# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Stage 3

# Drainage Report

*May 22nd, 2024*

Michael Baker
INTERNATIONAL

## CONTENTS



## APPENDICES

## INTRODUCTION/BACKGROUND

The Ohio Department of Transportation (ODOT) has implemented a comprehensive strategy for rebuilding and modernizing the Cleveland Innerbelt corridor. The project has been divided into Construction Contract Groups (CCG).

CCG3 included modifications to I-77 and I-90, including the Central Interchange, and surrounding local streets including Carnegie Avenue which are required to accommodate the improvements associated with the CCG1/CCG2 projects and the future CCG5 project. Construction of CCG3 will include removing and building new structures within the project limits as the Central Interchange is reconfigured. These changes include the construction of a new flyover ramp from I-90 westbound to I-77 southbound, the construction of new bridges throughout the Central Interchange, a new structure over I-90 at E. 22nd Street, and a new structure over I-90 at Carnegie Avenue. These modifications will provide improved spacing for ramps and better traffic management throughout the project area.


**Figure 1-CCG3 Project Area**

Due to funding, the CCG3 project was split into phases. The first project to be constructed, dubbed CCG3A and assigned PID 82382, includes I-90 from approximately East 9th Street to Carnegie Avenue and the system ramps connecting I-90 and I-77. The remaining work in the overall CCG3 project area, which includes I-77 from Kingsbury Run to I-90, is anticipated to be completed in a future project(s).

The reconfiguration of the Central Interchange with CCG3A will permit additional roadway capacity and reconfiguration of merge points throughout the project.

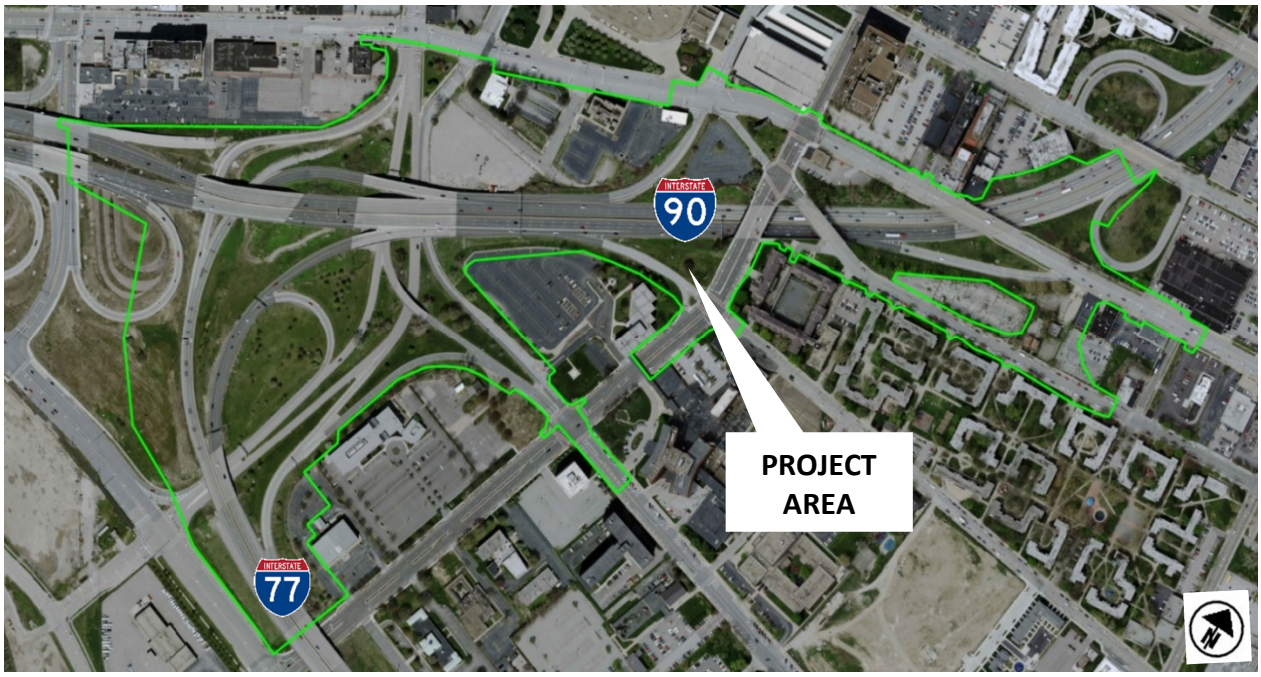



Figure 2-CCG3A Project Area

## CCG3A PROPOSED PROJECT PROGRESSION

Stage 1 (submitted October 2021) & Stage 2 (submitted June 2022) plans were completed which included fourteen (14) retaining walls and seven (7) bridges to accommodate the reconfiguration to the Central Interchange as part of CCG3A. The retaining walls adjacent to the Cuyahoga County Juvenile Court Building (JJC) and the Walker Weeks building , both of which are significant historic sites listed on or elgible for National Register of Historic Places, were designed to allow for the widening of I-90 in both directions.

Cuyahoga County Public Works issued an RFP in February 2022 seeking plans for the disposition of the JJC on E. 22nd Street. Campus District, Inc., a Community Development Corporation in Cleveland, submitted a proposal to demolish the building and transfer land to ODOT for relocation of Cedar Avenue and revisions to the E. 22nd Street bridge over I-90. This proposal was accepted by the County, allowing ODOT to eliminate the proposed bridge deck (Bridge 16) over eastbound I-90 intended to support the Cedar Avenue approach to E. 22nd Street. This change of condition resulting from the proposed demolition of the building reduced the estimated construction cost of the CCG3A project. It also opened opportunities for the Campus

District and other local stakeholders to realize greater potential for neighborhood connectivity on the E. 22nd St. bridge across I-90.

Leaders from ODOT Central Office, ODOT District 12, and the City of Cleveland administration met in August and September 2022 and agreed to redesign E. 22nd Street and Cedar Avenue based on the potential removal of the JJC building. The removal of Bridge 16 and redesign of Walls Z and AG created new cost saving opportunities for the proposed drainage design within the trench. The entire drainage system for I-90 from just west of E. 22nd Street to the eastern project limits has been redesigned and discussed throughout this report.

## EXISTING DRAINAGE

The CCG3A drainage analysis includes the original CCG3 project limits so that capacity is provided to accommodate improvements to I-77 and associated roadways planned under future construction contracts. The existing drainage system within the project limits consists of ODOT sewers and City of Cleveland combined sewers that outfall beyond the project limits to Northeast Ohio Regional Sewer District (NEORSD) Wastewater Treatment Plant sewers and interceptors. The ODOT and the City's pipe policies will be followed for this project. Appendix A contains ODOT's LD-35 and the City's pipe policy.

The project is located within the sewer sheds of four combined sewer overflows (CSO). See Appendix B for a map of the combined sewersheds described below.

### COMBINED SEWERSHED SUMMARY

| Sewershed area ID | Outfall location | General description |
|---|---|---|
| E. 12th Branch Regulator E-18 CSO-094 | Lake Erie | The south and western portion of the project bounded by the project limits, East 22nd Street, Orange Avenue and East 14th Street |
| E. 21st Branch Regulator E-13 CSO-095 | Lake Erie | Area of the project bounded by East 14th Street, East 22nd Street, Community College and Central Avenue |
| I-90 Storm only CSO-097 | Lake Erie | Area of the project confined to the I-90 trench. |
| E. 40th Branch Regulator E-03 CSO-201 | Lake Erie | The northeastern portion of the project not including the I-90 trench. |

# PROPOSED DRAINAGE

## PROPOSED DESIGN

Drainage design meets the requirements of the ODOT L&D Manual Volume 2 and the City of Cleveland. The criteria can be found in Appendix A of this report.

### DITCHES

Storm runoff from uncurbed ODOT maintained facilities and as required along City of Cleveland streets are collected in roadside and gore ditches. The ditches all meet the depth requirements for a 10% AEP storm and the shear stress is checked for a 20% AEP storm using ODOT CDSS to determine where erosion protection would be required. Clear zone and barrier grading are used throughout the project area due to the urban interchange setting. Erosion control is included in the Stage 2 plans. See Appendix C for ditch drainage area maps and calculations.

### INLET SPACING

The pavement spread for storm runoff collected on ODOT maintained facilities by curb and concrete barrier is checked using ODOT CDSS for the 10% AEP storm. The 2% AEP storm is also checked using ODOT CDSS at the sag of I-90 and E. 14$^{th}$ Street to ensure there is no ponding in the traveled lanes. Inlet spacing calculations and drainage area maps can be found in Appendix D. The pavement spread is also checked for City of Cleveland streets using the 50% AEP and 20% AEP storm to meet ODOT criteria since the City does not have criteria of their own. City of Cleveland Catch Basin No 3s are proposed in sag locations on the City streets. They are modeled as CB-3s in CDSS and represented by two ODOT CB-3A structures in the plans. All catch basins and manholes on City maintained streets are proposed City of Cleveland structures and are proposed as *As Per Plan* in the Stage 2 plans to include the standard 2’ sump and trap specified in the City of Cleveland standard construction drawings.

The City of Cleveland also requires the last ODOT structure on a storm sewer before outletting into a City sewer have a 2’ sump and trap. These ODOT structures are proposed as *As Per Plan 2* in the Stage 2 plans to accommodate this requirement.

Pavement spread was checked across all bridges in the project. Bridge 9 carrying Ramp A2 over I-90 and Bridge 14 carrying Carnegie Avenue over I-90 have spread issues and require scuppers. The redesigned wider Bridge 13 carrying E. 22$^{nd}$ Street over I-90 also requires scuppers. Scupper calculations were completed for all three bridges and are included in Appendix E.

Bridge 9 has a crest vertical curve and therefore spread was checked at all four corners of the bridge. Spread is only deficient at the forward right abutment where the shoulder tapers down from 12' to 4' before the end of the bridge. Four scuppers are proposed near the last pier, two in the second to last span and two in the final span, to outlet down the pier. Two additional scuppers are proposed within the final span to be piped to the forward abutment and outlet from there. Stage 1 comments requested additional scuppers be included on Bridge 9 at the modular joints and those are included with the Stage 2 design. The Bridge 9 scuppers outlet at piers 4 and 10 as well as the rear and forward abutments through downspouts which outlet into the grates of proposed CB-2-2Bs.

Bridge 14 carrying Carnegie over I-90 has a constant grade from west to east of 0.4%, a constant cross-slope of 2.0% and a constant curb to curb width of 68'. Without scuppers, the spread exceeds the allowable 8' into the traveled lane. The bridge carries three lanes WB and two lanes EB with a striped out median lane/future turn lane. Since scuppers are not preferred due to the maintenance challenges, Elie Ramy from the City of Cleveland Water Pollution Control and Tom Boyer from the City of Cleveland Engineering & Construction were consulted on options for not meeting the ODOT spread requirements across the bridge. Both agreed that scuppers are not preferred but noted that the City does not have their own spread criteria and therefore deferred to ODOT on a final determination. A meeting was held with ODOT on September 1, 2021, at which a range of options were discussed. A preferred option to place two pedestrian and bicycle safe scuppers per side at the pier and two per side at the forward abutment in addition to placing a catch basin within the approach slab on the left forward side to allow for the future Midtown Connector intersection was agreed upon. Follow-up agreements from the Offices of Structural and Hydraulic Engineering were received on September 7, 2021 to go with the preferred option and violate the 8' spread requirement across the bridge deck. The scuppers have proposed downspouts to the median pier and forward abutment where they outlet to a slope that is protected by rock channel protection and travel to the detention basin. The downspouts will need to be collected with the future storm sewer system of the CCG5 project when I-90 EB is routed through the forward span of Bridge 14.

Bridge 13 carrying E. 22nd Street over I-90 was widened with the redesign following coordination with stakeholders, creating a more open concept with space for pedestrian and bicycle facilities to meet the desire to connect neighborhoods. The crest vertical curve includes a high point near the rear abutment, so while spread is not a concern on the rear end of the bridge, scuppers are included on the left side to alleviate spread into the intersection with Ramp B6 where multiple curb ramps are included for the pedestrian and bicycle facilities. Scuppers were not included on the right rear side because the skew of the abutment limits the

space between the high point of the bridge and the abutment, creating an extremely small drainage area.

Spread on the right side of the bridge from the high point north confirms that scuppers are required and are thus proposed at both the pier and the forward abutment. Scuppers on the left side are proposed only at the forward abutment. All the Bridge 13 scuppers are proposed to be collected in the storm sewers along I-90 within the trench.

## STORM SEWERS

Storm sewer calculations were completed using OpenRoads Designer (ORD) Drainage and Utilities. The output results and drainage area maps can be found in Appendix F. The results have been formatted to mimic the output from CDSS Storm Sewer Design for ease of review. ODOT Office of Hydraulics accepts drainage design from ORD but does note that results vary slightly from calculations completed in ODOT CDSS.

Proposed storm sewers on the project meet a 10% AEP just full capacity for sizing and a 4% AEP storm for hydraulic grade line check. Calculations were also completed for the 2% AEP for two areas of interest: the I-90 trench at the far east end of the project and the E. 14$^{th}$ combined sewer behind the Hilton Garden Inn where the existing combined sewer was lined with the CCG1 project. These areas are discussed in more detail below.

## NEORSD PEAK FLOWS

Most of the project drains to the combined sewers which ultimately enter NEORSD facilities outside of the project limits and are treated at their wastewater treatment plants. The impacts for both CCG3A and the full CCG3 project were evaluated to determine any necessary detention volume needs be included with this project, CCG3A. NEORSD requires that there be no increase in flow from the pre- to post- flow conditions for the calculated 4% AEP, 24-hour event to their facilities and at CSO locations.

The drainage areas and runoff coefficients to each NEORSD regulator for the pre- and post-condition were evaluated for the project and can be found in Appendix G. There is a net decrease in area and flow to the Regulator E-13 (CSO-095). There is an increase in area to the I-90 storm only system (CSO-097), Regulator E-03 (CSO-201), and Regulator E-18 (CSO-094). There is an increase in area and flow to CSO-97, but it is exempt from NEORSD criteria since this is the storm-only sewer that ties in downstream of the NEORSD regulator. While there is an increase in area to Regulator E-03, there is a significant decrease in the runoff coefficient with the project and the ultimate result is a decrease in the peak flows. Therefore, there is no volume storage included with the project within this outfall area.

For the full build, after CCG3B is complete, there is an increase in drainage area to Regulator E-18 of 0.62 acres, but the runoff coefficient decreases enough that there is a net decrease in the peak flow. However, when the project is split into CCG3A and CCG3B and even more specifically, when the project is split for the E. 14th Street and Woodland Avenue divisions of the E. 12th Street Branch, there is a significant increase in area to the E. 14th Street branch of 7.89 acres and a decrease to the Woodland branch of 7.61 acres. Therefore, detention is included within the E. 14th Street combined sewer relocation drainage area.

## E. 14TH STORM SEWER & DETENTION

The E. 14th Street combined sewer is being relocated with the project due to impacts from Bridges 9, 10, 11 & 12. In addition to the requirements explained above resulting in the need for detention to restrict flow from the drainage area to this combined sewer, there is additional need for analysis of the peak flows. During the CCG1 project, a 57" HOBAS liner was installed within the existing 66" combined sewer along the innerbelt just east of E. 9th Street. That hydraulic analysis was reviewed for this project since the upstream drainage area of that liner is the E. 14th Street drainage area of this project, and it is critical that peak flows are not increased. Calculations and maps can be found in Appendix H.

The drainage areas from the CCG1 report were compared and validated. The existing upstream area for CCG1 includes some of the drainage area for this project, so that specific area was subtracted from the CCG1 area, and the runoff coefficient/curve numbers were reevaluated. See Appendix H for these calculations.

The existing system was recreated in Hydrocad and the existing flows were compared to the existing flows from the CCG1 drainage report for the 10-, 25- and 50- year events to validate the model. The results were similar and can be found in Appendix H.

The proposed storm sewer design and a proposed detention basin were then included in the Hydrocad model and the peak flows at the upstream end of the existing 57" HOBAS liner decreased for all storm events from 1-yr to 100-yr. This detention basin acts as a flow restriction structure and is not designed for water quality volume per the L&D Volume 2. It will be maintained by ODOT. A detention and utility access drive has been included in the Stage 2 plans to provide access for maintenance. The detention basin sits in the area between Ramps H5, H6, and the St. Vincent Hospital parking lot. The proposed traveled lanes of the ramps are 10'+/- higher than the top of the detention basin as well as being 50'+ away from the top berm. This is well outside of the clear zone and therefore guardrail was deemed unnecessary as it would be more of a hazard than the basin.

## I-90 STORM SEWER & DETENTION

The proposed profile of I-90 interim introduces a sag beneath the west end of the Carnegie Avenue overhead bridge. This sag decreases the available fall to the existing outlet. There is no record of flooding in this area, and NEORSD models do not extend up the trench since it is an ODOT maintained facility and ties in downstream of their regulators. The proposed project storm sewer could not tie into the last existing manhole within the project limits and maintain positive drainage, therefore the project limits were extended downstream to include two existing manholes north of Prospect Avenue. The outfall pipe is a 36" at 0.70%, with a flowline elevation of 628.65. For safety reasons, ODOT paved over four of the existing manholes, two between Carnegie Avenue and Prospect Avenue and the next two north of Prospect Avenue, so there are no hard survey shots on the existing trunkline at the tie in. The tie down flowline elevation of 628.65 was calculated considering the design in the existing plans, a vertical datum shift of 0.75' from the original plans done in NGVD 1929 versus the current NAVD1988, and a survey shot upstream on the trunk line.

The connection to the existing storm only sewer needs to ensure that flooding does not occur in the interim condition before construction of CCG4 & CCG5, which will upsize the storm only sewer downstream to Lake Erie. The realignment of Cedar Avenue and redesign of Walls AG & Z and the rear abutment of Bridge 13 to the south create additional space along the outside of I-90 EB for storm water conveyance and treatment not available with the original Stage 2 design. A proposed detention basin within the footprint of the future I-90 EB lanes restricts the flow in the trench to throttle back the peak flows. This not only ensures the downstream capacity of the existing system remains adequate, but it also keeps most of the runoff in the trench from needing to pass through the sag in the I-90 WB outside shoulder where vertical fall to the outlet is the least. The available fall is so shallow that the proposed system requires 34"x53" extra strength elliptical pipes at 0.15% & 0.30% to meet the outlet. The 0.30% 34" x 53" elliptical (an equivalent 42" round) is the last conduit in the system and is used instead of sacrificing some of the vertical fall from pipes upstream so that it can carry peak flows equivalent to the existing 36" conduit at 0.7% that it is replacing. This is due to outside drainage areas not impacted by the project which the design team was not able to fully analyze as they are well beyond the project survey limits.

Pre-and post- peak flows were calculated within the trench and are presented in Appendix I along with the detention calculations.

## FLOW RESTRICTOR

The detention basin along I-90 EB is considered a flow restrictor and is only required to remain in place until the time at which CCG4 & CCG5 are constructed, and the storm sewer downstream is upsized to manage the increase in flow. At that time, the detention basin can be removed, making way for the future I-90 EB lanes.

## POST-CONSTRUCTION BMPS

The project has an Earth Disturbed Area (EDA) of 69.0 acres, and 55.0 acres of that drains to the City of Cleveland combined sewers which outlet to NEORSD facilities and are treated at their wastewater treatment plants. 14.0 acres are collected in a storm-only sewer and are subject to BMP treatment per L&D Manual Volume 2, Section 1111. Maps & calculations can be found in Appendix J.

Of the 14.0 acres of project EDA in storm-only sewer, 0.35 acres are new impervious area in new right of way. Because this is less than one acre, the project is not required to treat water quantity, only water quality. The treatment percent is 22.0% with a treatment requirement of 3.1 acres.

A Manufactured System Type 4 is proposed along I-90 EB and treats 3.74 acres of runoff upstream of the detention basin. This manufactured system has been placed to obtain maximum treatment credit exceeding what is required, while still being constructed in a location out of the way of the CCG4 & CCG5 projects. This manufactured system must remain in place during the future projects, unless it is replaced with a different BMP that treats the same amount of stormwater or more. The detention basin along I-90 EB can be removed with future projects since its sole purpose is flow restriction to the existing downstream sewer. The access location on the I-90 EB outside shoulder beneath the E. 22$^{nd}$ Street bridge also must remain in place for access to the manufactured system.

## COMBINED TRUNKLINE IMPACTS

Three combined sewer trunk lines are impacted by the construction of the project. They are Central Avenue, Community College Avenue, and Woodland Avenue.

- **Central Ave:** I-90 is in cut over the existing No. 6 & No. 7 brick combined sewer for Central Avenue. The cut does not expose the conduit and the sewer will remain in place and be lined as part of this project. There is also fill over this combined sewer with Wall AD and Ramp A1/A2 gore to the north, and Wall Z and Ramp B6 to the south. Lightweight fill is proposed in the areas of fill as recommended by the geotechnical evaluation to limit settlement of the combined sewer.

- **Community College Ave/E. 14th Street:** The Community College/E. 14th Street No. 12 brick combined sewer is impacted by bridges 9, 10, 11, and 12 and will be relocated and replaced with a 66" sewer. There is a known dual- sewer running beneath E. 14th Street and to the west along I-90 WB. The existing 66" sewer was located with additional subsurface investigation in September 2023 and revealed that the piers for Bridges 9 & 10 conflict with the to be abandoned 66" RCP. Removal of portions of the 66" pipe beneath the proposed piers is now included in the plans.
- **Woodland Ave:** The AER presented multiple alternatives for Ramp A2 over the existing Woodland Avenue No. 10, 11, & 12 brick combined sewer due to the potential for fill and/or foundation impacts. In a meeting held between the design team partners, ODOT, and ODOT's review team on July 7, 2021, the decision was made to use the long Bridge 9 Alternative on Ramp A2 and to line the Woodland Avenue sewer.

See Appendix B for a map of these locations.

Multiple vendors were contacted to determine if their product was suitable to line the egg-shaped sewers. Hobas provided information and calculations for using a fiberglass reinforced polymer mortar pipe liner and while they have no issue lining egg-shaped sewers or this size, it is most efficient to use a single pipe size and that resulted in a decreased capacity within the largest No. 7 and No. 12 pipes on the runs. ODOT Office of Hydraulic Engineering recommended cured-in-place pipe (CIPP) liner with the caveat that vendors might not be able to supply for the larger No. 11 & No. 12 pipes. While a couple of vendors confirmed that they could not supply liners in this size, Inliner Solutions has and can provide for this size egg-shaped sewer on this project. The Manning's roughness coefficient drops to n=0.10 with the liner and with liner thicknesses ranging from 30.7-45.9mm there is significant increase in the pipe capacity. Results from the analysis by Inliner Solution can be found in the table below.

| Segment | | Length (ft) | Egg Height (in) | Egg Width (in) | Egg Equivalent Diameter (in) | Liner Thickness (mm) | Capacity Increase |
|---|---|---|---|---|---|---|---|
| Woodland | No. 12 | 595 | 81 | 64 | 68 | 45.9 | 38% |
| | No. 11 | 270 | 76 | 60 | 64 | 43.5 | 38% |
| | No. 10 | 415 | 71 | 56 | 60 | 41.0 | 38% |
| Central | No. 7 | 655 | 56 | 44 | 47 | 33.4 | 37% |
| | No. 6 | 460 | 51 | 40 | 43 | 30.7 | 37% |

Plans and specifications for the CIPP liner have been included in the Stage 2 plans. The specification is derived from the draft ODOT revised supplemental specification 899 cured-in-place pipe liner.

## MAINTENANCE OF TRAFFIC DRAINAGE

Drainage on the project was evaluated for the maintenance of traffic plans. A minimum dry lane of 10’ for each travelled lane is provided for the 50% AEP design frequency. Spread calculations needed to be performed for Phases 3, 4, 5, 7 & 8 and are included in Appendix K. A brief explanation of each of those situations is below.

Spread calculations were checked for Phase 3 I-90 EB LT on the far east end of the project where MOT traffic patterns require a decrease to the existing shoulder width. A 10’ dry lane remains available, and no temporary or permanent changes are required. In Phase 4 in the same location, a temporary crossover requires the installation of a temporary catch basin, and a spread calculation is provided to confirm the 10’ dry lane is available.

In Phase 4 I-90 EB RT over the E. 9$^{th}$ Street bridge, spread was checked. The 10’ dry lane is not violated, and no temporary drainage is required.

Phase 5 pushes traffic up against the proposed I-90 WB outside barrier under E. 22$^{nd}$ Street and Carnegie Avenue and the 10’ dry lane was violated. Two additional catch basins were added to the permanent proposed design to address the 10’ dry lane criteria.

In Phase 7 traffic is up against the existing barrier along Ramp IB5 as it exits I-90 EB. The spread was checked for the pinch point where a minimum 5.4’ is allowed and the criteria is met with no need for additional structures. WB traffic also is close to the barrier over E. 14$^{th}$ Street, but the spread was checked and the 10’ dry lane is not violated so no additional structures were needed.

Phase 8 moves traffic against the proposed I-90 EB median barrier and the 10’ dry lane was violated. Five additional barrier inlets were added to the permanent proposed design to address the criteria.

During construction, the proposed flow restrictor detention basin along I-90 EB cannot be constructed until Phase 7 when the I-90 temporary runaround is removed. The proposed Hydrocad model was revised by removing the detention basin to check the 50% AEP flow in the storm sewer to evaluate the capacity of the system during construction. The existing 50% AEP flow is 20.2 cfs and the proposed is 31.2 cfs. The existing 36” pipe at a slope of 0.7% has a capacity of 48.3 cfs, which is sufficient to pass the 50% AEP storm. While not required, the 20% AEP storm was also checked, and the peak flow of 42.5 cfs will also pass through the existing storm sewer.

Additional temporary catch basins, manholes, and storm sewer connections are required based on temporary pavement, crossovers, and the construction phasing. They are detailed in the Maintenance of Traffic plans through all proposed phases of construction.

## OPENROADS DESIGNER

While ORD works well, there are still a few quirks with the program that required work arounds. The program is constantly evolving, and versions and workspaces have changed multiple times through the life of the CCG3A project design. At this time, the program is still very buggy and when files get too large, they tend to lag and shut down, occasionally getting corrupted in the process. There is also still an issue with the drainage design in that design elements (pipes and structures) cannot be tied to elements in another design file. In other words, a proposed pipe in one DGN cannot "outlet" to an existing pipe/structure in another DGN. It is impossible on a project of this size to keep both the existing and proposed drainage in one DGN file due to workflow and file size, therefore the drainage design for the project was split into multiple DGN files. This means that we could not actively attach proposed storm pipes to existing pipes/structures. To work around this limitation, we used generic headwall nodes and short runs of pipe to mimic the existing or proposed pipe tie-ins that are in a different file. These are evident in the storm sewer profiles where proposed pipes display overtop of existing ones and where boxes represent the generic headwalls overtop of existing structures. While this isn't yet looking perfect, we've made significant strides, but there are still some anomalies impossible to fix.

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix A

## Drainage Criteria & Pipe Policies

Michael Baker INTERNATIONAL

Form LD-35
Revised January 2015

## PROJECT INFORMATION:

| Cuyahoga County | CUY-90-16.28 | | 82380 |
|---|---|---|---|
| **COUNTY** | **ROUTE** | **SECTION** | **PID** |

## PIPE POLICY:

The Pipe Policy of ODOT will be used for this project. Local roads will use the City of Cleveland pipe policy.

## POST CONSTRUCTION BMP POLICY:

The Post Construction BMP Policy of ODOT will be used for this project.
The NEORSD standards will also be required when connecting to a combined sewer. Any connections to a combined sewer must control the flow rates. The post construction BMPs will be used to control the flow rates at select connections to the combined sewers.

## DRAINAGE WATERSHED(S):

The existing terrain is highly urban setting near Cleveland. The major water bodies are the Cuyahoga River and Lake Erie.

## PROJECT SPECIFIC INFORMATION AFFECTING DRAINAGE:

The proposed project improves the interchange function of I-90 and I-77. Project is within the sewershed of several CSOs. The proposed alignments, profiles and grading cause changes to the sewershed areas of the CSOs.

Michael Baker INTERNATIONAL

**PROJECT: CUY-90-16.28**
**PID #82382**
**Drainage Criteria**

Created By: JARoss
Checked By: KGJohnson
Date: March 2021
Updated: May 2024

## Project Information

| Roadway | Functional Classification | ADT | Design Speed |
|---|---|---|---|
| IR 90 | Urban Interstate | 148000 | 60 mph (W of E22nd)<br>50 mph (E of E22nd) |
| IR 77 | Urban | 62000 | 60 mph |
| Ramp B6 | Diamond Ramp | 7500 | Varies |
| Ramp A1 | Diamond Ramp | 6000 | Varies |
| Ramp A2 | Directional Ramp | 23500 | Varies |
| Ramp A3 | Diamond Ramp | 7800 | Varies |
| Ramp IH4 | Diamond Ramp | 11300 | Varies |
| Ramp H5 | Directional Ramp | 19200 | Varies |
| Ramp H6 | Diamond Ramp | 3800 | Varies |
| Ramp IJ3 | Diamond Ramp | 8100 | Varies |

## Roadway Culverts (1105)

1. Design storm frequency (1004.2) –
    a. *Mainline -2% AEP*
    b. *Ramps – 4% AEP*

Freeways or other multi-lane facilities with limited access..... 50 Year
Other Highways (2000 ADT and over) and Freeway Ramps.....25 Year
Other Highways (under 2000 ADT)..... 10 Year

2. Maximum allowable headwater for design storm (1006.2)
    *a. Drainage area ≥ 1000 acres - 2 feet below the near, low edge of the pavement*
    *b. Drainage area < 1000 acres - 1 foot below the near, low edge of the pavement*
    *c. Flat to rolling terrain - 2 feet above the inlet crown of the culvert or above a tailwater elevation that submerges the inlet crown*
3. Manning's Roughness Coefficient (1105.5.5) – *0.012*

The "n" values for corrugated metal pipe are given in Figure 1105-2. The "n" value for all smooth flow pipe is 0.012. Use a weighted Manning's n for bankfull designed culverts or analyzing older culverts with sediment deposition.

**Table 1105-2**

| Type A Conduit Entrance Loss Coefficient $k_e$ | | | |
|---|---|---|---|
| **Type of Pipe** | **Headwall Type** | | |
| | **Full** | **One-Half** | **None** |
| Concrete, Vitrified (thick wall) * | 0.2 | 0.2 | 0.2 |
| Corrugated Metal (thin wall) | 0.25** | 0.9 | 0.9 |

* groove end entrance
** beveled entrance

Michael Baker INTERNATIONAL

**PROJECT: CUY-90-16.28**
**PID #82382**
**Drainage Criteria**

Created By: JARoss
Checked By: KGJohnson
Date: March 2021
Updated: May 2024

## Drainage (1101)

1. Runoff Coefficient (1101.2.2) –

**Table 1101-2**

| Types of Surface | Coefficient of Runoff "C" |
|---|---|
| Pavement & paved shoulders | 0.9 |
| Berms and slopes 4:1 or flatter | 0.5 |
| Berms and slopes steeper than 4:1 | 0.7 |
| **Contributing areas** | |
| Residential (single family) | 0.3-0.5 |
| Residential (multi-family) | 0.4-0.7 |
| Woods | 0.3 |
| Cultivated | 0.3-0.6 |

## Ditches (1102)

1. Design storm frequency for depth (1102.3.1) – *10% AEP*
    a. Depth requirements –
        i. *1 ft below edge of pavement*
        *ii.* *Toe of slope ditches – flow should not overtop ditch bank*
2. Design storm frequency for shear (1102.3.1) – *20% AEP*
3. Manning's Roughness Coefficient for ditch liners (1102.3.3)
    a.

**Table 1102-2**

| Manning's Roughness Coefficient | |
|---|---|
| **Type of Lining** | **n** |
| Bare Earth | 0.02 |
| Seeded | 0.03 |
| Sod | 0.04 |
| Item 670 | 0.04 |
| Concrete | 0.015 |
| Bituminous | 0.015 |
| Grouted Riprap | 0.02 |
| Tied Concrete Block Mat | 0.03 |
| Rock Channel Protection | 0.06 for ditches<br>0.04 for large channels |

4. Ditch Configuration (1102.2)
    *a.* *Trapezoidal traversable ditches*
5. Type of ditch catch basin (1102.3.4)
    a. *40 ft radius roadside or median ditches – CB No. 5*
    b. *20 ft radius roadside or depressed medians 40 ft or less in width – CB No. 8*
    c. *Depressed median at bridge terminals – CB No. 2-2-B*
6. Minimum longitudinal slope (1102.1)
    a. *0.50% is recommended, 0.25% minimum*
7. Ditch liners
    a. Allowable Shear Stress (1102.3.2)-

Table 1102-1

| Permanent Protection | |
|---|---|
| **Protective Lining** | **Allowable Shear Stress (lbs/ft²)** |
| Seed (659) | 0.40 |
| Sodding, Ditch Protection (660) | 1.0 |
| **Temporary Protection** | |
| Ditch Erosion Protection Mat Type___ (670) | |
| A | 1.25 |
| B | 1.50 |
| C | 2.0 |
| E | 2.25 |
| F | 0.45 |
| G | 1.75 |

b. Minimum width (1102.3.1)- 4 *ft (additional width should be in 0.5 ft increments)*

## Pavement Drainage (1103)

1. Design storm frequency (1103.2) – *10% AEP*
2. Check storm frequency for underpass or depressed roadway with only storm outlet (1103.2) – *2% AEP*
3. Maximum spread of flow into 12' traveled lane (Table 1103-1)
    a. Mainline/Ramps – *0 ft*
    b. Side Street/Other – *6 ft*
    c. Side Street/Other ≥ 4 lanes – *8 ft*
4. Maximum depth of flow at curb (1103.2) – *1" below top of curb, A maximum depth of 6 inches is permissible where a barrier shape is provided adjacent to the pavement*
5. Minimum time of concentration (1103.3) – *10 minutes*
6. Local depression (1103.6) –

Table 1103-2

| Basin/Inlet Type | Normal Pavement Slope | Depressed Shoulder/Gutter |
|---|---|---|
| | A (inches) | A (inches) |
| CB-3/3A | 0.5 | 0 |
| CB-6 | 0.5 | 0.5 |
| I-2/2A | 2 | 0.5 |
| I-3B/3C/3D-Grate Side | 2 | - |
| I-3B/3C-Window Only Side | 2 | - |

7. Type of catch basin –
    a. *Pavement sags - CB-3*
    b. *Low point of a sag in a drive - CB-3A, & CB-6*
    c. *Along curbed roadways and medians – CB-6*
    d. *Barrier Inlets – I-3B, I-3C, I-3D*

## Storm Sewers (1104)

1. Just Full Design storm frequency (1104.3.1) – *10% AEP*
2. Hydraulic grade line storm frequency (1104.3.2) – *4% AEP*
    a. Shall not exceed the following –
        i. *12 inches below the edge of pavement for sections without curb*
        ii. *The elevation of a curb opening inlet or grate elevation of a pavement catch basin*

3. Minimum time of concentration (1104.3.4)
    a. *15 minutes to the first ditch catch basin*
    b. *10 minutes to the first pavement inlet*
4. Pipe roughness coefficient (1104.3.5)
    a. *0.015 for 60" sewer and under*
    b. *0.013 for >60" sewers*
5. Minimum storm sewer pipe size (1104.3.6) - *15 inches*
6. Minimum cover (1104.2.1)
    a. *Rigid Pipe – 9" to bottom of subbase, 15" to pavement surface, 18" to ground*
    b. *Flexible Pipe – 12" to bottom of subbase, 24" to pavement or ground surface*
    c. *Extra strength – 4" to bottom of subbase, 10" to pavement surface, 4" to ground*
7. Desirable minimum velocity (1104.2.1.G) – *3 fps*
8. Maximum spacing between manholes or cleanouts (1104.2.3)
    a. *300' for <36"*
    b. *500' for 36" to 60"*
    c. *750'-1000' for >60"*

Michael Baker INTERNATIONAL

**PROJECT: CUY-90-16.28**
**PID #82382**
**Drainage Criteria**

Created By: JARoss
Checked By: KGJohnson
Date: March 2021
Updated: May 2024

## Project Information

| Roadway | Functional Classification | ADT | Design Speed |
|---|---|---|---|
| Carnegie Ave. | Urban Arterial | 30500 | 30 mph |
| Cedar Ave. | Urban Collector | 8700 | 30 mph |
| E 14th St. | Urban Collector | 19100 | 30 mph |
| E 18th St. | Urban Arterial | 14500 | 40 mph |
| E 21st St. | Urban Collector | 6400 | 30 mph |
| E 22nd St. | Urban Collector | 15300 | 30 mph |

## Drainage (1101)

1. Runoff Coefficient (1101.2.2) –

**Table 1101-2**

| Types of Surface | Coefficient of Runoff "C" |
|---|---|
| Pavement & paved shoulders | 0.9 |
| Berms and slopes 4:1 or flatter | 0.5 |
| Berms and slopes steeper than 4:1 | 0.7 |
| **Contributing areas** | |
| Residential (single family) | 0.3-0.5 |
| Residential (multi-family) | 0.4-0.7 |
| Woods | 0.3 |
| Cultivated | 0.3-0.6 |

## Ditches (1102)

1. Design storm frequency for depth (1102.3.1) – *10% AEP*
    a. Depth requirements –
        i. *1 ft below edge of pavement*
        *ii.* *Toe of slope ditches – flow should not overtop ditch bank*
2. Design storm frequency for shear (1102.3.1) – *20% AEP*
3. Manning's Roughness Coefficient for ditch liners (1102.3.3)
    a.

