim scenario 2, and 64% in scenario 3. The proposed ponding systems will reduce the annual TP load to Round Lake by 53% in interim scenario 1 and 60% in scenario 2.

Appendix A

Round Lake P8 Results
Rice Creek/Long Lake P8 Results

Round Lake P8 Results

Interim Scenario 1

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
06/08/15
Case        Round Lake - Spine Road Only.pFirstDate  01/01/01           Precip(in)
296.7
Title       Round Lake                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576             TotalYrs
9.99


File Directory        T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater Prelim
Design\Models\P8\
Case Title            Round Lake
Case File             Round Lake - Spine Road Only.p8c
Particle File         nurp50.p8p
Temperature File      temp1970-2011.tmp
Storm File            precip1970-2010.pcp
Precip Scale Factor       1

Watersheds                5
Devices                   6
Particles                 5
WQ Components             7

Start Date             06/01/00
Keep Date              01/01/01
Stop Date              12/31/10
Storm Count              598
Total Hours             87576
Wet Hours                9265
Precip (in)              297
Rain (in)                274
Snowfall (in)             23
Snowmelt (in)             22
EvapoTran(in)            303

Overall TSS Removal(%)    1
Water Balance Error(%)    0
TSS Mass Balance Error    0
```

```
P8 Urban Catchment Model, Version 3.5                                    Run Date
06/08/15
Case        Round Lake - Spine Road Only.pFirstDate  01/01/01            Precip(in)
296.7
Title       Round Lake                    LastDate   12/31/10            Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events        598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs     87576             TotalYrs
 9.99


Case Title                      Round Lake
Case Data File                  Round Lake - Spine Road Only.p8c
Path                            T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater
Prelim Design\Models\P8\
Case Notes:                     Round Lake
Ponds 1/2, 5/6, and 3
Storm Data File                 precip1970-2010.pcp
Particle File                   nurp50.p8p
Air Temp File File              temp1970-2011.tmp

Time Steps Per Hour                 8
Minimum Inter-Event Time (hrs)      10
Maximum Continuity Error %          2
Rainfall Breakpoint (inches)       0.8
Precipitation Scale Factor          1
Air Temp Offset (deg-F)             0
Loops Thru Storm File               1
Simulation Dates
Start                             6/1/2000
Keep                              1/1/2001
Stop                            12/31/2010

Max Snowfall Temperature (deg-f)   32.0
SnowMelt Temperature (deg-f)       32.0
Snowmelt Coef (in/degF-Day)        0.06
Soil Freeze Temp (deg-F)           32.0
Snowmelt Abstraction Factor        1.00
Evapo-Trans. Calibration Factor    1.00
Growing Season Start Month          5
Growing Season End Month            10

5-Day Antecedent Rainfall + Runoff (inches)
CN Antecedent Moisture Condition  AMC-II   AMC-III
Growing Season                     1.40      2.10
NonGrowing Season                  0.50      1.10

Watershed Data
Watershed Name                  Subbasins Subbasins Subbasins 3Subbasin 6Subbasin 5
Runoff to Device                  Pond 2  Outfall #2 Pond 5/6  Wetland 1   Pond 4
Infiltration to Device
Watershed Area                     68.5     21.55     43.27      0.1       7.86
SCS Curve Number (Pervious)         74        74        74        74        74
Scale Factor for Pervious Runoff    1         1         1         1         1
Indirectly Connected Imperv Frac    0         0         0         0         0
UnSwept Impervious Fraction        0.07       0        0.19      0.1       0.06
UnSwept Depression Storage (inch   0.02      0.02      0.02      0.02      0.02
UnSwept Imperv. Runoff Coefficie    1         1         1         1         1
UnSwept Scale Factor for Particl    1         1         1         1         1
Swept Impervious Fraction           0         0         0         0         0
Swept Depression Storage (inches   0.02       0        0.02       0         0
Swept Imperv. Runoff Coefficient    1         1         1         1         1
```

```
Swept Scale Factor for Particle     1         1          1         1         1
Sweeping Frequency                  0         0          0        0.5       0.5
Sweeping Efficiency                 1         1          1         1         1
Sweeping Start Date (MMDD)         101       101        101       101       101
Sweeping Stop Date (MMDD)          1231      1231       1231      1231      1231

Device Data
Device Name                       Pond 2   Pond 5/6   Pond 4   Wetland 1 Outfall
#1Outfall #2
Device Type                        POND      POND      POND       POND      PIPE
 PIPE
Infiltration Outlet
Normal Outlet                   Outfall #2Outfall #2Outfall #1 Outfall #1
Spillway Outlet                 Outfall #2Outfall #2Outfall #1 Outfall #1
Particle Removal Scale Factor       1         1          1         1
Bottom Elevation (ft)               0         0          0         0
Bottom Area (acres)               0.095     2.151        0        0.129
Permanent Pool Area (acres)       0.368     2.729      0.266     0.241
Permanent Pool Volume (ac-ft)     0.897     6.8         0.5        0
Perm Pool Infilt Rate (in/hr)       0         0          0         0
Flood Pool Area (acres)           0.637     3.737      0.593      0.38
Flood Pool Volume (ac-ft)         1.005     6.1         0.9       0.2
Flood Pool Infilt Rate (in/hr)      0         0          0         0
Infilt Basin Void Fraction (%)
Detention Pond Outlet Parameters
Outlet Type                      ORIFICE   ORIFICE    ORIFICE   ORIFICE
Outlet Orifice Diameter (in)        6        12         12         6
Orifice Discharge Coef              1         1         0.6       0.6
Outlet Weir Length (ft)
Weir Discharge Coef
Perforated Riser Height (ft)
Number of Holes in Riser
Holes Diameter
Flood Pool Drain Time (hrs)
Swale Parameters
Length of Flow Path (ft)
Slope of Flow Path %
Bottom Width (ft)
Side Slope (ft-v/ft-h)
Maximum Depth of Flow (ft)
Mannings n Constant
Hydraulic Model
Pipe, Splitter, Aquifer Parameter
Hydraulic Res. Time (hrs)                                                    0
  0

Particle Data
Particle File         nurp50.p8p
Particle Class           P0%       P10%      P30%      P50%       P80%
Filtration Efficiency     90       100       100        100       100
Settling Velocity (ft/    0        0.03      0.3        1.5        15
First Order Decay Rate    0         0         0          0         0
2nd Order Decay (1/day    0         0         0          0         0
Impervious Runoff Conc    1         0         0          0         0
Pervious Runoff Conc (    1        100       100        100       200
Pervious Conc Exponent    0         1         1          1         1
Accum. Rate (lbs-ac-da    0        1.75      1.75      1.75       3.5
Particle Removal Rate     0        0.25      0.25      0.25      0.25
Washoff Coefficient       0         20        20         20        20
Washoff Exponent          0         2         2          2         2
Sweeper Efficiency        0         0         0          5         15

Water Quality Component Data
```

```
Component Name           TSS        TP       TKN        CU         PB        ZN
  HC

Water Quality Criteria (ppm)
             Level 1      5       0.025       2          2        0.02       5
 0.1
             Level 2      10       0.05       1       0.0048     0.014     0.0362
 0.5
             Level 3      20       0.1       0.5       0.02       0.15      0.38
  1

Content Scale Factor      1         1         1          1         1         1
  1

Particle Composition (mg/kg)
P0%                       0       99000     600000     13600      2000     640000
250000
P10%                   1000000     3850     15000       340       180       1600
22500
P30%                   1000000     3850     15000       340       180       1600
22500
P50%                   1000000     3850     15000       340       180       1600
22500
P80%                   1000000      0         0         340       180        0
22500
```

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
06/08/15
Case        Round Lake - Spine Road Only.pFirstDate  01/01/01           Precip(in)
296.7
Title       Round Lake                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576             TotalYrs
9.99


Devices Listed in Downstream Order

Device:     Pond 2              Type:     POND
            Discharges normal outlet to   Outfall #2
            Discharges spillway to        Outfall #2
            Runoff from watershed         Subbasins 1, 2, 24

Device:     Pond 5/6            Type:     POND
            Discharges normal outlet to   Outfall #2
            Discharges spillway to        Outfall #2
            Runoff from watershed         Subbasins 3, 4, 25

Device:     Pond 4              Type:     POND
            Discharges normal outlet to   Outfall #1
            Discharges spillway to        Outfall #1
            Runoff from watershed         Subbasin 5

Device:     Wetland 1           Type:     POND
            Discharges normal outlet to   Outfall #1
            Discharges spillway to        Outfall #1
            Runoff from watershed         Subbasin 6

Device:     Outfall #1          Type:     PIPE

Device:     Outfall #2          Type:     PIPE
            Runoff from watershed         Subbasins 7
```

```
P8-V3.X      Round Lake - Spine Road Only.p8c
                                                                            Directly
Connected UnSwept AreasDirectly Connected Swept Areas--Street Sweeping Parameters
                 Total                              PerviousIndirectPervious
Depress          Imperv         Depress          Imperv  Start    Stop
Sweep
Watershed        Area        Outflow      Percol     Curve   Imperv   Load   Imperv
Storage  Runoff   Load   Imperv Storage  Runoff   Load    Date    Date   Sweep
Freq
Label            acres       Device       Device     Number Fraction Factor Fraction
inches   Coef   Factor Fraction inches   Coef   Factor   MMDD    MMDD   Effic
1/week
Subbasins 1,     68.5        Pond 2                    74    0.000     1      0.07
 0.02     1       1       0      0.02     1       1      101     1231     1       0
Subbasins 7      21.55     Outfall #2                  74    0.000     1       0
 0.02     1       1       0       0       1       1      101     1231     1       0
Subbasins 3,     43.27      Pond 5/6                   74    0.000     1      0.19
 0.02     1       1       0      0.02     1       1      101     1231     1       0
Subbasin 6        0.1       Wetland 1                  74    0.000     1      0.1
 0.02     1       1       0       0       1       1      101     1231     1      0.5
Subbasin 5       7.86        Pond 4                    74    0.000     1      0.06
 0.02     1       1       0       0       1       1      101     1231     1      0.5
```

```
P8 Urban Catchment Model, Version 3.5
 Run Date   06/08/15
Case                Round Lake - Spine Road Only.p8c FirstDate   01/01/01
 Precip(in)  296.7
Title               Round Lake                       LastDate    12/31/10
 Rain(in)    273.57
PrecFile            precip1970-2010.pcp              Events         598
 Snow(in)    23.12
PartFile            nurp50.p8p                       TotalHrs      87576
 TotalYrs     9.99


Mass Balances by Device and Variable

Device: OVERALL                Type: NONE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     524.83       0.07   111293.3    11140.0      78.02
06 normal outlet         524.83       0.07    17335.7     1735.2      12.15
08 sedimen + decay         0.00       0.00    93957.1     9404.7
09 total inflow          524.83       0.07   111293.3    11140.0      78.02
10 surface outflow       524.83       0.07    17335.7     1735.2      12.15
12 total outflow         524.83       0.07    17335.7     1735.2      12.15
13 total trapped           0.00       0.00    93957.1     9404.7
14 storage increase        0.00       0.00        0.4        0.0
15 mass balance chec      0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       84.4       84.4

Device: OVERALL                Type: NONE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     524.83       0.07      398.3       39.9       0.28
06 normal outlet         524.83       0.07      197.6       19.8       0.14
08 sedimen + decay         0.00       0.00      200.4       20.1
09 total inflow          524.83       0.07      398.3       39.9       0.28
10 surface outflow       524.83       0.07      197.6       19.8       0.14
12 total outflow         524.83       0.07      197.6       19.8       0.14
13 total trapped           0.00       0.00      200.4       20.1
14 storage increase        0.00       0.00        0.3        0.0
15 mass balance chec      0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       50.3       50.3

Device: Pond 2                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     215.76       0.03    43357.2     4339.9      73.93
06 normal outlet         192.85       0.03     5629.3      563.5      10.74
07 spillway outlet        22.92       0.00     4146.3      415.0      66.56
08 sedimen + decay         0.00       0.00    33581.5     3361.4
09 total inflow          215.76       0.03    43357.2     4339.9      73.93
10 surface outflow       215.76       0.03     9775.5      978.5      16.67
12 total outflow         215.76       0.03     9775.5      978.5      16.67
13 total trapped           0.00       0.00    33581.5     3361.4
14 storage increase        0.00       0.00        0.2        0.0
15 mass balance chec      0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       77.5       77.5

Device: Pond 2                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     215.76       0.03      158.2       15.8       0.27
06 normal outlet         192.85       0.03       73.1        7.3       0.14
07 spillway outlet        22.92       0.00       19.6        2.0       0.32
```

```
08 sedimen + decay         0.00       0.00       65.5        6.6
09 total inflow          215.76       0.03      158.2       15.8       0.27
10 surface outflow       215.76       0.03       92.7        9.3       0.16
12 total outflow         215.76       0.03       92.7        9.3       0.16
13 total trapped           0.00       0.00       65.5        6.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       41.4       41.4

Device: Pond 5/6               Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     251.16       0.03    58858.8     5891.5      86.22
06 normal outlet         251.16       0.03     2603.8      260.6       3.81
08 sedimen + decay         0.00       0.00    56254.7     5630.9
09 total inflow          251.16       0.03    58858.8     5891.5      86.22
10 surface outflow       251.16       0.03     2603.8      260.6       3.81
12 total outflow         251.16       0.03     2603.8      260.6       3.81
13 total trapped           0.00       0.00    56254.7     5630.9
14 storage increase        0.00       0.00        0.3        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       95.6       95.6

Device: Pond 5/6               Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     251.16       0.03      203.5       20.4       0.30
06 normal outlet         251.16       0.03       77.2        7.7       0.11
08 sedimen + decay         0.00       0.00      126.0       12.6
09 total inflow          251.16       0.03      203.5       20.4       0.30
10 surface outflow       251.16       0.03       77.2        7.7       0.11
12 total outflow         251.16       0.03       77.2        7.7       0.11
13 total trapped           0.00       0.00      126.0       12.6
14 storage increase        0.00       0.00        0.3        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       61.9       61.9

Device: Pond 4                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      23.02       0.00     4498.6      450.3      71.90
06 normal outlet          23.02       0.00      457.3       45.8       7.31
08 sedimen + decay         0.00       0.00     4041.3      404.5
09 total inflow           23.02       0.00     4498.6      450.3      71.90
10 surface outflow        23.02       0.00      457.3       45.8       7.31
12 total outflow          23.02       0.00      457.3       45.8       7.31
13 total trapped           0.00       0.00     4041.3      404.5
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       89.8       89.8

Device: Pond 4                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      23.02       0.00       16.6        1.7       0.27
06 normal outlet          23.02       0.00        7.9        0.8       0.13
08 sedimen + decay         0.00       0.00        8.7        0.9
09 total inflow           23.02       0.00       16.6        1.7       0.27
10 surface outflow        23.02       0.00        7.9        0.8       0.13
12 total outflow          23.02       0.00        7.9        0.8       0.13
13 total trapped           0.00       0.00        8.7        0.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
```

```
Reduction (%)              0.00       0.00       52.3       52.3

Device: Wetland 1             Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows       0.38       0.00       81.5        8.2      78.61
06 normal outlet           0.38       0.00        1.9        0.2       1.87
08 sedimen + decay         0.00       0.00       79.5        8.0
09 total inflow            0.38       0.00       81.5        8.2      78.61
10 surface outflow         0.38       0.00        1.9        0.2       1.87
12 total outflow           0.38       0.00        1.9        0.2       1.87
13 total trapped           0.00       0.00       79.5        8.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       97.6       97.6

Device: Wetland 1             Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows       0.38       0.00        0.3        0.0       0.28
06 normal outlet           0.38       0.00        0.1        0.0       0.11
08 sedimen + decay         0.00       0.00        0.2        0.0
09 total inflow            0.38       0.00        0.3        0.0       0.28
10 surface outflow         0.38       0.00        0.1        0.0       0.11
12 total outflow           0.38       0.00        0.1        0.0       0.11
13 total trapped           0.00       0.00        0.2        0.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       62.1       62.1

Device: Outfall #1            Type: PIPE                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device        23.40       0.00      459.2       46.0       7.22
06 normal outlet          23.40       0.00      459.2       46.0       7.22
09 total inflow           23.40       0.00      459.2       46.0       7.22
10 surface outflow        23.40       0.00      459.2       46.0       7.22
12 total outflow          23.40       0.00      459.2       46.0       7.22
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #1            Type: PIPE                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device        23.40       0.00        8.0        0.8       0.13
06 normal outlet          23.40       0.00        8.0        0.8       0.13
09 total inflow           23.40       0.00        8.0        0.8       0.13
10 surface outflow        23.40       0.00        8.0        0.8       0.13
12 total outflow          23.40       0.00        8.0        0.8       0.13
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #2            Type: PIPE                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      34.51       0.00     4497.2      450.1      47.95
02 upstream device       466.92       0.06    12379.3     1239.1       9.75
06 normal outlet         501.43       0.07    16876.5     1689.3      12.38
09 total inflow          501.43       0.07    16876.5     1689.3      12.38
10 surface outflow       501.43       0.07    16876.5     1689.3      12.38
12 total outflow         501.43       0.07    16876.5     1689.3      12.38
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #2            Type: PIPE                      Variable: TP
```

```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      34.51       0.00       19.7         2.0      0.21
02 upstream device       466.92       0.06      169.9        17.0      0.13
06 normal outlet         501.43       0.07      189.6        19.0      0.14
09 total inflow          501.43       0.07      189.6        19.0      0.14
10 surface outflow       501.43       0.07      189.6        19.0      0.14
12 total outflow         501.43       0.07      189.6        19.0      0.14
15 mass balance chec       0.00       0.00        0.0         0.0
Reduction (%)              0.00       0.00        0.0         0.0
```

Round Lake P8 Results
Scenario 2: Fully Developed Conditions

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
06/08/15
Case        Round Lake.p8c                FirstDate  01/01/01           Precip(in)
296.7
Title       Round Lake                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576             TotalYrs
9.99


File Directory        T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater Prelim
Design\Models\P8\
Case Title            Round Lake
Case File             Round Lake.p8c
Particle File         nurp50.p8p
Temperature File      temp1970-2011.tmp
Storm File            precip1970-2010.pcp
Precip Scale Factor       1

Watersheds                5
Devices                   7
Particles                 5
WQ Components             7

Start Date             06/01/00
Keep Date              01/01/01
Stop Date              12/31/10
Storm Count              598
Total Hours             87576
Wet Hours                9265
Precip (in)              297
Rain (in)                274
Snowfall (in)             23
Snowmelt (in)             22
EvapoTran(in)            303

Overall TSS Removal(%)    1
Water Balance Error(%)    0
TSS Mass Balance Error    0
```

```
P8 Urban Catchment Model, Version 3.5                                    Run Date
06/08/15
Case        Round Lake.p8c                FirstDate  01/01/01            Precip(in)
296.7
Title       Round Lake                    LastDate   12/31/10            Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events        598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs     87576             TotalYrs
 9.99


Case Title                      Round Lake
Case Data File                  Round Lake.p8c
Path                            T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater
Prelim Design\Models\P8\
Case Notes:                     Round Lake
Ponds 1/2, 5/6, and 3
Storm Data File                 precip1970-2010.pcp
Particle File                   nurp50.p8p
Air Temp File File              temp1970-2011.tmp

Time Steps Per Hour                 8
Minimum Inter-Event Time (hrs)      10
Maximum Continuity Error %          2
Rainfall Breakpoint (inches)       0.8
Precipitation Scale Factor          1
Air Temp Offset (deg-F)             0
Loops Thru Storm File               1
Simulation Dates
Start                            6/1/2000
Keep                             1/1/2001
Stop                            12/31/2010

Max Snowfall Temperature (deg-f)   32.0
SnowMelt Temperature (deg-f)       32.0
Snowmelt Coef (in/degF-Day)        0.06
Soil Freeze Temp (deg-F)           32.0
Snowmelt Abstraction Factor        1.00
Evapo-Trans. Calibration Factor    1.00
Growing Season Start Month          5
Growing Season End Month            10

5-Day Antecedent Rainfall + Runoff (inches)
CN Antecedent Moisture Condition  AMC-II   AMC-III
Growing Season                     1.40      2.10
NonGrowing Season                  0.50      1.10

Watershed Data
Watershed Name                  Watershed Watershed Watershed 5Subbasin 6Subbasin 5
Runoff to Device                 Pond 1/2   Pond 3   Pond 5/6  Wetland 1   Pond 4
Infiltration to Device
Watershed Area                     68.5     21.55      43.27     0.997     7.853
SCS Curve Number (Pervious)         74        74        74         74        74
Scale Factor for Pervious Runoff    1         1          1         1         1
Indirectly Connected Imperv Frac    0         0          0         0         0
UnSwept Impervious Fraction        0.58      0.85      0.47      0.2447    0.7037
UnSwept Depression Storage (inch   0.02      0.02      0.02       0.02      0.02
UnSwept Imperv. Runoff Coefficie    1         1          1         1         1
UnSwept Scale Factor for Particl    1         1          1         1         1
Swept Impervious Fraction           0         0          0         0         0
Swept Depression Storage (inches   0.02      0.02      0.02        0         0
Swept Imperv. Runoff Coefficient    1         1          1         1         1
```

```
Swept Scale Factor for Particle     1         1          1         1         1
Sweeping Frequency                  0         0          0       0.5       0.5
Sweeping Efficiency                 1         1          1         1         1
Sweeping Start Date (MMDD)         101       101        101       101       101
Sweeping Stop Date (MMDD)          1231      1231       1231      1231      1231

Device Data
Device Name                      Pond 1/2   Pond 3   Pond 5/6    Pond 4  Wetland 1
Outfall #1Outfall #2
Device Type                        POND      POND      POND       POND      POND
 PIPE      PIPE
Infiltration Outlet
Normal Outlet                     Pond 3  Outfall #2  Pond 3   Outfall #1Outfall #1
Spillway Outlet                   Pond 3  Outfall #2  Pond 3   Outfall #1Outfall #1
Particle Removal Scale Factor       1         1          1         1         1
Bottom Elevation (ft)               0         0          0         0         0
Bottom Area (acres)               0.865     1.401      2.151       0       0.129
Permanent Pool Area (acres)       1.295      2.27      2.729     0.266     0.241
Permanent Pool Volume (ac-ft)      4.3       7.4        6.8       0.5        0
Perm Pool Infilt Rate (in/hr)       0         0          0         0         0
Flood Pool Area (acres)           1.539     3.678      3.737     0.593      0.38
Flood Pool Volume (ac-ft)          2.4       16.3       6.1       0.9       0.3
Flood Pool Infilt Rate (in/hr)      0         0          0         0         0
Infilt Basin Void Fraction (%)
Detention Pond Outlet Parameters
Outlet Type                      ORIFICE   ORIFICE    ORIFICE   ORIFICE   ORIFICE
Outlet Orifice Diameter (in)        6         12        12        12         6
Orifice Discharge Coef              1         1          1        0.6       0.6
Outlet Weir Length (ft)
Weir Discharge Coef
Perforated Riser Height (ft)
Number of Holes in Riser
Holes Diameter
Flood Pool Drain Time (hrs)
Swale Parameters
Length of Flow Path (ft)
Slope of Flow Path %
Bottom Width (ft)
Side Slope (ft-v/ft-h)
Maximum Depth of Flow (ft)
Mannings n Constant
Hydraulic Model
Pipe, Splitter, Aquifer Parameter
Hydraulic Res. Time (hrs)
  0         0

Particle Data
Particle File         nurp50.p8p
Particle Class           P0%       P10%      P30%      P50%       P80%
Filtration Efficiency     90       100       100        100       100
Settling Velocity (ft/    0        0.03      0.3        1.5        15
First Order Decay Rate    0         0         0          0         0
2nd Order Decay (1/day    0         0         0          0         0
Impervious Runoff Conc    1         0         0          0         0
Pervious Runoff Conc (    1        100       100        100       200
Pervious Conc Exponent    0         1         1          1         1
Accum. Rate (lbs-ac-da    0        1.75      1.75       1.75      3.5
Particle Removal Rate     0        0.25      0.25      0.25       0.25
Washoff Coefficient       0         20        20        20         20
Washoff Exponent          0         2         2          2         2
Sweeper Efficiency        0         0         0          5         15

Water Quality Component Data
```

```
Component Name            TSS         TP        TKN         CU          PB         ZN
  HC

Water Quality Criteria (ppm)
             Level 1       5        0.025        2           2         0.02         5
 0.1
             Level 2       10        0.05        1        0.0048      0.014      0.0362
 0.5
             Level 3       20        0.1        0.5        0.02        0.15       0.38
  1

Content Scale Factor       1          1          1           1          1          1
  1

Particle Composition (mg/kg)
P0%                        0        99000     600000      13600       2000      640000
250000
P10%                    1000000      3850      15000        340        180        1600
22500
P30%                    1000000      3850      15000        340        180        1600
22500
P50%                    1000000      3850      15000        340        180        1600
22500
P80%                    1000000       0          0          340        180          0
22500
```

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
06/08/15
Case        Round Lake.p8c                FirstDate  01/01/01           Precip(in)
296.7
Title       Round Lake                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576             TotalYrs
9.99


Devices Listed in Downstream Order

Device:     Pond 1/2            Type:     POND
            Discharges normal outlet to   Pond 3
            Discharges spillway to        Pond 3
            Runoff from watershed         Watershed 1/2

Device:     Pond 5/6            Type:     POND
            Discharges normal outlet to   Pond 3
            Discharges spillway to        Pond 3
            Runoff from watershed         Watershed 5/6

Device:     Pond 3              Type:     POND
            Discharges normal outlet to   Outfall #2
            Discharges spillway to        Outfall #2
            Runoff from watershed         Watershed 3

Device:     Pond 4              Type:     POND
            Discharges normal outlet to   Outfall #1
            Discharges spillway to        Outfall #1
            Runoff from watershed         Subbasin 5

Device:     Wetland 1           Type:     POND
            Discharges normal outlet to   Outfall #1
            Discharges spillway to        Outfall #1
            Runoff from watershed         Subbasin 6

Device:     Outfall #1          Type:     PIPE

Device:     Outfall #2          Type:     PIPE
```

```
P8-V3.X      Round Lake.p8c
                                                                             Directly
Connected UnSwept AreasDirectly Connected Swept Areas--Street Sweeping Parameters
                 Total                              PerviousIndirectPervious
Depress          Imperv         Depress          Imperv  Start    Stop
Sweep
Watershed        Area        Outflow      Percol     Curve   Imperv   Load   Imperv
Storage  Runoff   Load   Imperv Storage  Runoff   Load    Date    Date   Sweep
Freq
Label            acres       Device       Device     Number Fraction Factor Fraction
inches   Coef   Factor Fraction inches   Coef    Factor   MMDD    MMDD   Effic
1/week
Watershed 1/2    68.5       Pond 1/2                   74    0.000     1      0.58
 0.02     1       1       0      0.02      1       1      101      1231     1       0
Watershed 3      21.55       Pond 3                    74    0.000     1      0.85
 0.02     1       1       0      0.02      1       1      101      1231     1       0
Watershed 5/6    43.27      Pond 5/6                   74    0.000     1      0.47
 0.02     1       1       0      0.02      1       1      101      1231     1       0
Subbasin 6       0.997      Wetland 1                  74    0.000     1     0.2447
 0.02     1       1       0       0        1       1      101      1231     1     0.5
Subbasin 5       7.853       Pond 4                    74    0.000     1     0.7037
 0.02     1       1       0       0        1       1      101      1231     1     0.5
```

```
P8 Urban Catchment Model, Version 3.5
 Run Date   06/08/15
Case                Round Lake.p8c                   FirstDate   01/01/01
 Precip(in)  296.7
Title               Round Lake                       LastDate    12/31/10
 Rain(in)    273.57
PrecFile            precip1970-2010.pcp              Events         598
 Snow(in)    23.12
PartFile            nurp50.p8p                       TotalHrs     87576
 TotalYrs     9.99


Mass Balances by Device and Variable

Device: OVERALL                Type: NONE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    2089.33       0.29   539726.0    54024.4      95.04
06 normal outlet        2089.33       0.29    42179.9     4222.0       7.43
08 sedimen + decay         0.00       0.00   497542.0    49801.9
09 total inflow         2089.33       0.29   539726.0    54024.4      95.04
10 surface outflow      2089.33       0.29    42179.9     4222.0       7.43
12 total outflow        2089.33       0.29    42179.9     4222.0       7.43
13 total trapped           0.00       0.00   497542.0    49801.9
14 storage increase        0.00       0.00        3.7        0.4
15 mass balance chec       0.00       0.00        0.3        0.0
Reduction (%)              0.00       0.00       92.2       92.2

Device: OVERALL                Type: NONE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    2089.33       0.29     1809.0      181.1       0.32
06 normal outlet        2089.33       0.29      723.4       72.4       0.13
08 sedimen + decay         0.00       0.00     1085.5      108.7
09 total inflow         2089.33       0.29     1809.0      181.1       0.32
10 surface outflow      2089.33       0.29      723.4       72.4       0.13
12 total outflow        2089.33       0.29      723.4       72.4       0.13
13 total trapped           0.00       0.00     1085.5      108.7
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       60.0       60.0

Device: Pond 1/2               Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     988.60       0.14   255096.9    25534.2      94.94
06 normal outlet         815.77       0.11    28710.8     2873.8      12.95
07 spillway outlet       172.83       0.02    11334.5     1134.5      24.13
08 sedimen + decay         0.00       0.00   215049.7    21525.6
09 total inflow          988.60       0.14   255096.9    25534.2      94.94
10 surface outflow       988.60       0.14    40045.3     4008.4      14.90
12 total outflow         988.60       0.14    40045.3     4008.4      14.90
13 total trapped           0.00       0.00   215049.7    21525.6
14 storage increase        0.00       0.00        1.9        0.2
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       84.3       84.3

Device: Pond 1/2               Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     988.60       0.14      855.3       85.6       0.32
06 normal outlet         815.77       0.11      328.6       32.9       0.15
07 spillway outlet       172.83       0.02       87.6        8.8       0.19
```

```
08 sedimen + decay         0.00       0.00      439.1       43.9
09 total inflow          988.60       0.14      855.3       85.6       0.32
10 surface outflow       988.60       0.14      416.2       41.7       0.15
12 total outflow         988.60       0.14      416.2       41.7       0.15
13 total trapped           0.00       0.00      439.1       43.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       51.3       51.3

Device: Pond 5/6               Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     519.18       0.07   132290.9    13241.8      93.75
06 normal outlet         519.18       0.07     8669.8      867.8       6.14
08 sedimen + decay         0.00       0.00   123620.4    12373.9
09 total inflow          519.18       0.07   132290.9    13241.8      93.75
10 surface outflow       519.18       0.07     8669.8      867.8       6.14
12 total outflow         519.18       0.07     8669.8      867.8       6.14
13 total trapped           0.00       0.00   123620.4    12373.9
14 storage increase        0.00       0.00        0.7        0.1
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       93.4       93.4

Device: Pond 5/6               Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     519.18       0.07      445.3       44.6       0.32
06 normal outlet         519.18       0.07      172.7       17.3       0.12
08 sedimen + decay         0.00       0.00      272.5       27.3
09 total inflow          519.18       0.07      445.3       44.6       0.32
10 surface outflow       519.18       0.07      172.7       17.3       0.12
12 total outflow         519.18       0.07      172.7       17.3       0.12
13 total trapped           0.00       0.00      272.5       27.3
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       61.2       61.2

Device: Pond 3                 Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     439.73       0.06   115518.8    11563.0      96.65
02 upstream device      1507.78       0.21    48715.1     4876.2      11.89
06 normal outlet        1947.51       0.27    36008.9     3604.3       6.80
08 sedimen + decay         0.00       0.00   128224.0    12834.7
09 total inflow         1947.51       0.27   164233.9    16439.1      31.03
10 surface outflow      1947.51       0.27    36008.9     3604.3       6.80
12 total outflow        1947.51       0.27    36008.9     3604.3       6.80
13 total trapped           0.00       0.00   128224.0    12834.7
14 storage increase        0.00       0.00        1.0        0.1
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       78.1       78.1

Device: Pond 3                 Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     439.73       0.06      385.2       38.6       0.32
02 upstream device      1507.78       0.21      588.9       58.9       0.14
06 normal outlet        1947.51       0.27      662.0       66.3       0.13
08 sedimen + decay         0.00       0.00      312.1       31.2
09 total inflow         1947.51       0.27      974.1       97.5       0.18
10 surface outflow      1947.51       0.27      662.0       66.3       0.13
12 total outflow        1947.51       0.27      662.0       66.3       0.13
13 total trapped           0.00       0.00      312.1       31.2
```

```
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       32.0       32.0

Device: Pond 4                 Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     134.82       0.02    35132.6     3516.6      95.87
06 normal outlet         134.82       0.02     6022.7      602.8      16.44
08 sedimen + decay         0.00       0.00    29109.8     2913.8
09 total inflow          134.82       0.02    35132.6     3516.6      95.87
10 surface outflow       134.82       0.02     6022.7      602.8      16.44
12 total outflow         134.82       0.02     6022.7      602.8      16.44
13 total trapped           0.00       0.00    29109.8     2913.8
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       82.9       82.9

Device: Pond 4                 Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     134.82       0.02      117.4       11.8       0.32
06 normal outlet         134.82       0.02       58.9        5.9       0.16
08 sedimen + decay         0.00       0.00       58.5        5.9
09 total inflow          134.82       0.02      117.4       11.8       0.32
10 surface outflow       134.82       0.02       58.9        5.9       0.16
12 total outflow         134.82       0.02       58.9        5.9       0.16
13 total trapped           0.00       0.00       58.5        5.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       49.8       49.8

Device: Wetland 1              Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows       6.99       0.00     1686.7      168.8      88.74
06 normal outlet           6.99       0.00      148.3       14.8       7.80
08 sedimen + decay         0.00       0.00     1538.2      154.0
09 total inflow            6.99       0.00     1686.7      168.8      88.74
10 surface outflow         6.99       0.00      148.3       14.8       7.80
12 total outflow           6.99       0.00      148.3       14.8       7.80
13 total trapped           0.00       0.00     1538.2      154.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.3        0.0
Reduction (%)              0.00       0.00       91.2       91.2

Device: Wetland 1              Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows       6.99       0.00        5.8        0.6       0.30
06 normal outlet           6.99       0.00        2.4        0.2       0.13
08 sedimen + decay         0.00       0.00        3.3        0.3
09 total inflow            6.99       0.00        5.8        0.6       0.30
10 surface outflow         6.99       0.00        2.4        0.2       0.13
12 total outflow           6.99       0.00        2.4        0.2       0.13
13 total trapped           0.00       0.00        3.3        0.3
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       57.6       57.6

Device: Outfall #1             Type: PIPE                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
```

```
02 upstream device       141.82       0.02     6171.0      617.7      16.01
06 normal outlet         141.82       0.02     6171.0      617.7      16.01
09 total inflow          141.82       0.02     6171.0      617.7      16.01
10 surface outflow       141.82       0.02     6171.0      617.7      16.01
12 total outflow         141.82       0.02     6171.0      617.7      16.01
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #1             Type: PIPE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device       141.82       0.02       61.4        6.1       0.16
06 normal outlet         141.82       0.02       61.4        6.1       0.16
09 total inflow          141.82       0.02       61.4        6.1       0.16
10 surface outflow       141.82       0.02       61.4        6.1       0.16
12 total outflow         141.82       0.02       61.4        6.1       0.16
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #2             Type: PIPE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      1947.51       0.27    36008.9     3604.3       6.80
06 normal outlet        1947.51       0.27    36008.9     3604.3       6.80
09 total inflow         1947.51       0.27    36008.9     3604.3       6.80
10 surface outflow      1947.51       0.27    36008.9     3604.3       6.80
12 total outflow        1947.51       0.27    36008.9     3604.3       6.80
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #2             Type: PIPE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      1947.51       0.27      662.0       66.3       0.13
06 normal outlet        1947.51       0.27      662.0       66.3       0.13
09 total inflow         1947.51       0.27      662.0       66.3       0.13
10 surface outflow      1947.51       0.27      662.0       66.3       0.13
12 total outflow        1947.51       0.27      662.0       66.3       0.13
Reduction (%)              0.00       0.00        0.0        0.0
```

Rice Creek P8 Results

Interim Scenario 1

```
P8 Urban Catchment Model, Version 3.5                                  Run Date
07/30/15
Case        Rice Creek Spine Road.p8c     FirstDate  01/01/01          Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10          Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598             Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576            TotalYrs
9.99


File Directory        T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater Prelim
Design\CSMP_Final\Appendix A P8\P8\
Case Title            Rice Creek
Case File             Rice Creek Spine Road.p8c
Particle File         nurp50.p8p
Temperature File      temp1970-2011.tmp
Storm File            precip1970-2010.pcp
Precip Scale Factor       1

Watersheds                16
Devices                   19
Particles                 5
WQ Components             7

Start Date              06/01/00
Keep Date               01/01/01
Stop Date               12/31/10
Storm Count               598
Total Hours             87576
Wet Hours                9265
Precip (in)               297
Rain (in)                 274
Snowfall (in)              23
Snowmelt (in)              22
EvapoTran(in)             303

Overall TSS Removal(%)    1
Water Balance Error(%)    0
TSS Mass Balance Error    0
```

```
P8 Urban Catchment Model, Version 3.5                                    Run Date
07/30/15
Case        Rice Creek Spine Road.p8c     FirstDate  01/01/01            Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10            Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events        598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs     87576             TotalYrs
 9.99


Case Title                      Rice Creek
Case Data File                  Rice Creek Spine Road.p8c
Path                            T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater
Prelim Design\CSMP_Final\Appendix A P8\P8\
Case Notes:                     Spine Road Only
Storm Data File                 precip1970-2010.pcp
Particle File                   nurp50.p8p
Air Temp File File              temp1970-2011.tmp

Time Steps Per Hour                 4
Minimum Inter-Event Time (hrs)      10
Maximum Continuity Error %          2
Rainfall Breakpoint (inches)       0.8
Precipitation Scale Factor          1
Air Temp Offset (deg-F)             0
Loops Thru Storm File               1
Simulation Dates
Start                            6/1/2000
Keep                             1/1/2001
Stop                            12/31/2010

Max Snowfall Temperature (deg-f)   32.0
SnowMelt Temperature (deg-f)       32.0
Snowmelt Coef (in/degF-Day)        0.06
Soil Freeze Temp (deg-F)           32.0
Snowmelt Abstraction Factor        1.00
Evapo-Trans. Calibration Factor    1.00
Growing Season Start Month          5
Growing Season End Month            10

5-Day Antecedent Rainfall + Runoff (inches)
CN Antecedent Moisture Condition  AMC-II   AMC-III
Growing Season                     1.40      2.10
NonGrowing Season                  0.50      1.10

Watershed Data
Watershed Name                     SB 8     SB 10      SB 9      SB 12     SB 11
SB 14     SB 13     SB 18   SB 15, 16,  SB 17   Inflow fro  SB 19     SB 28     SB
29       1S    SB 22 and 27
Runoff to Device                  Pond 7    Pond 8    Pond 9    Pond 10   Pond 11
Pond 12  Wetland 4 SB 18 Swal Pond 13  Wetland 5 Wetland 3 Outfall #4  CHR-1
CRH-2     CRH-3   Thumb Infiltration
Infiltration to Device
Watershed Area                    29.69      6.39      25.78      1.39      3.29
10.23      2.98     52.79    105.345    7.608     4.311     21.19     6.955
10.214    1.601     48.539
SCS Curve Number (Pervious)         74        74        74         74        74
  74        74        74        74        74        74        74        74        74
       74        80
Scale Factor for Pervious Runoff    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
```

```
       1         1
Indirectly Connected Imperv Frac    0         0          0         0         0
  0         0         0         0         0         0         0         0         0
       0         0
UnSwept Impervious Fraction       0.0551     0.05     0.0012     0.2098    0.3678
 0.16     0.2617      0       0.1517    0.4841    0.1861      0       0.4676
0.3773    0.3198    0.1138
UnSwept Depression Storage (inch   0.02      0.02      0.02       0.02      0.02
 0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.02
0.02      0.02      0.02
UnSwept Imperv. Runoff Coefficie    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
UnSwept Scale Factor for Particl    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Swept Impervious Fraction           0         0          0         0         0
  0         0         0         0         0         0         0         0         0
       0         0
Swept Depression Storage (inches   0.02      0.02      0.02       0.02      0.02
 0.02      0.02       0        0.02      0.02       0        0.02       0         0
       0        0.02
Swept Imperv. Runoff Coefficient    1         1          1         1         1
  1         1         1         1         1         1         1         1         0
       1         1
Swept Scale Factor for Particle     1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Sweeping Frequency                 0.5       0.5        0.5       0.5       0.5
 0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5
      0.5       0.5
Sweeping Efficiency                 1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Sweeping Start Date (MMDD)         101       101        101       101       101
 101       101       101       101       101       101       101       101       101
      101       101
Sweeping Stop Date (MMDD)          1231      1231      1231       1231      1231
 1231      1231      1231      1231      1231      1231      1231      1231
1231      1231      1231

Device Data
Device Name                      Pond 7    Pond 8    Pond 9    Pond 10   Pond 11
Pond 12   Pond 13  Outfall #4Wetland 4 Wetland 5 Outfall #5Wetland 3 Wetland 2
CHR-1     CRH-2   To Rice Cr  CRH-3   SB 18 SwalThumb Infiltration
Device Type                       POND      POND      POND       POND      POND
 POND      POND      PIPE      POND      POND      PIPE      POND      POND
POND      POND      PIPE      POND   INF_BASIN INF_BASIN
Infiltration Outlet
Normal Outlet                    Pond 9   Pond 10    Pond 11   Pond 12   Pond 10
Pond 13  Outfall #5To Rice Cr Pond 12           To Rice Cr  Pond 9  Wetland 3 To
Rice Cr  CRH-3            To Rice Creek
Spillway Outlet                  Pond 9   Pond 10    Pond 11   Pond 12   Pond 10
Pond 13  Outfall #5          Pond 12                        Pond 9  Wetland 3 To
Rice Cr  CRH-3            To Rice Cr Pond 13  To Rice Creek
Particle Removal Scale Factor       1         1          1         1         1
  1         1                   1         1                    1         1         1
       1                   1         1         1
Bottom Elevation (ft)               0         0          0         0         0
  0         0                   0         0                    0         0         0
       0                   0         0         0
Bottom Area (acres)              0.143     0.057      0.024      0.13      0.97
 1.2       0.02                0         0                 2.157     2.157
```

```
0.15      0.2                 0.15       0         0
Permanent Pool Area (acres)       0.548      0.26      0.41      0.288      1.32
 1.64     1.988                 0         0                 2.355      2.18
0.225      0.35               0.225
Permanent Pool Volume (ac-ft)       1        0.6        0.5       0.8       4.5
 5.7       6.2                  0         0                   0         0
0.187     0.412               0.187
Perm Pool Infilt Rate (in/hr)       0         0          0         0         0
  0         0                   0         0                   0         0         0
       0                  0
Flood Pool Area (acres)           0.723     0.669      0.75       0.61      2.11
 2.38      4.03               1.891     1.891               2.653     2.591      0.5
      0.6                 0.5       0.31      3.74
Flood Pool Volume (ac-ft)          0.5       0.9        0.4       1.1       6.6
 5.3       8.1                 2.5       5.8                 2.6       1.2
0.663     1.188               0.663      6.15      3.74
Flood Pool Infilt Rate (in/hr)      0         0          0         0         0
  0         0                   0         0                   0         0         0
       0                  0        0.45      0.45
Infilt Basin Void Fraction (%)

                                    100       100
Detention Pond Outlet Parameters
Outlet Type                        WEIR    ORIFICE     WEIR       WEIR    ORIFICE
ORIFICE     WEIR              ORIFICE   ORIFICE             ORIFICE   ORIFICE
ORIFICE   ORIFICE             ORIFICE
Outlet Orifice Diameter (in)                  24                             12
  12                            12        6                   12        12        24
       24                 24
Orifice Discharge Coef                        1                             0.6
 0.6                           0.6       0.6                 0.6       0.6       0.6
      0.6                 0.6
Outlet Weir Length (ft)             75                  80         50
            55
Weir Discharge Coef                3.3                 3.3       3.3
           3.3
Perforated Riser Height (ft)
Number of Holes in Riser
Holes Diameter
Flood Pool Drain Time (hrs)
Swale Parameters
Length of Flow Path (ft)
Slope of Flow Path %
Bottom Width (ft)
Side Slope (ft-v/ft-h)
Maximum Depth of Flow (ft)
Mannings n Constant
Hydraulic Model
Pipe, Splitter, Aquifer Parameter
Hydraulic Res. Time (hrs)
                      0                             0
                 0

Particle Data
Particle File         nurp50.p8p
Particle Class           P0%       P10%      P30%      P50%       P80%
Filtration Efficiency     90       100       100        100       100
Settling Velocity (ft/    0        0.03      0.3        1.5        15
First Order Decay Rate    0         0         0          0         0
2nd Order Decay (1/day    0         0         0          0         0
Impervious Runoff Conc    1         0         0          0         0
Pervious Runoff Conc (    1        100       100        100       200
Pervious Conc Exponent    0         1         1          1         1
```

```
Accum. Rate (lbs-ac-da    0        1.75      1.75      1.75       3.5
Particle Removal Rate     0        0.25      0.25      0.25       0.25
Washoff Coefficient       0         20        20        20         20
Washoff Exponent          0         2         2          2         2
Sweeper Efficiency        0         0         0          5         15

Water Quality Component Data
Component Name           TSS         TP        TKN        CU          PB         ZN
  HC

Water Quality Criteria (ppm)
             Level 1      5       0.025       2          2        0.02        5
 0.1
             Level 2      10       0.05       1        0.0048     0.014      0.0362
 0.5
             Level 3      20       0.1       0.5       0.02       0.15       0.38
  1

Content Scale Factor      1         1         1          1         1          1
  1

Particle Composition (mg/kg)
P0%                       0       99000     600000     13600      2000      640000
250000
P10%                   1000000     3850     15000       340       180        1600
22500
P30%                   1000000     3850     15000       340       180        1600
22500
P50%                   1000000     3850     15000       340       180        1600
22500
P80%                   1000000      0         0         340       180         0
22500
```

```
P8 Urban Catchment Model, Version 3.5                                  Run Date
07/30/15
Case        Rice Creek Spine Road.p8c     FirstDate  01/01/01          Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10          Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598             Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576            TotalYrs
9.99


Devices Listed in Downstream Order

Device:     Pond 7              Type:     POND
            Discharges normal outlet to   Pond 9
            Discharges spillway to        Pond 9
            Runoff from watershed         SB 8

Device:     Pond 8              Type:     POND
            Discharges normal outlet to   Pond 10
            Discharges spillway to        Pond 10
            Runoff from watershed         SB 10

Device:     Outfall #4          Type:     PIPE
            Discharges normal outlet to   To Rice Creek
            Runoff from watershed         SB 19

Device:     Wetland 4           Type:     POND
            Discharges normal outlet to   Pond 12
            Discharges spillway to        Pond 12
            Runoff from watershed         SB 13

Device:     Wetland 5           Type:     POND
            Runoff from watershed         SB 17

Device:     Wetland 2           Type:     POND
            Discharges normal outlet to   Wetland 3
            Discharges spillway to        Wetland 3

Device:     Wetland 3           Type:     POND
            Discharges normal outlet to   Pond 9
            Discharges spillway to        Pond 9
            Runoff from watershed         Inflow from Ponds 4/5

Device:     Pond 9              Type:     POND
            Discharges normal outlet to   Pond 11
            Discharges spillway to        Pond 11
            Runoff from watershed         SB 9

Device:     Pond 11             Type:     POND
            Discharges normal outlet to   Pond 10
            Discharges spillway to        Pond 10
            Runoff from watershed         SB 11

Device:     Pond 10             Type:     POND
            Discharges normal outlet to   Pond 12
            Discharges spillway to        Pond 12
            Runoff from watershed         SB 12

Device:     Pond 12             Type:     POND
            Discharges normal outlet to   Pond 13
            Discharges spillway to        Pond 13
```

```
            Runoff from watershed         SB 14

Device:     CHR-1               Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 28

Device:     CRH-2               Type:     POND
            Discharges normal outlet to   CRH-3
            Discharges spillway to        CRH-3
            Runoff from watershed         SB 29

Device:     CRH-3               Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         1S

Device:     SB 18 Swale         Type:     INF_BASIN
            Discharges spillway to        Pond 13
            Runoff from watershed         SB 18

Device:     Pond 13             Type:     POND
            Discharges normal outlet to   Outfall #5
            Discharges spillway to        Outfall #5
            Runoff from watershed         SB 15, 16, 26

Device:     Outfall #5          Type:     PIPE
            Discharges normal outlet to   To Rice Creek

Device:     Thumb Infiltration  Type:     INF_BASIN
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 22 and 27

Device:     To Rice Creek       Type:     PIPE
```

```
P8-V3.X      Rice Creek Spine Road.p8c
                                                                            Directly
Connected UnSwept AreasDirectly Connected Swept Areas--Street Sweeping Parameters
                 Total                              PerviousIndirectPervious
Depress          Imperv         Depress          Imperv  Start    Stop
Sweep
Watershed        Area        Outflow      Percol     Curve   Imperv   Load   Imperv
Storage  Runoff   Load   Imperv Storage  Runoff   Load    Date    Date   Sweep
Freq
Label            acres       Device       Device     Number Fraction Factor Fraction
inches   Coef   Factor Fraction inches   Coef   Factor   MMDD    MMDD   Effic
1/week
SB 8             29.69       Pond 7                    74    0.000     1     0.0551
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 10            6.39        Pond 8                    74    0.000     1      0.05
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 9             25.78       Pond 9                    74    0.000     1     0.0012
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 12            1.39        Pond 10                   74    0.000     1     0.2098
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 11            3.29        Pond 11                   74    0.000     1     0.3678
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 14            10.23       Pond 12                   74    0.000     1      0.16
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 13            2.98       Wetland 4                  74    0.000     1     0.2617
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 18            52.79     SB 18 Swale                 74    0.000     1       0
 0.02     1       1       0       0       1       1      101     1231     1      0.5
SB 15, 16, 26   105.345      Pond 13                   74    0.000     1     0.1517
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 17            7.608      Wetland 5                  74    0.000     1     0.4841
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
Inflow from P    4.311      Wetland 3                  74    0.000     1     0.1861
 0.02     1       1       0       0       1       1      101     1231     1      0.5
SB 19            21.19     Outfall #4                  74    0.000     1       0
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 28            6.955        CHR-1                    74    0.000     1     0.4676
 0.02     1       1       0       0       1       1      101     1231     1      0.5
SB 29           10.214        CRH-2                    74    0.000     1     0.3773
 0.02     1       1       0       0       0       1      101     1231     1      0.5
1S               1.601        CRH-3                    74    0.000     1     0.3198
 0.02     1       1       0       0       1       1      101     1231     1      0.5
SB 22 and 27    48.539    Thumb Infiltration           80    0.000     1     0.1138
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
```

```
P8 Urban Catchment Model, Version 3.5
 Run Date   07/30/15
Case                 Rice Creek Spine Road.p8c        FirstDate   01/01/01
 Precip(in)  296.7
Title                Rice Creek                       LastDate    12/31/10
 Rain(in)    273.57
PrecFile             precip1970-2010.pcp              Events         598
 Snow(in)    23.12
PartFile             nurp50.p8p                       TotalHrs      87576
 TotalYrs     9.99


Mass Balances by Device and Variable

Device: OVERALL               Type: NONE                        Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1462.01       0.20   319623.0    31993.0     80.43
03 infiltrate            321.31       0.04     8515.7      852.4      9.75
04 exfiltrate            321.31       0.04        0.0        0.0      0.00
05 filtered                0.00       0.00     8515.7      852.4
06 normal outlet        1140.94       0.16    39272.9     3931.1     12.66
08 sedimen + decay         0.00       0.00   271832.0    27209.3
09 total inflow         1462.01       0.20   319623.0    31993.0     80.43
10 surface outflow      1140.94       0.16    39272.9     3931.1     12.66
11 groundw outflow       321.31       0.04        0.0        0.0      0.00
12 total outflow        1462.25       0.20    39272.9     3931.1      9.88
13 total trapped           0.00       0.00   280347.7    28061.7
14 storage increase        0.00       0.00        1.0        0.1
15 mass balance chec      -0.24       0.00        1.3        0.1
Reduction (%)              0.00       0.00       87.7       87.7

Device: OVERALL               Type: NONE                        Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1462.01       0.20     1131.7      113.3      0.28
03 infiltrate            321.31       0.04      119.0       11.9      0.14
04 exfiltrate            321.31       0.04        8.6        0.9      0.01
05 filtered                0.00       0.00      110.4       11.0
06 normal outlet        1140.94       0.16      444.5       44.5      0.14
08 sedimen + decay         0.00       0.00      566.9       56.7
09 total inflow         1462.01       0.20     1131.7      113.3      0.28
10 surface outflow      1140.94       0.16      444.5       44.5      0.14
11 groundw outflow       321.31       0.04        8.6        0.9      0.01
12 total outflow        1462.25       0.20      453.2       45.4      0.11
13 total trapped           0.00       0.00      677.2       67.8
14 storage increase        0.00       0.00        1.3        0.1
15 mass balance chec      -0.24       0.00        0.0        0.0
Reduction (%)              0.00       0.00       59.8       59.8

Device: Pond 7                Type: POND                        Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.73       0.01    16079.2     1609.5     70.65
06 normal outlet          83.76       0.01     2768.9      277.2     12.16
08 sedimen + decay         0.00       0.00    13310.3     1332.3
09 total inflow           83.73       0.01    16079.2     1609.5     70.65
10 surface outflow        83.76       0.01     2768.9      277.2     12.16
12 total outflow          83.76       0.01     2768.9      277.2     12.16
13 total trapped           0.00       0.00    13310.3     1332.3
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.03       0.00        0.0        0.0
Reduction (%)              0.00       0.00       82.8       82.8
```

```
Device: Pond 7                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.73       0.01       59.7        6.0       0.26
06 normal outlet          83.76       0.01       32.4        3.2       0.14
08 sedimen + decay         0.00       0.00       27.3        2.7
09 total inflow           83.73       0.01       59.7        6.0       0.26
10 surface outflow        83.76       0.01       32.4        3.2       0.14
12 total outflow          83.76       0.01       32.4        3.2       0.14
13 total trapped           0.00       0.00       27.3        2.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.03       0.00        0.0        0.0
Reduction (%)              0.00       0.00       45.8       45.8

Device: Pond 8                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      17.30       0.00     3263.1      326.6      69.40
06 normal outlet          17.30       0.00      314.5       31.5       6.69
08 sedimen + decay         0.00       0.00     2948.6      295.1
09 total inflow           17.30       0.00     3263.1      326.6      69.40
10 surface outflow        17.30       0.00      314.5       31.5       6.69
12 total outflow          17.30       0.00      314.5       31.5       6.69
13 total trapped           0.00       0.00     2948.6      295.1
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       90.4       90.4

Device: Pond 8                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      17.30       0.00       12.2        1.2       0.26
06 normal outlet          17.30       0.00        5.8        0.6       0.12
08 sedimen + decay         0.00       0.00        6.4        0.6
09 total inflow           17.30       0.00       12.2        1.2       0.26
10 surface outflow        17.30       0.00        5.8        0.6       0.12
12 total outflow          17.30       0.00        5.8        0.6       0.12
13 total trapped           0.00       0.00        6.4        0.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       52.5       52.5

Device: Outfall #4             Type: PIPE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      33.93       0.00     4400.1      440.4      47.71
06 normal outlet          33.93       0.00     4400.1      440.4      47.71
09 total inflow           33.93       0.00     4400.1      440.4      47.71
10 surface outflow        33.93       0.00     4400.1      440.4      47.71
12 total outflow          33.93       0.00     4400.1      440.4      47.71
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #4             Type: PIPE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      33.93       0.00       19.3        1.9       0.21
06 normal outlet          33.93       0.00       19.3        1.9       0.21
09 total inflow           33.93       0.00       19.3        1.9       0.21
10 surface outflow        33.93       0.00       19.3        1.9       0.21
12 total outflow          33.93       0.00       19.3        1.9       0.21
Reduction (%)              0.00       0.00        0.0        0.0
```

```
Device: Wetland 4             Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      22.02       0.00     5345.0      535.0      89.29
06 normal outlet          22.03       0.00     1710.1      171.2      28.56
08 sedimen + decay         0.00       0.00     3634.6      363.8
09 total inflow           22.02       0.00     5345.0      535.0      89.29
10 surface outflow        22.03       0.00     1710.1      171.2      28.56
12 total outflow          22.03       0.00     1710.1      171.2      28.56
13 total trapped           0.00       0.00     3634.6      363.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.01       0.00        0.3        0.0
Reduction (%)              0.00       0.00       68.0       68.0

Device: Wetland 4             Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      22.02       0.00       18.3        1.8       0.31
06 normal outlet          22.03       0.00       12.4        1.2       0.21
08 sedimen + decay         0.00       0.00        5.9        0.6
09 total inflow           22.02       0.00       18.3        1.8       0.31
10 surface outflow        22.03       0.00       12.4        1.2       0.21
12 total outflow          22.03       0.00       12.4        1.2       0.21
13 total trapped           0.00       0.00        5.9        0.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.01       0.00        0.0        0.0
Reduction (%)              0.00       0.00       32.4       32.4

Device: Wetland 5             Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      93.66       0.01    23900.0     2392.3      93.89
06 normal outlet          93.66       0.01     7194.2      720.1      28.26
08 sedimen + decay         0.00       0.00    16705.6     1672.2
09 total inflow           93.66       0.01    23900.0     2392.3      93.89
10 surface outflow        93.66       0.01     7194.2      720.1      28.26
12 total outflow          93.66       0.01     7194.2      720.1      28.26
13 total trapped           0.00       0.00    16705.6     1672.2
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.2        0.0
Reduction (%)              0.00       0.00       69.9       69.9

Device: Wetland 5             Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      93.66       0.01       80.4        8.0       0.32
06 normal outlet          93.66       0.01       52.3        5.2       0.21
08 sedimen + decay         0.00       0.00       28.1        2.8
09 total inflow           93.66       0.01       80.4        8.0       0.32
10 surface outflow        93.66       0.01       52.3        5.2       0.21
12 total outflow          93.66       0.01       52.3        5.2       0.21
13 total trapped           0.00       0.00       28.1        2.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       35.0       35.0

Device: Wetland 2             Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
Reduction (%)              0.00       0.00        0.0        0.0

Device: Wetland 2             Type: POND                      Variable: TP
```

```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
Reduction (%)             0.00       0.00        0.0        0.0

Device: Wetland 3             Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      24.65       0.00     5757.2      576.3      85.93
06 normal outlet          24.65       0.00      101.8       10.2       1.52
08 sedimen + decay         0.00       0.00     5654.6      566.0
09 total inflow           24.65       0.00     5757.2      576.3      85.93
10 surface outflow        24.65       0.00      101.8       10.2       1.52
12 total outflow          24.65       0.00      101.8       10.2       1.52
13 total trapped           0.00       0.00     5654.6      566.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.8        0.1
Reduction (%)              0.00       0.00       98.2       98.2

Device: Wetland 3             Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      24.65       0.00       19.9        2.0       0.30
06 normal outlet          24.65       0.00        7.0        0.7       0.10
08 sedimen + decay         0.00       0.00       12.9        1.3
09 total inflow           24.65       0.00       19.9        2.0       0.30
10 surface outflow        24.65       0.00        7.0        0.7       0.10
12 total outflow          24.65       0.00        7.0        0.7       0.10
13 total trapped           0.00       0.00       12.9        1.3
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       64.7       64.7

Device: Pond 9                Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      41.97       0.01     5540.6      554.6      48.58
02 upstream device       108.41       0.01     2870.7      287.3       9.74
06 normal outlet         150.44       0.02     4727.1      473.2      11.56
08 sedimen + decay         0.00       0.00     3684.2      368.8
09 total inflow          150.38       0.02     8411.3      841.9      20.58
10 surface outflow       150.44       0.02     4727.1      473.2      11.56
12 total outflow         150.44       0.02     4727.1      473.2      11.56
13 total trapped           0.00       0.00     3684.2      368.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.06       0.00        0.0        0.0
Reduction (%)              0.00       0.00       43.8       43.8

Device: Pond 9                Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      41.97       0.01       24.1        2.4       0.21
02 upstream device       108.41       0.01       39.4        3.9       0.13
06 normal outlet         150.44       0.02       57.2        5.7       0.14
08 sedimen + decay         0.00       0.00        6.2        0.6
09 total inflow          150.38       0.02       63.5        6.4       0.16
10 surface outflow       150.44       0.02       57.2        5.7       0.14
12 total outflow         150.44       0.02       57.2        5.7       0.14
13 total trapped           0.00       0.00        6.2        0.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.06       0.00        0.0        0.0
Reduction (%)              0.00       0.00        9.8        9.8

Device: Pond 11               Type: POND                      Variable: TSS
```

```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     32.04       0.00     8016.5      802.4      92.06
02 upstream device      150.44       0.02     4727.1      473.2      11.56
06 normal outlet        182.48       0.03     1996.6      199.9       4.03
08 sedimen + decay        0.00       0.00    10746.8     1075.7
09 total inflow         182.48       0.03    12743.5     1275.6      25.69
10 surface outflow      182.48       0.03     1996.6      199.9       4.03
12 total outflow        182.48       0.03     1996.6      199.9       4.03
13 total trapped          0.00       0.00    10746.8     1075.7
14 storage increase       0.00       0.00        0.1        0.0
15 mass balance chec      0.00       0.00        0.0        0.0
Reduction (%)             0.00       0.00       84.3       84.3

Device: Pond 11               Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     32.04       0.00       27.1        2.7       0.31
02 upstream device      150.44       0.02       57.2        5.7       0.14
06 normal outlet        182.48       0.03       56.5        5.7       0.11
08 sedimen + decay        0.00       0.00       27.7        2.8
09 total inflow         182.48       0.03       84.4        8.4       0.17
10 surface outflow      182.48       0.03       56.5        5.7       0.11
12 total outflow        182.48       0.03       56.5        5.7       0.11
13 total trapped          0.00       0.00       27.7        2.8
14 storage increase       0.00       0.00        0.3        0.0
15 mass balance chec      0.00       0.00        0.0        0.0
Reduction (%)             0.00       0.00       32.8       32.8

Device: Pond 10               Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      8.68       0.00     2055.9      205.8      87.17
02 upstream device      199.78       0.03     2311.2      231.3       4.26
06 normal outlet        208.55       0.03     2076.5      207.9       3.66
08 sedimen + decay        0.00       0.00     2290.5      229.3
09 total inflow         208.45       0.03     4367.1      437.1       7.71
10 surface outflow      208.55       0.03     2076.5      207.9       3.66
12 total outflow        208.55       0.03     2076.5      207.9       3.66
13 total trapped          0.00       0.00     2290.5      229.3
14 storage increase       0.00       0.00        0.0        0.0
15 mass balance chec     -0.10       0.00        0.0        0.0
Reduction (%)             0.00       0.00       52.5       52.5

Device: Pond 10               Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      8.68       0.00        7.1        0.7       0.30
02 upstream device      199.78       0.03       62.2        6.2       0.11
06 normal outlet        208.55       0.03       63.7        6.4       0.11
08 sedimen + decay        0.00       0.00        5.6        0.6
09 total inflow         208.45       0.03       69.3        6.9       0.12
10 surface outflow      208.55       0.03       63.7        6.4       0.11
12 total outflow        208.55       0.03       63.7        6.4       0.11
13 total trapped          0.00       0.00        5.6        0.6
14 storage increase       0.00       0.00        0.0        0.0
15 mass balance chec     -0.10       0.00        0.0        0.0
Reduction (%)             0.00       0.00        8.1        8.1

Device: Pond 12               Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     52.59       0.01    12043.7     1205.5      84.26
02 upstream device      230.58       0.03     3786.7      379.0       6.04
```

```
06 normal outlet         283.17       0.04     1795.0      179.7       2.33
08 sedimen + decay         0.00       0.00    14035.3     1404.9
09 total inflow          283.17       0.04    15830.4     1584.6      20.57
10 surface outflow       283.17       0.04     1795.0      179.7       2.33
12 total outflow         283.17       0.04     1795.0      179.7       2.33
13 total trapped           0.00       0.00    14035.3     1404.9
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       88.7       88.7

Device: Pond 12                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      52.59       0.01       42.0        4.2       0.29
02 upstream device       230.58       0.03       76.0        7.6       0.12
06 normal outlet         283.17       0.04       82.1        8.2       0.11
08 sedimen + decay         0.00       0.00       35.3        3.5
09 total inflow          283.17       0.04      118.0       11.8       0.15
10 surface outflow       283.17       0.04       82.1        8.2       0.11
12 total outflow         283.17       0.04       82.1        8.2       0.11
13 total trapped           0.00       0.00       35.3        3.5
14 storage increase        0.00       0.00        0.6        0.1
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       29.9       29.9

Device: CHR-1                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.08       0.01    21153.2     2117.3      93.67
06 normal outlet          83.08       0.01     4281.6      428.6      18.96
08 sedimen + decay         0.00       0.00    16871.6     1688.8
09 total inflow           83.08       0.01    21153.2     2117.3      93.67
10 surface outflow        83.08       0.01     4281.6      428.6      18.96
12 total outflow          83.08       0.01     4281.6      428.6      18.96
13 total trapped           0.00       0.00    16871.6     1688.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       79.8       79.8

Device: CHR-1                  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.08       0.01       71.2        7.1       0.32
06 normal outlet          83.08       0.01       38.4        3.8       0.17
08 sedimen + decay         0.00       0.00       32.8        3.3
09 total inflow           83.08       0.01       71.2        7.1       0.32
10 surface outflow        83.08       0.01       38.4        3.8       0.17
12 total outflow          83.08       0.01       38.4        3.8       0.17
13 total trapped           0.00       0.00       32.8        3.3
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       46.1       46.1

Device: CRH-2                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     101.61       0.01    25475.6     2550.0      92.25
06 normal outlet         101.61       0.01     4019.6      402.3      14.55
08 sedimen + decay         0.00       0.00    21456.1     2147.7
09 total inflow          101.61       0.01    25475.6     2550.0      92.25
10 surface outflow       101.61       0.01     4019.6      402.3      14.55
12 total outflow         101.61       0.01     4019.6      402.3      14.55
13 total trapped           0.00       0.00    21456.1     2147.7
```

```
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       84.2       84.2

Device: CRH-2                  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     101.61       0.01       86.2        8.6       0.31
06 normal outlet         101.61       0.01       42.4        4.2       0.15
08 sedimen + decay         0.00       0.00       43.8        4.4
09 total inflow          101.61       0.01       86.2        8.6       0.31
10 surface outflow       101.61       0.01       42.4        4.2       0.15
12 total outflow         101.61       0.01       42.4        4.2       0.15
13 total trapped           0.00       0.00       43.8        4.4
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       50.8       50.8

Device: CRH-3                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      13.89       0.00     3435.3      343.9      90.99
02 upstream device       101.61       0.01     4019.6      402.3      14.55
06 normal outlet         115.50       0.02     2778.6      278.1       8.85
08 sedimen + decay         0.00       0.00     4676.3      468.1
09 total inflow          115.50       0.02     7454.9      746.2      23.75
10 surface outflow       115.50       0.02     2778.6      278.1       8.85
12 total outflow         115.50       0.02     2778.6      278.1       8.85
13 total trapped           0.00       0.00     4676.3      468.1
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       62.7       62.7

Device: CRH-3                  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      13.89       0.00       11.7        1.2       0.31
02 upstream device       101.61       0.01       42.4        4.2       0.15
06 normal outlet         115.50       0.02       41.7        4.2       0.13
08 sedimen + decay         0.00       0.00       12.4        1.2
09 total inflow          115.50       0.02       54.1        5.4       0.17
10 surface outflow       115.50       0.02       41.7        4.2       0.13
12 total outflow         115.50       0.02       41.7        4.2       0.13
13 total trapped           0.00       0.00       12.4        1.2
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       22.9       22.9

Device: SB 18 Swale            Type: INF_BASIN                  Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      84.53       0.01    10961.7     1097.2      47.71
03 infiltrate             79.77       0.01     1287.0      128.8       5.94
04 exfiltrate             79.77       0.01        0.0        0.0       0.00
05 filtered                0.00       0.00     1287.0      128.8
07 spillway outlet         4.76       0.00     1041.3      104.2      80.49
08 sedimen + decay         0.00       0.00     8633.4      864.2
09 total inflow           84.53       0.01    10961.7     1097.2      47.71
10 surface outflow         4.76       0.00     1041.3      104.2      80.49
11 groundw outflow        79.77       0.01        0.0        0.0       0.00
12 total outflow          84.53       0.01     1041.3      104.2       4.53
13 total trapped           0.00       0.00     9920.4      993.0
14 storage increase        0.00       0.00        0.0        0.0
```

```
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       90.5       90.5

Device: SB 18 Swale            Type: INF_BASIN                Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      84.53       0.01       48.1        4.8       0.21
03 infiltrate             79.77       0.01       26.4        2.6       0.12
04 exfiltrate             79.77       0.01        2.1        0.2       0.01
05 filtered                0.00       0.00       24.2        2.4
07 spillway outlet         4.76       0.00        4.6        0.5       0.35
08 sedimen + decay         0.00       0.00       17.1        1.7
09 total inflow           84.53       0.01       48.1        4.8       0.21
10 surface outflow         4.76       0.00        4.6        0.5       0.35
11 groundw outflow        79.77       0.01        2.1        0.2       0.01
12 total outflow          84.53       0.01        6.7        0.7       0.03
13 total trapped           0.00       0.00       41.3        4.1
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       86.0       86.0

Device: Pond 13                Type: POND                     Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     522.22       0.07   118722.9    11883.7      83.64
02 upstream device       287.93       0.04     2836.2      283.9       3.62
06 normal outlet         810.20       0.11    19922.0     1994.1       9.05
08 sedimen + decay         0.00       0.00   101636.4    10173.4
09 total inflow          810.15       0.11   121559.1    12167.6      55.20
10 surface outflow       810.20       0.11    19922.0     1994.1       9.05
12 total outflow         810.20       0.11    19922.0     1994.1       9.05
13 total trapped           0.00       0.00   101636.4    10173.4
14 storage increase        0.00       0.00        0.7        0.1
15 mass balance chec      -0.05       0.00        0.0        0.0
Reduction (%)              0.00       0.00       83.6       83.6

Device: Pond 13                Type: POND                     Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     522.22       0.07      414.8       41.5       0.29
02 upstream device       287.93       0.04       86.7        8.7       0.11
06 normal outlet         810.20       0.11      289.1       28.9       0.13
08 sedimen + decay         0.00       0.00      212.0       21.2
09 total inflow          810.15       0.11      501.4       50.2       0.23
10 surface outflow       810.20       0.11      289.1       28.9       0.13
12 total outflow         810.20       0.11      289.1       28.9       0.13
13 total trapped           0.00       0.00      212.0       21.2
14 storage increase        0.00       0.00        0.4        0.0
15 mass balance chec      -0.05       0.00        0.0        0.0
Reduction (%)              0.00       0.00       42.3       42.3

Device: Outfall #5             Type: PIPE                     Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device       810.20       0.11    19922.0     1994.1       9.05
06 normal outlet         810.20       0.11    19922.0     1994.1       9.05
09 total inflow          810.20       0.11    19922.0     1994.1       9.05
10 surface outflow       810.20       0.11    19922.0     1994.1       9.05
12 total outflow         810.20       0.11    19922.0     1994.1       9.05
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #5             Type: PIPE                     Variable: TP
```

```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device       810.20       0.11      289.1       28.9       0.13
06 normal outlet         810.20       0.11      289.1       28.9       0.13
09 total inflow          810.20       0.11      289.1       28.9       0.13
10 surface outflow       810.20       0.11      289.1       28.9       0.13
12 total outflow         810.20       0.11      289.1       28.9       0.13
Reduction (%)              0.00       0.00        0.0        0.0

Device: Thumb Infiltration     Type: INF_BASIN                  Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     246.11       0.03    53473.0     5352.4      79.94
03 infiltrate            241.54       0.03     7228.7      723.6      11.01
04 exfiltrate            241.54       0.03        0.0        0.0       0.00
05 filtered                0.00       0.00     7228.7      723.6
07 spillway outlet         4.57       0.00      696.4       69.7      56.03
08 sedimen + decay         0.00       0.00    45547.9     4559.2
09 total inflow          246.11       0.03    53473.0     5352.4      79.94
10 surface outflow         4.57       0.00      696.4       69.7      56.03
11 groundw outflow       241.54       0.03        0.0        0.0       0.00
12 total outflow         246.11       0.03      696.4       69.7       1.04
13 total trapped           0.00       0.00    52776.5     5282.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       98.7       98.7

Device: Thumb Infiltration     Type: INF_BASIN                  Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     246.11       0.03      189.7       19.0       0.28
03 infiltrate            241.54       0.03       92.6        9.3       0.14
04 exfiltrate            241.54       0.03        6.5        0.7       0.01
05 filtered                0.00       0.00       86.1        8.6
07 spillway outlet         4.57       0.00        3.8        0.4       0.30
08 sedimen + decay         0.00       0.00       93.4        9.3
09 total inflow          246.11       0.03      189.7       19.0       0.28
10 surface outflow         4.57       0.00        3.8        0.4       0.30
11 groundw outflow       241.54       0.03        6.5        0.7       0.01
12 total outflow         246.11       0.03       10.3        1.0       0.02
13 total trapped           0.00       0.00      179.5       18.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       94.6       94.6

Device: To Rice Creek          Type: PIPE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      1047.28       0.14    32078.7     3210.9      11.27
06 normal outlet        1047.28       0.14    32078.7     3210.9      11.27
09 total inflow         1047.28       0.14    32078.7     3210.9      11.27
10 surface outflow      1047.28       0.14    32078.7     3210.9      11.27
12 total outflow        1047.28       0.14    32078.7     3210.9      11.27
Reduction (%)              0.00       0.00        0.0        0.0

Device: To Rice Creek          Type: PIPE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      1047.28       0.14      392.2       39.3       0.14
06 normal outlet        1047.28       0.14      392.2       39.3       0.14
09 total inflow         1047.28       0.14      392.2       39.3       0.14
10 surface outflow      1047.28       0.14      392.2       39.3       0.14
12 total outflow        1047.28       0.14      392.2       39.3       0.14
Reduction (%)              0.00       0.00        0.0        0.0
```