**Table 1102-2**

| Manning's Roughness Coefficient | |
|---|---|
| **Type of Lining** | **n** |
| Bare Earth | 0.02 |
| Seeded | 0.03 |
| Sod | 0.04 |
| Item 670 | 0.04 |
| Concrete | 0.015 |
| Bituminous | 0.015 |
| Grouted Riprap | 0.02 |
| Tied Concrete Block Mat | 0.03 |
| Rock Channel Protection | 0.06 for ditches<br>0.04 for large channels |

4. Ditch Configuration (1102.2)
    *a.* *Trapezoidal traversable ditches*
5. Type of ditch catch basin (1102.3.4)
    a. *40 ft radius roadside or median ditches – CB No. 5*
    b. *20 ft radius roadside or depressed medians 40 ft or less in width – CB No. 8*

c. *Depressed median at bridge terminals – CB No. 2-2-B*

6. Minimum longitudinal slope (1102.1)
   a. *0.50% is recommended, 0.25% minimum*
7. Ditch liners
   a. Allowable Shear Stress (1102.3.2)-

**Table 1102-1**

| Permanent Protection | |
|---|---|
| **Protective Lining** | **Allowable Shear Stress (lbs/ft²)** |
| Seed (659) | 0.40 |
| Sodding, Ditch Protection (660) | 1.0 |
| **Temporary Protection** | |
| Ditch Erosion Protection Mat Type___ (670) | |
| A | 1.25 |
| B | 1.50 |
| C | 2.0 |
| E | 2.25 |
| F | 0.45 |
| G | 1.75 |

   b. Minimum width (1102.3.1)- 4.0 *ft (additional width should be in 0.5 ft increments)*

## Pavement Drainage (1103)

1. Design storm frequency (1103.2) –

| Facility | Design (years) |
|---|---|
| Freeways | 10 |
| High volume highways (Over 6000 ADT Rural or 9000 ADT Urban) | 5 |
| All other Highways | 2 |

   a. *Carnegie/ E 14th, E 18th, E 22nd – 20% AEP*
   b. *Cedar/E 21st – 50% AEP*
2. Check storm frequency for underpass or depressed roadway with only storm outlet (1103.2) –
   a. *Carnegie/ E 14th, E 18th, E 22nd – 2% AEP*
   b. *Cedar/E 21st - 4% AEP*
3. Maximum spread of flow into traveled lane (Table 1103-1)

**Table 1103-1**

| Facility | | Allowable Pavement Spread* (ft) |
|---|---|---|
| Freeways | | 0 |
| High Volume Highways (Over 6000 ADT Rural or 9000 ADT Urban) | | |
| ≥ 45 mph | | 4 |
| < 45mph | 2 lanes | 6 |
| | ≥4 lanes | 8 |
| All other Highways | | |
| | 2 lanes | 6 |
| | ≥4 lanes | 8 |

*Pavement spread applies to the through lane only

a. *6 ft & 8ft*

4. Maximum depth of flow at curb (1103.2) –
   a. *1" below top of curb*
   b. *6 inches is permissible where a barrier shape is provided adjacent to the pavement*
5. Minimum time of concentration (1103.3) – *10 minutes*
6. Local depression (1103.6) –

Table 1103-2

| Basin/Inlet Type | Normal Pavement Slope | Depressed Shoulder/Gutter |
|---|---|---|
| | A (inches) | A (inches) |
| CB-3/3A | 0.5 | 0 |
| CB-6 | 0.5 | 0.5 |
| I-2/2A | 2 | 0.5 |
| I-3B/3C/3D-Grate Side | 2 | - |
| I-3B/3C-Window Only Side | 2 | - |

7. Type of catch basin –
   a. *Pavement sags - CB-3*
   b. *Low point of a sag in a drive - CB-3A, & CB-6*
   c. *Along curbed roadways and medians – CB-6*

## Storm Sewers (1104)

1. Just Full Design storm frequency (1104.3.1) – *10% AEP*
2. Hydraulic grade line storm frequency (1104.3.2) – *4% AEP*
   a. Shall not exceed the following –
      i. *12 inches below the edge of pavement for sections without curb*
      ii. *The elevation of a curb opening inlet or grate elevation of a pavement catch basin*
3. Minimum time of concentration (1104.3.4)
   a. *15 minutes to the first ditch catch basin*
   b. *10 minutes to the first pavement inlet*
4. Pipe roughness coefficient (1104.3.5)
   a. *0.015 for 60" sewer and under*
   b. *0.013 for >60" sewers*
5. Minimum storm sewer pipe size (1104.3.6) - *12 inches*
6. Minimum cover (1104.2.1)
   a. *Rigid Pipe – 9" to bottom of subbase, 15" to pavement surface, 18" to ground*
   b. *Flexible Pipe – 12" to bottom of subbase, 24" to pavement or ground surface*
   c. *Extra strength – 4" to bottom of subbase, 10" to pavement surface, 4" to ground*
7. Desirable minimum velocity (1104.2.1.G) – *3 fps*
8. Maximum spacing between manholes or cleanouts (1104.2.3)
   a. *300' for <36"*
   b. *500' for 36" to 60"*
   c. *750'-1000' for >60"*

## WPC Standards

1. Minimum 8 ft is required between the main sewer and any underground utility line.

2. Minimum cover of 3 ft.
3. Minimum size of 12”.
4. Minimum size of 15” for proposed combined sewers.
5. Use Vitrified Clay Pipe (VCP), Extra Strength (EX), C-700, with premium joints, ODOT Item 706.08 for all proposed main sewer pipe 18” and smaller.
6. Use reinforced concrete pipe (RCP) with premium joints, ODOT Item 706.02 for all proposed main sewer pipe 21” and larger.
7. Ductile Iron Pipe (DIP) may be used if approved by the WPC engineer.
8. Velocity cannot exceed 15 ft/s and must be greater than 3 ft/s.
9. Use a minimum slope of 0.5% for all proposed main sewers.
10. Use 1% minimum slope for all proposed catch basin connections.
11. Use the City of Cleveland standard rectangular catch basin detail CB-1 for all proposed catch basins in the roadway. This detail requires a trap and 24” minimum sump.
12. No more than two catch basins can be tied in series.

## NEORSD Combined Sewers (Title IV)

1. Post-development peak flows shall not exceed existing condition peak flows, nor shall they result in an increase to CSO volumes and/or typical year activations
    a. Storm events up to the 5-year, 24-hour event: storage volume shall be provided to ensure that there is no increase in flow to the combined sewer system
    b. Storm event greater than the 5-year and up to the 25-year, 24-hour event: the maximum release rate shall be defined as the existing conditions peak discharge of the corresponding storm frequency evaluate for post-development conditions
2. For connections to the combined sewer system, stormwater shall be managed in accordance to Part III.G.2.e of the Ohio EPA’s General Permit OHC000003 or Chapter 3116 of the City of Cleveland’s Codified Ordinances, whichever is more restrictive
3. For separated storm connections to a CSO pipe or receiving water, the District will only accept stormwater control measures that provide water quality treatment for 100% of the project area whether the project is defined as a redevelopment project or new development.
4. Rainfall Depth Table – ODOT is more conservative so ODOT values will be used

## Appendix A. NEORSD Rainfall Depth/Intensity Data

a.

**Table A-1. Rainfall Depth-Duration.**

| Tc (min) | Rainfall Depth (in) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2-Month | 3-Month | 4-Month | 6-Month | 9-Month | 1-Year | 2-Year | 5-Year | 10-Year | 25-Year | 50-Year | 100-Year |
| 5 | 0.13 | 0.15 | 0.17 | 0.19 | 0.22 | 0.32 | 0.39 | 0.46 | 0.53 | 0.60 | 0.67 | 0.73 |
| 10 | 0.24 | 0.28 | 0.30 | 0.35 | 0.40 | 0.50 | 0.60 | 0.72 | 0.81 | 0.93 | 1.01 | 1.10 |
| 15 | 0.30 | 0.35 | 0.38 | 0.45 | 0.51 | 0.61 | 0.74 | 0.88 | 1.00 | 1.14 | 1.25 | 1.36 |
| 20 | 0.34 | 0.39 | 0.43 | 0.50 | 0.57 | 0.68 | 0.82 | 0.99 | 1.12 | 1.29 | 1.42 | 1.56 |
| 25 | 0.37 | 0.44 | 0.47 | 0.56 | 0.63 | 0.74 | 0.90 | 1.10 | 1.25 | 1.45 | 1.60 | 1.76 |
| 30 | 0.41 | 0.48 | 0.52 | 0.61 | 0.69 | 0.81 | 0.98 | 1.21 | 1.38 | 1.61 | 1.78 | 1.96 |
| 35 | 0.43 | 0.50 | 0.55 | 0.64 | 0.72 | 0.84 | 1.01 | 1.26 | 1.44 | 1.69 | 1.87 | 2.07 |
| 40 | 0.45 | 0.52 | 0.57 | 0.67 | 0.75 | 0.87 | 1.05 | 1.31 | 1.51 | 1.77 | 1.97 | 2.18 |
| 45 | 0.47 | 0.55 | 0.60 | 0.70 | 0.79 | 0.90 | 1.09 | 1.36 | 1.57 | 1.85 | 2.06 | 2.29 |
| 50 | 0.49 | 0.57 | 0.62 | 0.72 | 0.82 | 0.93 | 1.13 | 1.41 | 1.63 | 1.93 | 2.16 | 2.40 |
| 55 | 0.51 | 0.59 | 0.65 | 0.75 | 0.85 | 0.96 | 1.17 | 1.46 | 1.69 | 2.01 | 2.25 | 2.51 |
| 60 | 0.53 | 0.61 | 0.67 | 0.78 | 0.88 | 0.99 | 1.21 | 1.51 | 1.76 | 2.09 | 2.35 | 2.62 |
| 65 | 0.54 | 0.62 | 0.68 | 0.80 | 0.90 | 1.00 | 1.22 | 1.53 | 1.78 | 2.12 | 2.39 | 2.67 |
| 70 | 0.55 | 0.64 | 0.70 | 0.81 | 0.92 | 1.01 | 1.24 | 1.55 | 1.81 | 2.15 | 2.43 | 2.72 |
| 75 | 0.56 | 0.65 | 0.71 | 0.83 | 0.93 | 1.03 | 1.25 | 1.57 | 1.83 | 2.18 | 2.47 | 2.76 |
| 80 | 0.57 | 0.66 | 0.72 | 0.84 | 0.95 | 1.04 | 1.27 | 1.59 | 1.86 | 2.22 | 2.51 | 2.81 |
| 85 | 0.58 | 0.67 | 0.74 | 0.86 | 0.97 | 1.05 | 1.28 | 1.61 | 1.88 | 2.25 | 2.55 | 2.86 |
| 90 | 0.59 | 0.69 | 0.75 | 0.87 | 0.99 | 1.07 | 1.30 | 1.64 | 1.91 | 2.28 | 2.59 | 2.91 |
| 95 | 0.60 | 0.70 | 0.76 | 0.89 | 1.00 | 1.08 | 1.31 | 1.66 | 1.93 | 2.31 | 2.63 | 2.95 |
| 100 | 0.61 | 0.71 | 0.78 | 0.90 | 1.02 | 1.09 | 1.33 | 1.68 | 1.96 | 2.35 | 2.67 | 3.00 |
| 105 | 0.62 | 0.72 | 0.79 | 0.92 | 1.04 | 1.11 | 1.34 | 1.70 | 1.98 | 2.38 | 2.71 | 3.05 |
| 110 | 0.63 | 0.74 | 0.80 | 0.93 | 1.06 | 1.12 | 1.36 | 1.72 | 2.01 | 2.41 | 2.75 | 3.10 |
| 115 | 0.64 | 0.75 | 0.82 | 0.95 | 1.07 | 1.13 | 1.37 | 1.74 | 2.03 | 2.44 | 2.79 | 3.14 |
| 120 | 0.65 | 0.76 | 0.83 | 0.96 | 1.09 | 1.15 | 1.39 | 1.76 | 2.06 | 2.48 | 2.83 | 3.19 |
| 180 | 0.72 | 0.84 | 0.92 | 1.06 | 1.21 | 1.23 | 1.49 | 1.89 | 2.21 | 2.68 | 3.06 | 3.48 |
| 360 | 0.84 | 0.98 | 1.07 | 1.24 | 1.41 | 1.45 | 1.75 | 2.21 | 2.61 | 3.20 | 3.70 | 4.25 |
| 720 | 0.97 | 1.13 | 1.24 | 1.43 | 1.63 | 1.67 | 2.01 | 2.52 | 2.96 | 3.61 | 4.17 | 4.79 |
| 1440 | 1.12 | 1.31 | 1.43 | 1.65 | 1.88 | 1.95 | 2.33 | 2.92 | 3.40 | 4.09 | 4.66 | 5.28 |

5. Rainfall Intensity Table

a.

**Table A-2. Rainfall Intensity-Duration.**

| Tc (min) | Rainfall Intensity (in/hr) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2-Month | 3-Month | 4-Month | 6-Month | 9-Month | 1-Year | 2-Year | 5-Year | 10-Year | 25-Year | 50-Year | 100-Year |
| 5 | 1.56 | 1.80 | 2.04 | 2.28 | 2.64 | 3.84 | 4.62 | 5.52 | 6.30 | 7.20 | 7.98 | 8.70 |
| 10 | 1.44 | 1.68 | 1.80 | 2.10 | 2.40 | 3.00 | 3.60 | 4.29 | 4.83 | 5.55 | 6.03 | 6.57 |
| 15 | 1.20 | 1.40 | 1.52 | 1.80 | 2.04 | 2.44 | 2.94 | 3.52 | 3.98 | 4.54 | 4.98 | 5.44 |
| 20 | 1.01 | 1.18 | 1.28 | 1.51 | 1.71 | 2.03 | 2.45 | 2.97 | 3.37 | 3.88 | 4.27 | 4.68 |
| 25 | 0.90 | 1.05 | 1.14 | 1.34 | 1.51 | 1.78 | 2.15 | 2.63 | 3.00 | 3.48 | 3.84 | 4.22 |
| 30 | 0.82 | 0.96 | 1.04 | 1.22 | 1.38 | 1.61 | 1.95 | 2.41 | 2.76 | 3.21 | 3.56 | 3.92 |
| 35 | 0.74 | 0.86 | 0.93 | 1.09 | 1.24 | 1.43 | 1.74 | 2.15 | 2.47 | 2.89 | 3.21 | 3.55 |
| 40 | 0.68 | 0.79 | 0.86 | 1.00 | 1.13 | 1.30 | 1.58 | 1.96 | 2.26 | 2.65 | 2.95 | 3.27 |
| 45 | 0.63 | 0.73 | 0.79 | 0.93 | 1.05 | 1.19 | 1.45 | 1.81 | 2.09 | 2.46 | 2.75 | 3.05 |
| 50 | 0.59 | 0.68 | 0.74 | 0.87 | 0.98 | 1.11 | 1.35 | 1.69 | 1.96 | 2.31 | 2.59 | 2.88 |
| 55 | 0.56 | 0.64 | 0.70 | 0.82 | 0.93 | 1.04 | 1.27 | 1.59 | 1.85 | 2.19 | 2.46 | 2.74 |
| 60 | 0.53 | 0.61 | 0.67 | 0.78 | 0.88 | 0.99 | 1.21 | 1.51 | 1.76 | 2.09 | 2.35 | 2.62 |
| 65 | 0.50 | 0.57 | 0.63 | 0.73 | 0.83 | 0.92 | 1.13 | 1.41 | 1.64 | 1.95 | 2.20 | 2.46 |
| 70 | 0.47 | 0.54 | 0.60 | 0.69 | 0.78 | 0.87 | 1.06 | 1.33 | 1.55 | 1.84 | 2.08 | 2.33 |
| 75 | 0.45 | 0.52 | 0.57 | 0.66 | 0.75 | 0.82 | 1.00 | 1.26 | 1.46 | 1.75 | 1.97 | 2.21 |
| 80 | 0.43 | 0.50 | 0.54 | 0.63 | 0.71 | 0.78 | 0.95 | 1.20 | 1.39 | 1.66 | 1.88 | 2.11 |
| 85 | 0.41 | 0.47 | 0.52 | 0.60 | 0.68 | 0.74 | 0.91 | 1.14 | 1.33 | 1.59 | 1.80 | 2.02 |
| 90 | 0.39 | 0.46 | 0.50 | 0.58 | 0.66 | 0.71 | 0.87 | 1.09 | 1.27 | 1.52 | 1.72 | 1.94 |
| 95 | 0.38 | 0.44 | 0.48 | 0.56 | 0.63 | 0.68 | 0.83 | 1.05 | 1.22 | 1.46 | 1.66 | 1.86 |
| 100 | 0.37 | 0.43 | 0.47 | 0.54 | 0.61 | 0.66 | 0.80 | 1.01 | 1.17 | 1.41 | 1.60 | 1.80 |
| 105 | 0.35 | 0.41 | 0.45 | 0.52 | 0.59 | 0.63 | 0.77 | 0.97 | 1.13 | 1.36 | 1.55 | 1.74 |
| 110 | 0.34 | 0.40 | 0.44 | 0.51 | 0.58 | 0.61 | 0.74 | 0.94 | 1.09 | 1.31 | 1.50 | 1.69 |
| 115 | 0.33 | 0.39 | 0.43 | 0.49 | 0.56 | 0.59 | 0.72 | 0.91 | 1.06 | 1.27 | 1.45 | 1.64 |
| 120 | 0.33 | 0.38 | 0.42 | 0.48 | 0.55 | 0.57 | 0.70 | 0.88 | 1.03 | 1.24 | 1.41 | 1.60 |
| 180 | 0.24 | 0.28 | 0.31 | 0.35 | 0.40 | 0.41 | 0.50 | 0.63 | 0.74 | 0.89 | 1.02 | 1.16 |
| 360 | 0.14 | 0.16 | 0.18 | 0.21 | 0.24 | 0.24 | 0.29 | 0.37 | 0.43 | 0.53 | 0.62 | 0.71 |
| 720 | 0.08 | 0.09 | 0.10 | 0.12 | 0.14 | 0.14 | 0.17 | 0.21 | 0.25 | 0.30 | 0.35 | 0.40 |
| 1440 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.10 | 0.12 | 0.14 | 0.17 | 0.19 | 0.22 |

## Attachment A

# CITY OF CLEVELAND

# DIVISION OF WATER POLLUTION CONTROL (WPC)

# STANDARDS FOR PREPARATION OF PLANS FOR NEW SEWERS

A plan of existing and/or proposed sewers shall be submitted for all projects involving new sewer systems or substantial additions to existing sewer systems. When preparing the sewer plan, the following are to be taken into consideration:

**General information**

1. The sewer plans should be legible and clear, otherwise the plan review cannot proceed.
2. Use 24"x36" size
3. North arrow
4. Legend for utilities
5. Label the existing and/or proposed streets and indicate their status: public, private, dedicated, vacated, existing public or private sewer easement, etc.
6. Show the sewer or utility easement if it exists and provide copies of the easement records. Show the owner of the easement.
7. Show the location and width of all existing or proposed utility easements.
8. Label the right of way (in bold type), curb, underground utilities and property lines.
9. Show the addresses and names of the existing and/or proposed properties if available.
10. Show on the plan and profile views the location and type of all utility lines.
11. Show the elevation of the finished floor and/or basement floor on the property in relation to the existing and/or proposed sewer.
12. It is highly recommended to check the availability of sewer records for the plan and profile views and location of sewer connections during the design stage.
13. Include a list of all file numbers and sewer records that have been provided by WPC on the plans.
14. Plans should be prepared with 1:20 horizontal scale and 1:5 vertical (elevations) scale.

15. The sewer plans should show the plan view with its respective profile view on the same sheet. Also, cross section views are required for the proposed catch basins.

**Sewer Bulkheads**

If a sewer bulkhead is required, show the location on the plans. Indicate that a masonry bulkhead should be constructed, by the contractor, for all existing sewers to be cut and abandoned.

**Sewer Abandoned**

If sewer pipes are to be abandoned, show the location and size of the pipes. Indicate if the pipes will be sandfilled or grouted in place, or removed.

**Main Sewer**

The following are required when preparing plans for proposed main sewers located in the City right of way or public easement:

1. Show all existing and proposed underground utilities on both plan and profile views.
2. A minimum horizontal clearance of 8 ft is required between the main sewer and any underground utility line.
3. Show the actual width of the existing and proposed main sewers.
4. Show the new main sewers in bold type.
5. Storm and sanitary main sewers are required in proposed public roadways. In addition to WPC approval, approval of the new sewers should be granted by the Ohio EPA and the Northeast Ohio Regional Sewer District (NEORSD). Approved copies of the plans and/or correspondence should be submitted to WPC. The NEORSD phone number is (216) 881-6600.
6. If the main sewer is not owned by the City, show its ownership.
7. If the proposed main sewer is private, an encroachment permit approved by the City Council is required.
8. All new main sewers and manholes should be located within the public roadway.
9. All proposed main sewers should flow by gravity.
10. Show the length, size, material type and slope of the proposed main sewer. Also indicate if the sewer is combined, sanitary or storm.
11. The minimum depth of a proposed main sewer is 9 ft. It can be shallower if it is intended for street drainage only.
12. A minimum cover of 3 ft is required for all proposed main sewers.
13. Use a minimum size of 12" for proposed storm and/or sanitary main sewers.
14. Use a minimum size of 15" for proposed combined main sewers.
15. Use Vitrified Clay Pipe (VCP), Extra Strength (ES), C-700, with premium joints, ODOT item 706.08 for all proposed main sewer pipe 18" and smaller.

16. Use Reinforced Concrete Pipe (RCP) with premium joints, ODOT Item 706.02 for all proposed main sewer pipe 21" and larger.

17. Ductile Iron Pipe (DIP) may be used if approved by the WPC engineer.

18. No horizontal bends are allowed in the main sewers.

19. Use a minimum slope of 0.50% for all proposed main sewers.

20. Submit sewer calculations for any proposed main sewer. For the design of sewers, the velocity of water cannot exceed 15 ft/s but not less than 3 ft/s.

21. If a sewer easement is required for the proposed main sewer, it should be labeled on the plans along with its width. Generally, the sewer easement should not be less than 50 ft and it should be accessible at all times.

22. Show locations of all special sewers such as inverted siphons, concrete encasements, culverts, etc.

23. Include the EPA requirements for sewer testing.

24. If a storm sewer is discharging to a body of water (i.e. river, creek or lake) the plans should be approved by the authorizing agency (i.e. Ohio EPA, Ohio Department of Natural Resources (ODNR), US Army Corps of Engineers)

25. The following notes should be included in the plans when a public sewer is built:

    a. The contractor should notify the Division of Water Pollution Control (WPC) prior to start of construction. Call the engineering office at (216) 664-2756 or (216) 664-2787 to coordinate the sewer work.

    b. The contractor is required to submit sewer shop drawings to WPC prior to sewer installation. The drawings should include the sewer pipes, manholes, catch basins and other sewer appurtenances.

    c. WPC will inspect the City sewer installation. The cost of the full time inspection shall be paid by the contractor. An inspection deposit shall be submitted to WPC prior to the start of construction.

    d. The proposed sewers should be constructed in accordance to the plans and specifications approved by WPC. Any deviations from the approved plans or specifications require a new plan submittal reflecting the changes. Upon review of the revised items, WPC will re-issue a new approval. It is strictly prohibited to construct any sewers unless they are approved by WPC.

    e. Upon completion of the sewer installation, the contractor is required to submit a hard copy and an electronic copy of as-built plans, and a CCTV copy of the new City sewers. WPC reserves the right not to approve any sewer that does not meet the City requirements.

    f. The contractor is responsible for the plan review fees of the new City main sewers.
    g. The contractor is required to obtain permits for all proposed or existing sewer connections that will service any property.

## Sewer Connection (or Lateral)

The following are required for all proposed sewer connections located in the City right of way.

1. All proposed sewer connections should flow by gravity in the City right of way.
2. Show on the plan view the station of each proposed sewer connection.
3. Use a minimum size of 6" for all proposed sewer connections.
4. In general, use a 6" pipe for new house sewer connections.
5. Use a minimum slope of 1% for proposed 6" and 8" sewer connections.
6. The size and the slope of a proposed sewer connection should be based on its capacity.
7. If the proposed sewer connection will damage the structural integrity of a main sewer, a new manhole is needed. This requires special approval from WPC.
8. A minimum cover of 3 ft is required for all proposed sewer connections.
9. Label the sewer connections as "combined", "storm" or "sanitary".
10. If the proposed sewer connection is private, an encroachment permit approved by the City Council is required.
11. Use Vitrified Clay Pipe (VCP), ASTM C-700 ES, with premium joints, (ODOT item 706.08) for all proposed sewer connections 18" and smaller.
12. Use Reinforced Concrete Pipe (RCP) with premium joints, (ODOT Item 706.0) for all sewer connections 21" and larger.
13. Ductile Iron Pipe (DIP) may be used if approved by the WPC engineer.
14. Per the City standards, a test tee is required for each proposed sanitary and storm connection. Two test tees are required for a proposed combined sewer connection. The test tee should be located inside the property at 1 to 2 ft from the right of way. In commercial projects, a test tee can be replaced with a manhole.
15. It is preferred to tie the sewer connection to a manhole in the street. If this is not possible, the size of the sewer connection must be reviewed and approved by WPC to avoid structural damage of the main line.
16. No horizontal bends are allowed for sewer connections.
17. It is strictly prohibited to tie a sanitary sewer connection to a storm main sewer and vice versa.
18. Use a VCP Wye or Tee for sewer connections that tie to a VCP main sewer.
19. Use a saddle for sewer connections that tie to a brick or RCP main sewer.
20. Protrusion

**Manhole**

The following are required for all proposed sewer manholes located in the City right of way or public easement:

1. Show the type of material (brick or concrete), station, actual size, rim and invert elevations of existing and proposed manholes, including invert elevations of all pipes connecting to the manholes.

2. Indicate the station of the manhole on both plan and profile views.

3. Indicate the rim elevation of the manhole and the invert elevation of each sewer pipe that ties to the manhole with its respective direction and type (storm, sanitary or combined).

4. Indicate if the manhole is storm, sanitary, combined, regulator, chamber, dual, etc.

5. Indicate the type and size of the special manhole when it is required (i.e. large manhole, drop manhole, baffle manhole, junction chamber, etc.).

6. The difference of invert elevations between a manhole and a sanitary or combined sewer pipe that ties to this manhole should not exceed 2 ft. Special approval is required for a drop manhole.

7. The difference of invert elevations between a manhole and a storm sewer pipe that ties to this manhole should not exceed 10 ft. Special approval is required for a drop storm manhole.

8. It is prohibited to propose a drop pipe inside the manhole.

9. For the manhole cover and casting, use EJIW 1700 **with vented holes**, or approved equal.

10. All proposed manholes should be accessible for maintenance purposes.

11. For main sewers 36" in diameter and less, manholes should be spaced at a maximum of 300 ft.

12. For main sewers 42" in diameter and larger, manholes should be spaced at a maximum of 500 ft.

**Catch Basin**

The following are required for all proposed catch basins that are located in the City right of way.

1. Show the station, rim and invert elevations of existing and proposed catch basins, including invert elevations of all pipes connecting to the catch basins.

2. All proposed catch basins should be located in the public roadway.

3. It is preferred to tie a proposed catch basin to a manhole.

4. Use 12" VCP Extra Strength (ES), C-700, with premium joints, ODOT item 706.08, for all catch basin connections.

5. Use 1% minimum slope for all proposed catch basin connections.

6. It is prohibited to tie a service sewer connection to the City catch basin.

7. Use the City of Cleveland standard rectangular catch basin detail CB-1 for all proposed catch basins in the roadway unless another detail is required by a WPC engineer. This detail requires a trap and 24" minimum sump. For the trap use EJIW 5964-12 or approved equal. For the casting and grate, use EJIW 7350 or approved equal.

8. In a special project, WPC may require a 36" minimum sump.

9. It is prohibited to propose a catch basin within the limits of an ADA ramp.

10. It is prohibited to propose a catch basin within the limits of a driveway apron.

11. No more than two catch basins can be tied in series.

**Water Pollution Control Address and Contacts:**

Address:
Division of Water Pollution Control
12302 Kirby Avenue
Cleveland, Ohio 44108

Engineering Office:
(216) 664-2787
(216) 664-3638
(216) 664-3783
(216) 664-2052
(216) 664-2756

Customer Service:
(216) 664-2513

Fax Number:
(216) 664-3477

**Plan Review Process:**
It is highly recommended that the consultant contact WPC Engineering office prior to the start of the sewer design to receive every available sewer record and guidelines.

Estimated review of each plan submittal is approximately three (3) weeks. WPC Engineering office will issue all comments in writing.

Addressee's response to WPC comments must be in writing and included with the revised plan submittal.

**Additional Reference Information:**

- WPC Standard Details for Sewer Appurtenances (see attached)
- Cuyahoga County Book of Uniform Standard Sewer Details
  To receive a copy contact Cuyahoga County Engineer's Office at (216) 348-3800
- Cuyahoga County Book of Uniform Standards for Sewerage Improvements
  To receive a copy contact Cuyahoga County Engineer's Office at (216) 348-3800
- ODOT Book of Construction and Material Specifications
- To receive an electronic copy of the WPC Standards for Preparation of Plans for New Sewers contact WPC Engineering Office

# Northeast Ohio Regional Sewer District

# Submittal Requirements for Connections to the Combined Sewer System

### Guidelines for Review and Approval

Requests for connection approval are required for all new development and redevelopment projects within the NEORSD service area seeking to connect to a combined sewer, combined sewer overflow (CSO) pipe, or separated storm sewer tributary to a combined sewer or CSO pipe.

Northeast Ohio Regional Sewer District
Protecting Your Health and Environment

**Version 1.3**

# Version History

| Version | Date | Description of Revisions |
|---|---|---|
| 0.0 | 4/10/2011 | Official release for distribution. |
| 1.0 | 1/3/2012 | Revised document title; changed all references to “designer” to “applicant”. |
| 1.1 | 11/01/12 | Revised 3.1 Design Criteria language |
| 1.2 | 9/10/14 | Revised Sections 2.2 and 3.1 |
| 1.3 | 7/25/2017 | Revised Section 3.7-inspection contact information |
| | | |
| | | |

# Table of Contents



# List of Appendices

# 1.0 Purpose

The Title IV Combined Sewer Code of the Northeast Ohio Regional Sewer District's (NEORSD) Code of Regulations provides the NEORSD with the authority to control combined sewer overflows (CSOs) from the combined sewer system and to control peak flows from local combined sewer systems at the point of connection into sewers owned by the NEORSD or a member community. Therefore, the NEORSD has the authority to review all requests for connection approval within the combined sewer system.

The purpose of this document is to provide guidance to landowners, developers, and design engineers interested in developing land in the combined sewer service area regarding the uniform process for submitting construction plans to the NEORSD for review and approval. Design standards and criteria are also provided for use in developing stormwater control measures to provide quantity and water quality benefit.

# 2.0 Procedures for Submittal Review

Requests for connection approval are required for all new development and redevelopment projects within the NEORSD service area seeking to connect to a combined sewer, CSO pipe, or separated storm sewer tributary to a combined sewer or CSO pipe. This section outlines the procedures that should be followed to ensure a complete submittal package is provided for review.

## 2.1 General Information

- Landowners, developers, and design engineers on behalf of the owner/developer may request approval to connect by submitting a set of construction plans with associated calculations supporting the stormwater management plan. The term "Applicant" will be used throughout this document to refer to the landowner, developer and/or design engineer working on behalf of the owner/developer.

- Connection requests shall be made prior to the start of construction requiring approval from NEORSD. Construction activities shall only start after District approval has been granted. To avoid project delays, contact NEORSD as early as possible, preferably in the early stages of design.

- As stated in the Title IV Combined Sewer Code, the NEORSD has 15 business days upon receipt of a complete submittal package to review a connection request. The NEORSD will attempt to review these requests in the shortest possible time. The Applicant is encouraged to contact the NEORSD early in the design process to avoid delays in the project schedule. A definition of a complete submittal package is provided in **Section 2.2**. If a submittal package is not complete as determined by NEORSD, the 15 business days will stop accruing until the submittal package is deemed complete by NEORSD.

- Minimum design standards and criteria for designing acceptable stormwater management plans are provided in this document. For development sites upstream of areas with capacity issues, NEORSD may potentially require that more restrictive design criteria are met. The Applicant is encouraged to contact the NEORSD early in the design phase to determine whether the site is located in a critical area of the combined sewer system and subject to stricter design criteria.

- Construction plans showing the layout of the area intended to be developed shall be submitted to the NEORSD by the Applicant. The plans shall be prepared under the direction of and sealed by a registered professional engineer.

- The NEORSD will review the plans for adequacy of stormwater management design to ensure that the proposed stormwater drainage system has the capacity to handle all

contributing flow without diminution of the existing level of service in the combined sewer system.

## 2.2 Submittal Requirements

Stormwater criteria and design standards shall be used as designated in Section 4.0309 of Title IV. No other stormwater criteria and design standards shall be used unless prior written approval is provided by NEORSD.

A complete submittal package shall include and clearly state, at minimum, the following:

1. Site map(s) showing project site location, total drainage area, land use/cover, amount of impervious area and longest flow paths for existing and proposed conditions.

2. Detailed topographical map showing existing topography and proposed grades of the entire project area, as well as the topography of all adjacent property to the extent that off-site contributing flow can be determined. All off-site contributing flow must be accommodated. All existing watercourses, lakes, wetlands and floodplain shall be included on the map. Specify the horizontal and vertical national datum used.

3. Location, size, and type of all existing storm sewers, channels, and/or stormwater structures located upstream and downstream of project area.

4. Location, size, and type of proposed storm sewers, channels, and/or stormwater structures to be built as part of the site's stormwater management plan.

5. Plans, cross-section views and details of all stormwater control measures (SCMs). If an existing on or off-site SCM will be used, as-built information shall be provided. Please identify drainage area unique to each SCM on plans.

6. Predominant soil type from USDA soil surveys or soil borings found at site.

7. Runoff Calculation Worksheet indicating the number of acres and percent imperviousness contributing to each specific drainage structure or SCM.

8. Design data and criteria used for sizing all drainage structures, channels, and SCMs.

9. Hydrologic and hydraulic calculations, assumptions, and parameters used for quantifying peak flows for existing and post-development conditions. Existing condition is defined as the current land use and impervious area on the subject property at the time of submission to NEORSD. Longest flow paths used in quantifying time of concentration for each shall be shown on a site map.

10. A Long-Term Operation and Maintenance Plan as described below in **Section 3.1**.

11. Complete set of plans (including the stormwater management report) submitted to NEORSD in electronic format (preferred) or single hard copy set.

# 3.0 Design Criteria and Engineering Standards

The design criteria and engineering standards set forth herein are intended to guide Applicants to develop a stormwater management system that controls the quantity and quality of the stormwater discharge for a development site. The internal drainage for a site as well as the downstream conditions will be reviewed. Every site is part of an overall watershed and the system should be designed with this in mind. These standards are the minimum requirements of the NEORSD and should not be construed as all-inclusive. The Applicant should consider many factors when planning the stormwater management system. In particular, Federal, State, and Local standards may be stricter than these standards. In the case where conflicting standards arise, the more stringent requirement will govern.

## 3.1 Title IV Design Criteria

A proposed stormwater management design for the site must meet the District's Code of Regulations, Title IV - Combined Sewer Code. Title IV is applicable to any development activity in the combined sewer area. The following standards are necessary to show compliance with Title IV.

1. The District will not authorize increases in wet-weather flow at combined sewer overflow (CSO) locations. Post-development peak flows shall not exceed existing condition peak flows, nor shall they result in an increase to CSO volumes and/or typical year activations. Existing condition is defined as the current land use and impervious area on the subject property at the time of submission to NEORSD. The District's preferred method to demonstrate these requirements will be met is as follows:

    - Storm events up to the 5-year, 24-hour event: The Applicant shall demonstrate to the District's satisfaction that storage volume shall be provided to ensure that there is no increase in flow to the combined sewer system;
    - Storm events greater than the 5-year and up to the 25-year, 24-hour event: The maximum release rate shall be defined as the existing conditions peak discharge of the corresponding storm frequency evaluated for post-development conditions;

    The Applicant shall demonstrate to the District's satisfaction that post-development peak flows will not exceed existing condition peak flows and that proposed post-development peak flows will not create increases in flow at CSO locations. Applicants shall submit a summary of existing and post-development discharge locations and flows, and identify any corresponding impacts the new discharge locations and/or flows have on CSO flows up to the 25-year design event. The applicant may show compliance through use of the District hydraulic/hydrologic InfoWorks ICM sewer models. A copy of the District models and model standards are available upon request from the Permit Program Manager.

The NEORSD reserves the right to require additional peak rate and/or volume controls. A more restrictive allowable discharge rate than that stated above may be required due to downstream capacity issues and/or to ensure no increases in flow at specific CSO locations. The Applicant is encouraged to contact the District early in the project development process to determine if the project is located in a critical CSO area and will be required to meet more restrictive criteria.

2. For connections to the combined sewer system, stormwater shall be managed in accordance to Part III.G.2.e of the Ohio EPA's General Permit OHC000003 or Chapter 3116 of the City of Cleveland's Codified Ordinances, whichever is more restrictive.

3. For separated storm connections to a CSO pipe or receiving water, the District will only accept stormwater control measures that provide water quality treatment for 100% of the project area whether the project is defined as a redevelopment project or new development.

4. A Long-Term Operation and Maintenance Plan shall be managed in accordance to Part III.G.2.e of the Ohio EPA's General Permit OHC000003 and shall include the proposed schedule for the perpetual maintenance of the complete storm drainage system. This plan shall indicate who will be responsible (i.e. municipality, landowner, or association) for this operation and maintenance and the legally binding mechanism which ensures perpetual funding. If there is a maintenance agreement with the City of Cleveland or other applicable local government, a copy of the agreement must be submitted to the District. Approval of the Long Term Operation and Maintenance Plan by the District is necessary prior to plan approval.

5. Stormwater runoff impacts to the local collection system capacity need to be considered. The local community shall be engaged as necessary on this item. Projects in the City of Cleveland shall contact the City of Cleveland's Division of Water Pollution Control (WPC).

   The criteria are the minimum design standard accepted by the NEORSD. In addition to the Title IV criteria herein, the Applicant must also abide by the rules, standards, specifications and master plan of the municipality where the site is located. In the case where conflicting standards arise, the more stringent requirements will govern.

## 3.2 Rainfall Intensity-Duration-Frequency

Rainfall intensity-duration-frequency (IDF) estimates provided in **Appendix A** shall be used in the design of the stormwater management plans. Other sources of rainfall IDF estimates may be used if required by another Federal, State, or local standard applicable to the development site. If a different rainfall IDF source is used to support the stormwater design as dictated by another Federal, State or local authority, it should be clearly documented in the submittal package for review and approval by NEORSD.

## 3.3 Conveyance of Peak Stormwater Flows

There are no NEORSD restrictions on the type of engineering methodology or software that the Applicant may use to quantify stormwater runoff from the site at this time. It is the responsibility of the Applicant to select an appropriate methodology suitable for the nature of the site. Supporting documentation, clearly stating the methodology, assumptions, parameters, and computations, must be submitted for review and approval. In addition, the basis for selecting critical parameters, i.e., runoff coefficients, curve number, time of concentration, etc., should also be documented and provided for review.

## 3.4 Maximum Release Rate

As detailed in **Section 3.1**, the District will not authorize increases in flow at combined sewer overflow (CSO) locations. Post-development peak flows shall not exceed existing condition peak flows, nor shall they result in an increase to CSO volumes and/or typical year activations. The preferred release rate is defined as the existing condition 6-month, 24-hour peak flow. As detailed in item 3 of Section 3.1 of this document, there may be cases where a more restrictive allowable discharge rate is required due to downstream capacity issues. In this situation, the Applicant will be required to incorporate a more restrictive release rate criterion into the stormwater management design to protect existing connections by avoiding the increased risk of basement flooding and/or any increase in CSO volume. The Applicant is encouraged to contact the NEORSD early in the project to determine whether the development site is located in a critical area of the combined sewer system that may be subject to stricter release rate limits.

## 3.5 Stormwater Storage Requirements

It is the responsibility of the Applicant to select an appropriate methodology for site design. Supporting documentation, clearly stating the methodology, assumptions, parameters, and computations, must be submitted for review and approval. Documentation with supporting calculations on the maximum allowable discharge used to determine the required storage volume must be clearly stated and provided for review and approval.

## 3.6 Stormwater Conveyance

There are no NEORSD restrictions on the type of engineering methodology or software that the Applicant may use to size the stormwater conveyance system at this time. It is the responsibility of the Applicant to select an appropriate methodology for site design. Supporting documentation, clearly stating the methodology, assumptions, parameters, and computations, must be submitted for review and approval.

## 3.7 Physical Connections

The following general conditions are required by the NEORSD for direct connections to its facilities (NEORSD-owned pipes, manholes, etc.).

Connections to Existing Laterals

- The existing laterals to be used shall be inspected by video camera, and a copy of the video shall be submitted to the NEORSD for review and approval prior to the connections being made. Upon review of the videotape by the NEORSD, if the existing lateral(s) needs to be cleaned and or repaired the work shall be performed at no cost to the NEORSD prior to the connections being made.
- The laterals shall be re-inspected after the cleaning and/or repair and a copy of the video shall be submitted to the NEORSD for review and approval prior to the connection being made. All laterals not approved for use shall be abandoned.
- The contractor shall provide a watertight connection to the existing lateral and encase the connection in concrete.

If an existing lateral cannot be used, a new lateral shall be installed and the contractor shall meet the following conditions. (lay permit)

- Provide pre-construction and post-construction video inspection of the interceptor showing footage measurement from either the upstream or the downstream manhole and extending a minimum of 20 feet past the connection point. The inspection video shall be submitted to the NEORSD for approval prior to the commencement of work.
- The connection shall be made through a properly sized cored hole. If the connection is to a reinforced concrete or vitrified clay pipe, then the lateral shall be concreted to the sewer using a manufactured boot that makes a watertight connection. If the connection is to a brick sewer, then the lateral shall be connected by wrapping a waterstop material, such as Volclay RX101 or equal, around the lateral with two (2) wraps minimum in accordance with the attached detail. If waterstop material is used, the annular space between the sewer wall and lateral shall be filled with hydraulic cement. Either type of connection shall then be encased in concrete. The contractor shall warrant that the connection will be watertight for a period of one year.

The following conditions apply to either the use of an existing lateral or the construction of a new lateral.

- The contractor shall warrant that the connection will be watertight for a period of one year.
- The contractor is responsible for any and all damage to the interceptor as determined by the NEORSD.
- The contractor shall prevent any debris from entering the sewer. Any debris entering the sewer shall be removed by the contractor.
- The contractor is responsible for obtaining any and all permits required for the work.
- A 72-hour notice shall be provided to Maintenance Services – Technical Support at permits@neorsd.org to schedule an NEORSD inspector for the connection.

# Appendix A. NEORSD Rainfall Depth/Intensity Data

## Table A-1. Rainfall Depth-Duration.

| Tc (min) | Rainfall Depth (in) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2-Month | 3-Month | 4-Month | 6-Month | 9-Month | 1-Year | 2-Year | 5-Year | 10-Year | 25-Year | 50-Year | 100-Year |
| **5** | **0.13** | **0.15** | **0.17** | **0.19** | **0.22** | **0.32** | **0.39** | **0.46** | **0.53** | **0.60** | **0.67** | **0.73** |
| **10** | **0.24** | **0.28** | **0.30** | **0.35** | **0.40** | **0.50** | **0.60** | **0.72** | **0.81** | **0.93** | **1.01** | **1.10** |
| **15** | **0.30** | **0.35** | **0.38** | **0.45** | **0.51** | **0.61** | **0.74** | **0.88** | **1.00** | **1.14** | **1.25** | **1.36** |
| 20 | 0.34 | 0.39 | 0.43 | 0.50 | 0.57 | 0.68 | 0.82 | 0.99 | 1.12 | 1.29 | 1.42 | 1.56 |
| 25 | 0.37 | 0.44 | 0.47 | 0.56 | 0.63 | 0.74 | 0.90 | 1.10 | 1.25 | 1.45 | 1.60 | 1.76 |
| **30** | **0.41** | **0.48** | **0.52** | **0.61** | **0.69** | **0.81** | **0.98** | **1.21** | **1.38** | **1.61** | **1.78** | **1.96** |
| 35 | 0.43 | 0.50 | 0.55 | 0.64 | 0.72 | 0.84 | 1.01 | 1.26 | 1.44 | 1.69 | 1.87 | 2.07 |
| 40 | 0.45 | 0.52 | 0.57 | 0.67 | 0.75 | 0.87 | 1.05 | 1.31 | 1.51 | 1.77 | 1.97 | 2.18 |
| 45 | 0.47 | 0.55 | 0.60 | 0.70 | 0.79 | 0.90 | 1.09 | 1.36 | 1.57 | 1.85 | 2.06 | 2.29 |
| 50 | 0.49 | 0.57 | 0.62 | 0.72 | 0.82 | 0.93 | 1.13 | 1.41 | 1.63 | 1.93 | 2.16 | 2.40 |
| 55 | 0.51 | 0.59 | 0.65 | 0.75 | 0.85 | 0.96 | 1.17 | 1.46 | 1.69 | 2.01 | 2.25 | 2.51 |
| **60** | **0.53** | **0.61** | **0.67** | **0.78** | **0.88** | **0.99** | **1.21** | **1.51** | **1.76** | **2.09** | **2.35** | **2.62** |
| 65 | 0.54 | 0.62 | 0.68 | 0.80 | 0.90 | 1.00 | 1.22 | 1.53 | 1.78 | 2.12 | 2.39 | 2.67 |
| 70 | 0.55 | 0.64 | 0.70 | 0.81 | 0.92 | 1.01 | 1.24 | 1.55 | 1.81 | 2.15 | 2.43 | 2.72 |
| 75 | 0.56 | 0.65 | 0.71 | 0.83 | 0.93 | 1.03 | 1.25 | 1.57 | 1.83 | 2.18 | 2.47 | 2.76 |
| 80 | 0.57 | 0.66 | 0.72 | 0.84 | 0.95 | 1.04 | 1.27 | 1.59 | 1.86 | 2.22 | 2.51 | 2.81 |
| 85 | 0.58 | 0.67 | 0.74 | 0.86 | 0.97 | 1.05 | 1.28 | 1.61 | 1.88 | 2.25 | 2.55 | 2.86 |
| 90 | 0.59 | 0.69 | 0.75 | 0.87 | 0.99 | 1.07 | 1.30 | 1.64 | 1.91 | 2.28 | 2.59 | 2.91 |
| 95 | 0.60 | 0.70 | 0.76 | 0.89 | 1.00 | 1.08 | 1.31 | 1.66 | 1.93 | 2.31 | 2.63 | 2.95 |
| 100 | 0.61 | 0.71 | 0.78 | 0.90 | 1.02 | 1.09 | 1.33 | 1.68 | 1.96 | 2.35 | 2.67 | 3.00 |
| 105 | 0.62 | 0.72 | 0.79 | 0.92 | 1.04 | 1.11 | 1.34 | 1.70 | 1.98 | 2.38 | 2.71 | 3.05 |
| 110 | 0.63 | 0.74 | 0.80 | 0.93 | 1.06 | 1.12 | 1.36 | 1.72 | 2.01 | 2.41 | 2.75 | 3.10 |
| 115 | 0.64 | 0.75 | 0.82 | 0.95 | 1.07 | 1.13 | 1.37 | 1.74 | 2.03 | 2.44 | 2.79 | 3.14 |
| **120** | **0.65** | **0.76** | **0.83** | **0.96** | **1.09** | **1.15** | **1.39** | **1.76** | **2.06** | **2.48** | **2.83** | **3.19** |
| **180** | **0.72** | **0.84** | **0.92** | **1.06** | **1.21** | **1.23** | **1.49** | **1.89** | **2.21** | **2.68** | **3.06** | **3.48** |
| **360** | **0.84** | **0.98** | **1.07** | **1.24** | **1.41** | **1.45** | **1.75** | **2.21** | **2.61** | **3.20** | **3.70** | **4.25** |
| **720** | **0.97** | **1.13** | **1.24** | **1.43** | **1.63** | **1.67** | **2.01** | **2.52** | **2.96** | **3.61** | **4.17** | **4.79** |
| **1440** | **1.12** | **1.31** | **1.43** | **1.65** | **1.88** | **1.95** | **2.33** | **2.92** | **3.40** | **4.09** | **4.66** | **5.28** |

Bolded numbers indicate values taken directly from rainfall atlas references. Rainfall estimates for 2-month through 9-month frequencies were taken from the Illinois State Water Survey's *Rainfall Frequency Atlas of the Midwest (Bulletin 71)* by Huff and Angel dated 1992. Rainfall estimates for the 1-year through 100-year frequencies are based on average estimates obtained from the NOAA Atlas 14 website (http://hdsc.nws.noaa.gov/hdsc/pfds/orb/oh_pfds.html). Two observation sites (Cleveland WSO AP 33-1657 and Cleveland Easterly 33-1651) were used to develop the average estimates shown in the table above. Non-bolded numbers were derived by means of linear interpretation between the two rainfall atlas references for estimates.

## Table A-2. Rainfall Intensity-Duration.

| Tc (min) | Rainfall Intensity (in/hr) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2-Month | 3-Month | 4-Month | 6-Month | 9-Month | 1-Year | 2-Year | 5-Year | 10-Year | 25-Year | 50-Year | 100-Year |
| 5 | 1.56 | 1.80 | 2.04 | 2.28 | 2.64 | 3.84 | 4.62 | 5.52 | 6.30 | 7.20 | 7.98 | 8.70 |
| 10 | 1.44 | 1.68 | 1.80 | 2.10 | 2.40 | 3.00 | 3.60 | 4.29 | 4.83 | 5.55 | 6.03 | 6.57 |
| 15 | 1.20 | 1.40 | 1.52 | 1.80 | 2.04 | 2.44 | 2.94 | 3.52 | 3.98 | 4.54 | 4.98 | 5.44 |
| 20 | 1.01 | 1.18 | 1.28 | 1.51 | 1.71 | 2.03 | 2.45 | 2.97 | 3.37 | 3.88 | 4.27 | 4.68 |
| 25 | 0.90 | 1.05 | 1.14 | 1.34 | 1.51 | 1.78 | 2.15 | 2.63 | 3.00 | 3.48 | 3.84 | 4.22 |
| 30 | 0.82 | 0.96 | 1.04 | 1.22 | 1.38 | 1.61 | 1.95 | 2.41 | 2.76 | 3.21 | 3.56 | 3.92 |
| 35 | 0.74 | 0.86 | 0.93 | 1.09 | 1.24 | 1.43 | 1.74 | 2.15 | 2.47 | 2.89 | 3.21 | 3.55 |
| 40 | 0.68 | 0.79 | 0.86 | 1.00 | 1.13 | 1.30 | 1.58 | 1.96 | 2.26 | 2.65 | 2.95 | 3.27 |
| 45 | 0.63 | 0.73 | 0.79 | 0.93 | 1.05 | 1.19 | 1.45 | 1.81 | 2.09 | 2.46 | 2.75 | 3.05 |
| 50 | 0.59 | 0.68 | 0.74 | 0.87 | 0.98 | 1.11 | 1.35 | 1.69 | 1.96 | 2.31 | 2.59 | 2.88 |
| 55 | 0.56 | 0.64 | 0.70 | 0.82 | 0.93 | 1.04 | 1.27 | 1.59 | 1.85 | 2.19 | 2.46 | 2.74 |
| 60 | 0.53 | 0.61 | 0.67 | 0.78 | 0.88 | 0.99 | 1.21 | 1.51 | 1.76 | 2.09 | 2.35 | 2.62 |
| 65 | 0.50 | 0.57 | 0.63 | 0.73 | 0.83 | 0.92 | 1.13 | 1.41 | 1.64 | 1.95 | 2.20 | 2.46 |
| 70 | 0.47 | 0.54 | 0.60 | 0.69 | 0.78 | 0.87 | 1.06 | 1.33 | 1.55 | 1.84 | 2.08 | 2.33 |
| 75 | 0.45 | 0.52 | 0.57 | 0.66 | 0.75 | 0.82 | 1.00 | 1.26 | 1.46 | 1.75 | 1.97 | 2.21 |
| 80 | 0.43 | 0.50 | 0.54 | 0.63 | 0.71 | 0.78 | 0.95 | 1.20 | 1.39 | 1.66 | 1.88 | 2.11 |
| 85 | 0.41 | 0.47 | 0.52 | 0.60 | 0.68 | 0.74 | 0.91 | 1.14 | 1.33 | 1.59 | 1.80 | 2.02 |
| 90 | 0.39 | 0.46 | 0.50 | 0.58 | 0.66 | 0.71 | 0.87 | 1.09 | 1.27 | 1.52 | 1.72 | 1.94 |
| 95 | 0.38 | 0.44 | 0.48 | 0.56 | 0.63 | 0.68 | 0.83 | 1.05 | 1.22 | 1.46 | 1.66 | 1.86 |
| 100 | 0.37 | 0.43 | 0.47 | 0.54 | 0.61 | 0.66 | 0.80 | 1.01 | 1.17 | 1.41 | 1.60 | 1.80 |
| 105 | 0.35 | 0.41 | 0.45 | 0.52 | 0.59 | 0.63 | 0.77 | 0.97 | 1.13 | 1.36 | 1.55 | 1.74 |
| 110 | 0.34 | 0.40 | 0.44 | 0.51 | 0.58 | 0.61 | 0.74 | 0.94 | 1.09 | 1.31 | 1.50 | 1.69 |
| 115 | 0.33 | 0.39 | 0.43 | 0.49 | 0.56 | 0.59 | 0.72 | 0.91 | 1.06 | 1.27 | 1.45 | 1.64 |
| 120 | 0.33 | 0.38 | 0.42 | 0.48 | 0.55 | 0.57 | 0.70 | 0.88 | 1.03 | 1.24 | 1.41 | 1.60 |
| 180 | 0.24 | 0.28 | 0.31 | 0.35 | 0.40 | 0.41 | 0.50 | 0.63 | 0.74 | 0.89 | 1.02 | 1.16 |
| 360 | 0.14 | 0.16 | 0.18 | 0.21 | 0.24 | 0.24 | 0.29 | 0.37 | 0.43 | 0.53 | 0.62 | 0.71 |
| 720 | 0.08 | 0.09 | 0.10 | 0.12 | 0.14 | 0.14 | 0.17 | 0.21 | 0.25 | 0.30 | 0.35 | 0.40 |
| 1440 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.10 | 0.12 | 0.14 | 0.17 | 0.19 | 0.22 |

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix B

## Existing Sewersheds and Combined Sewer Maps

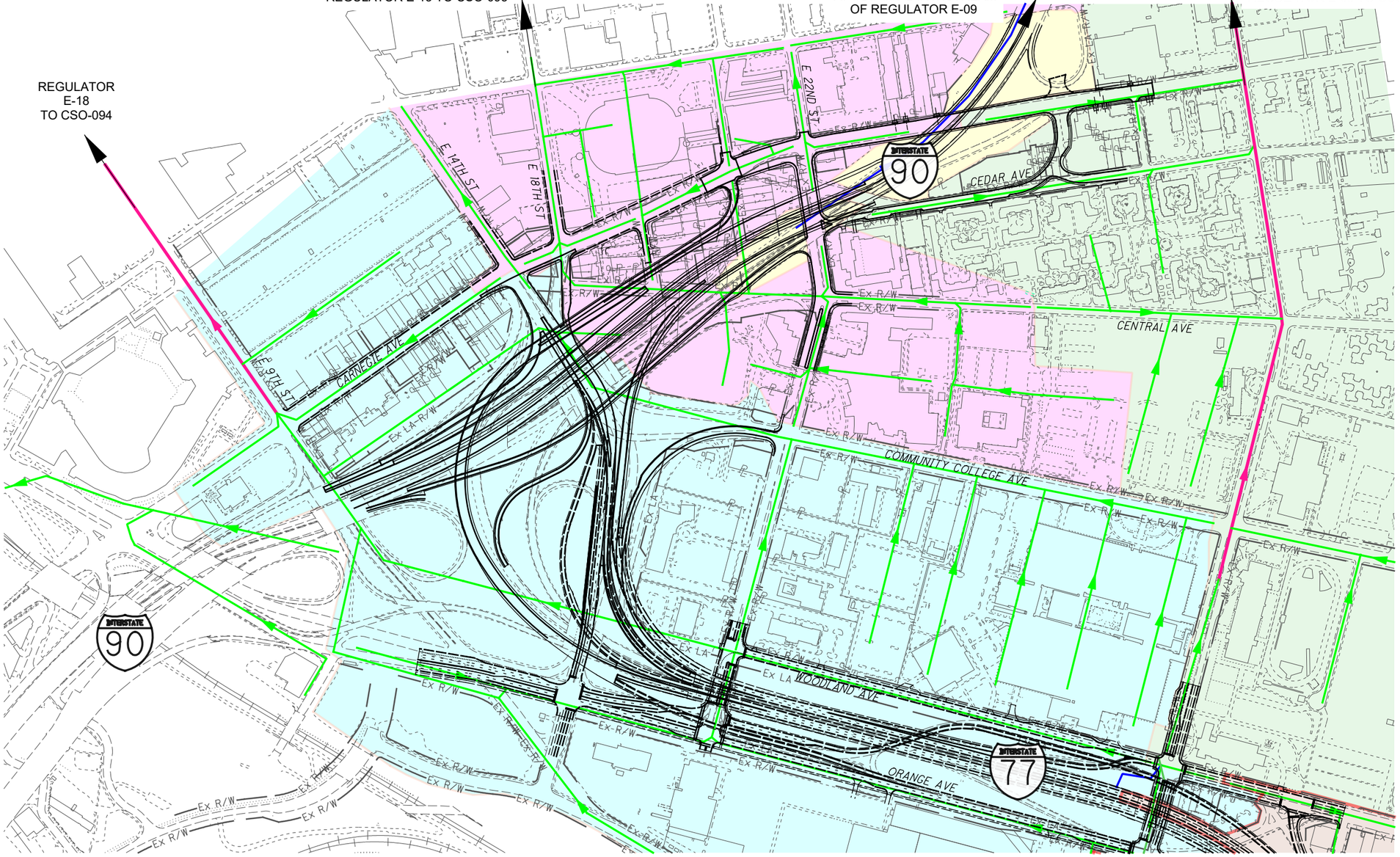
Michael Baker INTERNATIONAL

REGULATOR E-13 TO CSO-095

TO CSO-097 DOWNSTREAM OF REGULATOR E-09

REGULATOR E-03 TO CSO-200

REGULATOR E-18 TO CSO-094




**LEGEND**

- E-03
- E-13
- E-18
- CSO-97
- EX NEORSD INTERCEPTOR
- EX LOCAL COMBINED SEWER
- EX STORM ONLY SEWER

HORIZONTAL SCALE IN FEET
0 125 250 500

CALCULATED | CHECKED

# CCG3A CONCEPTUAL DRAINAGE EXISTING CSO OUTFALL AREAS

CUY-90-16.28

CTY-RTE-SECTION

MODEL: Liner Locations (Sheet) PAPERSIZE: 17x11(in.) DATE: 9/29/2021 TIME: 9:39:59 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker.Kathy.Johnson\82382_BD200l.dgn

HORIZONTAL SCALE IN FEET
0 100 200 400

E. 14TH AVE
E. 18TH AVE
CARNEGIE AVE
CEDAR AVE
CENTRAL AVE
COMMUNITY AVE
E. 22ND AVE
WOODLAND AVE
I-90
I-77

CENTRAL AVE
NO. 6 BRICK COMBINED SEWER
TO BE LINED

COMMUNITY COLLEGE AVE / E. 14TH STREET
NO. 12 BRICK COMBINED SEWER
TO BE RELOCATED

WOODLAND AVE
NO. 10, 11, & 12 BRICK COMBINED SEWER
TO BE LINED

# COMBINED SEWER TRUNKLINE PROPOSED IMPACTS

DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER
KGJ

REVIEWER
SM 9/28/21

PROJECT ID
0

SHEET P.0 | TOTAL 0

OHIO DEPARTMENT OF TRANSPORTATION

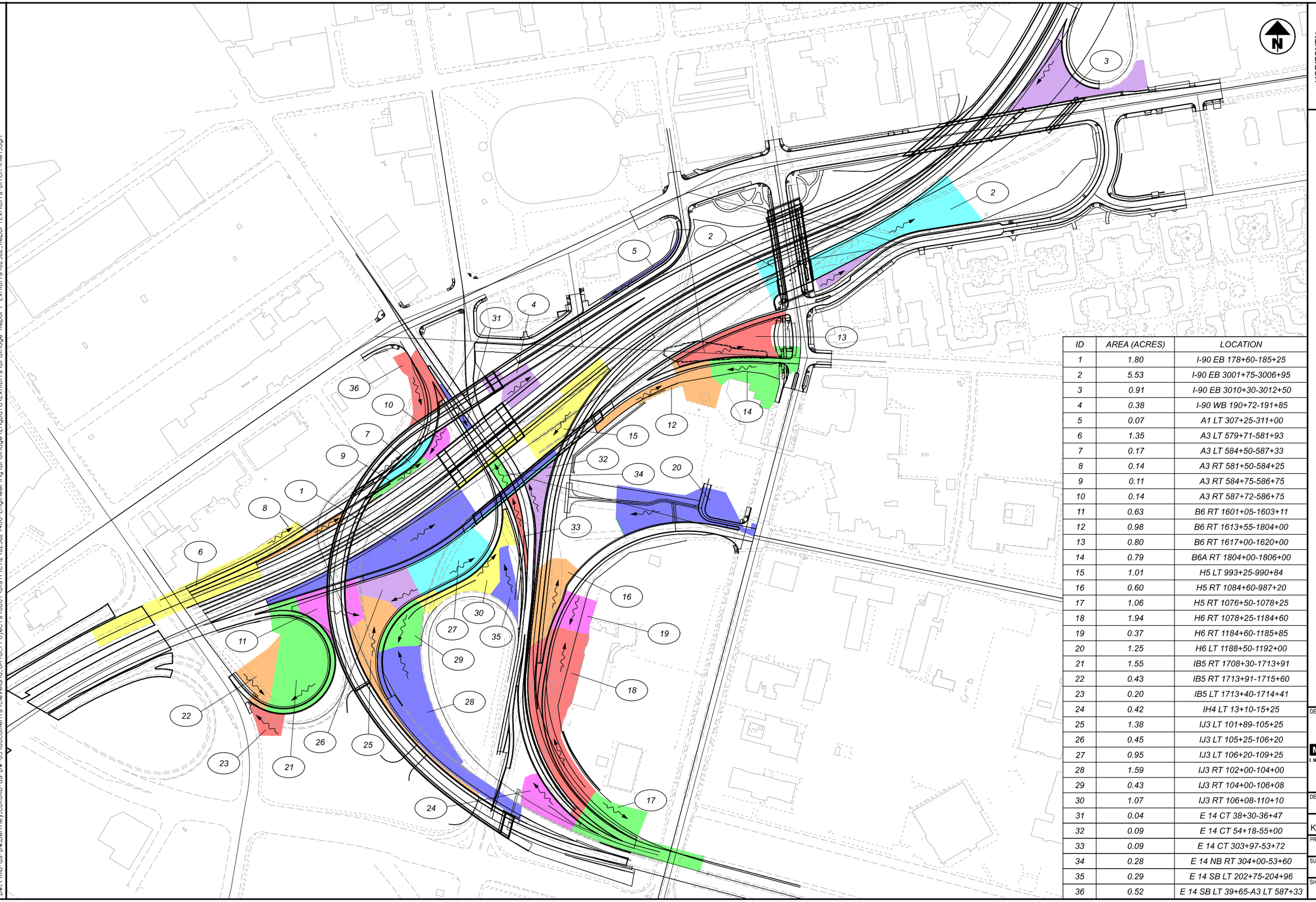
# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix C

## Ditch Drainage Area Maps & Calculations

Michael Baker INTERNATIONAL




| ID | AREA (ACRES) | LOCATION |
|---|---|---|
| 1 | 1.80 | I-90 EB 178+60-185+25 |
| 2 | 5.53 | I-90 EB 3001+75-3006+95 |
| 3 | 0.91 | I-90 EB 3010+30-3012+50 |
| 4 | 0.38 | I-90 WB 190+72-191+85 |
| 5 | 0.07 | A1 LT 307+25-311+00 |
| 6 | 1.35 | A3 LT 579+71-581+93 |
| 7 | 0.17 | A3 LT 584+50-587+33 |
| 8 | 0.14 | A3 RT 581+50-584+25 |
| 9 | 0.11 | A3 RT 584+75-586+75 |
| 10 | 0.14 | A3 RT 587+72-586+75 |
| 11 | 0.63 | B6 RT 1601+05-1603+11 |
| 12 | 0.98 | B6 RT 1613+55-1804+00 |
| 13 | 0.80 | B6 RT 1617+00-1620+00 |
| 14 | 0.79 | B6A RT 1804+00-1806+00 |
| 15 | 1.01 | H5 LT 993+25-990+84 |
| 16 | 0.60 | H5 RT 1084+60-987+20 |
| 17 | 1.06 | H5 RT 1076+50-1078+25 |
| 18 | 1.94 | H6 RT 1078+25-1184+60 |
| 19 | 0.37 | H6 RT 1184+60-1185+85 |
| 20 | 1.25 | H6 LT 1188+50-1192+00 |
| 21 | 1.55 | IB5 RT 1708+30-1713+91 |
| 22 | 0.43 | IB5 RT 1713+91-1715+60 |
| 23 | 0.20 | IB5 LT 1713+40-1714+41 |
| 24 | 0.42 | IH4 LT 13+10-15+25 |
| 25 | 1.38 | IJ3 LT 101+89-105+25 |
| 26 | 0.45 | IJ3 LT 105+25-106+20 |
| 27 | 0.95 | IJ3 LT 106+20-109+25 |
| 28 | 1.59 | IJ3 RT 102+00-104+00 |
| 29 | 0.43 | IJ3 RT 104+00-106+08 |
| 30 | 1.07 | IJ3 RT 106+08-110+10 |
| 31 | 0.04 | E 14 CT 38+30-36+47 |
| 32 | 0.09 | E 14 CT 54+18-55+00 |
| 33 | 0.09 | E 14 CT 303+97-53+72 |
| 34 | 0.28 | E 14 NB RT 304+00-53+60 |
| 35 | 0.29 | E 14 SB LT 202+75-204+96 |
| 36 | 0.52 | E 14 SB LT 39+65-A3 LT 587+33 |

HORIZONTAL SCALE IN FEET
0 75 150 300

# DRAINAGE AREA MAP
## DITCHES

DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER JAR
REVIEWER KGJ —
PROJECT ID 82382
SUBSET — TOTAL —
SHEET — TOTAL —

CUY-90-16.28

MODEL: Sheet - Ditch Area PAPERSIZE: 7x11(in.) DATE: 1/17/2024 TIME: 3:45:50 PM USER: Jennifer.DeVale
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\000T\District2\82382\400-Engineering\Drainage\EngData\Exhibits\Drainage Report Exhibits\82382_ReportExhibits-Ditch-Inlet.dgn

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB STA 178+60 TO STA 185+25 **Designer :** KGJ