Rice Creek P8 Results

Interim Scenario 2

```
P8 Urban Catchment Model, Version 3.5                              Run Date
07/30/15
Case        Rice Creek Full Build without FirstDate  01/01/01          Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10          Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598             Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576            TotalYrs
9.99


File Directory        C:\Users\patmf0648\Desktop\P8\
Case Title            Rice Creek
Case File             Rice Creek Full Build without Infiltration Dev.p8c
Particle File         nurp50.p8p
Temperature File      temp1970-2011.tmp
Storm File            precip1970-2010.pcp
Precip Scale Factor       1

Watersheds                16
Devices                   19
Particles                 5
WQ Components             7

Start Date             06/01/00
Keep Date              01/01/01
Stop Date              12/31/10
Storm Count              598
Total Hours             87576
Wet Hours                9265
Precip (in)              297
Rain (in)                274
Snowfall (in)             23
Snowmelt (in)             22
EvapoTran(in)            303

Overall TSS Removal(%)    1
Water Balance Error(%)    0
TSS Mass Balance Error    0
```

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
07/30/15
Case        Rice Creek Full Build without FirstDate  01/01/01           Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events        598             Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs     87576            TotalYrs
 9.99


Case Title                       Rice Creek
Case Data File                   Rice Creek Full Build without Infiltration Dev.p8c
Path                             C:\Users\patmf0648\Desktop\P8\
Case Notes:                      No Development in SB 18 (no infiltration)

Storm Data File                  precip1970-2010.pcp
Particle File                    nurp50.p8p
Air Temp File File               temp1970-2011.tmp

Time Steps Per Hour                  4
Minimum Inter-Event Time (hrs)       10
Maximum Continuity Error %           2
Rainfall Breakpoint (inches)        0.8
Precipitation Scale Factor           1
Air Temp Offset (deg-F)              0
Loops Thru Storm File                1
Simulation Dates
Start                             6/1/2000
Keep                              1/1/2001
Stop                             12/31/2010

Max Snowfall Temperature (deg-f)    32.0
SnowMelt Temperature (deg-f)        32.0
Snowmelt Coef (in/degF-Day)         0.06
Soil Freeze Temp (deg-F)            32.0
Snowmelt Abstraction Factor         1.00
Evapo-Trans. Calibration Factor     1.00
Growing Season Start Month           5
Growing Season End Month             10

5-Day Antecedent Rainfall + Runoff (inches)
CN Antecedent Moisture Condition  AMC-II   AMC-III
Growing Season                      1.40      2.10
NonGrowing Season                   0.50      1.10

Watershed Data
Watershed Name                      SB 8     SB 10      SB 9      SB 12     SB 11
SB 14     SB 13     SB 18   SB 15, 16,  SB 17     SB 19   Inflow fro  SB 28     SB
29      SB 1   SB 22 and 27
Runoff to Device                   Pond 7    Pond 8    Pond 9    Pond 10   Pond 11
Pond 12  Wetland 4 SB 18 Swal Pond 13  Wetland 5 Pond 14 (OWetland 3   CRH-2
CRH-1     CRH-3   Thumb Infiltration
Infiltration to Device
Watershed Area                      29.6      6.39      25.79      1.38      3.29
10.23     2.985     52.79    105.327    7.608     21.198     4.16     6.955
10.214    1.601     43.013
SCS Curve Number (Pervious)          74        74        74         74        74
  74        74        74        74        74        74        74        74        74
       74        80
Scale Factor for Pervious Runoff     1         1         1          1         1
  1         1         1         1         1         1         1         1         1
```

```
       1         1
Indirectly Connected Imperv Frac    0         0          0         0         0
  0         0         0         0         0         0         0         0         0
       0         0
UnSwept Impervious Fraction       0.3001    0.076     0.3317     0.3871    0.3216
0.4262    0.3099      0       0.505     0.4841    0.3993     0.47     0.4676
0.3773    0.3198    0.1138
UnSwept Depression Storage (inch   0.02      0.02      0.02       0.02      0.02
 0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.02
0.02      0.02      0.02
UnSwept Imperv. Runoff Coefficie    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
UnSwept Scale Factor for Particl    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Swept Impervious Fraction           0         0          0         0         0
  0         0         0         0         0         0         0         0         0
       0         0
Swept Depression Storage (inches   0.02      0.02      0.02       0.02      0.02
 0.02      0.02      0.02      0.02      0.02      0.02       0         0         0
       0        0.02
Swept Imperv. Runoff Coefficient    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Swept Scale Factor for Particle     1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Sweeping Frequency                 0.5       0.5        0.5       0.5       0.5
 0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5
      0.5       0.5
Sweeping Efficiency                 1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Sweeping Start Date (MMDD)         101       101        101       101       101
 101       101       101       101       101       101       101       101       101
      101       101
Sweeping Stop Date (MMDD)          1231      1231      1231       1231      1231
 1231      1231      1231      1231      1231      1231      1231      1231
1231      1231      1231

Device Data
Device Name                       Pond 7    Pond 8    Pond 9    Pond 10   Pond 11
Pond 12   Pond 13  Pond 14 (OWetland 4 Wetland 5 Outfall #5Wetland 3 Wetland 2
CRH-1     CRH-2   To Rice Cr  CRH-3   SB 18 SwalThumb Infiltration
Device Type                        POND      POND      POND       POND      POND
 POND      POND      POND      POND      POND      PIPE      POND      POND
POND      POND      PIPE      POND   INF_BASIN INF_BASIN
Infiltration Outlet
Normal Outlet                     Pond 9   Pond 10    Pond 11   Pond 12   Pond 10
Pond 13  Outfall #5           Pond 12            To Rice Cr  Pond 9  Wetland 3 To
Rice Cr  CRH-3             To Rice Creek
Spillway Outlet                   Pond 9   Pond 10    Pond 11   Pond 12   Pond 10
Pond 13  Outfall #5           Pond 12  Outfall #5            Pond 9  Wetland 3 To
Rice Cr  CRH-3             To Rice Cr Pond 13  To Rice Creek
Particle Removal Scale Factor       1         1          1         1         1
  1         1         1         1         1                   1         1         1
       1                   1         1         1
Bottom Elevation (ft)               0         0          0         0         0
  0         0         0         0         0                   0         0         0
       0                   0         0         0
Bottom Area (acres)                0.11      0.03      0.03       0.12      0.76
 1.2        0        0.95       0         0                 2.157     2.157
```

```
0.15      0.2                 0.15       0         0
Permanent Pool Area (acres)        0.44      0.3       0.21       0.29      1.21
 1.64      1.87      1.38       0         0                 2.355      2.18
0.225      0.35               0.225
Permanent Pool Volume (ac-ft)      1.1       0.5        0.4       0.7       3.6
 5.1       4.3       4.5        0         0                   0         0
0.187      0.412              0.187
Perm Pool Infilt Rate (in/hr)       0         0          0         0         0
  0         0         0         0         0                   0         0         0
       0                   0
Flood Pool Area (acres)            0.5       0.53       0.6       0.42      1.68
 2.04      2.96      1.73     1.891     1.891               2.653     2.591      0.5
      0.65                0.5       0.31      3.74
Flood Pool Volume (ac-ft)          0.4       0.9        0.3       0.9       5.4
 5.1       6.3       4.9       2.5       5.8                 2.6       1.2
0.663      1.18               0.663      6.15      3.74
Flood Pool Infilt Rate (in/hr)      0         0          0         0         0
  0         0         0         0         0                   0         0         0
       0                   0        0.45      0.45
Infilt Basin Void Fraction (%)

                                    100       100
Detention Pond Outlet Parameters
Outlet Type                        WEIR    ORIFICE     WEIR       WEIR    ORIFICE
ORIFICE     WEIR    ORIFICE   ORIFICE   ORIFICE             ORIFICE   ORIFICE
ORIFICE   ORIFICE             ORIFICE
Outlet Orifice Diameter (in)                  24                             12
  12                  12        12        6                   12        12        24
       24                  24
Orifice Discharge Coef                        1                             0.6
 0.6                 0.6       0.6       0.6                 0.6       0.6       0.6
      0.6                 0.6
Outlet Weir Length (ft)             75                  80        50
            55
Weir Discharge Coef                3.3                 3.3       3.3
           3.3
Perforated Riser Height (ft)
Number of Holes in Riser
Holes Diameter
Flood Pool Drain Time (hrs)
Swale Parameters
Length of Flow Path (ft)
Slope of Flow Path %
Bottom Width (ft)
Side Slope (ft-v/ft-h)
Maximum Depth of Flow (ft)
Mannings n Constant
Hydraulic Model
Pipe, Splitter, Aquifer Parameter
Hydraulic Res. Time (hrs)
                                                    0
                 0

Particle Data
Particle File         nurp50.p8p
Particle Class           P0%       P10%      P30%      P50%       P80%
Filtration Efficiency     90       100       100        100       100
Settling Velocity (ft/    0        0.03      0.3        1.5        15
First Order Decay Rate    0         0         0          0         0
2nd Order Decay (1/day    0         0         0          0         0
Impervious Runoff Conc    1         0         0          0         0
Pervious Runoff Conc (    1        100       100        100       200
Pervious Conc Exponent    0         1         1          1         1
```

```
Accum. Rate (lbs-ac-da    0        1.75      1.75      1.75       3.5
Particle Removal Rate     0        0.25      0.25      0.25       0.25
Washoff Coefficient       0         20        20        20         20
Washoff Exponent          0         2         2          2         2
Sweeper Efficiency        0         0         0          5         15

Water Quality Component Data
Component Name           TSS        TP       TKN       CU          PB        ZN
  HC

Water Quality Criteria (ppm)
             Level 1      5       0.025       2          2        0.02       5
 0.1
             Level 2      10       0.05       1       0.0048     0.014     0.0362
 0.5
             Level 3      20       0.1       0.5       0.02       0.15      0.38
  1

Content Scale Factor      1         1         1          1         1         1
  1

Particle Composition (mg/kg)
P0%                       0       99000     600000     13600      2000     640000
250000
P10%                   1000000     3850     15000       340       180       1600
22500
P30%                   1000000     3850     15000       340       180       1600
22500
P50%                   1000000     3850     15000       340       180       1600
22500
P80%                   1000000      0         0         340       180        0
22500
```

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
07/30/15
Case        Rice Creek Full Build without FirstDate  01/01/01           Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576             TotalYrs
9.99


Devices Listed in Downstream Order

Device:     Pond 7              Type:     POND
            Discharges normal outlet to   Pond 9
            Discharges spillway to        Pond 9
            Runoff from watershed         SB 8

Device:     Pond 8              Type:     POND
            Discharges normal outlet to   Pond 10
            Discharges spillway to        Pond 10
            Runoff from watershed         SB 10

Device:     Pond 14 (Outfall #10Type:     POND
            Runoff from watershed         SB 19

Device:     Wetland 4           Type:     POND
            Discharges normal outlet to   Pond 12
            Discharges spillway to        Pond 12
            Runoff from watershed         SB 13

Device:     Wetland 5           Type:     POND
            Discharges spillway to        Outfall #5
            Runoff from watershed         SB 17

Device:     Wetland 2           Type:     POND
            Discharges normal outlet to   Wetland 3
            Discharges spillway to        Wetland 3

Device:     Wetland 3           Type:     POND
            Discharges normal outlet to   Pond 9
            Discharges spillway to        Pond 9
            Runoff from watershed         Inflow from Ponds 4/5

Device:     Pond 9              Type:     POND
            Discharges normal outlet to   Pond 11
            Discharges spillway to        Pond 11
            Runoff from watershed         SB 9

Device:     Pond 11             Type:     POND
            Discharges normal outlet to   Pond 10
            Discharges spillway to        Pond 10
            Runoff from watershed         SB 11

Device:     Pond 10             Type:     POND
            Discharges normal outlet to   Pond 12
            Discharges spillway to        Pond 12
            Runoff from watershed         SB 12

Device:     Pond 12             Type:     POND
            Discharges normal outlet to   Pond 13
            Discharges spillway to        Pond 13
```

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            Runoff from watershed         SB 14

Device:     CRH-1               Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 29

Device:     CRH-2               Type:     POND
            Discharges normal outlet to   CRH-3
            Discharges spillway to        CRH-3
            Runoff from watershed         SB 28

Device:     CRH-3               Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 1

Device:     SB 18 Swale         Type:     INF_BASIN
            Discharges spillway to        Pond 13
            Runoff from watershed         SB 18

Device:     Pond 13             Type:     POND
            Discharges normal outlet to   Outfall #5
            Discharges spillway to        Outfall #5
            Runoff from watershed         SB 15, 16,  26

Device:     Outfall #5          Type:     PIPE
            Discharges normal outlet to   To Rice Creek

Device:     Thumb Infiltration  Type:     INF_BASIN
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 22 and 27

Device:     To Rice Creek       Type:     PIPE
```

```
P8-V3.X      Rice Creek Full Build without Infiltration Dev.p8c
                                                                            Directly
Connected UnSwept AreasDirectly Connected Swept Areas--Street Sweeping Parameters
                 Total                               PerviousIndirectPervious
Depress          Imperv         Depress          Imperv  Start    Stop
Sweep
Watershed        Area        Outflow      Percol     Curve   Imperv   Load   Imperv
Storage  Runoff   Load   Imperv Storage  Runoff   Load    Date    Date   Sweep
Freq
Label            acres       Device       Device     Number Fraction Factor Fraction
inches   Coef   Factor Fraction inches   Coef   Factor   MMDD    MMDD   Effic
1/week
SB 8             29.6        Pond 7                    74    0.000     1     0.3001
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 10            6.39        Pond 8                    74    0.000     1     0.076
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 9             25.79       Pond 9                    74    0.000     1     0.3317
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 12            1.38        Pond 10                   74    0.000     1     0.3871
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 11            3.29        Pond 11                   74    0.000     1     0.3216
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 14            10.23       Pond 12                   74    0.000     1     0.4262
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 13            2.985      Wetland 4                  74    0.000     1     0.3099
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 18            52.79     SB 18 Swale                 74    0.000     1       0
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 15, 16,  2   105.327      Pond 13                   74    0.000     1     0.505
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 17            7.608      Wetland 5                  74    0.000     1     0.4841
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
SB 19           21.198    Pond 14 (Outfall #10)        74    0.000     1     0.3993
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
Inflow from P    4.16       Wetland 3                  74    0.000     1      0.47
 0.02     1       1       0        0      1       1      101     1231     1      0.5
SB 28            6.955        CRH-2                    74    0.000     1     0.4676
 0.02     1       1       0        0      1       1      101     1231     1      0.5
SB 29           10.214        CRH-1                    74    0.000     1     0.3773
 0.02     1       1       0        0      1       1      101     1231     1      0.5
SB 1             1.601        CRH-3                    74    0.000     1     0.3198
 0.02     1       1       0        0      1       1      101     1231     1      0.5
SB 22 and 27    43.013    Thumb Infiltration           80    0.000     1     0.1138
 0.02     1       1       0      0.02     1       1      101     1231     1      0.5
```

```
P8 Urban Catchment Model, Version 3.5
 Run Date   07/30/15
Case                Rice Creek Full Build without InfFirstDate   01/01/01
 Precip(in)  296.7
Title               Rice Creek                      LastDate    12/31/10
 Rain(in)    273.57
PrecFile            precip1970-2010.pcp             Events         598
 Snow(in)    23.12
PartFile            nurp50.p8p                      TotalHrs      87576
 TotalYrs     9.99


Mass Balances by Device and Variable

Device: OVERALL                Type: NONE                        Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    2887.51       0.40   711779.7     71246.2     90.69
03 infiltrate            295.35       0.04     7763.6       777.1      9.67
04 exfiltrate            295.35       0.04        0.0         0.0      0.00
05 filtered                0.00       0.00     7763.6       777.1
06 normal outlet        2593.69       0.36   114410.0     11452.0     16.23
08 sedimen + decay         0.00       0.00   589602.3     59016.8
09 total inflow         2887.51       0.40   711779.7     71246.2     90.69
10 surface outflow      2593.69       0.36   114410.0     11452.0     16.23
11 groundw outflow       295.35       0.04        0.0         0.0      0.00
12 total outflow        2889.04       0.40   114410.0     11452.0     14.57
13 total trapped           0.00       0.00   597365.9     59793.9
14 storage increase        0.00       0.00        2.7         0.3
15 mass balance chec      -1.53       0.00        1.0         0.1
Reduction (%)              0.00       0.00       83.9        83.9

Device: OVERALL                Type: NONE                        Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    2887.51       0.40     2421.2       242.4      0.31
03 infiltrate            295.35       0.04      109.1        10.9      0.14
04 exfiltrate            295.35       0.04        7.9         0.8      0.01
05 filtered                0.00       0.00      101.2        10.1
06 normal outlet        2593.69       0.36     1117.2       111.8      0.16
08 sedimen + decay         0.00       0.00     1194.6       119.6
09 total inflow         2887.51       0.40     2421.2       242.4      0.31
10 surface outflow      2593.69       0.36     1117.2       111.8      0.16
11 groundw outflow       295.35       0.04        7.9         0.8      0.01
12 total outflow        2889.04       0.40     1125.2       112.6      0.14
13 total trapped           0.00       0.00     1295.8       129.7
14 storage increase        0.00       0.00        0.2         0.0
15 mass balance chec      -1.53       0.00        0.0         0.0
Reduction (%)              0.00       0.00       53.5        53.5

Device: Pond 7                 Type: POND                        Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     243.91       0.03    59979.5      6003.7     90.47
06 normal outlet         244.52       0.03    12052.6      1206.4     18.13
08 sedimen + decay         0.00       0.00    47926.6      4797.3
09 total inflow          243.91       0.03    59979.5      6003.7     90.47
10 surface outflow       244.52       0.03    12052.6      1206.4     18.13
12 total outflow         244.52       0.03    12052.6      1206.4     18.13
13 total trapped           0.00       0.00    47926.6      4797.3
14 storage increase        0.00       0.00        0.3         0.0
15 mass balance chec      -0.62       0.00        0.0         0.0
Reduction (%)              0.00       0.00       79.9        79.9
```

```
Device: Pond 7                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     243.91       0.03      204.2       20.4       0.31
06 normal outlet         244.52       0.03      108.8       10.9       0.16
08 sedimen + decay         0.00       0.00       95.4        9.5
09 total inflow          243.91       0.03      204.2       20.4       0.31
10 surface outflow       244.52       0.03      108.8       10.9       0.16
12 total outflow         244.52       0.03      108.8       10.9       0.16
13 total trapped           0.00       0.00       95.4        9.5
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.62       0.00        0.0        0.0
Reduction (%)              0.00       0.00       46.7       46.7

Device: Pond 8                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      20.98       0.00     4270.0      427.4      74.90
06 normal outlet          20.98       0.00      379.7       38.0       6.66
08 sedimen + decay         0.00       0.00     3890.3      389.4
09 total inflow           20.98       0.00     4270.0      427.4      74.90
10 surface outflow        20.98       0.00      379.7       38.0       6.66
12 total outflow          20.98       0.00      379.7       38.0       6.66
13 total trapped           0.00       0.00     3890.3      389.4
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       91.1       91.1

Device: Pond 8                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      20.98       0.00       15.5        1.6       0.27
06 normal outlet          20.98       0.00        7.0        0.7       0.12
08 sedimen + decay         0.00       0.00        8.5        0.8
09 total inflow           20.98       0.00       15.5        1.6       0.27
10 surface outflow        20.98       0.00        7.0        0.7       0.12
12 total outflow          20.98       0.00        7.0        0.7       0.12
13 total trapped           0.00       0.00        8.5        0.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       54.6       54.6

Device: Pond 14 (Outfall #10)  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     221.19       0.03    55698.1     5575.1      92.64
06 normal outlet         221.19       0.03     3087.4      309.0       5.14
08 sedimen + decay         0.00       0.00    52610.2     5266.1
09 total inflow          221.19       0.03    55698.1     5575.1      92.64
10 surface outflow       221.19       0.03     3087.4      309.0       5.14
12 total outflow         221.19       0.03     3087.4      309.0       5.14
13 total trapped           0.00       0.00    52610.2     5266.1
14 storage increase        0.00       0.00        0.4        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       94.5       94.5

Device: Pond 14 (Outfall #10)  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     221.19       0.03      188.2       18.8       0.31
06 normal outlet         221.19       0.03       71.1        7.1       0.12
08 sedimen + decay         0.00       0.00      116.9       11.7
```

```
09 total inflow          221.19       0.03      188.2       18.8       0.31
10 surface outflow       221.19       0.03       71.1        7.1       0.12
12 total outflow         221.19       0.03       71.1        7.1       0.12
13 total trapped           0.00       0.00      116.9       11.7
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       62.1       62.1

Device: Wetland 4              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      25.24       0.00     6225.9      623.2      90.74
06 normal outlet          25.26       0.00     2001.2      200.3      29.15
08 sedimen + decay         0.00       0.00     4224.3      422.8
09 total inflow           25.24       0.00     6225.9      623.2      90.74
10 surface outflow        25.26       0.00     2001.2      200.3      29.15
12 total outflow          25.26       0.00     2001.2      200.3      29.15
13 total trapped           0.00       0.00     4224.3      422.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.01       0.00        0.4        0.0
Reduction (%)              0.00       0.00       67.9       67.9

Device: Wetland 4              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      25.24       0.00       21.2        2.1       0.31
06 normal outlet          25.26       0.00       14.3        1.4       0.21
08 sedimen + decay         0.00       0.00        6.9        0.7
09 total inflow           25.24       0.00       21.2        2.1       0.31
10 surface outflow        25.26       0.00       14.3        1.4       0.21
12 total outflow          25.26       0.00       14.3        1.4       0.21
13 total trapped           0.00       0.00        6.9        0.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.01       0.00        0.0        0.0
Reduction (%)              0.00       0.00       32.4       32.4

Device: Wetland 5              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      93.66       0.01    23900.0     2392.3      93.89
06 normal outlet          93.66       0.01     7194.2      720.1      28.26
08 sedimen + decay         0.00       0.00    16705.6     1672.2
09 total inflow           93.66       0.01    23900.0     2392.3      93.89
10 surface outflow        93.66       0.01     7194.2      720.1      28.26
12 total outflow          93.66       0.01     7194.2      720.1      28.26
13 total trapped           0.00       0.00    16705.6     1672.2
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.2        0.0
Reduction (%)              0.00       0.00       69.9       69.9

Device: Wetland 5              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      93.66       0.01       80.4        8.0       0.32
06 normal outlet          93.66       0.01       52.3        5.2       0.21
08 sedimen + decay         0.00       0.00       28.1        2.8
09 total inflow           93.66       0.01       80.4        8.0       0.32
10 surface outflow        93.66       0.01       52.3        5.2       0.21
12 total outflow          93.66       0.01       52.3        5.2       0.21
13 total trapped           0.00       0.00       28.1        2.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       35.0       35.0
```

```
Device: Wetland 2              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
Reduction (%)             0.00       0.00        0.0        0.0

Device: Wetland 2              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
Reduction (%)             0.00       0.00        0.0        0.0

Device: Wetland 3              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     49.91       0.01    12712.9     1272.5      93.71
06 normal outlet         49.91       0.01      297.6       29.8       2.19
08 sedimen + decay        0.00       0.00    12414.8     1242.7
09 total inflow          49.91       0.01    12712.9     1272.5      93.71
10 surface outflow       49.91       0.01      297.6       29.8       2.19
12 total outflow         49.91       0.01      297.6       29.8       2.19
13 total trapped          0.00       0.00    12414.8     1242.7
14 storage increase       0.00       0.00        0.0        0.0
15 mass balance chec      0.00       0.00        0.5        0.0
Reduction (%)             0.00       0.00       97.7       97.7

Device: Wetland 3              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     49.91       0.01       42.8        4.3       0.32
06 normal outlet         49.91       0.01       14.6        1.5       0.11
08 sedimen + decay        0.00       0.00       28.2        2.8
09 total inflow          49.91       0.01       42.8        4.3       0.32
10 surface outflow       49.91       0.01       14.6        1.5       0.11
12 total outflow         49.91       0.01       14.6        1.5       0.11
13 total trapped          0.00       0.00       28.2        2.8
14 storage increase       0.00       0.00        0.0        0.0
15 mass balance chec      0.00       0.00        0.0        0.0
Reduction (%)             0.00       0.00       65.9       65.9

Device: Pond 9                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    230.54       0.03    57198.1     5725.3      91.28
02 upstream device      294.44       0.04    12350.2     1236.2      15.43
06 normal outlet        525.76       0.07    32794.1     3282.6      22.95
08 sedimen + decay        0.00       0.00    36754.1     3678.9
09 total inflow         524.98       0.07    69548.3     6961.5      48.74
10 surface outflow      525.76       0.07    32794.1     3282.6      22.95
12 total outflow        525.76       0.07    32794.1     3282.6      22.95
13 total trapped          0.00       0.00    36754.1     3678.9
14 storage increase       0.00       0.00        0.1        0.0
15 mass balance chec     -0.78       0.00        0.0        0.0
Reduction (%)             0.00       0.00       52.8       52.8

Device: Pond 9                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    230.54       0.03      194.2       19.4       0.31
02 upstream device      294.44       0.04      123.4       12.4       0.15
06 normal outlet        525.76       0.07      258.8       25.9       0.18
08 sedimen + decay        0.00       0.00       58.8        5.9
09 total inflow         524.98       0.07      317.5       31.8       0.22
10 surface outflow      525.76       0.07      258.8       25.9       0.18
```

```
12 total outflow         525.76       0.07      258.8       25.9       0.18
13 total trapped           0.00       0.00       58.8        5.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.78       0.00        0.0        0.0
Reduction (%)              0.00       0.00       18.5       18.5

Device: Pond 11                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      28.67       0.00     7095.3      710.2      91.04
02 upstream device       525.76       0.07    32794.1     3282.6      22.95
06 normal outlet         554.44       0.08     9575.7      958.5       6.35
08 sedimen + decay         0.00       0.00    30313.5     3034.3
09 total inflow          554.44       0.08    39889.4     3992.8      26.47
10 surface outflow       554.44       0.08     9575.7      958.5       6.35
12 total outflow         554.44       0.08     9575.7      958.5       6.35
13 total trapped           0.00       0.00    30313.5     3034.3
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       76.0       76.0

Device: Pond 11                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      28.67       0.00       24.1        2.4       0.31
02 upstream device       525.76       0.07      258.8       25.9       0.18
06 normal outlet         554.44       0.08      185.6       18.6       0.12
08 sedimen + decay         0.00       0.00       97.3        9.7
09 total inflow          554.44       0.08      282.9       28.3       0.19
10 surface outflow       554.44       0.08      185.6       18.6       0.12
12 total outflow         554.44       0.08      185.6       18.6       0.12
13 total trapped           0.00       0.00       97.3        9.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       34.4       34.4

Device: Pond 10                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      14.03       0.00     3523.9      352.7      92.43
02 upstream device       575.41       0.08     9955.4      996.5       6.37
06 normal outlet         589.57       0.08     8048.1      805.6       5.02
08 sedimen + decay         0.00       0.00     5431.2      543.6
09 total inflow          589.44       0.08    13479.4     1349.2       8.41
10 surface outflow       589.57       0.08     8048.1      805.6       5.02
12 total outflow         589.57       0.08     8048.1      805.6       5.02
13 total trapped           0.00       0.00     5431.2      543.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.14       0.00        0.0        0.0
Reduction (%)              0.00       0.00       40.3       40.3

Device: Pond 10                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      14.03       0.00       11.9        1.2       0.31
02 upstream device       575.41       0.08      192.6       19.3       0.12
06 normal outlet         589.57       0.08      189.1       18.9       0.12
08 sedimen + decay         0.00       0.00       15.4        1.5
09 total inflow          589.44       0.08      204.5       20.5       0.13
10 surface outflow       589.57       0.08      189.1       18.9       0.12
12 total outflow         589.57       0.08      189.1       18.9       0.12
13 total trapped           0.00       0.00       15.4        1.5
14 storage increase        0.00       0.00        0.0        0.0
```

```
15 mass balance chec      -0.14       0.00        0.0        0.0
Reduction (%)              0.00       0.00        7.5        7.5

Device: Pond 12                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     112.83       0.02    28547.2     2857.5      93.08
02 upstream device       614.83       0.08    10049.3     1005.9       6.01
06 normal outlet         727.67       0.10     6421.4      642.8       3.25
08 sedimen + decay         0.00       0.00    32174.9     3220.6
09 total inflow          727.67       0.10    38596.5     3863.4      19.51
10 surface outflow       727.67       0.10     6421.4      642.8       3.25
12 total outflow         727.67       0.10     6421.4      642.8       3.25
13 total trapped           0.00       0.00    32174.9     3220.6
14 storage increase        0.00       0.00        0.2        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       83.4       83.4

Device: Pond 12                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     112.83       0.02       96.3        9.6       0.31
02 upstream device       614.83       0.08      203.4       20.4       0.12
06 normal outlet         727.67       0.10      220.0       22.0       0.11
08 sedimen + decay         0.00       0.00       79.7        8.0
09 total inflow          727.67       0.10      299.7       30.0       0.15
10 surface outflow       727.67       0.10      220.0       22.0       0.11
12 total outflow         727.67       0.10      220.0       22.0       0.11
13 total trapped           0.00       0.00       79.7        8.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       26.6       26.6

Device: CRH-1                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     101.61       0.01    25475.6     2550.0      92.25
06 normal outlet         101.61       0.01     5758.7      576.4      20.85
08 sedimen + decay         0.00       0.00    19716.9     1973.6
09 total inflow          101.61       0.01    25475.6     2550.0      92.25
10 surface outflow       101.61       0.01     5758.7      576.4      20.85
12 total outflow         101.61       0.01     5758.7      576.4      20.85
13 total trapped           0.00       0.00    19716.9     1973.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       77.4       77.4

Device: CRH-1                  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     101.61       0.01       86.2        8.6       0.31
06 normal outlet         101.61       0.01       48.9        4.9       0.18
08 sedimen + decay         0.00       0.00       37.3        3.7
09 total inflow          101.61       0.01       86.2        8.6       0.31
10 surface outflow       101.61       0.01       48.9        4.9       0.18
12 total outflow         101.61       0.01       48.9        4.9       0.18
13 total trapped           0.00       0.00       37.3        3.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       43.3       43.3

Device: CRH-2                  Type: POND                       Variable: TSS
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```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.08       0.01    21153.2     2117.3      93.67
06 normal outlet          83.08       0.01     2881.7      288.4      12.76
08 sedimen + decay         0.00       0.00    18271.5     1828.9
09 total inflow           83.08       0.01    21153.2     2117.3      93.67
10 surface outflow        83.08       0.01     2881.7      288.4      12.76
12 total outflow          83.08       0.01     2881.7      288.4      12.76
13 total trapped           0.00       0.00    18271.5     1828.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       86.4       86.4

Device: CRH-2                  Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.08       0.01       71.2        7.1       0.32
06 normal outlet          83.08       0.01       33.2        3.3       0.15
08 sedimen + decay         0.00       0.00       38.0        3.8
09 total inflow           83.08       0.01       71.2        7.1       0.32
10 surface outflow        83.08       0.01       33.2        3.3       0.15
12 total outflow          83.08       0.01       33.2        3.3       0.15
13 total trapped           0.00       0.00       38.0        3.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       53.4       53.4

Device: CRH-3                  Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      13.89       0.00     3435.3      343.9      90.99
02 upstream device        83.08       0.01     2881.7      288.4      12.76
06 normal outlet          96.97       0.01     2052.2      205.4       7.79
08 sedimen + decay         0.00       0.00     4264.8      426.9
09 total inflow           96.97       0.01     6317.0      632.3      23.97
10 surface outflow        96.97       0.01     2052.2      205.4       7.79
12 total outflow          96.97       0.01     2052.2      205.4       7.79
13 total trapped           0.00       0.00     4264.8      426.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       67.5       67.5

Device: CRH-3                  Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      13.89       0.00       11.7        1.2       0.31
02 upstream device        83.08       0.01       33.2        3.3       0.15
06 normal outlet          96.97       0.01       33.9        3.4       0.13
08 sedimen + decay         0.00       0.00       10.9        1.1
09 total inflow           96.97       0.01       44.9        4.5       0.17
10 surface outflow        96.97       0.01       33.9        3.4       0.13
12 total outflow          96.97       0.01       33.9        3.4       0.13
13 total trapped           0.00       0.00       10.9        1.1
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       24.4       24.4

Device: SB 18 Swale            Type: INF_BASIN                 Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      84.53       0.01    10961.7     1097.2      47.71
03 infiltrate             79.77       0.01     1287.0      128.8       5.94
04 exfiltrate             79.77       0.01        0.0        0.0       0.00
05 filtered                0.00       0.00     1287.0      128.8
```

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07 spillway outlet         4.76       0.00     1041.3      104.2      80.49
08 sedimen + decay         0.00       0.00     8633.4      864.2
09 total inflow           84.53       0.01    10961.7     1097.2      47.71
10 surface outflow         4.76       0.00     1041.3      104.2      80.49
11 groundw outflow        79.77       0.01        0.0        0.0       0.00
12 total outflow          84.53       0.01     1041.3      104.2       4.53
13 total trapped           0.00       0.00     9920.4      993.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       90.5       90.5

Device: SB 18 Swale            Type: INF_BASIN                 Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      84.53       0.01       48.1        4.8       0.21
03 infiltrate             79.77       0.01       26.4        2.6       0.12
04 exfiltrate             79.77       0.01        2.1        0.2       0.01
05 filtered                0.00       0.00       24.2        2.4
07 spillway outlet         4.76       0.00        4.6        0.5       0.35
08 sedimen + decay         0.00       0.00       17.1        1.7
09 total inflow           84.53       0.01       48.1        4.8       0.21
10 surface outflow         4.76       0.00        4.6        0.5       0.35
11 groundw outflow        79.77       0.01        2.1        0.2       0.01
12 total outflow          84.53       0.01        6.7        0.7       0.03
13 total trapped           0.00       0.00       41.3        4.1
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       86.0       86.0

Device: Pond 13                Type: POND                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1345.33       0.19   344217.7    34454.8      94.14
02 upstream device       732.43       0.10     7462.6      747.0       3.75
06 normal outlet        2077.74       0.29    95897.0     9598.9      16.98
08 sedimen + decay         0.00       0.00   255781.9    25602.7
09 total inflow         2077.76       0.29   351680.3    35201.8      62.27
10 surface outflow      2077.74       0.29    95897.0     9598.9      16.98
12 total outflow        2077.74       0.29    95897.0     9598.9      16.98
13 total trapped           0.00       0.00   255781.9    25602.7
14 storage increase        0.00       0.00        1.4        0.1
15 mass balance chec       0.02       0.00        0.0        0.0
Reduction (%)              0.00       0.00       72.7       72.7

Device: Pond 13                Type: POND                      Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1345.33       0.19     1157.1      115.8       0.32
02 upstream device       732.43       0.10      224.5       22.5       0.11
06 normal outlet        2077.74       0.29      908.8       91.0       0.16
08 sedimen + decay         0.00       0.00      472.9       47.3
09 total inflow         2077.76       0.29     1381.7      138.3       0.24
10 surface outflow      2077.74       0.29      908.8       91.0       0.16
12 total outflow        2077.74       0.29      908.8       91.0       0.16
13 total trapped           0.00       0.00      472.9       47.3
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.02       0.00        0.0        0.0
Reduction (%)              0.00       0.00       34.2       34.2

Device: Outfall #5             Type: PIPE                      Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2077.74       0.29    95897.0     9598.9      16.98
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06 normal outlet        2077.74       0.29    95897.0     9598.9      16.98
09 total inflow         2077.74       0.29    95897.0     9598.9      16.98
10 surface outflow      2077.74       0.29    95897.0     9598.9      16.98
12 total outflow        2077.74       0.29    95897.0     9598.9      16.98
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #5             Type: PIPE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2077.74       0.29      908.8       91.0       0.16
06 normal outlet        2077.74       0.29      908.8       91.0       0.16
09 total inflow         2077.74       0.29      908.8       91.0       0.16
10 surface outflow      2077.74       0.29      908.8       91.0       0.16
12 total outflow        2077.74       0.29      908.8       91.0       0.16
Reduction (%)              0.00       0.00        0.0        0.0

Device: Thumb Infiltration     Type: INF_BASIN                  Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     218.09       0.03    47385.3     4743.1      79.94
03 infiltrate            215.58       0.03     6476.5      648.3      11.05
04 exfiltrate            215.58       0.03        0.0        0.0       0.00
05 filtered                0.00       0.00     6476.5      648.3
07 spillway outlet         2.51       0.00      420.4       42.1      61.54
08 sedimen + decay         0.00       0.00    40488.3     4052.7
09 total inflow          218.09       0.03    47385.3     4743.1      79.94
10 surface outflow         2.51       0.00      420.4       42.1      61.54
11 groundw outflow       215.58       0.03        0.0        0.0       0.00
12 total outflow         218.09       0.03      420.4       42.1       0.71
13 total trapped           0.00       0.00    46964.9     4701.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       99.1       99.1

Device: Thumb Infiltration     Type: INF_BASIN                  Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     218.09       0.03      168.1       16.8       0.28
03 infiltrate            215.58       0.03       82.8        8.3       0.14
04 exfiltrate            215.58       0.03        5.8        0.6       0.01
05 filtered                0.00       0.00       77.0        7.7
07 spillway outlet         2.51       0.00        2.2        0.2       0.32
08 sedimen + decay         0.00       0.00       83.2        8.3
09 total inflow          218.09       0.03      168.1       16.8       0.28
10 surface outflow         2.51       0.00        2.2        0.2       0.32
11 groundw outflow       215.58       0.03        5.8        0.6       0.01
12 total outflow         218.09       0.03        8.0        0.8       0.01
13 total trapped           0.00       0.00      160.1       16.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       95.2       95.2

Device: To Rice Creek          Type: PIPE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2278.84       0.31   104128.4    10422.8      16.81
06 normal outlet        2278.84       0.31   104128.4    10422.8      16.81
09 total inflow         2278.84       0.31   104128.4    10422.8      16.81
10 surface outflow      2278.84       0.31   104128.4    10422.8      16.81
12 total outflow        2278.84       0.31   104128.4    10422.8      16.81
Reduction (%)              0.00       0.00        0.0        0.0

Device: To Rice Creek          Type: PIPE                       Variable: TP
```

```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2278.84       0.31      993.8       99.5       0.16
06 normal outlet        2278.84       0.31      993.8       99.5       0.16
09 total inflow         2278.84       0.31      993.8       99.5       0.16
10 surface outflow      2278.84       0.31      993.8       99.5       0.16
12 total outflow        2278.84       0.31      993.8       99.5       0.16
Reduction (%)              0.00       0.00        0.0        0.0
```