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 178+60 | 179+50 | R | 90.00 | 0.00 | 5.00 | 5.00 | 0.0066 | 0.12 | 0.12 | 0.69 | 0.08 | Seed | 3.48 | 5 | 0.030 | 16.49 | 0.96 | 0.10 | 0.29 | 0.25 | 2.47 |
| | | | | | | | | | | | | Seed | 3.90 | 10 | 0.040 | 16.81 | 0.81 | 0.12 | 0.33 | 0.28 | 2.85 |
| 179+50 | 180+00 | R | 50.00 | 3.00 | 6.00 | 6.00 | 0.0060 | 0.06 | 0.18 | 0.64 | 0.12 | Seed | 3.37 | 5 | 0.030 | 17.47 | 0.85 | 0.05 | 0.40 | 0.13 | 4.51 |
| | | | | | | | | | | | | Seed | 3.77 | 10 | 0.040 | 17.96 | 0.73 | 0.06 | 0.45 | 0.16 | 4.87 |
| 180+00 | 183+00 | R | 300.00 | 6.00 | 6.00 | 6.00 | 0.0290 | 0.56 | 0.73 | 0.62 | 0.46 | Seed | 3.13 | 5 | 0.030 | 20.06 | 1.88 | 0.21 | 1.45 | 0.12 | 7.39 |
| | | | | | | | | | | | | Seed | 3.47 | 10 | 0.040 | 20.98 | 1.62 | 0.26 | 1.61 | 0.15 | 7.74 |
| 183+00 | 184+00 | R | 100.00 | 6.00 | 6.00 | 6.00 | 0.0186 | 0.33 | 1.06 | 0.60 | 0.66 | Seed | 3.05 | 5 | 0.030 | 20.97 | 1.82 | 0.18 | 2.01 | 0.16 | 7.91 |
| | | | | | | | | | | | | Seed | 3.37 | 10 | 0.040 | 22.04 | 1.56 | 0.23 | 2.23 | 0.20 | 8.38 |
| 184+00 | 185+00 | R | 100.00 | 6.00 | 6.00 | 6.00 | 0.0065 | 0.34 | 1.40 | 0.59 | 0.86 | Seed | 2.95 | 5 | 0.030 | 22.15 | 1.39 | 0.10 | 2.54 | 0.25 | 8.95 |
| | | | | | | | | | | | | Seed | 3.26 | 10 | 0.040 | 23.45 | 1.18 | 0.12 | 2.81 | 0.30 | 9.66 |
| 185+00 | 185+25 | R | 25.00 | 6.00 | 6.00 | 6.00 | 0.0024 | 0.39 | 1.80 | 0.75 | 1.16 | Seed | 2.92 | 5 | 0.030 | 22.54 | 1.08 | 0.06 | 3.38 | 0.38 | 10.55 |
| | | | | | | | | | | | | Seed | 3.22 | 10 | 0.040 | 23.91 | 0.91 | 0.07 | 3.73 | 0.47 | 11.61 |

2

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB STA 3001+75 TO 3006+95 **Designer :** JLD

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3001+75 | 3006+95 | R | 520.00 | 4.00 | 4.00 | 4.00 | 0.0035 | 5.53 | 5.53 | 0.77 | 4.26 | Seed | 3.21 | 5 | 0.030 | 19.08 | 2.05 | 0.19 | 13.68 | 0.88 | 11.08 |
| | | | | | | | | | | | | Seed | 3.57 | 10 | 0.040 | 19.88 | 1.71 | 0.23 | 15.21 | 1.07 | 12.58 |

3

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB STA 3010+30 TO 3012+50 **Designer :** JLD

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3012+50 | 3011+50 | R | 100.00 | 6.00 | 3.00 | 6.00 | 0.0135 | 0.65 | 0.65 | 0.55 | 0.35 | Seed | 3.51 | 5 | 0.030 | 16.17 | 1.42 | 0.11 | 1.25 | 0.13 | 7.20 |
| | | | | | | | | | | | | Seed | 3.96 | 10 | 0.040 | 16.34 | 1.23 | 0.14 | 1.40 | 0.17 | 7.52 |
| 3011+50 | 3010+30 | R | 127.00 | 6.00 | 3.00 | 20.00 | 0.0484 | 0.27 | 0.91 | 0.60 | 0.52 | Seed | 3.41 | 5 | 0.030 | 17.11 | 2.23 | 0.33 | 1.76 | 0.11 | 8.50 |
| | | | | | | | | | | | | Seed | 3.83 | 10 | 0.040 | 17.44 | 1.91 | 0.41 | 1.98 | 0.14 | 9.15 |

4

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** I-90 WB STA 190+72 TO 191+85 **Designer :** KGJ

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 190+72 | 191+85 | L | 113.00 | 4.00 | 3.00 | 4.00 | 0.0233 | 0.38 | 0.38 | 0.81 | 0.31 | Seed | 3.53 | 5 | 0.030 | 16.01 | 1.85 | 0.19 | 1.10 | 0.13 | 4.93 |
| | | | | | | | | | | | | Seed | 3.98 | 10 | 0.040 | 16.17 | 1.59 | 0.25 | 1.23 | 0.17 | 5.18 |

5

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP A1 STA 307+25 TO 311+00 **Designer :** KGJ

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 311+00 | 310+40 | L | 60.00 | 2.00 | 2.00 | 2.00 | 0.0027 | 0.01 | 0.01 | 0.70 | 0.01 | Seed | 3.30 | 5 | 0.030 | 18.19 | 0.28 | 0.01 | 0.03 | 0.04 | 2.17 |
| | | | | | | | | | | | | Seed | 3.63 | 10 | 0.040 | 19.32 | 0.31 | 0.01 | 0.03 | 0.04 | 2.17 |
| 310+40 | 309+50 | L | 90.00 | 2.00 | 2.00 | 2.00 | 0.0120 | 0.01 | 0.03 | 0.70 | 0.02 | Seed | 3.09 | 5 | 0.030 | 20.52 | 0.60 | 0.03 | 0.05 | 0.04 | 2.17 |
| | | | | | | | | | | | | Seed | 3.38 | 10 | 0.040 | 21.99 | 0.52 | 0.04 | 0.06 | 0.05 | 2.21 |
| 309+50 | 307+25 | L | 225.00 | 2.00 | 2.00 | 2.00 | 0.0044 | 0.04 | 0.07 | 0.70 | 0.05 | Seed | 2.67 | 5 | 0.030 | 26.18 | 0.65 | 0.02 | 0.12 | 0.09 | 2.34 |
| | | | | | | | | | | | | Seed | 2.91 | 10 | 0.040 | 28.43 | 0.56 | 0.03 | 0.13 | 0.11 | 2.43 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** RAMP A3 LT STA 579+71 TO 581+93 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 579+71 | 579+90 | L | 19.00 | 0.00 | 6.00 | 6.00 | 0.0487 | 1.12 | 1.12 | 0.87 | 0.97 | Seed | 3.64 | 5 | 0.030 | 15.09 | 3.71 | 1.21 | 3.55 | 0.40 | 4.79 |
| | | | | | | | | | | | | Jute Mat | 3.64 | 5 | 0.040 | 15.11 | 2.98 | 1.35 | 3.55 | 0.45 | 5.34 |
| | | | | | | | | | | | | Temp. Mat | 3.64 | 5 | 0.040 | 15.11 | 2.98 | 1.35 | 3.55 | 0.45 | 5.34 |
| | | | | | | | | | | | | Temp. Mat | 4.12 | 10 | 0.040 | 15.10 | 3.08 | 1.42 | 4.01 | 0.47 | 5.59 |
| 579+90 | 580+10 | L | 20.00 | 0.00 | 6.00 | 6.00 | 0.0303 | 0.03 | 1.15 | 0.80 | 1.00 | Seed | 3.63 | 5 | 0.030 | 15.21 | 3.11 | 0.83 | 3.62 | 0.44 | 5.29 |
| | | | | | | | | | | | | Jute Mat | 3.62 | 5 | 0.040 | 15.24 | 2.51 | 0.93 | 3.61 | 0.49 | 5.88 |
| | | | | | | | | | | | | Temp. Mat | 3.62 | 5 | 0.040 | 15.24 | 2.51 | 0.93 | 3.61 | 0.49 | 5.88 |
| | | | | | | | | | | | | Temp. Mat | 4.10 | 10 | 0.040 | 15.23 | 2.59 | 0.97 | 4.09 | 0.51 | 6.16 |
| 580+10 | 580+61 | L | 51.00 | 2.00 | 6.00 | 6.00 | 0.0303 | 0.05 | 1.20 | 0.75 | 1.04 | Seed | 3.59 | 5 | 0.030 | 15.52 | 3.05 | 0.59 | 3.72 | 0.31 | 5.77 |
| | | | | | | | | | | | | Jute Mat | 3.58 | 5 | 0.040 | 15.58 | 2.47 | 0.68 | 3.71 | 0.36 | 6.33 |
| | | | | | | | | | | | | Temp. Mat | 3.58 | 5 | 0.040 | 15.58 | 2.47 | 0.68 | 3.71 | 0.36 | 6.33 |
| | | | | | | | | | | | | Temp. Mat | 4.06 | 10 | 0.040 | 15.56 | 2.55 | 0.72 | 4.20 | 0.38 | 6.60 |
| 580+61 | 581+51 | L | 90.00 | 4.00 | 6.00 | 6.00 | 0.0392 | 0.10 | 1.30 | 0.73 | 1.11 | Seed | 3.53 | 5 | 0.030 | 16.06 | 3.15 | 0.56 | 3.92 | 0.23 | 6.77 |

# DITCH ANALYSIS

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Jute Mat | 3.51 | 5 | 0.040 | 16.16 | 2.58 | 0.66 | 3.91 | 0.27 | 7.23 |
| | | | | | | | | | | | | Temp. Mat | 3.51 | 5 | 0.040 | 16.16 | 2.58 | 0.66 | 3.91 | 0.27 | 7.23 |
| | | | | | | | | | | | | Temp. Mat | 3.99 | 10 | 0.040 | 16.12 | 2.68 | 0.71 | 4.43 | 0.29 | 7.46 |
| 581+51 | 581+93 | L | 41.40 | 2.00 | 12.00 | 12.00 | 0.0160 | 0.05 | 1.35 | 0.72 | 1.15 | Seed | 3.48 | 5 | 0.030 | 16.49 | 2.10 | 0.32 | 3.99 | 0.32 | 9.75 |
| | | | | | | | | | | | | Seed | 3.94 | 10 | 0.040 | 16.51 | 1.75 | 0.39 | 4.52 | 0.39 | 11.31 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** RAMP A3 LT STA 584+50 TO 587+33 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 584+50 | 586+41 | L | 186.81 | 4.00 | 4.00 | 4.00 | 0.0445 | 0.09 | 0.09 | 0.90 | 0.08 | Seed | 3.39 | 5 | 0.030 | 17.27 | 1.31 | 0.13 | 0.27 | 0.05 | 4.39 |
| | | | | | | | | | | | | Seed | 3.81 | 10 | 0.040 | 17.64 | 1.16 | 0.17 | 0.30 | 0.06 | 4.48 |
| 586+41 | 587+10 | L | 59.93 | 4.00 | 4.00 | 4.00 | 0.0245 | 0.06 | 0.14 | 0.90 | 0.13 | Seed | 3.32 | 5 | 0.030 | 18.03 | 1.32 | 0.11 | 0.43 | 0.08 | 4.60 |
| | | | | | | | | | | | | Seed | 3.71 | 10 | 0.040 | 18.51 | 1.14 | 0.15 | 0.48 | 0.10 | 4.76 |
| 587+10 | 587+33 | L | 19.87 | 4.00 | 4.00 | 4.00 | 0.0029 | 0.03 | 0.17 | 0.90 | 0.15 | Seed | 3.27 | 5 | 0.030 | 18.50 | 0.69 | 0.03 | 0.50 | 0.16 | 5.25 |
| | | | | | | | | | | | | Seed | 3.66 | 10 | 0.040 | 19.05 | 0.61 | 0.03 | 0.56 | 0.19 | 5.55 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Ramp A3 Rt - 581+50 to 584+25 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 581+50 | 582+00 | R | 50.00 | 1.00 | 2.00 | 2.00 | 0.0671 | 0.06 | 0.06 | 0.75 | 0.05 | Seed | 3.60 | 5 | 0.030 | 15.41 | 2.00 | 0.31 | 0.17 | 0.08 | 1.30 |
| | | | | | | | | | | | | Seed | 4.07 | 10 | 0.040 | 15.49 | 1.81 | 0.38 | 0.20 | 0.09 | 1.37 |
| 582+00 | 584+25 | R | 225.00 | 2.00 | 2.00 | 2.00 | 0.0507 | 0.08 | 0.14 | 0.74 | 0.10 | Seed | 3.39 | 5 | 0.030 | 17.29 | 2.02 | 0.25 | 0.35 | 0.08 | 2.32 |
| | | | | | | | | | | | | Seed | 3.81 | 10 | 0.040 | 17.61 | 1.70 | 0.33 | 0.39 | 0.10 | 2.42 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** RAMP A3 R STA 584+75 TO 586+75 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 584+75 | 585+50 | R | 75.00 | 2.00 | 2.00 | 2.00 | 0.0385 | 0.05 | 0.05 | 0.73 | 0.03 | Seed | 3.53 | 5 | 0.030 | 16.06 | 1.21 | 0.11 | 0.12 | 0.05 | 2.18 |
| | | | | | | | | | | | | Seed | 3.98 | 10 | 0.040 | 16.15 | 1.05 | 0.14 | 0.13 | 0.06 | 2.24 |
| 585+50 | 586+00 | R | 50.00 | 2.00 | 2.00 | 2.00 | 0.0203 | 0.02 | 0.07 | 0.74 | 0.05 | Seed | 3.45 | 5 | 0.030 | 16.76 | 1.15 | 0.09 | 0.17 | 0.07 | 2.28 |
| | | | | | | | | | | | | Seed | 3.88 | 10 | 0.040 | 16.99 | 0.97 | 0.12 | 0.19 | 0.09 | 2.37 |
| 586+00 | 586+50 | R | 50.00 | 2.00 | 2.00 | 2.00 | 0.0296 | 0.02 | 0.09 | 0.74 | 0.07 | Seed | 3.39 | 5 | 0.030 | 17.34 | 1.42 | 0.14 | 0.23 | 0.08 | 2.30 |
| | | | | | | | | | | | | Seed | 3.80 | 10 | 0.040 | 17.66 | 1.21 | 0.18 | 0.26 | 0.10 | 2.39 |
| 586+50 | 586+75 | R | 25.00 | 2.00 | 2.00 | 2.00 | 0.0596 | 0.02 | 0.11 | 0.74 | 0.08 | Seed | 3.36 | 5 | 0.030 | 17.56 | 1.88 | 0.25 | 0.27 | 0.07 | 2.27 |
| | | | | | | | | | | | | Seed | 3.78 | 10 | 0.040 | 17.92 | 1.62 | 0.32 | 0.30 | 0.09 | 2.34 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** RAMPA3 RT STA 587+72 TO 586+75 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 587+72 | 587+50 | R | 26.00 | 1.00 | 2.00 | 3.50 | 0.0410 | 0.03 | 0.03 | 0.62 | 0.02 | Seed | 3.61 | 5 | 0.030 | 15.34 | 1.27 | 0.12 | 0.07 | 0.05 | 1.27 |
| | | | | | | | | | | | | Seed | 4.07 | 10 | 0.040 | 15.41 | 1.03 | 0.16 | 0.08 | 0.06 | 1.35 |
| 587+50 | 587+00 | R | 58.00 | 2.00 | 2.00 | 3.50 | 0.0050 | 0.08 | 0.11 | 0.64 | 0.07 | Seed | 3.47 | 5 | 0.030 | 16.51 | 0.79 | 0.04 | 0.24 | 0.13 | 2.71 |
| | | | | | | | | | | | | Seed | 3.90 | 10 | 0.040 | 16.82 | 0.69 | 0.05 | 0.27 | 0.16 | 2.89 |
| 587+00 | 586+75 | R | 30.00 | 2.00 | 2.00 | 2.00 | 0.0163 | 0.03 | 0.14 | 0.72 | 0.09 | Seed | 3.43 | 5 | 0.030 | 16.90 | 1.30 | 0.11 | 0.30 | 0.10 | 2.42 |
| | | | | | | | | | | | | Seed | 3.85 | 10 | 0.040 | 17.26 | 1.11 | 0.14 | 0.34 | 0.13 | 2.54 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP B6 RT STA 1601+05 TO STA 1603+11 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1601+05 | 1601+79 | R | 81.00 | 3.80 | 3.10 | 9.00 | 0.1500 * | 0.14 | 0.14 | 0.67 | 0.10 | Seed | 3.58 | 5 | 0.030 | 15.63 | 2.16 | 0.36 | 0.34 | 0.04 | 4.27 |
| | | | | | | | | | | | | Seed | 4.04 | 10 | 0.040 | 15.72 | 1.88 | 0.47 | 0.38 | 0.05 | 4.40 |
| 1601+79 | Concent | | | | | | | 0.18 | | 0.90 | 0.26 | | | | | 10.00 | | | | | |
| 1601+79 | 1602+45 | R | 73.00 | 3.80 | 3.10 | 9.00 | 0.1500 * | 0.11 | 0.43 | 0.61 | 0.32 | Seed | 3.53 | 5 | 0.030 | 16.00 | 3.31 | 0.75 | 1.14 | 0.08 | 4.77 |
| | | | | | | | | | | | | Jute Mat | 3.52 | 5 | 0.040 | 16.07 | 2.73 | 0.89 | 1.14 | 0.10 | 4.95 |
| | | | | | | | | | | | | Temp. Mat | 3.52 | 5 | 0.040 | 16.07 | 2.73 | 0.89 | 1.14 | 0.10 | 4.95 |
| | | | | | | | | | | | | Temp. Mat | 3.98 | 10 | 0.040 | 16.14 | 2.86 | 0.96 | 1.29 | 0.10 | 5.03 |
| 1602+45 | 1603+11 | R | 76.00 | 3.90 | 3.00 | 3.00 | 0.0960 | 0.20 | 0.63 | 0.62 | 0.45 | Seed | 3.48 | 5 | 0.030 | 16.45 | 3.33 | 0.66 | 1.55 | 0.11 | 4.56 |
| | | | | | | | | | | | | Jute Mat | 3.47 | 5 | 0.040 | 16.53 | 2.77 | 0.78 | 1.55 | 0.13 | 4.68 |
| | | | | | | | | | | | | Temp. Mat | 3.47 | 5 | 0.040 | 16.53 | 2.77 | 0.78 | 1.55 | 0.13 | 4.68 |
| | | | | | | | | | | | | Temp. Mat | 3.93 | 10 | 0.040 | 16.58 | 2.90 | 0.84 | 1.75 | 0.14 | 4.74 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.238 CCG3A **Location :** Cleveland, Ohio

**Description :**RAMP B6 RT STA 1613+55 TO RAMP B6A RT STA 1804+00 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1613+55 | 1800+50 | R | 87.00 | 1.00 | 2.00 | 2.00 | 0.0398 | 0.07 | 0.07 | 0.70 | 0.05 | Seed | 3.55 | 5 | 0.030 | 15.83 | 1.70 | 0.23 | 0.18 | 0.09 | 1.37 |
| | | | | | | | | | | | | Seed | 4.01 | 10 | 0.040 | 15.94 | 1.50 | 0.28 | 0.21 | 0.11 | 1.45 |
| 1800+50 | 1802+75 | R | 225.00 | 1.00 | 2.00 | 2.00 | 0.0523 | 0.14 | 0.21 | 0.70 | 0.15 | Seed | 3.40 | 5 | 0.030 | 17.23 | 2.67 | 0.47 | 0.50 | 0.15 | 1.58 |
| | | | | | | | | | | | | Jute Mat | 3.37 | 5 | 0.040 | 17.52 | 2.19 | 0.55 | 0.50 | 0.17 | 1.68 |
| | | | | | | | | | | | | Temp. Mat | 3.37 | 5 | 0.040 | 17.52 | 2.19 | 0.55 | 0.50 | 0.17 | 1.68 |
| | | | | | | | | | | | | Temp. Mat | 3.81 | 10 | 0.040 | 17.58 | 2.25 | 0.60 | 0.56 | 0.18 | 1.73 |
| 1802+75 | 1803+00 | R | 25.00 | 2.00 | 2.00 | 2.00 | 0.1445 * | 0.17 | 0.38 | 0.74 | 0.27 | Seed | 3.36 | 5 | 0.030 | 17.63 | 3.88 | 0.96 | 0.91 | 0.11 | 2.42 |
| | | | | | | | | | | | | Jute Mat | 3.35 | 5 | 0.040 | 17.65 | 3.24 | 1.13 | 0.91 | 0.12 | 2.50 |
| | | | | | | | | | | | | Temp. Mat | 3.35 | 5 | 0.040 | 17.65 | 3.24 | 1.13 | 0.91 | 0.12 | 2.50 |
| | | | | | | | | | | | | Temp. Mat | 3.80 | 10 | 0.040 | 17.71 | 3.38 | 1.21 | 1.03 | 0.13 | 2.54 |
| 1803+00 | Concent | | | | | | | 0.30 | | 0.90 | 0.54 | | | | | 10.00 | | | | | |
| 1803+00 | 1804+00 | R | 100.00 | 1.00 | 2.00 | 3.00 | 0.0266 | 0.30 | 0.98 | 0.73 | 0.76 | Seed | 3.30 | 5 | 0.030 | 18.17 | 3.21 | 0.65 | 2.51 | 0.39 | 2.97 |
| | | | | | | | | | | | | Jute Mat | 3.29 | 5 | 0.040 | 18.29 | 2.59 | 0.75 | 2.50 | 0.45 | 3.26 |

# DITCH ANALYSIS

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Temp. Mat | 3.29 | 5 | 0.040 | 18.29 | 2.59 | 0.75 | 2.50 | 0.45 | 3.26 |
| | | | | | | | | | | | | Temp. Mat | 3.73 | 10 | 0.040 | 18.33 | 2.68 | 0.80 | 2.83 | 0.48 | 3.40 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.238 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP B6 RT STA 1617+00 TO 1620+00 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1617+00 | 1619+00 | R | 200.00 | 2.00 | 12.50 | 16.00 | 0.0550 | 0.32 | 0.32 | 0.64 | 0.21 | Seed | 3.46 | 5 | 0.030 | 16.63 | 2.02 | 0.35 | 0.71 | 0.10 | 4.91 |
| | | | | | | | | | | | | Seed | 3.89 | 10 | 0.040 | 16.94 | 1.69 | 0.43 | 0.80 | 0.12 | 5.56 |
| 1619+00 | 1619+50 | R | 50.00 | 2.00 | 12.50 | 16.00 | 0.0420 | 0.12 | 0.44 | 0.59 | 0.28 | Seed | 3.42 | 5 | 0.030 | 17.05 | 1.98 | 0.33 | 0.95 | 0.13 | 5.60 |
| | | | | | | | | | | | | Seed | 3.83 | 10 | 0.040 | 17.44 | 1.66 | 0.40 | 1.06 | 0.15 | 6.36 |
| 1619+50 | 1620+00 | R | 50.00 | 2.00 | 12.50 | 16.00 | 0.0340 | 0.36 | 0.80 | 0.61 | 0.50 | Seed | 3.38 | 5 | 0.030 | 17.44 | 2.13 | 0.37 | 1.68 | 0.18 | 6.99 |
| | | | | | | | | | | | | Seed | 3.78 | 10 | 0.040 | 17.91 | 1.78 | 0.45 | 1.88 | 0.21 | 8.01 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP B6A RT STA 1804+00 TO 1806+00 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1806+00 | 1805+00 | R | 100.00 | 2.00 | 4.00 | 4.00 | 0.0092 | 0.61 | 0.61 | 0.76 | 0.47 | Seed | 3.54 | 5 | 0.030 | 15.97 | 1.71 | 0.17 | 1.64 | 0.30 | 4.41 |
| | | | | | | | | | | | | Seed | 3.98 | 10 | 0.040 | 16.15 | 1.44 | 0.21 | 1.85 | 0.37 | 4.96 |
| 1805+00 | 1804+00 | R | 100.00 | 3.00 | 2.50 | 4.00 | 0.0092 | 0.18 | 0.79 | 0.76 | 0.60 | Seed | 3.43 | 5 | 0.030 | 16.89 | 1.79 | 0.17 | 2.06 | 0.29 | 4.89 |
| | | | | | | | | | | | | Seed | 3.85 | 10 | 0.040 | 17.24 | 1.52 | 0.21 | 2.31 | 0.36 | 5.37 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP H5 LT STA 993+25 TO 990+84 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 993+25 | 992+50 | L | 78.31 | 0.00 | 5.00 | 7.00 | 0.0035 | 0.33 | 0.33 | 0.77 | 0.25 | Seed | 3.49 | 5 | 0.030 | 16.33 | 0.98 | 0.08 | 0.88 | 0.39 | 4.64 |
| | | | | | | | | | | | | Seed | 3.93 | 10 | 0.040 | 16.59 | 0.81 | 0.10 | 0.99 | 0.45 | 5.41 |
| 992+50 | 990+84 | L | 160.22 | 4.00 | 5.00 | 5.00 | 0.0197 | 0.68 | 1.01 | 0.65 | 0.69 | Seed | 3.36 | 5 | 0.030 | 17.55 | 2.18 | 0.26 | 2.34 | 0.21 | 6.12 |
| | | | | | | | | | | | | Seed | 3.76 | 10 | 0.040 | 18.02 | 1.84 | 0.33 | 2.61 | 0.27 | 6.66 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP H5/H6 GORE STA 1084+60 TO 987+20 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1084+60 | 1084+85 | C | 20.67 | 0.00 | 6.00 | 6.00 | 0.0514 | 0.03 | 0.03 | 0.75 | 0.02 | Seed | 3.62 | 5 | 0.030 | 15.26 | 1.31 | 0.31 | 0.07 | 0.10 | 1.16 |
| | | | | | | | | | | | | Seed | 4.09 | 10 | 0.040 | 15.29 | 1.20 | 0.34 | 0.08 | 0.11 | 1.29 |
| 1084+85 | 1085+00 | C | 15.41 | 0.00 | 5.00 | 6.00 | 0.0514 | 0.02 | 0.05 | 0.76 | 0.04 | Seed | 3.60 | 5 | 0.030 | 15.41 | 1.66 | 0.38 | 0.13 | 0.12 | 1.30 |
| | | | | | | | | | | | | Seed | 4.07 | 10 | 0.040 | 15.48 | 1.34 | 0.45 | 0.14 | 0.14 | 1.54 |
| 1085+00 | 985+55 | C | 79.40 | 0.00 | 4.00 | 6.00 | 0.0514 | 0.13 | 0.17 | 0.72 | 0.13 | Seed | 3.54 | 5 | 0.030 | 15.98 | 2.37 | 0.62 | 0.44 | 0.19 | 1.93 |
| | | | | | | | | | | | | Jute Mat | 3.52 | 5 | 0.040 | 16.11 | 1.91 | 0.69 | 0.44 | 0.21 | 2.15 |
| | | | | | | | | | | | | Temp. Mat | 3.52 | 5 | 0.040 | 16.11 | 1.91 | 0.69 | 0.44 | 0.21 | 2.15 |
| | | | | | | | | | | | | Temp. Mat | 3.98 | 10 | 0.040 | 16.15 | 1.96 | 0.72 | 0.50 | 0.23 | 2.26 |
| 985+55 | 985+88 | C | 33.14 | 4.00 | 4.00 | 4.00 | 0.0514 | 0.08 | 0.25 | 0.70 | 0.18 | Seed | 3.49 | 5 | 0.030 | 16.40 | 1.91 | 0.25 | 0.63 | 0.08 | 4.61 |
| | | | | | | | | | | | | Seed | 3.94 | 10 | 0.040 | 16.48 | 1.67 | 0.31 | 0.71 | 0.10 | 4.77 |
| 985+88 | 986+46 | C | 57.89 | 4.00 | 4.00 | 4.00 | 0.0314 | 0.12 | 0.37 | 0.65 | 0.26 | Seed | 3.43 | 5 | 0.030 | 16.91 | 1.88 | 0.21 | 0.89 | 0.11 | 4.86 |
| | | | | | | | | | | | | Seed | 3.87 | 10 | 0.040 | 17.07 | 1.62 | 0.27 | 1.01 | 0.14 | 5.10 |
| 986+46 | 987+20 | C | 76.53 | 4.00 | 4.00 | 4.00 | 0.0797 | 0.22 | 0.60 | 0.64 | 0.40 | Seed | 3.39 | 5 | 0.030 | 17.34 | 2.93 | 0.52 | 1.37 | 0.11 | 4.84 |

# DITCH ANALYSIS

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Jute Mat | 3.38 | 5 | 0.040 | 17.43 | 2.42 | 0.62 | 1.36 | 0.12 | 5.00 |
| | | | | | | | | | | | | Temp. Mat | 3.38 | 5 | 0.040 | 17.43 | 2.42 | 0.62 | 1.36 | 0.12 | 5.00 |
| | | | | | | | | | | | | Temp. Mat | 3.81 | 10 | 0.040 | 17.57 | 2.53 | 0.67 | 1.54 | 0.13 | 5.07 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.238 **Location :** Cleveland, Ohio

**Description :** RAMP H5 RT STA 1076+50 TO 1078+25 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1078+25 | 1077+50 | R | 75.00 | 4.00 | 3.00 | 3.00 | 0.0067 | 0.27 | 0.27 | 0.84 | 0.22 | Seed | 3.52 | 5 | 0.030 | 16.12 | 1.10 | 0.07 | 0.78 | 0.16 | 4.95 |
| | | | | | | | | | | | | Seed | 3.96 | 10 | 0.040 | 16.30 | 0.95 | 0.08 | 0.88 | 0.20 | 5.21 |
| 1077+50 | 1077+00 | R | 50.00 | 4.00 | 3.00 | 3.00 | 0.0080 | 0.15 | 0.42 | 0.81 | 0.35 | Seed | 3.45 | 5 | 0.030 | 16.73 | 1.35 | 0.10 | 1.20 | 0.19 | 5.16 |
| | | | | | | | | | | | | Seed | 3.88 | 10 | 0.040 | 17.01 | 1.16 | 0.12 | 1.35 | 0.24 | 5.47 |
| 1077+00 | 1076+50 | R | 50.00 | 21.00 | 3.00 | 8.00 | 0.0060 | 0.16 | 0.58 | 0.79 | 0.47 | Seed | 3.34 | 5 | 0.030 | 17.79 | 0.78 | 0.04 | 1.58 | 0.09 | 22.03 |
| | | | | | | | | | | | | Seed | 3.74 | 10 | 0.040 | 18.21 | 0.68 | 0.04 | 1.77 | 0.12 | 22.31 |
| 1076+50 | 1076+00 | R | 50.00 | 29.00 | 3.00 | 12.00 | 0.0180 | 0.49 | 1.06 | 0.86 | 0.89 | Seed | 3.27 | 5 | 0.030 | 18.47 | 1.22 | 0.09 | 2.92 | 0.08 | 30.21 |
| | | | | | | | | | | | | Seed | 3.66 | 10 | 0.040 | 18.98 | 1.07 | 0.12 | 3.26 | 0.10 | 30.54 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.238 **Location :** Cleveland, Ohio

**Description :** RAMP H6 RT STA 1078+25 TO 1184+60 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1078+25 | 1082+00 | R | 375.00 | 4.00 | 3.00 | 3.00 | 0.0120 | 0.82 | 0.82 | 0.80 | 0.66 | Seed | 3.30 | 5 | 0.030 | 18.19 | 1.90 | 0.18 | 2.16 | 0.24 | 5.45 |
| | | | | | | | | | | | | Seed | 3.69 | 10 | 0.040 | 18.71 | 1.62 | 0.23 | 2.42 | 0.30 | 5.82 |
| 1082+00 | 1082+50 | R | 50.00 | 4.00 | 3.50 | 3.50 | 0.0180 | 0.15 | 0.97 | 0.77 | 0.77 | Seed | 3.26 | 5 | 0.030 | 18.56 | 2.25 | 0.26 | 2.52 | 0.23 | 5.63 |
| | | | | | | | | | | | | Seed | 3.65 | 10 | 0.040 | 19.14 | 1.92 | 0.33 | 2.82 | 0.29 | 6.04 |
| 1082+50 | 1083+50 | R | 100.00 | 4.00 | 4.00 | 4.00 | 0.0260 | 0.36 | 1.33 | 0.66 | 1.01 | Seed | 3.21 | 5 | 0.030 | 19.17 | 2.72 | 0.39 | 3.24 | 0.24 | 5.92 |
| | | | | | | | | | | | | Seed | 3.57 | 10 | 0.040 | 19.86 | 2.32 | 0.49 | 3.62 | 0.30 | 6.40 |
| 1083+50 | 1184+60 | R | 155.00 | 4.00 | 4.00 | 4.00 | 0.0194 | 0.61 | 1.94 | 0.64 | 1.40 | Seed | 3.12 | 5 | 0.030 | 20.11 | 2.71 | 0.37 | 4.37 | 0.31 | 6.47 |
| | | | | | | | | | | | | Seed | 3.47 | 10 | 0.040 | 20.97 | 2.30 | 0.46 | 4.86 | 0.38 | 7.06 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.238 **Location :** Cleveland, Ohio

**Description :** RAMP H6 RT STA 1184+60 TO 1185+85 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1185+85 | 1185+50 | R | 34.50 | 4.00 | 4.00 | 4.00 | 0.0214 | 0.11 | 0.11 | 0.62 | 0.07 | Seed | 3.59 | 5 | 0.030 | 15.55 | 1.04 | 0.08 | 0.25 | 0.06 | 4.45 |
| | | | | | | | | | | | | Seed | 4.05 | 10 | 0.040 | 15.63 | 0.90 | 0.10 | 0.28 | 0.07 | 4.58 |
| 1185+50 | 1185+00 | R | 47.66 | 4.00 | 4.00 | 4.00 | 0.0398 | 0.13 | 0.25 | 0.60 | 0.15 | Seed | 3.53 | 5 | 0.030 | 16.03 | 1.66 | 0.18 | 0.53 | 0.07 | 4.59 |
| | | | | | | | | | | | | Seed | 3.98 | 10 | 0.040 | 16.17 | 1.44 | 0.23 | 0.59 | 0.09 | 4.75 |
| 1185+00 | 1184+60 | R | 37.39 | 4.00 | 4.00 | 4.00 | 0.0098 | 0.12 | 0.37 | 0.59 | 0.22 | Seed | 3.47 | 5 | 0.030 | 16.54 | 1.21 | 0.09 | 0.77 | 0.14 | 5.12 |
| | | | | | | | | | | | | Seed | 3.91 | 10 | 0.040 | 16.76 | 1.04 | 0.11 | 0.87 | 0.18 | 5.42 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP H6 LT STA 1188+50 TO 1192+00 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1192+00 | 1190+50 | L | 160.00 | 0.00 | 12.00 | 6.00 | 0.0123 | 0.53 | 0.53 | 0.56 | 0.30 | Seed | 3.44 | 5 | 0.030 | 16.80 | 1.47 | 0.21 | 1.02 | 0.28 | 5.00 |
| | | | | | | | | | | | | Seed | 3.86 | 10 | 0.040 | 17.16 | 1.22 | 0.25 | 1.14 | 0.32 | 5.80 |
| 1190+50 | 1188+50 | L | 235.00 | 4.00 | 12.00 | 5.00 | 0.0271 | 0.73 | 1.25 | 0.53 | 0.68 | Seed | 3.27 | 5 | 0.030 | 18.54 | 2.21 | 0.31 | 2.22 | 0.18 | 7.08 |
| | | | | | | | | | | | | Seed | 3.64 | 10 | 0.040 | 19.22 | 1.87 | 0.38 | 2.48 | 0.22 | 7.81 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP IB5 RT STA 1708+30 TO 1713+91 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1708+30 | 1709+05 | R | 64.00 | 4.50 | 8.00 | 3.00 | 0.0255 | 0.27 | 0.27 | 0.72 | 0.19 | Seed | 3.57 | 5 | 0.030 | 15.70 | 1.52 | 0.15 | 0.69 | 0.09 | 5.50 |
| | | | | | | | | | | | | Seed | 4.02 | 10 | 0.040 | 15.81 | 1.30 | 0.19 | 0.78 | 0.12 | 5.79 |
| 1709+05 | 1710+00 | R | 80.00 | 4.50 | 8.00 | 3.00 | 0.0403 | 0.16 | 0.43 | 0.68 | 0.31 | Seed | 3.49 | 5 | 0.030 | 16.35 | 2.04 | 0.26 | 1.07 | 0.10 | 5.64 |
| | | | | | | | | | | | | Seed | 3.93 | 10 | 0.040 | 16.56 | 1.75 | 0.33 | 1.20 | 0.13 | 5.95 |
| 1710+00 | 1713+91 | R | 329.00 | 4.50 | 8.00 | 3.00 | 0.0571 | 1.12 | 1.55 | 0.65 | 1.03 | Seed | 3.32 | 5 | 0.030 | 17.94 | 3.40 | 0.65 | 3.43 | 0.18 | 6.52 |
| | | | | | | | | | | | | Jute Mat | 3.29 | 5 | 0.040 | 18.27 | 2.79 | 0.76 | 3.40 | 0.21 | 6.86 |
| | | | | | | | | | | | | Temp. Mat | 3.29 | 5 | 0.040 | 18.27 | 2.79 | 0.76 | 3.40 | 0.21 | 6.86 |
| | | | | | | | | | | | | Temp. Mat | 3.72 | 10 | 0.040 | 18.42 | 2.90 | 0.82 | 3.84 | 0.23 | 7.03 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP IB5 RT STA 1713+91 TO 1715+60 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1715+60 | 1714+20 | R | 128.00 | 4.50 | 6.00 | 3.00 | 0.0046 | 0.34 | 0.34 | 0.60 | 0.20 | Seed | 3.38 | 5 | 0.030 | 17.37 | 0.88 | 0.04 | 0.69 | 0.15 | 5.85 |
| | | | | | | | | | | | | Seed | 3.79 | 10 | 0.040 | 17.77 | 0.76 | 0.05 | 0.77 | 0.19 | 6.22 |
| 1714+20 | 1713+91 | R | 24.00 | 4.50 | 6.00 | 3.00 | 0.0163 | 0.10 | 0.43 | 0.66 | 0.27 | Seed | 3.35 | 5 | 0.030 | 17.65 | 1.45 | 0.12 | 0.89 | 0.12 | 5.60 |
| | | | | | | | | | | | | Seed | 3.76 | 10 | 0.040 | 18.09 | 1.25 | 0.16 | 1.00 | 0.15 | 5.89 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP IB5 LT STA 1713+40 TO 1714+41 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1714+41 | 1713+67 | L | 92.00 | 2.00 | 12.50 | 12.50 | 0.0050 | 0.09 | 0.09 | 0.53 | 0.05 | Seed | 3.35 | 5 | 0.030 | 17.64 | 0.58 | 0.03 | 0.17 | 0.09 | 4.28 |
| | | | | | | | | | | | | Seed | 3.76 | 10 | 0.040 | 18.10 | 0.48 | 0.04 | 0.19 | 0.11 | 4.82 |
| 1713+67 | 1713+40 | L | 56.00 | 2.00 | 10.00 | 14.00 | 0.0050 | 0.11 | 0.20 | 0.51 | 0.11 | Seed | 3.23 | 5 | 0.030 | 18.92 | 0.71 | 0.04 | 0.34 | 0.13 | 5.22 |
| | | | | | | | | | | | | Seed | 3.59 | 10 | 0.040 | 19.66 | 0.60 | 0.05 | 0.38 | 0.16 | 5.87 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP IH4 LT STA 13+10 TO 15+25 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13+10 | 13+84 | L | 74.00 | 0.00 | 2.00 | 2.00 | 0.0598 | 0.09 | 0.09 | 0.78 | 0.07 | Seed | 3.59 | 5 | 0.030 | 15.48 | 2.54 | 0.82 | 0.25 | 0.22 | 0.88 |
| | | | | | | | | | | | | Jute Mat | 3.58 | 5 | 0.040 | 15.60 | 2.01 | 0.92 | 0.25 | 0.25 | 0.99 |
| | | | | | | | | | | | | Temp. Mat | 3.58 | 5 | 0.040 | 15.60 | 2.01 | 0.92 | 0.25 | 0.25 | 0.99 |
| | | | | | | | | | | | | Temp. Mat | 4.05 | 10 | 0.040 | 15.58 | 2.09 | 0.96 | 0.28 | 0.26 | 1.03 |
| 13+84 | 14+25 | L | 41.00 | 0.00 | 2.00 | 2.00 | 0.0916 | 0.07 | 0.15 | 0.79 | 0.12 | Seed | 3.56 | 5 | 0.030 | 15.80 | 3.52 | 1.41 | 0.43 | 0.25 | 0.99 |
| | | | | | | | | | | | | Jute Mat | 3.55 | 5 | 0.040 | 15.85 | 2.75 | 1.60 | 0.43 | 0.28 | 1.12 |
| | | | | | | | | | | | | Temp. Mat | 3.55 | 5 | 0.040 | 15.85 | 2.75 | 1.60 | 0.43 | 0.28 | 1.12 |
| | | | | | | | | | | | | Perm, Type 1 | 3.55 | 5 | 0.040 | 15.85 | 2.75 | 1.60 | 0.43 | 0.28 | 1.12 |
| | | | | | | | | | | | | Perm, Type 1 | 4.02 | 10 | 0.040 | 15.81 | 2.89 | 1.66 | 0.49 | 0.29 | 1.16 |
| 14+25 | 14+50 | L | 25.00 | 2.00 | 3.00 | 4.00 | 0.0572 | 0.05 | 0.20 | 0.71 | 0.16 | Seed | 3.53 | 5 | 0.030 | 16.03 | 2.33 | 0.36 | 0.55 | 0.10 | 2.70 |
| | | | | | | | | | | | | Seed | 4.00 | 10 | 0.040 | 16.02 | 1.98 | 0.46 | 0.62 | 0.13 | 2.90 |
| 14+50 | 15+00 | L | 50.00 | 13.00 | 5.00 | 6.00 | 0.0572 | 0.13 | 0.34 | 0.67 | 0.25 | Seed | 3.47 | 5 | 0.030 | 16.59 | 1.45 | 0.16 | 0.85 | 0.04 | 13.49 |
| | | | | | | | | | | | | Seed | 3.92 | 10 | 0.040 | 16.67 | 1.28 | 0.20 | 0.96 | 0.06 | 13.62 |

# DITCH ANALYSIS

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15+00 | 15+25 | L | 25.00 | 22.00 | 30.00 | 8.00 | 0.0572 | 0.08 | 0.42 | 0.62 | 0.30 | Seed | 3.43 | 5 | 0.030 | 16.92 | 1.26 | 0.13 | 1.01 | 0.04 | 23.35 |
| | | | | | | | | | | | | Seed | 3.87 | 10 | 0.040 | 17.04 | 1.11 | 0.16 | 1.15 | 0.05 | 23.72 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP IJ3 LT STA 101+89 TO 105+25 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101+89 | 102+75 | L | 92.40 | 4.00 | 4.00 | 4.00 | 0.0340 | 0.16 | 0.16 | 0.53 | 0.08 | Seed | 3.51 | 5 | 0.030 | 16.19 | 1.27 | 0.12 | 0.30 | 0.06 | 4.44 |
| | | | | | | | | | | | | Seed | 3.95 | 10 | 0.040 | 16.38 | 1.12 | 0.15 | 0.33 | 0.07 | 4.56 |
| 102+75 | 103+75 | L | 107.60 | 4.00 | 4.00 | 4.00 | 0.0256 | 0.14 | 0.30 | 0.54 | 0.16 | Seed | 3.38 | 5 | 0.030 | 17.41 | 1.44 | 0.14 | 0.54 | 0.09 | 4.69 |
| | | | | | | | | | | | | Seed | 3.79 | 10 | 0.040 | 17.77 | 1.27 | 0.17 | 0.60 | 0.11 | 4.86 |
| 103+75 | 104+10 | L | 39.50 | 4.00 | 4.00 | 4.00 | 0.0861 | 0.09 | 0.39 | 0.52 | 0.21 | Seed | 3.35 | 5 | 0.030 | 17.69 | 2.33 | 0.38 | 0.70 | 0.07 | 4.56 |
| | | | | | | | | | | | | Seed | 3.76 | 10 | 0.040 | 18.09 | 2.06 | 0.47 | 0.78 | 0.09 | 4.70 |
| 104+10 | 104+15 | L | 5.90 | 4.00 | 3.00 | 4.00 | 0.0861 | 0.02 | 0.41 | 0.67 | 0.22 | Seed | 3.35 | 5 | 0.030 | 17.73 | 2.41 | 0.38 | 0.73 | 0.07 | 4.50 |
| | | | | | | | | | | | | Seed | 3.75 | 10 | 0.040 | 18.14 | 2.10 | 0.48 | 0.82 | 0.09 | 4.63 |
| 104+15 | 104+50 | L | 42.40 | 4.00 | 2.00 | 4.00 | 0.0861 | 0.11 | 0.51 | 0.66 | 0.29 | Seed | 3.32 | 5 | 0.030 | 17.99 | 2.67 | 0.45 | 0.96 | 0.08 | 4.51 |
| | | | | | | | | | | | | Jute Mat | 3.31 | 5 | 0.040 | 18.05 | 2.24 | 0.53 | 0.96 | 0.10 | 4.60 |
| | | | | | | | | | | | | Temp. Mat | 3.31 | 5 | 0.040 | 18.05 | 2.24 | 0.53 | 0.96 | 0.10 | 4.60 |
| | | | | | | | | | | | | Temp. Mat | 3.72 | 10 | 0.040 | 18.44 | 2.32 | 0.58 | 1.07 | 0.11 | 4.64 |
| 104+50 | Concent | | | | | | | 0.63 | | 0.71 | 0.73 | | | | | 15.00 | | | | | |

# DITCH ANALYSIS

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 104+50 | 105+25 | L | 88.50 | 4.00 | 2.00 | 4.00 | 0.0065 | 0.24 | 1.38 | 0.64 | 0.89 | Seed | 3.23 | 5 | 0.030 | 18.91 | 1.69 | 0.14 | 2.86 | 0.34 | 6.03 |
| | | | | | | | | | | | | Seed | 3.61 | 10 | 0.040 | 19.46 | 1.44 | 0.17 | 3.20 | 0.42 | 6.54 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP IJ3 LT STA 106+20 TO 105+25 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106+20 | 105+80 | L | 43.00 | 4.00 | 4.00 | 4.00 | 0.0101 | 0.15 | 0.15 | 0.67 | 0.10 | Seed | 3.56 | 5 | 0.030 | 15.76 | 0.95 | 0.06 | 0.36 | 0.09 | 4.71 |
| | | | | | | | | | | | | Seed | 4.02 | 10 | 0.040 | 15.87 | 0.82 | 0.07 | 0.41 | 0.11 | 4.90 |
| 105+80 | 105+50 | L | 34.60 | 4.00 | 4.00 | 4.00 | 0.0317 | 0.10 | 0.25 | 0.66 | 0.17 | Seed | 3.52 | 5 | 0.030 | 16.12 | 1.62 | 0.17 | 0.59 | 0.08 | 4.68 |
| | | | | | | | | | | | | Seed | 3.97 | 10 | 0.040 | 16.28 | 1.40 | 0.21 | 0.67 | 0.11 | 4.86 |
| 105+50 | 105+25 | L | 30.40 | 4.00 | 4.00 | 4.00 | 0.0516 | 0.20 | 0.45 | 0.62 | 0.29 | Seed | 3.49 | 5 | 0.030 | 16.34 | 2.30 | 0.32 | 1.02 | 0.10 | 4.81 |
| | | | | | | | | | | | | Seed | 3.93 | 10 | 0.040 | 16.54 | 2.00 | 0.41 | 1.15 | 0.13 | 5.02 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP IJ3 LT STA 106+20 TO 109+25 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106+20 | 107+00 | L | 80.00 | 4.00 | 4.00 | 4.00 | 0.0094 | 0.17 | 0.17 | 0.60 | 0.10 | Seed | 3.48 | 5 | 0.030 | 16.45 | 0.91 | 0.05 | 0.36 | 0.09 | 4.73 |
| | | | | | | | | | | | | Seed | 3.92 | 10 | 0.040 | 16.64 | 0.79 | 0.07 | 0.41 | 0.12 | 4.92 |
| 107+00 | 107+75 | L | 74.13 | 4.00 | 4.00 | 4.00 | 0.0302 | 0.23 | 0.40 | 0.65 | 0.25 | Seed | 3.41 | 5 | 0.030 | 17.12 | 1.82 | 0.20 | 0.85 | 0.11 | 4.85 |
| | | | | | | | | | | | | Seed | 3.83 | 10 | 0.040 | 17.43 | 1.58 | 0.25 | 0.96 | 0.13 | 5.07 |
| 107+75 | 108+50 | L | 67.82 | 4.00 | 4.00 | 4.00 | 0.0215 | 0.21 | 0.61 | 0.65 | 0.39 | Seed | 3.35 | 5 | 0.030 | 17.72 | 1.88 | 0.20 | 1.30 | 0.15 | 5.20 |
| | | | | | | | | | | | | Seed | 3.75 | 10 | 0.040 | 18.12 | 1.62 | 0.25 | 1.46 | 0.19 | 5.51 |
| 108+50 | 109+25 | L | 69.03 | 4.00 | 4.00 | 4.00 | 0.0215 | 0.34 | 0.95 | 0.73 | 0.64 | Seed | 3.30 | 5 | 0.030 | 18.24 | 2.21 | 0.27 | 2.10 | 0.20 | 5.58 |
| | | | | | | | | | | | | Seed | 3.69 | 10 | 0.040 | 18.72 | 1.90 | 0.33 | 2.35 | 0.25 | 5.99 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP IJ3 RT STA 102+00 to 104+00 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.50 |
| **Permanent Mat** | **Type 1:** | 3.00 | **Type 2:** 4.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102+00 | Concent | | | | | | | 0.45 | | 0.57 | 0.26 | | | | | 10.00 | | | | | |
| 102+00 | Concent | | | | | | | 0.60 | | 0.90 | 0.80 | | | | | 10.00 | | | | | |
| 102+00 | 103+75 | R | 117.00 | 0.00 | 10.00 | 4.00 | 0.0571 | 0.47 | 1.52 | 0.59 | 1.07 | Seed | 3.59 | 5 | 0.030 | 15.50 | 3.87 | 1.34 | 3.86 | 0.38 | 5.28 |
| | | | | | | | | | | | | Jute Mat | 3.58 | 5 | 0.040 | 15.62 | 3.11 | 1.50 | 3.84 | 0.42 | 5.88 |
| | | | | | | | | | | | | Temp. Mat | 3.58 | 5 | 0.040 | 15.62 | 3.11 | 1.50 | 3.84 | 0.42 | 5.88 |
| | | | | | | | | | | | | Temp. Mat | 4.05 | 10 | 0.040 | 15.60 | 3.20 | 1.57 | 4.35 | 0.44 | 6.17 |
| 103+75 | 104+00 | R | 21.00 | 2.00 | 6.00 | 3.00 | 0.0571 | 0.07 | 1.59 | 0.66 | 1.12 | Seed | 3.57 | 5 | 0.030 | 15.71 | 4.12 | 1.04 | 3.99 | 0.29 | 4.63 |
| | | | | | | | | | | | | Jute Mat | 3.56 | 5 | 0.040 | 15.73 | 3.36 | 1.20 | 3.99 | 0.34 | 5.04 |
| | | | | | | | | | | | | Temp. Mat | 3.56 | 5 | 0.040 | 15.73 | 3.36 | 1.20 | 3.99 | 0.34 | 5.04 |
| | | | | | | | | | | | | Temp. Mat | 4.04 | 10 | 0.040 | 15.70 | 3.47 | 1.28 | 4.52 | 0.36 | 5.24 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP IJ3 RT STA 104+00 TO 106+08 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106+08 | 105+25 | R | 73.00 | 2.00 | 6.00 | 3.00 | 0.0056 | 0.10 | 0.10 | 0.65 | 0.06 | Seed | 3.47 | 5 | 0.030 | 16.56 | 0.78 | 0.04 | 0.22 | 0.11 | 3.02 |
| | | | | | | | | | | | | Seed | 3.90 | 10 | 0.040 | 16.86 | 0.65 | 0.05 | 0.25 | 0.15 | 3.31 |
| 105+25 | 104+60 | R | 58.00 | 2.00 | 6.00 | 2.00 | 0.0609 | 0.15 | 0.25 | 0.68 | 0.16 | Seed | 3.42 | 5 | 0.030 | 16.98 | 2.36 | 0.38 | 0.56 | 0.10 | 2.79 |
| | | | | | | | | | | | | Seed | 3.84 | 10 | 0.040 | 17.34 | 2.00 | 0.48 | 0.63 | 0.13 | 3.01 |
| 104+60 | 104+00 | R | 46.00 | 2.00 | 6.00 | 2.00 | 0.0390 | 0.18 | 0.43 | 0.66 | 0.29 | Seed | 3.39 | 5 | 0.030 | 17.29 | 2.42 | 0.37 | 0.97 | 0.15 | 3.22 |
| | | | | | | | | | | | | Seed | 3.80 | 10 | 0.040 | 17.71 | 2.06 | 0.46 | 1.09 | 0.19 | 3.53 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**RAMP IJ3 RT STA 106+08 TO 110+10 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106+08 | 106+50 | R | 41.00 | 1.00 | 3.00 | 3.00 | 0.0134 | 0.15 | 0.15 | 0.72 | 0.11 | Seed | 3.59 | 5 | 0.030 | 15.47 | 1.43 | 0.15 | 0.39 | 0.18 | 2.06 |
| | | | | | | | | | | | | Seed | 4.06 | 10 | 0.040 | 15.56 | 1.24 | 0.18 | 0.44 | 0.21 | 2.29 |
| 106+50 | 108+00 | R | 154.00 | 1.00 | 2.00 | 2.00 | 0.0179 | 0.08 | 0.23 | 0.76 | 0.17 | Seed | 3.44 | 5 | 0.030 | 16.79 | 1.89 | 0.24 | 0.58 | 0.21 | 1.86 |
| | | | | | | | | | | | | Seed | 3.86 | 10 | 0.040 | 17.13 | 1.62 | 0.29 | 0.65 | 0.26 | 2.05 |
| 108+00 | 108+25 | R | 28.00 | 1.00 | 2.50 | 2.00 | 0.0243 | 0.22 | 0.45 | 0.61 | 0.30 | Seed | 3.42 | 5 | 0.030 | 16.98 | 2.49 | 0.40 | 1.04 | 0.26 | 2.18 |
| | | | | | | | | | | | | Seed | 3.84 | 10 | 0.040 | 17.35 | 2.08 | 0.49 | 1.17 | 0.32 | 2.46 |
| 108+25 | 109+30 | R | 125.00 | 2.00 | 6.00 | 2.00 | 0.0291 | 0.21 | 0.66 | 0.55 | 0.42 | Seed | 3.34 | 5 | 0.030 | 17.82 | 2.44 | 0.37 | 1.40 | 0.20 | 3.63 |
| | | | | | | | | | | | | Seed | 3.73 | 10 | 0.040 | 18.35 | 2.07 | 0.46 | 1.57 | 0.25 | 4.02 |
| 109+30 | Concent | | | | | | | 0.29 | | 0.50 | 0.56 | | | | | 3.26 | | | | | |
| 109+30 | 109+50 | R | 23.00 | 2.00 | 6.00 | 4.00 | 0.0209 | 0.03 | 0.98 | 0.53 | 0.58 | Seed | 3.32 | 5 | 0.030 | 17.99 | 2.30 | 0.33 | 1.92 | 0.26 | 4.55 |
| | | | | | | | | | | | | Seed | 3.71 | 10 | 0.040 | 18.55 | 1.92 | 0.41 | 2.14 | 0.31 | 5.13 |
| 109+50 | 109+80 | R | 34.00 | 2.00 | 6.00 | 6.00 | 0.0156 | 0.04 | 1.01 | 0.53 | 0.60 | Seed | 3.29 | 5 | 0.030 | 18.27 | 2.01 | 0.26 | 1.97 | 0.27 | 5.24 |
| | | | | | | | | | | | | Seed | 3.67 | 10 | 0.040 | 18.89 | 1.68 | 0.32 | 2.19 | 0.33 | 5.95 |

# DITCH ANALYSIS

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109+80 | 110+10 | R | 34.00 | 2.00 | 6.00 | 6.00 | 0.0088 | 0.06 | 1.07 | 0.54 | 0.63 | Seed | 3.26 | 5 | 0.030 | 18.61 | 1.65 | 0.18 | 2.05 | 0.32 | 5.82 |
| | | | | | | | | | | | | Seed | 3.63 | 10 | 0.040 | 19.30 | 1.38 | 0.21 | 2.28 | 0.38 | 6.61 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** E14TH MEDIAN CT STA 38+30 TO 36+47 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38+30 | 36+47 | C | 183.00 | 0.00 | 6.00 | 6.00 | 0.0230 | 0.04 | 0.04 | 0.50 | 0.02 | Seed | 3.29 | 5 | 0.030 | 18.30 | 1.03 | 0.14 | 0.06 | 0.10 | 1.16 |
| | | | | | | | | | | | | Seed | 3.71 | 10 | 0.040 | 18.54 | 0.94 | 0.15 | 0.06 | 0.11 | 1.29 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** E14TH MEDIAN CT STA 54+18 TO 55+00 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54+18 | 54+50 | C | 32.00 | 2.00 | 6.00 | 10.00 | 0.0334 | 0.03 | 0.03 | 0.50 | 0.02 | Seed | 3.57 | 5 | 0.030 | 15.71 | 0.74 | 0.07 | 0.05 | 0.03 | 2.52 |
| | | | | | | | | | | | | Seed | 4.03 | 10 | 0.040 | 15.74 | 0.70 | 0.08 | 0.06 | 0.04 | 2.60 |
| 54+50 | 55+00 | C | 50.00 | 2.00 | 6.00 | 10.00 | 0.0156 | 0.06 | 0.09 | 0.50 | 0.04 | Seed | 3.46 | 5 | 0.030 | 16.65 | 0.86 | 0.07 | 0.15 | 0.07 | 3.12 |
| | | | | | | | | | | | | Seed | 3.90 | 10 | 0.040 | 16.82 | 0.75 | 0.08 | 0.17 | 0.09 | 3.38 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** E14TH MEDIAN CT STA 303+97 TO 53+72 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 303+97 | 305+00 | C | 102.70 | 0.00 | 4.00 | 6.00 | 0.0249 | 0.01 | 0.01 | 0.50 | 0.01 | Seed | 3.37 | 5 | 0.030 | 17.47 | 1.14 | 0.10 | 0.02 | 0.06 | 0.64 |
| | | | | | | | | | | | | Seed | 3.86 | 10 | 0.040 | 17.19 | 0.73 | 0.13 | 0.03 | 0.09 | 0.86 |
| 305+00 | 52+60 | C | 62.54 | 0.00 | 4.00 | 6.00 | 0.0159 | 0.02 | 0.03 | 0.50 | 0.02 | Seed | 3.25 | 5 | 0.030 | 18.66 | 0.85 | 0.11 | 0.05 | 0.11 | 1.07 |
| | | | | | | | | | | | | Seed | 3.69 | 10 | 0.040 | 18.68 | 0.67 | 0.13 | 0.06 | 0.13 | 1.29 |
| 52+60 | 53+50 | C | 90.00 | 2.00 | 4.00 | 6.00 | 0.0283 | 0.05 | 0.08 | 0.50 | 0.04 | Seed | 3.12 | 5 | 0.030 | 20.08 | 1.08 | 0.09 | 0.12 | 0.05 | 2.48 |
| | | | | | | | | | | | | Seed | 3.53 | 10 | 0.040 | 20.30 | 0.88 | 0.11 | 0.13 | 0.06 | 2.64 |
| 53+50 | 53+72 | C | 22.23 | 2.00 | 4.00 | 6.00 | 0.0224 | 0.02 | 0.09 | 0.50 | 0.05 | Seed | 3.09 | 5 | 0.030 | 20.42 | 1.07 | 0.08 | 0.15 | 0.06 | 2.59 |
| | | | | | | | | | | | | Seed | 3.49 | 10 | 0.040 | 20.70 | 0.92 | 0.11 | 0.16 | 0.08 | 2.75 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP E 14TH NB Rt STA 304+00 TO 53+60 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 304+00 | 305+00 | R | 100.00 | 2.00 | 2.00 | 2.00 | 0.0182 | 0.02 | 0.02 | 0.70 | 0.02 | Seed | 3.40 | 5 | 0.030 | 17.21 | 0.70 | 0.04 | 0.05 | 0.04 | 2.15 |
| | | | | | | | | | | | | Seed | 3.82 | 10 | 0.040 | 17.54 | 0.69 | 0.05 | 0.06 | 0.04 | 2.17 |
| 305+00 | 305+50 | R | 50.00 | 2.00 | 2.00 | 3.00 | 0.0182 | 0.02 | 0.04 | 0.70 | 0.03 | Seed | 3.30 | 5 | 0.030 | 18.19 | 0.83 | 0.06 | 0.09 | 0.05 | 2.27 |
| | | | | | | | | | | | | Seed | 3.70 | 10 | 0.040 | 18.60 | 0.76 | 0.07 | 0.11 | 0.06 | 2.32 |
| 305+50 | 53+00 | R | 58.00 | 2.00 | 3.00 | 3.00 | 0.0698 | 0.03 | 0.07 | 0.70 | 0.05 | Seed | 3.24 | 5 | 0.030 | 18.79 | 1.60 | 0.21 | 0.17 | 0.05 | 2.29 |
| | | | | | | | | | | | | Seed | 3.63 | 10 | 0.040 | 19.26 | 1.44 | 0.26 | 0.19 | 0.06 | 2.35 |
| 53+00 | 53+60 | R | 60.00 | 2.00 | 3.00 | 4.00 | 0.0108 | 0.21 | 0.28 | 0.55 | 0.16 | Seed | 3.17 | 5 | 0.030 | 19.55 | 1.31 | 0.10 | 0.52 | 0.16 | 3.09 |
| | | | | | | | | | | | | Seed | 3.55 | 10 | 0.040 | 20.16 | 1.10 | 0.13 | 0.58 | 0.20 | 3.37 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** RAMP E 14TH SB LT STA 202+75 TO 204+96 EX DITCH **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | |
|---|---|---|---|---|---|
| | **Seed:** | 0.40 | **Jute Mat:** 0.45 | **Temporary Mat:** | 1.00 |
| **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** 3.00 | **Type 3:** | 5.00 |
| **RCP** | **Type B:** | 6.00 | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 202+75 | 204+96 | R | 214.60 | 0.00 | 16.00 | 9.00 | 0.0110 | 0.29 | 0.29 | 0.50 | 0.14 | Seed | 3.29 | 5 | 0.030 | 18.26 | 1.08 | 0.13 | 0.48 | 0.19 | 4.70 |
| | | | | | | | | | | | | Seed | 3.67 | 10 | 0.040 | 18.90 | 0.90 | 0.15 | 0.53 | 0.22 | 5.44 |

# DITCH ANALYSIS

**PID :** 82382 **Date :** 04/22/2024 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** E 14TH SB LT STA 39+65 TO RAMP A3 LT 587+33 **Designer :** JAR

**Rainfall Area :** A

**Allowable Shears**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Seed:** | 0.40 | **Jute Mat:** | 0.45 | **Temporary Mat:** | 1.00 |
| | **Permanent Mat** | **Type 1:** | 2.00 | **Type 2:** | 3.00 | **Type 3:** | 5.00 |
| | **RCP** | **Type B:** | 6.00 | | | | |

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

| STATION BEGIN | STATION END | SIDE | LENGTH (ft.) | RADIUS WIDTH (ft.) | IN SLOPE (ft./ft.) | BACK SLOPE (ft./ft.) | GRADE (ft./ft.) | AREA (acres) | AREA SUM (acres) | RUNOFF COEFF. | CA (Sum) | PROTECT TYPE | RAIN INT. (in./hr.) | STORM FREQ. (yrs.) | MANN. COEFF. | TIME FLOW (min.) | VEL. FLOW (fps.) | SHEAR (lbs./ sq.ft.) | DESIGN FLOW (cfs.) | DEPTH FLOW (ft.) | WIDTH FLOW (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 39+65 | 39+00 | L | 66.70 | 4.00 | 6.00 | 6.00 | 0.0178 | 0.15 | 0.15 | 0.65 | 0.09 | Seed | 3.53 | 5 | 0.030 | 16.03 | 1.09 | 0.08 | 0.33 | 0.07 | 4.84 |
| | | | | | | | | | | | | Seed | 3.98 | 10 | 0.040 | 16.18 | 0.91 | 0.10 | 0.38 | 0.09 | 5.10 |
| 39+00 | 38+50 | L | 50.70 | 4.00 | 4.00 | 4.00 | 0.0328 | 0.10 | 0.24 | 0.74 | 0.17 | Seed | 3.47 | 5 | 0.030 | 16.55 | 1.62 | 0.17 | 0.57 | 0.08 | 4.66 |
| | | | | | | | | | | | | Seed | 3.91 | 10 | 0.040 | 16.77 | 1.39 | 0.21 | 0.65 | 0.10 | 4.84 |
| 38+50 | 38+00 | L | 52.40 | 4.00 | 4.00 | 4.00 | 0.0472 | 0.14 | 0.38 | 0.75 | 0.27 | Seed | 3.43 | 5 | 0.030 | 16.96 | 2.15 | 0.28 | 0.91 | 0.10 | 4.77 |
| | | | | | | | | | | | | Seed | 3.85 | 10 | 0.040 | 17.24 | 1.85 | 0.36 | 1.03 | 0.12 | 4.99 |
| 38+00 | 587+33 | L | 106.26 | 4.00 | 4.00 | 4.00 | 0.0171 | 0.15 | 0.52 | 0.73 | 0.37 | Seed | 3.32 | 5 | 0.030 | 17.98 | 1.73 | 0.17 | 1.24 | 0.16 | 5.25 |
| | | | | | | | | | | | | Seed | 3.72 | 10 | 0.040 | 18.43 | 1.47 | 0.21 | 1.39 | 0.20 | 5.58 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY-90-16.28
PID: 82382

Computed by: JAR Date: 6/24/22
Checked by: KGJ Date: 6/24/22


## WEIGHTED RUNOFF COEFFICIENTS

**I-90EB CT STA 175+47 TO STA 180+66 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 175+47 | 179+80 | C | 0.120 | | | | | 0.1080 | 0.120 | 0.90 |
| 179+80 | 180+66 | C | 0.030 | | | | | 0.0270 | 0.030 | 0.90 |
| | | | | | | | | 0.1350 | 0.150 | 0.90 |

**I-90EB STA 181+60 TO STA 185+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 181+60 | 185+00 | C | 0.070 | | | | | 0.0630 | 0.070 | 0.90 |

**I-90EB STA 185+00 TO STA 185+73 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 181+60 | 185+00 | C | 0.010 | | | | | 0.0090 | 0.010 | 0.90 |

**I-90EB STA 178+60 TO STA 185+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 178+60 | 179+50 | R | 0.059 | | 0.063 | | | 0.0846 | 0.122 | 0.69 |
| 179+50 | 180+00 | R | 0.019 | | 0.036 | | | 0.0351 | 0.055 | 0.64 |
| 180+00 | 183+00 | R | 0.165 | | 0.392 | | | 0.3445 | 0.557 | 0.62 |
| 183+00 | 184+00 | R | 0.079 | | 0.247 | | | 0.1946 | 0.326 | 0.60 |
| 184+00 | 185+00 | R | 0.079 | | 0.262 | | | 0.2021 | 0.341 | 0.59 |
| 185+00 | 185+25 | R | 0.242 | | 0.152 | | | 0.2938 | 0.394 | 0.75 |
| | | | | | | | | 1.1547 | 1.795 | 0.64 |

**I-90EB RT STA 203+05 TO STA 209+71 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 203+05 | 209+71 | R | | | 0.970 | | | 0.4850 | 0.970 | 0.50 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY-90-16.28
PID: 82382

Computed by: JAR Date: 6/24/22
Checked by: KGJ Date: 6/24/22
Page: 2 of 2

**I-90EB TIE-IN STA 3001+75 TO STA 3006+95 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 3001+75 | | R | | | | | | 3.3200 | 3.980 | 0.83 |
| 3001+75 | 3006+95 | R | 0.226 | 0.401 | 0.920 | | | 0.9441 | 1.547 | 0.61 |
| | | | | | | | | 4.2641 | 5.527 | 0.77 |

**I-90EB TIE-IN STA 3010+30 TO STA 3012+50 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 3010+30 | 3011+50 | R | 0.041 | 0.046 | 0.182 | | | 0.1601 | 0.269 | 0.60 |
| 3011+50 | 3012+50 | R | 0.052 | 0.062 | 0.531 | | | 0.3557 | 0.645 | 0.55 |
| | | | | | | | | 0.5158 | 0.914 | 0.56 |

**I-90WB STA 190+72 TO STA 191+85 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 190+72 | 191+85 | L | 0.270 | 0.040 | 0.070 | | | 0.3060 | 0.380 | 0.81 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


## WEIGHTED RUNOFF COEFFICIENTS

**RAMP A1 STA 307+25 TO STA 311+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 311+00 | 310+40 | L | | 0.011 | | | | 0.0077 | 0.011 | 0.70 |
| 310+40 | 309+50 | L | | 0.014 | | | | 0.0098 | 0.014 | 0.70 |
| 309+50 | 307+25 | L | | 0.040 | | | | 0.0280 | 0.040 | 0.70 |
| | | | | | | | | 0.0455 | 0.065 | 0.70 |