Rice Creek P8 Results
Scenario 3: Fully Developed Conditions

```
P8 Urban Catchment Model, Version 3.5                                  Run Date
06/10/15
Case        Rice Creek Full Build.p8c     FirstDate  01/01/01          Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10          Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598             Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576            TotalYrs
9.99


File Directory        T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater Prelim
Design\Models\P8\
Case Title            Rice Creek
Case File             Rice Creek Full Build.p8c
Particle File         nurp50.p8p
Temperature File      temp1970-2011.tmp
Storm File            precip1970-2010.pcp
Precip Scale Factor       1

Watersheds                16
Devices                   19
Particles                 5
WQ Components             7

Start Date             06/01/00
Keep Date              01/01/01
Stop Date              12/31/10
Storm Count              598
Total Hours             87576
Wet Hours                9265
Precip (in)              297
Rain (in)                274
Snowfall (in)             23
Snowmelt (in)             22
EvapoTran(in)            303

Overall TSS Removal(%)    1
Water Balance Error(%)    0
TSS Mass Balance Error    0
```

```
P8 Urban Catchment Model, Version 3.5                                   Run Date
06/10/15
Case        Rice Creek Full Build.p8c     FirstDate  01/01/01           Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events        598             Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs     87576            TotalYrs
 9.99


Case Title                       Rice Creek
Case Data File                   Rice Creek Full Build.p8c
Path                             T:\1382 KimleyHorn\01 TCAAP\TASK 03 Stormwater
Prelim Design\Models\P8\
Case Notes:                      Full Build
Storm Data File                  precip1970-2010.pcp
Particle File                    nurp50.p8p
Air Temp File File               temp1970-2011.tmp

Time Steps Per Hour                  4
Minimum Inter-Event Time (hrs)       10
Maximum Continuity Error %           2
Rainfall Breakpoint (inches)        0.8
Precipitation Scale Factor           1
Air Temp Offset (deg-F)              0
Loops Thru Storm File                1
Simulation Dates
Start                             6/1/2000
Keep                              1/1/2001
Stop                             12/31/2010

Max Snowfall Temperature (deg-f)    32.0
SnowMelt Temperature (deg-f)        32.0
Snowmelt Coef (in/degF-Day)         0.06
Soil Freeze Temp (deg-F)            32.0
Snowmelt Abstraction Factor         1.00
Evapo-Trans. Calibration Factor     1.00
Growing Season Start Month           5
Growing Season End Month             10

5-Day Antecedent Rainfall + Runoff (inches)
CN Antecedent Moisture Condition  AMC-II   AMC-III
Growing Season                      1.40      2.10
NonGrowing Season                   0.50      1.10

Watershed Data
Watershed Name                      SB 8     SB 10      SB 9      SB 12     SB 11
SB 14     SB 13     SB 18   SB 15, 16,  SB 17     SB 19   Inflow fro  SB 28     SB
29      SB 1   SB 22 and 27
Runoff to Device                   Pond 7    Pond 8    Pond 9    Pond 10   Pond 11
Pond 12  Wetland 4 Infiltrati Pond 13  Wetland 5 Pond 14 (OWetland 3   CRH-1
CRH-2     CRH-3   Thumb Infiltration
Infiltration to Device
Watershed Area                      29.6      6.39      25.79      1.38      3.29
10.23     2.985     52.908   105.327    7.608     21.198     4.16     6.955
10.214    1.601     7.656
SCS Curve Number (Pervious)          74         74         74         74         74
  74         74         74         74         74         74         74         74         74
       74         74
Scale Factor for Pervious Runoff     1          1          1          1          1
  1          1          1          1          1          1          1          1          1
```

```
       1         1
Indirectly Connected Imperv Frac    0         0          0         0         0
  0         0         0         0         0         0         0         0         0
       0         0
UnSwept Impervious Fraction        0.3      0.076     0.3317     0.3871    0.3216
0.4262    0.3099    0.8455    0.505     0.4841    0.3993     0.47     0.4676
0.3773    0.3198    0.8423
UnSwept Depression Storage (inch   0.02      0.02      0.02       0.02      0.02
 0.02      0.02      0.02      0.02      0.02      0.02      0.02      0.02
0.02      0.02      0.02
UnSwept Imperv. Runoff Coefficie    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
UnSwept Scale Factor for Particl    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Swept Impervious Fraction           0         0          0         0         0
  0         0         0         0         0         0         0         0         0
       0         0
Swept Depression Storage (inches   0.02      0.02      0.02       0.02      0.02
 0.02      0.02      0.02      0.02      0.02      0.02       0         0         0
       0        0.02
Swept Imperv. Runoff Coefficient    1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Swept Scale Factor for Particle     1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Sweeping Frequency                 0.5       0.5        0.5       0.5       0.5
 0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5       0.5
      0.5       0.5
Sweeping Efficiency                 1         1          1         1         1
  1         1         1         1         1         1         1         1         1
       1         1
Sweeping Start Date (MMDD)         101       101        101       101       101
 101       101       101       101       101       101       101       101       101
      101       101
Sweeping Stop Date (MMDD)          1231      1231      1231       1231      1231
 1231      1231      1231      1231      1231      1231      1231      1231
1231      1231      1231

Device Data
Device Name                       Pond 7    Pond 8    Pond 9    Pond 10   Pond 11
Pond 12   Pond 13  InfiltratiPond 14 (OWetland 4 Wetland 5 Outfall #5Wetland 3
Wetland 2   CRH-1     CRH-2   To Rice Cr  CRH-3   Thumb Infiltration
Device Type                        POND      POND      POND       POND      POND
 POND      POND   INF_BASIN    POND      POND      POND      PIPE      POND
POND      POND      POND      PIPE      POND   INF_BASIN
Infiltration Outlet
Normal Outlet                     Pond 9   Pond 10    Pond 11   Pond 12   Pond 10
Pond 13  Outfall #5          To Rice Cr Pond 12  Outfall #5To Rice Cr  Pond 9
Wetland 3 To Rice Cr  CRH-3             To Rice Creek
Spillway Outlet                   Pond 9   Pond 10    Pond 11   Pond 12   Pond 10
Pond 13  Outfall #5 Pond 13  To Rice Cr Pond 12  Outfall #5            Pond 9
Wetland 3 To Rice Cr  CRH-3             To Rice CrTo Rice Creek
Particle Removal Scale Factor       1         1          1         1         1
  1         1         1         1         1         1                   1         1
       1         1                   1         1
Bottom Elevation (ft)               0         0          0         0         0
  0         0         0         0         0         0                   0         0
       0         0                   0         0
Bottom Area (acres)               0.143     0.057      0.024      0.13      0.97
 1.2       0.02       0        1.22       0         0                 2.157
```

```
2.157      0.15      0.2                 0.15       0
Permanent Pool Area (acres)       0.548      0.26      0.41      0.288      1.32
 1.64     1.988               1.557       0         0                 2.355
2.18     0.225      0.35               0.225
Permanent Pool Volume (ac-ft)       1        0.6        0.5       0.8       4.5
 5.7       6.2                 2.3        0         0                   0         0
     0.187     0.412               0.187
Perm Pool Infilt Rate (in/hr)       0         0          0         0         0
  0         0                  0         0         0                   0         0
       0         0                  0
Flood Pool Area (acres)           0.723     0.669      0.75       0.61      2.11
 2.38      4.03      3.32     2.179     1.891     1.891               2.653
2.591      0.5       0.6                 0.5       3.74
Flood Pool Volume (ac-ft)          0.5       0.9        0.4       1.1       6.6
 5.3       8.1       3.32      5.1       2.5       5.8                 2.6       1.2
     0.663      1.18               0.663      3.74
Flood Pool Infilt Rate (in/hr)      0         0          0         0         0
  0         0        0.45       0         0         0                   0         0
       0         0                  0        0.45
Infilt Basin Void Fraction (%)
                     100
                                              100
Detention Pond Outlet Parameters
Outlet Type                        WEIR    ORIFICE     WEIR       WEIR    ORIFICE
ORIFICE     WEIR              ORIFICE   ORIFICE   ORIFICE             ORIFICE
ORIFICE   ORIFICE   ORIFICE             ORIFICE
Outlet Orifice Diameter (in)                  24                            12
  12                            12        12        6                   12        12
       24        24                  24
Orifice Discharge Coef                        1                            0.6
 0.6                           0.6       0.6       0.6                 0.6       0.6
      0.6       0.6                 0.6
Outlet Weir Length (ft)             75                  80         50
            55
Weir Discharge Coef                3.3                 3.3       3.3
           3.3
Perforated Riser Height (ft)
Number of Holes in Riser
Holes Diameter
Flood Pool Drain Time (hrs)
Swale Parameters
Length of Flow Path (ft)
Slope of Flow Path %
Bottom Width (ft)
Side Slope (ft-v/ft-h)
Maximum Depth of Flow (ft)
Mannings n Constant
Hydraulic Model
Pipe, Splitter, Aquifer Parameter
Hydraulic Res. Time (hrs)
                                                              0
                           0

Particle Data
Particle File         nurp50.p8p
Particle Class           P0%       P10%      P30%      P50%       P80%
Filtration Efficiency     90       100       100        100       100
Settling Velocity (ft/    0        0.03      0.3        1.5        15
First Order Decay Rate    0         0         0          0         0
2nd Order Decay (1/day    0         0         0          0         0
Impervious Runoff Conc    1         0         0          0         0
Pervious Runoff Conc (    1        100       100        100       200
Pervious Conc Exponent    0         1         1          1         1
```

```
Accum. Rate (lbs-ac-da    0        1.75      1.75      1.75       3.5
Particle Removal Rate     0        0.25      0.25      0.25       0.25
Washoff Coefficient       0         20        20        20         20
Washoff Exponent          0         2         2          2         2
Sweeper Efficiency        0         0         0          5         15

Water Quality Component Data
Component Name           TSS        TP       TKN       CU          PB         ZN
  HC

Water Quality Criteria (ppm)
             Level 1      5       0.025       2          2        0.02        5
 0.1
             Level 2      10       0.05       1       0.0048     0.014     0.0362
 0.5
             Level 3      20       0.1       0.5       0.02       0.15       0.38
  1

Content Scale Factor      1         1         1          1         1          1
  1

Particle Composition (mg/kg)
P0%                       0       99000     600000     13600      2000     640000
250000
P10%                   1000000     3850     15000       340       180        1600
22500
P30%                   1000000     3850     15000       340       180        1600
22500
P50%                   1000000     3850     15000       340       180        1600
22500
P80%                   1000000      0         0         340       180         0
22500
```

```
P8 Urban Catchment Model, Version 3.5                                  Run Date
06/10/15
Case        Rice Creek Full Build.p8c     FirstDate  01/01/01           Precip(in)
296.7
Title       Rice Creek                    LastDate   12/31/10           Rain(in)
273.57
PrecFile    precip1970-2010.pcp           Events       598              Snow(in)
23.12
PartFile    nurp50.p8p                    TotalHrs    87576             TotalYrs
9.99


Devices Listed in Downstream Order

Device:     Pond 7              Type:     POND
            Discharges normal outlet to   Pond 9
            Discharges spillway to        Pond 9
            Runoff from watershed         SB 8

Device:     Pond 8              Type:     POND
            Discharges normal outlet to   Pond 10
            Discharges spillway to        Pond 10
            Runoff from watershed         SB 10

Device:     Infiltration BMP    Type:     INF_BASIN
            Discharges spillway to        Pond 13
            Runoff from watershed         SB 18

Device:     Pond 14 (Outfall #10Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 19

Device:     Wetland 4           Type:     POND
            Discharges normal outlet to   Pond 12
            Discharges spillway to        Pond 12
            Runoff from watershed         SB 13

Device:     Wetland 5           Type:     POND
            Discharges normal outlet to   Outfall #5
            Discharges spillway to        Outfall #5
            Runoff from watershed         SB 17

Device:     Wetland 2           Type:     POND
            Discharges normal outlet to   Wetland 3
            Discharges spillway to        Wetland 3

Device:     Wetland 3           Type:     POND
            Discharges normal outlet to   Pond 9
            Discharges spillway to        Pond 9
            Runoff from watershed         Inflow from Ponds 4/5

Device:     Pond 9              Type:     POND
            Discharges normal outlet to   Pond 11
            Discharges spillway to        Pond 11
            Runoff from watershed         SB 9

Device:     Pond 11             Type:     POND
            Discharges normal outlet to   Pond 10
            Discharges spillway to        Pond 10
            Runoff from watershed         SB 11

Device:     Pond 10             Type:     POND
```

```
            Discharges normal outlet to   Pond 12
            Discharges spillway to        Pond 12
            Runoff from watershed         SB 12

Device:     Pond 12             Type:     POND
            Discharges normal outlet to   Pond 13
            Discharges spillway to        Pond 13
            Runoff from watershed         SB 14

Device:     Pond 13             Type:     POND
            Discharges normal outlet to   Outfall #5
            Discharges spillway to        Outfall #5
            Runoff from watershed         SB 15, 16, 26

Device:     Outfall #5          Type:     PIPE
            Discharges normal outlet to   To Rice Creek

Device:     CRH-1               Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 28

Device:     CRH-2               Type:     POND
            Discharges normal outlet to   CRH-3
            Discharges spillway to        CRH-3
            Runoff from watershed         SB 29

Device:     CRH-3               Type:     POND
            Discharges normal outlet to   To Rice Creek
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 1

Device:     Thumb Infiltration  Type:     INF_BASIN
            Discharges spillway to        To Rice Creek
            Runoff from watershed         SB 22 and 27

Device:     To Rice Creek       Type:     PIPE
```

```
P8-V3.X      Rice Creek Full Build.p8c
                                                                              Directly
Connected UnSwept AreasDirectly Connected Swept Areas--Street Sweeping Parameters
                Total                              PerviousIndirectPervious
Depress         Imperv        Depress         Imperv  Start    Stop
Sweep
Watershed       Area        Outflow     Percol     Curve   Imperv   Load   Imperv
Storage  Runoff  Load   Imperv Storage  Runoff   Load    Date     Date   Sweep
Freq
Label           acres       Device      Device     Number Fraction Factor Fraction
inches   Coef   Factor Fraction inches   Coef   Factor   MMDD    MMDD   Effic
1/week
SB 8            29.6        Pond 7                    74    0.000     1      0.3
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 10           6.39        Pond 8                    74    0.000     1     0.076
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 9            25.79       Pond 9                    74    0.000     1     0.3317
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 12           1.38        Pond 10                   74    0.000     1     0.3871
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 11           3.29        Pond 11                   74    0.000     1     0.3216
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 14           10.23       Pond 12                   74    0.000     1     0.4262
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 13           2.985      Wetland 4                  74    0.000     1     0.3099
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 18          52.908    Infiltration BMP             74    0.000     1     0.8455
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 15, 16, 26  105.327      Pond 13                   74    0.000     1     0.505
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 17           7.608      Wetland 5                  74    0.000     1     0.4841
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
SB 19          21.198    Pond 14 (Outfall #10)        74    0.000     1     0.3993
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
Inflow from P   4.16       Wetland 3                  74    0.000     1      0.47
 0.02     1      1      0      0        1       1      101      1231     1       0.5
SB 28           6.955        CRH-1                    74    0.000     1     0.4676
 0.02     1      1      0      0        1       1      101      1231     1       0.5
SB 29          10.214        CRH-2                    74    0.000     1     0.3773
 0.02     1      1      0      0        1       1      101      1231     1       0.5
SB 1            1.601        CRH-3                    74    0.000     1     0.3198
 0.02     1      1      0      0        1       1      101      1231     1       0.5
SB 22 and 27    7.656    Thumb Infiltration           74    0.000     1     0.8423
 0.02     1      1      0      0.02     1       1      101      1231     1       0.5
```

```
P8 Urban Catchment Model, Version 3.5
 Run Date   06/10/15
Case                Rice Creek Full Build.p8c        FirstDate   01/01/01
 Precip(in)  296.7
Title               Rice Creek                       LastDate    12/31/10
 Rain(in)    273.57
PrecFile            precip1970-2010.pcp              Events         598
 Snow(in)    23.12
PartFile            nurp50.p8p                       TotalHrs      87576
 TotalYrs     9.99


Mass Balances by Device and Variable

Device: OVERALL                Type: NONE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    3814.06       0.53   976169.8    97710.6      94.16
03 infiltrate           1065.79       0.15    41546.7     4158.7      14.34
04 exfiltrate           1065.79       0.15        0.0        0.0       0.00
05 filtered                0.00       0.00    41546.7     4158.7
06 normal outlet        2749.56       0.38   112085.8    11219.3      15.00
08 sedimen + decay         0.00       0.00   822533.1    82332.2
09 total inflow         3814.06       0.53   976169.8    97710.6      94.16
10 surface outflow      2749.56       0.38   112085.8    11219.3      15.00
11 groundw outflow      1065.79       0.15        0.0        0.0       0.00
12 total outflow        3815.34       0.53   112085.8    11219.3      10.81
13 total trapped           0.00       0.00   864079.9    86490.9
14 storage increase        0.00       0.00        3.1        0.3
15 mass balance chec      -1.29       0.00        1.0        0.1
Reduction (%)              0.00       0.00       88.5       88.5

Device: OVERALL                Type: NONE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    3814.06       0.53     3281.2      328.4       0.32
03 infiltrate           1065.79       0.15      445.5       44.6       0.15
04 exfiltrate           1065.79       0.15       28.7        2.9       0.01
05 filtered                0.00       0.00      416.8       41.7
06 normal outlet        2749.56       0.38     1151.2      115.2       0.15
08 sedimen + decay         0.00       0.00     1684.4      168.6
09 total inflow         3814.06       0.53     3281.2      328.4       0.32
10 surface outflow      2749.56       0.38     1151.2      115.2       0.15
11 groundw outflow      1065.79       0.15       28.7        2.9       0.01
12 total outflow        3815.34       0.53     1179.9      118.1       0.11
13 total trapped           0.00       0.00     2101.2      210.3
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec      -1.29       0.00        0.0        0.0
Reduction (%)              0.00       0.00       64.0       64.0

Device: Pond 7                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     243.84       0.03    59961.6     6001.9      90.47
06 normal outlet         244.26       0.03    11590.2     1160.1      17.46
08 sedimen + decay         0.00       0.00    48371.2     4841.8
09 total inflow          243.84       0.03    59961.6     6001.9      90.47
10 surface outflow       244.26       0.03    11590.2     1160.1      17.46
12 total outflow         244.26       0.03    11590.2     1160.1      17.46
13 total trapped           0.00       0.00    48371.2     4841.8
14 storage increase        0.00       0.00        0.2        0.0
15 mass balance chec      -0.42       0.00        0.0        0.0
Reduction (%)              0.00       0.00       80.7       80.7
```

```
Device: Pond 7               Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     243.84       0.03      204.1        20.4      0.31
06 normal outlet         244.26       0.03      107.7        10.8      0.16
08 sedimen + decay         0.00       0.00       96.4         9.7
09 total inflow          243.84       0.03      204.1        20.4      0.31
10 surface outflow       244.26       0.03      107.7        10.8      0.16
12 total outflow         244.26       0.03      107.7        10.8      0.16
13 total trapped           0.00       0.00       96.4         9.7
14 storage increase        0.00       0.00        0.0         0.0
15 mass balance chec      -0.42       0.00        0.0         0.0
Reduction (%)              0.00       0.00       47.2        47.2

Device: Pond 8               Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      20.98       0.00     4270.0       427.4     74.90
06 normal outlet          20.98       0.00      363.5        36.4      6.38
08 sedimen + decay         0.00       0.00     3906.5       391.0
09 total inflow           20.98       0.00     4270.0       427.4     74.90
10 surface outflow        20.98       0.00      363.5        36.4      6.38
12 total outflow          20.98       0.00      363.5        36.4      6.38
13 total trapped           0.00       0.00     3906.5       391.0
14 storage increase        0.00       0.00        0.0         0.0
15 mass balance chec       0.00       0.00        0.0         0.0
Reduction (%)              0.00       0.00       91.5        91.5

Device: Pond 8               Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      20.98       0.00       15.5         1.6      0.27
06 normal outlet          20.98       0.00        6.9         0.7      0.12
08 sedimen + decay         0.00       0.00        8.5         0.9
09 total inflow           20.98       0.00       15.5         1.6      0.27
10 surface outflow        20.98       0.00        6.9         0.7      0.12
12 total outflow          20.98       0.00        6.9         0.7      0.12
13 total trapped           0.00       0.00        8.5         0.9
14 storage increase        0.00       0.00        0.0         0.0
15 mass balance chec       0.00       0.00        0.0         0.0
Reduction (%)              0.00       0.00       55.1        55.1

Device: Infiltration BMP     Type: INF_BASIN                  Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1074.32       0.15   282084.8     28235.5     96.60
03 infiltrate            910.87       0.13    35885.1      3592.0     14.49
04 exfiltrate            910.87       0.13        0.0         0.0      0.00
05 filtered                0.00       0.00    35885.1      3592.0
07 spillway outlet       163.45       0.02     9649.1       965.8     21.72
08 sedimen + decay         0.00       0.00   236550.6     23677.7
09 total inflow         1074.32       0.15   282084.8     28235.5     96.60
10 surface outflow       163.45       0.02     9649.1       965.8     21.72
11 groundw outflow       910.87       0.13        0.0         0.0      0.00
12 total outflow        1074.32       0.15     9649.1       965.8      3.30
13 total trapped           0.00       0.00   272435.7     27269.7
14 storage increase        0.00       0.00        0.0         0.0
15 mass balance chec       0.00       0.00        0.0         0.0
Reduction (%)              0.00       0.00       96.6        96.6

Device: Infiltration BMP     Type: INF_BASIN                  Variable: TP
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```
Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1074.32       0.15      940.7       94.2       0.32
03 infiltrate            910.87       0.13      382.2       38.3       0.15
04 exfiltrate            910.87       0.13       24.5        2.5       0.01
05 filtered                0.00       0.00      357.7       35.8
07 spillway outlet       163.45       0.02       80.7        8.1       0.18
08 sedimen + decay         0.00       0.00      477.8       47.8
09 total inflow         1074.32       0.15      940.7       94.2       0.32
10 surface outflow       163.45       0.02       80.7        8.1       0.18
11 groundw outflow       910.87       0.13       24.5        2.5       0.01
12 total outflow        1074.32       0.15      105.2       10.5       0.04
13 total trapped           0.00       0.00      835.5       83.6
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       88.8       88.8

Device: Pond 14 (Outfall #10)  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     221.19       0.03    55698.1     5575.1      92.64
06 normal outlet         221.19       0.03     3588.4      359.2       5.97
08 sedimen + decay         0.00       0.00    52109.6     5216.0
09 total inflow          221.19       0.03    55698.1     5575.1      92.64
10 surface outflow       221.19       0.03     3588.4      359.2       5.97
12 total outflow         221.19       0.03     3588.4      359.2       5.97
13 total trapped           0.00       0.00    52109.6     5216.0
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       93.6       93.6

Device: Pond 14 (Outfall #10)  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     221.19       0.03      188.2       18.8       0.31
06 normal outlet         221.19       0.03       73.2        7.3       0.12
08 sedimen + decay         0.00       0.00      115.0       11.5
09 total inflow          221.19       0.03      188.2       18.8       0.31
10 surface outflow       221.19       0.03       73.2        7.3       0.12
12 total outflow         221.19       0.03       73.2        7.3       0.12
13 total trapped           0.00       0.00      115.0       11.5
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       61.1       61.1

Device: Wetland 4              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      25.24       0.00     6225.9      623.2      90.74
06 normal outlet          25.26       0.00     2001.2      200.3      29.15
08 sedimen + decay         0.00       0.00     4224.3      422.8
09 total inflow           25.24       0.00     6225.9      623.2      90.74
10 surface outflow        25.26       0.00     2001.2      200.3      29.15
12 total outflow          25.26       0.00     2001.2      200.3      29.15
13 total trapped           0.00       0.00     4224.3      422.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.01       0.00        0.4        0.0
Reduction (%)              0.00       0.00       67.9       67.9

Device: Wetland 4              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      25.24       0.00       21.2        2.1       0.31
06 normal outlet          25.26       0.00       14.3        1.4       0.21
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08 sedimen + decay         0.00       0.00        6.9        0.7
09 total inflow           25.24       0.00       21.2        2.1       0.31
10 surface outflow        25.26       0.00       14.3        1.4       0.21
12 total outflow          25.26       0.00       14.3        1.4       0.21
13 total trapped           0.00       0.00        6.9        0.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.01       0.00        0.0        0.0
Reduction (%)              0.00       0.00       32.4       32.4

Device: Wetland 5              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      93.66       0.01    23900.0     2392.3      93.89
06 normal outlet          93.66       0.01     7194.2      720.1      28.26
08 sedimen + decay         0.00       0.00    16705.6     1672.2
09 total inflow           93.66       0.01    23900.0     2392.3      93.89
10 surface outflow        93.66       0.01     7194.2      720.1      28.26
12 total outflow          93.66       0.01     7194.2      720.1      28.26
13 total trapped           0.00       0.00    16705.6     1672.2
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.2        0.0
Reduction (%)              0.00       0.00       69.9       69.9

Device: Wetland 5              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      93.66       0.01       80.4        8.0       0.32
06 normal outlet          93.66       0.01       52.3        5.2       0.21
08 sedimen + decay         0.00       0.00       28.1        2.8
09 total inflow           93.66       0.01       80.4        8.0       0.32
10 surface outflow        93.66       0.01       52.3        5.2       0.21
12 total outflow          93.66       0.01       52.3        5.2       0.21
13 total trapped           0.00       0.00       28.1        2.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       35.0       35.0

Device: Wetland 2              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
Reduction (%)              0.00       0.00        0.0        0.0

Device: Wetland 2              Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
Reduction (%)              0.00       0.00        0.0        0.0

Device: Wetland 3              Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      49.91       0.01    12712.9     1272.5      93.71
06 normal outlet          49.91       0.01      297.6       29.8       2.19
08 sedimen + decay         0.00       0.00    12414.8     1242.7
09 total inflow           49.91       0.01    12712.9     1272.5      93.71
10 surface outflow        49.91       0.01      297.6       29.8       2.19
12 total outflow          49.91       0.01      297.6       29.8       2.19
13 total trapped           0.00       0.00    12414.8     1242.7
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.5        0.0
Reduction (%)              0.00       0.00       97.7       97.7

Device: Wetland 3              Type: POND                       Variable: TP
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Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      49.91       0.01       42.8        4.3       0.32
06 normal outlet          49.91       0.01       14.6        1.5       0.11
08 sedimen + decay         0.00       0.00       28.2        2.8
09 total inflow           49.91       0.01       42.8        4.3       0.32
10 surface outflow        49.91       0.01       14.6        1.5       0.11
12 total outflow          49.91       0.01       14.6        1.5       0.11
13 total trapped           0.00       0.00       28.2        2.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       65.9       65.9

Device: Pond 9                 Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     230.54       0.03    57198.1     5725.3      91.28
02 upstream device       294.18       0.04    11887.9     1189.9      14.87
06 normal outlet         525.31       0.07    27696.0     2772.3      19.40
08 sedimen + decay         0.00       0.00    41389.9     4143.0
09 total inflow          524.72       0.07    69086.0     6915.2      48.44
10 surface outflow       525.31       0.07    27696.0     2772.3      19.40
12 total outflow         525.31       0.07    27696.0     2772.3      19.40
13 total trapped           0.00       0.00    41389.9     4143.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.59       0.00        0.0        0.0
Reduction (%)              0.00       0.00       59.9       59.9

Device: Pond 9                 Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     230.54       0.03      194.2       19.4       0.31
02 upstream device       294.18       0.04      122.3       12.2       0.15
06 normal outlet         525.31       0.07      242.7       24.3       0.17
08 sedimen + decay         0.00       0.00       73.8        7.4
09 total inflow          524.72       0.07      316.4       31.7       0.22
10 surface outflow       525.31       0.07      242.7       24.3       0.17
12 total outflow         525.31       0.07      242.7       24.3       0.17
13 total trapped           0.00       0.00       73.8        7.4
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.59       0.00        0.0        0.0
Reduction (%)              0.00       0.00       23.3       23.3

Device: Pond 11                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      28.67       0.00     7095.3      710.2      91.04
02 upstream device       525.31       0.07    27696.0     2772.3      19.40
06 normal outlet         553.99       0.08     7896.3      790.4       5.24
08 sedimen + decay         0.00       0.00    26894.9     2692.1
09 total inflow          553.99       0.08    34791.4     3482.5      23.11
10 surface outflow       553.99       0.08     7896.3      790.4       5.24
12 total outflow         553.99       0.08     7896.3      790.4       5.24
13 total trapped           0.00       0.00    26894.9     2692.1
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       77.3       77.3

Device: Pond 11                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      28.67       0.00       24.1        2.4       0.31
02 upstream device       525.31       0.07      242.7       24.3       0.17
06 normal outlet         553.99       0.08      179.1       17.9       0.12
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08 sedimen + decay         0.00       0.00       87.7        8.8
09 total inflow          553.99       0.08      266.8       26.7       0.18
10 surface outflow       553.99       0.08      179.1       17.9       0.12
12 total outflow         553.99       0.08      179.1       17.9       0.12
13 total trapped           0.00       0.00       87.7        8.8
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       32.9       32.9

Device: Pond 10                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      14.03       0.00     3523.9      352.7      92.43
02 upstream device       574.96       0.08     8259.8      826.8       5.29
06 normal outlet         589.11       0.08     6817.9      682.4       4.26
08 sedimen + decay         0.00       0.00     4965.9      497.1
09 total inflow          588.99       0.08    11783.8     1179.5       7.36
10 surface outflow       589.11       0.08     6817.9      682.4       4.26
12 total outflow         589.11       0.08     6817.9      682.4       4.26
13 total trapped           0.00       0.00     4965.9      497.1
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.12       0.00        0.0        0.0
Reduction (%)              0.00       0.00       42.1       42.1

Device: Pond 10                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      14.03       0.00       11.9        1.2       0.31
02 upstream device       574.96       0.08      186.1       18.6       0.12
06 normal outlet         589.11       0.08      184.3       18.4       0.12
08 sedimen + decay         0.00       0.00       13.7        1.4
09 total inflow          588.99       0.08      198.0       19.8       0.12
10 surface outflow       589.11       0.08      184.3       18.4       0.12
12 total outflow         589.11       0.08      184.3       18.4       0.12
13 total trapped           0.00       0.00       13.7        1.4
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.12       0.00        0.0        0.0
Reduction (%)              0.00       0.00        6.9        6.9

Device: Pond 12                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     112.83       0.02    28547.2     2857.5      93.08
02 upstream device       614.37       0.08     8819.0      882.8       5.28
06 normal outlet         727.20       0.10     5725.6      573.1       2.90
08 sedimen + decay         0.00       0.00    31640.4     3167.1
09 total inflow          727.20       0.10    37366.2     3740.2      18.90
10 surface outflow       727.20       0.10     5725.6      573.1       2.90
12 total outflow         727.20       0.10     5725.6      573.1       2.90
13 total trapped           0.00       0.00    31640.4     3167.1
14 storage increase        0.00       0.00        0.3        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       84.7       84.7

Device: Pond 12                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     112.83       0.02       96.3        9.6       0.31
02 upstream device       614.37       0.08      198.6       19.9       0.12
06 normal outlet         727.20       0.10      217.2       21.7       0.11
08 sedimen + decay         0.00       0.00       77.6        7.8
09 total inflow          727.20       0.10      294.9       29.5       0.15
10 surface outflow       727.20       0.10      217.2       21.7       0.11
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12 total outflow         727.20       0.10      217.2       21.7       0.11
13 total trapped           0.00       0.00       77.6        7.8
14 storage increase        0.00       0.00        0.1        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       26.3       26.3

Device: Pond 13                Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1345.33       0.19   344217.7    34454.8      94.14
02 upstream device       890.65       0.12    15374.7     1538.9       6.35
06 normal outlet        2236.13       0.31    94243.1     9433.4      15.51
08 sedimen + decay         0.00       0.00   265346.9    26560.1
09 total inflow         2235.99       0.31   359592.4    35993.7      59.17
10 surface outflow      2236.13       0.31    94243.1     9433.4      15.51
12 total outflow        2236.13       0.31    94243.1     9433.4      15.51
13 total trapped           0.00       0.00   265346.9    26560.1
14 storage increase        0.00       0.00        2.3        0.2
15 mass balance chec      -0.14       0.00        0.0        0.0
Reduction (%)              0.00       0.00       73.8       73.8

Device: Pond 13                Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows    1345.33       0.19     1157.1      115.8       0.32
02 upstream device       890.65       0.12      297.9       29.8       0.12
06 normal outlet        2236.13       0.31      945.6       94.7       0.16
08 sedimen + decay         0.00       0.00      509.4       51.0
09 total inflow         2235.99       0.31     1455.1      145.6       0.24
10 surface outflow      2236.13       0.31      945.6       94.7       0.16
12 total outflow        2236.13       0.31      945.6       94.7       0.16
13 total trapped           0.00       0.00      509.4       51.0
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec      -0.14       0.00        0.0        0.0
Reduction (%)              0.00       0.00       35.0       35.0

Device: Outfall #5             Type: PIPE                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2329.79       0.32   101437.4    10153.5      16.02
06 normal outlet        2329.79       0.32   101437.4    10153.5      16.02
09 total inflow         2329.79       0.32   101437.4    10153.5      16.02
10 surface outflow      2329.79       0.32   101437.4    10153.5      16.02
12 total outflow        2329.79       0.32   101437.4    10153.5      16.02
Reduction (%)              0.00       0.00        0.0        0.0

Device: Outfall #5             Type: PIPE                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2329.79       0.32      997.9       99.9       0.16
06 normal outlet        2329.79       0.32      997.9       99.9       0.16
09 total inflow         2329.79       0.32      997.9       99.9       0.16
10 surface outflow      2329.79       0.32      997.9       99.9       0.16
12 total outflow        2329.79       0.32      997.9       99.9       0.16
Reduction (%)              0.00       0.00        0.0        0.0

Device: CRH-1                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.08       0.01    21153.2     2117.3      93.67
06 normal outlet          83.08       0.01     4281.6      428.6      18.96
08 sedimen + decay         0.00       0.00    16871.6     1688.8
09 total inflow           83.08       0.01    21153.2     2117.3      93.67
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10 surface outflow        83.08       0.01    4281.6       428.6      18.96
12 total outflow          83.08       0.01    4281.6       428.6      18.96
13 total trapped           0.00       0.00   16871.6      1688.8
14 storage increase        0.00       0.00       0.0         0.0
15 mass balance chec       0.00       0.00       0.0         0.0
Reduction (%)              0.00       0.00      79.8        79.8

Device: CRH-1                  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      83.08       0.01      71.2         7.1       0.32
06 normal outlet          83.08       0.01      38.4         3.8       0.17
08 sedimen + decay         0.00       0.00      32.8         3.3
09 total inflow           83.08       0.01      71.2         7.1       0.32
10 surface outflow        83.08       0.01      38.4         3.8       0.17
12 total outflow          83.08       0.01      38.4         3.8       0.17
13 total trapped           0.00       0.00      32.8         3.3
14 storage increase        0.00       0.00       0.0         0.0
15 mass balance chec       0.00       0.00       0.0         0.0
Reduction (%)              0.00       0.00      46.1        46.1

Device: CRH-2                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     101.61       0.01   25475.6      2550.0      92.25
06 normal outlet         101.61       0.01    4019.2       402.3      14.55
08 sedimen + decay         0.00       0.00   21456.4      2147.7
09 total inflow          101.61       0.01   25475.6      2550.0      92.25
10 surface outflow       101.61       0.01    4019.2       402.3      14.55
12 total outflow         101.61       0.01    4019.2       402.3      14.55
13 total trapped           0.00       0.00   21456.4      2147.7
14 storage increase        0.00       0.00       0.0         0.0
15 mass balance chec       0.00       0.00       0.0         0.0
Reduction (%)              0.00       0.00      84.2        84.2

Device: CRH-2                  Type: POND                       Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     101.61       0.01      86.2         8.6       0.31
06 normal outlet         101.61       0.01      42.4         4.2       0.15
08 sedimen + decay         0.00       0.00      43.8         4.4
09 total inflow          101.61       0.01      86.2         8.6       0.31
10 surface outflow       101.61       0.01      42.4         4.2       0.15
12 total outflow         101.61       0.01      42.4         4.2       0.15
13 total trapped           0.00       0.00      43.8         4.4
14 storage increase        0.00       0.00       0.0         0.0
15 mass balance chec       0.00       0.00       0.0         0.0
Reduction (%)              0.00       0.00      50.8        50.8

Device: CRH-3                  Type: POND                       Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      13.89       0.00    3435.3       343.9      90.99
02 upstream device       101.61       0.01    4019.2       402.3      14.55
06 normal outlet         115.50       0.02    2778.5       278.1       8.85
08 sedimen + decay         0.00       0.00    4676.1       468.1
09 total inflow          115.50       0.02    7454.5       746.2      23.75
10 surface outflow       115.50       0.02    2778.5       278.1       8.85
12 total outflow         115.50       0.02    2778.5       278.1       8.85
13 total trapped           0.00       0.00    4676.1       468.1
14 storage increase        0.00       0.00       0.0         0.0
15 mass balance chec       0.00       0.00       0.0         0.0
Reduction (%)              0.00       0.00      62.7        62.7
```

```
Device: CRH-3                  Type: POND                     Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows      13.89       0.00       11.7        1.2       0.31
02 upstream device       101.61       0.01       42.4        4.2       0.15
06 normal outlet         115.50       0.02       41.7        4.2       0.13
08 sedimen + decay         0.00       0.00       12.4        1.2
09 total inflow          115.50       0.02       54.1        5.4       0.17
10 surface outflow       115.50       0.02       41.7        4.2       0.13
12 total outflow         115.50       0.02       41.7        4.2       0.13
13 total trapped           0.00       0.00       12.4        1.2
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       22.9       22.9

Device: Thumb Infiltration     Type: INF_BASIN                Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     154.92       0.02    40670.3     4070.9      96.59
03 infiltrate            154.92       0.02     5661.6      566.7      13.45
04 exfiltrate            154.92       0.02        0.0        0.0       0.00
05 filtered                0.00       0.00     5661.6      566.7
08 sedimen + decay         0.00       0.00    35008.7     3504.2
09 total inflow          154.92       0.02    40670.3     4070.9      96.59
11 groundw outflow       154.92       0.02        0.0        0.0       0.00
12 total outflow         154.92       0.02        0.0        0.0       0.00
13 total trapped           0.00       0.00    40670.3     4070.9
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00      100.0      100.0

Device: Thumb Infiltration     Type: INF_BASIN                Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
01 watershed inflows     154.92       0.02      135.6       13.6       0.32
03 infiltrate            154.92       0.02       63.3        6.3       0.15
04 exfiltrate            154.92       0.02        4.2        0.4       0.01
05 filtered                0.00       0.00       59.2        5.9
08 sedimen + decay         0.00       0.00       72.3        7.2
09 total inflow          154.92       0.02      135.6       13.6       0.32
11 groundw outflow       154.92       0.02        4.2        0.4       0.01
12 total outflow         154.92       0.02        4.2        0.4       0.01
13 total trapped           0.00       0.00      131.5       13.2
14 storage increase        0.00       0.00        0.0        0.0
15 mass balance chec       0.00       0.00        0.0        0.0
Reduction (%)              0.00       0.00       96.9       96.9

Device: To Rice Creek          Type: PIPE                     Variable: TSS

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2749.56       0.38   112085.8    11219.3      15.00
06 normal outlet        2749.56       0.38   112085.8    11219.3      15.00
09 total inflow         2749.56       0.38   112085.8    11219.3      15.00
10 surface outflow      2749.56       0.38   112085.8    11219.3      15.00
12 total outflow        2749.56       0.38   112085.8    11219.3      15.00
Reduction (%)              0.00       0.00        0.0        0.0

Device: To Rice Creek          Type: PIPE                     Variable: TP

Mass Balance Term    Flow_acft   Flow_cfs   Load_lbs Load_lbs/yr  Conc_ppm
02 upstream device      2749.56       0.38     1151.2      115.2       0.15
06 normal outlet        2749.56       0.38     1151.2      115.2       0.15
```

```
09 total inflow        2749.56        0.38     1151.2      115.2        0.15
10 surface outflow     2749.56        0.38     1151.2      115.2        0.15
12 total outflow       2749.56        0.38     1151.2      115.2        0.15
Reduction (%)             0.00        0.00        0.0        0.0
```

Appendix B

Soil Borings (2007)

Interim Report—Preliminary Geotechnical Evaluation

Twin Cities Army Ammunition Plant Redevelopment
Northeast of US Highway 10 and Highway 96
Arden Hills, Minnesota

Prepared for

Ryan Companies US, Inc.

October 3, 2007

American Engineering and Testing, Inc.
Braun Intertec Corporation

October 3, 2007

Ms. Genevieve McJilton
Ryan Companies US, Inc.
50 South 10th Street, Suite 300
Minneapolis, MN 55403

Re: Interim Report—Preliminary Geotechnical Evaluation
Twin Cities Army Ammunition Plant Redevelopment
Northeast of US Highway 10 and Highway 96
Arden Hills, Minnesota

Dear Ms. McJilton:

The following is a summary of the geotechnical evaluation being conducted by our firms, American Engineering and Testing, Inc. (AET), and Braun Intertec Corporation (Braun). The purpose of this summary is to inform the design team of the subsurface conditions that we found in our borings on the Twin Cities Army Ammunition Plant (TCAAP) site and to provide preliminary geotechnical analyses and general opinions on the suitability of the subsurface conditions for the proposed development.

Project Background

TCAAP covers approximately 2,370 acres. The site is bounded by Lexington Avenue on the east, Interstate Highway 35W and US Highway 10 on the west, Highway 96 on the south, and County Road I on the north.

Prior to 1941, this site was used mainly for agricultural purposes. Construction of the TCAAP facility started in August of 1941 by Federal Cartridge Corporation. The facility operated between 1942 and the mid-1970s. Many of the buildings on this site are currently vacant and several of the original buildings have been completely or partially demolished.

In December of 2006, AET and Braun submitted a joint work plan to conduct a preliminary geotechnical evaluation for the proposed TCAAP redevelopment. The geotechnical evaluation was to be performed together with an environmental investigation lead by Tetra Tech EM, Inc. (Tetra Tech), for whom AET and Braun would also be providing drilling services. As such, three types of investigation sites were defined for this project: (a) environmental investigation sites, (b) geotechnical investigation sites, and (c) combined environmental and geotechnical investigation sites. This summary discusses data obtained from the geotechnical sites and combined environmental and geotechnical investigation sites. Tetra Tech will provide a summary of their environmental investigation.

In preparation for our field exploration, we reviewed available geotechnical publications/reports pertinent to the site and the general area around the site, well logs obtained through the Minnesota Department of Health and historical aerial photographs, and noted geotechnical-related site characteristics during site visits. The information gathered from those preparatory efforts helped determine an appropriate soil boring grid spacing for this preliminary geotechnical evaluation, as well as targeting locations believed to be of significance from a geotechnical perspective; for example, where review of historical aerial photographs indicated previous wetland or swampy areas prior to the construction of TCAAP.

Proposed Development

Of the 2,370 acres encompassed by TCAAP, approximately 580 acres is slated for future redevelopment. Actual development will be concentrated in a subset of about 385 acres of the available 580 acres. The proposed development will include retail structures, generally one- to two-stories in height, a corporate campus adjacent to Interstate Highway 35W in the northwestern portion of the site, which may include several multi-story structures, residential structures, recreation areas, such as ball fields and parks, and associated infrastructure and roadways. There will be a designated wildlife corridor in the northeastern portion of the redevelopment area and a designated wetland conservation area within the Rice Creek Watershed (north central portion of redevelopment area).

The development will be completed in several phases over the next 10 to 15 years. However, it is our understanding that you plan to "rough" grade the entire site prior to the first phase of development.

General Overview of Surficial Geology

Based on our review of the available geotechnical publications/reports that were made available to us prior to beginning our geotechnical investigation, we understood that the surface soils on this site generally consist of outwash and lacustrine sands, surface fill, with some areas of organic soils and wetlands. The upper soil layers, typically referred to in previous studies as "Unit 1," vary in thicknesses from about 10 to 20 feet. Below the upper soil layers in most areas of the site, there is a cohesive and relatively impervious clay till (Unit 2) that varies in thickness from about 20 to 70 feet. Older glacial outwash and valley fill materials (Unit 3) underlie the till, and extend to depths on the order of 100 to 400 feet, or to the top of bedrock. The depth to bedrock varies considerably across the site. The bedrock in this area generally consists of weathered and fractured dolomite of the Prairie du Chien Group overlying Jordan Sandstone.

Perched groundwater is present above the Unit 2 "aquitard," with hydrostatic groundwater present in the Unit 3 glacial outwash above the bedrock. The bedrock also acts as a separate aquifer.

Review of historic aerial photographs indicates that depressions and wetlands existed throughout the site before TCAAP was first constructed. Many of those depressions and wetlands had been filled during the original development of the TCAAP site. Some of the borings drilled for previous environmental studies indicated buried organic soils, which probably represent buried wetland areas.

Summary of Results

Summary of Borings

We drilled a total of 219 Standard Penetration test borings at an approximate nominal grid spacing of 500 lineal feet across the site; the grid spacing varied along the perimeter of the site and in areas believed to be of significance from a geotechnical perspective (e.g., previous wetland areas). The approximate boring locations are shown on Figure 1; Westwood Professional Services surveyed the as-drilled boring locations and shot the ground surface elevations at the borings. The planned depth of most borings was 25 feet. However, several of the borings in the southeastern portion of the site (near Building 502) were extended to depths of 40 feet or more based on planned cuts of more than 15 feet shown on the preliminary grading plan. In addition, two borings in the northwestern portion of the site were drilled to a depth of about 100 feet; this is an area where heavily-loaded buildings are anticipated (i.e., mult-story corporate campus office buildings). We backfilled all borings with bentonite grout.

Summary of Soils Encountered

The native mineral soils that we found in our borings were generally consistent with the soils identified by previous investigations on this site. As indicated on the attached Subsurface Boring Log/Log of Boring sheets, we generally found varying thicknesses of topsoil, organic deposits and existing fill, overlying glacial and alluvial deposits consisting predominately of poorly graded sand, silty sand, clayey sand, lean clay, and, to a lesser extent, local deposits of sandy silt and silt. As anticipated, we did not encounter bedrock in any of our borings.

Table 1 provides a boring-by-boring tabulation of the depths and corresponding bottom elevations of topsoil, organic soils (swamp deposits), existing fill, and soft soils encountered in our borings. The topsoil, organic soils and existing fill have been grouped into a general category called "unsuitable soils" on Table 1, representing the greatest depth of topsoil, organic soil, existing fill, and/or soft soils. The estimated depths to unsuitable soils and corresponding bottom elevations are also presented in plan view on Figure 2, including contours of the estimated bottom elevations.

Groundwater Summary

Our drillers checked for groundwater in the boreholes as the borings were advanced. Based on our observations during and after drilling, the measured moisture content and apparent moisture condition of samples we collected, and soil properties such as color, we developed the groundwater elevation summary presented in Table 1 and on Figure 3.

Summary of Preliminary Geotechnical Recommendations

Building Areas—Spread Footings

The topsoil, swamp deposits, and soft clay are compressible and, in our opinion, are unsuitable for support of the proposed building structures. The existing fill overlying buried organic soils or existing fill containing organic material and debris are also considered to be unsuitable for support of the proposed buildings. For purposes of this preliminary evaluation, we assume that the unsuitable soils summarized in Table 1 will have to be removed from building areas and replaced with suitable, compacted backfill. More detailed supplemental investigations and evaluations will be required to further assess the horizontal and vertical extent of unsuitable soils on this site. As mentioned previously, Table 1 and Figure 2 present approximate excavation depths to remove unsuitable soils, along with corresponding bottom elevations of the unsuitable soils.

Please note that pending the results of further supplemental evaluations performed after building locations have been determined, it is possible that some of the existing fill might be able to be left in place below buildings, depending on the condition of the existing fill and the type of structure.

After necessary earthwork corrections, we estimate buildings on this site can generally be supported on typical concrete spread footings sized for the net allowable bearing capacities presented in Table 2 below.

Table 2. Range of Net Allowable Bearing Capacities

Soil Type	Soil Classification	Typical Range of Net Allowable Bearing Pressures (psf)	Typical Ground Improvement to Achieve Higher Limit of Bearing Capacities
Granular Glacial Deposits	SM, SP, SP-SM	2,000 to 4,000	Surface compaction of footing subgrades
Cohesive Glacial Deposits	SC, CL	2,000 to 3,000	Local subexcavation and replacement with aggregate
Granular Lacustrine Deposits	SM, SP, SP-SM	2,000 to 4,000	Surface compaction of footing subgrades
Cohesive Lacustrine Deposits	CL, ML	2,000 to 2,500	Local subexcavation and replacement with aggregate

Supplemental field explorations with pressuremeter testing and/or CPT soundings could be used to evaluate the feasibility of allowable bearing capacities higher than those summarized above.

Building Areas—Pile Supported

In the northwestern portion of the site, where heavily loaded office buildings are planned, it might be economical to support those buildings on deep foundations, depending on the structural loads and settlement tolerances of those buildings. Assuming that deep foundations would consist of commonly available 9 5/8-inch or 12 3/4-inch driven steel pipe pile extended to depths on the order of about 90 to 100 feet, we estimate that working capacities ranging from about 50 to 100 tons could be achieved in the northwestern portion of the site, based on data collected from our soil borings.

Parking and Roadway Areas

Swamp Deposits and Topsoil

It is our opinion that the swamp deposits encountered on this site are generally unsuitable for direct support of pavements. We recommend removing the organic soils from the upper 5 to 10 feet of pavement subgrades, and replacing them with suitable, compacted backfill. Provided that the surface vegetation and heavy root zone are removed, it is likely that low-organic topsoil materials could be left in place at depths of 3 feet or more below pavement subgrade elevations.

Existing Fill and Native Mineral Soils

Based on the results of our Standard Penetration tests, the existing fill and native mineral soils are, in our opinion, generally suitable for support of parking lots and roadways provided that pavement subgrades are adequately improved prior to placing pavement materials. We estimate that subgrade improvement methods would range from surface compaction of loose granular soils to subexcavation-and-replacement of soft clayey/silty soils to depths of 2 to 3 feet below proposed pavement subgrade elevations.

Preliminary Recommended Pavement Sections

For preliminary planning purposes, we estimate that regular-duty pavement sections, those supporting typical automobile traffic, would typically consist of 3 1/2 to 4 1/2 inches of bituminous over about 6 to 8 inches of aggregate base course. For heavy-duty pavement areas, we estimate that pavement sections will typically consist of 4 to 5 inches of bituminous over 8 to 12 inches of aggregate base course.

For concrete pavements placed over at least 6 inches of aggregate base course, concrete thicknesses will likely range from about 5 inches for regular-duty pavements to 7 inches for heavy-duty pavements.

Utility Support

Swamp Deposits

To the extent possible, we recommend routing utilities around swamp deposits. In the event that utilities will run through highly organic swamp deposits, utilities might have to be supported on deep foundations or utility subgrades will have to be corrected (i.e., swamp deposits removed and replaced with new compacted fill), especially if the grade is raised over the utility alignment. In the areas of buried organic soils where the grade will not be raised along the utility alignment, it might be possible to "float" the utilities across the swamp deposits; this would require additional further evaluation. Please note that the organic soils should be considered corrosive to metallic pipe, and all utility pipe material subject to corrosion should be cathodically protected or wrapped with polyethylene sleeves.

Existing Fill and Native Mineral Soils

In our opinion, the existing fill and native mineral soils are generally suitable for support of utilities (sanitary sewer, watermain and storm water pipes and associated manholes). Where the utility subgrade consists of clay or silt, granular pipe bedding could be required depending on the size and type of pipe. For larger utility structures, such as lift stations and pump houses, we recommend further geotechnical evaluation on a structure-by-structure basis.

Reuse of On-site Materials and Compaction

Please note that comments on the reuse of on-site materials as fill are based on geotechnical considerations only. Environmental conditions could also dictate the reuse of on-site materials, as on-site material planned for reuse as fill will be evaluated with respect to plans approved by the United States Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA).

Building Areas

Materials having an organic content of no more than 3 percent are generally considered suitable for reuse as structural fill and backfill in building areas. You should anticipate that buildings exerting higher bearing pressures will require the use of relatively clean sand as fill below footings.

You should anticipate that most on-site borrow material will have to be moisture conditioned to near-optimum levels prior to compaction. Please note that soils classified as clayey sand, lean clay, silty sand and silt, and some fine-grained clean sand, will be difficult to compact if wet.

Pavement Areas

It is our opinion that you could consider placing soils with organic contents between 3 and 7 percent at depths greater than 3 feet below pavement subgrades as long as the overall thickness of this slightly organic material is limited to less than about 4 to 8 feet.

Within the upper 3 feet of pavement subgrades, the soils should consist of mineral soils with an organic content less than 3 percent.

Recycled Material

If you consider using demolition spoils as recycled aggregate base course or as haul road materials, we recommend that the recycled materials consist of crushed concrete and bituminous. We recommend that the use of recycled aggregate containing bituminous be limited to pavement areas only.

Dewatering

Based on the conditions we found in our borings, construction dewatering will be required during the excavation of unsuitable soils in building pad areas, and during excavation of deeper underground utilities such as sanitary sewer. It is our opinion that pumping from open sump pits would be effective as the dewatering method where the excavation terminates in clayey soils. Where the excavation terminates in granular soils, the contractor will likely have to use well points and/or wells, plus pumping from screened sumps at the excavation base ("mop-up sumps").

Environmental conditions could dictate the discharge and/or disposal of pumped groundwater, and all dewatering plans should be evaluated with respect to plans approved by the EPA and the MPCA.

Remarks

This report is for the exclusive use of the parties to which it has been addressed. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

The conclusions contained in this report represent our professional opinions. American Engineering and Testing, Inc., and Braun Intertec Corporation endeavored to perform the engineering services for this project in a manner consistent with that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality under similar budgetary and time constraints. No warranty, express or implied, is made.

If you have any questions regarding this report, please contact Tom Venema at 952.361.3781 or Bob Janssen at 651.487.7017.

Sincerely,

Prepared By:

Chad A. Underwood, PE, PG
American Engineering and Testing, Inc.
Senior Geotechnical Engineer

Prepared By:

Joel Kurpius

Joel C. Kurpius, PE
Braun Intertec Corporation
Project Engineer

Reviewed By:

Thomas P Venema

Thomas P. Venema, PE
American Engineering and Testing, Inc.
Principal Engineer

Reviewed By:

Robert J. Janssen, PE
Braun Intertec Corporation
Principal Engineer

Attachments:
Table 1
Figure 1
Figure 2
Figure 3
Subsurface Boring Log/Log of Boring Sheets

Twin Cities Army Ammunition Plant (TCAAP) Redevelopment
Northeast of Highway 96 and US Highway 10
Arden Hills, Minnesota

Table 1

		Topsoil / Orgainic Soils		Existing Fill		Soft Clays and Silts		Unsuitable Soil		Groundwater			
Boring Number	Surface Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Measured Depth (ft)	Measured Groundwater Elevation	Estimated Depth (ft)	Estimated Elevation
ST-1	908.1	0.5	907					0.5	907				
ST-2	901.3	0.5	900					0.5	900	23.0	879	23.0	879
ST-3	902.4	0.5	901					0.5	901			23.0	880
ST-11	901.0	0.5	900					0.5	900	24.4	877	24.4	877
ST-19	898.1	1	897					1.0	897	18.0	881	18.0	881
ST-20	900.8	0.5	900					0.5	900	22.0	879	22.0	879
ST-21	900.6	0.5	900					0.5	900	24.0	877	24.0	877
ST-25	895.9	1	894					1.0	894	17.0	879	17.0	879
ST-26	896.2	0.5	895					0.5	895	19.0	878	19.0	878
ST-27	893.3	1	892					1.0	892	12.0	882	12.0	882
ST-31	892.9	0.5	892					0.5	892	11.0	882	11.0	882
ST-32	893.5	1	892					1.0	892	13.0	881	13.0	881
ST-33	895.7	1	894					1.0	894	14.0	882	14.0	882
ST-34	894.3	1	893					1.0	893	14.0	881	14.0	881
ST-35	896.0	0.5	895					0.5	895	16.0	881	16.0	881
ST-40	893.7	0.5	893					0.5	893	13.0	881	13.0	881
ST-41	892.5	0.7	891					0.7	891	12.0	881	12.0	881

Twin Cities Army Ammunition Plant (TCAAP) Redevelopment
Northeast of Highway 96 and US Highway 10
Arden Hills, Minnesota

Table 1

		Topsoil / Orgainic Soils		Existing Fill		Soft Clays and Silts		Unsuitable Soil		Groundwater			
Boring Number	Surface Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Measured Depth (ft)	Measured Groundwater Elevation	Estimated Depth (ft)	Estimated Elevation
ST-42	885.3	11.5	873	9	876			11.5	873	10.1	876	10.1	876
ST-43	890.2			4	886			4.0	886	6.8	884	7.0	884
ST-44	888.6			2	886			2.0	886			7.0	882
ST-45	892.4			8.5	883			8.5	883	6.5	886	7.0	886
ST-46	895.4	22	873	12	883			22.0	873	11.0	885	11.0	885
ST-47	893.3			4	889			4.0	889	14.4	879	11.5	882
ST-48	890.9			1.5	889			1.5	889	11.0	880	11.0	880
ST-50	882.8	12	870	7	875			12.0	870	11.0	872	11.0	872
ST-51	881.2	12	869	7	874			12.0	869	9.0	873	9.0	873
ST-52	885.9			12	873			12.0	873	10.9	876	10.9	876
ST-53	885.5			7	878			7.0	878	10.3	876	10.3	876
ST-54	888.9			4.5	884	6	882	6.0	882	0.0	889	4.5	885
ST-55	892.4			2	890			2.0	890	0.0	893	9.5	883
ST-57	893.6	23.5	870	22	871			23.5	870	22.5	872	22.0	872
ST-59	884.4	12	872	11	873			12.0	872	12.1	873	12.1	873
ST-60	883.9	16.5	867	14	869			16.5	867	8.0	876	8.0	876
ST-61	885.9	8	877	7	878			8.0	877	9.4	877	9.4	877
ST-62	884.3	14	870	12	872			14.0	870	12.0	873	12.0	873
ST-63	886.1			9	877			9.0	877	14.0	873	14.0	873
ST-64	883.5	10.5	872	9	874			10.5	872	10.2	874	10.2	874
ST-65	886.2			2.5	883			2.5	883	10.0	877	10.0	877
ST-66	888.9			2	886			2.0	886	10.0	879	10.0	879
ST-67	888.7			3	885			3.0	885	6.0	883	6.0	883
ST-68	895.0	9	885	7	887			9.0	885	5.2	890	5.2	890
ST-69	894.8			1	893			1.0	893	4.0	891	4.0	891
ST-70	885.0	1.5	883					1.5	883	7.0	878	7.0	878
ST-71	887.3			1.5	885			1.5	885	7.0	881	7.0	881
ST-72	887.4			7	880			7.0	880	4.8	883	4.8	883
ST-73	891.3	6.5	884	4	887			6.5	884	9.0	883	9.0	883
ST-74	891.8			5	886			5.0	886	6.4	886	6.4	886
ST-75	898.8			4	894			4.0	894	4.3	895	4.3	895
ST-76	907.0			7	899			7.0	899			14.0	893
ST-77	892.4			7	885			7.0	885	11.0	882	11.0	882
ST-78	886.1	14	872	7	879			14.0	872	14.0	873	7.0	880
ST-79	888.9	0.5	888					0.5	888	7.0	882	7.0	882
ST-80	891.1			2	889			2.0	889			12.0	880
ST-81	895.1	1	894					1.0	894			9.5	886
ST-82	898.6	8.5	890	7	891			8.5	890			14.5	885
ST-83	903.0			4.5	898			4.5	898			9.5	894
ST-84	911.0			4.5	906			4.5	906			12.0	900
ST-85	892.1			2	890	7	885	7.0	885			9.5	883

Twin Cities Army Ammunition Plant (TCAAP) Redevelopment
Northeast of Highway 96 and US Highway 10
Arden Hills, Minnesota

Table 1

		Topsoil / Orgainic Soils		Existing Fill		Soft Clays and Silts		Unsuitable Soil		Groundwater			
Boring Number	Surface Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Measured Depth (ft)	Measured Groundwater Elevation	Estimated Depth (ft)	Estimated Elevation
ST-86	897.0	0.5	896					0.5	896	8.1	889	8.1	889
ST-87	898.3			2	896			2.0	896			12.0	887
ST-88	889.7			6	883			6.0	883	8.0	882	8.0	882
ST-89	890.4			7	883			7.0	883	7.0	884	7.0	884
ST-90	891.0	2	888					2.0	888	6.0	885	6.0	885
ST-91	893.1	13.5	879	8.5	884			13.5	879	12.0	882	12.0	882
ST-92	898.4	7	891	2	896			7.0	891			18.0	881
ST-93	901.2			3.5	897			3.5	897			18.0	884
ST-94	922.9	3	919					3.0	919			18.0	905
ST-95	924.0	9	914	7	916			9.0	914	13.0	911	13.0	911
ST-96	892.3	9	883	4	888			9.0	883	9.0	884	9.0	884
ST-97	891.0			2.5	888			2.5	888	6.1	885	6.1	885
ST-98	892.3	9	883	7	885			9.0	883	8.0	885	8.0	885
ST-99	892.8	18	874	12	880	22	870	22.0	870	12.0	881	12.0	881
ST-100	895.7	9	886	6	889			9.0	886	9.0	887	9.0	887
ST-101	897.9	7	890	4.5	893	11	886	11.0	886	10.4	888	7.0	891
ST-102	902.2			7	895			7.0	895			7.0	896
ST-103	924.9			4	920			4.0	920			18.0	907
ST-104	934.9	12	922	7	927			12.0	922			23.0	912
ST-105	899.1			7	892			7.0	892	9.0	891	9.0	891
ST-106	903.4	7	896	5	898			7.0	896	12.2	892	12.2	892
ST-107	902.7	1	901					1.0	901	12.1	891	12.1	891
ST-108	906.6			4	902			4.0	902	12.5	895	12.5	895
ST-109	904.5			7	897			7.0	897			12.0	893
ST-110	913.2	1	912					1.0	912			9.0	905
ST-111	922.1			4	918			4.0	918			14.0	909
ST-112	936.8			1	935			1.0	935				
ST-113	941.8	2.3	939					2.3	939				
ST-114	913.1	4.5	908	2.5	910	5	908	5.0	908	5.2	908	5.2	908
ST-115	908.2			4.5	903			4.5	903			12.0	897
ST-116	913.0			0.5	912			0.5	912			9.5	904
ST-117	914.4			2.5	911			2.5	911	3.6	911	9.5	905
ST-118	914.9	14	900					14.0	900	6.0	909	6.0	909
ST-119	929.7			9	920			9.0	920			22.0	908
ST-120	940.8	0.5	940					0.5	940				
ST-121	944.6			4	940	12	932	12.0	932				
ST-122	959.5			2	957	7	952	7.0	952				
ST-123	913.4			6	907			6.0	907	25.0	889	25.0	889
ST-124	923.8	14	909	9	914			14.0	909			14.0	910
ST-125	932.7			9.5	923			9.5	923				
ST-126	957.0	12	944	7	949			12.0	944	12.0	945	12.0	945

Twin Cities Army Ammunition Plant (TCAAP) Redevelopment
Northeast of Highway 96 and US Highway 10
Arden Hills, Minnesota

Table 1

		Topsoil / Orgainic Soils		Existing Fill		Soft Clays and Silts		Unsuitable Soil		Groundwater			
Boring Number	Surface Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Measured Depth (ft)	Measured Groundwater Elevation	Estimated Depth (ft)	Estimated Elevation
ST-127	952.8			6	946	12	940	12.0	940			18.0	935
ST-128	954.1			7	947	12	942	12.0	942				
ST-129	915.9			4.5	911			4.5	911			11.5	905
ST-130	915.1			7	908			7.0	908			14.0	902
ST-131	926.9			9.5	917			9.5	917			18.0	909
ST-132	936.0			3	933			3.0	933				
ST-133	945.0			12	932	18	926	18.0	926				
ST-134	949.0			7	942	12	937	12.0	937	24.0	926	24.0	926
ST-135	950.5			4.5	946			4.5	946				
ST-136	956.7	9	947	7	949			9.0	947				
ST-137	956.0	9	947	7	949			9.0	947				
ST-138	955.9	22	933	14.5	941	26	929	26.0	929	24.3	932	14.5	942
ST-139	951.8	12	939	9.5	942	14.5	937	14.5	937	9.6	943	9.5	943
ST-140	962.9	1	961					1.0	961				
ST-141	913.3			7	906			7.0	906	26.5	887	18.0	896
ST-142	933.7	19.5	914	15	918			19.5	914	23.7	910	15.0	919
ST-143	949.9			4	945			4.0	945				
ST-144	955.0			4.5	950			4.5	950				
ST-145	954.7			0.5	954			0.5	954				
ST-146	966.0			0.5	965	9	957	9.0	957				
ST-147	958.6	0.5	958					0.5	958				
ST-148	957.9	16	941	6	951			16.0	941	7.3	951	7.3	951
ST-149	990.9			22	968			22.0	968	19.0	972	19.0	972
ST-150	927.0	7	919	4.5	922			7.0	919				
ST-151	922.3			2	920			2.0	920	5.1	918	5.1	918
ST-152	942.0			12	929			12.0	929	12.3	930	12.3	930
ST-153	951.2			4.5	946	7	944	7.0	944			23.0	929
ST-154	956.7			16	940			16.0	940				
ST-155	959.9							0.0					
ST-156	959.8							0.0					
ST-157	995.9			14	981			14.0	981				
ST-158	955.5			21.5	934			21.5	934			22.0	934
ST-159	959.4			25	934			25.0	934	18.0	942	18.0	942
ST-160	920.2	8.5	911	7	913	12	908	12.0	908	11.8	909	11.8	909
ST-161	926.7			4.5	922			4.5	922			18.0	909
ST-162	956.7			1	955			1.0	955				
ST-163	949.2	17	932	14.5	934			17.0	932			17.0	933
ST-164	951.0			2	949			2.0	949			23.0	929
ST-165	953.1			2	951			2.0	951				
ST-166	955.0			2	952			2.0	952	21.2	934	21.2	934
ST-167	945.0			4.5	940	12	932	12.0	932	21.2	924	21.2	924

Twin Cities Army Ammunition Plant (TCAAP) Redevelopment
Northeast of Highway 96 and US Highway 10
Arden Hills, Minnesota

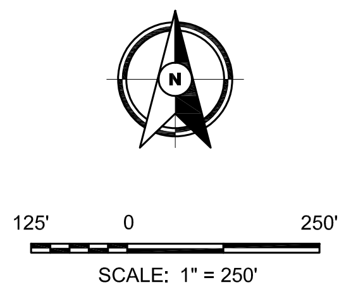
Table 1

		Topsoil / Orgainic Soils		Existing Fill		Soft Clays and Silts		Unsuitable Soil		Groundwater			
Boring Number	Surface Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Measured Depth (ft)	Measured Groundwater Elevation	Estimated Depth (ft)	Estimated Elevation
ST-168	947.2			3	944			3.0	944				
ST-169	948.1	12.5	935	10.5	937			12.5	935			12.5	936
ST-170	949.7	12	937	10.5	939			12.0	937	12.6	938	12.6	938
ST-171	915.0	12	903	9.5	905			12.0	903	8.6	907	8.6	907
ST-172	925.1	17	908	7	918	24	901	24.0	901	6.0	920	6.0	920
ST-173	942.9	1	941					1.0	941				943
ST-174	944.9			4	940			4.0	940				945
ST-175	948.1			3	945			3.0	945	15.1	934	15.1	934
ST-176	951.0	12.5	938	10	941			12.5	938			16.0	936
ST-177	953.6	14.5	939	13	940			14.5	939				
ST-178	948.4	10	938	9.5	938			10.0	938			18.0	931
ST-179	929.3	0.5	928					0.5	928			14.0	916
ST-180	935.9	1	934					1.0	934			12.0	924
ST-181	935.0	1	933					1.0	933				
ST-182	941.8	0.5	941					0.5	941				
ST-183	933.7	0.5	933					0.5	933	18.0	916	18.0	916
ST-184	942.1			4.5	937			4.5	937			12.0	931
ST-185	901.0							0.0	900				
ST-186	925.2	9	916	7	918			9.0	916			14.0	912
ST-187	914.2	1	913					1.0	913			12.0	903
ST-188	934.5			4	930			4.0	930	19.0	916	19.0	916
ST-189	952.2	0.7	951					0.7	951				
ST-190	952.8			2	950			2.0	950				
ST-191	956.3			4	952			4.0	952				
ST-192	959.1							0.0	959				
ST-193	961.9			4	957			4.0	957				
ST-195	942.2			4.5	937	9	933	9.0	933				
ST-196	943.4			7	936	12	931	12.0	931	18.0	926	18.0	926
ST-197	944.3	9	935	7	937	18	926	18.0	926	9.0	936	9.0	936
ST-198	944.4	19	925	14	930	22	922	22.0	922			19.0	926
ST-199	944.2			7	937			7.0	937				
ST-200	949.2			14	935	22	927	22.0	927	20.0	930	20.0	930
ST-201	956.8			4.5	952			4.5	952				
ST-202	955.0			2.5	952			2.5	952				
ST-203	954.4			4.5	949			4.5	949				
ST-204	938.6			18.0	920			18.0	920				
ST-205	937.1			4.5	932			4.5	932				
ST-206	916.0			4.0	912			4.0	912			12.0	905
ST-207	908.5			4.5	904			4.5	904			9.0	900
ST-208	914.5			4.5	909			4.5	909			12.0	903
ST-209	892.8			7.0	885			7.0	885	9.1	884	9.1	884

Twin Cities Army Ammunition Plant (TCAAP) Redevelopment
Northeast of Highway 96 and US Highway 10
Arden Hills, Minnesota

Table 1

		Topsoil / Orgainic Soils		Existing Fill		Soft Clays and Silts		Unsuitable Soil		Groundwater			
Boring Number	Surface Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Approximate Depth (ft)	Estimated Bottom Elevation	Measured Depth (ft)	Measured Groundwater Elevation	Estimated Depth (ft)	Estimated Elevation
ST-210	898.8	6.0	892	4.5	894			6.0	892			12.0	887
ST-211	892.3			8.5	883			8.5	883	7.6	885	7.6	885
ST-212	895.1	13.0	882	9.5	885			13.0	882	7.3	888	7.3	888
ST-213	890.2		890	5.5	884			5.5	884	7.1	884	7.1	884
ST-214	884.9		884	9.5	875			9.5	875	12.7	873	12.7	873
ST-215	894.5	11.0	883	9.0	885			11.0	883	9.3	886	9.3	886
ST-216	895.0	13.5	881	11.5	883			13.5	881			13.5	882
ST-217	889.3	1.0	888		889			1.0	888	3.3	887	3.0	887
ST-218	885.7		885	7.0	878			7.0	878			12.0	874
ST-219	891.3	1.0	890		891			1.0	890	15.0	877	15.0	877
ST-220	897.0	2.0	894		896			2.0	894	17.8	880	17.8	880
ST-221	899.0	2.0	897		899			2.0	897	18.3	881	18.3	881
ST-222	898.6		898	9.5	889			9.5	889	18.9	880	18.9	880
ST-223	908.4		908	9.5	898			9.5	898	28.9	880	28.9	880
ST-224	938.6	6.0	932	4.0	934			6.0	932				



● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

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Revisions	
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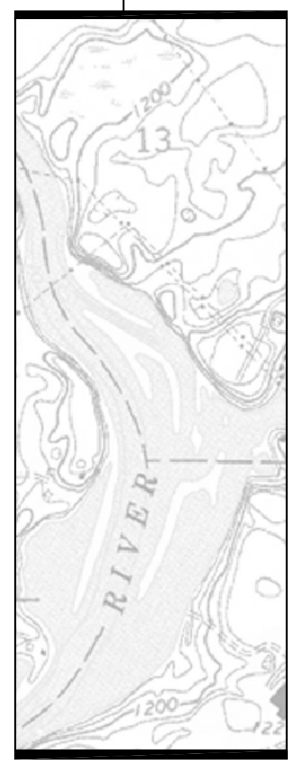

Project No:
SP0605871

Drawing No:
SP0605871B

Scale:	1" = 250'
Drawn By:	MRG
Date Drawn:	8/27/07
Checked By:	JK
Last Modified:	10/3/07

SOIL BORING LOCATION SKETCH
GEOTECHNICAL EVALUATION
TCAAP REDEVELOPMENT
NORTHEAST OF HIGHWAY 10 AND HIGHWAY 96
ARDEN HILLS, MINNESOTA

Sheet:
of

Fig:

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125' 0 250'
SCALE: 1" = 250'

● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

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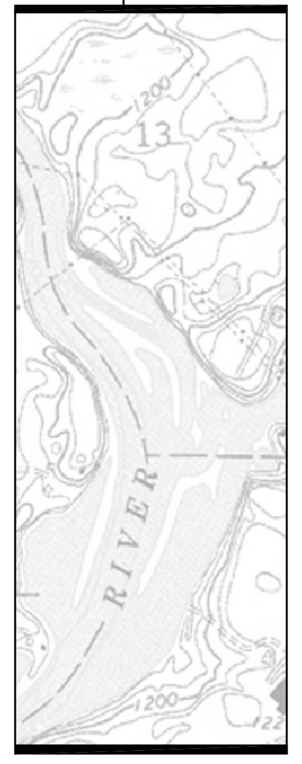
Date:	Checked By:



Project No:
SP0605871

Drawing No:
SP0605871B

Scale:	1" = 250'
Drawn By:	MRG
Date Drawn:	8/27/07
Checked By:	JK
Last Modified:	10/3/07

SOIL BORING LOCATION SKETCH
GEOTECHNICAL EVALUATION
TCAAP REDEVELOPMENT
NORTHEAST OF HIGHWAY 10 AND HIGHWAY 96
ARDEN HILLS, MINNESOTA

Sheet: of
Fig:

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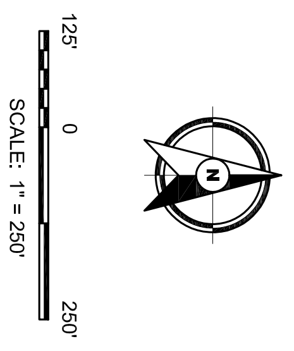

● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

XX / XX UNSUITABLE SOIL DEPTH / UNSUITABLE SOIL ELEVATION (FT.)

— UNSUITABLE SOIL ELEVATION CONTOUR (FT.)

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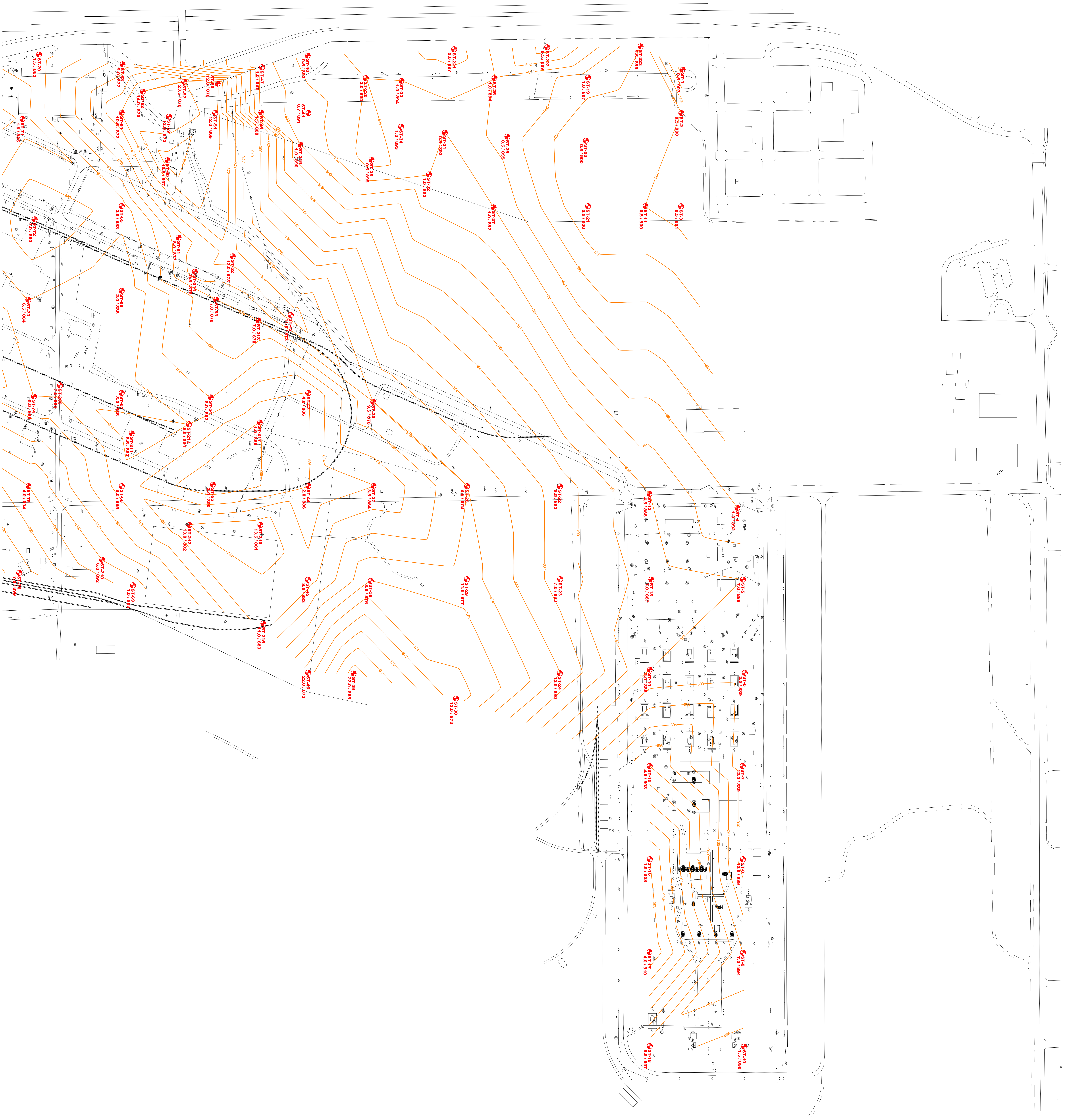

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Fig:

SOIL BORING LOCATION AND UNSUITABLE SOIL DEPTH / ELEVATION / CONTOUR SKETCH
GEOTECHNICAL EVALUATION
TCAAP REDEVELOPMENT
NORTHEAST OF HIGHWAY 10 AND HIGHWAY 96
ARDEN HILLS, MINNESOTA

Scale:	1" = 250'
Drawn By:	MRG
Date Drawn:	8/27/07
Checked By:	JK
Last Modified:	10/3/07

Drawing No:
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SCALE: 1" = 250'

125' 0 250'

● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

XX / XX UNSUITABLE SOIL DEPTH / UNSUITABLE SOIL ELEVATION (FT.)

— UNSUITABLE SOIL ELEVATION CONTOUR (FT.)

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SOIL BORING LOCATION AND UNSUITABLE SOIL DEPTH / ELEVATION / CONTOUR SKETCH
GEOTECHNICAL EVALUATION
TCAAP REDEVELOPMENT
NORTHEAST OF HIGHWAY 10 AND HIGHWAY 96
ARDEN HILLS, MINNESOTA

Sheet: of
Fig:

Scale:	1" = 250'
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125' 0 250'
SCALE: 1" = 250'

● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

XX / XX GROUNDWATER DEPTH / GROUNDWATER ELEVATION (FT.)

— GROUNDWATER ELEVATION CONTOUR (FT.)

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Drawing No:
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Scale:	1" = 250'
Drawn By:	MRG
Date Drawn:	8/27/07
Checked By:	JK
Last Modified:	10/3/07

SOIL BORING LOCATION AND GROUNDWATER DEPTH / ELEVATION / CONTOUR SKETCH
GEOTECHNICAL EVALUATION
TCAAP REDEVELOPMENT
NORTHEAST OF HIGHWAY 10 AND HIGHWAY 96
ARDEN HILLS, MINNESOTA

Sheet: of
Fig:

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SCALE: 1" = 250'

125' 0 250'

● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

XX / XX GROUNDWATER DEPTH / GROUNDWATER ELEVATION (FT.)

— GROUNDWATER ELEVATION CONTOUR (FT.)