**RAMP A3 STA 579+71 TO STA 581+93 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 579+71 | 579+90 | L | 1.042 | | 0.078 | | | 0.9768 | 1.120 | 0.87 |
| 579+90 | 580+10 | L | 0.022 | | 0.007 | | | 0.0233 | 0.029 | 0.80 |
| 580+10 | 580+61 | L | 0.032 | | 0.020 | | | 0.0388 | 0.052 | 0.75 |
| 580+61 | 581+51 | L | 0.058 | | 0.045 | | | 0.0747 | 0.103 | 0.73 |
| 581+51 | 581+93 | L | 0.028 | | 0.022 | | | 0.0362 | 0.050 | 0.72 |
| | | | | | | | | 1.1498 | 1.354 | 0.85 |

**RAMP A3 STA 584+50 TO STA 587+33 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 584+50 | 586+41 | L | 0.087 | | | | | 0.0783 | 0.087 | 0.90 |
| 586+41 | 587+10 | L | 0.056 | | | | | 0.0504 | 0.056 | 0.90 |
| 587+10 | 587+33 | L | 0.027 | | | | | 0.0243 | 0.027 | 0.90 |
| | | | | | | | | 0.1530 | 0.170 | 0.90 |

**RAMP A3 STA 581+50 TO STA 584+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 581+50 | 582+00 | R | 0.016 | 0.048 | | | | 0.0480 | 0.064 | 0.75 |
| 582+00 | 584+25 | R | 0.014 | 0.061 | | | | 0.0553 | 0.075 | 0.74 |
| | | | | | | | | 0.1033 | 0.139 | 0.74 |

**RAMP A3 STA 584+75 TO STA 586+75 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 584+75 | 585+50 | R | 0.006 | 0.039 | | | | 0.0327 | 0.045 | 0.73 |
| 585+50 | 586+00 | R | 0.005 | 0.018 | | | | 0.0171 | 0.023 | 0.74 |
| 586+00 | 586+50 | R | 0.005 | 0.019 | | | | 0.0178 | 0.024 | 0.74 |
| 586+50 | 586+75 | R | 0.003 | 0.014 | | | | 0.0125 | 0.017 | 0.74 |
| | | | | | | | | 0.0801 | 0.109 | 0.73 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


**RAMP A3 STA 587+72 TO STA 586+75 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 587+72 | 587+50 | R | | 0.019 | 0.012 | | | 0.0193 | 0.031 | 0.62 |
| 587+50 | 587+00 | R | 0.005 | 0.044 | 0.029 | | | 0.0498 | 0.078 | 0.64 |
| 587+00 | 586+75 | R | 0.003 | 0.023 | | | | 0.0188 | 0.026 | 0.72 |
| | | | | | | | | 0.0879 | 0.135 | 0.65 |

**RAMP B6 STA 1601+05 TO STA 1603+11 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1601+05 | 1601+79 | R | 0.048 | 0.022 | 0.072 | | | 0.0946 | 0.142 | 0.67 |
| 1601+79 | | R | | | | | | 0.1620 | 0.180 | 0.90 |
| 1601+79 | 1602+45 | R | 0.022 | 0.017 | 0.070 | | | 0.0667 | 0.109 | 0.61 |
| 1602+45 | 1603+11 | R | 0.019 | 0.082 | 0.095 | | | 0.1220 | 0.196 | 0.62 |
| | | | | | | | | 0.4453 | 0.627 | 0.71 |

**RAMP B6 STA 1613+55 TO Ramp B6A STA 1806+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1613+55 | 1800+50 | R | | 0.074 | | | | 0.0518 | 0.074 | 0.70 |
| 1800+50 | 1802+75 | R | | 0.136 | | | | 0.0952 | 0.136 | 0.70 |
| 1802+75 | 1803+00 | R | 0.030 | 0.138 | | | | 0.1236 | 0.168 | 0.74 |
| 1803+00 | | R | 0.299 | | | | | 0.2691 | 0.299 | 0.90 |
| 1803+00 | 1804+00 | R | 0.052 | 0.247 | | | | 0.2197 | 0.299 | 0.73 |
| 1804+00 | 1805+00 | R | 0.051 | 0.127 | | | | 0.1348 | 0.178 | 0.76 |
| 1805+00 | 1806+00 | R | 0.205 | 0.374 | 0.033 | | | 0.4628 | 0.612 | 0.76 |
| | | | | | | | | 1.357 | 1.766 | 0.77 |

**RAMP B6 STA 1617+00 TO STA 1620+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1617+00 | 1619+00 | R | 0.116 | | 0.205 | | | 0.2069 | 0.321 | 0.64 |
| 1619+00 | 1619+50 | R | 0.028 | | 0.094 | | | 0.0722 | 0.122 | 0.59 |
| 1619+50 | 1620+00 | R | 0.100 | | 0.260 | | | 0.22 | 0.36 | 0.61 |
| | | | | | | | | 0.4991 | 0.803 | 0.62 |

**RAMP H5 STA 993+25 TO STA 990+84 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 993+25 | 992+50 | L | 0.220 | | 0.106 | | | 0.2510 | 0.326 | 0.77 |
| 992+50 | 990+84 | L | 0.256 | | 0.426 | | | 0.4434 | 0.682 | 0.65 |
| | | | | | | | | 0.6944 | 1.008 | 0.69 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22
Page: 3 of 7

**RAMP H5 & H6 Gore STA 1084+60 TO STA 987+20 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1084+60 | 1084+85 | C | 0.017 | | 0.010 | | | 0.0203 | 0.027 | 0.75 |
| 1084+85 | 1085+00 | C | 0.013 | | 0.007 | | | 0.0152 | 0.020 | 0.76 |
| 1085+00 | 985+55 | C | 0.068 | | 0.057 | | | 0.0897 | 0.125 | 0.72 |
| 985+55 | 985+88 | C | 0.039 | | 0.039 | | | 0.0546 | 0.078 | 0.70 |
| 985+88 | 986+46 | C | 0.046 | | 0.077 | | | 0.0799 | 0.123 | 0.65 |
| 986+46 | 987+20 | C | 0.078 | | 0.146 | | | 0.1432 | 0.224 | 0.64 |
| | | | | | | | | 0.4029 | 0.597 | 0.67 |

**RAMP H6 STA 1188+50 TO STA 1192+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1192+00 | 1190+50 | L | 0.077 | | 0.452 | | | 0.2953 | 0.529 | 0.56 |
| 1190+50 | 1188+50 | L | 0.049 | | 0.677 | | | 0.3826 | 0.726 | 0.53 |
| | | | | | | | | 0.6779 | 1.255 | 0.54 |

**RAMP H6 STA 1078+25 TO STA 1185+85 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1078+25 | 1082+00 | R | 0.421 | 0.399 | | | | 0.6582 | 0.820 | 0.80 |
| 1082+00 | 1082+50 | R | 0.056 | 0.096 | | | | 0.1176 | 0.152 | 0.77 |
| 1082+50 | 1083+50 | R | 0.145 | | 0.216 | | | 0.2385 | 0.361 | 0.66 |
| 1083+50 | 1184+60 | R | 0.216 | | 0.394 | | | 0.3914 | 0.610 | 0.64 |
| 1184+60 | 1185+00 | R | 0.026 | | 0.096 | | | 0.0714 | 0.122 | 0.59 |
| 1185+00 | 1185+50 | R | 0.031 | | 0.100 | | | 0.0779 | 0.131 | 0.59 |
| 1185+50 | 1185+85 | R | 0.030 | | 0.079 | | | 0.0665 | 0.109 | 0.61 |
| | | | | | | | | 1.6215 | 2.305 | 0.70 |

**RAMP H5 STA 1076+00 TO STA 1078+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1076+00 | 1076+50 | R | 0.391 | 0.096 | | | | 0.4191 | 0.487 | 0.86 |
| 1076+50 | 1077+00 | R | 0.075 | 0.083 | | | | 0.1256 | 0.158 | 0.79 |
| 1077+00 | 1077+50 | R | 0.086 | 0.068 | | | | 0.125 | 0.154 | 0.81 |
| 1077+50 | 1078+50 | R | 0.186 | 0.079 | | | | 0.2227 | 0.265 | 0.84 |
| | | | | | | | | 0.8924 | 1.064 | 0.84 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


**RAMP IB5 STA 1708+30 TO STA 1715+60 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1708+30 | 1709+05 | R | 0.125 | 0.053 | 0.092 | | | 0.1956 | 0.270 | 0.72 |
| 1709+05 | 1710+00 | R | 0.052 | 0.046 | 0.066 | | | 0.1120 | 0.164 | 0.68 |
| 1710+00 | 1713+91 | R | 0.238 | 0.339 | 0.540 | | | 0.7215 | 1.117 | 0.65 |
| 1713+91 | 1714+20 | R | 0.023 | 0.028 | 0.044 | | | 0.0623 | 0.095 | 0.66 |
| 1714+20 | 1715+60 | R | 0.018 | 0.127 | 0.194 | | | 0.2021 | 0.339 | 0.60 |
| | | | | | | | | 1.2935 | 1.9850 | 0.65 |

**RAMP IB5 STA 1713+40 TO 1714+41 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1714+41 | 1713+67 | L | 0.006 | | 0.087 | | | 0.0489 | 0.093 | 0.53 |
| 1713+67 | 1713+40 | L | 0.003 | | 0.108 | | | 0.0567 | 0.111 | 0.51 |
| | | | | | | | | 0.1056 | 0.204 | 0.52 |

**RAMP IH4 STA 13+10 to 15+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 13+10 | 13+84 | L | 0.053 | 0.017 | 0.018 | | | 0.0686 | 0.088 | 0.78 |
| 13+84 | 14+25 | L | 0.039 | 0.018 | 0.009 | | | 0.0522 | 0.066 | 0.79 |
| 14+25 | 14+50 | L | 0.026 | | 0.024 | | | 0.0354 | 0.050 | 0.71 |
| 14+50 | 15+00 | L | 0.056 | | 0.078 | | | 0.0894 | 0.134 | 0.67 |
| 15+00 | 15+25 | L | 0.024 | | 0.056 | | | 0.0496 | 0.080 | 0.62 |
| | | | | | | | | 0.2952 | 0.418 | 0.71 |

**RAMP IJ3 STA 101+89 TO STA 105+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 101+89 | 102+75 | L | 0.012 | | 0.147 | | | 0.0843 | 0.159 | 0.53 |
| 102+75 | 103+75 | L | 0.014 | | 0.125 | | | 0.0751 | 0.139 | 0.54 |
| 103+75 | 104+10 | L | 0.004 | | 0.089 | | | 0.0481 | 0.093 | 0.52 |
| 104+10 | 104+15 | L | 0.001 | 0.011 | 0.003 | | | 0.0101 | 0.015 | 0.67 |
| 104+15 | 104+50 | L | 0.004 | 0.079 | 0.025 | | | 0.0714 | 0.108 | 0.66 |
| 104+50 | | L | | | | | | 0.4452 | 0.627 | 0.71 |
| 104+50 | 105+25 | L | 0.013 | 0.141 | 0.084 | | | 0.1524 | 0.238 | 0.64 |
| | | | | | | | | 0.8866 | 1.379 | 0.64 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


**RAMP IJ3 STA 106+20 TO STA 105+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 106+20 | 105+80 | L | 0.017 | 0.099 | 0.037 | | | 0.1031 | 0.153 | 0.67 |
| 105+80 | 105+50 | L | 0.009 | 0.062 | 0.029 | | | 0.0660 | 0.100 | 0.66 |
| 105+50 | 105+25 | L | 0.020 | 0.082 | 0.097 | | | 0.1239 | 0.199 | 0.62 |
| | | | | | | | | 0.2930 | 0.452 | 0.65 |

**RAMP IJ3 STA 106+20 TO STA 109+25 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 106+20 | 107+00 | L | 0.021 | 0.047 | 0.105 | | | 0.1043 | 0.173 | 0.60 |
| 107+00 | 107+75 | L | 0.048 | 0.068 | 0.110 | | | 0.1458 | 0.226 | 0.65 |
| 107+75 | 108+50 | L | 0.047 | 0.064 | 0.100 | | | 0.1371 | 0.211 | 0.65 |
| 108+50 | 109+25 | L | 0.143 | 0.113 | 0.086 | | | 0.2508 | 0.342 | 0.73 |
| | | | | | | | | 0.6380 | 0.952 | 0.67 |

**RAMP IJ3 STA 102+00 TO STA 104+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 102+00 | | R | 0.079 | | 0.372 | | | 0.2571 | 0.451 | 0.57 |
| 102+00 | | R | 0.600 | | | | | 0.5400 | 0.600 | 0.90 |
| 102+00 | 103+75 | R | 0.106 | | 0.364 | | | 0.2774 | 0.470 | 0.59 |
| 103+75 | 104+00 | R | 0.011 | 0.033 | 0.024 | | | 0.0450 | 0.068 | 0.66 |
| | | | | | | | | 1.1195 | 1.589 | 0.70 |

**RAMP IJ3 STA 104+00 TO STA 106+08 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 106+08 | 105+25 | L | 0.033 | 0.007 | 0.058 | | | 0.0636 | 0.098 | 0.65 |
| 105+25 | 104+60 | L | 0.029 | 0.078 | 0.041 | | | 0.1012 | 0.148 | 0.68 |
| 104+60 | 104+00 | L | 0.040 | 0.067 | 0.077 | | | 0.1214 | 0.184 | 0.66 |
| | | | | | | | | 0.2862 | 0.430 | 0.67 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


**RAMP IJ3 STA 106+08 TO STA 110+10 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 106+08 | 106+50 | R | 0.019 | 0.130 | 0.001 | | | 0.1086 | 0.150 | 0.72 |
| 106+50 | 108+00 | R | 0.026 | 0.050 | 0.004 | | | 0.0604 | 0.080 | 0.76 |
| 108+00 | 108+25 | R | 0.002 | 0.120 | 0.101 | | | 0.1363 | 0.223 | 0.61 |
| 108+25 | 109+30 | R | 0.007 | 0.035 | 0.169 | | | 0.1153 | 0.211 | 0.55 |
| 109+30 | | R | | | 0.290 | | | 0.1450 | 0.290 | 0.50 |
| 109+30 | 109+50 | R | 0.002 | | 0.026 | | | 0.0148 | 0.028 | 0.53 |
| 109+50 | 109+80 | R | 0.003 | | 0.033 | | | 0.0192 | 0.036 | 0.53 |
| 109+80 | 110+10 | R | 0.006 | | 0.053 | | | 0.0319 | 0.059 | 0.54 |
| | | | | | | | | 0.6315 | 1.077 | 0.59 |

**E 14TH MEDIAN STA 38+30 TO STA 36+47 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 38+30 | 36+47 | C | | | 0.040 | | | 0.0200 | 0.040 | 0.50 |

**E 14TH MEDIAN STA 54+18 TO STA 55+00 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 54+18 | 54+50 | C | | | 0.030 | | | 0.0150 | 0.030 | 0.50 |
| 54+50 | 55+00 | C | | | 0.059 | | | 0.0295 | 0.059 | 0.50 |
| | | | | | | | | 0.0445 | 0.089 | 0.50 |

**E 14TH MEDIAN STA 303+97 TO STA 53+72 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 303+97 | 305+00 | C | | | 0.014 | | | 0.0070 | 0.014 | 0.50 |
| 305+00 | 52+60 | C | | | 0.016 | | | 0.0080 | 0.016 | 0.50 |
| 52+60 | 53+50 | C | | | 0.045 | | | 0.0225 | 0.045 | 0.50 |
| 53+50 | 53+72 | C | | | 0.019 | | | 0.0095 | 0.019 | 0.50 |
| | | | | | | | | 0.0470 | 0.094 | 0.50 |

**E 14TH NB STA 304+00 TO STA 53+60 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 304+00 | 305+00 | R | | 0.020 | | | | 0.0140 | 0.020 | 0.70 |
| 305+00 | 305+50 | R | | 0.018 | | | | 0.0126 | 0.018 | 0.70 |
| 305+50 | 53+00 | R | | 0.032 | | | | 0.0224 | 0.032 | 0.70 |
| 53+00 | 53+60 | R | | 0.056 | 0.149 | | | 0.1137 | 0.205 | 0.55 |
| | | | | | | | | 0.1627 | 0.275 | 0.59 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22

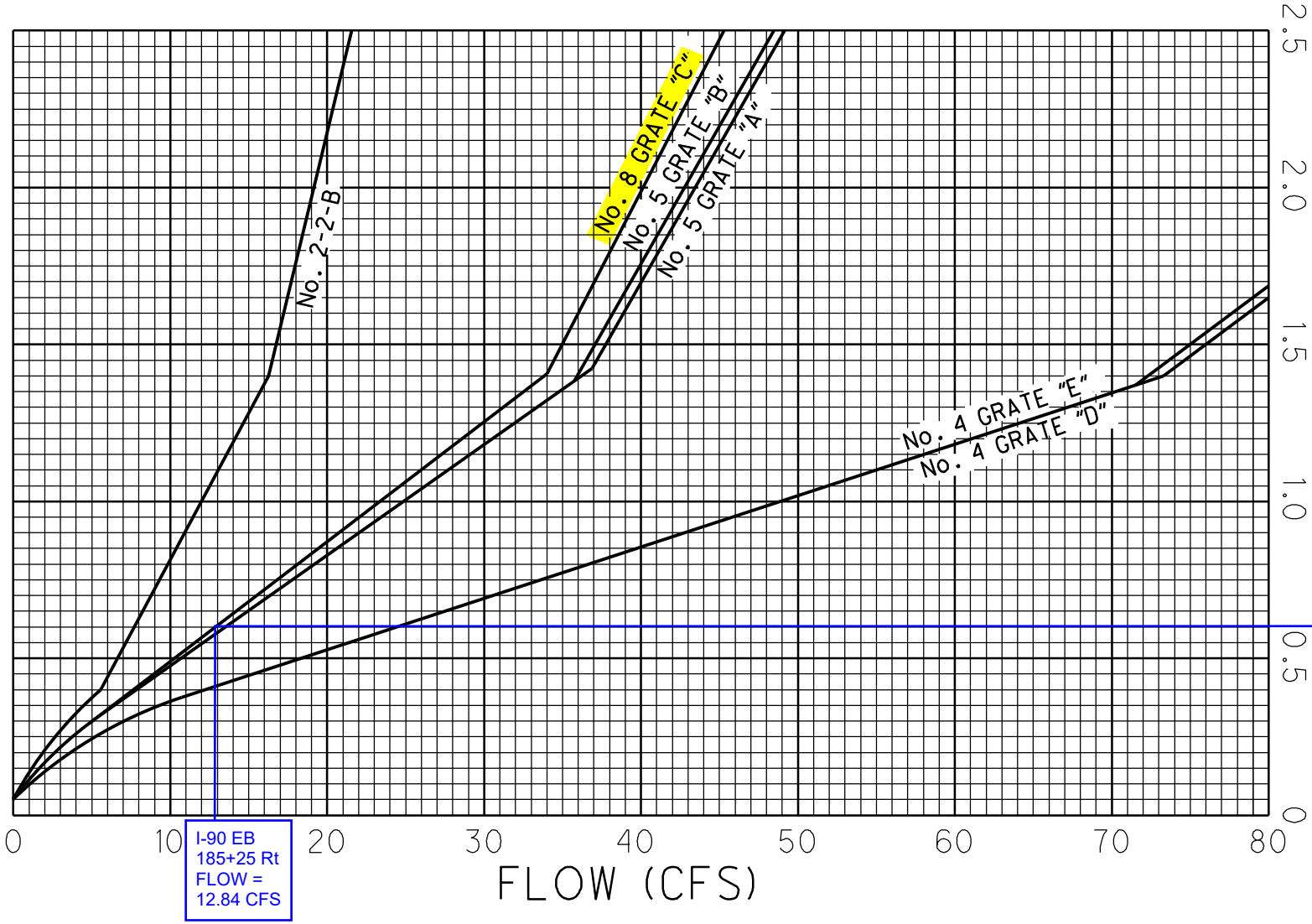

**E 14TH SB STA 39+65 TO RAMP A3 STA 587+33 (DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 39+65 | 39+00 | L | 0.056 | | 0.090 | | | 0.0954 | 0.146 | 0.65 |
| 39+00 | 38+50 | L | 0.056 | | 0.039 | | | 0.0699 | 0.095 | 0.74 |
| 38+50 | 38+00 | L | 0.086 | | 0.049 | | | 0.1019 | 0.135 | 0.75 |
| 38+00 | 587+33 | L | 0.085 | | 0.063 | | | 0.1080 | 0.148 | 0.73 |
| | | | | | | | | 0.3752 | 0.524 | 0.72 |

**E 14TH SB STA 202+75 TO STA 204+96 (EX DITCH)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 202+75 | 204+96 | R | | | 0.290 | | | 0.1450 | 0.290 | 0.50 |

I-90 EB 185+25 Rt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

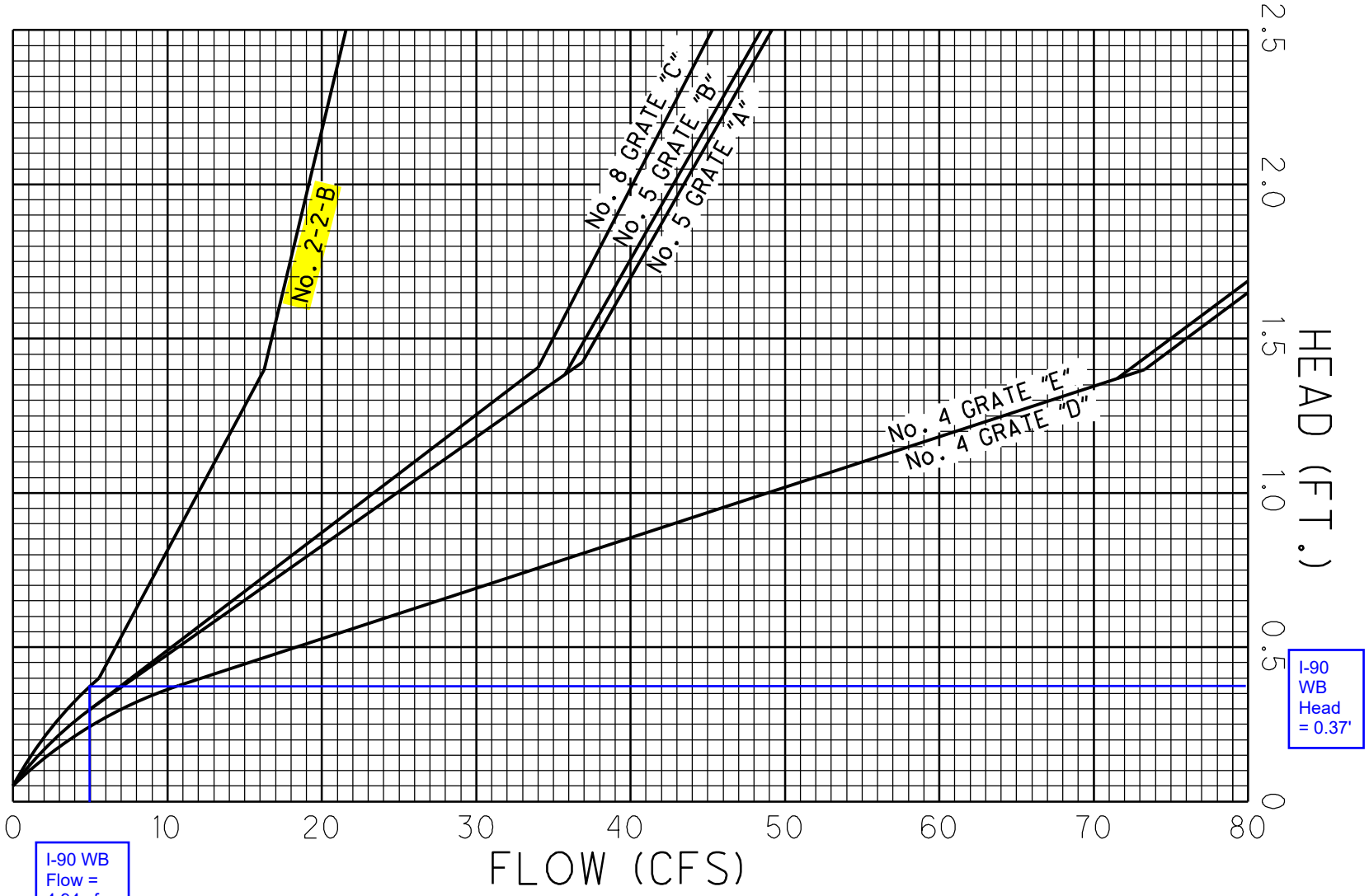
I-90 EB 185+25 Rt: Flow=6.42cfs*2=12.48cfs => HEAD=0.60'; NO. 8 Grate "C"=685.58, Edge of Pavement=691.97; 685.58+0.60+1=687.18 < 691.97

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

**REFERENCE SECTION**
1102.3.5

I-90 WB 191+85 Lt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE CATCH BASIN IN A SUMP

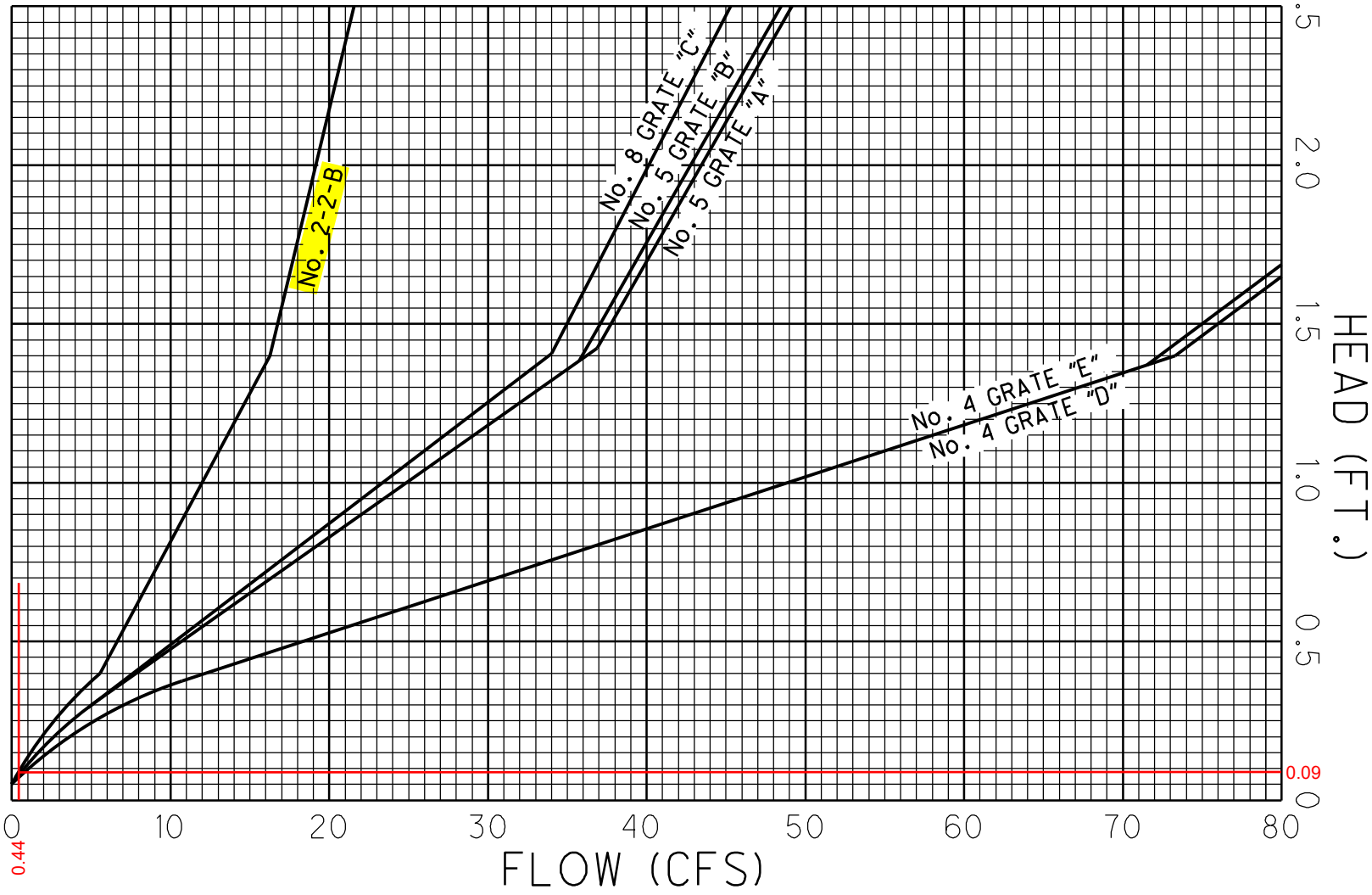
1102-1

**REFERENCE SECTION**
1102.3.5

I-90 WB Sta 191+85 Lt: Flow= 2.47 cfs*2=4.94 cfs => HEAD=0.37'; NO. 2-2B=679.80, Edge of Pavement=681.17; 679.80+0.37+1=681.17 = 681.17

Ramp A1 Lt 307+25

Ramp A1 Lt 307+25: 0.22*2 = 0.44 CFS => 0.09'
Water Elev = 669.87'+0.09'=669.96'
High point of ground: 671.63'
Top of barrier: 673.37'



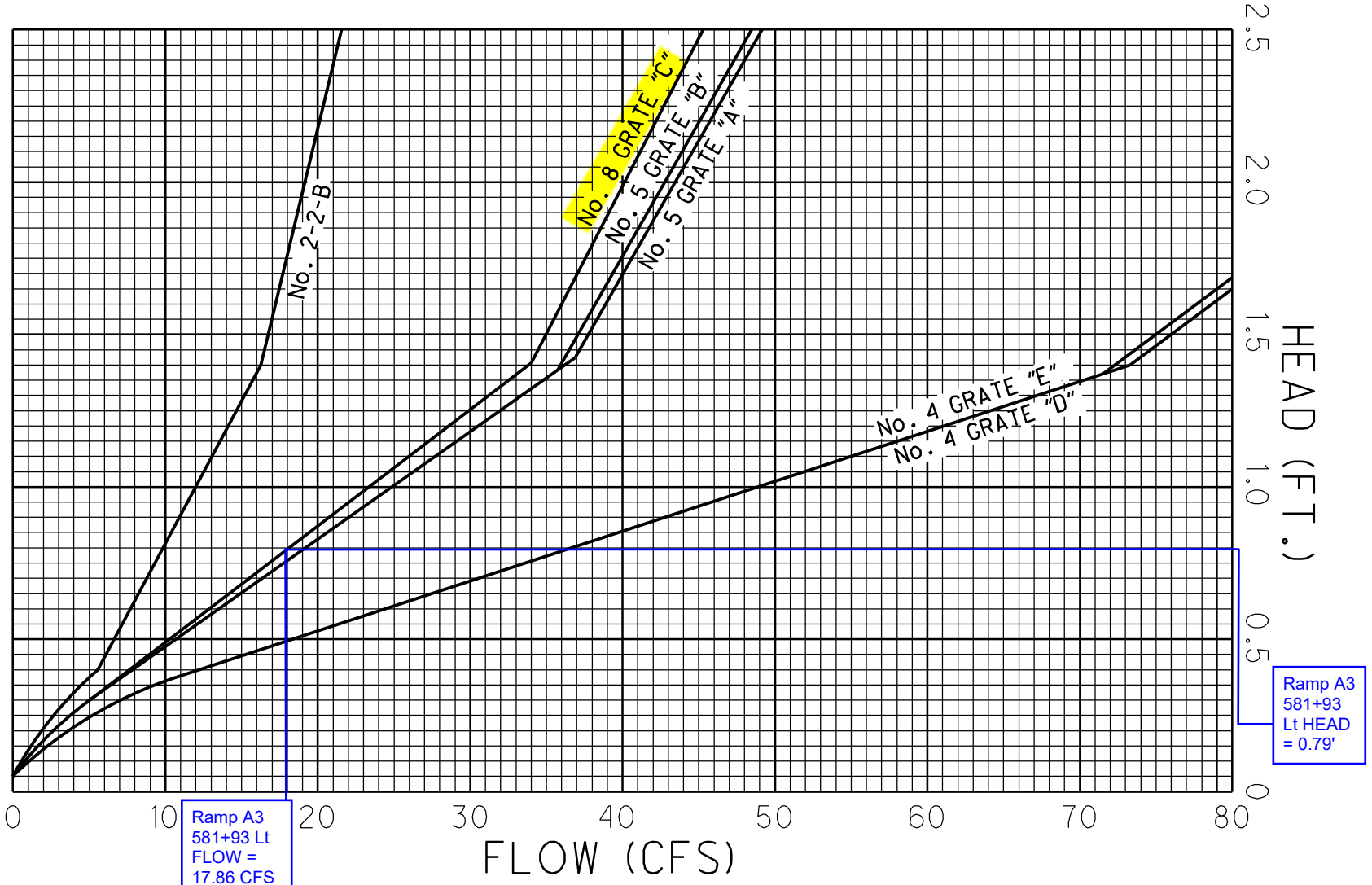

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5

Ramp A3 581+93 Lt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

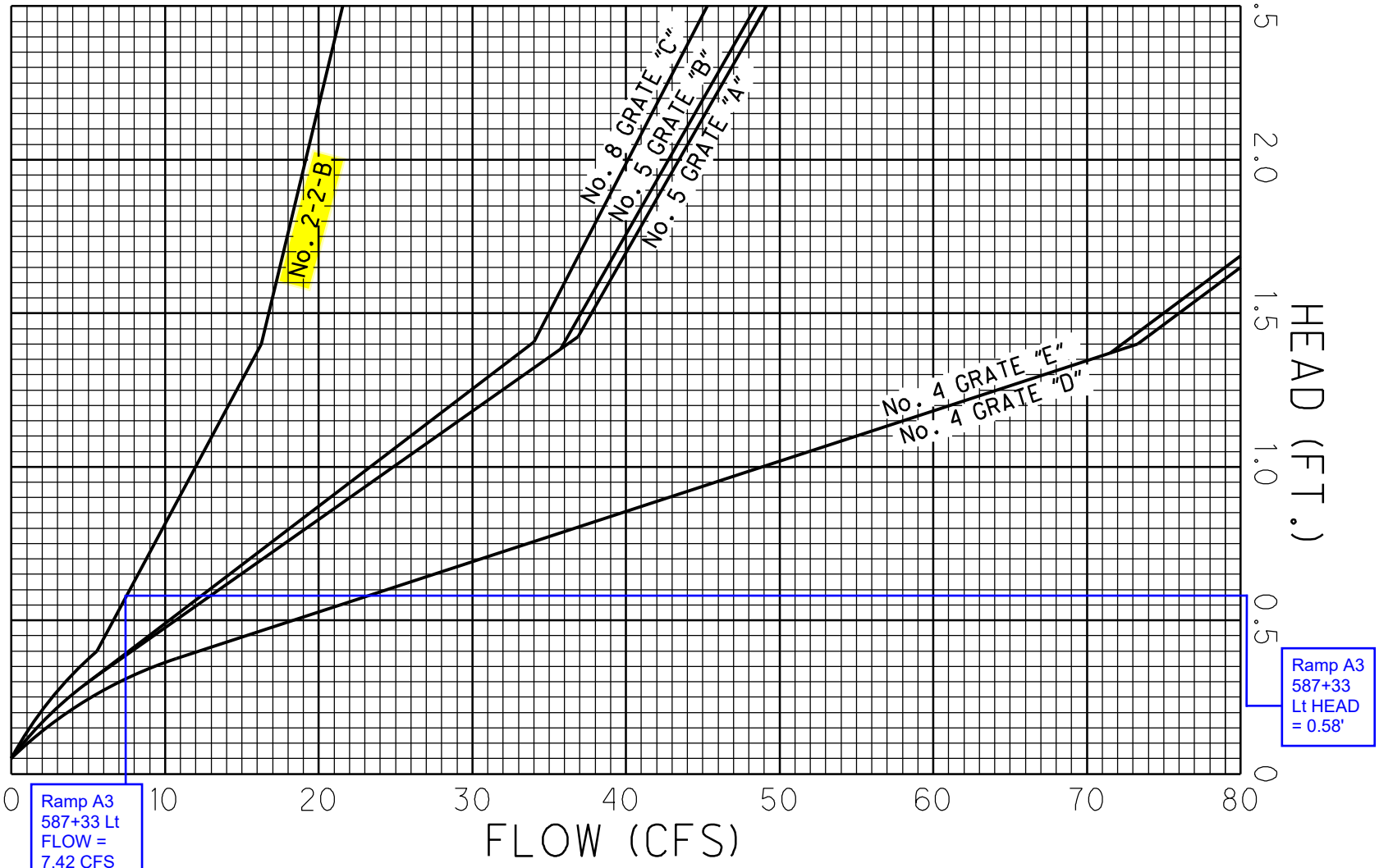
Ramp A3 Sta 581+93 Lt: Flow=8.93cfs*2=17.86cfs => HEAD=0.79'; NO. 2-2B=682.00, Edge of Pavement=684.74; 682.00+0.79+1=683.79 < 684.74