DRAFT
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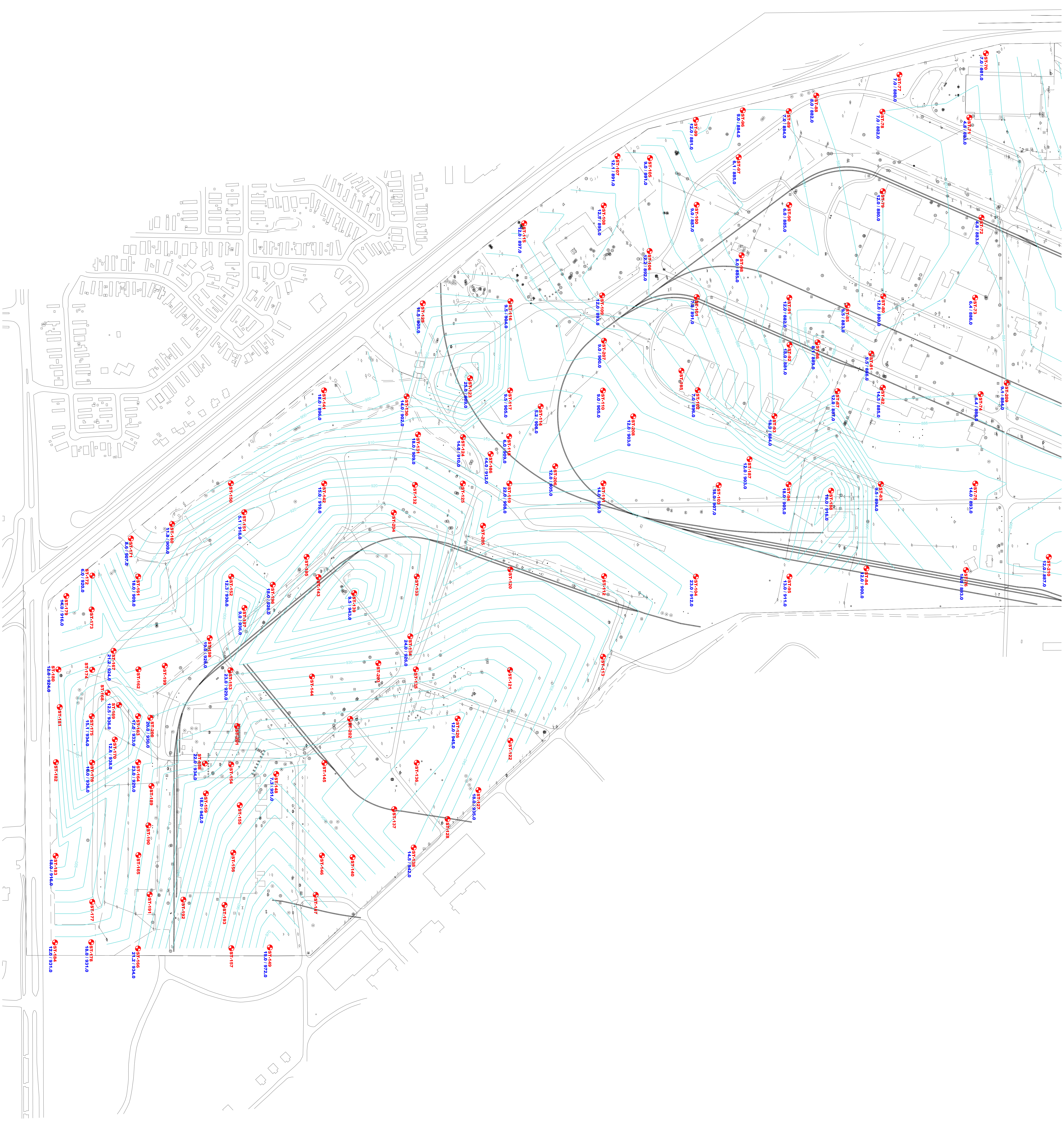

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Fig:

SOIL BORING LOCATION AND GROUNDWATER DEPTH / ELEVATION / CONTOUR SKETCH
GEOTECHNICAL EVALUATION
TCAAP REDEVELOPMENT
NORTHEAST OF HIGHWAY 10 AND HIGHWAY 96
ARDEN HILLS, MINNESOTA

Scale:	1" = 250'
Drawn By:	MRG
Date Drawn:	8/27/07
Checked By:	JK
Last Modified:	10/3/07

Drawing No:
SP0605871B

Project No:
SP0605871

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Date: Checked By:

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LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-1** LOCATION: N: 213690.577, E: 550665.094 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/19/07**	SCALE: **1" = 4'**

Elev. feet 908.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
907.6	0.5	SM	SILTY SAND, trace of Roots, dark brown, wet. (Topsoil)			
896.1	12.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown to light brown, moist, loose. (Lacustrine)	4 3 5 5		
890.1	18.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, loose to medium dense. (Glaciofluvium)	6 13		
886.1	22.0	ML	SANDY SILT, Sand seams, brown, wet, medium dense. (Glaciofluvium)	19		
882.1	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, medium dense. (Glaciofluvium)	15		
			END OF BORING. Water not observed with 24 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-2**

LOCATION: N: 213683.523, E: 550898.513 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/22/07**

SCALE: **1" = 4'**

Elev. feet 901.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
900.8	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
892.3	9.0	SM	SILTY SAND, fine-grained, reddish-brown to brown, moist, loose to medium dense. (Glaciofluvium)	8 16 13		
878.3	23.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose to medium dense. (Glaciofluvium)	11 9 7 14	∇	
875.3	26.0	SM	SILTY SAND, fine-grained, gray, waterbearing.	21		

END OF BORING.

Water observed at 23 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST- 3 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 902.4

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	SILTY SAND, trace roots, dark brown, moist, medium dense (SM)	TOPSOIL									
1	SAND WITH SILT, fine grained, trace roots, brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM	11	M	SS	17					
2											
3	SAND WITH SILT, fine grained, brown, moist, loose (SP-SM)		9	M	SS	14					
4	SILTY SAND, fine grained, brown, light grayish brown, moist, medium dense, laminations of sand with silt (SM)										
5											
6			13	M	SS	19					
7											
8			16	M	SS	19					
9											
10	SAND WITH SILT, fine grained, light grayish brown, a little brown, moist, medium dense, laminations of silty sand (SP-SM)										
11			15	M	SS	19					
12	SAND WITH SILT, fine grained, light brownish gray, a little brown, moist, loose, laminations of silty sand (SP-SM)										
13			10	M	SS	17					
14											
15	SILTY SAND, fine grained, light brownish gray, moist, loose (SM)										
16			7	M	SS	18					
17											
18	SAND WITH SILT, fine grained, light brownish gray, a little brown, moist, dense, laminations of silty sand (SP-SM)										
19											
20											
21			34	M	SS	17					
22											
23	SILT, gray, wet, dense (ML)	FINE ALLUVIUM									
24											
25											
26			32	M/W	SS	16	25				
	END OF BORING Northing=213682.3 Easting=551397.5										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

BORING COMPLETED: 6/20/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/20/07	2:15	26.5	24.5	24.6		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-11 (p. 1 of 4)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **901.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	SILTY SAND, surface roots, trace roots, dark brown, moist, loose (SM)	TOPSOIL	8	M	SS	14					
2	SAND WITH SILT, trace roots, light brown, moist, loose (SP-SM)	COARSE ALLUVIUM									
3	SILTY SAND, fine grained, brown, a little light brown, moist, medium dense, laminations of sand with silt (SM)		15	M	SS	18					
4											
5											
6			20	M	SS	18					
7	SAND WITH SILT, fine grained, light grayish brown to light brownish gray, moist, medium dense to loose (SP-SM)										
8			15	M	SS	16					
9											
10											
11			11	M	SS	17					
12											
13			6	M	SS	17					
14											
15	SAND WITH SILT, fine grained, light brownish gray, a little brown, moist, medium dense, laminations of sandy silt (SP-SM)										
16			18	M	SS	20					
17											
18	SAND WITH SILT, fine grained, light gray, a little gray, moist, dense, laminations of silt (SP-SM)										
19											
20											
21			33	M	SS	17					
22											
23	SAND WITH SILT, fine grained, light brownish gray, waterbearing, medium dense (SP-SM)										
24				▼							
25											
26			16	M/W	SS	19					
27											
28		TILL									

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA
24½'-99½'	RD w/DM

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/20/07	8:55	26.5	24.5	24.5		24.4

BORING COMPLETED: **6/20/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-11 (p. 2 of 4)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#20
30	SANDY LEAN CLAY, a little gravel, gray, firm to stiff (CL) *(continued)*	TILL *(continued)*									
31			6	M	SS	24	17				
32											
33											
34											
35											
36			7	M	SS	24	17				
37											
38											
39											
40											
41			10	M	SS	24	20				
42											
43											
44											
45											
46			10	M	SS	24	17				
47											
48											
49											
50											
51			11	M	SS	24	19				
52											
53											
54											
55											
56			10	M	SS	24	20				
57											
58											
59											
60											
61			10	M	SS	22	18				
62											
63											

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00081

LOG OF BORING NO. ST-11 (p. 3 of 4)

PROJECT: TCAAP Redevelopment; Arden Hills, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
64	SANDY LEAN CLAY, a little gravel, gray, firm to stiff (CL) *(continued)*	TILL *(continued)*									
65											
66			5	M	SS	24	19				
67											
68											
69	SILTY SAND, fine to medium grained, brownish gray, wet, loose (SM)	COARSE ALLUVIUM									
70											
71			5	M	SS	2	23				
72											
73											
74	LEAN CLAY WITH SAND, brown, hard (CL)	FINE ALLUVIUM									
75											
76			36	M	SS	24	17				
77											
78											
79	FAT CLAY, brown, hard to very stiff, laminations of silty sand (CH)										
80											
81			43	M	SS	24	33				
82											
83											
84											
85											
86			27	M	SS	24	25				
87											
88											
89	CLAYEY SAND, a little gravel, possible cobbles, brown, hard (SC)	TILL									
90											
91			62	M	SS	21	13				
92											
93											
94											
95											
96			70	M	SS	21	11				
97											

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-11 (p. 4 of 4)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#20
98	CLAYEY SAND, a little gravel, possible cobbles, brown, hard (SC) *(continued)*	▨	TILL *(continued)*									
99		▨										
100		▨										
101		▨		98	M	SS	26	10				
	END OF BORING Northing=213491.7 Easting=551397.2											

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-19** LOCATION: N: 213183.570, E: 550706.966 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 6/19/07	SCALE: 1" = 4'

Elev. feet 898.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
897.1	1.0	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)					
894.1	4.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist. (Lacustrine)	9				
891.1	7.0	SM	SILTY SAND, fine-grained, brown, wet, medium dense. (Lacustrine)	11				
884.1	14.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose to medium dense. (Lacustrine)	11 9 6		6	6	
880.1	18.0	SM	SILTY SAND, light brown, moist, medium dense. (Glacial Outwash)	15	▽			
872.1	26.0	SM	SILTY SAND, fine-grained, light brown, to gray, waterbearing, medium dense to very dense. (Glacial Outwash)	35 60				
			END OF BORING. Water observed at 18 feet while drilling. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-20**

LOCATION: N: 213171.742, E: 551046.195 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/21/07**

SCALE: **1" = 4'**

Elev. feet 900.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
900.3	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)					
891.8	9.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, rust at 2' sample depth, moist, loose to medium dense. (Lacustrine)	15 10 8				
886.8	14.0	ML	SANDY SILT, light brown, wet, loose. (Lacustrine)	6 9		 17	 62	
882.8	18.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, medium dense. (Lacustrine)	28		4	7	
878.8	22.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, dense. (Lacustrine)	34	▽			
874.8	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, loose. (Lacustrine)	10				

END OF BORING.

Water observed at 22 feet while drilling.

Boring then grouted.

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-21**

LOCATION: N: 213183.350, E: 553196.596 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/21/07**

SCALE: **1" = 4'**

Elev. feet 900.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
900.1	0.5	SM	SILTY SAND, trace of Roots, brown, moist. (Topsoil)			
886.6	14.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, very loose to medium dense. (Lacustrine)	7 13 8 6 4		
876.6	24.0	SM	SILTY SAND, fine-grained, light brown, moist, loose. (Lacustrine)	9 10	∇	
874.6	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brownish-gray, waterbearing, medium dense. (Lacustrine)	11		

END OF BORING.

Water observed at 24 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-25** LOCATION: N: 212681.566, E: 550711.506 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/19/07**	SCALE: **1" = 4'**

Elev. feet 895.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
894.9	1.0	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)					
883.9	12.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose.	8 6 8 7				
881.9	14.0	ML	SANDY SILT, gray with bands of orangish-brown, wet, loose. (Lacustrine)	6				
878.9	17.0	SM	SILTY SAND, fine-grained, Silt laminations, brown to dark brown, wet, medium dense. (Glaciofluvium)	18				
873.9	22.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, waterbearing, medium dense. (Glaciofluvium)	6				
869.9	26.0	SC	CLAYEY SAND, trace of Gravel, gray, wet, medium dense. (Glacial Till)	6		13	42	LL = 23% PI = 12%
			END OF BORING. Water observed at 17 feet while drilling. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-26** LOCATION: N: 212751.010, E: 551024.200 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 896.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
895.7	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
877.2	19.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to brown, rust at 15' sample depth, moist, loose to medium dense. (Lacustrine)	10 12 12 10 12 11	▽	
870.2	26.0	ML	SANDY SILT, gray, waterbearing, medium dense. (Glaciofluvium)	19 15		
			END OF BORING. Water observed at 19 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-27** LOCATION: N: 212677.165, E: 551403.522 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 893.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
		SM	SILTY SAND, very fine- to fine-grained, dark brown, moist. (Topsoil)					
892.3	1.0							
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, very loose to medium dense. (Lacustrine)	4				
				9				
				10				
				11		4	5	
881.3	12.0				∇			
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown to light brown, waterbearing, loose. (Lacustrine)	8				
				6		22	11	
876.3	17.0							
		ML	SILT with SAND, grayish-brown to gray, wet, loose to medium dense. (Glaciofluvium)	9				
				24		24	82	
866.3	27.0							
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, medium dense. (Glaciofluvium)	28				
861.3	32.0							

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44 (See Descriptive Terminology sheet for explanation of abbreviations)

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-27 (cont.)**

LOCATION: N: 212677.165, E: 551403.522 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/21/07**

SCALE: **1" = 4'**

Elev. feet 861.3	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
		CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff. (Glacial Till)					
				9				
856.3	37.0	SC	CLAYEY SAND, trace of Gravel, gray, wet, rather stiff. (Glacial Till)					
				9		15	46	
850.3	43.0	CL	SANDY LEAN CLAY, trace of Gravel, wet, rather stiff. (Glacial Till)					
				9				
				10		18	51	
				9				
				9				

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-27 (cont.)** LOCATION: N: 212677.165, E: 551403.522 See attached sketch.
DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr
DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 829.3	Depth feet 64.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
			SANDY LEAN CLAY, trace of Gravel, wet, rather stiff. (Glacial Till) *(continued)*	9				
				9				
				12				
816.3	77.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, wet, very stiff to hard. (Glacial Till)	21				
				34		14	62	
				41				
801.3	92.0	CL	LEAN CLAY, reddish-brown to grayish-brown with laminatios of brown, very stiff to hard. (Glaciofluvium)	22				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-27 (cont.)** LOCATION: N: 212677.165, E: 551403.522 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 797.3	Depth feet 96.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
792.3	101.0	▨	LEAN CLAY, reddish-brown to grayish-brown with laminatios of brown, very stiff to hard. (Glaciofluvium) *(continued)*	30				
			END OF BORING. Water observed at 12 feet while drilling. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-31** LOCATION: N: 212415.495, E: 551003.074 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 892.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
892.4	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
888.9	4.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown, moist, medium dense. (Lacustrine)	11		
880.9	12.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, orange-brown to grayish-brown with rust at 7' sample depth, loose to medium dense. (Lacustrine)	9 15 12	▽	
869.9	23.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, grayish-brown, waterbearing, medium dense. (Glaciofluvium)	22 23 16		
866.9	26.0	ML	SANDY SILT, gray, wet, medium dense. (Glaciofluvium)	15		
			END OF BORING. Water observed at 11 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-32** LOCATION: N: 212330.333, E: 551226.541 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/20/07**	SCALE: **1" = 4'**

Elev. feet 893.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
892.5	1.0	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)					
886.5	7.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, very loose to loose. (Lacustrine)	2				
				7		5	5	
881.5	12.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, orange-brown, moist to wet, loose to medium dense. (Lacustrine)	11				
				9				
870.5	23.0	SM	SILTY SAND, fine-grained, grayish-brown, waterbearing, very loose to medium dense. (Lacustrine)	6	∇			
				2		23	29	
				12				
867.5	26.0	CL-ML	SILTY CLAY, gray, wet, loose. (Glaciofluvium)	9		23	96	LL = 27 PI = 6
			END OF BORING. Water observed at 13 feet while drilling. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-33**

LOCATION: N: 212183.655, E: 550725.056 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/19/07**

SCALE: **1" = 4'**

Elev. feet 895.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
894.7	1.0	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)					
886.7	9.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown to light brown, moist, very loose to loose. (Lacustrine)	4 6 7				
881.7	14.0	SM	SILTY SAND, fine-grained, brown to grayish-brown, moist, medium dense. (Glaciofluvium)	13 11	▽			
877.7	18.0	SM	SILTY SAND, fine-grained, grayish-brown, waterbearing, medium dense. (Glaciofluvium)	14				
873.7	22.0	ML	SANDY SILT, gray, wet, medium dense. (Glaciofluvium)	14		22	55	
869.7	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, loose. (Glaciofluvium)	7				
			END OF BORING. Water observed at 14 feet while drilling. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-34** LOCATION: N: 212181.205, E: 550971629 See attached sketch.
DRILLER: K. Keck METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07** SCALE: **1" = 4'**

Elev. feet 894.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
893.3	1.0	SM	SILTY SAND, dark brown, moist. (Topsoil)					
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to brown, moist, loose to medium dense. (Lacustrine)	5				
				12				
885.3	9.0			11		11	6	
		SP-SM	POORLY GRADED SAND with SILT,fine-grained, orange-brown, moist to wet, medium dense. (Lacustrine)	11				
880.3	14.0			11	▽			
876.3	18.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, grayish-brown, waterbearing, very loose. (Lacustrine)	4				
		SM	SILTY SAND, fine-grained, grayish-brown, waterbearing, medium dense. (Lacustrine)	13				
868.3	26.0			13				
			END OF BORING. Water observed at 14 feet while drilling. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-35** LOCATION: N: 212022.662, E: 551147.722 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/20/07**	SCALE: **1" = 4'**

Elev. feet 896.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
895.5	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
879.0	17.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to brown, moist, very loose to loose. (Lacustrine)	3 7 10 10 8 8	∇	
870.0	26.0	SM	SILTY SAND, fine-grained, grayish-brown to gray, waterbearing, medium dense. (Glaciofluvium)	13 11		
			END OF BORING. Water observed at 16 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-40**

LOCATION: N: 211680.392, E: 550589.817 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/22/07**	SCALE: **1" = 4'**

Elev. feet 893.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
893.2	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
889.7	4.0	SM	SILTY SAND, fine-grained, dark brown, moist, very loose. (Lacustrine)	2		
879.7	14.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to grayish-brown with rust at 10' sample depth, moist, very loose to medium dense. (Lacustrine)	3 8 9 11	 ▽	
867.7	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, grayish-brown to gray, waterbearing, loose to medium dense. (Lacustrine)	6 16 24		

Silty Sand 0' to 4'
Poorly Graded Sand w Silt 4' to 26'

END OF BORING.

Water observed at 13 feet while drilling.

Boring then grouted.

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

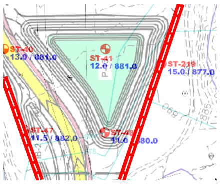
Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-41**

LOCATION: N: 211684.376. E: 550897.834 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 892.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
891.8	0.7	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
880.5	12.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to brown, moist, loose to medium dense. (Lacustrine)	15 8 12 12	▽	
870.5	22.0	SM	SILTY SAND, fine-grained, brownish-gray, waterbearing, loose to medium dense. (Lacustrine)	10 17 16		
866.5	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, loose. (Lacustrine)	7		
			END OF BORING. Water observed at 12 feet while drilling. Boring then grouted.			



Poorly Graded Sand w Silt 0.7' to 12'
Silty Sand 12' to 22'

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-42 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **885.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sandy silt and silty sand, with gravel, surface roots, trace roots, brown and dark brown	FILL	29	M	SS	14					
3	FILL, mixture of sand with silt, silty sand and clayey sand, a little gravel, brown, a little brownish gray and gray		23	M	SS	8					
6			10	M	SS	7					
8			20	M	SS	16					
11	SAND WITH SILT, fine grained, brownish gray to gray and black, medium dense, lenses and laminations of organic silt (SP-SM)	COARSE ALLUVIUM OR TOPSOIL	17	▼ M	SS	19					
13	SAND, medium to fine grained, brown and gray, waterbearing, loose, lenses of sandy silt (SP)	COARSE ALLUVIUM	5	W	SS	4					
16	SANDY LEAN CLAY, a little gravel, gray, firm to stiff (CL)	TILL	7	M	SS	8	22				
21			8	M	SS	15	16				
26			13	M	SS	18	16				

END OF BORING
Northing=211590.1
Easting=551980.4

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA
9½'-24½'	RD w/DM

BORING COMPLETED: **6/21/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/21/07	11:45	11.5	9.5	10.3		10.1

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-43 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **890.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand and silty sand, trace roots, brown and dark brown		11	M	SS	16	13				
3	SAND WITH SILT, trace roots, brown mottled to grayish brown, moist, dense, lenses and laminations of organic silt (SP-SM) (possible fill)	COARSE ALLUVIUM OR FILL	31	M	SS	14					
6	SAND WITH SILT, light brown and gray mottled, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM	22	W	SS	16	20				
7				▼							
8	SILTY SAND, a little gravel, gray, medium dense (SM)	TILL	25	M	SS	14	11				
11	SANDY LEAN CLAY, a little gravel, gray, firm to stiff (CL)		8	M	SS	15	18				
13			6	M	SS	21	17				
16			9	M	SS	20	18				
21			8	M	SS	22	15				
26			6	M	SS	21	23				

END OF BORING
Northing=211683.6
Easting=552398.6

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA
9½'-24½'	RD w/DM

BORING COMPLETED: **6/25/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/25/07	8:15	6.5	4.5	5.5		None
6/25/07	8:20	9.0	7.0	7.6		6.8

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-44 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 888.6 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and clayey sand, a little gravel, trace roots, surface roots, pieces of plastic and concrete, brown and dark brown		FILL	5	M	SS	16	9 13				
2 3 4	SANDY LEAN CLAY, a little gravel, gray and brown mottled, firm, laminations of silty sand (CL)	▨	TILL	8	M	SS	7	16				
5 6 7	SANDY LEAN CLAY, a little gravel, grayish brown, a little brown, stiff, laminations of silty sand (CL)	▨		11	M	SS	19	17				
8 9	SANDY LEAN CLAY, a little gravel, dark gray, a little brown, stiff, laminations of silty sand (CL)	▨		9	M	SS	18	15				
10 11 12		▨		10	M	SS	16	16				
13 14	SANDY LEAN CLAY, a little gravel, dark gray, firm to stiff (CL)	▨		9	M	SS	3	17				
15 16 17 18 19		▨		8	M	SS	21	15				
20 21 22 23 24		▨		9	M	SS	21	14				
25 26		▨		11	M	SS	20	15				
	END OF BORING Northing=211684.3 Easting=552896.6											

WATER LEVEL MEASUREMENTS

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA							
	6/22/07	**11:45**	**26.5**	**24.5**	**26.5**		**None**
BORING COMPLETED: **6/22/07**							
DR: **SG** LG: **SB** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-45 RI-3008-18** LOCATION: N: 211681.830, E: 553399.700 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/18/07**	SCALE: **1" = 4'**

Elev. feet 892.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
		FILL ▨	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, moist.	26		
888.4	4.0					
		FILL ▨	FILL: Clayey Sand, trace of Roots, brown to dark gray.	12	▽	Fuel Odor
885.4	7.0					
		FILL ▨	FILL: Silty Sand, fine-grained, waterbearing, medium dense.	12		
883.9	8.5					
			END OF BORING. (Per Tetra Tech). Water observed at 6 1/2 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-46** LOCATION: N: 211683.156, E: 553897.273 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/11/07**	SCALE: **1" = 4'**

Elev. feet 895.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
894.4	1.0	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.			
883.4	12.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel with Wood fragments at 8' sample depth, reddish brown to gray moist to wet.	12 14 5 2	▽	
873.4	22.0	PT	PEAT, dark gray, wet. (Swamp Deposit)	3 3 5		
869.4	26.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, waterbearing, medium dense. (Glacial Outwash)	11		
			END OF BORING. Water observed at 11 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-47 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **893.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	SAND WITH SILT, surface roots, trace roots, fine grained, brown, a little dark brown, moist, very loose (SP-SM) (possible fill)	COARSE ALLUVIUM OR FILL	4	M	SS	13					
2 3	SAND WITH SILT, trace roots, fine grained, light brown and brown mottled, moist, very loose (SP-SM) (possible fill)		7	M	SS	15					
4 5 6	SAND WITH SILT, trace roots, fine grained, light brown and brown mottled, moist, loose, lenses and laminations of silty sand (SP-SM) (possible fill)	COARSE ALLUVIUM	8	M	SS	17					
7	SILTY SAND, fine grained, brown, moist, loose (SM) (possible fill)										
8 9	SAND WITH SILT, fine grained, light grayish brown, a little brown mottled, moist, loose (SP-SM)		10	M	SS	16					
10 11	SAND WITH SILT, trace roots, fine grained, light grayish brown, a little brown. moist, loose, laminations of silty sand (SP-SM)		9	M ▽	SS	17					
12 13 14 15 16 17 18 19 20 21 22 23	SAND WITH SILT, fine grained, light grayish brown, waterbearing, loose to dense (SP-SM)		9 11 41	W ▼ M M	SS SS SS	16 15 18					
24 25	SAND WITH SILT, a little gravel, fine grained, gray, waterbearing, loose (SP-SM)										
26	CLAYEY SAND, a little gravel, gray, stiff (SC)	TILL	10	M	SS	18	17				

END OF BORING
Northing=211436.0
Easting=550652.0

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA
14½'-24½'	RD w/DM

BORING COMPLETED: 6/19/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/19/07	10:30	14.0	12.0	12.1		None
6/19/07	10:35	16.5	14.5	14.5		14.4

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

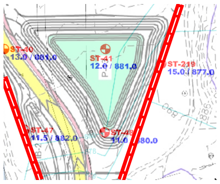
06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-48** LOCATION: N: 211431.925, E: 550895.208 See attached sketch.
DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr
DATE: **6/21/07**	SCALE: **1" = 4'**

Elev. feet 890.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
889.4	1.5	FILL	FILL: Silty Sand, trace of Roots and concrete debris, dark brown, moist.					
879.9	11.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, orange-brown to light brown, moist, loose. (Lacustrine)	5 10 10	▽			
872.9	18.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown to gray, waterbearing, very loose to loose. (Lacustrine)	6 4		22	11	
864.9	26.0	SM	SILTY SAND, fine-grained, grayish-brown to gray, waterbearing, medium dense. (Lacustrine)	8 14				
			END OF BORING. Water observed at 11 feet while drilling. Boring then grouted.					



Fill (silty sand) 0' to 1.5'
Poorly Graded Sand w Silt 1.5' to 18'
Silty Sand 18' to 26'

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING:	**ST-50**
LOCATION:	N: 211197.779, E: 550740.041 See attached sketch.
DRILLER:	K. Keck
METHOD:	3 1/4" HSA, Autohmr
DATE:	6/22/07
SCALE:	1" = 4'

Elev. feet 882.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
881.8	1.0	FILL	FILL: Silty Sand, very fine- to fine-grained, trace of Roots, dark brown, moist.					
878.8	4.0	FILL	FILL: Clayey Sand, asphalt and concrete debris, trace of Roots, dark gray, moist.	15		8	16	OC = 2%
875.8	7.0	FILL	FILL: Poorly Graded Sand with Silt, very fine- to fine-grained, brown, moist.	11				
870.8	12.0	SM	SILTY SAND, slightly Organic, dark gray, wet, very loose. (Swamp Deposit)	3				
				3	⊽	39	34	OC = 4 LL = 34 PI = 1
856.8	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft to rather stiff. (Glacial Till)	4				
				10				
				5				
				7				
			END OF BORING. Water observed at 11 feet while drilling. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-51** LOCATION: N: 211184.241, E: 550897.404 See attached sketch.
DRILLER: K. Keck — METHOD: 3 1/4" HSA, Autohmr	DATE: **6/21/07** — SCALE: **1" = 4'**

Elev. feet 881.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
		FILL	FILL: Silty Sand, very fine- to fine-grained, trace of Roots, dark brown, moist.					
880.4	0.8							
		FILL	FILL: Silty Sand, very fine- to fine-grained, mixed dark brown to brown, moist.					
				8				
				2		13	15	OC = 2%
874.2	7.0							
		SM	SILTY SAND, fine-grained, trace of fibers, dark gray, moist, very loose. (Swamp Deposit)					
				3		28	17	OC = 3
					∇			
				4				
869.2	12.0							
		SM	SILTY SAND, fine-grained, dark gray, waterbearing, loose. (Lacustrine)					
				5				
				5				
864.2	17.0							
		CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)					
				6				
				6				
855.2	26.0							
			END OF BORING. Water observed at 9 feet while drilling. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO:	**22-00081**	LOG OF BORING NO.	**ST-52 (p. 1 of 1)**
PROJECT:	**TCAAP Redevelopment; Arden Hills, MN**		

SURFACE ELEVATION: 885.9

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC. IN.	WC	DEN	LL	PL	%-#200
0	4.5" Bituminous Pavement	FILL			SU						
1	FILL, mixture of clayey sand and silty sand, with gravel, trace roots, brown and light brownish gray						10				
1.5			12	M	SS	12					
3	FILL, mixture of sand, silty sand and clayey sand, a little gravel, pieces of wood at about 5', brown, light brownish gray and black		18	M	SS	19					
6			41	M	SS	19					
7				▽							
8			14	W	SS	17					
11			16	▼	SS	17					
12	SAND WITH SILT, fine grained, gray, a little black, waterbearing, very loose, laminations of silty sand (SP-SM)	COARSE ALLUVIUM	4	W	SS	14					
14	CLAYEY SAND, a little gravel, dark gray, soft (SC)	TILL					19				
15	CLAYEY SAND, gray, a little brown, soft, laminations of silty sand (SC)		4	M	SS	19	20				
18	SANDY LEAN CLAY, a little gravel, gray, soft to firm (CL)										
21			4	M	SS	19	20				
26			7	M	SS	17	19				

END OF BORING
Northing=211278.6
Easting=551665.8

DEPTH:	DRILLING METHOD
0-14½'	**3.25" HSA**
14½'-24½'	**RD w/DM**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/21/07	10:45	14.0	12.0	12.4		10.9

BORING COMPLETED: **6/21/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-53 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **885.5**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly sand with silt, with gravel, surface roots, trace roots, dark brown and brown	FILL	13	M	SS	12					
2											
3	FILL, mixture of silty sand and sand with silt, trace roots, brown, light brown, a little black		9	M	SS	13					
4											
5											
6			16	M	SS	8					
7											
8	SILTY SAND, fine grained, brown, moist to about 9.5', then wet, medium dense, lenses and laminations of sand with silt (SM)	COARSE ALLUVIUM	21	W/M	SS	17					
9											
10											
11			18	▼ W	SS	19					
12											
13	CLAYEY SAND, a little gravel, brownish gray, firm (SC)	TILL	6	M	SS	24	19				
14											
15	SANDY LEAN CLAY, a little gravel, brownish gray, stiff (CL)										
16			13	M	SS	23	19				
17											
18											
19											
20											
21			10	M	SS	21	16				
22											
23											
24											
25											
26			12	M	SS	24	17				
	END OF BORING Northing=211190.3 Easting=551897.8										

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA
9½'-24½'	RD w/DM

BORING COMPLETED: 6/21/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/21/07	1:00	11.5	9.5	10.6		10.3

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-54 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 888.9 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, dark brown and brown, pieces of brick	FILL	18	M	SS	16					
2											
3			56	W/M	SS	1	19				
4											
5	CLAYEY SAND, brown and gray mottled, very soft, laminations of silty sand and sand with silt (SC)	WEATHERED TILL									
6			4	W/M	SS	17	22				
7	SANDY LEAN CLAY, a little gravel, gray, soft to stiff (CL)	TILL									
8			5	M	SS	19	18				
9											
10											
11			15	M	SS	19	16				
12											
13			8	M	SS	24	17				
14											
15											
16			9	M	SS	23	14				
17											
18											
19											
20											
21			10	M	SS	24	19				
22											
23											
24											
25											
26			10	M	SS	24	16				
	END OF BORING Northing=211160.7 Easting=552421.7										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

BORING COMPLETED: **6/25/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/25/07	9:30	9.0	7.0	8.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-55 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **892.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand and silty sand, a little gravel, trace roots, pieces of bituminous, brown, gray and black	FILL	12	M	SS	13	10				
2											
3	SANDY LEAN CLAY, a little gravel, gray and brown mottled, firm, laminations of silty sand and silt (CL)	WEATHERED TILL	7	M	SS	14	18				
4											
5	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, stiff to very stiff, laminations of silty sand (CL)	TILL									
6			9	M	SS	22	17				
7											
8			16	M	SS	22	16				
9											
10	SANDY LEAN CLAY, a little gravel, dark gray, a little brown, stiff to firm, laminations of silty sand (CL)										
11			14	M	SS	18	16				
12											
13			11	M	SS	20					
14							16				
15											
16			10	M	SS	21	17				
17											
18											
19											
20											
21			8	M	SS	19	15				
22											
23											
24											
25											
26			13	M	SS	24	15				
	END OF BORING Northin=211171.6 Easting=552889.1										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

BORING COMPLETED: **6/22/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/22/07	11:00	26.5	24.5	25.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-57 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 893.6 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	4.25" Bituminous Pavement	FILL									
1	FILL, mixture of sand with silt and silty sand, light brown and brown			M	SU						
2											
3			67	M	SS	18					
4											
5			44	M	SS	18					
6											
7	FILL, mixture of sand with silt and silty sand, a little gravel, brown, dark brownish gray and black										
8			64	M	SS	23					
9											
10			78	M	SS	17					
11											
12											
13			5	M	SS	14					
14											
15			12	M	SS	17					
16											
17											
18			38	W/M	SS	19					
19											
20			14	M	SS	17					
21											
22	SAND WITH SILT, trace roots, fine grained, brownish gray, a little black, waterbearing, medium dense, laminations of organic silt (SP-SM)	TOPSOIL OR COARSE ALLUVIUM		▼							
23			19	W/M	SS	19					
24	SAND, fine grained, brownish gray, waterbearing, medium dense, lense of fine to medium grained sand (SP)	COARSE ALLUVIUM									
25			14	W	SS	22					
26	SANDY LEAN CLAY, a little gravel, brownish gray, stiff (CL)	TILL					15				
27											
28											

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA
24½'-29½'	RD w/DM

BORING COMPLETED: **6/19/07**

DR: **SG**　LG: **SB**　Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/19/07	12:15	24.0	22.0	22.4		None
6/19/07	12:20	26.5	24.5	24.1		22.5

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-57 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
30 31	SANDY LEAN CLAY, a little gravel, brownish gray, stiff (CL) *(continued)*	TILL *(continued)*	9	M	SS	24	15				
	END OF BORING Northing=211018.6 Easting=550730.8										

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-59 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 884.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, a little gravel, pieces of bituminous, surface roots, trace roots, brown and dark brown	FILL									
1			10	M	SS	14					
2	FILL, mixture of sand with silt and silty sand, a little gravel, trace roots, brown and dark brown										
3			26	M	SS	16					
4											
5											
6			28	M	SS	19					
7											
8			23	M	SS	17					
9	FILL, mixture of organic clay and silty sand, trace roots, black and brown										
10							17				
11	LEAN CLAY WITH ORGANICS, trace roots, black, a little gray, stiff, laminations of sand (CL)	TOPSOIL	13	M	SS	17					
12		COARSE ALLUVIUM		▼			24				
13	SAND, fine grained, light brownish gray, waterbearing, medium dense (SP)		11	W	SS	17					
14	SAND, a little gravel, fine grained, brownish gray, a little black, waterbearing, very loose, laminations of organic silt (SP)										
15											
16			4	W	SS	16					
17											
18	SAND WITH SILT, fine grained, light brownish gray, waterbearing, dense (SP-SM)										
19											
20											
21			37	W	SS	18					
22											
23	SILTY SAND, fine grained, light brownish gray, wet, dense (SM)										
24											
25											
26			31	W	SS	18					
	END OF BORING Northing=210936.8 Easting=550917.0										

Fill (silty sand) 0' to 2'
Fill (sand w silt) 2' to 9'
Fill (organic clay) 9' to 11'
topsoil 11' to 12'
Sand 12' to 18'
Sand w silt 18' to 23'

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA
14½'-20½'	RD w/DM

BORING COMPLETED: 6/19/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/19/07	1:40	14.0	12.0	12.2		12.1

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-60 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **883.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand, sandy silt and organic silt, a little gravel, trace roots, brown, dark brown and black	FILL	10	M	SS	14					
2	FILL, mixture of sand with silt, silty sand and clayey sand, a little gravel, organic clay, trace roots, brown, a little light brown and black										
3			16	M	SS	14					
4											
5											
6			4	W/M	SS	14					
7											
8			3	▼ M	SS	14					
9											
10											
11			5	W	SS	17					
12											
13			13	W	SS	12					
14	SAPRIC PEAT, black, laminations of waterbearing sand (PT)	SWAMP DEPOSIT									
15											
16			WH	W	SS	19	48				
17	SAND, fine grained, gray to brownish gray, waterbearing, medium dense (SP)										
18			12	W	SS	16					
19											
20											
21			22	W	SS	19					
22											
23											
24											
25											
26			28	W	SS	21					

Fill (silty sand) 0' to 14'
Sapric Peat 14' to 16.5'
Sand 16.5' to 26'

END OF BORING
Northing=210929.3
Easting=551151.1

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA
9½'-24½'	RD w/DM

BORING COMPLETED: **6/19/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/19/07	2:45	9.0	7.0	7.0		None
6/19/07	2:50	11.5	9.5	9.0		8.0

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-61 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **885.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0	5" Bituminous Pavement	FILL			SU						
0.4	FILL, mixture of silty sand and sand with silt, a little gravel, trace roots, brown and gray		20	M	SS	14					
			32	M	SS	17					
			39	M	SS	19					
7	CLAYEY SAND, black, a little gray, hard, laminations of sand with silt (SC)	TOPSOIL					13				
			38	M	SS	20					
8.3	SILTY SAND, fine grained, light brownish gray, moist, dense (SM)	COARSE ALLUVIUM		▼							
9.5	SILTY SAND, fine grained, gray, wet, loose (SM)		8	W	SS	18					
12	SAND WITH SILT, trace roots, fine grained, gray, a little black, waterbearing, medium dense, laminations of clayey sand (SP-SM)		12	W	SS	14					
			11	W	SS	10					
			10	W	SS	15					
19	SAND WITH SILT, fine grained, gray, waterbearing, medium dense (SP-SM)		21	W	SS	17					
			22	W	SS	15					

END OF BORING
Northing=210988.6
Easting=551565.3

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA
9½'-24½'	RD w/DM

BORING COMPLETED: **6/21/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/21/07	9:30	11.5	9.5	9.7		9.4

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-62** LOCATION: N: 210796.368, E: 550782.855 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/25/07**	SCALE: **1" = 4'**

Elev. feet 884.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
883.8	0.5	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.					
872.3	12.0	FILL	FILL: Silty Sand, very fine- to fine-grained, trace of Gravel, mixed with Poorly Graded Sand, light brown to brown, moist.	18 22 14 7				
870.3	14.0	SM	SILTY SAND, fine-grained, trace of Roots, slightly Organic, dark gray, waterbearing, loose. (Swamp Deposit)	6	▽	25	17	OC = 2%
866.3	18.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, loose. (Lacustrine)	5				
858.3	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium to rather stiff. (Glacial Till)	7 10				
			END OF BORING. Water observed at 12 feet while drilling. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-63** LOCATION: N: 210687.940, E: 550637.026 See attached sketch.
DRILLER: K. Keck METHOD: 3 1/4" HSA, Autohmr	DATE: **6/25/07** SCALE: **1" = 4'**

Elev. feet 886.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
		FILL	FILL: Poorly Graded Sand with Silt, fine-grained, trace of Gravel, mostly brown mixed with dark brown, moist.	23 17 23		
877.1	9.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown to grayish-brown, loose. (Lacustrine)	7 6		
872.1	14.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, very loose. (Lacustrine)	3	∇	
868.1	18.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft to rather stiff. (Glacial Till)	5 10		
860.1	26.0		END OF BORING. Water observed at 14 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-64 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **883.5**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2.25" Bituminous Pavement	FILL			SU						
1	FILL, mixture of gravelly sand with silt and clayey sand, trace roots, brown		7	M	SS	12					
3	FILL, mixture of sand with silt, silty sand and clayey sand, a little gravel, brown, a little dark brown, gray and black		12	M	SS	16	11				
6			32	M	SS	19	7				
8	FILL, mixture of silty sand and organic clay, trace roots, brownish gray and black		25	M	SS	20					
9	SAPRIC PEAT, black (PT)	SWAMP DEPOSIT									
11	SILTY SAND, trace roots, fine grained, gray and black, wet very loose, laminations of organic silt (SM)	COARSE ALLUVIUM	3	▼ M	SS	14					
13			3	W	SS	12					
15	SANDY LEAN CLAY, a little gravel, gray, firm to stiff, laminations of sand (CL)	TILL	6	M	SS	12	14				
21			6	M	SS	22	16				
26			12	M	SS	22	17				
	END OF BORING Northing=210683.3 Easting=550895.7										

DEPTH:	DRILLING METHOD
0-9½'	**3.25" HSA**
9½'-24½'	**RD w/DM**

BORING COMPLETED: **6/20/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/20/07	**3:35**	**11.5**	**9.5**	**10.9**		**10.2**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-65 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **886.2**

MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
4.5" Bituminous Pavement	FILL			SU						
FILL, mixture of silty sand, sand with silt and clayey sand, with gravel, trace roots, dark brown, light brown and gray		14	M	SS	13					
SAND WITH SILT, fine grained, light brown and brown mottled, moist, medium dense, laminations of silty sand (SP-SM)	COARSE ALLUVIUM	22	M	SS	19					
SAND WITH SILT, fine grained, light brown, moist to waterbearing, medium dense (SP-SM)		23	W	SS	17					
SAND WITH SILT, fine grained, brownish gray, a little black, w … then moist, medium … y sand (SP-SM)		15	M	SS	17					
▼		14	M	SS	20					
SAND WITH SILT, trace roots, fine grained, gray and black, moist, medium dense, lenses of organic silt (SP-SM)										
SAND, fine grained, gray and light grayish brown mottled, waterbearing, medium dense (SP)		12	W	SS	19					
SANDY SILT, gray and brownish gray, wet, loose, lenses and laminations of lean clay (ML)	FINE ALLUVIUM	8	M	SS	17					
CLAYEY SAND, a little gravel, gray, stiff, laminations of wet silty sand (SC)	TILL	9	M	SS	20	14				
SANDY LEAN CLAY, a little gravel, gray, stiff (CL)		13	M	SS	19	19				

Fill (silty sand) 0.3' to 2.5'
Sand w Silt 2.5' to 12'
Sand 12' to 14.5'
Sandy Silt 14.5' to 18'
Clayey Sand 18' to 23'

END OF BORING
Northing=210684.0
Easting=551396.3

DEPTH:	DRILLING METHOD
0-12'	3.25" HSA
12'-24½'	RD w/DM

BORING COMPLETED: **6/21/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/21/07	8:20	14.0	12.0	12.1		10.0

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-66 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **888.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, a little gravel, trace roots, dark brown	FILL									
2	FILL, mixture of sand with silt and silty sand, a little gravel, trace roots, light brown and brown		20	M	SS	19					
3	SILTY SAND, fine grained, brown, moist, medium dense (SM)	COARSE ALLUVIUM	20	M	SS	18					
4	SAND WITH SILT, fine grained, light grayish brown to brown mottled, moist, medium dense, laminations of silty sand (SP-SM)										
5											
6			15	M	SS	15					
7											
8	SAND WITH SILT, fine grained, light brownish gray and brown mottled, moist to about 9.5', then waterbearing, medium dense to loose (SP-SM)		18	M	SS	18					
9											
10				▼							
11			12	W	SS	17					
12											
13			6	W	SS	14					
14											
15	SILTY SAND, a little gravel, fine to medium grained, gray, wet, very loose (SM)										
16			2	W	SS	13					
17											
18											
19	CLAYEY SAND, a little gravel, gray, soft (SC)	TILL									
20											
21			4	M	SS	24	18				
22											
23											
24	SANDY LEAN CLAY, a little gravel, gray, firm (CL)										
25											
26			7	M	SS	24	21				
	END OF BORING Northing=210683.5 Easting=551850.2										

DEPTH:	DRILLING METHOD
0-9½'	**3.25" HSA**
9½'-24½'	**RD w/DM**

BORING COMPLETED: **6/21/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/21/07	**2:05**	**11.5**	**9.5**	**10.2**		**10.0**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-67 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 888.7 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	FILL, mostly organic silt, surface roots, trace roots, dark brown and black	FILL									
1			8	M	SS	15					
2	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, dark brown, brown and light brown										
3	SAND WITH SILT, a little gravel, light brown to light brown mottled, waterbearing, loose to medium dense (SP-SM)	COARSE ALLUVIUM	17	M	SS	14					
4											
5											
6			17	▼	SS	15					
7											
8			21	W	SS	17					
9											
10											
11			9	W	SS	15					
12	CLAYEY SAND, a little gravel, gray, stiff (CL)	TILL									
13			9	M	SS	10	17				
14											
15	SANDY LEAN CLAY, a little gravel, gray, firm to stiff										
16			6	M	SS	17	15				
17											
18											
19											
20											
21			11	M	SS	16	17				
22											
23											
24											
25											
26			10	M	SS	18	18				
	END OF BORING Northing=210683.4 Easting=552397.5										

Fill (silty sand) 0.7' to 3'
Sand w Silt 3' to 12'
Clayey Sand 12' to 14.5'
Sandy Lean Clay 14.5' to 26'

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA
9½'-24½'	RD w/DM

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/22/07	8:40	9.0	7.0	6.8		6.0

BORING COMPLETED: 6/22/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-68 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 895.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
	FILL, mixture of silty sand and sand with silt, a little gravel, surface roots, trace roots, light brown, brown and dark brown	FILL									
1			13	M	SS	12					
2											
3			16	M	SS	6					
4											
5				▼							
6			12	M	SS	14					
7	ORGANIC CLAY, trace roots, black, soft (OL/OH)	TOPSOIL OR SWAMP DEPOSIT									
8			3	M	SS	10	39				
9	SAND WITH SILT, a little gravel, brown and gray, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM									
10			28	W	SS	17					
11											
12	LEAN CLAY, gray and black, stiff, lenses of sandy lean clay, laminations of fat clay (CL)	TILL									
13			14	M	SS	24	16				
14	SANDY LEAN CLAY, a little gravel, gray, firm to stiff, laminations of lean clay (CL)										
15			5	M	SS	6					
16											
17											
18											
19											
20			11	M	SS	19	17				
21											
22											
23											
24											
25			12	M	SS	21	18				
26											
	END OF BORING Northing=210684.3 Easting=552897.4										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4½'	3.25" HSA							
4½'-24½'	RD w/DM	6/22/07	1:00	6.5	4.5	6.0		5.2

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/22/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-69 RI-3002-05** LOCATION: N: 210744.173, E: 553428.679 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/19/07**	SCALE: **1" = 4'**

Elev. feet 894.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
893.8	1.0	FILL	FILL: Poorly Graded Sand with Silt, trace of Gravel, dark brown, moist.			
890.8	4.0	SM	SILTY SAND, fine-grained, gray, moist, loose. (Lacustrine)	8	∇	
880.8	14.0	SP-SM	POORLY GRADED SAND with SILT, trace of Gravel, brown, waterbearing, very loose to loose. (Lacustrine)	10 7 3 10		
868.8	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium to rather stiff. (Glacial Till)	10 8 10		
			END OF BORING. Water observed at 4 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-70** LOCATION: N: 210240.974. E: 550584.304 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: 6/25/07
SCALE: 1" = 4'

Elev. feet 885.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
883.5	1.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
878.0	7.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, orange-brown, moist, loose. (Lacustrine)	9 9	▽	
871.0	14.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to gray with rust, waterbearing, very loose to loose. (Lacustrine)	4 4 8		
859.0	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray,w et, medium to rather stiff. (Glacial Till)	9 6 9		
			END OF BORING. Water observed at 7 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-71 RI-1015-01** LOCATION: N: 210151.469. E: 550929.912 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/25/07**	SCALE: **1" = 4'**

Elev. feet 887.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
887.1	0.3	PAV	3" of Bituminous			
885.8	1.5	FILL	FILL: Poorly Graded Sand with Silt, fine-grained, trace of Gravel, brown, moist.			
880.3	7.0	SP-SM	POORLY GRADED SAND with SILT,fine-grained, light brown to orange-brown, moist, loose to medium dense. (Lacustrine)	16 7	∇	
875.3	12.0	SP-SM	POORLY GRADED SAND with SILT,fine-grained, brownish-gray to gray, waterbearing, very loose to loose. (Lacustrine)	4 10		
861.3	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff to very stiff. (Glacial Till)	25 14 11 11		
			END OF BORING. Water observed at 7 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-72 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **887.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and sand, light brown, brown and dark brown	FILL	6	M	SS	14					
2											
3			3	W	SS	12					
4											
5				▼							
6			7	W	SS	15					
7											
8	SAND WITH SILT, fine to medium grained, a little gravel, brown, waterbearing, loose (SP-SM)	COARSE ALLUVIUM	6	W	SS	14					
9											
10	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, waterbearing, loose (SP-SM)	TILL									
11			5	M	SS	18	16				
12	CLAYEY SAND, a little gravel, gray, firm (CL)										
13			6	M	SS	14	15				
14											
15											
16			7	M	SS	15	14				
17											
18											
19	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)										
20											
21			9	M	SS	23	17				
22											
23											
24											
25											
26			12	M	SS	23	16				
	END OF BORING Northing=210217.1 Easting=551467.5										

Fill (silty sand) 0' to 7'
Sand w Silt 7' to 10'
Clayey Sand 10' to 18'

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

BORING COMPLETED: 6/26/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/26/07	11:55	6.5	4.5	4.9		4.8
6/26/07	12:20	26.5	24.5	26.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-73 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **891.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
1 2 3	FILL, mixture of silty sand, sand with silt and sandy silt, a little gravel, surface roots, trace roots, dark brown, black and gray	FILL	8 6	M M	SS SS	12 8					
4 5 6	LEAN CLAY WITH ORGANICS, trace roots, black, firm (CL)	TOPSOIL	6	M	SS	14	23				
7 8	SAND WITH SILT, fine grained, gray and brown mottled, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM	13	W ▼	SS	16					
9 10 11	SAND WITH SILT, a little gravel, fine to medium grained, brown, a little gray mottled, waterbearing, medium dense (SP-SM)		22	W	SS	17					
12 13 14	SAND WITH SILT, fine grained, light brownish gray, waterbearing, medium dense (SP-SM)		25	W	SS	16					
15 16 17	SANDY LEAN CLAY, a little gravel, gray, firm (CL)	TILL	6	M	SS	15	24				
18 19 20 21 22	CLAYEY SAND, a little gravel, gray, firm (SC)		5	M	SS	24	19				
23 24 25 26	SANDY LEAN CLAY, a little gravel, gray, firm (CL)		7	M	SS	17	18				
	END OF BORING Northing=210182.9 Easting=551898.2										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-9½'	3.25" HSA							
9½'-24½'	RD w/DM	6/21/07	3:00	11.5	9.5	10.0		9.0
BORING COMPLETED:	6/21/07							
DR: SG LG: SB Rig: 91C								

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-74 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 891.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and silty sand, a little gravel, surface roots, trace roots, brown	FILL	15	M	SS	15					
3	FILL, mixture of clayey sand and silty sand, a little gravel, trace roots, brown		14	M	SS	18	15				
6	SAND WITH SILT, a little gravel, fine to medium grained, light brown, waterbearing, loose to medium dense, laminations of silty sand (SP-SM)	COARSE ALLUVIUM	6	M ▼	SS	13					
8			13	W	SS	15					
11	SAND WITH SILT, a little gravel, fine to medium grained, gray, medium dense (SP-SM)		19	W	SS	19					
12	CLAYEY SAND, a little gravel, gray, firm to very stiff (SC)	TILL					17				
13			7	M	SS	18	17				
16			10	M	SS	17	13				
19	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)										
21			10	M	SS	14	17				
26			13	M	SS	24	14				
	END OF BORING Northing=210212.8 Easting=552416.8										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

BORING COMPLETED: 6/27/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/7/07	3:05	6.5	4.5	4.8		None
6/27/07	3:10	9.0	7.0	7.0		6.4
6/27/07	3:35	26.5	24.5	26.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-75 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **898.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1–2	SAND WITH SILT, fine to medium grained, a little gravel, surface roots, trace roots, brown (SP-SM) (possible fill)	COARSE ALLUVIUM OR FILL	8	M	SS	10					
3			15	M	SS	10					
4–5	CLAYEY SAND, a little gravel, brown, light brown and gray mottled, firm, lenses and laminations of sand with silt (SC)	MIXED ALLUVIUM		▼			14				
6	SAND WITH SILT, a little gravel, trace roots, brown, waterbearing, loose (SP-SM)	COARSE ALLUVIUM	7	W/M	SS	14					
7–8	SANDY SILT, a little gravel, trace roots, gray, wet, medium dense (ML)	FINE ALLUVIUM	12	W	SS	NR					
9–11	CLAYEY SAND, a little gravel, brownish gray, stiff (SC)	TILL	10	W	SS	13	14				
12–13	SANDY LEAN CLAY, a little gravel, dark gray, firm to stiff (CL)		7	W	SS	21	19				
16			10	W	SS	18	18				
21			12	M	SS	18	16				
26			13	M	SS	17	11				

END OF BORING
Northing=210184.0
Easting=552897.6

DEPTH:	DRILLING METHOD
0-4½'	**3.25" HSA**
4½'-24½'	**RD w/DM**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/25/07	**10:30**	**6.5**	**4.5**	**4.9**		**4.3**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: **6/25/07**

DR: **SG** LG: **SB** Rig: **91C**

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4001-02 ST-76**

LOCATION: N: 210133.678, E: 553362.349 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/23/07	SCALE: 1" = 4'

Elev. feet 907.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
906.0	1.0	FILL	FILL: Silty Sand, fine-grained, with Organics and Gravel, dark brown, moist.			
900.0	7.0	FILL	FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist. Petroleum odor at 5 1/2 feet.	19 32		
893.0	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, medium to rather stiff. (Glacial Till)	8 9 9		
881.0	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium. (Glacial Till)	7 7 7		

END OF BORING.

Water not observed during drilling.

Water not observed with 24 1/2 feet of hollow-stem auger in the ground.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-77** LOCATION: N: 209775.961, E: 550699.340 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/26/07**	SCALE: **1" = 4'**

Elev. feet 892.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
891.4	1.0	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.			
885.4	7.0	FILL	FILL: Silty Sand, fine-grained, trace of Gravel, dark brown to brown, moist.	9 8		
881.4	11.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to grayish-brown, moist, loose to medium dense. (Lacustrine)	12 7	▽	
870.4	22.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brownish-gray to gray, wet, very loose to loose. (Lacustrine)	4 5 10		
866.4	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff. (Glacial Till)	9		
			END OF BORING. Water observed at 11 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-78** LOCATION: N: 209684.547, E: 550898.325 See attached sketch.

DRILLER:	METHOD:	DATE:	SCALE:
K. Keck	3 1/4" HSA, Autohmr	**6/26/07**	**1" = 4'**

Elev. feet 886.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
884.6	1.5	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.					
879.1	7.0	FILL	FILL: Silty Sand, fine-grained, dark brown mixed with light brown and gray, moist.	3 2				
872.1	14.0	PT	PEAT, fibrous, dark gray, wet, very soft. (Swamp Deposit)	WH WH WH		 421 	 61 	
860.1	26.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, very loose to loose. (Lacustrine)	1 4 8	▽			

END OF BORING.

Water observed at 14 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-79 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **888.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	SILTY SAND, a little gravel, surface roots, trace roots, dark brown, moist, loose (SM)	TOPSOIL									
1		COARSE ALLUVIUM	10	M	SS	16					
2	SILTY SAND WITH GRAVEL, trace roots, brown, moist, loose (SM)										
3	SAND, fine grained, light brown, moist, loose, laminations of silty sand (SP)		9	M	SS	16					
4											
5											
6			13	W/M	SS	18					
7	SAND, fine grained, light brown, waterbearing, medium dense to loose (SP)			▼							
8			11	W	SS	17					
9											
10											
11			7	W	SS	17					
12	SAND WITH SILT, fine grained, gray, waterbearing, very loose to very dense (SP-SM)										
13			2	W	SS	13					
14											
15											
16			55	W	SS	14					
17											
18	SILTY SAND, a little gravel, gray, waterbearing, very loose (SM)	TILL									
19											
20	SANDY LEAN CLAY, a little gravel, gray, soft to very stiff, laminations of silty sand at 24.5' (CL)										
21			4	W	SS	16	15				
22											
23											
24											
25											
26			17	M	SS	21	16				

Silty Sand 0' to 2'
Sand 2' to 11.5'
Sand w Silt 11.5' to 18'

END OF BORING
Northing=209686.5
Easting=551325.7

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA	**6/26/07**	**1:05**	**9.0**	**7.0**	**7.6**		**7.0**
BORING COMPLETED: **6/26/07**							
DR: **SG** LG: **SB** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-80** LOCATION: N: 209689.484, E: 551891.038 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/28/07**	SCALE: **1" = 4'**

Elev. feet 891.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
889.1	2.0	FILL	FILL: Silty Sand, very fine- to fine-grained, trace of Gravel, brown, moist.				
884.1	7.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown to brown and gray mixed with rust, wet. (Glacial Till)	5			
				7		15	
879.1	12.0	CL	SANDY LEAN CLAY, trace of Gravel, grayish-brown, wet, rather stiff to medium. (Glacial Till)	9		14	
				7			
865.1	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft to medium. (Glacial Till)	5			
				7		16	
				7			
				8			
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.				

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**
LOG OF BORING NO. **ST-81 (p. 1 of 1)**
PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **895.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
	SANDY SILT, a little gravel, surface roots, trace roots, dark brown, moist, loose (ML)	TOPSOIL									
1	SAND WITH SILT, fine grained, a little gravel, trace roots, brown, moist, loose (SP-SM)	COARSE ALLUVIUM	10	M	SS	16					
2											
3			6	M	SS	6					
4	SILTY SAND, trace roots, brown, waterbearing, loose, laminations of lean clay (SM)										
5	SANDY LEAN CLAY, a little gravel, brown and gray mottled, firm (CL)	TILL									
6			7	M	SS	15	16				
7	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of silty sand (CL)										
8			11	M	SS	19	15				
9											
10	CLAYEY SAND, a little gravel, gray, firm (SC)										
11			8	M	SS	22	15				
12	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of silty sand (CL)										
13			13	M	SS	21	16				
14	SANDY LEAN CLAY, a little gravel, gray, firm to stiff (CL)										
15											
16			8	M	SS	17	15				
17											
18											
19											
20											
21			11	M	SS	20	17				
22											
23											
24											
25											
26			12	M	SS	19	14				
	END OF BORING Northing=209624.8 Easting=552198.7										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/26/07	2:55	26.5	24.5	26.0		None

BORING COMPLETED: **6/26/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-82 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **898.6**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly sandy silt, surface roots, trace roots, dark brown	FILL									
1			25	M	SS	14					
2	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, light brown, brown and dark brown										
3			15	M	SS	13					
4											
5											
6			20	M	SS	16					
7											
8	LEAN CLAY WITH ORGANICS, trace roots, gray and black, moist, very stiff, lenses and laminations of silty sand (CL)	TOPSOIL	19	M/W	SS	17	15				
9	SILTY SAND, a little gravel, brownish gray, waterbearing, medium dense (SM)	TILL									
10											
11	CLAYEY SAND, a little gravel, trace roots, gray and brown mottled, soft (SC)		3	M	SS	20	19				
12											
13			4	M	SS	21	17				
14											
15	SANDY LEAN CLAY, gray, firm to stiff (CL)										
16			6	M	SS	21	16				
17											
18											
19											
20											
21			11	M	SS	22	14				
22											
23											
24											
25											
26			15	M	SS	22	15				

END OF BORING
Northing=209687.1
Easting=552381.8

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**							
		6/28/07	**8;15**	**11.5**	**9.5**	**11.2**		**None**
		6/28/07	**8:30**	**26.5**	**24.5**	**26.5**		**None**

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/28/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-83 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 903.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and silty sand, gravelly, trace roots, brown to dark brown	FILL	25	M	☒ SS	12					
	Hit gas line between 1' to 2'										
2	**END OF BORING** Northing=209676.4 Easting=552900.3										

DEPTH:	DRILLING METHOD
0-2'	3.25" HSA

BORING COMPLETED: **6/25/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-83A (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 903.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2.5" Bituminous Pavement				SU						
1	FILL, mixture of clayey sand and silty sand with gravel, possible cobbles, brown	FILL									
2			27	M	SS	6					
3											
4			37	M	SS	10					
5	SANDY LEAN CLAY, a little gravel, light brown and gray mottled, stiff, laminations of silty sand (CL)	TILL									
6			9	M	SS	16	17				
7	SANDY LEAN CLAY, a little gravel, brown, very stiff (CL)										
8			18	M	SS	18	16				
9											
10	SANDY LEAN CLAY, a little gravel, dark gray, stiff to very stiff (CL)										
11			15	M	SS	20	16				
12											
13			13	M	SS	20	15				
14											
15											
16			13	M	SS	22	16				
17											
18											
19											
20											
21			13	M	SS	17	15				
22											
23											
24											
25											
26			16	M	SS	24	15				
	END OF BORING Northing=209676.4 Easting=552900.3										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/28/07	**10:00**	**26.5**	**24.5**	**26.0**		**None**

BORING COMPLETED: **6/28/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-84 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **911.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, a little gravel, surface roots, trace roots, brown	FILL	13	M	SS	14					
3	FILL, mixture of sand with silt and sandy lean clay, a little gravel, trace roots, brown, gray, light gray and light brown		7	M	SS	13	16				
6	SANDY LEAN CLAY, a little gravel, light brown and gray mottled, with gray, firm to stiff (CL)	TILL	7	M	SS	17	19				
8			10	M	SS	20	17				
11	SANDY LEAN CLAY, a little gravel, brown mottled, dark brown, stiff, laminations of silt (CL)		14	M	SS	24	15				
13	SANDY LEAN CLAY, a little gravel, dark gray, stiff to very stiff (CL)		14	M	SS	19	15				
16			15	M	SS	16	15				
21			19	M	SS	16	14				
26			21	M	SS	18	16				
	END OF BORING Northing=209598.8 Easting=553354.1										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/18/07	3:35	26.5	24.5	26.5		None

BORING COMPLETED: 7/18/07

DR: SG LG: SB/BR Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-85 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **892.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and sand with silt, a little gravel, surface roots, trace roots, brown	FILL	13	M	SS	15					
3	CLAYEY SAND, a little gravel, trace roots, dark brown, very stiff (SC)	TILL	23	M	SS	17	8				
6	SILTY SAND, trace roots, fine to medium grained, moist, very loose, laminations of sand with silt (SM)		4	M	SS	18					
8	CLAYEY SAND, a little gravel, trace roots, gray and brown mottled, firm (SC)		5	M	SS	18	19				
11	CLAYEY SAND, a little gravel, trace roots, dark gray, firm to stiff (SC)		5	M	SS	23	17				
13			6	M	SS	24	15				
16			10	M	SS	23	14				
21	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL)		9	M	SS	24	19				
26			14	M	SS	22	15				

END OF BORING
Northing=209496.7
Easting=551939.7

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/27/07	9:35	9.0	7.0	8.2		None
6/27/07	10:05	26.5	24.5	26.5		None

BORING COMPLETED: **6/27/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-86 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **897.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–4.7	SAND WITH SILT, fine grained, a little gravel, trace roots, brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM									
1			22	M	SS	15					
3			22	M	SS	19					
4.7–8	SILTY SAND, a little gravel, brown and gray, moist, medium dense (SM)										
6			33	M	SS	16					
8–11	SANDY LEAN CLAY, a little gravel, gray, firm to stiff, lenses of lean clay with sand at 8' (CL)	WEATHERED TILL									
8.5			6	▼ M	SS	17					
11			9	M	SS	20					
11–18	SANDY LEAN CLAY, a little gravel, brown and gray mottled, stiff to firm, laminations of silty sand (CL)	TILL									
12							17				
13.5			8	M	SS	22	15				
16			9	M	SS	24	17				
18–23	SANDY LEAN CLAY, a little gravel, dark gray, a little brown, stiff, laminations of silty sand (CL)										
21			13	M	SS	21	14				
23–26.5	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL)										
26			15	M	SS	20	15				

END OF BORING
Northing=209336.2
Easting=552138.3

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/26/07	3:40	9.0	7.0	9.0		8.1

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: 6/26/07

DR: SG LG: SB Rig: 91C

AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-87 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **898.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand, clayey sand and sand with silt, a little gravel, surface roots, trace roots, dark brown and black	FILL	19	M	SS	14	7				
2	SANDY LEAN CLAY, a little gravel, trace roots, brown and gray mottled, firm (CL)	TILL					17				
3			8	M	SS	14					
4	SANDY LEAN CLAY, a little gravel, light brown and gray mottled, stiff (CL)										
5							16				
6			11	M	SS	19					
7							14				
8			11	M	SS	20					
9	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of silty sand (CL)										
10							15				
11			14	M	SS	21					
12	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)						14				
13			11	M	SS	22					
14											
15							15				
16			14	M	SS	20					
17											
18											
19											
20							14				
21			15	M	SS	21					
22											
23											
24											
25							15				
26			14	M	SS	19					
	END OF BORING Northing=209443.6 Easting=552400.6										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/26/07	9:20	26.5	24.5	26.0		None

BORING COMPLETED: **6/26/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-88**

LOCATION: N: 209329.011, E: 550811.898 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/28/07**	SCALE: **1" = 4'**

Elev. feet 889.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
883.7	6.0	FILL	FILL: Silty Sand, very fine- to fine-grained, trace of Gravel, trace of Roots at 5' sample depth, mixed dark brown to brown, moist.	16 24		
881.7	8.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown, moist, loose. (Lacustrine)	6	∇	
871.7	18.0	SP-SM	POORLY GRADED SAND with SILT,fine-grained, brownish-gray to gray, waterbearing, loose to medium dense. (Lacustrine)	15 6 10		
863.7	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft to rather stiff. (Glacial Till)	10 4		

END OF BORING.

Water observed at 8 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:45

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-89** LOCATION: N: 209181.170, E: 550895.450 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: 6/27/07
SCALE: 1" = 4'

Elev. feet 890.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
890.2	0.2	PAV	2" of Bituminous			
883.4	7.0	FILL	FILL: Silty Sand, fine-grained, trace of Gravel, mixed dark brown to brown, moist.	21 10		
872.4	18.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown, waterbearing, medium dense. (Lacustrine)	14 10 11 11	∇	
864.4	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft. (Glacial Till)	4 5		

END OF BORING.

Water observed at 7 feet while drilling

Boring then grouted..

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-90**

LOCATION: N: 209183.404, E: 551399.923 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/26/07**

SCALE: **1" = 4'**

Elev. feet 891.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
889.0	2.0	SM	SILTY SAND, very fine- to fine-grained, trace of Roots, dark brown, moist. (Topsoil)			
885.0	6.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose to medium dense. (Lacustrine)	9 11	▽	
880.0	11.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, grayish-brown with rust, waterbearing, medium dense. (Lacustrine)	15 14		
874.0	17.0	SP-SM	POORLY GRADED SAND with SILT,fine-grained, gray, waterbearing, loose to medium dense. (Lacustrine)	11 10		
865.0	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	6 7		
			END OF BORING. Water observed at 6 feet while drilling. Boring then grouted.			

Silty Sand 0' to 2'
Poorly Graded Sand w Silt 2' to 17'
Sandy Lean Clay 17' to 26'

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-91 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **893.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy silt, a little gravel, surface rots, trace roots, dark brown	FILL	13	M	SS	16					
2	FILL, mixture of silty sand and sand with silt, a little gravel, pieces of brick, brown and black										
3			26	M	SS	21					
4											
5											
6			28	M	SS	23					
7											
8			14	M	SS	18					
9	ORGANIC CLAY, trace roots, trace shells, black, stiff to very soft (OL/OH)	SWAMP DEPOSIT					89				
10	BOGLIME, trace roots, gray, a little black, moist, very soft to firm, lense of sapric peat (OL)						118				
11			2	M	SS	23	149				
12				▼							
13			7	W	SS	20					
14	SAND WITH SILT, a little gravel, gray, waterbearing, loose (SP-SM)	COARSE ALLUVIUM									
15	CLAYEY SAND, a little gravel, gray, very soft to stiff (SC/CL)	TILL									
16			2	M	SS	18	17				
17											
18											
19											
20											
21			6	M	SS	17	15				
22											
23											
24											
25											
26			9	M	SS	18	14				

END OF BORING
Northing=209184.1
Easting=551898.2

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	3.25" HSA	6/27/07	11:05	14.0	12.0	12.5		12.0

BORING COMPLETED: **6/27/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-92 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **898.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	1.5" Bituminous Pavement	FILL			SU						
1 2	FILL, mixture of silty sand and clayey sand, a little gravel, pieces of bituminous, brown		26	M	SS	3	7				
3 4	ORGANIC CLAY, a little gravel, black, a little gray, stiff, laminations of sandy lean clay (OL/OH)	SWAMP DEPOSIT	10	M	SS	17	13				
5 6 7	ORGANIC CLAY, trace roots, black, soft (OL/OH)		4	M	SS	17	46				
8 9	CLAYEY SAND, a little gravel, gray, soft, laminations of sand with silt (SC)	TILL	3	M	SS	18	18				
10 11	CLAYEY SAND, a little gravel, trace roots, brown and gray mottled, soft to firm (SC)		4	M	SS	17	16				
12 13 14			8	M	SS	23	16				
15 16 17 18	SANDY LEAN CLAY, a little gravel, brownish gray, a little black, stiff, laminations of silty sand (CL)		10	M	SS	23	16				
19 20 21	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)		10	M	SS	24	13				
22 23 24 25 26			15	M	SS	21	14				
	END OF BORING Northing=209185.3 Easting=552151.9										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/27/07	12:25	26.5	24.5	26.0		None

BORING COMPLETED: **6/27/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-93 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **901.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and silty sand, surface roots, trace roots, dark brown	FILL	14	M	SS	16					
2	FILL, mixture of clayey sand and silty sand, a little gravel, trace roots, brown and dark brown										
3			8	M	SS	14					
4	CLAYEY SAND, a little gravel, brown, firm to stiff (SC)	TILL					13				
5							17				
6			8	M	SS	20					
7											
8			9	M	SS	23	16				
9											
10	SANDY LEAN CLAY, a little gravel, light brown to brown, firm to stiff (CL)										
11			7	M	SS	22	16				
12											
13			11	M	SS	24	16				
14											
15											
16			13	M	SS	24	18				
17											
18	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)										
19											
20											
21			11	M	SS	22	16				
22											
23											
24											
25											
26			11	M	SS	23	16				
	END OF BORING Northing=209104.1 Easting=552534.6										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/27/07	**2:10**	**26.5**	**24.5**	**26.5**		**None**

BORING COMPLETED: **6/27/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-94** LOCATION: N: 209180.273, E: 552902.330 See attached sketch.
DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr
DATE: **7/11/07**	SCALE: **1" = 4'**

Elev. feet 922.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
		SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)	8			
918.9	4.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown, wet, rather soft to medium. (Glacial Till)	5			
				5		16	
				7			
				8			
				7			
904.9	18.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium to rather stiff. (Glacial Till)	11			
				7			
893.9	29.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium. (Glacial Till)	7			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46 (See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-94 (cont.)** LOCATION: N: 209180.273, E: 552902.330 See attached sketch.
DRILLER: K. Keck — METHOD: 3 1/4" HSA, Autohmr	DATE: **7/11/07** — SCALE: **1" = 4'**

Elev. feet 890.9	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
		▨	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium. (Glacial Till) *(continued)*	7 7			
881.9	41.0		END OF BORING. Water not observed with 39 1/2 feet of hollow-stem auger in the ground. Boring then grouted.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-95**

LOCATION: N: 209184.739, E: 553397.793 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/11/07**

SCALE: **1" = 4'**

Elev. feet 924.0	Depth feet 0.0	ASTM Symbol		Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
922.0	2.0	FILL	▩	FILL: Silty Sand, trace of Roots, trace of Roots, dark brown, moist.			
917.0	7.0	FILL	▩	FILL: Sandy Lean Clay, mixed light brown, brown and dark brown, moist.	6 9		
915.0	9.0	SC	▨	CLAYEY SAND, trace of Roots, dark gray, moist. (Buried Topsoil)	10		
907.0	17.0	CL	▨	SANDY LEAN CLAY, trace of Gravel, greenish gray to light brown, wet. (Glacial Till)	5 4 5	 ▽	
898.0	26.0	CL	▨	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff to stiff. (Glacial Till)	13 10		
				END OF BORING. Water observed at 13 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-96** LOCATION: N: 208934.186, E: 550891.188 See attached sketch.
DRILLER: K. Keck — METHOD: 3 1/4" HSA, Autohmr	DATE: **6/27/07** — SCALE: **1" = 4'**

Elev. feet 892.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
888.3	4.0	FILL	FILL: Sandy Lean Clay, dark brown to light brown, wet.	10		
883.3	9.0	PT	PEAT, dark gray, wet, rather soft to soft. (Swamp Deposit)	5 3	▽	
869.3	23.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, loose to medium dense. (Lacustrine)	7 8 12 8		
866.3	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	8		
			END OF BORING. Water observed at 9 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-97 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **891.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1 2	FILL, mixture of sand with silt, silty sand and clayey sand, a little gravel, surface roots, trace roots, dark brown and black	FILL	14	M	SS	17	12				
3 4	SAND WITH SILT, fine grained, a little gravel, brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM	26	M	SS	10	9				
5 6 7			12	▼	SS	9					
8 9			2	W	SS	14					
10 11 12	SILTY SAND, a little gravel, trace roots, fine to medium grained, gray, waterbearing, very loose to medium dense (SM)		2	W	SS	10					
13 14			22	W	SS	17					
15 16 17			23	W	SS	17					
18 19 20 21 22	SANDY SILT, dark gray, waterbearing, medium dense, laminations of lean clay at 20' (ML)	FINE ALLUVIUM	16	W	SS	15	24				
23 24 25 26	CLAYEY SAND, a little gravel, dark gray, firm (SC)	TILL	7	M	SS	19	16				
	END OF BORING Northing=208912.1 Easting=551143.1										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-9½'	3.25" HSA							
9½'-24½'	3.25" HSA	7/25/07	8:05	9.0	7.0	7.0		6.1

BORING COMPLETED: 7/11/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

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LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-98** LOCATION: N: 208927.565, E: 551670.574 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/26/07**	SCALE: **1" = 4'**

Elev. feet 892.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
885.8	7.0	FILL	FILL: Sandy Lean Clay, dark brown, moist.	11 5		
883.8	9.0	PT	PEAT, dark gray, wet, medium. (Swamp Deposit)	6	▽	
876.8	16.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with Gravel, light brown to gray with rust at 12' sample depth, waterbearing, medium dense to dense. (Glaciofluvium)	* 26 18		* 50 blows for 5 inches
866.8	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	7 7		

END OF BORING.

Water observed at 8 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-99**

LOCATION: N: 208681.670, E: 550941.756 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/27/07**

SCALE: **1" = 4'**

Elev. feet 892.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
		FILL	FILL: Clayey Sand, trace of Gravel, mixed dark gray to brown, moist to wet.					
				13				
				5				
				4				
				5		17	43	LL = 30% PI = 15
880.8	12.0				∇			
		PT	PEAT, dark gray, wet, rather soft. (Swamp Deposit)					
				4				
				4		322		OC = 69
874.8	18.0							
		SM	SILTY SAND, fine-grained, gray to brownish-gray, waterbearing, very loose to loose. (Lacustrine)					
				4				
				7				
866.8	26.0							

END OF BORING.

Water observed at 12 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:46

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-100** LOCATION: N: 208686.177, E: 551398.832 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/26/07**	SCALE: **1" = 4'**

Elev. feet 895.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
889.7	6.0	FILL	FILL: Clayey Sand, fine- to medium-grained, trace of Gravel, dark brown to brown, moist.	9 6		
886.7	9.0	PT	PEAT, Fibrous, dark gray, wet, rather stiff. (Swamp Deposit)	11	▽	
873.7	22.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, waterbearing, loose to medium dense. (Glacial Till)	12 14 6		
869.7	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	6		
			END OF BORING. Water observed at 9 feet while drilling. Boring then grouted.			

Fill (Clayey Sand) 0' to 6'
Peat 6' to 9'
Poorly Graded Sand 9' to 22'

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-101 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **897.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	FILL, mixture of sand with silt, silty sand and clayey sand, a little gravel, surface roots, trace roots, brown	FILL									
1			28	M	SS	12					
2											
3			5	M	SS	13	10				
4											
5	CLAYEY SAND, a little gravel, trace roots, dark gray, a little black, very soft, laminations of organic clay (SC)	MIXED ALLUVIUM OR TOPSOIL	1	W/M	SS	4					
6											
7	SANDY LEAN CLAY, a little gravel, trace roots, dark gray, very soft to firm, a lense of sand with silt at 9.5' to 9.9' (CL)	TILL									
8			1	M	SS	2	15				
9											
10			5	▼M	SS	10	18				
11	CLAYEY SAND, a little gravel, trace roots, gray and brown, stiff (SC)										
12											
13			10	M	SS	19	14				
14											
15	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL)		10	M	SS	19	14				
16											
17											
18											
19											
20			12	M	SS	23	14				
21											
22											
23											
24											
25			13	M	SS	23	15				
26											
	END OF BORING Northing=208686.2 Easting=551895.0										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/29/07	9:40	9.0	7.0	7.1		None
6/29/07	9:45	11.5	9.5	10.5		10.4
6/29/07	10:00	26.5	24.5	26.5		None

BORING COMPLETED: **6/29/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-102 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 902.2

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy silt, a little gravel, surface roots, trace roots, dark brown, possible cobbles	FILL	10	M	SS	3					
2 3 4	FILL, moslty clayey sand, a little gravel, trace roots, brown, dark brown and a little gray		5	M	SS	6	12				
5 6			16	M	SS	7	16				
7 8 9	CLAYEY SAND, a little gravel, dark gray, firm to stiff (SC)	TILL	10	M	SS	19	13				
10 11			8	M	SS	17					
12 13 14			9	M	SS	20	15				
15 16 17			9	M	SS	21	16				
18 19 20 21 22 23	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL)		9	M	SS	21	16				
24 25 26			10	M	SS	21	15				
	END OF BORING Northing=208692.0 Easting=552395.5										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**	**6/29/07**	**9:00**	**26.5**	**24.5**	**26.0**		**None**

BORING COMPLETED: **6/29/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-103 RI-1007-07** LOCATION: N: 208804.674, E: 552906.273 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/19/07**	SCALE: **1" = 4'**

Elev. feet 924.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
923.9	1.0	FILL	FILL: Silt, dark brown, moist.				
920.9	4.0	FILL	FILL: Lean Clay, brown to dark brown, dry.	18			
906.9	18.0	CL	SANDY LEAN CLAY, gray with iron staining, moist to wet, rather soft to rather stiff. (Glacial Till)	8			
				5			
				4		18	
				7			
				10			
		CL	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium to stiff. (Glacial Till)	8			
				8			
				15			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-103 RI-1007-07 (cont.)**

LOCATION: N: 208804.674, E: 552906.273 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/19/07**	SCALE: **1" = 4'**

Elev. feet 892.9	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
		▨	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium to stiff. (Glacial Till) *(continued)*				
				11			
				13			
884.9	40.0						
			END OF BORING. Water not observed with 38 1/2 feet of hollow-stem auger in the ground. Boring then grouted.				

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4003-01 ST-104** LOCATION: N: 208682.011, E: 552906.273 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/23/07**	SCALE: **1" = 4'**

Elev. feet 934.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
934.4	0.5	FILL	FILL: Silty Sand, fine-grained, dark brown, moist.			
930.9	4.0	FILL	FILL: Silty Sand, fine- to coarse-grained, trace of Gravel, with Clay layers, brown, moist.	11		
927.9	7.0	FILL	FILL: Silty Sand, fine-grained, mixed with Clay, black, moist.	8		
922.9	12.0	OL	ORGANIC CLAY, black wet, very soft to rather soft. (Swamp Deposit)	2 5		
916.9	18.0	CL	SANDY LEAN CLAY, bluish-gray, wet, soft to rather soft. (Lacustrine)	5 3		
911.9	23.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, medium. (Glacial Till)	7		
908.9	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium. (Glacial Till)	6		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-105** LOCATION: N: 208435.237, E: 551147.610 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/27/07**	SCALE: **1" = 4'**

Elev. feet 899.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
895.1	4.0	FILL	FILL: Clayey Sand, fine- to medium-grained, trace of Gravel, grayish-brown, moist.	13		
892.1	7.0	FILL	FILL: Silty Sand, fine-grained, dark brown, moist.	13		
890.1	9.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose. (Lacustrine)	6	∇	
877.1	22.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown to grayish-brown, waterbearing, loose to medium dense. (Lacustrine)	8 6 7 13		
873.1	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff. (Glacial Till)	9		
			END OF BORING. Water observed at 9 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-106 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **903.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand, silty sand and organic clay, a little gravel, surface roots, trace roots, dark brown, brown and black	FILL	11	M	SS	14	9				
3			26	M	SS	19	15				
5							8				
6	LEAN CLAY WITH ORGANICS, trace roots, black, stiff, lense of silty sand (CL)	TOPSOIL	14	M	SS	19	22				
8	SILTY SAND, a little gravel, fine to medium grained, light brown, medium dense (SM)	COARSE ALLUVIUM	15	M	SS	16					
11	SAND WITH SILT, a little gravel, fine to medium grained, light brown, waterbearing, medium dense (SP-SM)		16	M	SS	17					
12				▼							
13			23	W	SS	16	13				
14	CLAYEY SAND, a little gravel, brown, very stiff to stiff (SC)	TILL									
16	CLAYEY SAND, a little gravel, gray, soft to stiff (SC)		4	M	SS	17	17				
20			7	M	SS	20	14				
25			11	M	SS	23	14				
	END OF BORING Northing=208433.1 Easting=551647.6										

Fill (Clayey sand) 0' to 5'
topsoil 5' to 7'
silty sand 7' to 9.5'
Sand w silt 9.5' to 13.5'

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-24½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	7/11/07	9:20	14.0	12.0	12.4		12.2	
	7/11/07	9:30	26.5	24.5	26.4		None	
BORING COMPLETED: 7/11/07								
DR: SG LG: SB Rig: 91C								

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-107 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 902.7 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	SILTY SAND, a little gravel, surface roots, trace roots, dark brown, moist, medium dense (SM)	TOPSOIL									
1			11	M	SS	15	4				
2	SAND WITH SILT, fine grained, trace roots, light brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM									
3			14	M	SS	20					
4											
5			13	M	SS	20					
6											
7											
8			15	M	SS	21					
9											
10			11	W/M	SS	19					
11	SILTY SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense to very loose, lense of silt with sand at 11' (SM)										
12				▼							
13			9	W	SS	15					
14											
15			2	W	SS	8					
16											
17											
18	CLAYEY SAND, a little gravel, gray, stiff to firm (SC)	TILL									
19											
20			14	M	SS	19	12				
21											
22											
23											
24											
25			8	M	SS	23	15				
26											
	END OF BORING Northing=208260.5 Easting=551137.6										

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA							
	7/11/07	**10:30**	**14.0**	**12.0**	**12.3**		**12.1**
	7/11/07	**10:40**	**26.5**	**24.5**	**24.9**		**None**
BORING COMPLETED: **7/11/07**							
DR: **SG** LG: **SB** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

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LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-1011-02 ST-108**

LOCATION: N: 208186.939, E: 551402.993 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/24/07	SCALE: 1" = 4'

Elev. feet 906.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
906.4	0.2	PAV	2" of Bituminous			
902.6	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, dark brown, moist.	26		
897.6	9.0	SP	POORLY GRADED SAND, fine-grained, brown with iron staining, moist, loose to medium dense. (Glacial Outwash)	5 11		
888.6	18.0	SP	POORLY GRADED SAND, fine-grained, brown, wet to waterbearing, medium dense. (Glacial Outwash) With Gravel layer at 15 1/2 feet.	15 12 22	▽	
880.6	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft. (Glacial Till)	5 5		
			END OF BORING. Water observed at 12 1/2 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-109 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 904.5 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, a little gravel, surface roots, trace roots, dark brown	FILL									
	FILL, mixture of sand with silt, silty sand and clayey sand, a little gravel, trace roots, dark brown and light brown										
1			11	M	SS	12					
2							15				
3			7	M	SS	11					
4											
5							16				
6			11	M	SS	21					
7	SANDY LEAN CLAY, a little gravel, gray, a little brown, stiff to firm, laminations of silty sand (CL)	TILL									
8			12	M	SS	19	16				
9											
10											
11			8	M	SS	14	17				
12	SANDY LEAN CLAY, a little gravel, dark gray, firm to stiff (CL)										
13			9	M	SS	24	16				
14											
15											
16			7	M	SS	17	17				
17											
18											
19											
20											
21			8	M	SS	22	16				
22											
23											
24											
25											
26			10	M	SS	20	17				
	END OF BORING Northing=208177.9 Easting=551886.3										

Fill (sand w silt) 0.5' to 7'
Sandy lean clay 7' to 26.5'

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/18/07	9:40	26.5	24.5	24.9		None

BORING COMPLETED: 7/18/07

DR: SG　LG: SB/BR　Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-1007-05 ST-110**

LOCATION: N: 208182.321, E: 552397.605 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/24/07**

SCALE: **1" = 4'**

Elev. feet 913.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
912.2	1.0	FILL	FILL: Silty Sand, fine-grained, trace of Gravel, dark brown, moist.			
904.2	9.0	CL	SANDY LEAN CLAY, trace of Gravel, brown with iron staining, wet, rather soft to medium. (Glacial Till)	6 5 8		
887.2	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, moist, medium to rather stiff. (Glacial Till)	9 8 8 8 12		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-1007-06 ST-111** LOCATION: N: 208184.910, E: 552896.448 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/24/07**	SCALE: **1" = 4'**

Elev. feet 922.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
921.1	1.0	FILL	FILL: Silty Sand, fine-grained, with Roots, trace of Gravel, dark brown, moist.			
918.1	4.0	FILL	FILL: Organic Clay, with Silty Sand layer, black to dark brown, moist.	11		
915.1	7.0	SP	POORLY GRADED SAND, fine-grained, brown, wet, loose. (Glacial Outwash)	8		
913.1	9.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, wet, rather soft. (Glacial Till)	4		
908.1	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown and gray, moist, medium to rather stiff. (Glacial Till)	8 9		
893.6	28.5	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	7 7 6 6		
			END OF BORING. Water not observed with 27 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
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LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-112** LOCATION: N: 208188.459, E: 553395.319 See attached sketch.
DRILLER: K. Keck / METHOD: 3 1/4" HSA, Autohmr	DATE: **6/29/07** / SCALE: **1" = 4'**

Elev. feet 936.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
936.7	0.1	PAV	2" Bituminous Pavement.					
935.8	1.0	FILL	FILL: Poorly Graded Sand with Silt, trace of Gravel, brown, moist.					
		SM	POORLY GRADED SAND with SILT, fine- to medium-grained, trace of Gravel, reddish brown, moist, loose to medium dense. (Glacial Outwash)	7				
				24		4	9	
927.8	9.0			28				
		SP	POORLY GRADED SAND, fine- to medium-grained, reddish brown, moist, medium dense. (Glacial Till)	27				
924.8	12.0							
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish brown, moist, medium dense to dense. (Glacial Till)	32				
918.8	18.0							
		SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, light brown, dense to very dense.	39				
910.8	26.0			50		2		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-113**

LOCATION: N: 208182.505, E: 553828.508 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/29/07**	SCALE: **1" = 4'**

Elev. feet 941.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
939.5	2.3	SC	CLAYEY SAND, trace of roots, dark brown, moist. (Topsoil)			
929.8	12.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish brown, moist, medium dense. (Glacial Till)	17 21 55 32		
915.8	26.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, light brown, moist, medium dense to dense. (Glacial Outwash)	16 20 36 33		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP060587I.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**   LOG OF BORING NO. **ST-114 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 913.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1 2	FILL, mixture of clayey sand and sandy silt, a little gravel, surface roots, trace roots, black and brown	FILL	8	M	SS	6	8				
3 4	ORGANIC CLAY, trace roots, black, a little gray, firm, laminations of silty sand (OL/OH)	SWAMP DEPOSIT	7	M	SS	15	38 24				
5 6	LEAN CLAY, gray, very stiff (CL) SANDY SILT, a little gravel, trace roots, gray, a little dark gray, wet, medium dense, laminations of lean clay (ML)	FINE ALLUVIUM	19	▼ M	SS	12	44 28				
7 8	SILTY SAND, a little gravel, fine to medium grained, gray, waterbearing, very loose (SM)	TILL	3	W	SS	16	19				
9 10 11	SANDY LEAN CLAY, a little gravel, gray, soft to very stiff (CL)		3	M	SS	15	18				
12 13 14			9	M	SS	16	16				
15 16 17 18 19			11	M	SS	16	17				
20 21 22 23 24			14	M	SS	24	16				
25 26			17	M	SS	24	16				
	END OF BORING Northing=207847.6 Easting=552482.9										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**	7/18/07	11:40	9.0	7.0	7.0		5.2
		7/18/07	12:05	26.5	24.5	26.5		None
BORING COMPLETED: **7/18/07**								
DR: **SG** LG: **SB/BR** Rig: **91C**								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-115 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 908.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, surface roots, trace roots, dark brown	FILL	15	M	SS	21					
2	FILL, mixture of clayey sand and sand with silt, trace roots, brown and black										
3			20	M	SS	20					
4											
5	SAND WITH SILT, a little gravel, medium to fine grained, brown, moist to wet, medium dense (SP-SM)	COARSE ALLUVIUM	12	M	SS	18					
6											
7											
8			18	M	SS	19					
9											
10			11	W/M	SS	17	15				
11	CLAYEY SAND, a little gravel, dark brown, stiff (SC)	TILL									
12	CLAYEY SAND, a little gravel, dark gray, soft to stiff (SC)										
13			4	M	SS	19	17				
14											
15			7	M	SS	21	16				
16											
17											
18											
19											
20			8	M	SS	23	13				
21											
22											
23											
24											
25			10	M	SS	24	16				
26											
	END OF BORING Northing=207758.9 Easting=551498.2										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-24½'	**3.25" HSA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		7/11/07	**11:20**	**11.5**	**9.5**	**10.1**		**None**	
		7/11/07	**11:40**	**26.5**	**24.5**	**24.5**		**None**	
BORING COMPLETED: **7/11/07**									
DR: **SG** LG: **SB** Rig: **91C**									

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-116 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 913.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	SILTY SAND, a little gravel, surface roots, trace roots, brown and dark brown, moist, medium dense (SM)	TOPSOIL COARSE ALLUVIUM	13	M	SS	17					
2	SILTY SAND, trace roots, fine to medium grained, brown, medium dense, lense of clayey sand at 3.5' (SM)										
3			20	M	SS	18	14				
4	CLAYEY SAND, a little gravel, light brownish gray and gray mottled, very stiff (SC)	TILL									
5	CLAYEY SAND, a little gravel, gray and brown mottled, firm to stiff (SC)		8	M	SS	19	18				
6											
7											
8			11	M	SS	23	17				
9											
10	SANDY LEAN CLAY, a little gravel, gray, firm to stiff (CL)		8	M	SS	21	17				
11											
12											
13			6	M	SS	24	19				
14											
15			7	M	SS	24	19				
16											
17											
18											
19											
20			7	M	SS	24	17				
21											
22											
23											
24											
25			9	M	SS	24	17				
26											
	END OF BORING Northing=207685.1 Easting=551917.3										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

BORING COMPLETED: **7/11/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/11/07	**1:00**	**26.5**	**24.5**	**24.5**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-117 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 914.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	4" Bituminous Pavement	FILL			SU						
1 2	FILL, mixture of clayey sand, sandy silt and sand with silt, a little gravel, pieces of bituminous, brown, gray and black		18	M	SS	12	8				
3	SAND WITH SILT, fine grained, gray, medium dense (SP-SM)	COARSE ALLUVIUM	19	▼	SS	15					
4 5 6 7 8 9	SAND WITH SILT, fine to medium grained, brownish gray, medium dense (SP-SM)		13 15	W W	SS SS	16 17					
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	SANDY LEAN CLAY, a little gravel, dark gray, firm to stiff (CL)	TILL	8 8 9 10 12	M M M M M	SS SS SS SS SS	14 16 22 24 24	17 16 16 17 17				

END OF BORING
Northing=207683.1
Easting=552397.2

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/18/07	10:30	6.5	4.5	6.5		3.6
7/18/07	10:55	26.5	24.5	26.5		None

BORING COMPLETED: **7/18/07**

DR: **SG** LG: **SB/BR** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
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LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-118** LOCATION: N: 207677.923, E: 552643.604 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/10/07**	SCALE: **1" = 4'**

Elev. feet 914.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
910.9	4.0	OL	ORGANIC CLAY, trace of Roots, dark gray, wet. (Topsoil)	7		
905.9	9.0	SM	SILTY SAND, fine-grained, gray, wet, very loose. (Lacustrine)	3 3	∇	
900.9	14.0	PT	PEAT, dark gray, wet. (Swamp Deposit)	2 3		
892.9	22.0	SM	SILTY SAND, fine-grained, gray, waterbearing, very loose. (Lacustrine)	2 3		
888.9	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	7		
			END OF BORING. Water observed at 6 feet while drilling. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠ INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-119** LOCATION: N: 207678.910, E: 552897.340 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/9/07	SCALE: 1" = 4'

Elev. feet 929.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
929.2	0.5	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.			
920.7	9.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, brown, moist to wet.	20 13 12		
907.7	22.0	CL	SANDY LEAN CLAY, light brown to brown with gray and rust, wet, rather soft to rather stiff. (Glacial Till)	5 8 9 19		
903.7	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	8		*NR Suspected Cobble or Boulder
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-120**

LOCATION: N: 207684.634, E: 553359.506 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/29/07**

SCALE: **1" = 4'**

Elev. feet 940.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
940.3	0.5	SM	SILTY SAND, trace of roots, dark brown, moist.					
		CL	SANDY LEAN CLAY, trace of Gravel, yellowish brown, moist, rather stiff to medium. (Glacial Till)					
				7				
				5				
				9				
931.8	9.0	CL	LEAN CLAY with Sand, reddish brown, moist, very stiff. (Glaciofluvium)					
				21		16	73	LL = 26% PI = 10%
				21				
				18				
922.8	18.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish brown, moist, medium dense to dense. (Glacial Till)					
				48				
				27				
911.8	29.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to very dense. (Glacial Till)					
				23				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-120 (cont.)** LOCATION: N: 207684.634, E: 553359.506 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/29/07**	SCALE: **1" = 4'**

Elev. feet 908.8	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
904.8	36.0		SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to very dense. (Glacial Till) *(continued)* No sample recovery at 35 1/2 feet.	*				* 70 blows for 12 inches
898.8	42.0	SP	POORLY GRADED SAND, fine- to medium-grained, brown, moist, dense. (Glacial Till)	29				
894.8	46.0	SP	POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, brown, moist, very dense. (Glacial Outwash)	53				
			END OF BORING. Water not observed with 44 1/2 feet of hollow-stem auger in the ground. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-121** LOCATION: N: 207682.711, E: 553899.659 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/2/07**	SCALE: **1" = 4'**

Elev. feet 944.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
940.6	4.0	FILL	FILL: Silty Sand, trace of Gravel, trace of roots in upper foot, mixed light brown to brown, moist.	24		
935.6	9.0	CL	SANDY LEAN CLAY, trace of Gravel, grayish brown to brown, with rust, wet, rather soft to rather stiff. (Glacial Till)	13 4		
930.6	14.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown to brown, rather soft to rather stiff. (Glacial Till)	4 11		
918.6	26.0	CL-ML	SILTY CLAY, reddish brown, wet. (Glaciofluvium)	21 16 10		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-122** LOCATION: N: 207684.411, E: 554279.817 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **6/28/07**	SCALE: **1" = 4'**

Elev. feet 959.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
957.5	2.0	FILL	FILL: Silty Sand, with Gravel, brown, moist.			
945.5	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, rather soft to medium. (Glacial Till)	5 5 7 7		
941.5	18.0	SP	POORLY GRADED SAND, fine- to medium-grained, reddish-brown, moist, medium dense. (Glacial Outwash)	32		
937.5	22.0	SC	CLAYEY SAND, trace of Gravel, reddish-brown, moist, very stiff. (Glacial Till)	25		
933.5	26.0	SM	SILTY SAND, fine- to medium-grained, reddish-brown, moist, very dense. (Glaciofluvium)	70		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-1007-03 ST-123** LOCATION: N: 207468.088, E: 552331.548 See attached sketch.
DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr
DATE: **7/24/07**	SCALE: **1" = 4'**

Elev. feet 913.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
912.4	1.0	FILL	FILL: Silty Sand, fine- to medium-grained, dark brown, moist.			
907.4	6.0	FILL	FILL: Sandy Lean Clay, trace of Gravel, brown, moist. No sample recovery at 5 1/2 feet.	12 12		
887.4	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, moist to wet, rather soft to medium. (Glacial Till)	7 6 5 6 6 7	▽	

Fill (silty sand) 0' to 1'
Fill (sandy lean clay) 1' to 6'
Sandy Lean Clay 6' to 26'

END OF BORING.

Water observed at 25 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4009-01 ST-124**

LOCATION: N: 207429.899, E: 552647.857 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/24/07**	SCALE: **1" = 4'**

Elev. feet 923.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
922.8	1.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, dark brown, moist.			
914.8	9.0	FILL	FILL: Sandy Lean Clay, brown, moist to wet.	7 12 6		
911.8	12.0	OL	ORGANIC CLAY, black, wet. (Swamp Deposit)	5		
909.8	14.0	CL	SANDY LEAN CLAY, trace of Gravel, grayish-brown, wet, soft. (Lacustrine)	3		
897.8	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	7 6 6		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-125 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **932.7**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mixture of silty sand and silty clay, surface roots, trace roots, possible cobbles, dark brown	FILL					7				
1			27	M	SS	9					
2	FILL, mostly clayey sand with gravel, possible cobbles, trace roots, brown										
3			31	M	SS	11	7				
4											
5			12	M	SS	8	9				
6											
7											
8			6	M	SS	4	10				
9											
10	CLAYEY SAND, a little gravel, trace roots, brown, firm (SC)	TILL	7	M	SS	6	10				
11											
12											
13			7	M	SS	11	10				
14	SAND WITH GRAVEL, trace roots, well graded, light brownish gray, moist, medium dense (SW)	COARSE ALLUVIUM									
15		TILL	13	M	SS	16	14				
16	CLAYEY SAND, a little gravel, light brownish gray, stiff (SC)										
17											
18	CLAYEY SAND, a little gravel, possible cobbles, brown, very stiff (SC)										
19											
20			20	M	SS	21	10				
21											
22											
23	SAND WITH SILT, a little gravel, fine to medium grained, brown, moist, very dense (SP-SM)	COARSE ALLUVIUM									
24											
25			66	M	SS	NR					
26											
	END OF BORING Northing=207429.3 Easting=552897.4										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/6/07	**10:30**	**26.5**	**24.5**	**26.5**		**None**

BORING COMPLETED: **7/6/07**

DR: **SG**　LG: **SB**　Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-125A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **932.7**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	No samples taken to 29.5', Refer to Log of Boring ST-125										
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-39½'	3.25" HSA	7/25/07	1:20	41.5	39.5	41.5		None
BORING COMPLETED: 7/25/07								
DR: SG LG: BR Rig: 91C								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-125A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
30	SAND, a little gravel, fine to medium grained, light brown, moist, medium dense to dense (SP)		COARSE ALLUVIUM	31	M	SS	20					
31												
32												
33												
34												
35				25	M	SS	19					
36												
37												
38												
39												
40				38	M	SS	20					
41												
	END OF BORING Northing=207429.3 Easting=552897.4											

BRAUN℠
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LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-126**

LOCATION: N: 207401.256, E: 554161.240 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **6/28/07**

SCALE: **1" = 4'**

Elev. feet 957.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
		FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, brown to light brown, moist.	8 4		
950.0	7.0	OL	ORGANIC CLAY, dark gray, wet, soft to rather soft. (Swamp Deposit)	2 4		
945.0	12.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft to medium. (Glacial Till)	4 6 9 9		
931.0	26.0		END OF BORING. Water observed at 12 feet while drilling. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-126A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 957.0 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	No samples taken to 29.5', Refer to Log of Boring ST-126											
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
0-39½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
	7/23/07	**11:15**	**41.5**	**39.5**	**41.5**		**None**
BORING COMPLETED: **7/23/07**							
DR: **SG** LG: **BR** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-126A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#20
30	SILTY SAND, fine to medium grained, brown, moist, very dense (SM)	COARSE ALLUVIUM	79	M	SS	22	7				
31	LEAN CLAY WITH SAND, brown, hard, lense of sand with silt and gravel at 31 feet (CL)	TILL									
32											
33	SILTY SAND WITH GRAVEL, fine to medium grained, brown, moist, very dense (SM)										
34											
35			148	M	SS	15					
36											
37											
38	SILTY SAND, a little gravel, fine to medium grained, brown, a little light brown, moist, very dense, lense of sand with silt and gravel at 41 feet (SM)										
39											
40			63	M	SS	24					
41											
	END OF BORING Northing=207401.3 Easting=554161.2										

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-127 RI-4006-21** LOCATION: N: 207512.939, E: 554545.415 See attached sketch.
DRILLER: K. Keck METHOD: 3 1/4" HSA, Autohmr	DATE: **7/2/07** SCALE: **1" = 4'**

Elev. feet 952.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
951.8	1.0	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.					
		FILL	FILL: Clayey Sand, trace of Gravel, dark brown to brown and reddish brown, moist.	8				
946.8	6.0			4				
		SC	CLAYEY SAND, Organic, dark gray, wet, soft to medium. (Swamp Deposit)	4				
				3		35	42	OC = 6
938.8	14.0			6				
934.8	18.0	CL	LEAN CLAY, olive gray, wet, rather soft. (Swamp Deposit)	3				
		CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff. (Glacial Till)	12				
926.8	26.0			11		15		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-128 RI-4006-20**

LOCATION: N: 207347.078, E: 554700.746 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: 7/2/07

SCALE: 1" = 4'

Elev. feet 954.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
953.1	1.0	FILL	FILL: Silty Sand, trace of roots, dark brown, moist.				
947.1	7.0	FILL	FILL: Sandy Lean Clay, trace of Gravel, reddish brown, moist.	10			
				7			
942.1	12.0	CL	SANDY LEAN CLAY, slightly Organic, dark gray to olive gray, soft. (Swamp Deposit)	3			
				2		21	OC = 3%
936.1	18.0	CL	SANDY LEAN CLAY, grayish brown with rust, wet, medium. (Glacial Till)	7			
				7			
928.1	26.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish brown, moist, medium dense to dense. (Glacial Till)	26			
				33*			*Suspect cobble or boulder

END OF BORING.

Water not observed with 24 1/2 feet of hollow-stem auger in the ground.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-129 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **915.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand, silty sand and sand with silt, a little gravel, surface roots, trace roots, dark brown and brown	FILL	18	M	SS	15	6				
2											
3			12	M	SS	15					
4											
5	CLAYEY SAND, a little gravel, dark brown and brown mottled, firm (SC)	TILL	5	M	SS	19	12				
6	CLAYEY SAND, a little gravel, brown and gray mottled, firm, laminations of silt and sandy lean clay (SC)										
7											
8			8	M	SS	19	16				
9											
10	CLAYEY SAND, a little gravel, brown and brownish gray mottled, stiff (SC)		12	M	SS	18	15				
11											
12	CLAYEY SAND, a little gravel, dark gray, firm to stiff (SC)										
13			5	M	SS	22	16				
14											
15			8	M	SS	24	18				
16											
17											
18											
19											
20			9	M	SS	24	18				
21											
22											
23											
24											
25			11	M	SS	24	18				
26											
	END OF BORING Northing=207214.0 Easting=551928.3										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/11/07	2:05	26.5	24.5	24.5		None

BORING COMPLETED: **7/11/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-130** LOCATION: N: 207127.116, E: 552428.985 See attached sketch.
DRILLER: K. Keck — METHOD: 3 1/4" HSA, Autohmr	DATE: **7/13/07** — SCALE: **1" = 4'**

Elev. feet 915.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
914.8	0.3	FILL	FILL: Silty Sand, fine-grained, dark brown, moist.					
908.1	7.0	FILL	FILL: Silt, black, moist.	8 5		9	4	
906.1	9.0	CL	SANDY LEAN CLAY, brown, wet. (Glacial Till)	5				
901.1	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown and gray, wet, rather soft to medium. (Glacial Till)	8 5				
889.1	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	6 7 7				

END OF BORING.

Water not observed during drilling.

Water not observed with 24 1/2 feet of hollow-stem auger in the ground.

Boring then grouted.

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-131 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 926.9

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly sandy silt, surface roots, trace roots, grayish brown	FILL					7				
1			17	M	SS	17	6				
2	FILL, mixture of clayey sand and sandy lean clay, a little gravel, possible cobbles, trace roots, grayish brown and brown										
3			11	M	SS	5	11				
4											
5			6	M	SS	19	17				
6							18				
7	FILL, mixture of sand with silt and silty sand, trace roots, brown and black										
8	SILTY SAND, trace roots, fine grained, dark brown, a little brown, moist, loose (SM) (possible fill)	COARSE ALLUVIUM OR FILL	8	M	SS	12					
9											
10	SANDY LEAN CLAY, a little gravel, trace roots, gray, a little brown and black, firm (CL)	WEATHERED TILL	6	M	SS	20					
11							21				
12	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, stiff to very stiff, laminations of silty sand (CL)	TILL									
13			12	M	SS	15	17				
14											
15			18	M	SS	19	16				
16											
17											
18	SANDY LEAN CLAY, a little gravel, brownish gray to dark gray, very stiff to stiff (CL)										
19											
20			23	M	SS	24	16				
21											
22											
23											
24											
25			14	M	SS	24	16				
26											
	END OF BORING Northing=207188.3 Easting=552633.8										

Fill (sandy silt) 0' to 0.5'
Fill (clayey sand) 0.5' to 7'
Fill (sand w silt) 7' to 8'
Silty Sand 8' to 9.5'
Sandy Lean Clay 9.5' to 26'

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/6/07	11:45	26.5	24.5	26.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: 7/6/07

DR: SG LG: SB Rig: 91C

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-132 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **936.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0	4.25" Bituminous Pavement	FILL			SU						
1–3	FILL, mixture of clayey sand and sandy lean clay, a little gravel, dark brown, light brownish gray and black		9	M	SS	5	9				
3–7	SILTY SAND, a little gravel, possible cobbles, brown, medium dense to dense (SM)			[illegible]	SS	20	11				
			36	M	SS	18					
7–18	CLAYEY SAND, a little gravel, possible cobbles, brown, very stiff (SC)		29	M	SS	19	9				
			28	M	SS	14	10				
			19	M	SS	24	12				
			17	M	SS	24	13				
18–23	SAND WITH SILT AND GRAVEL, fine to medium grained, light brown, moist, dense (SP-SM)	COARSE ALLUVIUM									
			36	M	SS	13					
23–26	GRAVELLY SAND WITH SILT, possible cobbles, medium to fine grained, light brown, moist, very dense (SP-SM)										
			62	M	SS	15					

Fill (clayey sand) 0.3' to 3'
Silty Sand 3' to 7'
Clayey Sand 7' to 18'

END OF BORING
Northing=207171.7
Easting=552904.3

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**	**7/6/07**	**9:00**	**26.5**	**24.5**	**25.2**		**None**

BORING COMPLETED: **7/6/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-132A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: **936.0** MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	No samples taken in upper 29.5', Refer to Log of Boring ST-132											
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-39½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	7/25/07	**2:47**	**41.5**	**39.5**	**41.0**		**None**	
BORING COMPLETED: **7/25/07**								
DR: **SG** LG: **BR** Rig: **91C**								

06/04

AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-132A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#20
30	SAND, a little gravel, fine to medium grained, light brown, moist, dense to medium dense (SP)	COARSE ALLUVIUM	49	M	SS	19					
31											
32											
33											
34											
35			39	M	SS	23					
36											
37											
38											
39											
40			35	M	SS	19					
41											

END OF BORING
Northing=207171.7
Easting=552904.3

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-133 RI-4007-20**

LOCATION: N: 207181.741, E: 553397.254 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/20/07**

SCALE: **1" = 4'**

Elev. feet 945.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
944.0	1.0	FILL	FILL: Silt, with Roots, dark brown, moist.				
941.0	4.0	FILL	FILL: Sand Lean Clay, trace of Gravel, brown, moist.	9			
933.0	12.0	FILL	FILL: Sandy Lean Clay, reddish-brown, gray and dark brown, moist.	4 3 3			
931.0	14.0	FILL	FILL: Silty Sand, fine- to medium-grained, dark brown, wet.	3			
927.0	18.0	SM	SILTY SAND, fine- to medium-grained, reddish-brown, wet, very loose. (Glacial Till)	4			
922.0	23.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, wet, medium. (Glacial Till)	7			
917.0	28.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, wet, stiff. (Glacial Till)	16			
913.0	32.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, trace of Gravel, brown, wet, stiff. (Glacial Till)	15			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-133 RI-4007-20 (cont.)** LOCATION: N: 207181.741, E: 553397.254 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/20/07**	SCALE: **1" = 4'**

Elev. feet 913.0	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
		SP	POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, brown, moist, loose. (Glacial Outwash)				
				7		4	
				10			
899.0	46.0			10		3	
			END OF BORING. Water not observed with 44 1/2 feet of hollow-stem auger in the ground. Boring then grouted.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-134 RI-4007-22** LOCATION: N: 207146.617, E: 553719.021 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/20/07**	SCALE: **1" = 4'**

Elev. feet 949.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
948.0	1.0	FILL	FILL: Silt, with Root Fibers, dark brown, moist.			
942.0	7.0	FILL	FILL: Silty Sand, brown to dark brown, moist. With Roots and pieces of topsoil at 5 1/2 feet.	7 4		
935.0	14.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, wet, rather soft to rather stiff. (Glacial Till)	4 4 10		
931.0	18.0	SM	SILTY SAND, fine- to coarse-grained, trace of Gravel, reddish-brown, wet, medium dense. (Glacial Till)	15		
		SP	POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, reddish-brown, wet to waterbearing, very loose to medium dense. (Glacial Outwash)	7 3 10	▽	

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-134 RI-4007-22 (cont.)**

LOCATION: N: 207146.617, E: 553719.021 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/20/07**	SCALE: **1" = 4'**

Elev. feet 917.0	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
906.0	43.0		POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, reddish-brown, wet to waterbearing, very loose to medium dense. (Glacial Outwash) *(continued)*	4 24		
903.0	46.0	SP	POORLY GRADED SAND, fine-grained, brown, waterbearing, loose. (Glacial Till)	7		
			END OF BORING. Water down 24 feet with 44 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-135 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **950.5**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and silty sand, a little gravel, pieces of bituminous, surface roots, trace roots, dark brown	FILL	36	M	SS	15					
2	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, cinders and clinkers, brown										
3			18	M	SS	13	11				
4											
5	SANDY LEAN CLAY, a little gravel, trace roots, brown, very stiff to hard, laminations of silt (CL)	TILL	20	M	SS	20	14				
6											
7											
8			19	M	SS	23	15				
9											
10			31	M	SS	18	19				
11	CLAYEY SAND WITH GRAVEL, brown, hard, lense of silty sand (SC)						8				
12											
13	SAND WITH GRAVEL, medium to fine grained, brown, moist, very dense (SP)	COARSE ALLUVIUM	56	M	SS	14					
14											
15	GRAVEL WITH SAND, brown, moist, dense (GP)		44	M	SS	4					
16											
17											
18	SAND WITH GRAVEL, medium to fine grained, brown, moist, very dense (SP)										
19											
20			58	M	SS	8					
21											
22											
23											
24											
25			63	M	SS	12					
26											
	END OF BORING Northing=207176.8 Easting=553896.4										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/28/07	1:15	26.5	24.5	26.4		None

BORING COMPLETED: **6/28/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-135A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 950.5 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	No samples taken in upper 29.5', Refer to Log of Boring ST-135										
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

DEPTH:	DRILLING METHOD
0-44½'	3.25" HSA

BORING COMPLETED: **7/23/07**

DR: **SG** LG: **BR** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/23/07	9:12	46.5	44.5	46.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-135A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
30	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, moist, dense (SP-SM)	COARSE ALLUVIUM	39	M	SS	20					
31	SAND WITH SILT, fine grained, light brown, moist, dense (SP-SM)										
32											
33											
34											
35			40	M	SS	18					
36											
37											
38	SAND WITH SILT, a little gravel, medium to fine grained, brown, a little dark brown, moist, medium dense, lenses and laminations of silty sand (SP-SM)										
39											
40			29	M	SS	22					
41											
42											
43											
44											
45			35	M	SS	20					
46											
	END OF BORING Northing=207176.8 Easting=553896.4										

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-136** LOCATION: N: 207181.552, E: 554398.416 See attached sketch.
DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr
DATE: **6/28/07**	SCALE: **1" = 4'**

Elev. feet 956.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
		FILL	FILL: Clayey Sand, trace of Gravel, brown, moist.	9				
949.7	7.0			10				
947.7	9.0	OL	ORGANIC SILT, trace of fibers, dark green, wet, rather soft. (Swamp Deposit)	4				
		CL	SANDY LEAN CLAY, trace of Gravel, brown and gray with rust, wet, medium. (Glacial Till)	7				
942.7	14.0			7				
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish brown, moist, medium dense to dense. (Glacial Till)	29				
				28		6	25	LL = 13 PI = 1
930.7	26.0			35				
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.					

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-137** LOCATION: N: 207060.401, E: 554647.884 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: 7/2/07
SCALE: 1" = 4'

Elev. feet 956.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
955.0	1.0	FILL	FILL: Silty Sand, with Gravel, brown, moist.			
949.0	7.0	FILL	FILL: Clayey Sand, trace of Gravel, reddish-brown, moist.	7 5		
947.0	9.0	OL	ORGANIC CLAY, trace of Roots, dark brown, moist. (Buried Topsoil)	4		
939.0	17.0	SM	SILTY SAND, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till)	7 18 44		
930.0	26.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, light brown, moist, medium dense. (Glacial Outwash)	11 18		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-138 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 955.9 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mixture of sand with silt and silty sand, surface roots, trace roots, dark brown	FILL									
1	FILL, mixture of clayey sand and sand with silt, a little gravel, trace roots, brown, light brown and gray		17	M	SS	14					
							8				
2											
							10				
3			13	M	SS	7					
4											
5							13				
			15	M	SS	12					
6											
7											
8			9	W/M	SS	15	14				
9											
10											
			5	M	SS	14	20				
11											
12							15				
13			3	W/M	SS	18					
14											
	ORGANIC CLAY, trace roots, black, very soft to soft (OL/OH)	SWAMP DEPOSIT									
15							41				
			4	M	SS	20					
16											
17											
18			2	W/M	SS	24	28				
19											
20							29				
			3	M	SS	18					
21											
22	LEAN CLAY WITH SAND, trace roots, pieces of wood, dark gray, firm (CL)	FINE ALLUVIUM									
							38				
23			8	W/M	SS	4					
24				▼							
	CLAYEY SAND, a little gravel, dark gray, very soft (SC)	TILL									
25							23				
			3	W/M	SS	24					
26	CLAYEY SAND, a little gravel, gray, soft, lenses and laminations of silty sand (SC)						22				
27											
28											

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-29½'	3.25" HSA							
		6/29/07	11:45	26.5	24.5	25.0		24.3
		6/29/07	11:50	31.5	29.5	31.5		None
BORING COMPLETED: 6/29/07								
DR: SG　LG: SB　Rig: 91C								

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-138 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
30	SANDY LEAN CLAY, a little gravel, brown, stiff (CL) *(continued)*	▨		14	M	SS	24	17				
31	SAND WITH SILT, a little gravel, fine to medium grained, brown, moist, medium dense (SP-SM)		COARSE ALLUVIUM									
	END OF BORING Northing=207165.1 Easting=554854.2											

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-139 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **951.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand, sandy lean clay, silty sand and sand with silt, a little gravel, trace roots, brown and dark brown	FILL	26	M	SS	12	9				
2											
3			21	M	SS	19	8 10				
4											
5			14	M	SS	14					
6											
7											
8			10	M	SS	15	20 18				
9				▼							
10	ORGANIC CLAY, trace roots, pieces of wood, dark gray, firm, lenses and laminations of silty sand (OL/OH)	SWAMP DEPOSIT	5	W	SS	12	20 38				
11											
12	SANDY SILT, pieces of wood, dark gray, wet, very loose, laminations of silty sand (ML)	FINE ALLUVIUM					19				
13			4	W/M	SS	14	18				
14	SILTY SAND, fine grained, gray, waterbearing, very loose (SM)	COARSE ALLUVIUM									
15	SANDY LEAN CLAY, a little gravel, gray and brown mottled, stiff, laminations of silty sand (CL)	TILL	10	M	SS	19	19				
16											
17											
18	SANDY LEAN CLAY, a little gravel, brown, firm, laminations of silty sand (CL)										
19											
20			8	M	SS	21	19				
21											
22											
23											
24											
25	CLAYEY SAND WITH GRAVEL, brown, hard (SC)		54	M	SS	18	11				
26	SAND WITH SILT, a little gravel, fine to medium grained, brown, moist, very dense (SP-SM)	COARSE ALLUVIUM									
	END OF BORING Northing=206844.7 Easting=553486.0										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA							
	6/28/07	**10:44**	**11.5**	**9.5**	**9.8**		**9.6**
	6/28/07	**11:05**	**26.5**	**24.5**	**26.5**		**None**
BORING COMPLETED: **6/28/07**							
DR: **SG** LG: **SB** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-139A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 951.8 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#20
	No samples taken in upper 29.5', Refer to Log of Boring ST-139											
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-44½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	7/23/07	1:16	46.5	44.5	46.5		None	
BORING COMPLETED: 7/23/07								
DR: SG LG: BR Rig: 91C								

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-139A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
30	SILTY SAND WITH GRAVEL, medium to fine grained, brown, moist, dense (SM) (possible cobbles)	COARSE ALLUVIUM	40	M	SS	6					
31											
32											
33											
34											
35			47	M	SS	6					
36											
37											
38	SAND WITH SILT, a little gravel, fine to medium grained, light brown, moist, dense (SP-SM)										
39											
40			33	M	SS	21					
41											
42											
43	SAND, fine grained, light brown, dense (SP)										
44											
45			33	M	SS	20					
46											
	END OF BORING Northing=206844.7 Easting=553486.0										

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4006-15 ST-140**

LOCATION: N: 206836.519, E: 554906.041 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: 7/2/07

SCALE: 1" = 4'

Elev. feet 962.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
		CL	SANDY LEAN CLAY, trace of Gravel, yellowish-brown to brown, moist, medium dense. (Glacial Till)			
				8		
				6		
				8		
				17		
951.9	11.0					
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist. (Glacial Till)			
				42		
				*		*70 blows for 6" (set) suspected Cobble or Boulder
				*		*50 blows for 1" (set) suspected Cobble or boulder
939.9	23.0					
		SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, brown, moist, very dense. (Glacial Outwash)			
				54		
936.9	26.0					
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-140A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **962.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	No samples taken in upper 19.5', Refer to Log of Boring ST-140										
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20	CLAYEY SAND, a little gravel, brown, hard (SC)	TILL	37	M	SS	20	9				
21											
22											
23											
24											
25	SAND WITH SILT, a little gravel, fine to medium grained, light brown, moist, dense (SP-SM)	COARSE ALLUVIUM	44	M	SS	16					
26											
27											

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
0-44½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
	7/25/07	11:10	41.5	39.5	41.4		None
BORING COMPLETED: 7/25/07							
DR: SG LG: BR Rig: 91C							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-140A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
29	GRAVELLY SAND WITH SILT, medium to fine grained, light brown, moist, very dense (SP-SM)										
30			116	M	SS	14					
31											
32											
33											
34											
35			79	M	SS	17					
36											
37											
38	GRAVEL WITH SILTY SAND, light brown, moist, very dense (GP)										
39											
40			99	M	SS	16					
41											
	END OF BORING Northing=206836.5 Easting=554906.0										

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-141 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 913.3 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and sandy silt, a little gravel, surface roots, trace roots, brown	FILL	17	M	SS	17					
2 3 4	FILL, mixture of silty sand, clayey sand and sandy lean clay, a little gravel, trace roots, organic clay, brown, dark brown, gray and black		19	M	SS	22	10				
5 6			11	M	SS	17	9				
7 8	CLAYEY SAND, a little gravel, trace roots, brown and dark gray, stiff (SC)	TILL	9	M	SS	17	19				
9 10 11	SANDY LEAN CLAY, a little gravel, dark gray and gray mottled, a little brown, firm, laminations of silty sand and clayey sand (CL)		5	M	SS	20	22				
12 13 14	SANDY LEAN CLAY, a little gravel, light brown and gray mottled, stiff, laminations of brown silty sand (CL)		10	M	SS	12	19				
15 16 17			14	M	SS	24	18				
18 19 20 21	CLAYEY SAND, a little gravel, dark gray, stiff to very stiff (SC)		14	M	SS	24	15				
22 23 24 25 26			18	M ▼	SS	16	15				
	END OF BORING Northing=206683.1 Easting=552396.6										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/18/07	1:50	26.5	24.5	26.5		26.5

BORING COMPLETED: **7/18/07**

DR: **SG** LG: **BR** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-142 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **933.7**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly sandy silt, surface roots, trace roots, dark brownish gray	FILL					9				
1	FILL, mostly clayey sand, a little gravel, possible cobbles, trace roots, brown and grayish brown		17	M	SS	10	8				
2											
3			14	M	SS	4	10				
4											
5											
6			8	M	SS	7	13				
7											
8			2	W/M	SS	2	18				
9											
10	FILL, mixture of silty sand, clayey sand and sand with silt, a little gravel, dark grayish brown, gray and black						20				
11			18	M	SS	19					
12											
13			10	M	SS	14					
14											
15	SANDY SILT, trace roots, dark brownish gray, a little gray, moist, loose, lenses and laminations of silty sand (ML)	FINE ALLUVIUM					20				
16			6	M	SS	18	34				
17	SILT WITH ORGANICS, black, wet, loose (ML)										
18			5	W	SS	23	27				
19											
20	CLAYEY SAND, gray, a little brown, stiff, laminations of wet silty sand (SC)	MIXED ALLUVIUM									
21			9	M/W	SS	19	20				
22											
23	LEAN CLAY, trace roots, gray, a little black, stiff, laminations of fat clay (CL)	FINE ALLUVIUM									
24				▼							
25			11	M	SS	17	32				
26	SILTY SAND, fine grained, gray, wet, medium dense (SM)	COARSE ALLUVIUM									
27	SILTY SAND, a little gravel, fine to medium grained, gray, wet, medium dense (SM)										
28			14	W	SS	20					

Fill (sandy silt) 0' to 0.5'
Fill (clayey sand) 0.5' to 9.5'
Fill (silty sand) 9.5' to 15'

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-29½'	3.25" HSA							
		7/5/07	9:35	26.0	24.5	24.8		23.7
		7/5/07	2:00	31.5	29.5	29.9		24.5
BORING COMPLETED: 7/5/07								
DR: SG　LG: SB　Rig: 91C								

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-142 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#20
30	SANDY LEAN CLAY, a little gravel, gray, firm (CL)	▨	TILL	5	M	☒	SS	14	19				
31	**END OF BORING** Northing=206683.8 Easting=552897.3												

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-143 RI-4007-02** LOCATION: N: 206653.285, E: 553400.699 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/18/07**	SCALE: **1" = 4'**

Elev. feet 949.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
949.3	0.6	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.			
945.9	4.0	FILL	FILL: Clayey Sand, trace of Gravel, mixed light brown and dark brown, moist.	29		
940.9	9.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, trace of Gravel, light brown, moist.	18 5		
937.9	12.0	CL	SANDY LEAN CLAY, trace of Roots, dark brown, moist. (Buried Topsoil)	4		
930.9	19.0	CL	SANDY LEAN CLAY, trace of Gravel, grayish-brown, wet, rather soft to medium. (Glacial Till)	3 6		
921.9	28.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, wet, rather soft to rather stiff. (Glacial Till)	5 10		
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till)	21		

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-143 RI-4007-02 (cont.)** LOCATION: N: 206653.285, E: 553400.699 See attached sketch.
DRILLER: K. Keck / METHOD: 3 1/4" HSA, Autohmr	DATE: **7/18/07** / SCALE: **1" = 4'**

Elev. feet 917.9	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
			SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till) *(continued)*	18 35 12		
903.9	46.0		END OF BORING. Water not observed with 44 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**	LOG OF BORING NO. **ST-144 (p. 1 of 1)**
PROJECT: **TCAAP Redevelopment; Arden Hills, MN**	

SURFACE ELEVATION: 955.0

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	Concrete	FILL			SU						
1	FILL, mostly sand with silt, a little gravel, brown		10	M	SS	9					
2	FILL, mixture of clayey sand and silty sand, a little gravel, brown										
3			21	M	SS	20					
4											
5	SILTY SAND, a little gravel, fine grained, brown, medium dense (SM)	TILL	12	M	SS	20	13				
6											
7											
8	SILTY SAND, a little gravel, fine to medium grained, brown, medium dense (SM)		15	M	SS	20	13				
9											
10	SAND WITH SILT, a little gravel, medium to fine grained, brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM	12	M	SS	8					
11											
12											
13			15	M	SS	12					
14											
15	SAND WITH SILT WITH GRAVEL, medium to fine grained, brown, moist, medium dense to dense (SP-SM)		30	M	SS	6					
16											
17											
18											
19											
20			44	M	SS	14					
21											
22											
23											
24											
25			40	M	SS	15					
26											
	END OF BORING Northing=206618.1 Easting=553935.0										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-24½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		7/9/07	8:55	26.5	24.5	26.2		None	
BORING COMPLETED: 7/9/07									
DR: SG LG: SB Rig: 91C									

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-144A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 955.0 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
	No samples taken in upper 24.5', Refer to Log of Boring ST-144											
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-44½'	**3.25" HSA**	**7/24/07**	**12:02**	**46.5**	**44.5**	**46.0**		**None**

BORING COMPLETED: **7/24/07**

DR: **SG** LG: **BR** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00081

LOG OF BORING NO. ST-144A (p. 2 of 2)

PROJECT: TCAAP Redevelopment; Arden Hills, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#20
25	SAND WITH SILT, a little gravel, fine to medium grained, light brown, moist, dense to very dense (SP-SM)	COARSE ALLUVIUM	35	M	SS	20					
26											
27											
28											
29											
30			51	M	SS	24					
31											
32											
33	SAND WITH SILT, fine to medium grained, light brown, moist, dense to very dense (SP-SM)										
34											
35			39	M	SS	21					
36											
37											
38											
39											
40			53	M	SS	22					
41											
42											
43	SAND WITH SILT, a little gravel, fine to medium grained, light brown, moist, very dense (SP-SM)										
44											
45			57	M	SS	22					
46											
	END OF BORING Northing=206618.1 Easting=553935.0										

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**
LOG OF BORING NO. **ST-145 (p. 1 of 1)**
PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **954.7**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
	FILL, mixture of clayey sand and silty sand, a little gravel, surface roots, trace roots, light brown	FILL									
1		TILL	24	M	SS	16	7				
2	CLAYEY SAND, a little gravel, trace roots, brown, laminations of silty sand, very stiff (SC)						9 12				
3			25	M	SS	13					
4							7				
5							14				
6			18	M	SS	15	14				
7			67/0.9								
8				M	SS	11	7				
9											
10							8				
11			16	M	SS	12					
12											
13	SAND, a little gravel, medium to fine grained, brown, moist, medium dense to dense (SP)	COARSE ALLUVIUM	18	M	SS	14					
14											
15											
16			33	M	SS	14					
17											
18											
19	GRAVELLY SAND WITH SILT, fine to coarse grained, brown, moist, very dense (SP-SM)										
20											
21			60	M	SS	12					
22											
23											
24	SAND WITH SILT, fine to medium grained, brown, moist, dense (SP-SM)										
25											
26			44	M	SS	15					
	END OF BORING Northing=206685.1 Easting=554399.4										

DEPTH:	DRILLING METHOD								NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		WATER LEVEL MEASUREMENTS							
0-24½'	**3.25" HSA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		6/29/07	**1:40**	**26.5**	**24.5**	**26.5**		**None**	
BORING COMPLETED: **6/28/07**									
DR: **SG** LG: **SB** Rig: **91C**									

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-145A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 954.7 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	No samples taken in upper 29.5', Refer to Log of Boring ST-145										
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-39½'	3.25" HSA	7/24/07	9:55	41.5	39.5	40.4		None

BORING COMPLETED: 7/24/07

DR: SG LG: BR Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**   LOG OF BORING NO. **ST-145A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
30	SAND WITH SILT, fine grained, light brown, a little black, moist, medium dense, laminations of silt at 31 feet (SP-SM)	COARSE ALLUVIUM	25	M	SS	17					
31											
32											
33	SANDY SILT, light brown, moist, dense (ML)	FINE ALLUVIUM									
34											
35			50	M	SS	19					
36											
37											
38	SAND WITH SILT, a little gravel, medium to fine grained, brown, moist, very dense (SP-SM)	COARSE ALLUVIUM									
39											
40			57	M	SS	22					
41											