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

**REFERENCE SECTION**
1102.3.5

Ramp A3 587+33 Lt




Ramp A3 587+33 Lt FLOW = 7.42 CFS

Ramp A3 587+33 Lt HEAD = 0.58'

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

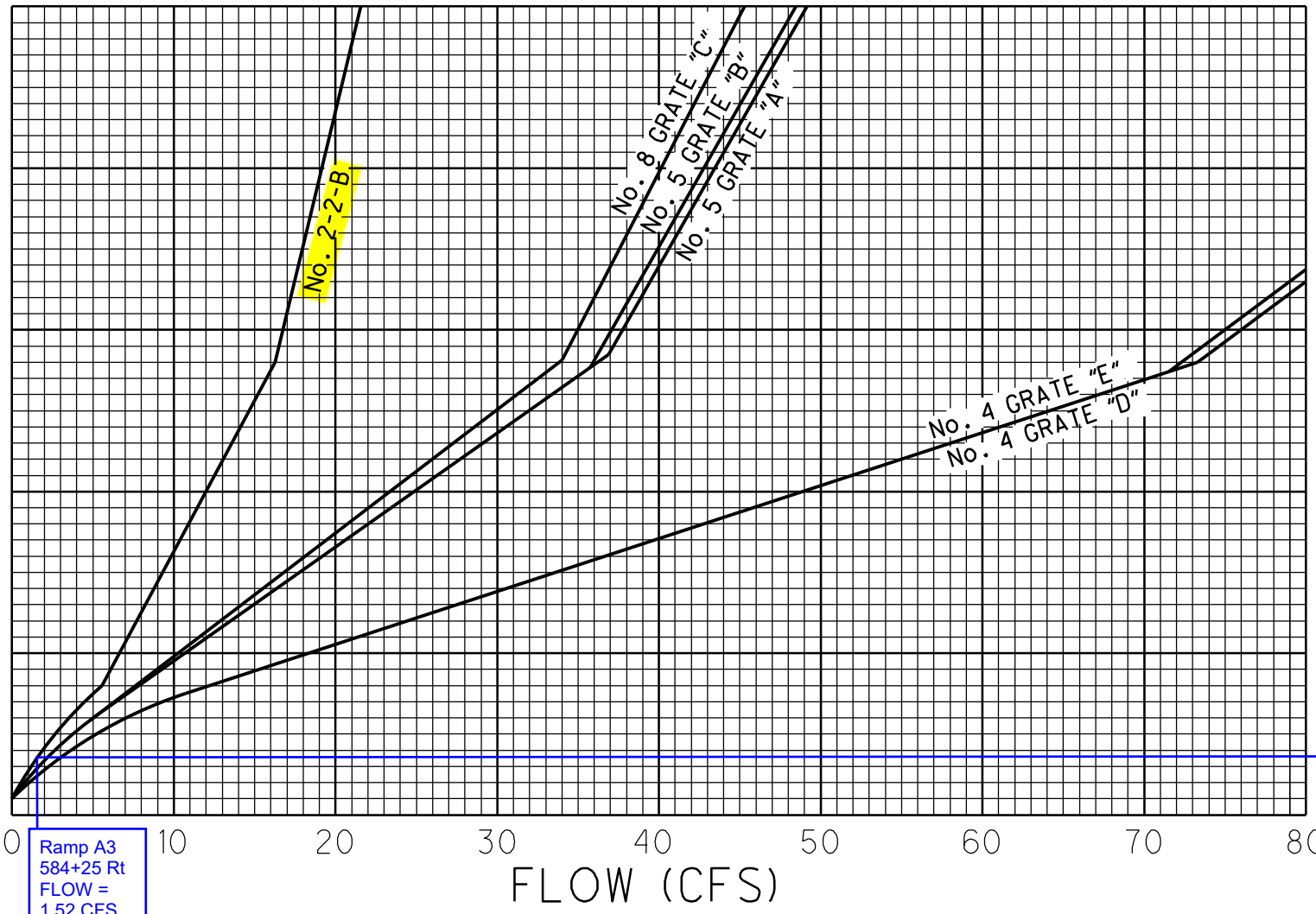
Ramp A3 Sta 587+33 Lt: Flow=(1.06+2.65)cfs*2=7.42cfs => HEAD=0.58'; NO. 2-2B=660.32, Edge of Pavement=662.83; 660.32+0.58+1=661.90 < 662.83

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5

Ramp A3 584+25 Rt




Ramp A3 584+25 Rt FLOW = 1.52 CFS

Ramp A3 STA 584+25 HEAD = 0.18'

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

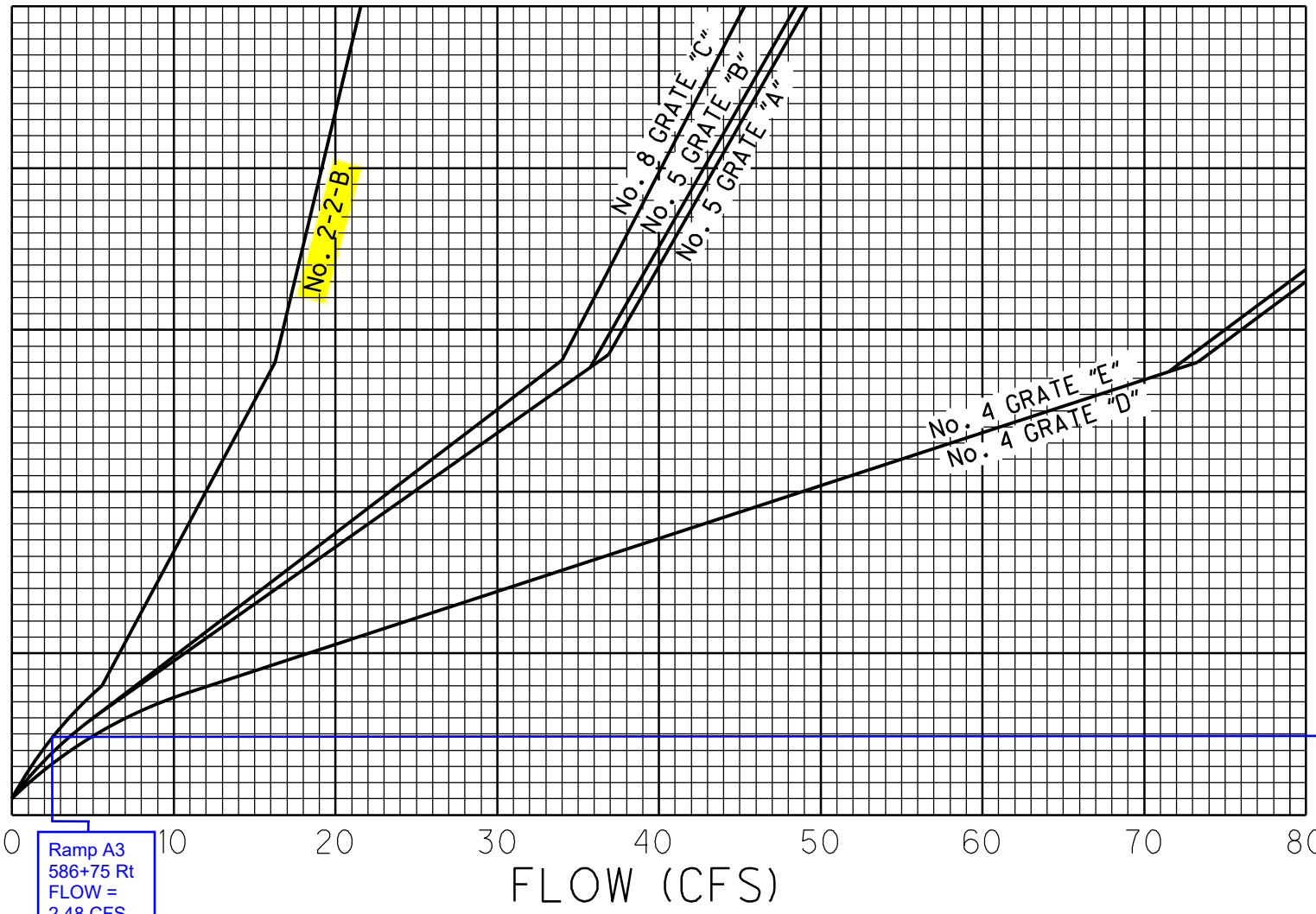
Ramp A3 Sta 584+25 Rt: Flow=0.76cfs*2=1.52cfs => HEAD=0.18'; NO. 2-2B=671.36, Edge of Pavement=674.11; 671.36+0.18+1=672.54 < 674.11

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5

Ramp A3 586+75 Rt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

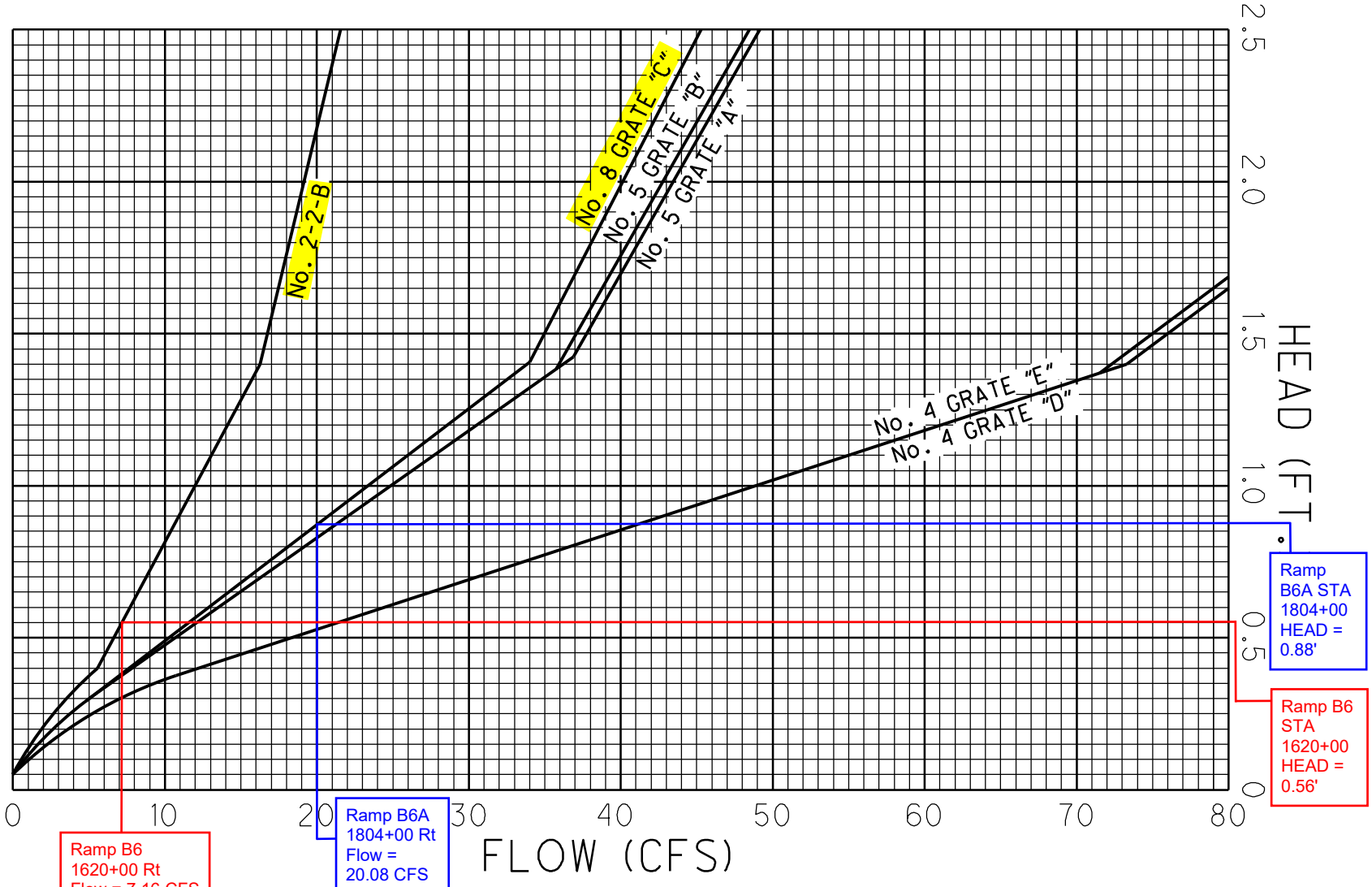
REFERENCE SECTION
1102.3.5

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

Ramp A3 Sta 586+75 Rt: Flow=(0.58+0.66)cfs*2=2.48cfs => HEAD=0.24'; NO. 2-2B=661.56, Edge of Pavement (@ VLP 587+31.23)=664.89; 661.56+0.24+1=662.8 < 664.89

Ramp B6 1620+00 Rt

Ramp B6A 1804+00 Rt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

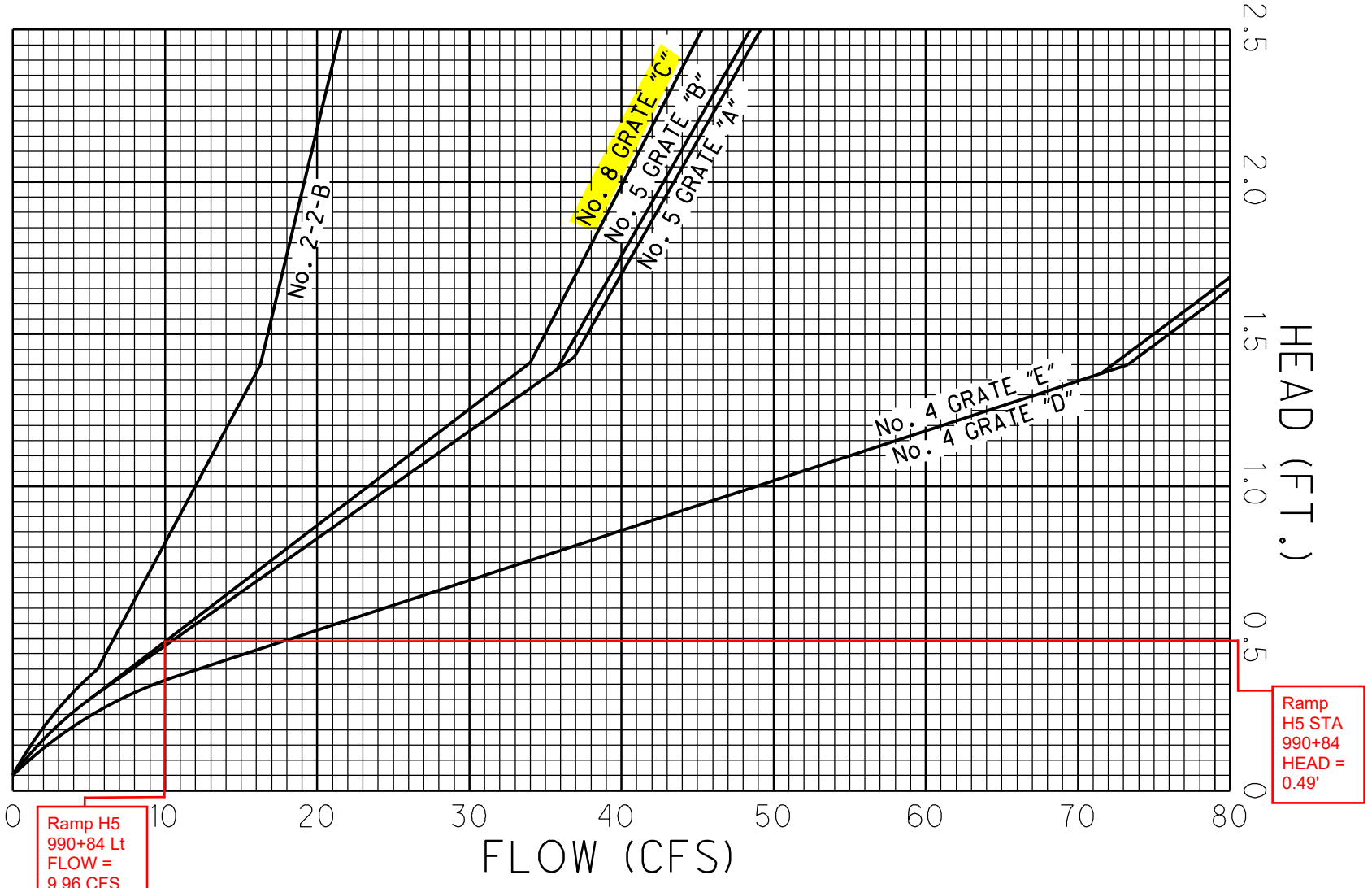
1102-1

REFERENCE SECTION
1102.3.5

Ramp B6A Sta 1804+00 Rt: Flow=(4.49+5.55)cfs*2=20.08cfs => HEAD=0.88'; NO. 8 Grate "C"=665.64, Ditch Bank=670.97; 665.64+0.88=666.52 < 670.97

Ramp B6 Sta 1620+00 Rt: Flow=3.58cfs*2=7.16cfs => HEAD=0.56'; NO. 2-2-B=666.18, EOP=669.07; 666.18+0.56+1=667.74< 669.07

Ramp H5 990+84 Lt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

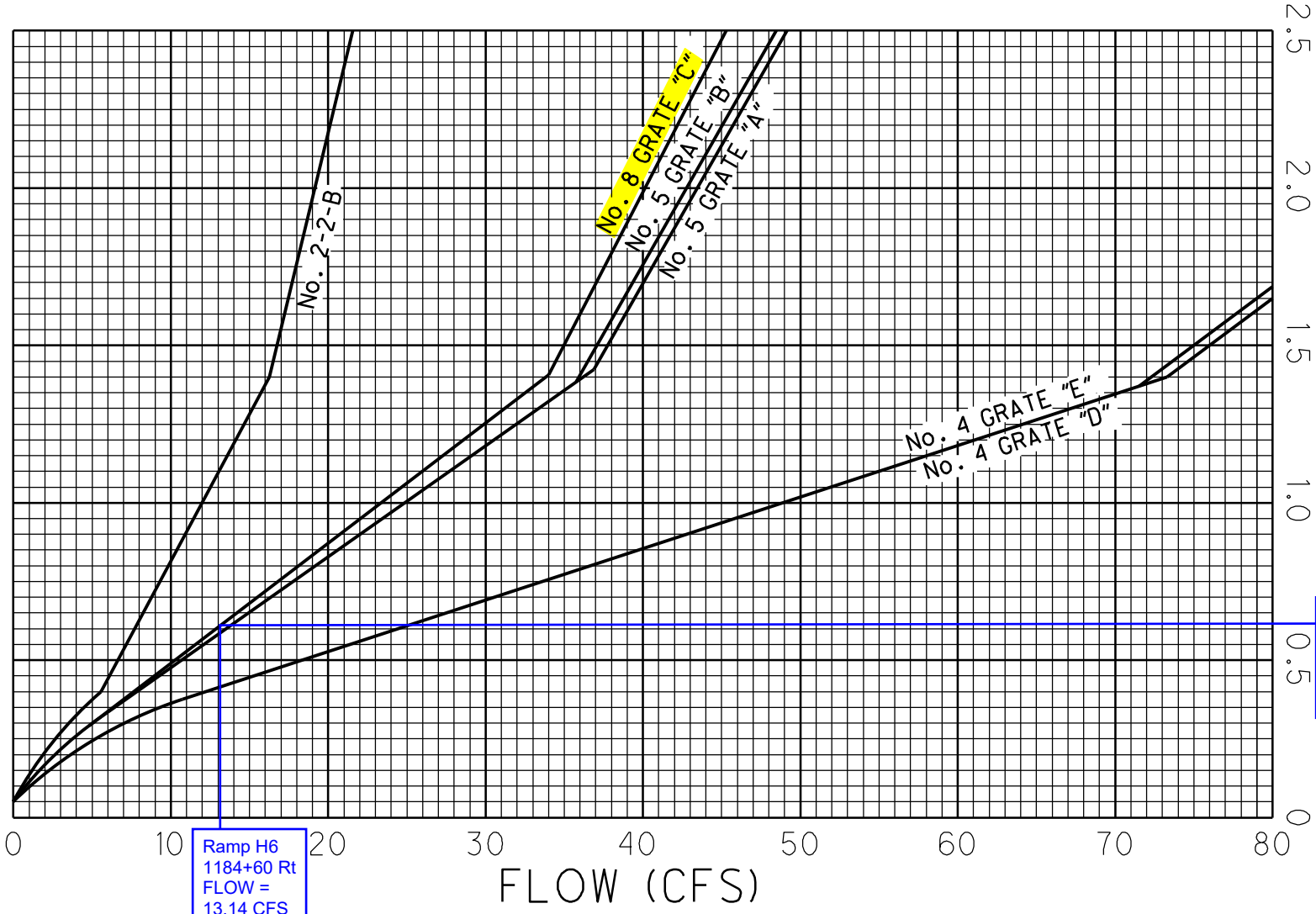
CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5

Ramp H5 Sta 990+84 Lt: Flow=4.98cfs*2=9.96cfs => HEAD=0.49'; NO. 8 Grate "C"=662.37, Edge of Pavement=675.32; 662.37+0.49+1=663.86 < 675.32

Ramp H6 1184+60 Rt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

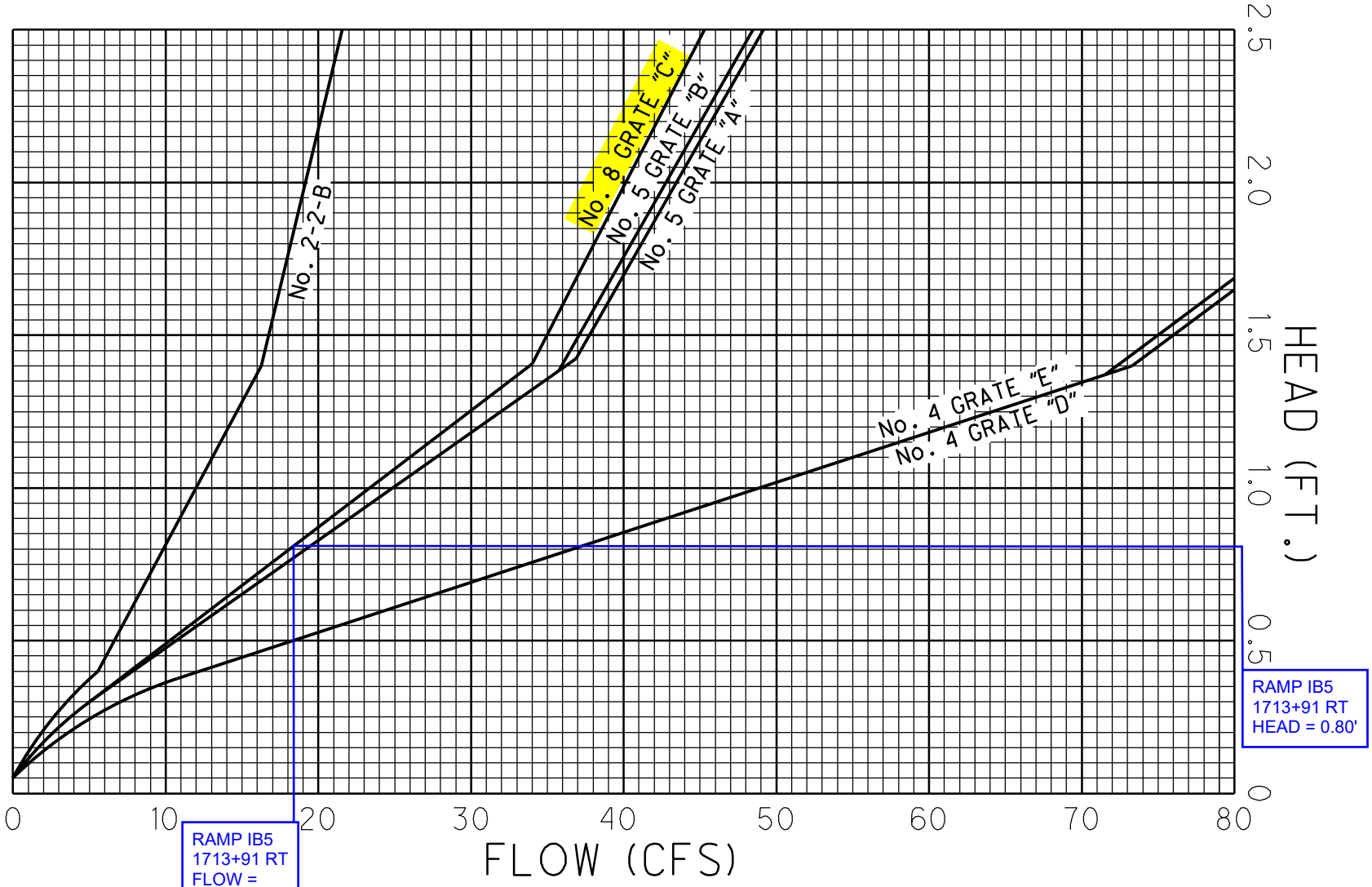
CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

**REFERENCE SECTION**
1102.3.5

Ramp H6 Sta 1184+60 Rt: Flow=(4.86+1.71)cfs*2=13.14cfs => HEAD=0.62'; NO. 8 Grate "C"=667.45, Ditch Bank=670.54; 667.45+0.62=668.07 < 670.54

Ramp IB5 1713+91 Rt - Existing CB. Calculation is to confirm capacity




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

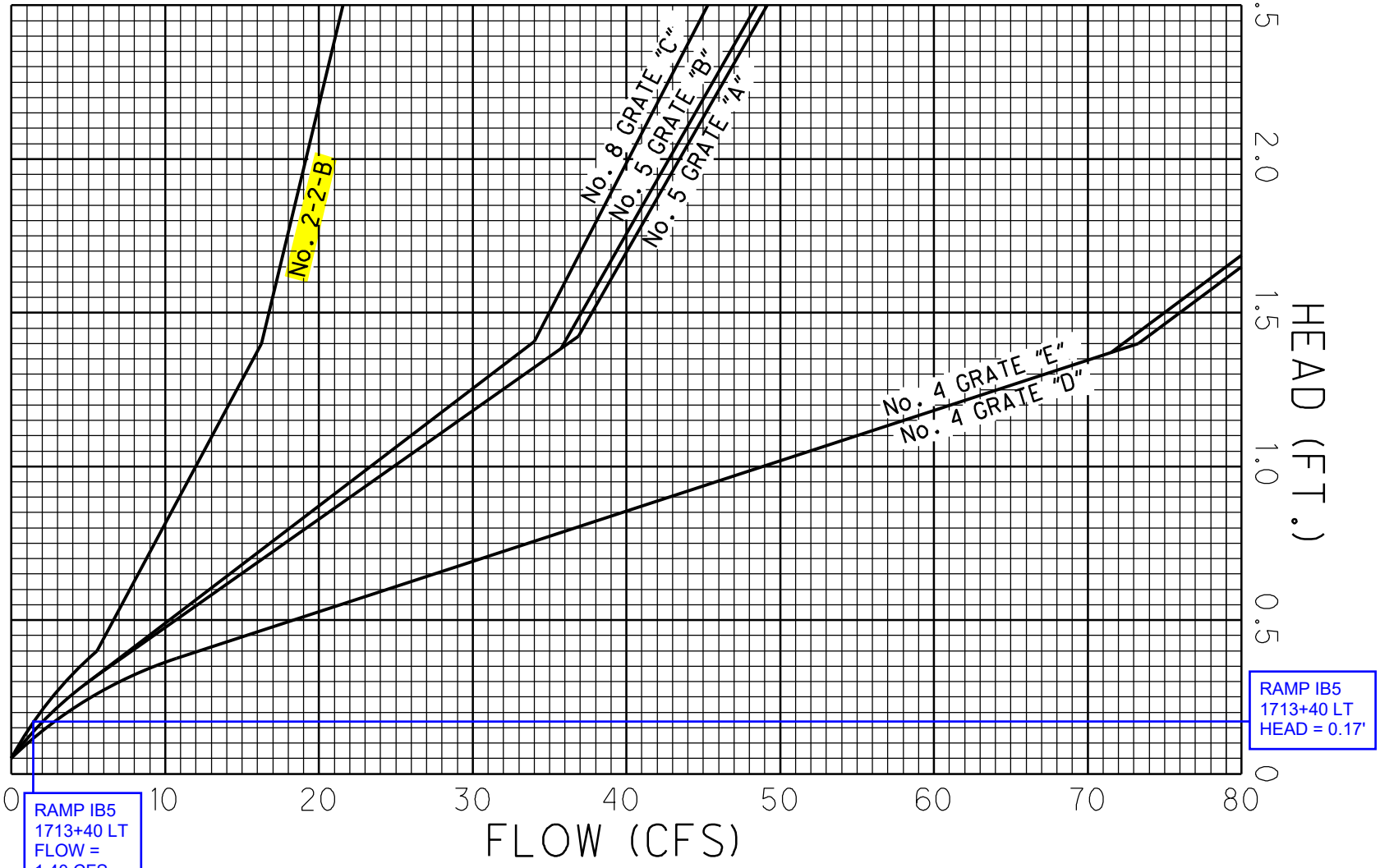
CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

**REFERENCE SECTION**
1102.3.5

Ramp IB5 1713+91 RT: Flow=(7.29+1.92)cfs*2=18.42cfs => HEAD=0.80'; CB-8 Grate "C"=671.22, EOP=674.52; 671.22+0.80+1=673.02 < 674.52

RAMP IB5 1713+40 LT




RAMP IB5 1713+40 LT FLOW = 1.40 CFS

RAMP IB5 1713+40 LT HEAD = 0.17'

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

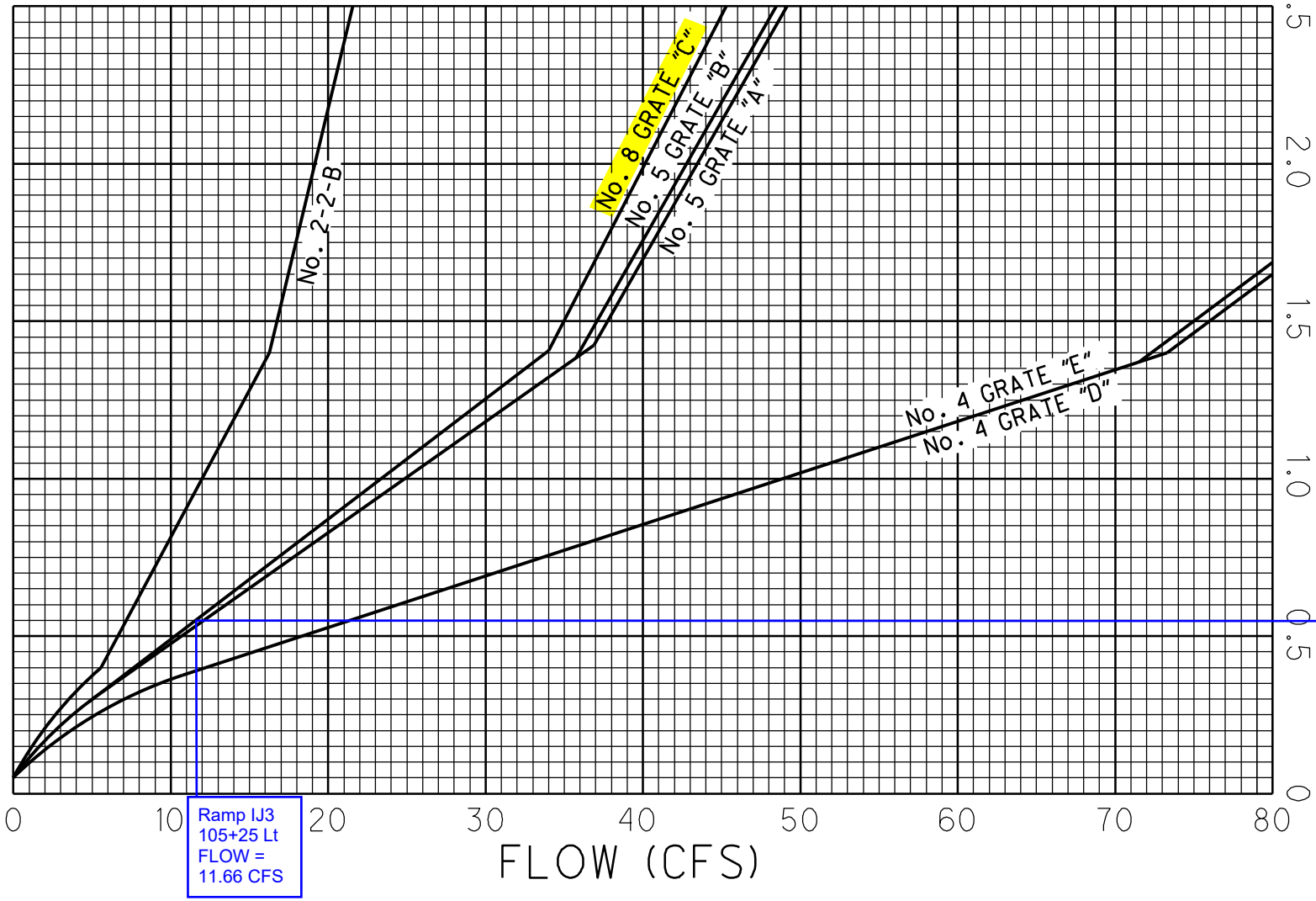
CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