END OF BORING
Northing=206685.1
Easting=554399.4

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-146 RI-4006-07**

LOCATION: N: 206671.599, E: 554897.200 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: 7/2/07

SCALE: 1" = 4'

Elev. feet 966.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
965.5	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)					
		CL	SANDY LEAN CLAY, trace of Gravel, brown, moist. (Glacial Till)	10				
962.0	4.0							
		CL	SANDY LEAN CLAY, trace of Gravel, yellowish-brown, wet. (Glacial Till)	7				
				4		22	54	LL = 29 PI = 17
957.0	9.0							
		CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, moist, hard. (Glacial Till)	33				
955.0	11.0							
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till)	82				NR Suspected Cobble or Boulder
				46		6	25	
				32				
				32				
940.0	26.0							
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-146A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: **966.0** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	No samples taken in upper 27', Refer to Log of Boring ST-146										
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-44½' **3.25" HSA**	**7/25/07**	**8:46**	**46.5**	**44.5**	**46.0**		**None**
BORING COMPLETED: **7/25/07**							
DR: **SG** LG: **BR** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-146A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#20
28	GRAVEL WITH SILTY SAND, light brown, moist, dense to very dense (GP)	COARSE ALLUVIUM	79	M	SS	19					
29											
30			42	M	SS	10					
31											
32											
33											
34											
35			57	M	SS	14					
36											
37											
38	SAND, a little gravel, fine to medium grained, light brown, moist, dense (SP)										
39											
40			40	M	SS	17					
41											
42											
43	GRAVELLY SAND WITH SILT, medium to fine grained, light brown, moist, very dense (SP-SM)										
44											
45			56	M	SS	18					
46											
	END OF BORING Northing=206671.6 Easting=554897.2										

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4006-16 ST-147**

LOCATION: N: 206638.252. E:555108.351 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/2/07**

SCALE: **1" = 4'**

Elev. feet 958.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
958.1	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Till)	20		
				22		
				28		
949.6	9.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, light brown, moist, medium dense to very dense. (Glacial Outwash)	22		
				52		Suspected Cobble or Boulder
				34		
				38		
				53		
932.6	26.0		END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP060587I.GPJ BRAUN.GDT 10/2/07 14:42

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-147A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 958.6 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	No samples taken in upper 29.5', Refer to Log of Boring ST-147										
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

DEPTH:	DRILLING METHOD
0-44½'	**3.25" HSA**

BORING COMPLETED: **7/24/07**

DR: **SG** LG: **BR** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/24/07	2:20	45.5	44.5	45.4		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-147A (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
30	GRAVEL WITH SAND, brown, very dense (GP)	COARSE ALLUVIUM	119	M	SS	16					
31											
32											
33											
34											
35			84/0.8	M	SS	14					
36											
37											
38	GRAVELLY SAND WITH SILT, medium to fine grained, brown, moist, very dense (SP-SM)										
39											
40			100/0.5	M	SS	8					
41											
42											
43											
44											
45			62/0.5	M	SS	8					
	END OF BORING Northing=206638.3 Easting=555108.4										

**AMERICAN
ENGINEERING
TESTING, INC.**

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-148 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 957.9

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	6" Bituminous Pavement	FILL			SU						
1	FILL, mostly gravelly silty sand, brown and light brown		26	M	SS	9					
2	FILL, mixture of sandy lean clay, clayey sand and silty sand, a little gravel, pieces of bituminous, brown, gray, dark gray and brown, a little black										
3			17	M	SS	10	10				
4											
5			20	M	SS	20					
6											
7				▼							
8			1	W	SS	14					
9											
10	ORGANIC CLAY, trace roots, black and dark gray, soft (OL/OH)	SWAMP DEPOSIT	2	M	SS	21	26				
11	HEMIC PEAT, dark brown, a little gray, laminations of lean clay (PT)						182				
12	ORGANIC CLAY, trace roots, black, soft to very soft (OL/OH)										
13			2	M	SS	24	102				
14											
15			1	M	SS	23	31				
16	SILTY CLAY, gray and black, very soft, laminations of silty sand (CL-ML)	FINE ALLUVIUM					27				
17	CLAYEY SAND, a little gravel, gray and brownish gray, very soft to very stiff (SC)	TILL									
18			2	M	SS	16	18				
19											
20			1	M	SS	7	23				
21											
22											
23											
24											
25			18	M	SS	5	18				
26											
27											
28											
29											
30	CLAYEY SAND, a little gravel, dark brown, very stiff (SC)		20	M	SS	20	10 15				
31											

WATER LEVEL MEASUREMENTS

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-39½' 3.25" HSA	7/17/07	12:05	9.0	7.0	7.4		7.3
	7/17/07	12:45	36.5	34.5	35.7		33.9
BORING COMPLETED: 7/17/07	7/17/07	12:50	41.5	39.5	40.3		39.9
DR: SG LG: SB/BR Rig: 91C							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-148 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#20
32	SANDY LEAN CLAY, a little gravel, dark brown, a little brown, very stiff, lense of silty sand at 31.5' (CL)										
33											
34	CLAYEY SAND, a little gravel, trace roots, brown, hard to firm (SC)										
35			36	W	SS	16	10				
36											
37											
38											
39											
40			8	W	SS	19	14				
41											

END OF BORING
Northing=206425.9
Easting=554458.6

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-149** LOCATION: N: 206391.747, E: 555391.606 See attached sketch.
DRILLER: K. Keck · METHOD: 3 1/4" HSA, Autohmr	DATE: **7/11/07** · SCALE: **1" = 4'**

Elev. feet 990.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
989.9	1.0	FILL	FILL: Silty Sand, trace of Roots, moist.				
		FILL	FILL: SANDY LEAN CLAY, trace of GRAVEL, mixed light brown to dark brown, moist.				
				11			
				7			
				5			
				8			
978.9	12.0						
		FILL	FILL: Silty Sand, fine- to medium-grained, trace of gravel, reddish-brown to grayish-brown, moist to wet.	7			
				4			
					▽		
				6			
968.9	22.0						
		CL	SANDY LEAN CLAY, trace of Gravel, gray, wet. (Glacial Till)				
				4			
				4		23	
958.9	32.0						

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-149 (cont.)** LOCATION: N: 206391.747, E: 555391.606 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/11/07**	SCALE: **1" = 4'**

Elev. feet 958.9	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
		CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, wet.				
				*			*50 blows for 6"
952.9	38.0						
		SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to hard.				
				30			
				59		7	
				29			
939.9	51.0						
			END OF BORING. Water observed at 19 feet while drilling. Boring then grouted. Given moist conditions at depth groundwater appears to be trapped in clay layer.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**
LOG OF BORING NO. **ST-150 (p. 1 of 1)**
PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 927.0 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy silt, surface roots, trace roots, dark brownish gray		FILL	34	M	SS	12	7				
2–4	FILL, mixture of clayey sand and silty sand, a little gravel, trace roots, grayish brown and brown			21	M	SS	19					
5–6	CLAYEY SAND, trace roots, dark brown, firm (SC) (possible fill)	▨	TOPSOIL OR FILL	7	M	SS	3	16				
7–8	CLAYEY SAND, a little gravel, brown and light gray mottled, stiff (SC/CL)	▨	TILL	10	M	SS	16	17				
9–11	CLAYEY SAND, a little gravel, light brownish gray, a little brown, stiff, laminations of silty sand (SC/CL)	▨		11	M	SS	21	18				
12–14		▨		14	M	SS	21	16				
15–16	SANDY LEAN CLAY, a little gravel, brown and dark brown, very stiff (CL)	▨		16	M	SS	24	14				
17–22		▨		16	M	SS	24	14				
23–26	SANDY LEAN CLAY, a little gravel, brown, very stiff, lenses and laminations of sand (CL)	▨		23	M	SS	21	14				

END OF BORING
Northing=206182.3
Easting=552896.3

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

BORING COMPLETED: **7/6/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/6/07	**2:10**	**26.5**	**24.5**	**26.5**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-151 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 922.3

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand and silty sand, surface roots, trace roots, black and brown	FILL	24	M	SS	14	33				
2 3	CLAYEY SAND, a little gravel, trace roots, brown, very stiff (SC)	TILL	18	M	SS	24	12				
4 5 6	SAND WITH SILT, fine to medium grained, a little gravel, brown, wet, medium dense (SP-SM)	COARSE ALLUVIUM	13	▼ W	SS	11					
7 8 9 10 11 12 13 14 15 16 17	SANDY LEAN CLAY, a little gravel, gray, a little reddish brown, firm to stiff, laminations of silty sand at 7.5' (CL)	TILL	5 7 10 10	M M M M	SS SS SS SS	18 24 24 21	18 15 16 15				
18 19 20 21 22 23 24 25 26	LEAN CLAY, brownish gray, a little gray, hard to very stiff, laminations of silt (CL)	FINE ALLUVIUM	33 25	M M	SS SS	21 24	17 25				
	END OF BORING Northing=206254.2 Easting=553051.5										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**	**7/9/07**	**9:35**	**6.5**	**4.5**	**5.2**		**5.1**
		7/9/07	**10:00**	**26.5**	**24.5**	**26.4**		**None**

BORING COMPLETED: **7/9/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-152 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 942.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	5" Bituminous Pavement	FILL			SU						
1	FILL, mostly sand with silt and gravel, brown		21	M	SS	5					
2–3	FILL, mixture of sandy lean clay and clayey sand, with gravel, brown and gray		16	M	SS	11	15				
5			9	M	SS	5	16				
8			7	M	SS	12	24				
10	SILTY SAND, fine grained, dark brown, wet, very loose (SM) (possible fill)	COARSE ALLUVIUM OR FILL	3	W	SS	14					
12				▼							
12–13	SAND WITH SILT, fine grained, brownish gray, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM	11	W	SS	13					
14–15	SILTY SAND, fine grained, gray, wet, medium dense (SM)		15	W	SS	14					
16	CLAYEY SAND, gray, stiff (SC)	TILL					22				
17–18	CLAYEY SAND, a little gravel, grayish brown, stiff (SC)		9	M	SS	21	17				
20	CLAYEY SAND, a little gravel, brown and gray mottled, stiff (SC)		12	M	SS	21	17				
23–25	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)		14	M	SS	8	15				
	END OF BORING Northing=206184.0 Easting=553397.6										

DEPTH:	DRILLING METHOD							
0-24½'	**3.25" HSA**							

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/5/07	11:50	14.0	12.0	12.5		12.3
7/5/07	12:10	26.5	24.5	26.4		None

BORING COMPLETED: **7/5/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-153 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 951.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly gravelly silty sand, possible cobbles, surface roots, trace roots, brown	FILL	22	M	SS	12					
2											
3	FILL, mixture of clayey sand and sandy lean clay, a little gravel, brown and dark brown		25	M	SS	10	13				
4											
5	SANDY LEAN CLAY, a little gravel, brown, a little gray, firm, laminations of sand (CL)						20				
6			5	M	SS	17					
7	CLAYEY SAND, a little gravel, brown mottled, stiff (SC)										
8			12	M	SS	18	17				
9											
10	CLAYEY SAND, a little gravel, light brownish gray, a little brown, mottled, stiff, lenses and laminations of silty sand (SC)		12	M	SS	17	18				
11											
12	SANDY LEAN CLAY, a little gravel, light brownish gray and brown mottled, stiff to very stiff (CL)										
13			14	M	SS	23	15				
14											
15			16	M	SS	23	15				
16											
17											
18											
19											
20			30	M	SS	22	13				
21											
22											
23	CLAYEY SAND, a little gravel, possible cobbles, dark grayish brown to brown, hard (SC)										
24											
25			100/0.9	M	SS	12	7				
	END OF BORING Northing=206179.7 Easting=553901.3										

Fill 0' to 4.5'
Sandy Lean Clay 4.5' to 7'

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA	7/5/07	11:05	25.9	24.5	25.3		None
BORING COMPLETED: 7/5/07							
DR: SG LG: SB Rig: 91C							

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-153A (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 951.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#20
1	No samples taken in upper 29.5', Refer to Log of Boring ST-153										
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-44½' 3.25" HSA								
	7/23/07	**3:07**	**46.5**	**44.5**	**46.4**		**None**	
BORING COMPLETED: **7/23/07**								
DR: **SG** LG: **BR** Rig: **91C**								

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00081

LOG OF BORING NO. ST-153A (p. 2 of 2)

PROJECT: TCAAP Redevelopment; Arden Hills, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
30	SILTY SAND, a little gravel, fine to medium grained, brown, moist, very dense (SM)	TILL	73	M	SS	22					
31											
32											
33	CLAYEY SAND WITH GRAVEL, brown, moist, hard to very stiff, lense of silty sand, a little gravel at 46 feet (SC)										
34											
35			56	M	SS	20	11				
36											
37											
38											
39											
40			34	M	SS	24	9				
41											
42											
43											
44											
45			28	M	SS	24	9				
46											
	END OF BORING Northing=206179.7 Easting=553901.3										

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-154 RI-4008-15**

LOCATION: N: 206184.030, E: 554408.064 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/17/07	SCALE: 1" = 4'

Elev. feet 956.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
955.7	1.0	FILL	FILL: Silty Sand, brown, moist.			
947.7	9.0	FILL	FILL: Sandy Lean Clay, with Sand layer, brown, dark brown and reddish-brown, moist. With topsoil lense at 8 feet.	30 21 12		
945.7	11.0	FILL	FILL: Sandy Lean Clay, trace of Gravel, brown, moist.	8		
940.7	16.0	FILL	FILL: Sandy Lean Clay, with topsoil chunks, brown to dark brown, wet. With Organic Clay layer at 15 1/2 feet.	6 3		
928.7	28.0	SC	CLAYEY SAND, trace of Gravel, brown and gray with iron staining, wet, medium. (Lacustrine)	6 7		
		CL	SANDY LEAN CLAY, trace of Gravel, brown with iron staining, moist, stiff. (Glacial Till)	13		

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-154 RI-4008-15 (cont.)** LOCATION: N: 206184.030, E: 554408.064 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/17/07	SCALE: 1" = 4'

Elev. feet 924.7	Depth feet 32.0	ASTM Symbol		Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
919.7	37.0		▨	SANDY LEAN CLAY, trace of Gravel, brown with iron staining, moist, stiff. (Glacial Till) *(continued)*	15		
915.7	41.0	SM	░	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, dense. (Glacial Till)	38		
				END OF BORING. Water not observed during drilling. Water not observed with 39 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-157** LOCATION: N: 206185.157, E: 555395.351 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/10/07**	SCALE: **1" = 4'**

Elev. feet 995.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
994.9	1.0	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.			
986.9	9.0	FILL	FILL: Sandy Lean Clay, mixed, light brown to grayish brown, moist.	12 7 12		
981.9	14.0	FILL	FILL: Silty Sand, fine-grained, trace of Roots at 12' Sample Depth, brown to dark brown, moist.	9 6		
963.9	32.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown to brown, moist, medium to very stiff. (Glacial Till)	7 18 13 14		

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-157 (cont.)** LOCATION: N: 206185.157, E: 555395.351 See attached sketch.
DRILLER: K. Keck — METHOD: 3 1/4" HSA, Autohmr	DATE: **7/10/07** — SCALE: **1" = 4'**

Elev. feet 963.9	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
		SM	SILTY SAND, fine-grained, reddish-brown, moist, dense to very dense. (Glaciofluvium)	38		
				38		
				*		*50 blows to for 5" (set) suspected cobble or boulder
948.9	47.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, light brown, moist, very dense. (Glacial Outwash)	74		
				88		
				*		*50 blows for 4" (set)

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-157 (cont.)** LOCATION: N: 206185.157, E: 555395.351 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/10/07**	SCALE: **1" = 4'**

Elev. feet 931.9	Depth feet 64.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
			POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, light brown, moist, very dense. (Glacial Outwash) *(continued)*	52		
				68		
				*		*50 blows for 6" (set)
				58		
914.9	81.0					
			END OF BORING. Water not observed with 79 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-158 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **955.5**

Fill (Sandy lean clay)
0' to 13'

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1 2	FILL, mixture of sandy lean clay, clayey sand and silty sand, surface roots, trave roots, brown, light brown and gray		FILL	26	M	SS	14	7				
3 4				35	M	SS	15	8				
5 6 7				7	M	SS	18	14				
8 9				12	M	SS	17	22				
10 11 12				15	M	SS	19	15				
13 14	FILL, mixture of clayey sand and sandy lean clay, a little gravel, trace roots, brown and gray, a little black, lense of organic clay, laminations of sandy silt			9	M	SS	15	19				
15 16 17				8	M	SS	14	20				
18 19				10	M	SS	24	17				
20 21				9	M	SS	20	19 24				
22	LEAN CLAY, trace roots, gray and black, stiff, lense of organic clay, lense of silty sand (CL)	▨	FINE ALLUVIUM									
23 24	CLAYEY SAND, a little gravel, gray, soft (SC)	▨	TILL	4	M	SS	24	19				
25 26	SANDY LEAN CLAY, a little gravel, gray, a little brown, stiff, laminations of lean clay (CL)	▨		11	M	SS	24	21				
	END OF BORING Northing=206042.2 Easting=554402.2											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	3.25" HSA	7/17/07	11:05	26.5	24.5	26.5		None
BORING COMPLETED: 7/17/07								
DR: SG LG: SB/BR	Rig: 91C							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING:	**ST-159**
LOCATION:	N: 206047.880. E: 554563.240 See attached sketch.
DRILLER:	M. Rowland
METHOD:	3 1/4" HSA, Autohmr
DATE:	**7/12/07**
SCALE:	**1" = 4'**

Elev. feet 959.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
		FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace of Gravel, brown, moist then waterbearing at 20' sample depth. (Lacustrine)		▽	
933.4	26.0		END OF BORING. Water observed at 18 feet while drilling. Boring then grouted.			

Fill (Poorly graded sand with silt)
0' to 26'

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-160 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 920.2

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, surface roots, black and brown	FILL	24	M	SS	13	15				
2 3 4	FILL, mixture of sand with silt, clayey sand, and silty sand, a little gravel, trace roots, brown and gray, possible cobbles		21	M	SS	23	10				
5 6			11	M	SS	12	16				
7 8	LEAN CLAY WITH ORGANICS, trace roots, black, firm (CL)	TOPSOIL OR SWAMP DEPOSITS	8	M	SS	20	20				
9	SILTY SAND, trace roots, fine grained, dark gray, loose (SM)	COARSE ALLUVIUM									
10 11	SILTY SAND, trace roots, fine grained, gray, waterbearing, very loose with lenses and laminations of lean clay with sand (SM)		4	W/M ▼	SS	14					
12 13 14	SAND WITH SILT, fine grained, brown, waterbearing, medium dense (SP-SM)		11	W	SS	15					
15 16 17 18 19	CLAYEY SAND, a little gravel, gray, soft to stiff, laminations of silty sand at 26' (SC)	TILL	4	M	SS	17	16				
20 21 22 23 24			11	M	SS	4	19				
25 26			10	M	SS	22	16				
	END OF BORING Northing=205865.8 Easting=553115.1										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**							
		7/9/07	**10:45**	**14.0**	**12.0**	**12.3**		**11.8**
		7/9/07	**11:00**	**26.5**	**24.5**	**26.5**		**None**

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **7/9/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-161 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 926.9 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly gravelly sand with silt, light grayish brown		FILL	15	M	SS	4					
2 3 4	FILL, mixture of sandy lean clay, clayey sand and silty sand, a little gravel, light brownish gray and brown			15	M	SS	20	12				
5 6	LEAN CLAY WITH SAND, gray, a little black, firm, laminations of organic clay and silty sand (CL)	▨	FINE ALLUVIUM	7	M	SS	5	13				
7 8 9	CLAYEY SAND, a little gravel, gray, stiff (SC)	▨	TILL	10	M	SS	14	18				
10 11 12	CLAYEY SAND, a little gravel, light brownish gray and brown mottled, stiff to firm, laminations of silty sand (SC)	▨		9	M	SS	20	18				
13 14		▨		8	M	SS	21	18				
15 16 17		▨		12	M	SS	21	18				
18 19 20 21 22 23	CLAYEY SAND, a little gravel, dark gray, stiff (SC)	▨		13	M	SS	20	13				
24 25 26		▨		14	M	SS	21	16				
	END OF BORING Northing=205683.9 Easting=553397.5											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	**3.25" HSA**	**7/9/07**	**3:05**	**26.5**	**24.5**	**26.5**		**None**	
BORING COMPLETED: **7/9/07**									
DR: **SG** LG: **SB** Rig: **91C**									

06/04

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-162** LOCATION: N: 205685.324, E: 553896.610 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/3/07**	SCALE: **1" = 4'**

Elev. feet 956.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
955.7	1.0	SM ⁙	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
927.7	29.0	CL ▨	SANDY LEAN CLAY, trace of Gravel, yellowish-brown to brown with rust lenses scattered, moist, medium to stiff. (Glacial Till)	7 9 13 14 15 16 13 11		
		CL ▨	SANDY LEAN CLAY, trace of Gravel, reddish-brown, moist, rather stiff. (Glacial Till)	12		

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:43 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-162 (cont.)** LOCATION: N: 205685.324, E: 553896.610 See attached sketch.
DRILLER: K. Keck METHOD: 3 1/4" HSA, Autohmr	DATE: **7/3/07** SCALE: **1" = 4'**

Elev. feet 924.7	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
923.7	33.0					
918.7	38.0	SM	SILTY SAND, fine- to medium-grianed, trace of Gravel, reddish-brown, moist, dense. (Glacial Till)	35		
910.7	46.0	SP	POORLY GRADED SAND, fine- to coarse-grained, brown, moist, dense. (Glacial Outwash)	40 40		
			END OF BORING. Water not observed with 44 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-163 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **949.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	7.5" Bituminous Pavement	FILL			SU						
1	FILL, mixture of sand with silt, silty sand and clayey sand with gravel, brown and brownish gray		15	M	SS	12					
2											
3	FILL, mixture of clayey sand and sandy lean clay, a little gravel, gray and brown		19	M	SS	12					
							17				
4											
5							13				
			15	M	SS	8					
6							16				
7											
							18				
8			3	M	SS	8					
							20				
9											
10							17				
			10	M	SS	15	20				
11							18				
12											
13			5	M	SS	7	19				
14											
15	SAPRIC PEAT, black (PT)	SWAMP DEPOSIT					159				
	ORGANIC CLAY, trace roots, black, firm (OL/OH)		7	M	SS	20	35				
16											
17	LEAN CLAY WITH SAND, dark brownish gray, firm, laminations of sand (CL)	FINE ALLUVIUM									
18			5	M	SS	21	25				
19											
20	CLAYEY SAND, a little gravel, gray, soft, laminations of fine grained sand (SC)	TILL									
			3	W/M	SS	14	18				
21											
22											
23											
24											
25											
			3	M	SS	24	17				
26											
	END OF BORING Northing=205683.4 Easting=554148.1										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/2/07	**1:55**	**26.5**	**24.5**	**26.4**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: **7/2/07**

DR: **SG** LG: **SB** Rig: **91C**

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-164 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **951.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	4.25" Bituminous Pavement	FILL			SU						
1	FILL, mixture of silty sand and clayey sand with gravel, brown and gray		19	M	SS	13	8				
2–3	SANDY LEAN CLAY, a little gravel, brownish gray and brown, stiff (CL)	TILL	15	M	SS	1	16				
5–6			15	M	SS	12	14 16				
8			9	M	SS	19	21				
9	SILTY SAND, trace roots, fine grained, dark brown and gray, moist, loose, lenses and laminations of sand with silt (SM)	COARSE ALLUVIUM									
10–12	SAND WITH SILT, fine grained, brown and gray, very loose, moist to wet, laminations of lean clay with sand (SP-SM)		4	W/M	SS	12					
12–13	CLAYEY SAND, a little gravel, gray, firm (SC)	TILL	6	M	SS	22	19				
15–16	CLAYEY SAND, a little gravel, gray and brown mottled, firm (SC)		5	M	SS	18	17				
18–20	CLAYEY SAND, a little gravel, brown, stiff (SC)		11	M	SS	24	15				
23–25	CLAYEY SAND, a little gravel, dark gray, very stiff (SC)		18	M	SS	24	15				

Sandy Lean Clay
2.0' to 8.5'

END OF BORING
Northing=205683.9
Easting=554395.9

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

BORING COMPLETED: 7/5/07

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/5/07	10:00	26.5	24.5	26.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-165 RI-4008-36**

LOCATION: N: 205684.892, E: 554894.762 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/16/07**	SCALE: **1" = 4'**

Elev. feet 953.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
952.8	0.3	PAV	3 1/2" of Bituminous			
951.1	2.0	FILL	FILL: Silty Sand, fine-grained, brown, moist.			
941.1	12.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, medium to very stiff. (Glacial Till)	7 8 13 19		
940.1	13.0	ML	SILT, reddish-brown, moist, medium dense. (Glaciofluvium)	24		
935.1	18.0	SP	POORLY GRADED SAND, fine-grained, reddish-brown, moist, medium dense. (Glacial Outwash)	23		
930.1	23.0	ML	SILT, reddish-brown, moist, medium dense. (Glaciofluvium)	22		
927.1	26.0	SM	SILTY SAND, fine-grained, with Cobbles, reddish-brown, moist, dense. (Glacial Till)	39		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

Sandy Lean Clay
2.0' to 12'

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-166 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 955.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	4.75" Bituminous Pavement	FILL			SU						
1	FILL, mostly gravelly sand with silt, brown (possible base)		19	M	SS	3					
2	SANDY LEAN CLAY, a little gravel, light grayish brown, a little light brown, stiff to very stiff, laminations of sandy silt (CL)	TILL OR WEATHERED TILL	11	M	SS	7	14				
5			16	M	SS	20	15				
7	SANDY LEAN CLAY, a little gravel, light grayish brown, a little brown and light brown, very stiff, laminations of silty sand and sandy silt (CL)	TILL	20	M	SS	18	15 15				
10			23	M	SS	21	15				
13			20	M	SS	17	15				
15			19	M	SS	21	15				
18	CLAYEY SAND, a little gravel, possible cobbles, brown, a little light brownish gray, hard (SC)										
20			88	▼ M	SS	14	13				
23	SAND, a little gravel, medium to fine grained, brown, waterbearing, dense (SP)	COARSE ALLUVIUM									
25			41	W	SS	24					
26	SILTY SAND, fine grained, brown, wet, dense (SM)										
	END OF BORING Northing=205683.0 Easting=555397.1										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

BORING COMPLETED: **7/5/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/5/07	8:35	26.5	24.5	24.1		21.2

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-167 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 945.0 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	5.75" Bituminous Pavement		FILL			SU						
1	FILL, mostly gravelly sand with silt, brown (possible base)			20	M	SS	8					
2	FILL, mixture of clayey sand, sandy lean clay and silty sand, a little gravel, brown and grayish brown											
3				9	M	SS	3	9				
4												
5	SANDY LEAN CLAY, a little gravel, grayish brown, firm (CL)	▨	WEATHERED TILL	8	M	SS	12	15				
6		▨										
7	SANDY LEAN CLAY, a little gravel, gray, firm, lenses and laminations of organic clay and sand (CL)	▨						20				
8		▨		5	M	SS	9					
9	CLAYEY SAND, gray, a little brown, soft (SC)	▨										
10		▨		3	M	SS	15	24 24				
11	CLAYEY SAND, a little gravel, gray, a little brown, soft, laminations of silty sand (SC)	▨	TILL									
12	SANDY LEAN CLAY, a little gravel, brown, soft (CL)	▨										
13		▨		4	M	SS	20	22				
14		▨										
15	SANDY LEAN CLAY WITH GRAVEL, gray, stiff (CL)	▨		9	M	SS	17	19				
16		▨										
17		▨										
18	CLAYEY SAND, a little gravel, gray, stiff (SC)	▨										
19		▨										
20		▨		9	W/M ▼	SS	19	16				
21		▨										
22		▨										
23		▨										
24		▨										
25		▨		13	M	SS	22	15				
26		▨										
	END OF BORING Northing=205551.6 Easting=553796.8											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	3.25" HSA	7/2/07	8:40	21.5	19.5	21.5		21.2
		7/2/07	8:45	26.5	24.5	26.5		None

BORING COMPLETED: 7/2/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-168 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **947.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	10.5" Bituminous Pavement	FILL			SU						
1	FILL, mostly gravelly sand with silt, brown			M	SS	8					
2 3	FILL, mostly sandy lean clay, a little sapric peat, trace roots, gray and brown, a little black		5	M	SS	14	19 16				
4 5	SANDY LEAN CLAY, trace roots, light brownish gray and light gray, firm, laminations of silt (CL)	WEATHERED TILL									
6 7	SANDY LEAN CLAY, a little gravel, trace roots, light brownish gray, a little light gray, stiff to very stiff, laminations of silt (CL)	TILL	15	M	SS	17	14 15				
8 9			20	M	SS	19	16				
10 11 12			21	M	SS	14	14				
13 14	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, very stiff, laminations of silty sand (CL)		18	M	SS	18	16				
15 16 17	CLAYEY SAND, a little gravel, grayish brown, a little brown, very stiff (SC)		29	M	SS	12	14				
18 19	CLAYEY SAND, a little gravel, brown, very stiff (SC)		21	M	SS	17	15				
20 21 22 23	SANDY LEAN CLAY, a little gravel, brown, very stiff (CL)		24	M	SS	19	16				
24 25 26	GRAVELLY SAND, medium grained, brown, moist, medium dense (SP)	COARSE ALLUVIUM	16	M	SS	6					
	END OF BORING Northing=205519.6 Easting=554022.3										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-24½'	**3.25" HSA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		7/2/07	**11:20**	**26.5**	**24.5**	**26.5**		**None**	
BORING COMPLETED: **7/2/07**									
DR: **SG** LG: **SB** Rig: **91C**									

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-169 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **948.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	10.75" Bituminous Pavement	FILL			SU						
1 2	FILL, mixture of sand with silt with gravel and clayey sand with gravel, brown		28	M	SS	11	7				
3 4	FILL, mixture of sand with silt and crushed limestone with gravel, brown and light brown		26	W	SS	6					
5 6	FILL, mixture of sandy lean clay, clayey sand and silty sand, a little gravel, gray and brown		16	M	SS	12	13				
7 8 9			9	M	SS	12	17				
10			14	M	SS	19					
11 12	ORGANIC CLAY, a little gravel, trace roots, gray, very stiff to soft (OL/OH)	SWAMP DEPOSIT					39 24				
13	SANDY LEAN CLAY, a little gravel, gray, soft (CL/SC)	TILL	3	M	SS	20	22				
14 15 16	SANDY LEAN CLAY, a little gravel, gray, a little brown, stiff, laminations of silty sand (CL)		15	M	SS	18	17				
17 18 19 20 21			14	M	SS	19	16				
22 23 24 25 26			14	M	SS	22	20				

END OF BORING
Northing=205580.7
Easting=554087.9

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/2/07	12:20	26.5	24.5	26.5		None

BORING COMPLETED: **7/2/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO:	**22-00081**	LOG OF BORING NO.	**ST-170 (p. 1 of 1)**
PROJECT:	**TCAAP Redevelopment; Arden Hills, MN**		

DEPTH IN FEET	SURFACE ELEVATION: 949.7 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	6.25" Bituminous Pavement	FILL			SU						
1	FILL, mixture of sand with silt and gravel and clayey sand, brown and brownish gray		14	M	SS	4					
2–3	FILL, mixture of clayey sand and sandy lean clay, a little gravel, light brownish gray, gray and a little brown		9	M	SS	6	15				
5							15				
6			12	M	SS	17					
8			14	M	SS	17	14				
10			6	M	SS	12	18				
11	LEAN CLAY WITH ORGANICS, trace roots, black, firm (CL)	TOPSOIL					23				
12–13	SILTY SAND, fine grained, gray and brown mottled, wet, medium dense (SM)	COARSE ALLUVIUM	11	▼ W	SS	15					
15	SANDY LEAN CLAY, a little gravel, gray, a little brown, firm, laminations of silty sand (CL)	TILL	5	M	SS	19	20				
18	CLAYEY SAND WITH GRAVEL, gray, a little brown, stiff, laminations of silty sand (SC)										
20			13	M	SS	21	17				
23	CLAYEY SAND, a little gravel, gray, stiff (SC)										
25			11	M	SS	5	17				
	END OF BORING Northing=205558.5 Easting=554273.5										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/2/07	2:40	14.0	12.0	13.2		12.6
7/2/07	2:55	26.5	24.5	26.5		None

BORING COMPLETED: **7/2/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-171 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **915.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3.25" Bituminous Pavement	FILL			SU						
1	FILL, mostly sand with silt and gravel, brown		21	M	SS	14					
2	FILL, mixture of sandy lean clay and clayey sand, a little gravel, light grayish brown to light brownish gray										
3			11	M	SS	8	14 10				
4											
5			4	M	SS	16	16				
6											
7											
8			5	▼	SS	17	20				
9	SAND, a little gravel, medium to fine grained, brown, waterbearing, loose (SP)	TOPSOIL OR COARSE ALLUVIUM					18				
10	SILTY SAND, fine grained, gray and black, wet, very loose, lenses and laminations of organic silt and sand (SM)		3	W	SS	19					
11											
12	CLAYEY SAND, a little gravel, trace roots, gray, very soft, lenses of waterbearing sand with silt (SC)	TILL									
13			1	M	SS	22	18				
14											
15	SANDY LEAN CLAY, a little gravel, gray, a 2" thick fine grained sand lenses at 15.6'		5	M	SS	24	19				
16											
17											
18											
19											
20			11	M	SS	17	17				
21											
22											
23											
24											
25			12	M	SS	23	19				
26											
	END OF BORING Northing=205644.7 Easting=553192.7										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

BORING COMPLETED: **7/6/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/6/07	12:50	11.5	9.5	9.5		8.6
7/6/07	1:05	26.5	24.5	26.4		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-172**

LOCATION: N: 205439.106, E: 553392.375 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: **7/9/07**
SCALE: **1" = 4'**

Elev. feet 925.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
924.6	0.5	FILL	FILL: Silty Sand, trace of Roots, dark brown, moist.					
918.1	7.0	FILL	FILL: Sandy Lean Clay, trace of Gravel, mixed light brown to brown, moist.	14 9	∇			
911.1	14.0	SC	CLAYEY SAND, Organic, dark gray, wet, soft to rather soft. (Swamp Deposit)	4 3 2		29	48	LL = 36 PI = 23
908.1	17.0	PT	PEAT, dark gray, soft. (Swamp Deposit)	3				
899.1	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, very soft to medium. (Glacial Till)	WH 6				

END OF BORING.

Water observed at 6 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-173**

LOCATION: N: 205433.823, E: 553574.478 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/9/07	SCALE: 1" = 4'

Elev. feet 942.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
941.9	1.0	SM	SILTY SAND, trace of Roots, dark brown, wet. (Topsoil)			
935.9	7.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown, moist, very stiff to hard. (Glacial Till)	19 46		 *NR Suspected Cobble or Boulder
920.9	22.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown to brown with gray and rust, wet, rather soft to rather stiff. (Glacial Till)	9 5 7 9 10		
916.9	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, very stiff. (Glacial Till)	17		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**	LOG OF BORING NO. **ST-174 (p. 1 of 1)**
PROJECT: **TCAAP Redevelopment; Arden Hills, MN**	

DEPTH IN FEET	SURFACE ELEVATION: 944.9 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sandy silt and sandy lean clay, a little gravel, possible cobbles, surface roots, trace roots, brown and light brown	FILL	15	M	SS	12	12				
2											
3			17	M	SS	3	13				
4											
5	SANDY LEAN CLAY, a little gravel, possible cobbles, trace roots, gray and brown mottled, a little light gray, very stiff, laminations of sandy silt (CL)	WEATHERED TILL	21	M	SS	19					
6							14				
7											
8	SANDY LEAN CLAY, a little gravel, apparent cobbles, trace roots, light grayish brown, a little brown, very stiff, laminations of sandy silt (CL) (possible fill)	TILL	27	M	SS	16	16				
9											
10			21	M	SS	NR					
11	CLAYEY SAND, a little gravel, grayish brown to gray, very stiff to stiff (SC)										
12											
13			21	M	SS	20	15				
14											
15			19	M	SS	18	16				
16											
17											
18											
19											
20			15	M	SS	18	16				
21											
22											
23											
24	CLAYEY SAND, a little gravel, apparent cobbles, brown and gray mottled, hard, laminations of sand with silt (SC)										
25			32	M	SS	20	13				
26											
	END OF BORING Northing=205436.5 Easting=553898.8										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-24½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	7/2/07	**10:10**	**26.5**	**24.5**	**26.4**		**None**	
BORING COMPLETED: **7/2/07**								
DR: **SG** LG: **SB** Rig: **91C**								

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-174** LOCATION: N: 205436.535, E: 553898.789 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/25/07**	SCALE: **1" = 4'**

Elev. feet 944.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
			Power Auger to 29 feet. No samples obtained.			
915.9	29.0	SM	SILTY SAND, fine-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till)	16		

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-174 (cont.)** LOCATION: N: 205436.535, E: 553898.789 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/25/07**	SCALE: **1" = 4'**

Elev. feet 912.9	Depth feet 32.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
			SILTY SAND, fine-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till) *(continued)*			
				31		
				27		
903.9	41.0		END OF BORING. Water not observed during drilling. Water not observed with 39 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-175 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 948.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand and silty sand, a little gravel, surface roots, trace roots, pieces of brick, brown and dark brown	FILL	18	M	SS	15	6				
3			18	M	SS	19					
3	SANDY LEAN CLAY, a little gravel, trace roots, brown, very stiff (CL)	TILL					11 11				
5	CLAYEY SAND, a little gravel, trace roots, brown, stiff (SC)		12	M	SS	17	12				
6	SANDY LEAN CLAY, a little gravel, trace roots, gray, stiff to hard (CL)						15 20				
8	CLAYEY SAND, a little gravel, brown, hard (SC)		30	M	SS	20					
10	CLAYEY SAND, a little gravel, brownish gray, stiff to firm, laminations of silty sand (SC)		10	M	SS	7	16				
13			8	M	SS	7	13				
15	LEAN CLAY WITH SAND, gray and brown mottled, firm, laminations of silty sand (CL)		7	▼ W	SS	16	31				
18	SANDY LEAN CLAY, a little gravel, gray, soft, laminations of brown silty sand (CL)										
20			8	M	SS	18	17				
23	SANDY LEAN CLAY, a little gravel, gray, soft (CL)										
25			7	M	SS	16	18				
	END OF BORING Northing=205434.5 Easting=554148.7										

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA							
	7/3/07	**8:45**	**16.5**	**14.5**	**15.4**		**15.1**
	7/3/07	**8:50**	**21.5**	**19.5**	**20.3**		**None**
BORING COMPLETED: **7/3/07**	**7/3/07**	**9:00**	**26.5**	**24.5**	**26.5**		**None**
DR: **SG** LG: **SB** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-176 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 951.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly sand with silt, a little gravel, surface roots, trace roots, brown	FILL	17	M	SS	8					
2	FILL, mixture of sand with silt and clayey sand, a little gravel, trace roots, brown, dark brown and gray										
3			23	M	SS	14					
4											
5			17	M	SS	3	16				
6											
7											
8			13	M	SS	10	13				
9											
10	LEAN CLAY WITH ORGANICS, trace roots, black and dark brown, stiff, laminations of silty sand (CL)	TOPSOIL	9	M	SS	17	13				
11							29				
12	SANDY LEAN CLAY, a little gravel, trace roots, gray, a little black, stiff to soft (CL)	WEATHERED TILL									
13			9	M	SS	16	20				
14											
15			3	M	SS	20	23				
16	SANDY LEAN CLAY, a little gravel, gray, soft to stiff (CL)	TILL					22				
17											
18											
19											
20			15	M	SS	22	18				
21											
22											
23	CLAYEY SAND WITH GRAVEL, gray (SC)										
24			50/0.3	M	SS	4	16				
	END OF BORING, Obstructed to SS at 24.8' Northing=205436.4 Easting=554397.8										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
6/29/07	**3:10**	**24.8**	**24.5**	**24.8**		**None**

BORING COMPLETED: **6/29/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-177 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **953.6**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and silty sand, a little gravel, surface roots, trace roots, piece of metal at 3", brown	FILL	28	M	SS	12					
2	FILL, mixture of sand with silt and clayey sand, a little gravel, trace roots, brown and gray										
3			40	M	SS	17	5				
4											
5			11	M	SS	18	8				
6											
7											
8			12	M	SS	17	11				
9											
10			16	M	SS	11	13				
11											
12											
13	CLAYEY SAND, trace roots, black and dark brown, a little gray, firm, laminations of silty sand (SC)	WEATHERED TILL OR TOPSOIL	6	M	SS	16	19				
14											
15	CLAYEY SAND, a little gravel, trace roots, gray and brown, stiff, laminations of sandy lean clay (SC)	TILL	10	M	SS	9	18				
16											
17											
18											
19											
20	CLAYEY SAND, a little gravel, brown and gray mottled, a little black, stiff, laminations of silty sand (SC)		12	M	SS	24	17				
21											
22											
23											
24											
25			14	M	SS	20	11				
26											
	END OF BORING Northing=205436.7 Easting=555146.5										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/3/07	**10:15**	**26.5**	**24.5**	**26.5**		**None**

BORING COMPLETED: **7/3/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-178 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 948.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#20
1	FILL, mostly silty sand, a little gravel, possible cobbles, brown and grayish brown	FILL	17	M	SS	6					
2											
3	FILL, mixture of sandy lean clay and clayey sand, a little gravel, possible cobbles, trace roots, brown and brownish gray		14	M	SS	18	11				
4											
5			9	M	SS	2	13				
6											
7											
8			27	M	SS	8	8				
9											
10	ORGANIC SILT, trace roots, black, wet, loose (OL)	SWAMP DEPOSIT	6	W	SS	14	47				
11	CLAYEY SAND, trace roots, dark brown, firm to soft, laminations of silty sand (SC)	WEATHERED TILL									
12							22				
13	CLAYEY SAND, gray, a little black, soft, laminations of sand (SC)		4	M	SS	15	20				
14											
15	CLAYEY SAND, a little gravel, trace roots, light gray, very soft (SC)	TILL	WH	M	SS	19	15				
16											
17											
18	CLAYEY SAND, a little gravel, gray, firm to stiff (SC)										
19											
20			6	M	SS	24	19				
21											
22											
23											
24											
25			15	M	SS	22	15				
26											
	END OF BORING Northing=205431.4 Easting=555363.5										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/3/07	11:50	26.5	24.5	26.5		None

BORING COMPLETED: 7/3/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-179** LOCATION: N: 205297.766, E: 553501.960 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/9/07**	SCALE: **1" = 4'**

Elev. feet 929.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
928.8	0.5	SM	SILTY SAND, trace of Roots, dark brown, wet. (Topsoil)			
925.3	4.0	SM	SILTY SAND, moist, stiff.	13		
915.3	14.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown to grayish-brown with rust and dark brown, wet medium to rather stiff. (Glacial Till)	8 8 8		
903.3	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium to rather stiff. (Glacial Till)	9 8 7 10		

END OF BORING.

Water not observed with 24 1/2 feet of hollow-stem auger in the ground.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-180** LOCATION: N: 205254.843, E: 553896.986 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/3/07	SCALE: 1" = 4'

Elev. feet 935.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
934.9	1.0	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
923.9	12.0	CL	SANDY LEAN CLAY, trace of Gravel, yellowish-brown to grayish-brown with rust at 5' sample depth, rather stiff tot very stiff. (Glacial Till)	18 12 14 16		
909.9	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff to stiff. (Glacial Till)	13 9 10 10		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-181**

LOCATION: N: 205262.130, E: 554099.221 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: 7/9/07

SCALE: 1" = 4'

Elev. feet 935.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
934.0	1.0	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
923.0	12.0	CL	SANDY LEAN CLAY, light brown, moit, rather stiff to very stiff. (Glacial Till)	11 15 19 19		
913.0	22.0	CL	SANDY LEAN CLAY, trace of Gravel, light brown to brown, wet, stiff to very stiff. (Glacial Till)	13 16 24		
909.0	26.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown to gray, stiff. (Glacial Till)	14		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **ST-182** LOCATION: N: 205241.842, E: 554395.289 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: 7/3/07
SCALE: 1" = 4'

Elev. feet 941.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
941.3	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
920.8	21.0	CL	SANDY LEAN CLAY, trace of Gravel, yellowish-brown to brown, rust lenses scattered, moist, very stiff to hard. (Glacial Till)	22 23 29 22 26 26 34		
915.8	26.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Till)	27		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

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LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **ST-183**

LOCATION: N: 205240.257, E: 554898.811 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/9/07**	SCALE: **1" = 4'**

Elev. feet 933.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
933.2	0.5	SM	SILTY SAND, trace of Roots, dark brown, moist. (Topsoil)			
915.7	18.0	CL	SANDY LEAN CLAY, light to brown seams of rust, wet rather soft to rather stiff. (Glacial Till)	9 8 6 4 6 5	▽	
907.7	26.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, waterbearing, medium dense. (Glaciofluvium)	12 16		

Sandy Lean Clay
0.5' to 18'

END OF BORING.

Water observed at 18 feet while drilling.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:44

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-184 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 942.1

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand, sand with silt and clayey sand, a little gravel, surface roots, trace roots, dark brown, brown and black	FILL	15	M	SS	14					
3			10	M	SS	1	9				
4				▽							
5	SILTY SAND, fine grained, brown and dark brown to brownish gray, wet, medium dense (SM)	COARSE ALLUVIUM	12	W	SS	16					
8			15	W	SS	15					
10	SANDY LEAN CLAY, a little gravel, brownish gray, stiff, laminations of waterbearing sand (CL)	TILL	9	M/W	SS	18	20				
13	CLAYEY SAND, a little gravel, gray, firm (SC)		7	M	SS	22	19				
15			6	M	SS	23	18				
20	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)		13	M	SS	21	15				
25	CLAYEY SAND, a little gravel, gray, very stiff (SC)		16	M	SS	18	14				
	END OF BORING Northing=205236.9 Easting=555364.5										

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/3/07	12:50	6.5	4.5	5.8		None
7/3/07	1:15	26.5	24.5	26.5		None

BORING COMPLETED: 7/3/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-1001-06 ST-185** LOCATION: N: 208603.970, E: 552291.002 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/24/07	SCALE: 1" = 4'

Elev. feet 901.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
			Redrill of Geo Probe Hole. Power Auger to 16 feet.			
885.0	16.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, medium. (Glacial Till)	7 7		
875.0	26.0		END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-1007-04 ST-186** LOCATION: N: 207579.028, E: 552738.508 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: 7/24/07
SCALE: 1" = 4'

Elev. feet 925.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
924.2	1.0	FILL	FILL: Silty Sand, fine-grained, dark brown, moist.			
922.2	3.0	FILL	FILL: Silty Sand, fine- to medium-grained, mixed with Lean Clay, brown, moist.	18		
918.2	7.0	FILL	FILL: Lean Clay, mixed with Silty Sand, brown, moist.	10		
916.2	9.0	SM	SILTY SAND, with Organic fines, black, moist. (Buried Topsoil)	8		
914.2	11.0	SM	SILTY SAND, fine- to coarse-grained, trace of Gravel, brown, wet, rather stiff. (Glacial Till)	9		
911.2	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, wet, medium. (Glacial Till)	8		
899.2	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather stiff to stiff. (Glacial Till)	9 13 9		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-1007-08 ST-187**

LOCATION: N: 208970.244, E: 552766.455 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/19/07**

SCALE: **1" = 4'**

Elev. feet 914.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
913.2	1.0	PT	PEAT, mixed with Sand, black, moist. (Swamp Deposit)			
902.2	12.0	CL	SANDY LEAN CLAY, trace of Gravel, brown with iron staining, moist, medium. (Glacial Till)	8 6 7 7		
888.2	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, moist to wet, medium to rather stiff. (Glacial Till)	11 10 7 7		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

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LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4003-03 ST-188**

LOCATION: N: 209408.636, E: 552935.915 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/23/07	SCALE: 1" = 4'

Elev. feet 918.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
917.7	0.3	PAV	3" of Bituminous			
914.0	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, dark brown, moist.	28		
907.0	11.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, medium to rather stiff. (Glacial Till)	7 9 12		
904.0	14.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, moist, stiff. (Glacial Till)	16		
899.0	19.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Till)	22	∇	
889.0	29.0	CL	LEAN CLAY, reddish-brown, wet to moist, medium to rather stiff. (Glacial Till)	9 8		* Water observed at 19 feet while drilling. Water not observed with 29 1/2 feet of hollow-stem auger in the ground.
887.0	31.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, dense. (Glacial Till)	36		Boring then grouted.
			END OF BORING. *			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:41

BRAUN℠
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LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4008-35 ST-189** LOCATION: N: 205755.343, E: 554523.702 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/17/07**

SCALE: **1" = 4'**

Elev. feet 952.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
951.5	0.7	SM	SILTY SAND, fine-grained, with Organic fines, dark brown, moist. (Topsoil)			
943.2	9.0	CL	SANDY LEAN CLAY, brown, moist, medium to rather stiff. (Glacial Till) With Gravel layer at 8 feet.	12 8 19		
940.2	12.0	CL	SANDY LEAN CLAY, trace of Gravel, brown with iron staining, moist, very stiff (Glacial Till)	18		
934.2	18.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, stiff. (Glacial Till)	14 15		
926.2	26.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, dense. (Glacial Till)	35 40		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4008-36 ST-190**

LOCATION: N: 205738.823, E: 554735.210 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/17/07**

SCALE: **1" = 4'**

Elev. feet 952.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
952.5	0.3	PAV	4" of Bituminous				
950.8	2.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace of Gravel, brown, moist.				
948.8	4.0	SC	CLAYEY SAND, gray with iron staining, moist, stiff. (Glacial Till)	16			
940.8	12.0	CL	SANDY LEAN CLAY, trace of Gravel, brown and gray with iron staining, wet, rather soft to medium. (Glacial Till)	6 6 5		15	
938.8	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown and gray with iron staining, wet, soft. (Glacial Till)	2			
929.8	23.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, medium to very stiff. (Glacial Till)	8 19			
926.8	26.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Till)	26			
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.				

Clayey Sand
2.0' to 4'
Sandy Lean Clay
4' to 12'

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4008-40 ST-191**

LOCATION: N: 205745.555, E: 555106.431 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/16/07**

SCALE: **1" = 4'**

Elev. feet 956.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
955.3	1.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Organic fines, dark brown, moist.			
952.3	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel and Roots, brown, moist.	33		
942.3	14.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, moist, loose to medium dense. (Glacial Till)	9 17 14 13		
930.3	26.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till)	23 34 25		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4008-42 ST-192** LOCATION: N: 205926.630, E: 555134.452 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: **7/16/07**
SCALE: **1" = 4'**

Elev. feet 959.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
953.1	6.0		Soil samples taken with Geoprobe to 6 foot depth.			
948.1	11.0	SM	SILTY SAND, fine-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Till)	16 29		
941.1	18.0	SP	POORLY GRADED SAND, fine- to medium-grained, brown,moist, loose to medium dense. (Glacial Outwash)	24 8		
938.1	21.0	SM	SILTY SAND, fine-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Till)	13		
933.1	26.0	SP	POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, brown,moist, medium dense. (Glacial Outwash)	26		
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4008-43 ST-193** LOCATION: N: 206148.097, E: 555162.879 See attached sketch.
DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr
DATE: **7/16/07**	SCALE: **1" = 4'**

Elev. feet 961.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
957.9	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Organic fines, trace of Gravel, dark brown, moist.	40		
945.9	16.0	SM	SILTY SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense to dense. (Glacial Till) Cobble at 10 1/2 feet. Cobbles at 13 feet.	17 44 38 37 33		
943.9	18.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, brown, moist, medium dense to dense. (Glacial Outwash)			
930.9	31.0	SP	POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, brown, moist, medium dense to dense. (Glacial Outwash)	34 16 30		* Water not observed during drilling. Water not observed with 29 1/2 feet of hollow-stem auger in the ground. Boring then grouted.
			END OF BORING. *			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP060587I.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4008-44 ST-194**

LOCATION: See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/16/07**

SCALE: **1" = 4'**

Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
0.5	FILL	FILL: Silty Sand, fine- to medium-grained, with Organics, dark brown, moist.			
	FILL	FILL: Sandy Lean Clay, brown, moist.	25		
4.0					
	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, reddish-brown, moist.	25		
		With trace of topsoil at 8 feet.	56		
9.0					
	SM	SILTY SAND, fine- to medium-grained, with Sand layers, trace of Gravel, reddish-brown, moist, very dense. (Glacial Till)	68		
			*		* 50 blows for 6 inches
			83		
16.0					
	SP	POORLY GRADED SAND, fine- to coarse-grained, trace of Gravel, brown, moist, dense. (Glacial Outwash)	32		
			35		
			33		* Water not observed during drilling.
28.0		END OF BORING. *			Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4009-06 ST-195** LOCATION: N: 206589.315, E: 553291.605 See attached sketch.
DRILLER: K. Keck METHOD: 3 1/4" HSA, Autohmr	DATE: **7/18/07** SCALE: **1" = 4'**

Elev. feet 942.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
941.9	0.3	PAV	3" of Bituminous				
937.7	4.5	FILL	FILL: Poorly Graded Sand with Silt, fine-grained, brown, moist.	8			
933.2	9.0	CL	SANDY LEAN CLAY, brown, wet, rather soft. (Lacustrine)	4 4		15	
930.2	12.0	CL	SANDY LEAN CLAY, trace of Gravel, brown with iron staining, moist, rather stiff. (Glacial Till)	10			
924.2	18.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown, moist, stiff to very stiff. (Glacial Till)	16 26			
921.2	21.0	CL	SANDY LEAN CLAY, trace of Gravel, grayish-brown, moist, very stiff. (Glacial Till)	17			
			END OF BORING. Water not observed during drilling. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Boring then grouted.				

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4009-07 ST-196**

LOCATION: N: 206407.349, E: 553441.134 See attached sketch.

DRILLER: K. Keck

METHOD: 3 1/4" HSA, Autohmr

DATE: **7/18/07**

SCALE: **1" = 4'**

Elev. feet 943.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
943.1	0.3	PAV	3" of Bituminous			
939.4	4.0	FILL	FILL: Poorly Graded Sand with Silt, fine-grained, brown, moist.			
936.4	7.0	FILL	FILL: Sandy Lean Clay, with topsoil chunks, olive, wet.	4		
931.4	12.0	CL	SANDY LEAN CLAY, brown with iron staining, wet, rather soft. (Lacustrine)	4 4		
925.4	18.0	CL	SANDY LEAN CLAY, trace of Gravel, brown and gray with iron staining, moist, rather soft to stiff. (Glacial Till)	5 8	▽	
922.4	21.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, wet, stiff. (Glacial Till)	13		

Fill (poorly graded sand) 0.3' to 4'
Fill (sandy lean clay) 4' to 7'
Sandy Lean Clay 7' to 21'

END OF BORING.

Water observed at 18 feet while drilling.

Boring then grouted.

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4009-08 ST-197** LOCATION: N: 206255.301, E: 553565.997 See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: **7/18/07**
SCALE: **1" = 4'**

Elev. feet 944.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
944.0	0.3	PAV	3" of Bituminous			
940.3	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, reddish-brown, moist.	11		
937.3	7.0	FILL	FILL: Sandy Lean Clay, trace of Gravel, brown, gray and olive, moist.	7		
935.3	9.0	OL	ORGANIC CLAY, black, wet. (Swamp Deposit)	2	∇	
933.3	11.0	SM	SILTY SAND, fine-grained, gray, waterbearing, very loose. (Lacustrine)	2		
930.3	14.0	CL	SANDY LEAN CLAY, gray with iron staining, wet, soft. (Lacustrine)	3		
923.3	21.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, wet, soft to medium. (Glacial Till)	3 6		

Fill (silty sand) 0.3' to 4'
Fill (sandy lean clay) 4' to 7'
Organic Clay 7' to 9'

END OF BORING.

Water observed at 9 feet while drilling.

Water down 9 feet with 19 1/2 feet of hollow-stem auger in the ground.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4009-09 ST-198** LOCATION: N: 206068.255, E: 553728.185 See attached sketch.
DRILLER: K. Keck / METHOD: 3 1/4" HSA, Autohmr	DATE: **7/17/07** / SCALE: **1" = 4'**

Elev. feet 944.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
944.1	0.3	PAV	4" of Bituminous					
		FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, brown, moist.					
				19				
				6				
			No sample recovery at 5 1/2 feet.					
936.4	8.0			1				
		FILL	FILL: Clayey Sand, gray, brown and olive, moist.					
				7		17	47	
				5		15		
930.4	14.0							
		CL	SANDY LEAN CLAY, with Organic fines, black, wet. (Swamp Deposit)					
				3				
925.4	19.0							
		CL	SANDY LEAN CLAY, gray, wet, soft. (Lacustrine)					
				3				
920.4	24.0							
		CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, very stiff. (Glacial Till)	19				
918.4	26.0							
			END OF BORING. Water not observed during drilling. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4009-10 ST-199**

LOCATION: N: 205827.000, E: 553879.890 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: 7/17/07	SCALE: 1" = 4'

Elev. feet 944.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
943.7	0.5	FILL	FILL: Silt, brown, moist.					
940.2	4.0	FILL	FILL: Sandy Lean Clay, brown, dry.	20				
937.2	7.0	FILL	FILL: Silty Sand, fine- to medium-grained, brown, moist.	4		7	20	
923.2	21.0	CL	SANDY LEAN CLAY, trace of Gravel, brown, wet, medium to stiff. (Glacial Till) No sample recovery at 20 1/2 feet.	8 7 7 11 16				

END OF BORING.

Water not observed during drilling.

Water not observed with 19 1/2 feet of hollow-stem auger in the ground.

Boring then grouted.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project SP-06-05871 **Geotecnical Evaluation** **TCAAP Redevelopment** **NE of Highway 10 and Highway 96** **Arden Hills, Minnesota**	BORING: **RI-4009-11 ST-200** LOCATION: N: 205748.933, E: 554156.383 See attached sketch.

DRILLER: K. Keck	METHOD: 3 1/4" HSA, Autohmr	DATE: **7/17/07**	SCALE: **1" = 4'**

Elev. feet 949.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
948.0	1.2	FILL	FILL: Silty Sand, fine- to medium-grained, trace of Gravel, dark brown, moist.			
945.2	4.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace of Gravel, brown, moist.	21		
935.2	14.0	FILL	FILL: Sandy Lean Clay, trace of Gravel and wood, brown to dark brown, wet.	8 7 5		
933.2	16.0	SC	CLAYEY SAND, black, wet. (Swamp Deposit)	4		
927.2	22.0	SC	CLAYEY SAND, gray, wet, soft. (Lacustrine)	2	∇	
923.2	26.0	CL	SANDY LEAN CLAY, trace of Gravel, gray, wet, rather soft. (Glacial Till)	2		
			END OF BORING. Water down 20 feet with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/2/07 14:42

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-201/AB- 1 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **956.8**

Fill 0' to 4.5'
Sandy Lean Clay 4.5' to 7'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1 2	FILL, mixture of silty sand and clayey sand, a little gravel, surface roots, trace roots, brown and dark brown	FILL	12	M	SS	7					
3 4	FILL, mixture of sand with silt and clayey sand, a little gravel, brown, a little gray and light brown		14	M	SS	17	7				
5 6	SANDY LEAN CLAY, a little gravel, brown, a little light brown and dark brown, stiff, laminations of silt and silty sand (CL)	WEATHERED TILL	14	M	SS	23	15				
7 8	SANDY LEAN CLAY, a little gravel, brown, a little light brown and dark brown, stiff, laminations of silt and silty sand (CL)	TILL	29	M	SS	16	8				
9 10 11 12 13 14	CLAYEY SAND, a little gravel, brown, a little light brown, very stiff, laminations of silt (SC)		24 21	M M	SS SS	18 22	7 7				
15 16 17 18	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, moist, dense (SP-SM)	COARSE ALLUVIUM	40	M	SS	7					
19 20 21 22 23 24 25 26 27 28	SAND WITH SILT, a little gravel, fine to medium grained, light brown, moist, medium dense to dense (SP-SM)		26 47	M M	SS SS	22 19					

DEPTH:	DRILLING METHOD
0-34½'	3.25" HSA

BORING COMPLETED: 7/26/07

DR: SG LG: BR Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/26/07	8:52	31.5	34.5	36.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-201/AB- 1 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
30	SAND WITH SILT, a little gravel, fine to medium grained, light brown, moist, medium dense to dense (SP-SM) *(continued)*		40	M	SS	24					
31											
32											
33											
34											
35			45	M	SS	20					
36											
	END OF BORING Northing=206215.3 Easting=554201.0										

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-202/AB- 2 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 955.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1 2	FILL, mostly silty sand, a little gravel, trace roots, brown	FILL	57	M	SS	7					
3	SANDY SILT, a little gravel, brown, moist, medium dense (ML)	TILL	24	M	SS	17	11				
4 5	CLAYEY SAND, a little gravel, brown, very stiff (SC)										
6 7	SILTY SAND, a little gravel, possible cobbles, fine to medium grained, brown, moist, medium dense (SM)		19	M	SS	15					
8	SAND, a little gravel, brown, moist, medium dense (SP) (possible fill)	COARSE ALLUVIUM	20	M	SS	16					
9	SAND WITH GRAVEL, medium grained, brown, moist, medium dense (SP)										
10 11	SAND WITH GRAVEL, possible cobbles, medium to fine grained, brown, moist, dense (SP)		37	M	SS	14					
12 13 14	GRAVEL WITH SAND, brown, moist, medium dense (GP)		27	M	SS	8					
15 16 17 18	SAND, fine to medium grained, light brown, moist, dense, laminations of silty sand (SP)		40	M	SS	14					
19 20 21 22 23	SAND, a little gravel, medium grained, light brown, moist, dense (SP)		43	M	SS	17					
24 25 26 27 28	SAND, a little gravel, fine to medium grained, light brown, moist, very dense (SP)		51	M	SS	18					

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-39½'	**3.25" HSA**	**7/26/07**	**10:55**	**41.5**	**39.5**	**41.0**		**None**

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **7/26/07**

DR: **SG** LG: **BR** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-202/AB- 2 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
30 31 32	SAND, a little gravel, medium to fine grained, light brown, moist, very dense (SP) *(continued)*		55	M	SS	19					
33 34 35 36 37	SAND, fine grained, light brown, moist, dense, laminations of silt (SP)		48	M	SS	18					
38 39 40 41	SAND WITH GRAVEL, medium grained, brown, moist, very dense (SP)		54	M	SS	19					
	END OF BORING Northing=206823.0 Easting=554162.7										

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-203/AB- 3 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: **954.4** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, surface roots, trace roots, dark brown	FILL	8	M	SS	14	10				
2	FILL, mostly clayey sand, a little gravel, trace roots, light brown, dark brown and brown										
3			13	M	SS	24	12				
4											
5	CLAYEY SAND, a little grave, brown, very stiff (SC)	TILL									
6			22	M	SS	17	11				
7											
8			27	M	SS	19	7				
9											
10											
11			28	M	SS	19	6				
12	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, moist, medium dense to very dense (SP-SM)	COARSE ALLUVIUM									
13			47	M	SS	10	7				
14											
15											
16			26	M	SS	14					
17											
18											
19											
20											
21			33	M	SS	16					
22											
23											
24											
25											
26			74	M	SS	12					
27											
28	SAND, medium to fine grained, brown, moist, medium dense to dense (SP)										

DEPTH:	DRILLING METHOD
0-49½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/27/07	2:47	51.5	49.5	51.5		None

BORING COMPLETED: **7/27/07**

DR: **SG** LG: **BR** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO. **ST-203/AB- 3 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
30	SAND, medium to fine grained, brown, moist, medium dense to dense (SP) *(continued)*										
31			24	M	SS	19					
32											
33											
34											
35											
36			39	M	SS	16					
37											
38	SAND WITH GRAVEL, fine to medium grained, light brown, moist, medium dense (SP)										
39											
40											
41			26	M	SS	17					
42											
43											
44											
45											
46			23	M	SS	20					
47											
48											
49											
50	SILTY CLAY, brown, very stiff (CL-ML)	FINE ALLUVIUM					19				
51	SAND WITH SILT, fine to medium grained, brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM	23	M	SS	16					
	END OF BORING Northing=206974.8 Easting=553863.2										

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-204/AB- 4 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 938.6 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, surface roots, trace roots, brown	FILL									
1			31	M	SS	10	7				
2	FILL, mixture of clayey sand, sandy lean clay and silty sand, a little gravel, trace roots, brown, light brown, dark brown and gray										
3			42	M	SS	18	9				
4											
5											
6			13	M	SS	17	19				
7											
8			2	M	SS	NR					
9											
10											
11			3	M	SS	9	14				
12				▽							
13			4	W	SS	12					
14											
15											
16			2	W	SS	17	17				
17											
18	CLAYEY SAND, a little sandy silt, a little gravel, brown, stiff (SC)	TILL	10	M	SS	17	19				
19											
20	SANDY LEAN CLAY, a little gravel, light brown, a little brown, stiff, laminations of silt (CL)										
21			11	M	SS	20	27				
22	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, a little dark brown, moist, very dense, lense of clayey sand at 24' very dense to medium dense (SP-SM)	COARSE ALLUVIUM									
23			52	M	SS	14					
24											
25											
26			22	M	SS	7					
27											
28											

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
0-34½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
	7/30/07	10:00	14.0	12.0	12.2		None
	7/30/07	10:30	36.5	34.5	36.5		None
BORING COMPLETED: 7/30/07							
DR: SG LG: SB Rig: 91C							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-204/AB- 4 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#20
	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, a little dark brown, moist, very dense, lense of clayey sand at 24' very dense to medium dense (SP-SM) *(continued)*	COARSE ALLUVIUM *(continued)*									
30											
			18	M	SS	13					
31											
32											
33											
34											
35											
			21	M	SS	12					
36											
	END OF BORING Northing=207058.0 Easting=553053.9										

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-205/AB- 5 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **937.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand and silty sand, a little gravel, surface roots, trace roots, brown and light brown	FILL	27	M	SS	12	6				
2											
3			39	M	SS	15	6				
4											
5	SILTY CLAY, brown, very stiff to hard (CL-ML)	FINE ALLUVIUM	22	M	SS	20	13				
6											
7											
8			17	M	SS	24	23				
9											
10			20	M	SS	24	18				
11											
12											
13			20	M	SS	24	17				
14											
15											
16	SAND WITH SILT AND GRAVEL, medium to fine grained, brown, moist, dense (SP-SM)	COARSE ALLUVIUM	33	M	SS	14	12				
17											
18											
19											
20											
21			47	M	SS	10					
22											
23	GRAVELLY SAND WITH SILT, medium to fine grained, brown, moist, dense to very dense (SP-SM)										
24											
25											
26			44	M	SS	10					
27											
28											

DEPTH:	DRILLING METHOD
0-44½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/30/07	8:50	46.5	44.5	46.4		None

BORING COMPLETED: 7/30/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO. **ST-205/AB- 5 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
30	GRAVELLY SAND WITH SILT, medium to fine grained, brown, moist, dense to very dense (SP-SM) *(continued)*		60	M	SS	14					
31											
32											
33											
34											
35			50+	M	SS	8					
36											
37											
38	SAND WITH SILT, fine to medium grained, brown, moist, very dense (SP-SM)										
39											
40			57	M	SS	16					
41											
42											
43											
44											
45			63	M	SS	17					
46											
	END OF BORING Northing=207537.6 Easting=553124.1										

AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-206/AB- 6 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **916.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, surface roots, trace roots, dark brown	FILL									
1			32	M	SS	14	5				
2	FILL, mixture of clayey sand and silty sand, a little gravel, trace roots, dark brown										
3			26	M	SS	13	12				
4	SANDY LEAN CLAY, a little gravel, gray and brown mottled, a little black, stiff, laminations of silt (CL)	WEATHERED TILL									
5			12	M	SS	17	18				
6											
7	SANDY LEAN CLAY, a little gravel, dark brown and brown mottled, stiff (CL)	TILL									
8			15	M	SS	20	18				
9											
10	SANDY LEAN CLAY, a little gravel, dark brown, very stiff (CL)		16	M	SS	22	16				
11											
12	SANDY LEAN CLAY, a little gravel, dark gray, stiff to very stiff (CL)										
13			15	M	SS	19	14				
14											
15			12	M	SS	20	15				
16											
17											
18											
19											
20			14	M	SS	22	16				
21											
22											
23											
24											
25			13	M	SS	24	16				
26											
27											
28											

DEPTH:	DRILLING METHOD
0-29½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/30/07	12:00	31.5	29.5	31.2		None

BORING COMPLETED: **7/30/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-206/AB- 6 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
30 31	SANDY LEAN CLAY, a little gravel, dark gray, stiff to very stiff (CL) *(continued)*	▨		18	M	☒	SS	23	13				
	END OF BORING Northing=207925.7 Easting=552804.2												

AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-207/AB- 7 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 908.5 MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand and silty sand, a little gravel, surface roots, trace roots, dark brown and brown		FILL	33	M	SS	12	4				
2												
3				22	M	SS	9	6				
4												
5	SANDY LEAN CLAY, a little gravel, dark brown, a little brown, stiff, laminations of silt (CL)	▨	TILL	15	M	SS	17	16				
6		▨										
7		▨										
8		▨		14	M	SS	18	17				
9	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL)	▨										
10		▨		10	M	SS	20	17				
11		▨										
12		▨										
13		▨		11	M	SS	20	15				
14		▨										
15		▨		10	M	SS	19	16				
16		▨										
17		▨										
18		▨										
19		▨										
20		▨		10	M	SS	20	16				
21		▨										
22		▨										
23		▨										
24		▨										
25		▨		10	M	SS	24	16				
26		▨										
	END OF BORING Northing=208187.8 Easting=552129.6											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	**3.25" HSA**	**7/30/07**	**1:30**	**26.5**	**24.5**	**24.9**		**None**	

BORING COMPLETED: **7/30/07**

DR: **SG** LG: **SB** Rig: **91C**

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00081

LOG OF BORING NO. ST-208/AB- 8 (p. 1 of 2)

PROJECT: TCAAP Redevelopment; Arden Hills, MN

SURFACE ELEVATION: 914.5

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and clayey sand, a little gravel, surface roots, trace roots, brown, dark brown and black	FILL	27	M	SS	12	4				
2											
3			16	M	SS	18	9				
4											
5	SANDY LEAN CLAY, a little gravel, light brown and gray, firm (CL)	WEATHERED TILL									
6			5	M	SS	17	19				
7											
8			7	M	SS	19	16				
9											
10	SANDY LEAN CLAY, a little gravel, brown, stiff (CL)	TILL									
11			10	M	SS	22	15				
12	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL)										
13			13	M	SS	22	15				
14											
15											
16			9	M	SS	20	15				
17											
18											
19											
20											
21			12	M	SS	23	15				
22											
23											
24											
25											
26			11	M	SS	24	16				
27											
28											

DEPTH:	DRILLING METHOD
0-34½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/30/07	2:35	36.5	34.5	36.3		None

BORING COMPLETED: 7/30/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-208/AB- 8 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#20
30	SANDY LEAN CLAY, a little gravel, dark gray, stiff (CL) *(continued)*						16				
31			14	M	SS	20					
32											
33											
34											
35							17				
36			14	M	SS	24					
	END OF BORING Northing=208345.2 Easting=552536.3										

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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO. **ST-209/AB- 9 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **892.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand with gravel, trace roots, brown	FILL									
1	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, brown, light brown, dark brown and black		36	M	SS	13	4				
2											
3			10	M	SS	16	11				
4											
5											
6			18	M	SS	16	6				
7	SAND WITH SILT, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM									
8			16	W/M	SS	14					
9				▼							
10											
11			7	W	SS	14					
12	SANDY LEAN CLAY, a little gravel, dark gray, firm to stiff (CL)	TILL									
13			6	M	SS	16	16				
14											
15											
16			9	M	SS	20	16				
17											
18											
19											
20											
21			9	M	SS	23	16				
	END OF BORING Northing=210352.9 Easting=552356.5										

DEPTH:	DRILLING METHOD
0-19½'	**3.25" HSA**

BORING COMPLETED: **7/31/07**

DR: **SG** LG: **SB** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/31/07	7:46	9.0	7.0	7.9		None
7/31/07	7:43	11.0	9.5	9.3		9.1
7/31/07	7:55	21.5	19.5	20.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO **ST-210/AB-10 (p. 1 of 1**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **898.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
1	FILL, mixture of silty sand and clayey sand, a little gravel, trace roots, pieces of brick, brown and dark brown	FILL	37	M	SS	15					
2											
3			11	M	SS	12					
4				▽							
5	SILT WITH ORGANICS, trace roots, black, loose (ML)	TOPSOIL									
6			5	W/M	SS	19	19				
	SILTY SAND, fine grained, trace roots, dark gray, waterbearing, loose to medium dense (SM)	COARSE ALLUVIUM									
7											
8			11	W	SS	2					
9											
10	SANDY LEAN CLAY, a little gravel, brown and gray mottled, a little dark brown, firm, laminations of silt (CL)	WEATHERED TILL									
11			6	W	SS	16	14				
12	SANDY LEAN CLAY, a little gravel, dark gray, stiff to very stiff (CL)	TILL									
13			9	M	SS	16	14				
14											
15											
16			9	M	SS	18	16				
17											
18											
19											
20											
21			20	M	SS	19	15				

END OF BORING
Northing=210578.9
Easting=553291.9

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

BORING COMPLETED: 7/31/07

DR: SG LG: SB Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/31/07	8:35	6.5	4.5	4.9		None
7/31/07	8:50	21.5	19.5	21.5		

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-211/AB-11 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **892.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand, clayey sand and sandy silt, surface roots, trace roots, brown, dark brown and gray	FILL	20	M	SS	15					
2											
3			14	M	SS	14					
4											
5											
6			12	M	SS	18	19				
7											
8			17	▼ W	SS	18	20				
9	SILTY CLAY, brown, very stiff (CL-ML)	FINE ALLUVIUM									
10	CLAYEY SAND, a little gravel, dark gray, stiff to firm (SC)	TILL									
11			10	M	SS	14	13				
12											
13			7	M	SS	21	15				
14											
15	SANDY LEAN CLAY, a little gravel, dark gray, stiff to firm (CL)										
16			9	M	SS	23	17				
17											
18											
19											
20											
21			8	M	SS	22	16				

END OF BORING
Northing=210737.1
Easting=552615.0

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/31/07	9:30	9.0	7.0	11.8		7.6
7/31/07	9:40	21.5	19.5	21.5		None

BORING COMPLETED: **7/31/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081** LOG OF BORING NO **ST-212/AB-12 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 895.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3.5" Bituminous pavement	FILL			SU						
1	FILL, mostly silty sand with gravel, brown		26	M	SS	14					
2	FILL, mixture of clayey sand and silty sand, a little gravel, organic clay, brown, dark brown, gray and black						5				
3			25	M	SS	15	10				
6			23	W/M	SS	16	11				
7				▼							
8			33	W	SS	NR					
10	SILT WITH ORGANICS, trace roots, black, moist, very loose (ML)	SWAMP DEPOSIT OR TOPSOIL	2	M	SS	17	25 23 26				
11	LEAN CLAY WITH ORGAINCS, trace roots, black, very soft to soft (CL)										
13	SILTY SAND, trace roots, fine grained, dark gray, waterbearing, loose (SM)	COARSE ALLUVIUM	5	W/M	SS	16	114				
16			9	W	SS	7					
18	CLAYEY SAND, a little gravel, dark gray, firm (SC)	TILL									
21			8	M	SS	16	17				

END OF BORING
Northing=211046.0
Easting=553106.0

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½'	**3.25" HSA**							
		7/31/07	**10:50**	**9.0**	**7.0**	**8.1**		**7.3**
		7/31/07	**11:10**	**21.5**	**19.5**	**19.5**		**18.9**
BORING COMPLETED: **7/31/07**								
DR: **SG** LG: **SB** Rig: **91C**								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-213/AB-13 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **890.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand, sandy silt and clayey sand, a little gravel, surface roots, trace roots, brown, dark brown and black	FILL	26	M	SS	16	4				
3			10	M	SS	16	9				
6	SAND WITH SILT, fine to medium grained, brownish gray, a little gray, waterbearing, loose, laminations of sandy silt (SP-SM)	COARSE ALLUVIUM	10	M	SS	16	18				
7				▼							
8	SILTY SAND, a little gravel, gray, a little dark gray, waterbearing, medium dense, lenses and laminations of lean clay and sandy lean clay (SM)		12	W	SS	14	24				
10	SANDY LEAN CLAY, a little gravel, dark gray, loose, lense of medium to fine grained silty sand at 10', laminations of sand with silt (CL)	TILL	8	M/W	SS	15	19				
13			3	M/W	SS	20	17				
16			4	M	SS	19	17				
21			4	M	SS	20	18				

END OF BORING
Northing=211044.1
Easting=552565.3

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/2/07	9:45	9.0	7.0	7.2		7.1
8/2/07	10:00	21.5	19.5	19.5		None

BORING COMPLETED: 8/2/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-214/AB-14 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **884.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sandy silt, clayey sand, silty sand and sand with silt, a little gravel, surface roots, trace roots, brown, dark brown, gray and black	FILL	51	M	SS	10	6				
2											
3			53	M	SS	19					
4											
5											
6			35	M	SS	20					
7											
8			19	M	SS	18					
9											
10	SAND WITH SILT, fine grained, gray, a little dark gray, waterbearing, medium dense, laminations of silty sand (SP-SM)	COARSE ALLUVIUM									
11			WH	W	SS	17					
12											
13	SILTY SAND, trace roots, fine grained, dark gray, a little black, waterbearing, loose, lense of organic clay at 15.5' (SM)		5	▼ W	SS	14					
14											
15	SAND WITH SILT, fine grained, gray, waterbearing, medium dense (SP-SM)										
16			12	W	SS	17					
17	SAND WITH SILT AND GRAVEL, medium to fine grained, dark gray, waterbearing, medium dense (SP-SM)										
18											
19	SANDY LEAN CLAY, a little gravel, gray, firm (CL)	TILL									
20											
21			6	M	SS	15	18				
	END OF BORING Northing=211075.3 Easting=551748.2										

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/2/07	8:15	11.5	9.5	9.5		None
8/2/07	8:20	14.0	12.0	12.0		None
8/2/07	8:25	16.0	14.5	14.5		12.7
8/2/07	8:30	21.5	19.5	19.5		18.7

BORING COMPLETED: 8/2/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**　　LOG OF BORING NO **ST-215/AB-15 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	SURFACE ELEVATION: 894.5 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, surface roots with silty sand, dark brown	FILL									
1	FILL, mostly sand with silt, a little gravel, trace roots, light brown		5	M	SS	1	11				
2											
3			21	M	SS	0					
4											
5	FILL, mixture of silty sand, clayey sand and sandy lean clay, a little gravel, trace roots, dark brown, brown, light brown and gray										
6			9	M	SS	12					
7											
8			9	M	SS	14	15				
9	LEAN CLAY, trace roots, organics, black, a little dark gray, stiff, laminations of silty sand (CL)	TOPSOIL		▽							
10			9	M	SS	15	21				
11	SILTY SAND, a little gravel, fine to medium grained, gray, a little dark gray, waterbearing, loose, laminations of lean clay (SM)	COARSE ALLUVIUM									
12											
13			17	W	SS	12					
14											
15											
16			16	W	SS	5					
17											
18	SANDY LEAN CLAY, a little gravel, gray, firm (CL)	TILL		▼							
19											
20											
21			5	M	SS	16	17				

END OF BORING
Northing=211443.2
Easting=553634.2

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

BORING COMPLETED: 8/1/07

DR: SG　LG: SB　Rig: 91C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/1/07	12:15	11.5	9.5	9.9		9.3
8/1/07	12:34	21.5	19.5	20.0		18.3

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-216/AB-16 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **895.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3" Bituminous pavement	FILL			SU						
1	FILL, mostly silty sand with gravel, brown		32	M	SS	14	8				
2–3	FILL, mixture of clayey sand, sandy lean clay and silty sand, a little gravel, pieces of concrete, brown, dark brown, gray and black		36	M	SS	17	8				
6			46	M	SS	15	6				
8			26	M	SS	17					
11			11	M ▽	SS	16	15				
12	ORGANIC CLAY, trace roots, black, stiff (OL/OH)	SWAMP DEPOSIT									
13	ORGANIC CLAY, trace roots, pieces of wood, black, a little gray, stiff, laminations of silty sand (OL/OH)		15	W	SS	18	74				
15	SAND WITH SILT, fine grained, gray, waterbearing, medium dense to very loose (SP-SM)	COARSE ALLUVIUM									
16			7	W	SS	19					
21			3	M	SS	17	16				
	CLAYEY SAND, a little gravel, dark gray, soft (SC)	TILL									

END OF BORING
Northing=211426.9
Easting=553105.1

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/1/07	11:00	11.5	9.5	11.8		None
8/1/07	11:10	14.0	12.0	12.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: **8/1/07**

DR: **SG** LG: **SB** Rig: **91C**

06/04

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-217/AB-17 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 899.3

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#20
1	CLAYEY SAND, surface roots, trace roots, dark brown, moist, medium dense (SC)	TOPSOIL	14	M	SS	15					
2	SAND WITH SILT, fine grained, light brown, a little brown, moist, medium dense, laminations of silt (SP-SM)	COARSE ALLUVIUM									
3			17	M	SS	16					
4											
5	SAND WITH SILT, fine grained, gray, a little brown, waterbearing, medium dense, laminations of silt (SP-SM)										
6			28	▼ M/W	SS	15					
7											
8	CLAYEY SAND, a little gravel, dark gray, firm (SC)	TILL	8	M	SS	14	13				
9											
10	CLAYEY SAND, a little gravel, brown, stiff (SC)										
11			10	M	SS	13	14				
12											
13	CLAYEY SAND, a little gravel, dark gray, firm to stiff (SC)		8	M	SS	17	15				
14											
15											
16			10	M	SS	16	16				
17											
18											
19											
20											
21			11	M	SS	24	15				
	END OF BORING Northing=211423.6 Easting=552556.4										

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/2/07	9:00	9.0	7.0	7.0		3.3
8/2/07	9:10	21.5	19.5	20.9		None

BORING COMPLETED: **8/2/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-218/AB-18 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: 885.7

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mixture of sand with silt and silty sand, a little gravel, trace roots, brown, light brown and dark brown	FILL	22	M	SS	4					
3			20	M	SS	16					
6			6	M	SS	18					
8	SILTY SAND, fine to medium grained, brownish gray, waterbearing, loose (SM)	COARSE ALLUVIUM	10	W	SS	17					
11	SANDY LEAN CLAY, a little gravel, brown, a little light brown, firm, laminations of silty sand (CL)	TILL	7	M	SS	18	17				
13	CLAYEY SAND, a little gravel, dark gray, stiff (SC)		9	M	SS	19	13				
16			10	M	SS	17	15				
21			9	M	SS	24	16				

END OF BORING
Northing=211416.5
Easting=552009.6

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/1/07	2:05	9.0	7.0	7.4		None
8/1/07	2:20	21.5	19.5	19.8		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: 8/1/07

DR: SG LG: SB Rig: 91C

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-219/AB-19 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **891.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	SILTY SAND, surface roots, trace roots, light brown and brown, moist, dense (SM)	TOPSOIL	37	M	SS	15					
2	SAND WITH SILT, fine grained, brown, moist, loose to medium dense (SP-SM)	COARSE ALLUVIUM									
3			18	M	SS	14					
4											
5											
6			9	M	SS	16					
7											
8			18	M	SS	18					
9											
10											
11			16	M	SS	18					
12	SILTY SAND, fine grained, grayish brown, a little brown, waterbearing, medium dense, laminations of silt (SM)										
13			14	W	SS	16					
14											
15				▼							
16			23	W	SS	14					
17											
18	SAND WITH SILT, fine grained, gray, waterbearing, dense (SP-SM)										
19											
20											
21			31	W	SS	19					
22											
23											
24											
25											
26			36	W	SS	21					

END OF BORING
Northing=211642.1
Easting=551067.3

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/30/07	12:15	14.0	12.0	12.5		None
7/30/07	12:25	16.5	14.5	15.0		15.0
7/30/07	1:00	26.5	24.5	24.5		23.1

BORING COMPLETED: 7/30/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-220/AB-20 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **897.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	SILTY SAND WITH GRAVEL, surface roots, trace roots, light brown, brown and dark brown, moist, medium dense (SM)	TOPSOIL	18	M	SS	14					
2	SILTY SAND, fine grained, brown, moist, medium dense (SM)	COARSE ALLUVIUM									
3			20	M	SS	14					
4											
5											
6			19	M	SS	14					
7	SAND WITH SILT, fine grained, light brown, moist, medium dense (SP-SM)										
8			17	M	SS	20					
9											
10											
11			14	M	SS	19					
12											
13			10	M	SS	18					
14											
15	SILTY SAND, fine grained, brown, waterbearing, medium dense to loose (SM)										
16			15	W	SS	17					
17											
18				▼							
19											
20											
21			7	W	SS	16					
22											
23											
24	SILT, gray, wet, medium dense (ML)	FINE ALLUVIUM									
25											
26			12	W	SS	17	30				
27											
28											
		COARSE ALLUVIUM									

DEPTH:	DRILLING METHOD
0-29½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/1/07	9:05	16.5	14.5	14.6		None
8/1/07	9:10	21.5	19.5	19.5		17.8
8/1/07	9:25	31.5	29.5	29.5		26.3

BORING COMPLETED: 8/1/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00081

LOG OF BORING NO ST-220/AB-20 (p. 2 of 2)

PROJECT: TCAAP Redevelopment; Arden Hills, MN

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
30 31	SILTY SAND, fine grained, gray, waterbearing, very loose (SM) *(continued)*	▨	COARSE ALLUVIUM *(continued)*	4	W	☒	SS	20					
	END OF BORING Northing=211992.3 Easting=550710.8												

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-221/AB-21 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **899.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1 2	SILTY SAND, a little gravel, surface roots, trace roots, brown, dark brown and black, moist, medium dense (SM)	TOPSOIL	19	M	SS	16					
3 4 5	SILTY SAND, fine grained, brown, moist, loose to medium dense (SM)	COARSE ALLUVIUM	9	M	SS	15					
6 7			13	M	SS	18					
8 9 10	SAND WITH SILT, fine grained, light brown, moist, loose (SP-SM)		10	M	SS	17					
11 12			9	M	SS	18					
13 14			9	M	SS	20					
15 16 17	SILT WITH SAND, light brown, a little brown, wet, medium dense, laminations of lean clay (ML)	FINE ALLUVIUM	17	W	SS	17	26				
18 19 20	SILTY SAND, fine grained, brown, waterbearing, loose (SM)	COARSE ALLUVIUM		▼							
21 22 23			10	W	SS	17					
24 25 26	CLAYEY SAND, a little gravel, dark gray, stiff (SC)	TILL	9	M	SS	8	15				

Silty Sand 0' to 7'
Sand w Silt 7' to 17'
Silty Sand 17' to 23'

END OF BORING
Northing=212465.7
Easting=550556.0

DEPTH:	DRILLING METHOD
0-24½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/1/07	7:55	16.5	14.5	14.5		None
8/1/07	8:00	21.5	19.5	19.2		18.3
8/1/07	8:10	26.5	24.5	24.5		23.9

BORING COMPLETED: **8/1/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-222/AB-22 (p. 1 of 1)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

Fill (silty sand) 0' to 7'
Fill (clayey sand) 7' to 9.5'
Sand w Silt 9.5' to 14.5'
Silty Sand 14.5' to 21'

DEPTH IN FEET	SURFACE ELEVATION: 898.6 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, a little gravel, trace roots, dark brown	FILL	21	M	SS	15					
3			7	M	SS	14					
6			4	M	SS	16					
7 – 9	FILL, mixture of clayey sand and silty sand, trace roots, brown and light brown		9	M	SS	14	11				
10 – 11	SAND WITH SILT, fine grained, trace roots, light brown and brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM	14	M	SS	16					
12 – 14	SAND WITH SILT, fine grained, light brown, moist, medium dense (SP-SM)		27	M	SS	19					
15 – 16	SILTY SAND, fine grained, brown, waterbearing, medium dense to loose (SM)		30	W/M	SS	24					
19				▼							
21			6	W	SS	16					

END OF BORING
Northing=212964.6
Easting=550545.4

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/31/07	3:22	21.5	19.5	20.0		18.9

BORING COMPLETED: 7/31/07

DR: SG LG: SB Rig: 91C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/04

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-223/AB-23 (p. 1 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

SURFACE ELEVATION: **908.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, surface roots, trace roots, pieces of wood at 5', brown, light brown and dark brown	FILL	27	M	SS	15					
2											
3			10	M	SS	12					
4											
5											
6			4	M	SS	12					
7											
8			3	M	SS	13					
9											
10	SAND WITH SILT, fine grained, light brown, a little brown, moist, loose to medium dense, laminations of silt (SP-SM)	COARSE ALLUVIUM									
11			5	M	SS	15					
12											
13			17	M	SS	17					
14											
15											
16			9	M	SS	17					
17											
18											
19											
20											
21			27	M	SS	19					
22											
23	SAND, fine to medium grained, light brown, a little brown and gray, moist, medium dense, laminations of silt and silty sand (SP)										
24											
25											
26			17	M	SS	16					
27											
28											

Fill (silty sand) 0' to 9.5'
Sand w Silt 9.5' to 23'
Sand 23' to 33'

DEPTH:	DRILLING METHOD
0-34½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/31/07	2:15	31.5	29.5	29.5		28.9
7/31/07	2:25	36.5	34.5	34.5		33.9

BORING COMPLETED: **7/31/07**

DR: **SG** LG: **SB** Rig: **91C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00081**

LOG OF BORING NO **ST-223/AB-23 (p. 2 of 2)**

PROJECT: **TCAAP Redevelopment; Arden Hills, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#20
30	SAND, fine to medium grained, gray, waterbearing, loose (SP) *(continued)*										
31			9	W	SS	17					
32											
33	CLAYEY SAND, a little gravel, dark gray, firm (SC)	TILL									
34											
35											
36			6	M	SS	23	18				

END OF BORING
Northing=213465.1
Easting=550540.6

LOG OF BORING

Braun Project SP-06-05871
Geotecnical Evaluation
TCAAP Redevelopment
NE of Highway 10 and Highway 96
Arden Hills, Minnesota

BORING: **RI-4009-5 ST-224**
LOCATION: See attached sketch.

DRILLER: K. Keck
METHOD: 3 1/4" HSA, Autohmr
DATE: **7/18/07**
SCALE: **1" = 4'**

Elev. feet 938.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
938.3	0.3	PAV	3" Bituminous.			
934.6	4.0	FILL	FILL: Clayey Sand, fine- to medium-grained, trace of Gravel, mixed dark brown to grayish-brown, moist.	21		
932.6	6.0	CL	SANDY LEAN CLAY, trace of Roots, dark gray, moist, rather stiff to stiff. (Buried Topsoil)	13		
929.6	9.0	CL	SANDY LEAN CLAY, reddish-brown, moist. (Glacial Till)	56		
926.6	12.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, yellowish-brown, moist, loose. (Glaciofluvium)	6		
915.6	23.0	CL	SANDY LEAN CLAY, trace of Gravel, reddish-brown to grayish-brown, moist to wet, rather soft to rather stiff. (Glacial Till)	5 4 10		
912.6	26.0	SP	POORLY GRADED SAND, fine- to medium-grained, trace of Gravel, reddish-brown, moist, medium dense. (Glacial Outwash)	19		
			END OF BORING. Water not observed with 24 1/2 feet of hollow-stem auger in the ground. Boring then grouted.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG OF BORING SP0605871.GPJ BRAUN.GDT 10/4/07 13:53

Appendix C

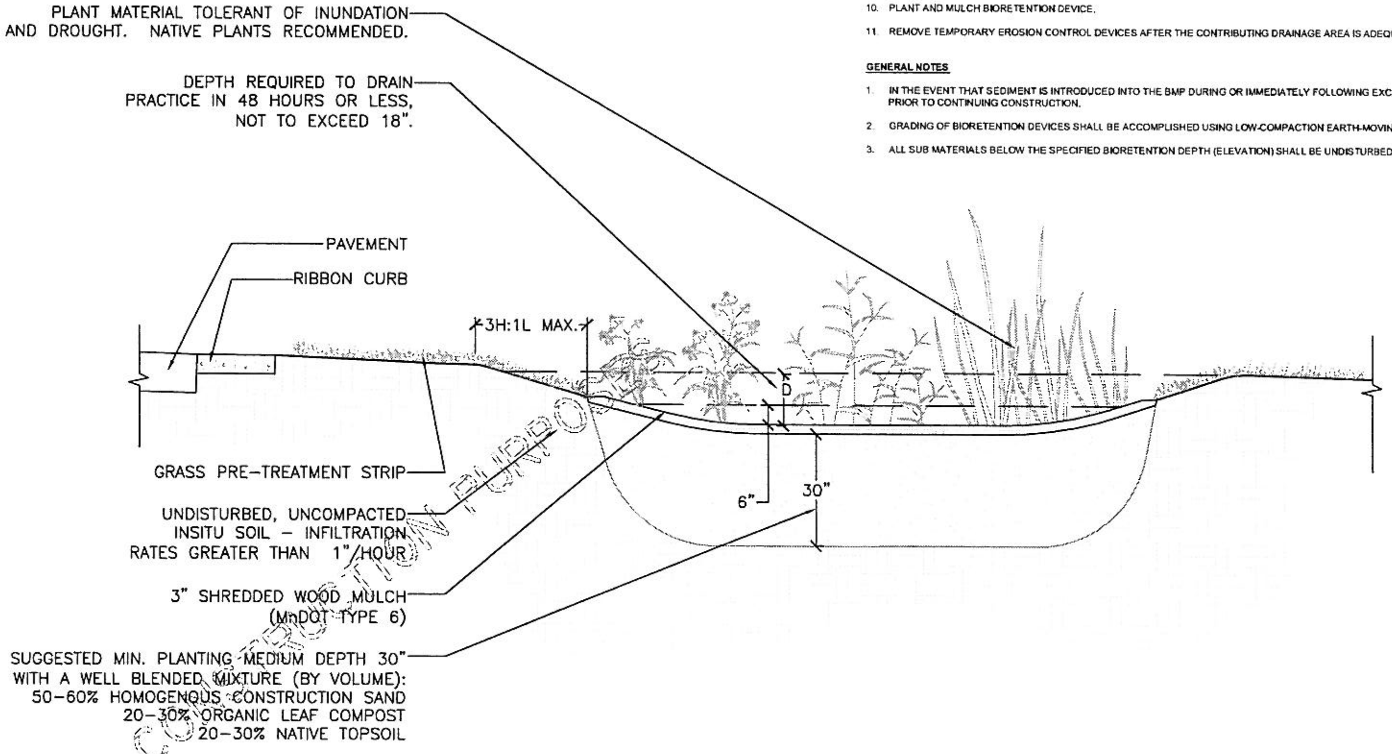
Infiltration Basins
(Minnesota Stormwater Manual)

CONSTRUCTION SEQUENCING

1. INSTALL SILT FENCE AND/OR OR OTHER APPROPRIATE TEMPORARY EROSION CONTROL DEVICES TO PREVENT SEDIMENT FROM LEAVING OR ENTERING THE PRACTICE DURING CONSTRUCTION.
2. ALL DOWN-GRADIENT PERIMETER SEDIMENT CONTROL BMP'S MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND DISTURBING ACTIVITY BEGINS.
3. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
4. INSTALL UTILITIES (WATER, SANITARY SEWER, ELECTRIC, PHONE, FIBER OPTIC, ETC) PRIOR TO SETTING FINAL GRADE OF BIORETENTION DEVICE.
5. ROUGH GRADE THE SITE. IF BIORETENTION AREAS ARE BEING USED AS TEMPORARY SEDIMENT BASINS LEAVE A MINIMUM OF 3 FEET OF COVER OVER THE PRACTICE TO PROTECT THE UNDERLYING SOILS FROM CLOGGING.
6. PERFORM ALL OTHER SITE IMPROVEMENTS.
7. SEED AND MULCH ALL AREAS AFTER DISTURBANCE.
8. CONSTRUCT BIORETENTION DEVICE UPON STABILIZATION OF CONTRIBUTING DRAINAGE AREA.
9. IMPLEMENT TEMPORARY AND PERMENATE EROSION CONTROL PRACTICES.
10. PLANT AND MULCH BIORETENTION DEVICE.
11. REMOVE TEMPORARY EROSION CONTROL DEVICES AFTER THE CONTRIBUTING DRAINAGE AREA IS ADEQUATELY VEGETATED

GENERAL NOTES

1. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL SHALL BE REMOVED FROM THE PRACTICE PRIOR TO CONTINUING CONSTRUCTION.
2. GRADING OF BIORETENTION DEVICES SHALL BE ACCOMPLISHED USING LOW-COMPACTION EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF UNDERLYING SOILS.
3. ALL SUB MATERIALS BELOW THE SPECIFIED BIORETENTION DEPTH (ELEVATION) SHALL BE UNDISTURBED, UNLESS OTHERWISE NOTED.



INFILTRATION/ RECHARGE FACILITY CROSS–SECTION

NOT TO SCALE

NO.	REVISION DESCRIPTION	DATE	BY

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota

Print Name:

Sign Name:

Date ______ License No.

Date

Designed By

Drawn By

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194
Phone: (651) 296-6300
TTY (651) 282-5332
WEBSITE: www.pca.state.mn.us

2005 MINNESOTA
STORMWATER
MANUAL

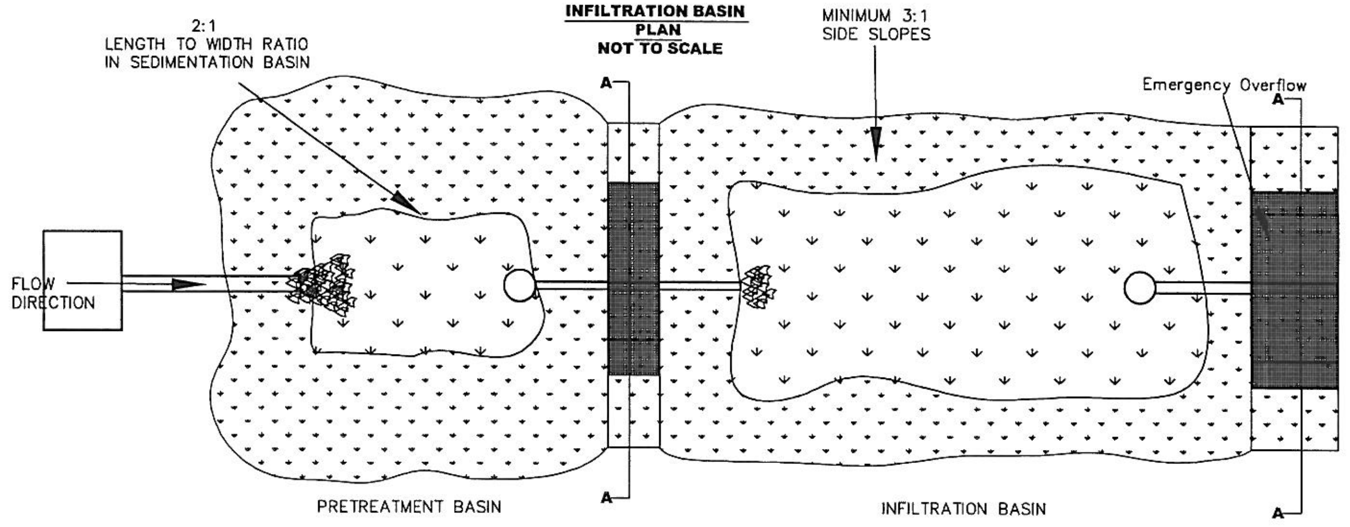
BIORETENTION
INFILTRATION/
RECHARGE
FACILITY

Sheet No.

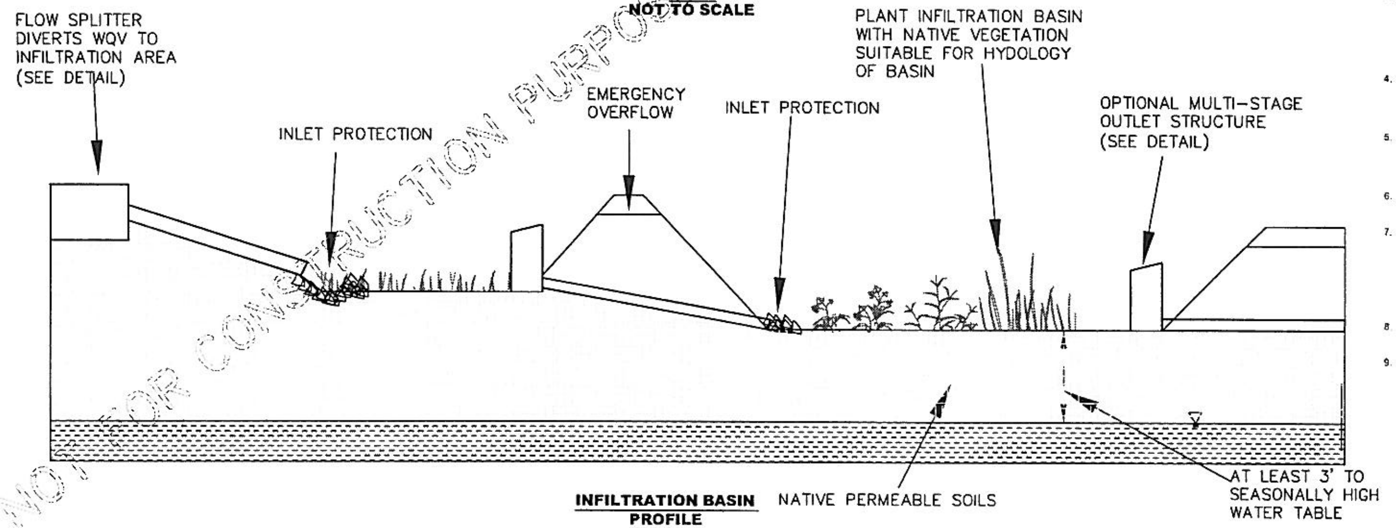
of

Sheets

INFILTRATION BASIN
PLAN
NOT TO SCALE



INFILTRATION BASIN
PLAN
NOT TO SCALE



INFILTRATION BASIN
PROFILE
NOT TO SCALE

CONSTRUCTION SEQUENCING:

1. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
3. ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPS MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS
4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
7. SEED AND MULCH DISTURBED AREAS ON SITE.
8. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
9. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPS INTO CONSIDERATION.
10. FINAL GRADE THE SITE.
11. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
12. INSTALL THE EROSION CONTROL BLANKET
13. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

GENERAL NOTES:

1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
3. IF THE STORMWATER BMP IS BEING DESIGNED TO SERVE AS A TEMPORARY SEDIMENT BASIN, GRADE THE BMP TO WITHIN THREE (3) FEET OF FINAL GRADE TO PROTECT THE UNDERLYING MATERIAL FROM CLOGGING. ONCE CONSTRUCTION IN THE CONTRIBUTING DRAINAGE AREA HAS BEEN COMPLETED AND THE SITE IS STABILIZED, EXCAVATE THE INFILTRATION BASIN TO FINAL GRADE AND COMPLETE CONSTRUCTION OF THE BMP.
4. GRADING OF THE INFILTRATION BASIN SHALL BE ACCOMPLISHED USING LOW-IMPACT EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF THE UNDERLYING SOILS. SMALL TRACKED DOZERS AND BOBCATS WITH RUNNER TRACKS ARE RECOMMENDED
5. EXCAVATE THE INFILTRATION BASIN TO THE SPECIFIED DEPTH (ELEVATION). IT IS RECOMMENDED THAT ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
6. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
7. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE BASIN PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. SEDIMENT THAT HAS BEEN WASHED INTO THE BASIN DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
8. SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.
9. INFILTRATION AREA SHALL BE STAKED OFF DURING CONSTRUCTION TO RESTRICT HEAVY EQUIPEMENT TRAFFIC FROM COMPACTING NATIVE SOILS

BY	DATE	REVISION DESCRIPTION	NO.

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota

Print Name:

Sign Name:

Date _____ License No._____

Date

Designed By

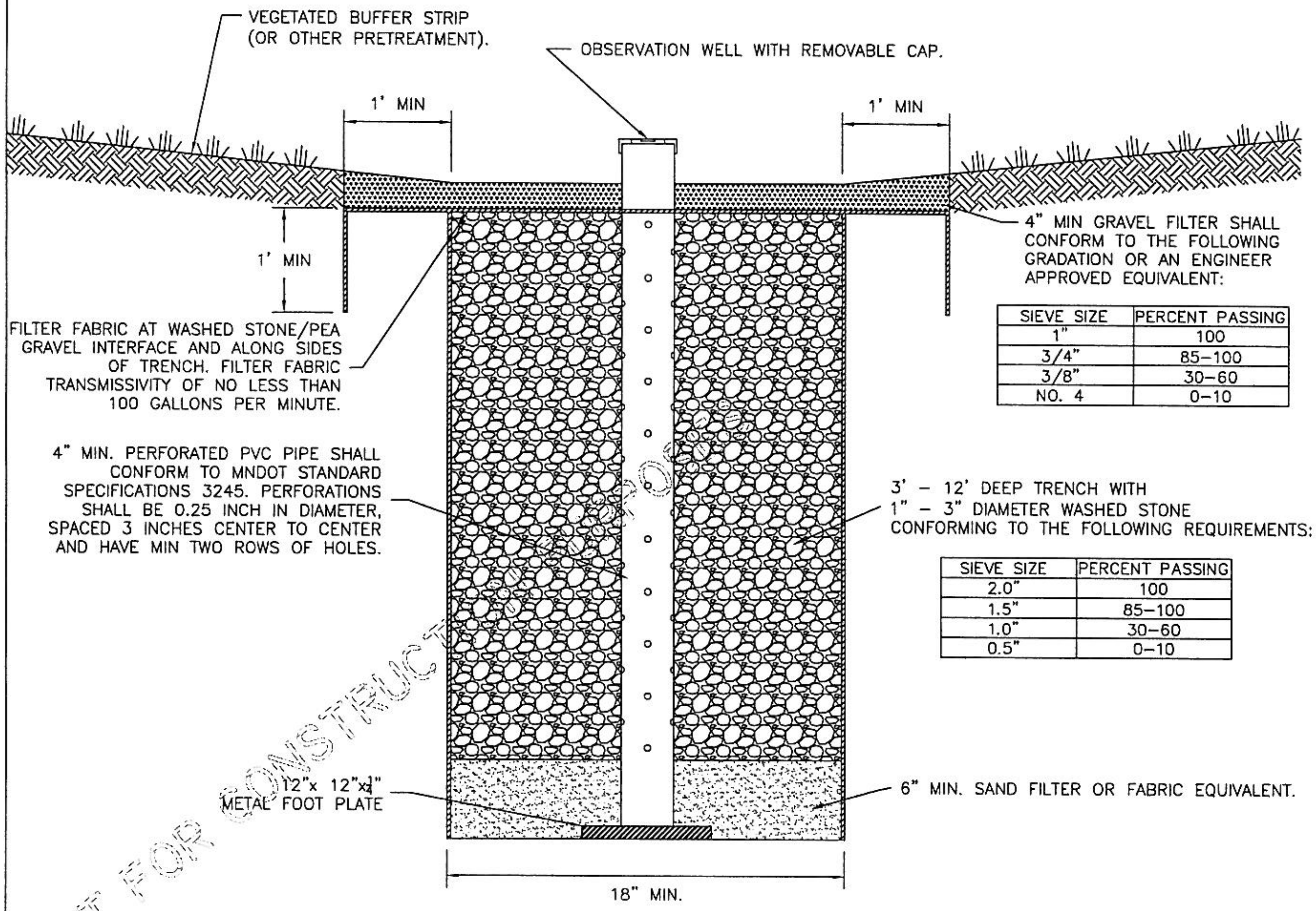
Drawn By

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul MN 55155-4194
Phone: (651) 296-6300
TTY: (651) 282-5332
WEBSITE: www.pca.state.mn.us

2005 MINNESOTA
STORMWATER
MANUAL

INFILTRATION BASIN
PLAN AND PROFILE

Sheet No. of Sheets



SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	85–100
3/8"	30–60
NO. 4	0–10

SIEVE SIZE	PERCENT PASSING
2.0"	100
1.5"	85–100
1.0"	30–60
0.5"	0–10

TYPICAL INFILTRATION TRENCH CROSS-SECTION

NOT TO SCALE

CONSTRUCTION SEQUENCING:

1. PERFORM CONTINUOUS INSPECTION OF EROSION CONTROL PRACTICES.
2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
3. ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPS MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
6. ROUGH GRADE THE SITE. IF THE INFILTRATION TRENCH IS GOING TO BE USED FOR TEMPORARY SEDIMENT CONTROL, GRADE THE INFILTRATION TRENCH TO WITHIN THREE (3) FEET OF FINAL GRADE TO PREVENT CLOGGING OF INSITU SOIL.
7. SEED AND MULCH DISTURBED AREAS ON SITE.
8. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPS INTO CONSIDERATION.
9. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPS INTO CONSIDERATION.
10. FINAL GRADE THE SITE.
11. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
12. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

GENERAL NOTES:

1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO SITE DISTURBANCE.
2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES
3. IF THE STORM WATER BMP IS BEING DESIGNED TO SERVE AS A TEMPORARY SEDIMENT BASIN, GRADE THE BMP TO WITHIN THREE (3) FEET OF FINAL GRADE TO PREVENT CLOGGING OF INSITU SOIL. ONCE CONSTRUCTION IN THE CONTRIBUTING DRAINAGE AREA HAS BEEN COMPLETED AND THE SITE IS STABILIZED, EXCAVATE THE INFILTRATION TRENCH TO FINAL GRADE AND COMPLETE CONSTRUCTION OF THE INFILTRATION TRENCH.
4. GRADING OF THE INFILTRATION TRENCH SHALL BE ACCOMPLISHED USING LOW-IMPACT EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF THE UNDERLYING SOILS. WIDE TRACKED VEHICLES SUCH AS BACK HOES, SMALL DOZERS AND BOBCATS ARE RECOMMENDED.
5. EXCAVATE THE INFILTRATION TRENCH TO THE SPECIFIED DEPTH (ELEVATION). ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
6. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
7. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THE SEDIMENT WILL NEED TO BE REMOVED FROM THE INFILTRATION TRENCH PRIOR TO INITIATING THE NEXT STEP IN THE INFILTRATION TRENCH CONSTRUCTION PROCESS.
8. MATERIAL EXCAVATED FROM THE INFILTRATION TRENCH SHALL BE DISPOSED OF ON-SITE AT LOCATIONS (TEMPORARY STOCKPILE AREAS) DESIGNATED BY ENGINEER.
9. CLEAN, WASHED 1 TO 3-INCH GRAVEL SHALL BE PLACED IN THE BOTTOM OF THE INFILTRATION TRENCH TO THE DEPTH SPECIFIED IN THE CONSTRUCTION DOCUMENTS. GRAVEL SHOULD BE PLACED IN LIFTS AND LIGHTLY COMPACTED WITH PLATE COMPACTORS.

NO.	REVISION DESCRIPTION	DATE	BY

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota

Print Name:

Sign Name:

Date ________ License No.________

Date

Designed By

Drawn By

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul MN 55155-4194
Phone: (651) 296-6300
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WEBSITE www.pca.state.mn.us

2005 MINNESOTA STORMWATER MANUAL

TYPICAL INFILTRATION TRENCH CROSS-SECTION

Sheet No.
of
Sheets

Minnesota Pollution Control Agency

Operation and maintenance of Infiltration basin

Effective long-term performance of infiltration practices requires an infiltration management plan (*HIGHLY RECOMMENDED*) and performance monitoring (*HIGHLY RECOMMENDED*).

Warning: Dedicated and routine maintenance schedule with clear guidelines and schedules are *REQUIRED*

The infiltration management plan (operation plan) should address the following items:

- periods of inundation;
- wet/dry cycling of soils; and
- operating instructions for drawdown valves gates and removable weirs.

The monitoring plan should address the following items:

- inspection and efficiency assessment;
- water quality monitoring; and
- monitoring of groundwater elevations, long-term infiltration capacity and plant tolerances.

Elements to be considered for the development of a maintenance plan are broken into the following categories:

- Design Phase Maintenance Considerations;
- Construction Phase Maintenance Considerations; and
- Post-Construction Maintenance Considerations.

In general terms, the most frequently cited maintenance concern for infiltration practices is clogging caused by organic matter and fine silts. Common operational problems include:

- clogging and sediment deposition;
- erosion of contributing land or in channels leading to the practice; and
- maintaining appropriate surface vegetation.

The table below provides a summary of common problems for infiltration trenches and basins.

Summary of infiltration practices cost components.
Link to this table

Implementation Stage	Primary Cost Components	Basic Cost Estimate	Other Considerations
Site Preparation	Tree & plant protection	Protection Cost ($/acre) * Affected Area (acre)	Removal of existing structures, topsoil removal and stockpiling

Implementation Stage	Primary Cost Components	Basic Cost Estimate	Other Considerations
Site Formation	Infiltration area protection	Silt fence cost ($/'foot) * Perimeter of infiltration area	Soil & rock fill material, tunneling
	Clearing & grubbing	Clearing Cost ($/acre) * Affected Area (acre)	
	Topsoil salvage	Salvage Cost ($/acre) * Affected Area	
	Excavation / grading	X-ft Depth Excavation Cost ($/acre) * Area (acre)	
	Hauling material offsite	Excavation Cost * (% of Material to be hauled away)	
Structural Components	Vault structure (for underground infiltration)	($/structure)	Pipes, catchbasins, manholes, valves, vaults
	Media (for infiltration trenches)	Media cost ($/cubic yard) * filter volume (cubic yard)	
	Geotextile	Geotextile cost ($/cy) * area of trench, including walls	
	inlet structure	($/structure)	
	Overflow structure	($/structure)	
	Observation well	($/structure)	
Site Restoration	Soil preparation	Topsoil or amendment cost ($/acre) * Area (acre)	Tree protection, soil amendments, seed bed preparation, trails
	Seeding	Seeding Cost ($/acre) * Seeded Area (acre)	
	Filter strip	Sod cost ($/square foot) * filter strip area	
	Planting / transplanting	Planting Cost ($/acre) * Planted Area (acre)	
Annual Operation, Maintenance, and Inspection	Sediment removal	Removal Cost ($/acre) * Area (acre) * Frequency (1 time per 5 years)	Vegetation maintenance, cleaning of structures
	Debris removal	Removal Cost ($/acre) * Area (acre) * Frequency (2 time per year)	
	Inspection	Inspection Cost ($) * Inspection Frequency (6 times per year)	
	Mowing (for some vegetative filters)	Mowing Cost ($) * Mowing Frequency (6 times per year)	

Contents

Design phase maintenance considerations

Implicit in the design guidance in the previous sections is the fact that many design elements for infiltration systems can minimize the maintenance burden and maintain pollutant removal efficiency.

- Open lawn areas are *RECOMMENDED* locations for infiltration practices because of their accessibility.
- It is *HIGHLY RECOMMENDED* that every dry well, infiltration trench and subsurface infiltration system design include an observation well consisting of an anchored 6-inch diameter perforated PVC pipe fitted with a cap to facilitate periodic inspection and maintenance. It is also *HIGHLY RECOMMENDED* that infiltration basins include a draw down device that can be used for winter diversion and to conduct regular maintenance.
- It is *HIGHLY RECOMMENDED* that a mechanism such as a multi-stage outlet structure be incorporated into the design of the pre-treatment and infiltration practices to facilitate draining for maintenance purposes.
- It is *RECOMMENDED* that a minimum of 3 soil borings or pits be dug in the same location as the proposed infiltration practice.

Warning: It is *REQUIRED* that a way to visually verify proper system operation be installed with each infiltration practice.
Warning: Providing easy access (typically 8 feet wide) to infiltration practices for routine maintenance is *REQUIRED*

Construction phase maintenance considerations

Infiltration practices are particularly vulnerable during the construction phase for two reasons. First, if the construction sequence is not followed correctly, construction sediment can clog the practice. In addition, heavy construction can result in compaction of the soil, which can then reduce the soil’s infiltration rate. For this reason, a careful construction sequence needs to be followed. Critical construction elements for infiltration practices are shown in the following table.

Infiltration Trench and infiltration basin - Construction inspection checklists.
Link to this table
To access an Excel version of form (for field use), click here.

Project:
Location:
Site Status:

Date:
Time:
Inspector:

Construction Sequence	Satisfactory / Unsatisfactory	Comments
1. Pre-Construction		
Pre-construction meeting		
Runoff diverted		
Soil permeability verified		
Groundwater / bedrock verified		
Project benchmark established		
Facility location staked out		
Temporary erosion and sediment control established		
2. Excavation		
Size and location per plans		
Side slopes stable		
Depth adjusted to soil layer with specified soil type and permeability		
Sub-soil not adjacent to excavation area and stabilized with vegetation and/ or silt fence		
Stockpile location not adjacent to excavation area and stabilized with vegetation and/ or silt fence		
3. Filter Fabric Placement		
Fabric per specifications		
Fabric per specifications		
Placed per plan location		
4. Aggregate Material		
Size as specified		
Clean / washed material		
Placed properly		
5. Observation Well		
Pipe size per plans		
Under-drain installed per plans		
Inlet installed per plans		
Pre-treatment devices installed per plans		
6. Vegetation		
Complies with planting specifications		
Topsoil complies with composition and placement in specifications		
Permanent erosion control measures in place		
7. Final Inspection		
Dimensions per plans		
Check dams operational		
Inlet / outlet operational		
Effective stand of vegetation and stabilization		

Contributing watershed stabilized before flow is routed to the facility
Comments:

Actions to be taken:

Avoid excessive compaction

Warning: It is *REQUIRED* that in order to prevent soil compaction, the proposed infiltration area be staked off and marked during construction to prevent heavy equipment and traffic from traveling over it.

In addition, it is *HIGHLY RECOMMENDED* that the side walls of dry wells and infiltration trenches be roughened if they have been smeared by heavy equipment.

Stabilize vegetation before and after construction

Excessive sediment loadings can occur without the use of proper erosion and sediment control practices during the construction process.

Warning: It is *REQUIRED* that upland drainage areas be properly stabilized with a thick layer of vegetation, particularly immediately following construction, to reduce sediment loads.
Warning: If infiltration practices are in-place during construction activities, it is *REQUIRED* that sediment and runoff be kept away the infiltration area, such as with diversion berms and soil-stabilizing vegetation around the perimeter of the practice.

Correctly install filter fabrics

Large tree roots should be trimmed flush with the sides of dry wells and infiltration trenches to prevent puncturing or tearing of the filter fabric during subsequent installation procedures. When laying out the geotextile, the width should include sufficient material to compensate for perimeter irregularities in the dry well or trench and for a 6-inch minimum top overlap. The filter fabric itself should be tucked under the sand layer on the bottom of the dry well of infiltration trench, and stones or other anchoring objects should be placed on the fabric at the trench sides to keep the excavation open during windy periods. Voids may occur between the fabric and the excavated sides of the practice. Natural soils should be placed in any voids to ensure fabric conformity to the excavation sides.

Carefully finish final grading

Initial infiltration basin excavation should be carried to within 2 feet of the final elevation of the basin floor.

Warning: It is *REQUIRED* that infiltration systems not be excavated to final grade until the contributing drainage area has been constructed and fully stabilized.

The final phase excavation should remove all accumulated sediment and be done by light tracked equipment to avoid compaction of the basin floor and provide a well-aerated, highly porous surface texture.

Keep infiltration practices “Off-line” until construction is complete

Warning: It is *REQUIRED* that sediment and runoff be kept completely away from the infiltration area during construction. Thus, infiltration practices should never serve as sediment control devices during site construction.

It is *HIGHLY RECOMMENDED* that construction of sediment practices be suspended during snowmelt or rainfall, in order to prevent soil smearing, clumping, or compaction.

Establish permanent vegetation

- Establishing dense vegetation on the basin side slopes is *HIGHLY RECOMMENDED*, to reduce erosion and sloughing and
- Provide a natural means of maintaining relatively high infiltration rates. Vegetative cover at inflow points to the basin is also *HIGHLY RECOMMENDED* to provide erosion protection and reduce sediment accumulation. The use of native grasses is *RECOMMENDED* for seeding primarily due to their adaptability to local climates and soil conditions.
- Inspections during construction are needed to ensure that the infiltration practice is built in accordance with the approved design and standards and specifications. Detailed inspection checklists should be used that include sign-offs by qualified individuals at critical stages of construction to ensure that the contractor’s interpretation of the plan is acceptable to the designer.

Post-construction operation and maintenance

Warning: A maintenance plan clarifying maintenance responsibility is *REQUIRED*.

Effective long-term operation of infiltration practices necessitates a dedicated and routine maintenance schedule with clear guidelines and schedules. Some important post-construction maintenance considerations are provided below.

- A legally binding and enforceable maintenance agreement should be executed between the practice owner and the local review authority.
- Adequate access must be provided for all infiltration practices for inspection, maintenance, and landscaping upkeep, including appropriate equipment and vehicles.
- General infiltration trench maintenance activities and schedule are provided in the tables below.

Typical maintenance problems for infiltration trenches and basins.
Link to this table

Problem	Practices Applied To	Comments
Clogging, sediment deposition	Both	Key issue for infiltration practice. Requires vigilant inspection and maintenance.
Surface Vegetation	Both	

		Often important to maintain vigorous growth at the base of infiltration practices (basins). Important to restrict woody vegetation from the surface of infiltration trenches.
Erosion of contributing land or in channels leading to practice	Both	In these practices, it is important to monitor not only the practice itself, but also upland infiltration to minimize the sediment load.
Damage to filter fabric	Trench	Infrequent but important maintenance concern.
Scouring at Inlet	Both	Similar issues to Ponds. Need to promote non-erosive flows that are evenly distributed
Access Issues	Both	Similar issues to Ponds. Need access for inspection and maintenance.
Concrete Failure	Basins, if they include a riser structure	Similar issues to ponds and wetlands.
Problems with the Embankment	Basins	Similar issues to dry ponds.

Typical maintenance activities for infiltration trenches and infiltration basins.
Link to this table

Activity	Schedule
Replace pea gravel/topsoil and top surface filter fabric (when clogged).	As needed
Ensure that contributing area, practice and inlets are clear of debris.	
Ensure that the contributing area is stabilized.	
Remove sediment and oil/grease from pre-treatment devices, as well as overflow structures.	Monthly
Mow grass filter strips should be mowed as necessary. Remove grass clippings.	
Repair undercut and eroded areas at inflow and outflow structures	
Inspect pre-treatment devices and diversion structures for sediment build-up and structural damage. Remove trees that start to grow in the vicinity of the trench.	Semi-annual Inspection
Disc or otherwise aerate basin bottom. De-thatch basin bottom.	Annually
Scrape basin bottom and remove sediment. Restore original crosssection and infiltration rate. Seed or sod to restore ground cover.	Every 5 years
Perform total rehabilitation of the trench to maintain design storage capacity. Excavate trench walls to expose clean soil	Upon Failure

Related pages

- Overview for Infiltration basin
- Design criteria for Infiltration basin

- Construction specifications for Infiltration basin
- **Operation and maintenance of Infiltration basin**
- Cost-benefit considerations for Infiltration basin
- External resources for Infiltration basin
- References for Infiltration basin

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Appendix D

Site K Infiltration Analysis

Technical Memo

WENCK ASSOCIATES
Responsive partner.
Exceptional outcomes.

To:	Ms. Shanna Schmitt, Project Manager Minnesota Pollution Control Agency VIC Program 520 Lafayette Road St. Paul, Minnesota 55155-4194	Ms. Amy Hadiaris, Technical Analyst Minnesota Pollution Control Agency VIC Program 520 Lafayette Road St. Paul, Minnesota 55155-4194

From: Pamela Massaro, Wenck Associates, Inc.

Copy: Beth Engum, Ramsey County Public Works
Rick Kubler, Gray Plant Mooty
Rick Van Allen, Bay West, PG
Joe Otte, Wenck Associates, Inc.
Jon Horn, PE, Kimley Horn
Tom Lincoln, PE, Kimley Horn
Beth Kunkel, Kimley Horn
Jon Libby, Kimley Horn

Date: August 3, 2015

Subject: Site K Infiltration Analysis

Attachments: Bay West's Proposed Actions Letter dated February 4, 2015
Exhibits from the Comprehensive Stormwater Management Plan
Exhibit from the Fiscal Year 2013 Annual Performance Report

As follow up to Bay West's letter dated February 4, 2015 and the meeting held on March 18, 2015 at Ramsey County Public Works, this memorandum presents the additional information regarding the proposed development. The purpose of this memorandum is to document:

- The predicted infiltration contributing to the surficial aquifers in the vicinity of the Installation Restoration Program (IRP) Site K before the start of the redevelopment project (circa 2012) and at the end of the redevelopment project (circa, TBD); and
- The measures prescribed in the comprehensive stormwater management planning process to limit impacts on the remaining impacted surficial groundwater associated with Site K after the current demolition and remediation efforts.

Background and 2012 conditions:

The first stage of the Rice Creek Commons (formerly Twin Cities Army Ammunition Plant) redevelopment Project consists of demolition and remediation activities on the 427-acres of land (Site), described in the lease/purchase agreements. On April 9, 2013, the MPCA issued a No Association Determination (NAD) to Ramsey County for demolition, remediation and redevelopment activities. Wenck submitted a Site plan and NAD request on behalf of Ramsey County on September 16, 2014. This NAD request was subsequently followed by a supplemental NAD request with more detailed Site stormwater construction plans in a letter prepared by Bay West dated February 4, 2015. Ramsey County now seeks a NAD for additional redevelopment activities at the Site, as described in Bay West's February 4, 2015 letter.

Demolition and remediation are nearing completion and have involved removal and off-site disposal of soils (above groundwater) from areas investigated and determined to have contaminants of concern above applicable MPCA Tier 1 Soil Reference Values (SRVs) and Soil Leaching Values (SLVs). Upon completion of the remaining cleanup activities, a Certificate of Completion is contemplated, as are modifications to the Uniform Environmental Covenant and Easement and Land Use Control Remedial Design, which, among other things, currently restrict the Site to industrial uses. For more information, you can visit the website (ricecreekcommons.com). There are many documents related to Site-wide environmental remediation available under the “Due Diligence” and “Documents for Developers” weblinks.

This memorandum assumes the predevelopment conditions for the site to be those existing in 2012, before commencement of demolition, cleanup and other redevelopment activities. In 2012, the Site included open space, buildings, roads, utilities, no engineered infiltration devices, and two operating groundwater remediation systems. The surficial geology on (**Exhibit 1**) shows the extent of the surficial aquifer (Unit 1), the extent to which the glacial till (aquitard) is exposed at the surface (Unit 2) and where the underlying (Unit 3) Hillside/Arsenal Sand aquifer is exposed at the surface. As part of the several decades of investigation and remediation at the Site, the geology is well documented.

The entire Site is underlain by bedrock and Unit 3 deep below the surface. Unit 2 also underlies the entire site, and varies in thickness, is exposed at the surface (in areas shown on **Exhibit 1**), and where it is present, prevents surface infiltration from recharging Unit 3. Unit 2 is not present east of the Site, where Unit 3 is exposed at the surface. **Exhibits 2** and **3** display the conceptual geologic layering below the surface at the Site in a cross-sectional view. The groundwater levels and flow directions in Unit 1 and Unit 3 have been extensively monitored and mapped. **Exhibit 4** shows the groundwater gradient for Unit 1 based on 1987 data. Where there are not Unit 1 groundwater gradients mapped it is assumed that the Unit 1 aquifer does not exist. As is evident on **Exhibit 4**, the Unit 1 aquifer is not continuous across the Site.

In the vicinity of former building 103 (IRP Site K) and former building 102 the groundwater flows in a north/northwesterly direction (respectively) toward Rice Creek. Just south and west of former building 102, Unit 1 groundwater also flows northwesterly toward Rice Creek. Subsequent annual groundwater monitoring, published in the Annual Performance Reports (APRs), prepared by the U.S. Army as required by the USEPA/MPCA, confirms the discontinuous extent and general groundwater flow directions as shown on **Exhibit 4**. **Exhibit 5** shows the 2012 groundwater gradient in the IRP Site K area, which is consistent in its direction toward Rice Creek as published in 1987.

Using LiDAR data and information available on soils, land use, and storm sewers (on Site in 2012), the predevelopment condition subwatersheds were delineated (**Exhibit 6**). The 2012 drainage break is the dividing line for surface hydrology and stormwater conveyance that sends drainage from the southern portion of the Site to Round Lake, while the remainder of the Site drains to Rice Creek. **Exhibit 6** also shows flow arrows representing stormwater flow directions. The 2012 drainage break roughly corresponds to the northern extent of the glacial till (aquitard) exposed at the surface (Unit 2). It is believed that the aging storm sewer infrastructure historically leaked stormwater, increasing infiltration where the bedding was above the groundwater table. The storm sewer bedding material may also have intermittently acted as a french drain causing localized groundwater dewatering during periods of elevated near surface groundwater. Prior to demolition and remediation activities, it is estimated that subwatersheds 16, 20, 21, 23 and 24 (**Exhibit 6**) were influencing and feeding the near surface groundwater tributary to the former building 102 and 103 plumes (**Exhibit 7**).

Exhibit 7 displays the areas proposed to be excluded from stormwater reintroduction (Bay West's February 4, 2015 letter). One area is associated with former Building 502 (Site I) and the other is the area of former Buildings 102 and 103. Stormwater infiltration BMPs located directly above the plumes would not mobilize contamination, since the soils are being remediated to meet Tier 1 SRVs and applicable SLVs above the groundwater table. The remaining shallow plumes (below the vadose zone) in these areas could be affected by increased volumes of stormwater causing the plumes to be diluted with clean water or change the residence time of the plume reaching the receiving waterbody. We are taking the conservative approach in the comprehensive stormwater management planning process to prevent stormwater from the redevelopment to be infiltrated in these areas shown on **Exhibit 7**.

Since TCE is heavier than water and has a low solubility value, TCE is classified as a dense nonaqueous phase liquid, or DNAPL. This class of chemicals will tend to sink through the water column (both surface and ground) until they encounter a barrier that is sufficiently impermeable to stop them. The glacial till (Unit 2) below Unit 1 in the vicinity of Site K (former building 103) and former building 102, acts as a barrier between the surficial aquifer (Unit 1) and the underlying Hillside/Arsenal Sand aquifer. Furthermore this area is excluded from stormwater reintroduction. Both Unit 1 and Unit 2 are labeled in the attached **Exhibit 8** for Site K (former building 103 plume) from the APR final report.

Proposed Ultimate Development:

The proposed fully developed Site plan (**Exhibit 9**) is only conceptual in nature at this time, leaving final design for various parts of the Site to developers. Stormwater ponds are necessary to meet the Rice Creek Watershed District's requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control). Each subwatershed's runoff is routed individually and directed to a pond and stormwater control structure, or drains directly to the receiving waterbody (**Exhibit 10**). The stormwater pond bottoms will be constructed to minimize infiltration utilizing techniques such as specifying compaction over the entire pond bottom. There are many examples in the seven-county metro area of failed infiltration BMPs due to unintentional compaction. Even unintentional compaction resulting from construction equipment driven over an infiltration trench can limit the infiltration rate of a stormwater BMP and compromise success. It is therefore reasonable to assume that intentional compaction of the stormwater pond bottoms would limit infiltration of the redevelopment stormwater into the underlying Unit 1 surficial groundwater table.

Based on the Master Plan land use designations, the impervious acreage was estimated using SCS TR-55 guidance (e.g., commercial areas assumed to be 85% impervious, etc.). The Site was modeled using HydroCAD for both 2012 and proposed fully-developed conditions to predict hydrology and hydraulic routing of stormwater. Wenck reviewed available soil borings in locations of the proposed ponds to estimate infiltration rates of the stormwater ponds. There is an increase in total area flowing to Rice Creek through a combination of onsite infiltration and wet detention ponds. **Table 1** compares the drainage areas and area-weighted average of runoff characteristics (in terms of curve number) of the subwatersheds identified as influencing and feeding the near surface groundwater tributary to IRP Site K for the 2012 Site conditions and the proposed fully developed Site conditions.

Table 1: Summary of subwatersheds

Subwatersheds	Scenario	Total Area (acres)	Areas of Impervious (Acres)	Composite CN
16, 20, 21, 22, 23, 24	2012 Conditions	120.7	52.1	84
15, 16,17, 26	Proposed Fully-Developed Conditions	113.3	46.9	78

Generally, the near surface groundwater flows tend to mimic the hydrologic subwatersheds. As was previously stated, prior to demolition and remediation activities subwatersheds 16, 20, 21, 23 and 24 (**Exhibit 6**) were influencing and feeding the near surface groundwater tributary to the former building 102 and 103 plumes (**Exhibit 7**).

When the Site has achieved the proposed full developed conditions in the Master Plan (**Exhibit 9**), it is estimated that subwatersheds 26, 15, 16 and 17 (**Exhibit 10**) would potentially influence and feed the near surface groundwater tributary to Site K (**Exhibit 7**). Stormwater from subwatersheds 8, 9, 10, 11, 12, 13 and 14 are routed individually and directed to ponds with compacted bottoms that limit infiltration. The stormwater ponds are a treatment system in series that reduce total suspended solids and total phosphorus are controlled by an outlet control structure. Stormwater from subwatershed 18 is planned to be centrally collected and infiltrated. At this location the near surface groundwater flows to the northwest toward Rice Creek, thus not influencing the near surface groundwater tributary to Site K.

Table 2 presents HydroCAD predicted surface infiltration to Unit 1 in the vicinity of Site K for four different precipitation events: the 1-inch, the two-year 24-hour, the 10-year 24-hour, and the 100-year 24-hour. The HydroCAD model predicts less infiltration in the area tributary to IRP Site K for proposed development conditions as compared to 2012 (predevelopment) conditions.

Table 2: Predicted infiltration in the vicinity of IRP Site K

		Infiltration Predicted (acre-ft)			
			100-year 24-hour	10-year 24-hour	2-year 24-hour
Subwatersheds	**Scenario**	**1-inch**	**7.31-inch**	**4.22-inch**	**2.82-inch**
16, 20, 21, 22, 23, 24	2012 Conditions	8.3	18.7	16.4	15.3
15, 16,17, 26	Proposed Fully Developed Conditions	5.5	15.1	12.6	10.5

Conclusions:

Based on modeling completed to support the comprehensive stormwater management planning and steps taken to ensure the regulatory requirements of federal, state and local water resource regulations are met, the fully developed conditions planned for Rice Creek Commons result in no increase in infiltration in the vicinity of Site K. The following points are important assumptions for this conclusion:

- The groundwater flow direction in the vicinity of Site K has not changed direction since mapped in 1987, as supported in subsequent annual publications of APRs.
- The ongoing groundwater treatment activity at IRP Site K continues to be effective based upon monitoring as documented in the draft 2014 APR (note that the stormwater utilities were removed in 2014).
- The redevelopment comprehensive stormwater management plan will not allow stormwater to be infiltrated through the use of engineering infiltration BMPs in the vicinity of Site K, as shown on **Exhibit 7**.
- Stormwater pond bottoms will be compacted to limit infiltration to Unit 1 groundwater.
- Redevelopment will include routing of stormwater to ponds with compacted bottoms that limits infiltration.
- Native soils (Type C and D soils with low permeability) naturally constrain infiltration on Site.
- Remediation efforts (including the removal and off-site disposal of vadose zone soils) will have cleaned up the soils above the groundwater table in Unit 1, so that redevelopment stormwater will pass through clean soils above the Unit 1 groundwater table.
- TCE at IRP Site K is a dense chemical that tends to sink through the Unit 1 groundwater and Unit 2 is acting as a barrier to further migration.

ATTACHMENT A

Bay West
Customer-Focused Environmental & Industrial Solutions

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February 4, 2015

Ms. Shanna Schmitt, Project Manager
Minnesota Pollution Control Agency
VIC Program
520 Lafayette Road
St. Paul, Minnesota 55155-4194

Ms. Amy Hadiaris, Technical Analyst
Minnesota Pollution Control Agency
VIC Program
520 Lafayette Road
St. Paul, Minnesota 55155-4194

Subject: **Proposed Actions Letter and Request for No Association Determination**
TCAAP Infrastructure Development
Arden Hills, Minnesota
MPCA Site ID: VP22892/PB4687
Bay West Project No. J130147

Dear Ms. Schmitt and Ms. Hadiaris:

Bay West LLC (Bay West) has prepared this letter to describe the proposed actions to be taken by Ramsey County (the County) in regards to mass grading, road construction, utility installation and other infrastructure improvements at the former Twin Cities Army Ammunition Plant (TCAAP) located at 2020 Highway Avenue, Arden Hills, Minnesota, in Ramsey County (the Site). The County is seeking the protection of a No Association Determination (NAD) under the Minnesota Environmental Response and Liability Act (MERLA) with respect to the identified releases of hazardous substances at the property. This NAD request is intended as a supplement to the Proposed Actions Letter/Request for No Association Determination submitted on behalf of Ramsey County by Wenck Associates, Inc. (Wenck) dated September 16, 2014 (September 16 PAL/NAD Request).

As is noted in the September 16 PAL/NAD Request, the County seeks issuance of a No Association Determination for the proposed actions described below, as well as concurrence from the U.S. EPA and the Army with those proposed actions.

BACKGROUND

The Site consists of approximately 427 acres of the former TCAAP located in portions of Section 9 and 16, Township 30 North, Range 23 West. The County currently owns 397 of the 427 acres comprising the Site. The County has leased the remaining 30 acres of the Site from the United States (Leased Property). The Leased Property was known to contain areas of contamination in excess of the Minnesota Pollution Control Agency (MPCA) Tier II Soil Reference Values for industrial land use (Tier II SRVs). The County was to function as a response action contractor to complete the soil response action activities on the Leased Property on behalf of the United States Army (Army) to satisfy the Army's obligations under the

Federal Facilities Agreement. The County will take title to the Leased Property once the remediation is complete.

The County entered into an agreement with Carl Bolander & Sons, Inc. (Bolander) to complete hazardous material abatement, demolition of Site improvements, and remediation of releases of hazardous substances and petroleum to the soil at the Site. The scope of remediation activities under Bolander's agreement with the County required remediation of all soil located above the unconfined water table aquifer with identified contamination exceeding MPCA Tier 1 SRVs for residential land use.

Remediation work commenced at the Site in May 2013 and is scheduled to be complete by October 2015. Once the Site remediation is complete, the County will request that the MPCA issue a Commissioner's Certificate of Completion for soil, and request amendment of the Operable Unit 2 (OU2) Land Use Control Remedial Design (LUCRD) and associated environmental covenants to allow residential use throughout the Site.

IDENTIFIED RELEASE

The identified release at the Site includes all hazardous substances identified and described in the MPCA's file, including, without limitation, heavy metals (e.g., antimony, arsenic, barium, copper, chromium, manganese, mercury, lead, thallium and vanadium), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs). The Identified Release refers to contamination of all affected media at the Site including soil, groundwater, soil gas, and any other affected media.

PROPOSED ACTIONS

We request that the MPCA issue a NAD to the County with respect to the Identified Release for the following proposed actions:

- Excavation, grading, movement, and stockpiling of soil located above the unconfined water table aquifer as these activities relate to construction site preparation, road construction, mass grading, utility installation and other infrastructure improvements. A figure illustrating the proposed spine road alignment and associated sewer and water utilities is attached as **Exhibit A**.
- Excavation, movement, stockpiling, and appropriate disposal of soil located below the unconfined water table aquifer when these activities occur in areas of known groundwater contamination and are completed in accordance with an MPCA-approved Response Action Plan (RAP). These areas are depicted on **Exhibit B** from the September 16 PAL/NAD request and **Exhibit C**, the grading plan for Rice Creek.
- Excavation, grading, movement, and stockpiling of soil located below the unconfined water table aquifer when these activities occur in areas with no known groundwater contamination.

ATTACHMENT A

- Construction of surface water management features, stormwater retention and infiltration basins, mitigated wetlands, and the new channel for Rice Creek in areas with no known contamination in the unconfined water table aquifer. These areas are depicted on **Exhibit B** from the September 16 PAL/NAD request and **Exhibit C**, the grading plan for Rice Creek.
- Construction of surface water management features, stormwater retention basins, mitigated wetlands, and the new channel for Rice Creek in areas with known contamination in the unconfined water table aquifer when these activities are completed in accordance with an MPCA-approved RAP. These areas are depicted on **Exhibit B** from the September 16 PAL/NAD request and **Exhibit C**, the grading plan for Rice Creek. Ramsey County will seek the concurrence of MPCA, Army, and USEPA prior to construction of stormwater management features in these areas to ensure they do not alter the groundwater flow regime in areas affected by historical solvent releases.
- Dewatering of excavation areas and discharge of water to an on-site infiltration basin when this work is completed in areas of the Site with no known contamination in the unconfined water table aquifer.
- Dewatering of excavation areas and discharge of water to the local POTW when this work is completed in areas of the Site with known or suspected contamination in the unconfined water table aquifer and is completed in compliance with a discharge permit.
- Sampling, excavation, segregation, stockpiling, and appropriate disposal of previously unidentified contaminated media in accordance with an MPCA-approved Construction Contingency Plan (CCP).
- All other actions of the County and its contractors and subcontractors associated with acquiring, maintaining, and preparing the Site for sale and redevelopment consistent with the Master Plan approved by the County and City of Arden Hills, including without limitation construction, installation and/or relocation of roads, utilities, sewers, water lines and other infrastructure.

If you have any questions regarding this request, please contact either me or Donovan Hannu using the contact information provided below.

Respectfully yours,

Rick Van Allen, PG
Senior Project Manager
651-291-3441

Donovan Hannu, PE
Project Manager
651-291-3424

ATTACHMENT A

Attachments

Exhibit A - TCAAP Preliminary Spine Road and Utility Plan
Exhibit B – Figure 1 from the Wenck September 2014 PAL/NAD
Exhibit C - Rice Creek channel excavation and meander

cc: Heather Worthington, Ramsey County
Beth Engum, Ramsey County
Rick Kubler, Gray Plant Mooty

Exhibit A

Kimley»Horn
2550 UNIVERSITY AVENUE WEST, SUITE 238N
SAINT PAUL, MINNESOTA 55114
Ph: 651-645-4197 www.kimley-horn.com

RAMSEY COUNTY

Department of Public Works
ENGINEERING/OPERATIONS
1425 Paul Kirkwold Drive
Arden Hills, MN 55112
(651) 266-7100 (FAX) (651) 266-7110

ARDEN HILLS

TCAAP Site Redevelopment
Infrastructure

SITE GRADING AND INFRASTRUCTURE IMPROVEMENTS
□ANUAR□ □□□5

ATTACHMENT A

Exhibit B

2012 Aerial Photograph (Source: ESRI)

Path: L:\1382\0001\mxd\TASK 03 Stormwater Prelim Design\Site I and K Location.mxd
Date: 9/16/2014 Time: 9:06:04 AM User: ShuJC0243

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

RAMSEY COUNTY

TCAAP: 427-acre Redevelopment Infiltration

Wenck

Engineers - Scientists
Business Professionals
www.wenck.com

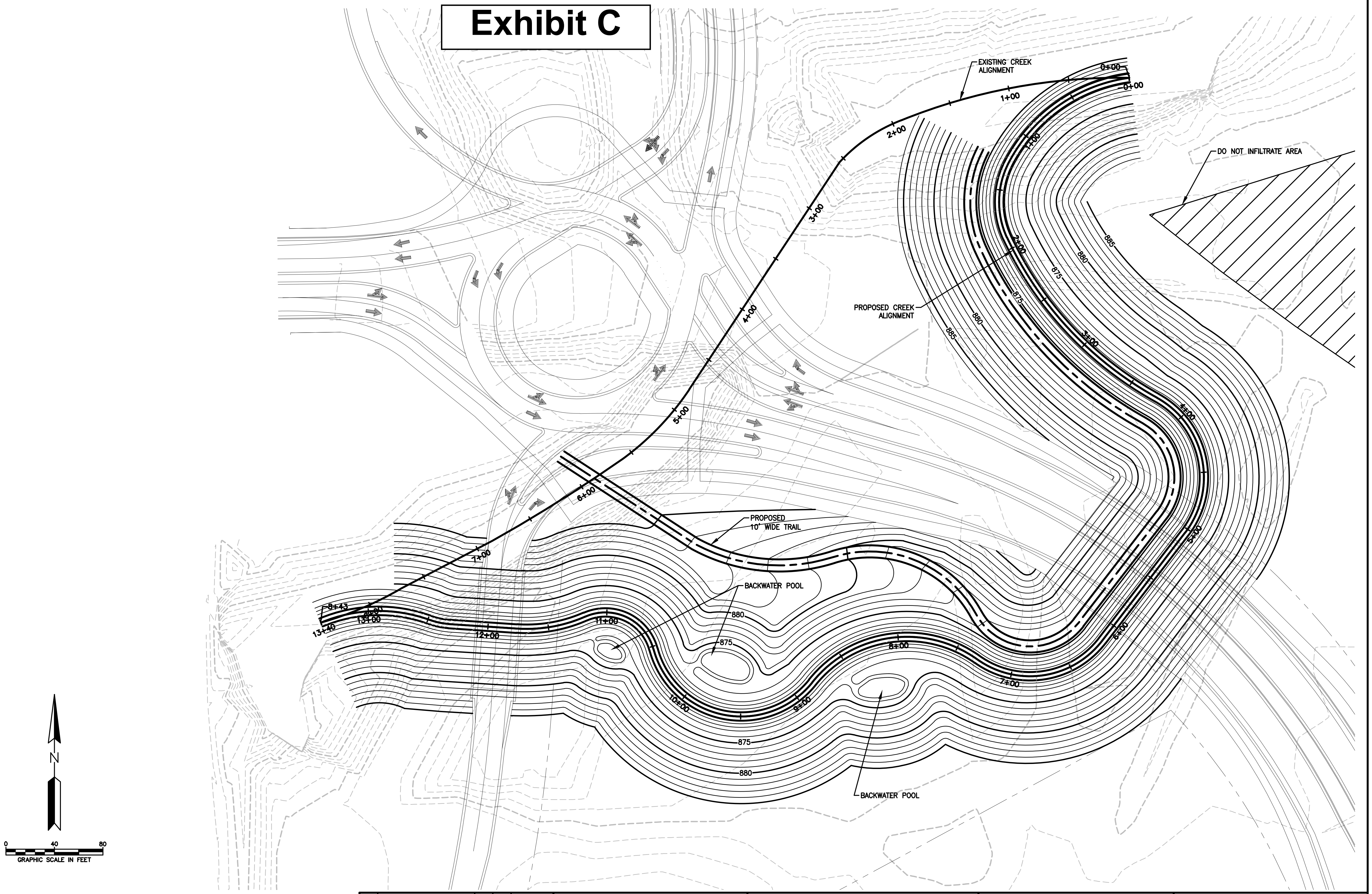
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

AUG 2014

Figure 1

ATTACHMENT A

Exhibit C



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REV	REVISION DESCRIPTION	DWN	APP	REV DATE
1	DRAFT GRADING PLAN	MJS		12/12/14
0	DRAFT GRADING PLAN	MJS		12/11/14

SEAL

PRIME CONSULTANT

Wenck

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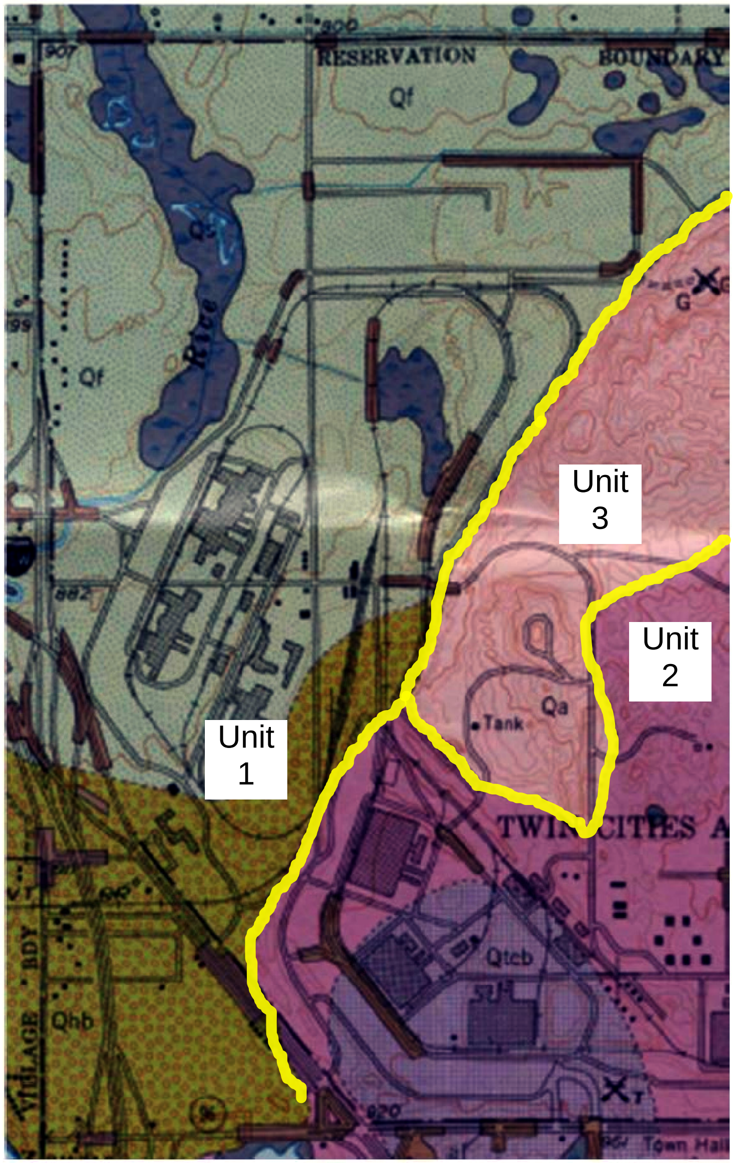
Consulting Engineers
Web Site: www.wenck.com

PROJECT TITLE

SHEET TITLE
CREEK MEANDER GRADING

DWN BY
CHK'D
APP'D
DWG DATE DEC 2014
SCALE AS SHOWN
PROJECT NO.
SHEET NO.
REV NO. 1



Qs Swamp and Marsh Deposits	
af Artificial Fill	
Qf Fridley Formation	Unit 1: Water Bearing (Low Yield)
Qa Arsenal Sand	Unit 3: Water Bearing (High Yield)
Qhb New Brighton Formation	Unit 1: Water Bearing (Low Yield)
Qtca Qtcb Twin Cities Formation	Unit 2 (Aquitard)

Source: Stone, John E., "Geologic Map Series 2. Surficial Geology of the New Brighton Quadrangle, MN GM-2 (1966.)

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Surficial Geology Map

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

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EXHIBIT 1

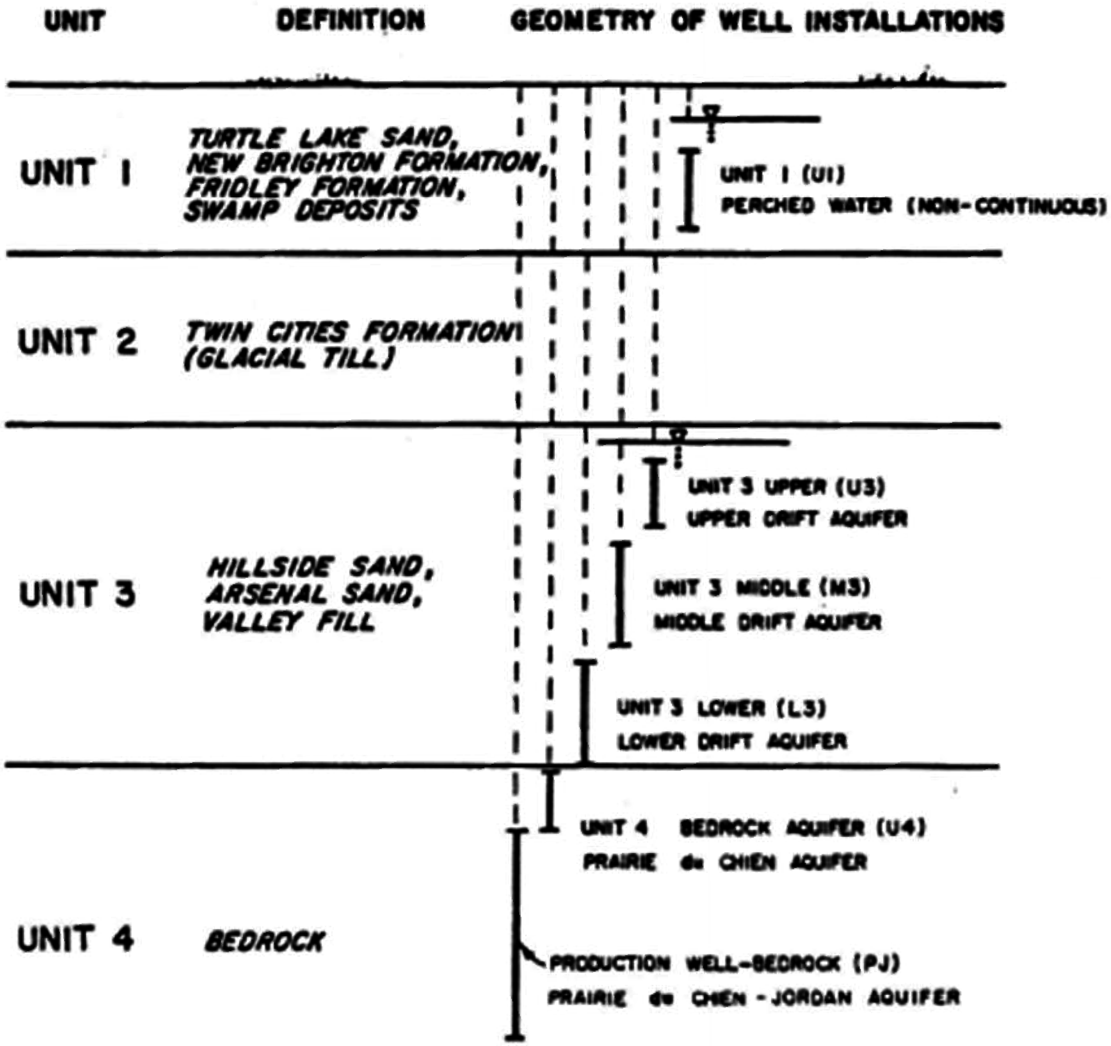

FIGURE 2.15 Illustration Showing Four Hydrologic Units at TCAAP (Source: Ref. 5207)

Source: Wenck, "Five-year review report of the final remedy for the New Brighton/Arden Hills Superfund Site" Figure 2-15, August 2009

RAMSEY COUNTY

TCAAP Four Hydrologic Units

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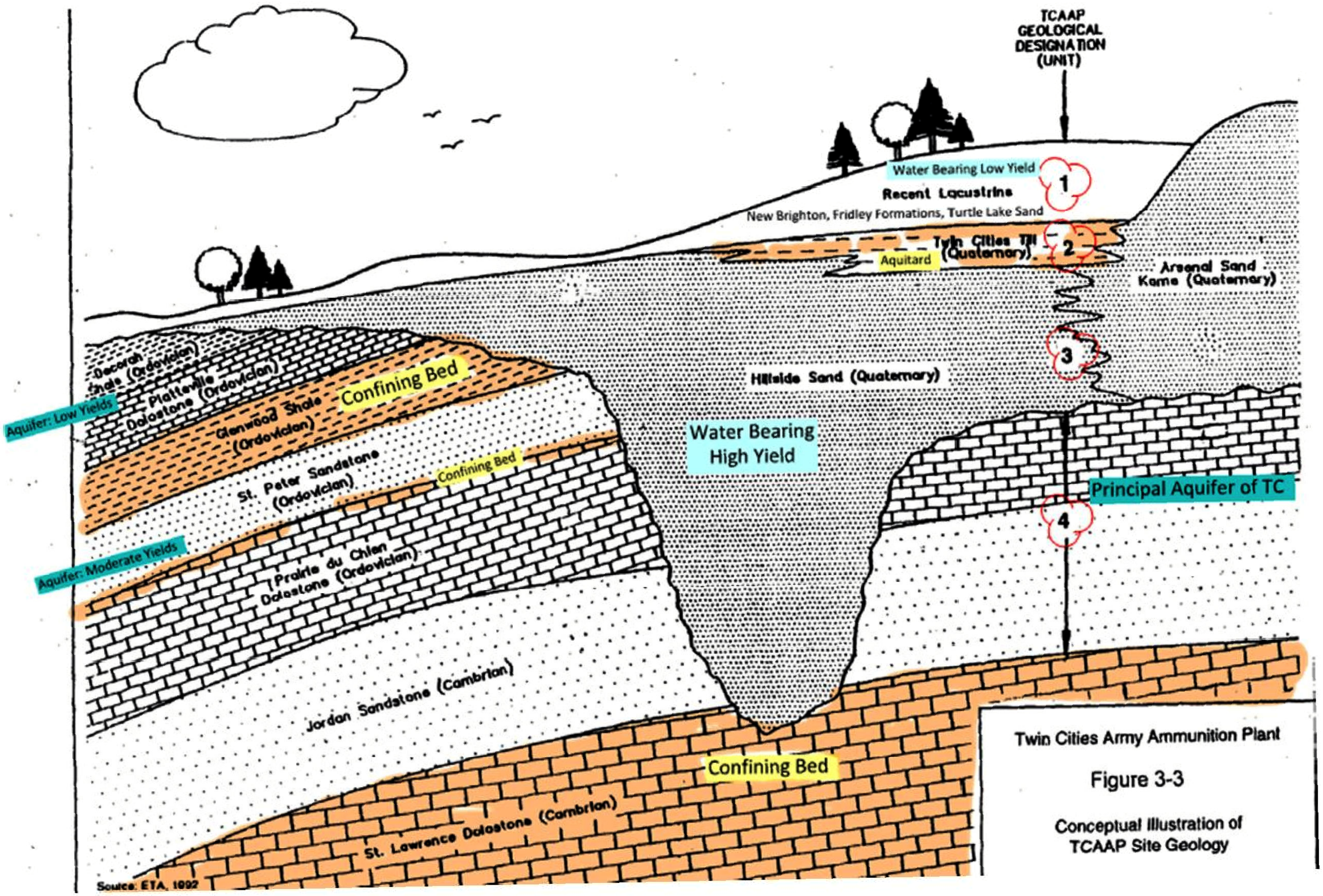
EXHIBIT 2



Twin Cities Army Ammunition Plant

Figure 3-3

Conceptual Illustration of TCAAP Site Geology

Source: Wenck, "Five-year review report of the final remedy for the New Brighton/Arden Hills Superfund Site" Figure 3-3, August 2009

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TCAAP Concept Site Geology

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EXHIBIT 3

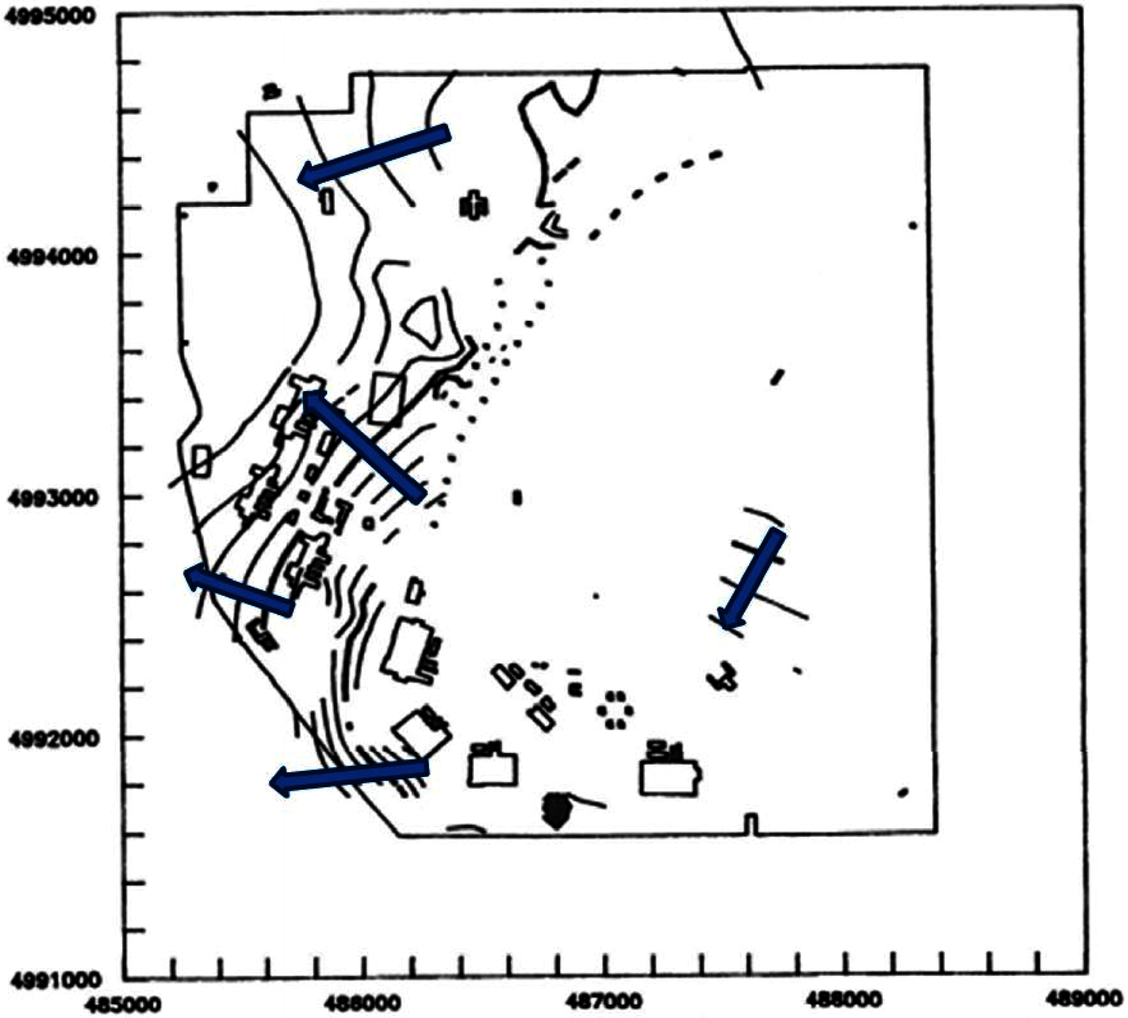

FIGURE 2.16 Water-Level Elevations for Hydrologic Unit 1 at TCAAP, February 17, 1987 (Source: USATHAMA database)

Source: Wenck, "Five-year review report of the final remedy for the New Brighton/Arden Hills Superfund Site" Figure 2-16, August 2009

Path: L:\1382\0001\mxd\TASK 03 Stormwater Prelim Design\Fig4-3 Pre-Development (1987) Groundwater Gradient Map.mxd
Date: 3/4/2015 Time: 1:13:44 PM User: MilKE0481

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Pre-Development (1987): Groundwater Gradient Map (Unit 1)

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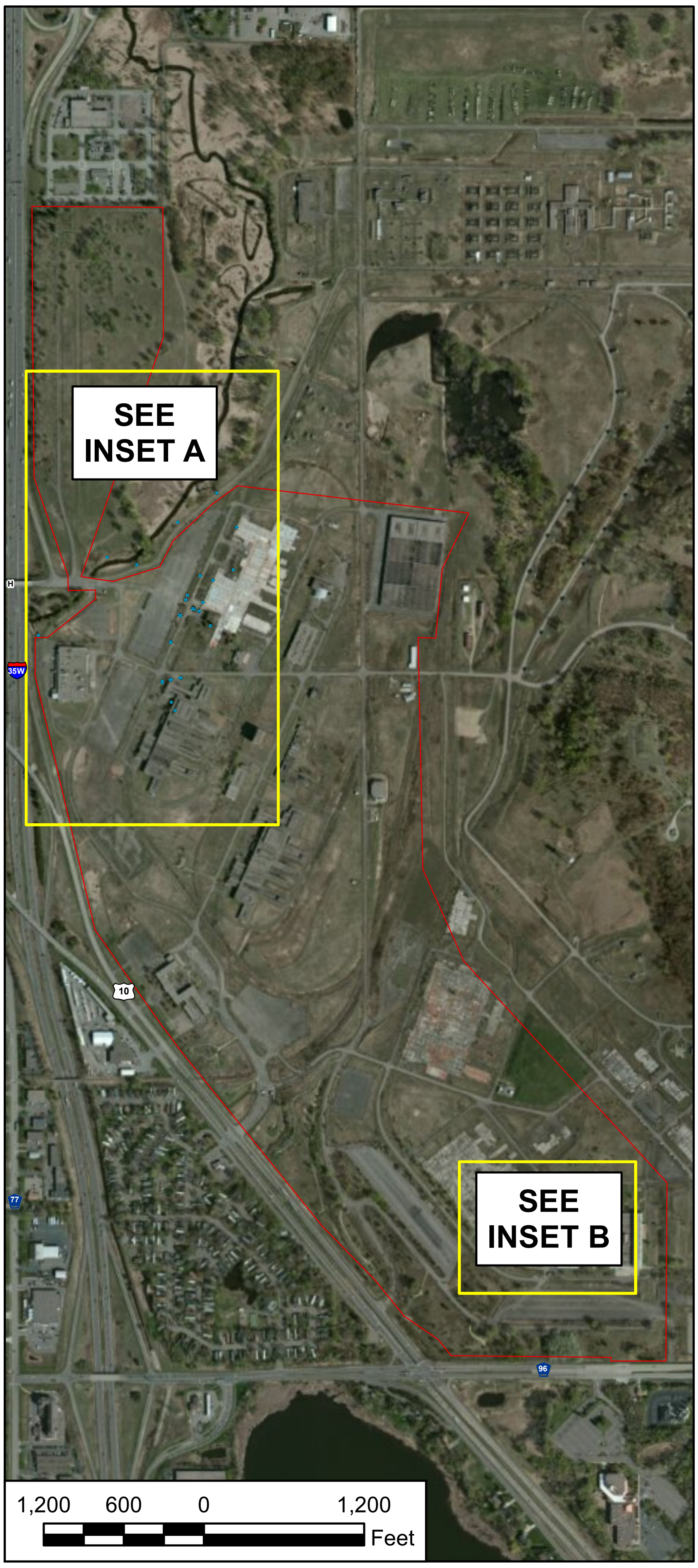
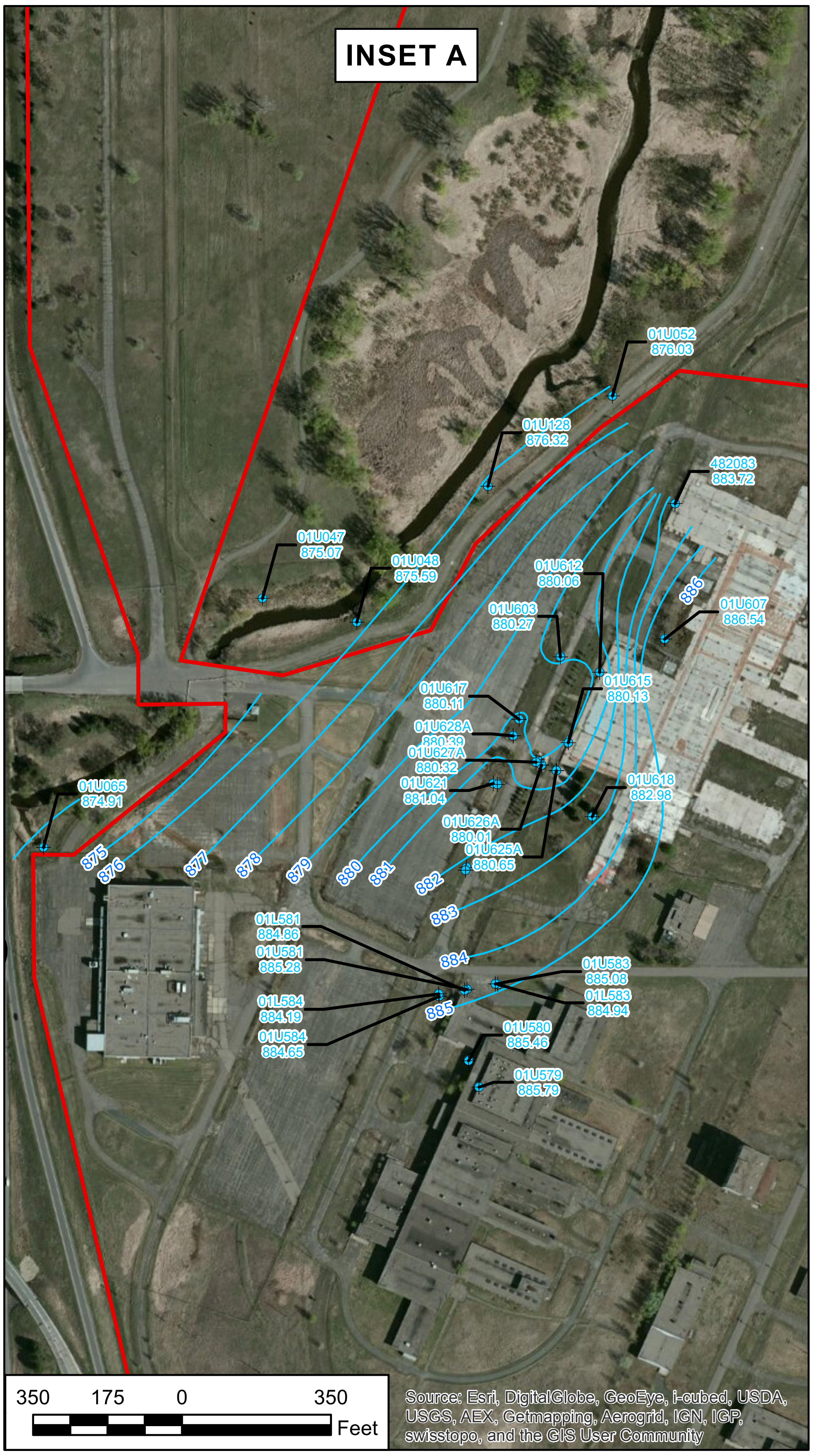
EXHIBIT 4





Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ⌖ Unit 1 Wells
- ─ 2012 APR Groundwater Elevation Contours (ft)
- ▭ 427-Acre Boundary

Note: Various Unit 1 groundwater wells have been sealed, since 2012. This figure only shows symbolized well locations for those wells that have not been abandoned and sealed. The unique well identifications and the water level observations are provided in this figure as label leaders. The source of this information is the 2012 TCAAP Annual Performance Report (APR).

N

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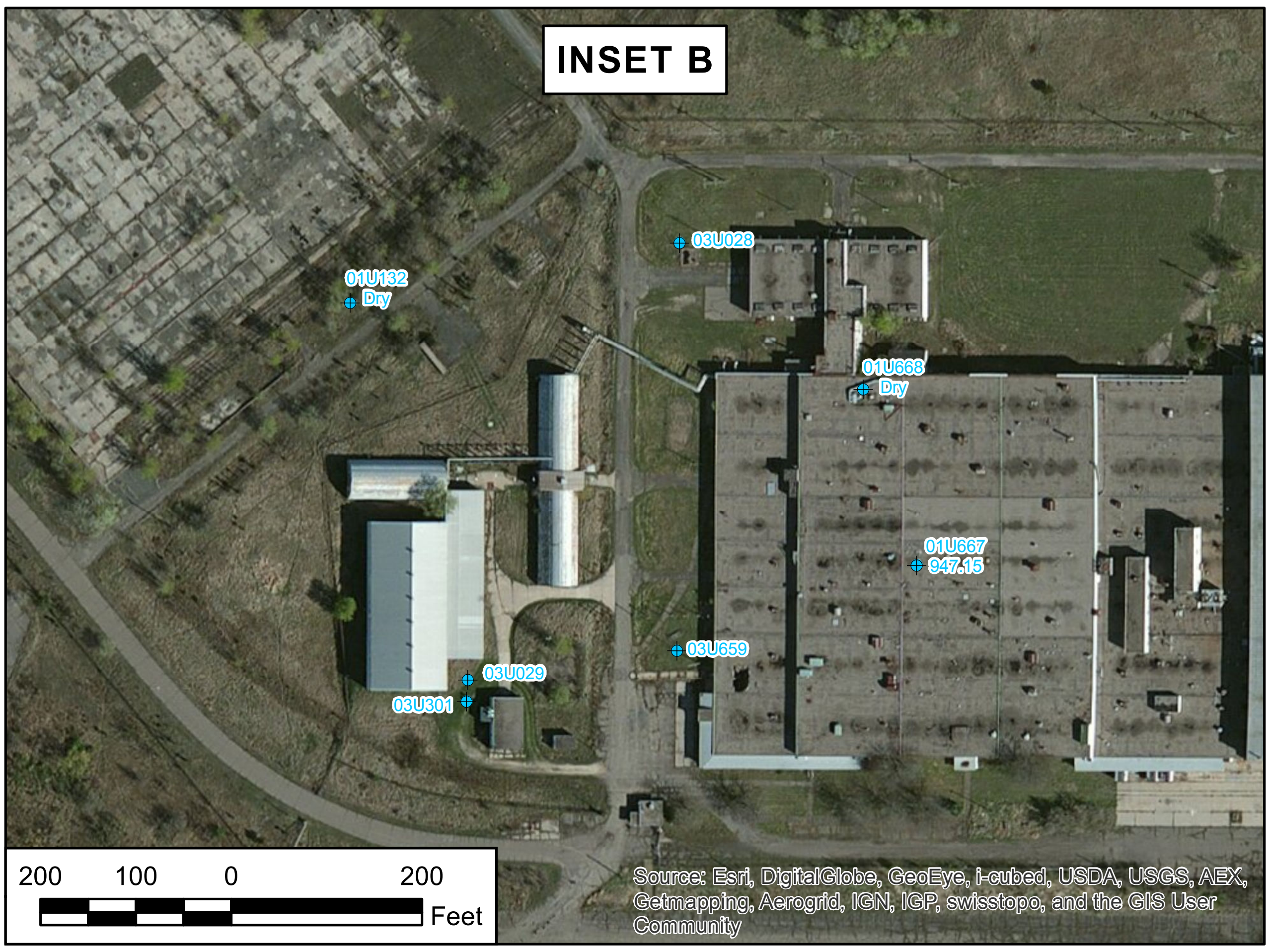

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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2012 Groundwater Elevation Map (Unit 1)

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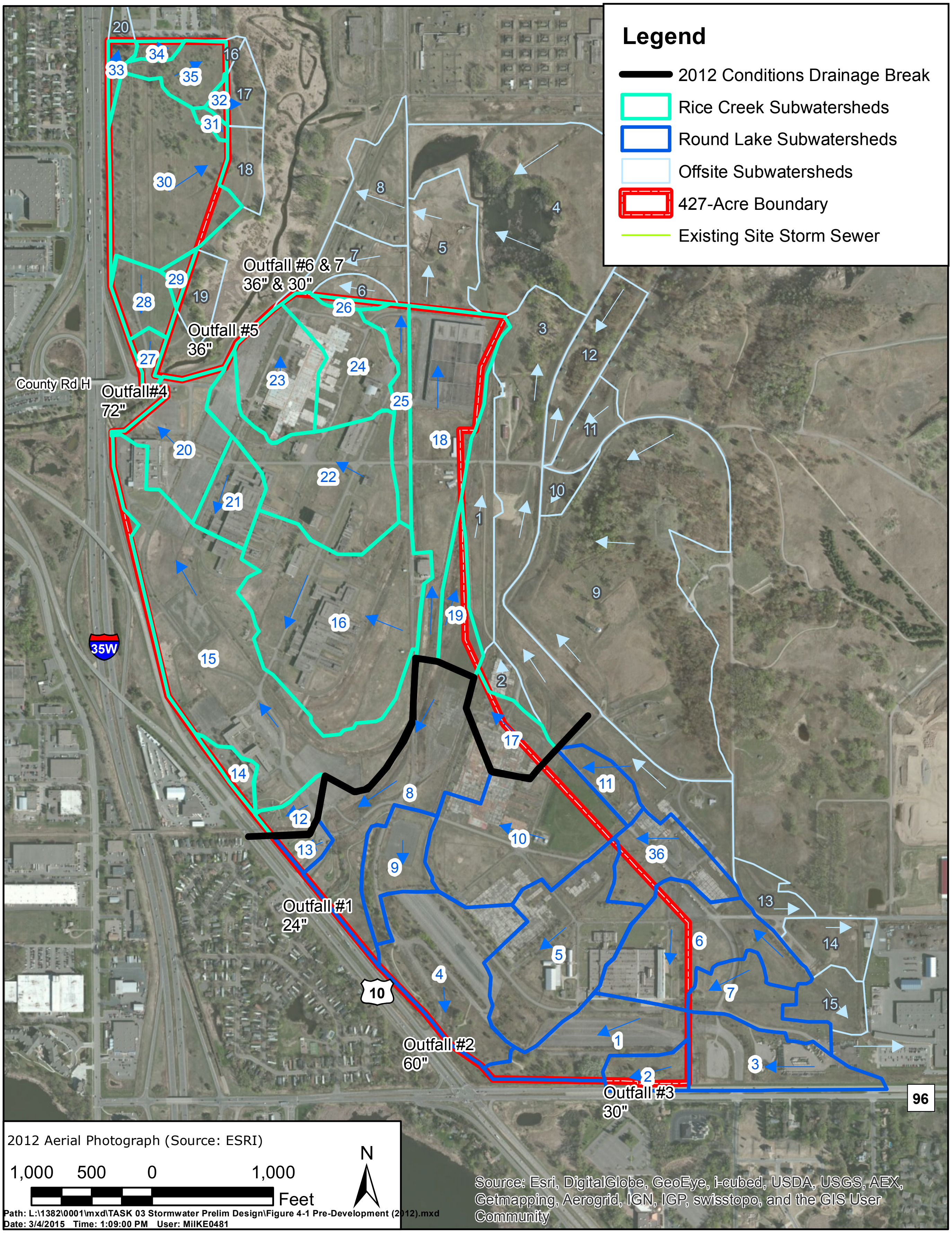
EXHIBIT 5



2012 Aerial Photograph (Source: ESRI)

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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Pre-Development (2012): Subwatershed Map

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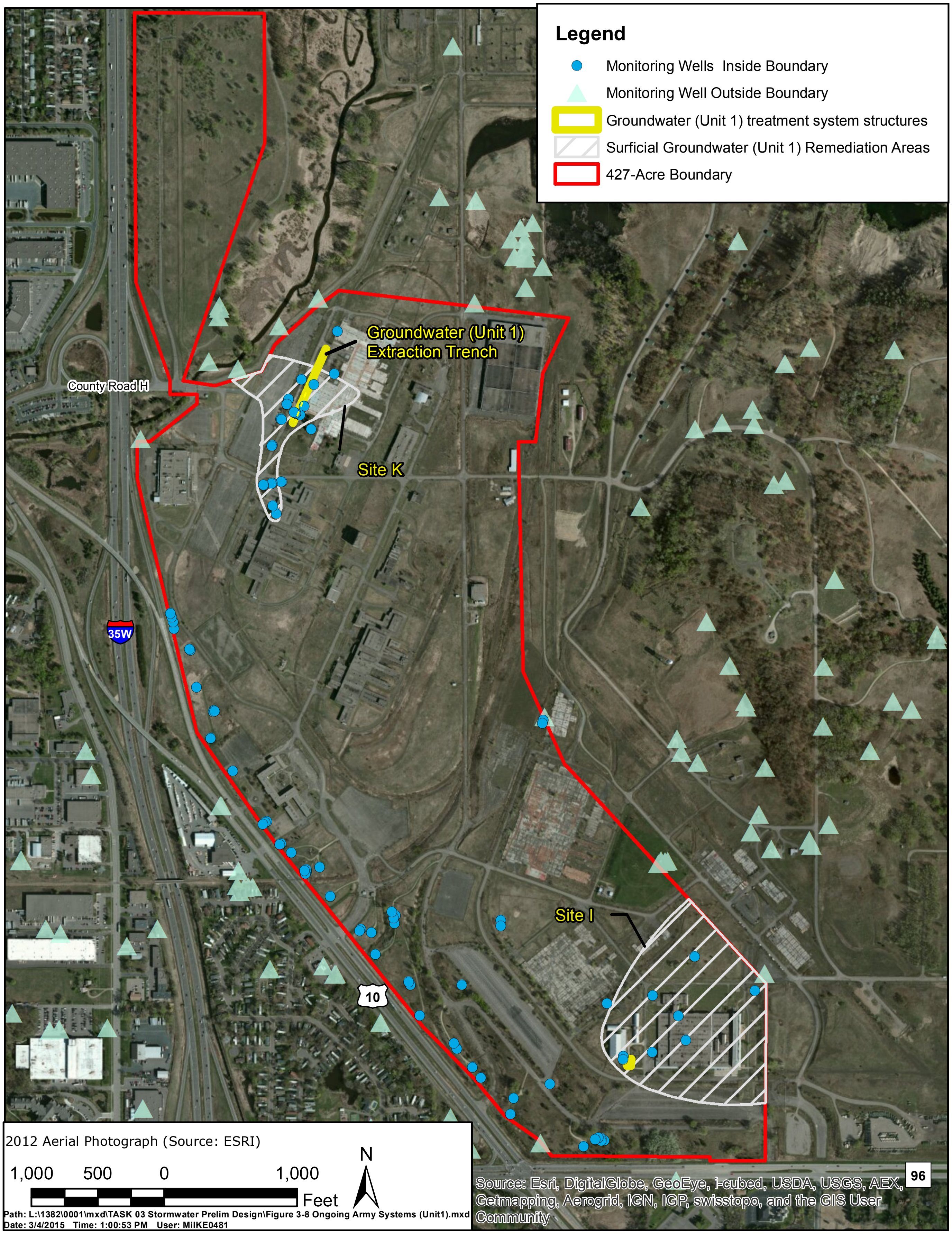
EXHIBIT 6



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Ongoing Army Systems (Unit 1)

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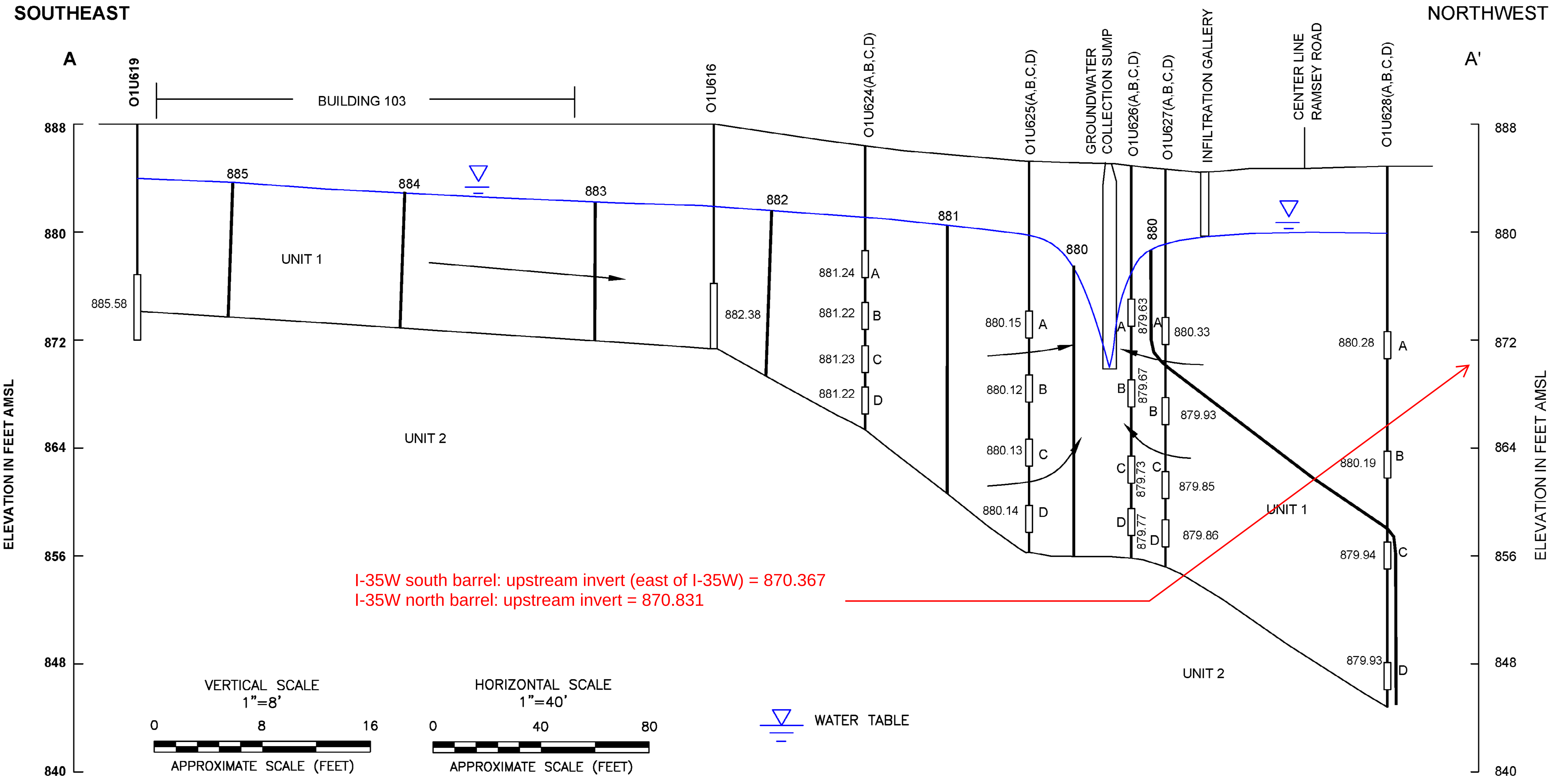
EXHIBIT 7



I-35W south barrel: upstream invert (east of I-35W) = 870.367
I-35W north barrel: upstream invert = 870.831

EXHIBIT 8

Geographic Information Systems

Stantec

2335 HIGHWAY 36 WEST, ST. PAUL, MINNESOTA 55113 PHONE 651.636.4600 www.stantec.com

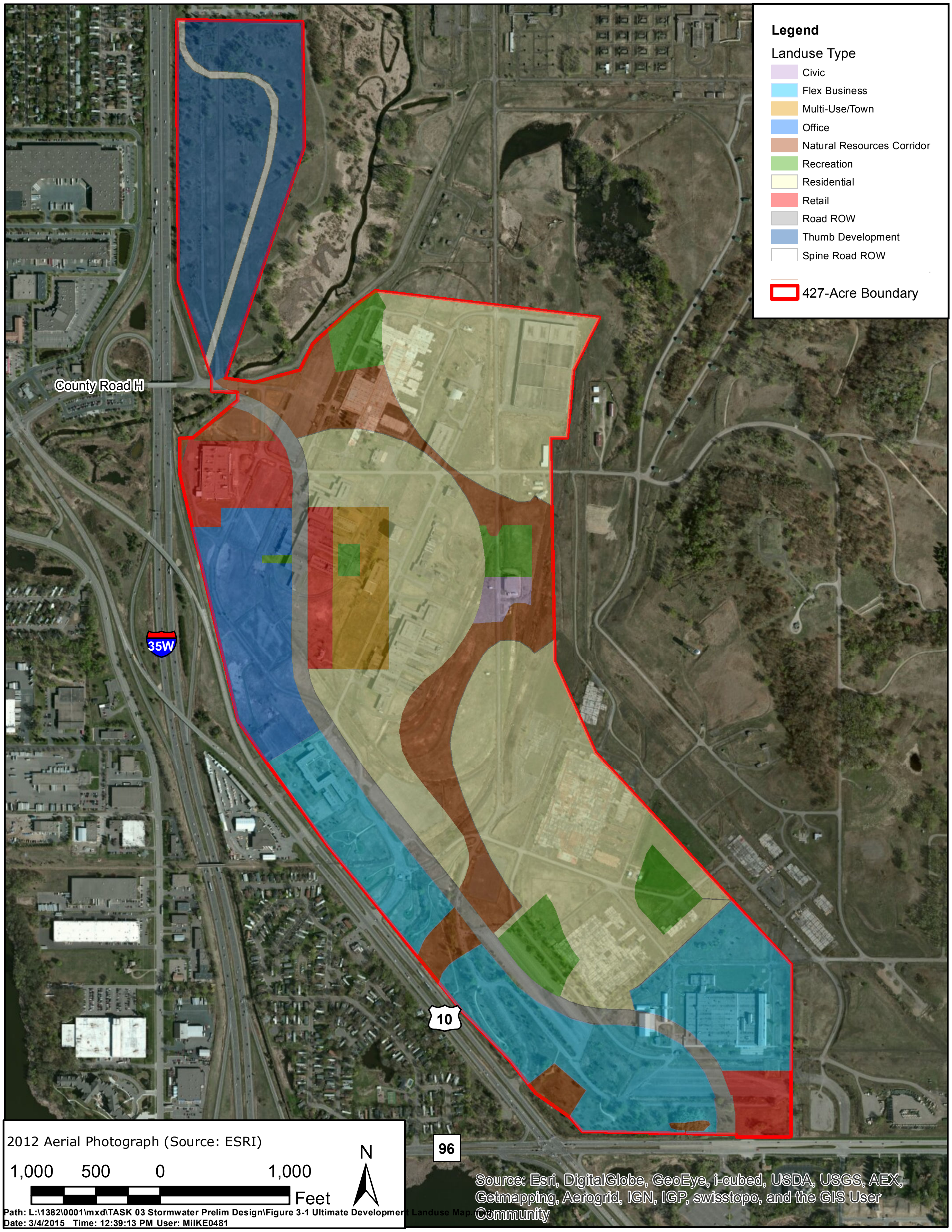
PREPARED FOR:

ALLIANT TECHSYSTEMS
TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE K
HYDROGEOLOGIC CROSS SECTION A-A'
06/01/12 (Q115)

FIGURE:
9-3

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
182602642	TF	AG	AG	11/21/13



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(FINAL AUAR) Fully Developed Conditions : Landuse Map

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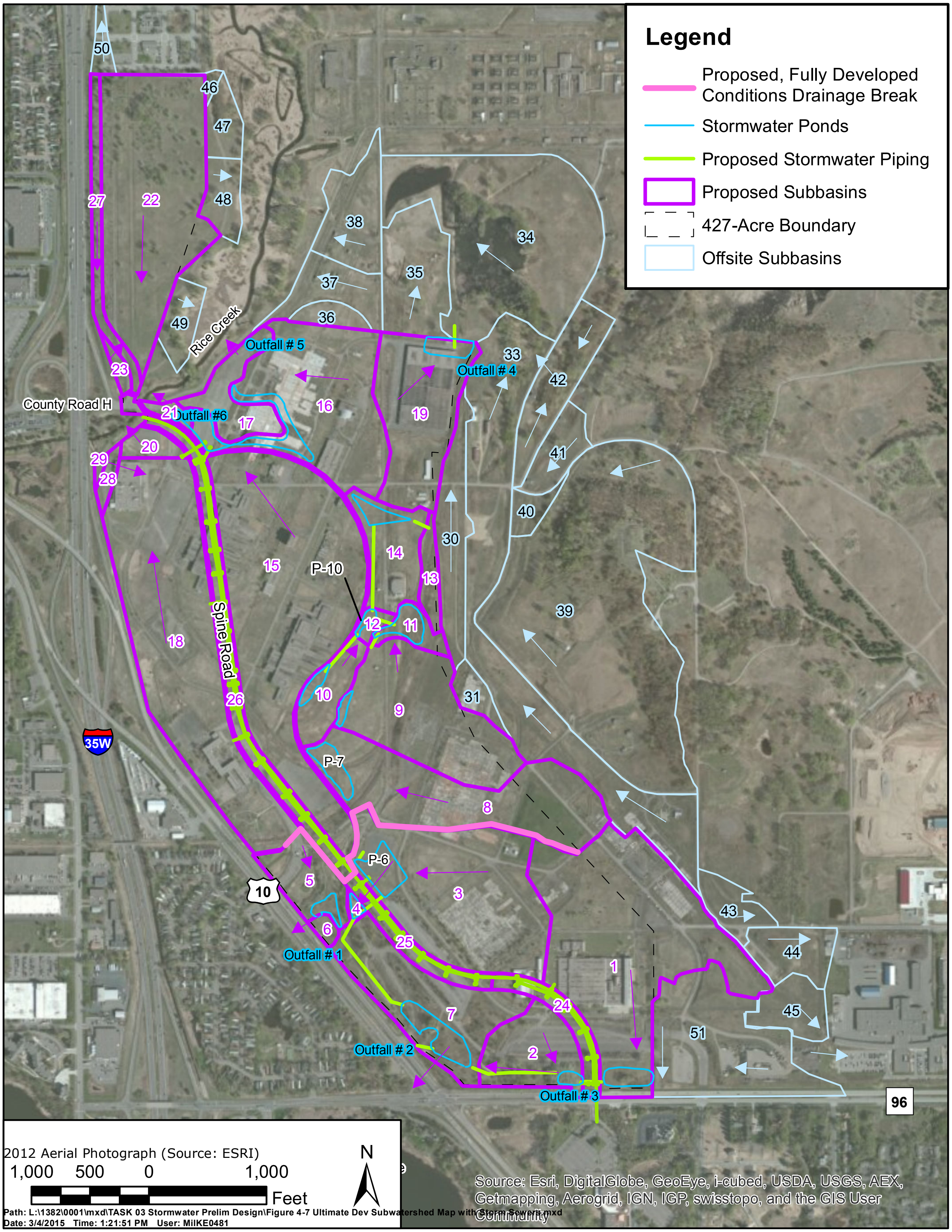
EXHIBIT 9



2012 Aerial Photograph (Source: ESRI)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Path: L:\1382\0001\mxd\TASK 03 Stormwater Prelim Design\Figure 4-7 Ultimate Dev Subwatershed Map with Storm Sewers.mxd
Date: 3/4/2015 Time: 1:21:51 PM User: MilKE0481

RAMSEY COUNTY

Fully Developed Conditions: Subwatershed Map & Storm Sewers

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EXHIBIT 10

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	Windom	Woodbury			Mandan		Sheridan
	507-831-2703	651-294-4580			701-751-3370		307-675-1148
					Williston		
					800-472-2232		