**REFERENCE SECTION**
1102.3.5

Ramp IB5 1713+40 LT: Flow=0.70cfs*2=1.40cfs => HEAD=0.17'; No. 2-2B=673.00, EOP=674.28; 673.00+0.17+1=674.17 < 674.28 ✓

Ramp IJ3 105+25 Lt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

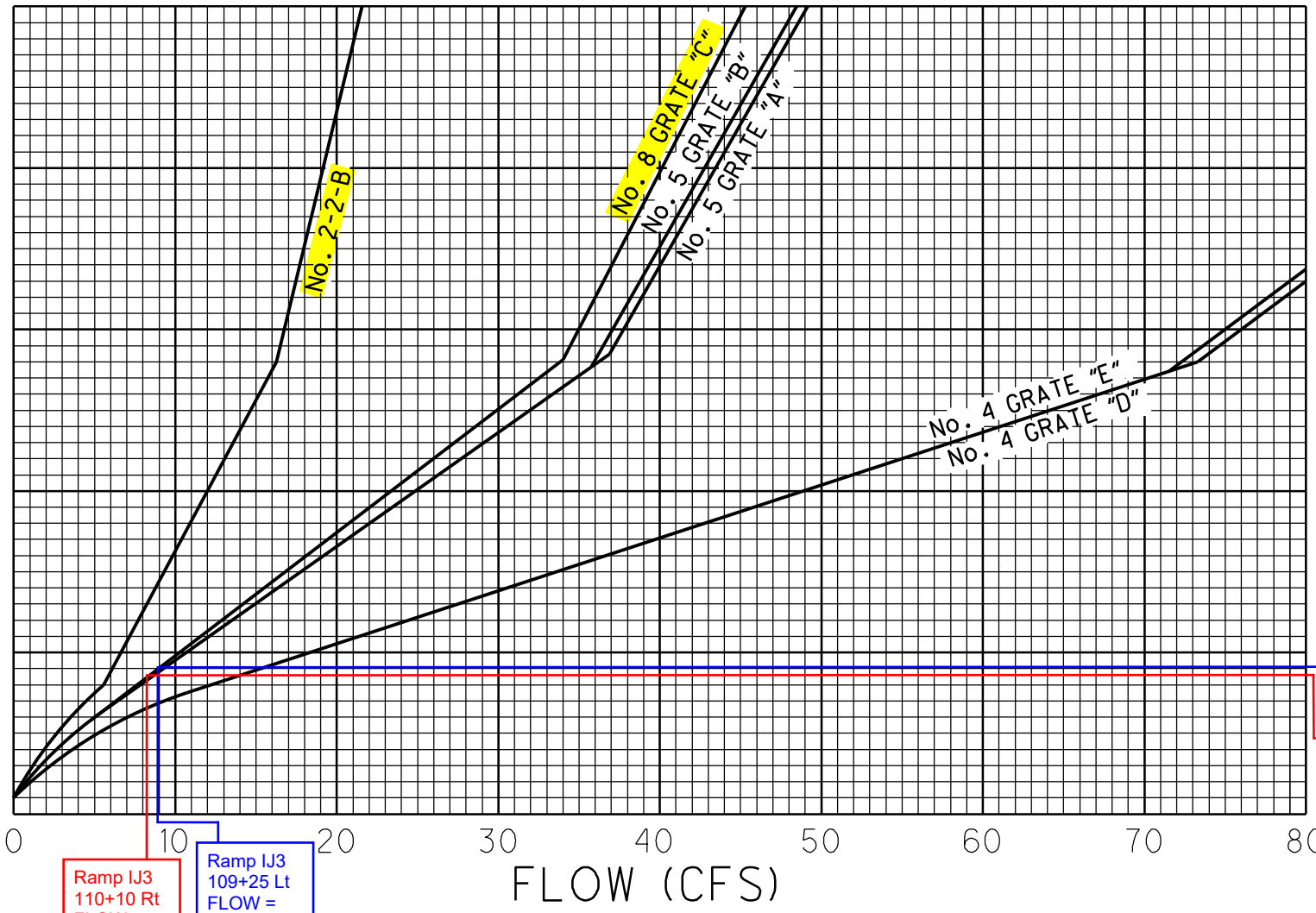
1102-1

**REFERENCE SECTION**
1102.3.5

Ramp IJ3 Sta 105+25 Lt: Flow=(3.55+2.28)cfs*2=11.66cfs => HEAD=0.55'; NO. 8 Grate "C"=668.83, Top of Ditch=672.76; 668.83+0.55=669.38 < 672.76

Ramp IJ3 109+25 Lt

Ramp IJ3 110+10 Rt




Ramp IJ3 STA 1109+25 HEAD = 0.46'

Ramp IJ3 STA 110+10 HEAD = 0.43'

Ramp IJ3 110+10 Rt FLOW = 8.22 CFS

Ramp IJ3 109+25 Lt FLOW = 8.90 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

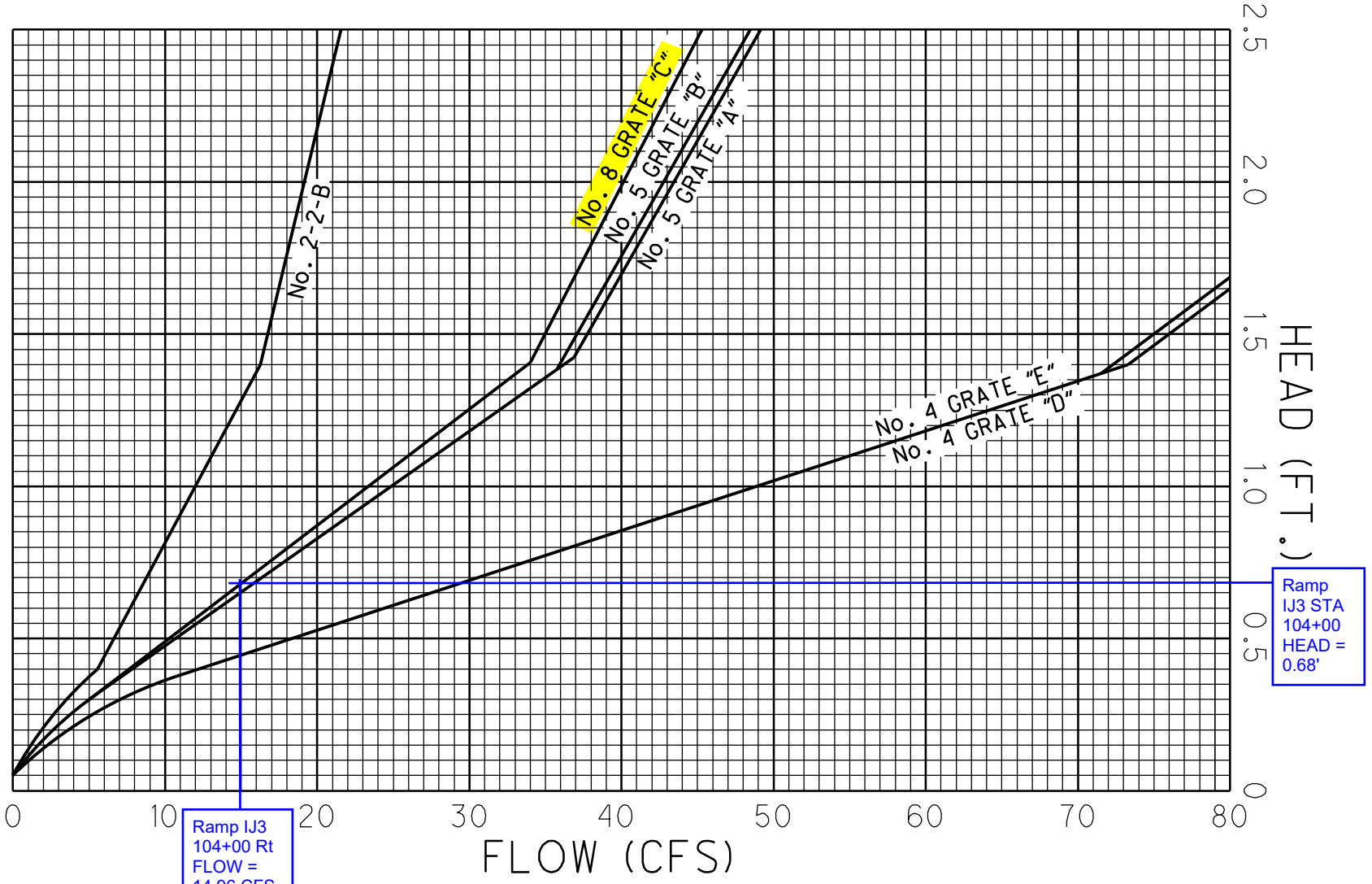
1102-1

**REFERENCE SECTION**
1102.3.5

Ramp IJ3 Sta 109+25 Lt: Flow=4.45cfs*2=8.90cfs => HEAD=0.46'; NO. 8 Grate "C"=665.97, Edge of Pavement=667.87; 665.97+0.46+1=667.43 < 667.87

Ramp IJ3 Sta 110+10 Rt: Flow=4.11cfs*2=5.86cfs => HEAD=0.43'; NO. 2-2B=665.37, Edge of Pavement=667.35; 665.37+0.43+1=666.80 < 667.35

Ramp IJ3 104+00 Rt




CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

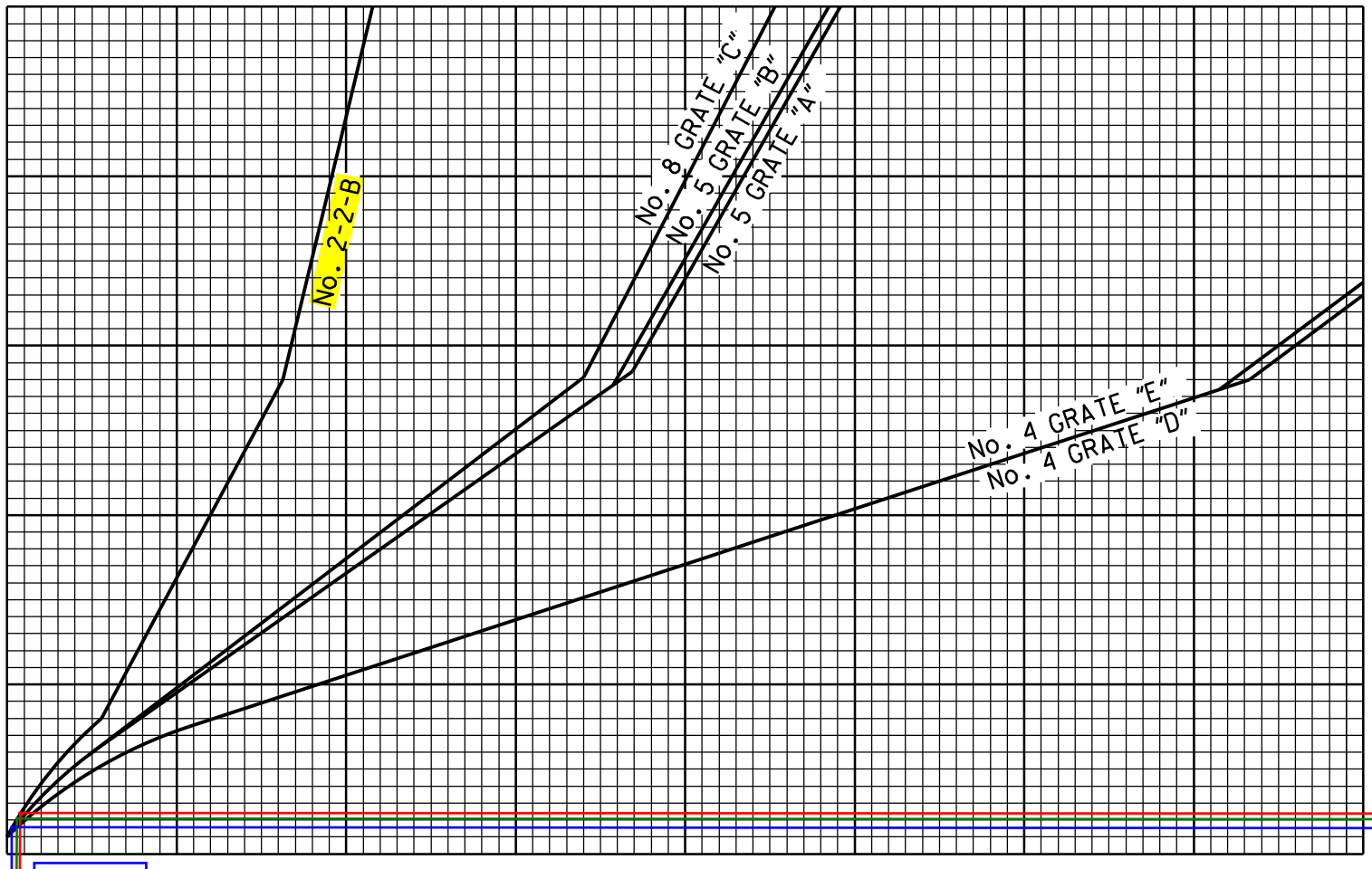
**REFERENCE SECTION**
1102.3.5

Ramp IJ3 Sta 104+00 Lt: Flow=(5.39+2.09)cfs*2=14.96cfs => HEAD=0.68'; NO. 8 Grate "C"=667.38, Edge of Pavement=677.29; 667.38+0.68+1=669.06 < 677.29

E 14th 36+47 Ct

E 14th 55+00 Ct

E 14th 53+72 Ct




CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5

E 14TH STA 53+72 HEAD = 0.10'

E 14TH STA 55+00 HEAD = 0.12'

E 14TH STA 36+47 HEAD = 0.08'

E 14th Sta 36+47 Ct FLOW = 0.24 CFS

E 14th Sta 55+00 Ct FLOW = 0.68 CFS

E 14th Sta 53+72 Ct FLOW = 0.58 CFS

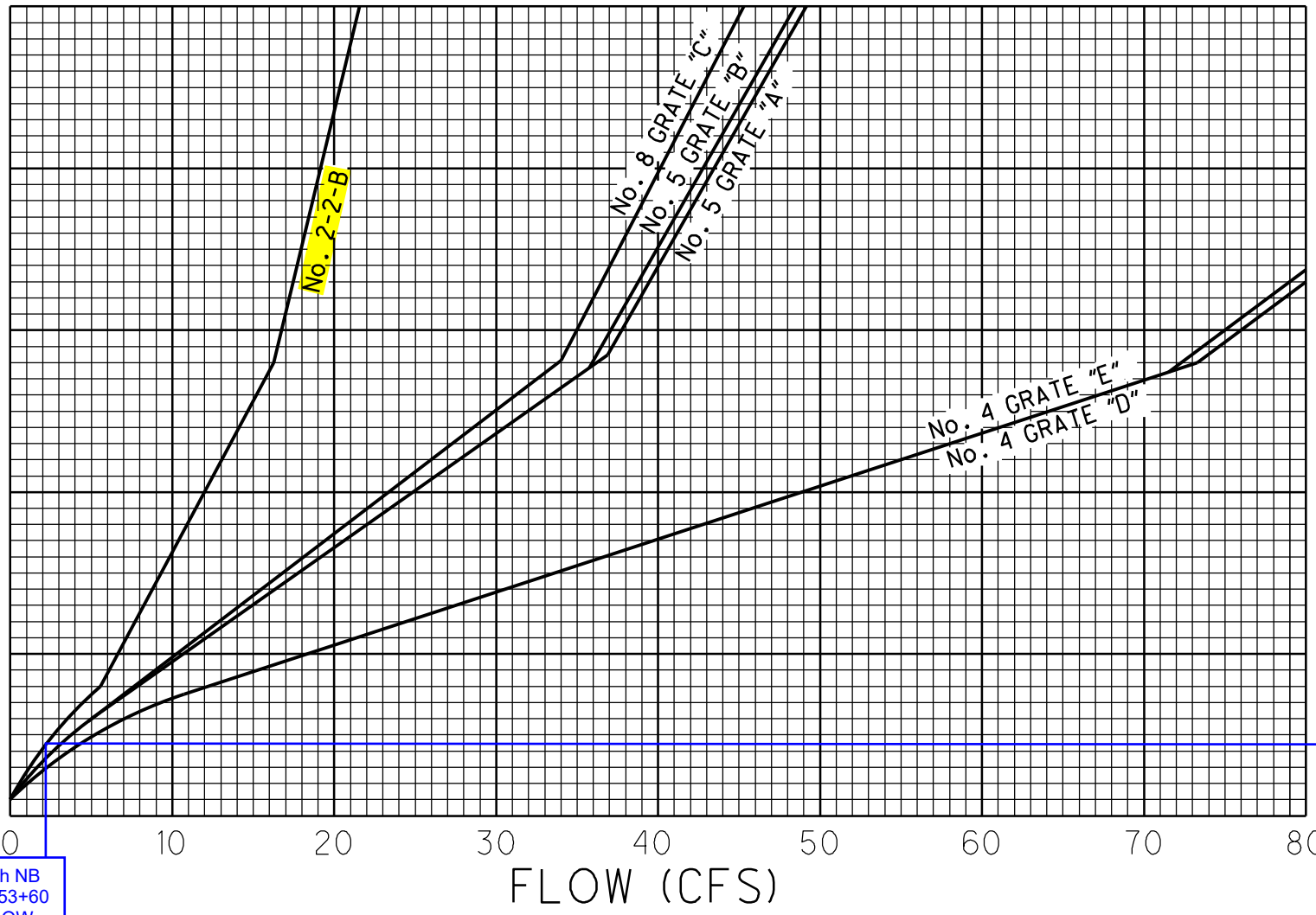
CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

E 14th Sta 36+47 Ct: Flow=0.12cfs*2=0.24cfs => HEAD=0.08'; 2-2B Grate=663.85, EOP=665.06, High Point=665.74; 663.85+0.08=663.93 < 665.74-1.0=664.74

E 14th Sta 55+00 Ct: Flow=0.34cfs*2=0.68cfs => HEAD=0.12'; 2-2B Grate=661.48, EOP=664.31, 661.48+0.12=661.60 < 664.31-1.0=663.31

E 14th Sta 53+72 Ct: Flow=0.29cfs*2=0.58cfs => HEAD=0.10'; 2-2B Grate=664.02, EOP=665.93, 664.08+0.10=664.18 < 665.93-1.0=664.93

E 14th NB 53+60 Rt




E 14th NB STA 53+60 HEAD = 0.23'

E 14th NB STA 53+60 Rt FLOW = 2.14 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

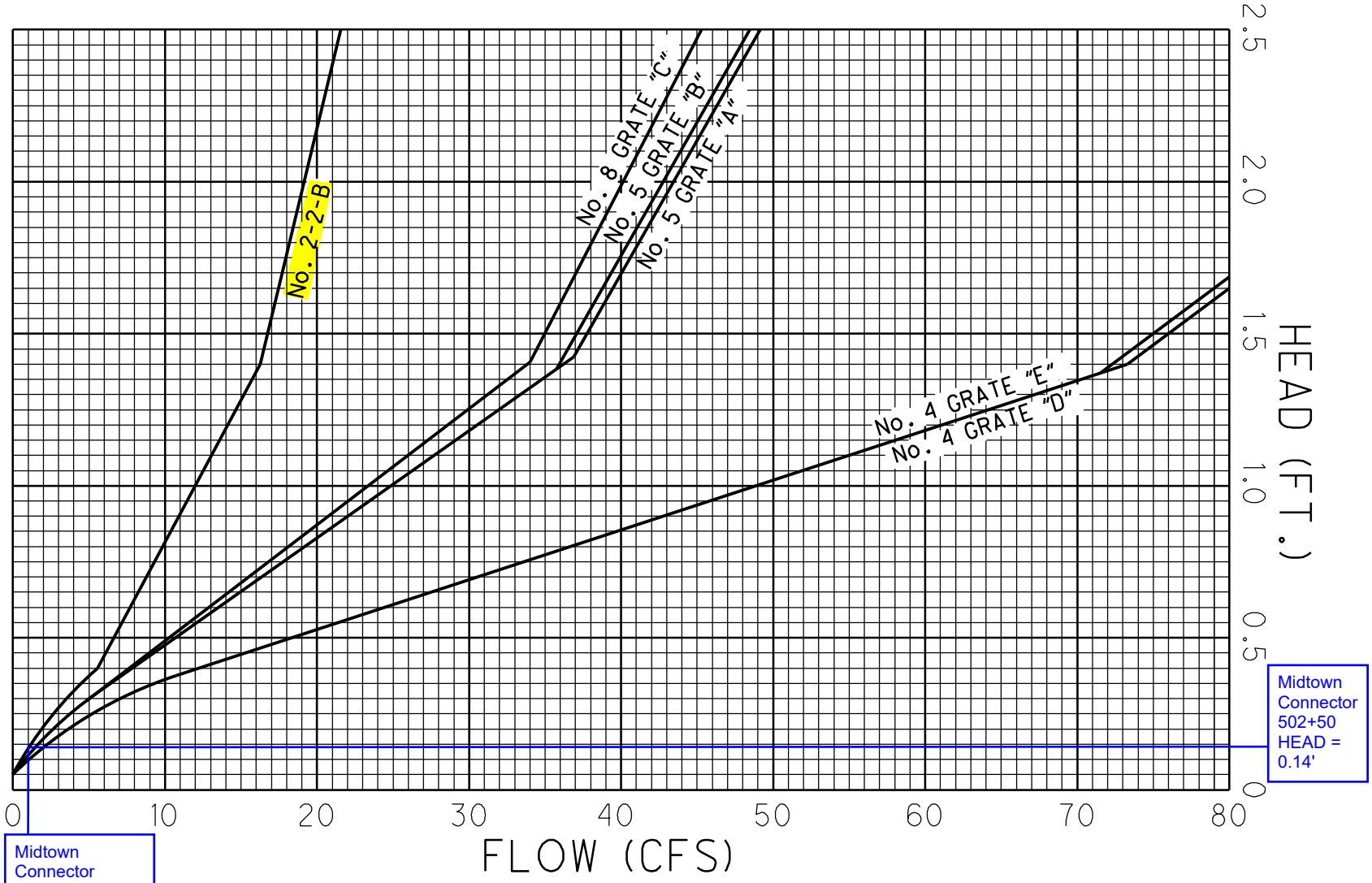
E 14th NB Sta 53+60 Rt: Flow=1.07cfs*2=2.14cfs => HEAD=0.23'; 2-2B Grate=663.57, High Point=665.07; 663.57+0.23+1=664.80 < 665.07

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

**REFERENCE SECTION**
1102.3.5

Midtown 502+50 Lt




Midtown Connector 502+50 HEAD = 0.14'

Midtown Connector 502+50 Lt Flow = 1.02 CFS

CAPACITY OF A GRATE CATCH BASIN IN A SUMP
(WATER PONDED ON THE GRATE)

CAPACITY OF A GRATE
CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5

Midtown Connector Sta 502+50 Lt: Flow=0.51cfs*2=1.02cfs => HEAD=0.14'; No. 2-2-B=668.77, Ditch Bank=669.57; 668.77+0.14=668.91 < 669.57

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

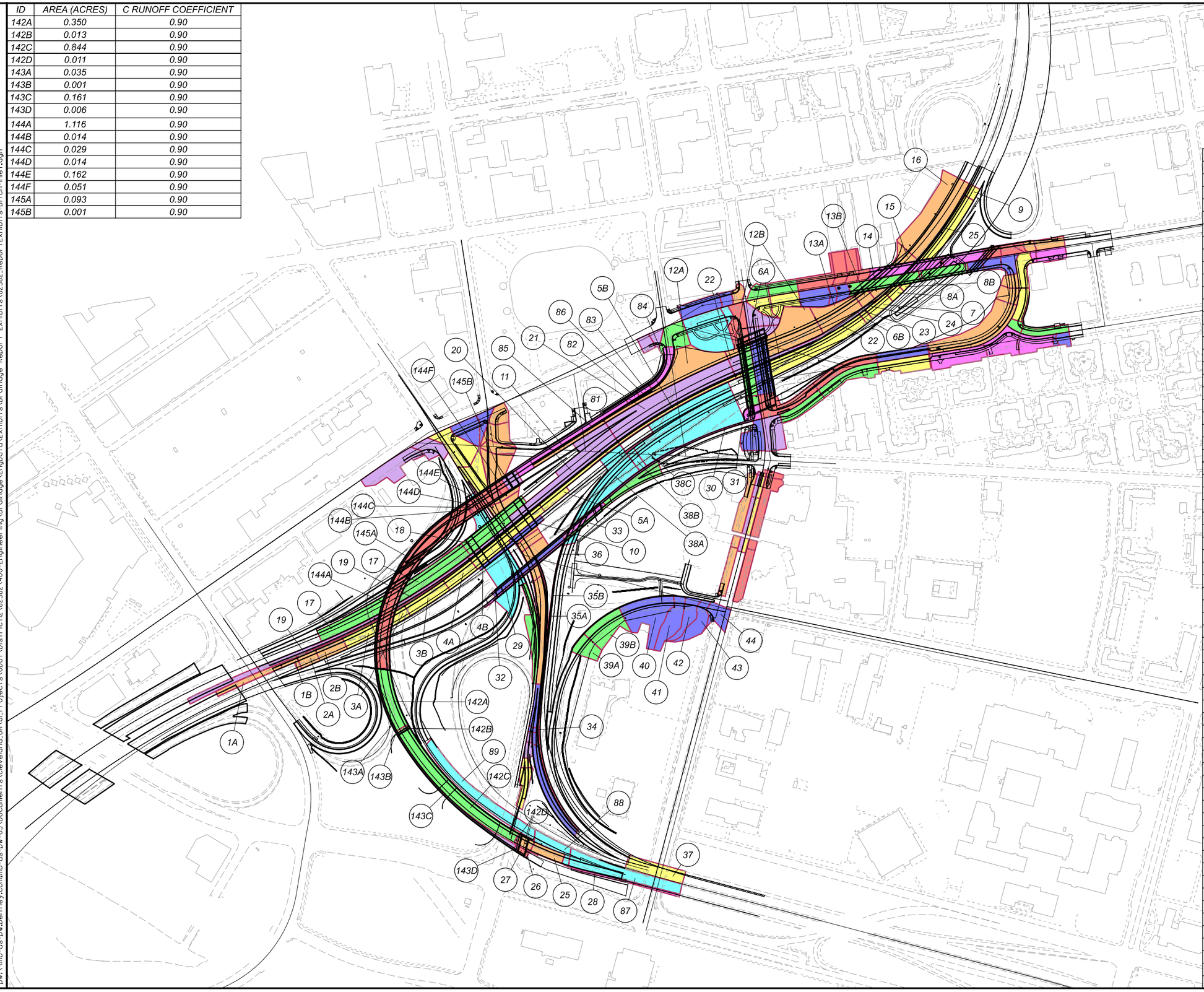
**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix D

## Inlet Spacing Area Maps & Calculations

Michael Baker INTERNATIONAL

| ID | AREA (ACRES) | C RUNOFF COEFFICIENT |
|---|---|---|
| 142A | 0.350 | 0.90 |
| 142B | 0.013 | 0.90 |
| 142C | 0.844 | 0.90 |
| 142D | 0.011 | 0.90 |
| 143A | 0.035 | 0.90 |
| 143B | 0.001 | 0.90 |
| 143C | 0.161 | 0.90 |
| 143D | 0.006 | 0.90 |
| 144A | 1.116 | 0.90 |
| 144B | 0.014 | 0.90 |
| 144C | 0.029 | 0.90 |
| 144D | 0.014 | 0.90 |
| 144E | 0.162 | 0.90 |
| 144F | 0.051 | 0.90 |
| 145A | 0.093 | 0.90 |
| 145B | 0.001 | 0.90 |




| ID | AREA (ACRES) | C RUNOFF COEFFICIENT |
|---|---|---|
| 1A | 0.16 | 0.90 |
| 1B | 0.05 | 0.90 |
| 2A | 0.11 | 0.90 |
| 2B | 0.16 | 0.90 |
| 3A | 0.24 | 0.90 |
| 3B | 0.22 | 0.90 |
| 4A | 0.16 | 0.90 |
| 4B | 0.38 | 0.90 |
| 5A | 0.23 | 0.90 |
| 5B | 0.21 | 0.90 |
| 6A | 0.62 | 0.90 |
| 6B | 0.04 | 0.90 |
| 7 | 0.13 | 0.90 |
| 8A | 0.07 | 0.90 |
| 8B | 0.34 | 0.90 |
| 9 | 0.06 | 0.90 |
| 10 | 0.16 | 0.90 |
| 11 | 0.12 | 0.90 |
| 12A | 0.67 | 0.76 |
| 12B | 0.74 | 0.81 |
| 13A | 0.41 | 0.84 |
| 13B | 0.09 | 0.90 |
| 14 | 0.06 | 0.90 |
| 15 | 0.11 | 0.83 |
| 16 | 1.05 | 0.80 |
| 17 | 0.86 | 0.90 |
| 18 | 0.41 | 0.90 |
| 19 | 0.54 | 0.90 |
| 20 | 0.90 | 0.90 |
| 21 | 1.11 | 0.90 |
| 22 | 0.21 | 0.90 |
| 23 | 0.01 | 0.90 |
| 24 | 0.01 | 0.90 |
| 25 | 0.07 | 0.90 |
| 26 | 0.14 | 0.90 |
| 27 | 0.04 | 0.90 |
| 28 | 0.09 | 0.90 |
| 29 | 0.21 | 0.90 |
| 30 | 0.25 | 0.90 |
| 31 | 0.11 | 0.90 |
| 32 | 0.10 | 0.90 |
| 33 | 0.30 | 0.90 |
| 34 | 0.16 | 0.90 |
| 35A | 0.01 | 0.90 |
| 35B | 0.01 | 0.90 |
| 36 | 0.02 | 0.90 |
| 37 | 0.33 | 0.90 |
| 38A | 0.64 | 0.81 |
| 38B | 0.10 | 0.78 |
| 38C | 1.23 | 0.82 |
| 39A | 0.19 | 0.67 |
| 39B | 0.37 | 0.69 |
| 40 | 0.62 | 0.65 |
| 41 | 0.34 | 0.56 |
| 42 | 0.18 | 0.61 |
| 43 | 0.24 | 0.56 |
| 44 | 0.18 | 0.86 |
| 81 | 0.34 | 0.90 |
| 82 | 0.03 | 0.90 |
| 83 | 0.03 | 0.90 |
| 84 | 0.14 | 0.90 |
| 85 | 0.06 | 0.90 |
| 86 | 0.04 | 0.90 |
| 87 | 0.70 | 0.90 |
| 88 | 0.29 | 0.90 |
| 89 | 0.60 | 0.90 |

HORIZONTAL SCALE IN FEET
0 100 200 400

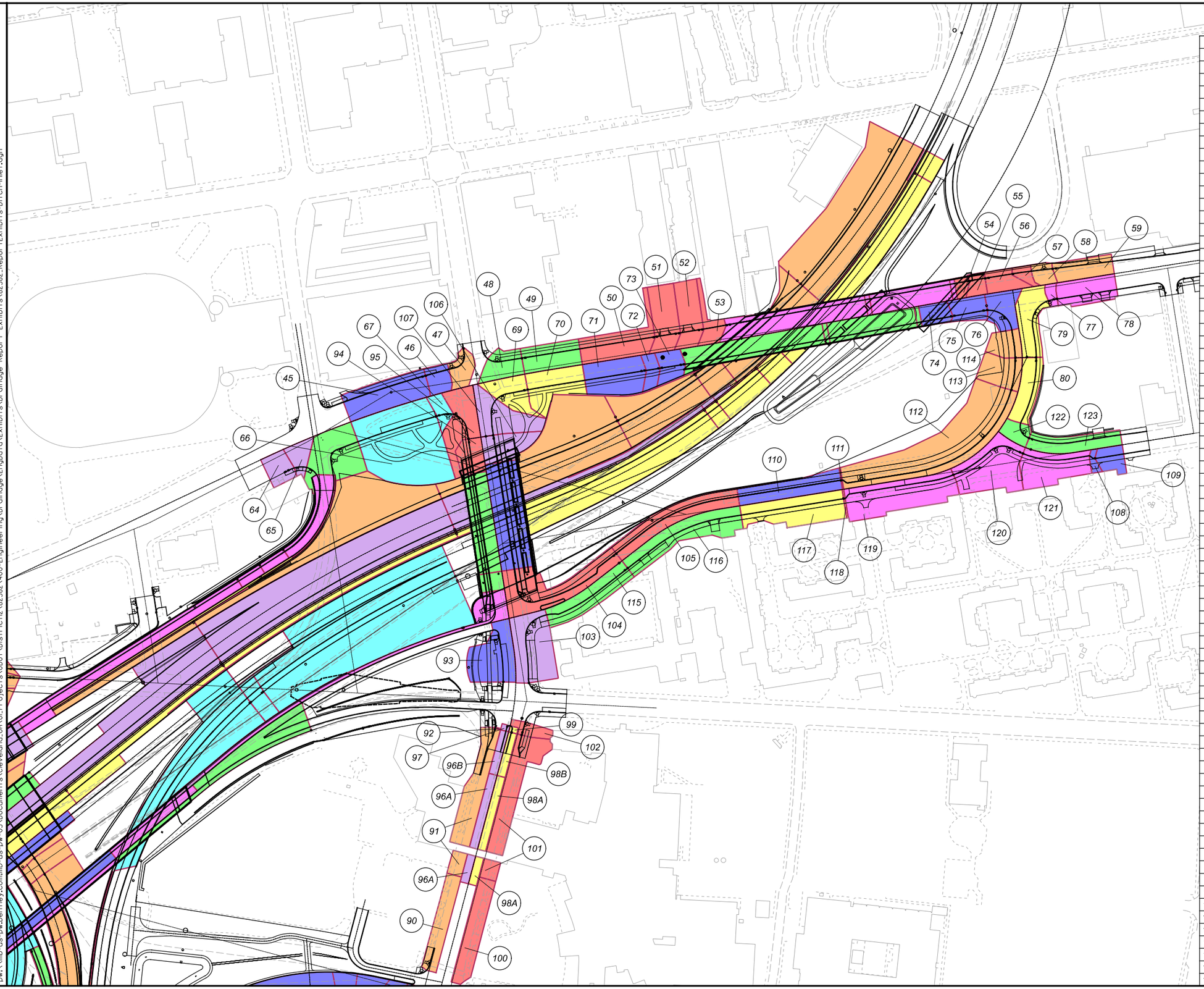
# DRAINAGE AREA MAP
## INLET SPACING 1 OF 3: I-90 & RAMPS

CTY-RTE-SECTION

DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER JAR
REVIEWER KGJ 09-30-21
PROJECT ID 82382
SUBSET 0 TOTAL 0
SHEET P.0 TOTAL 0


MODEL: Sheet - I-90 Inlet Spacing PAPERSIZE: 17x11(in.) DATE: 1/16/2024 TIME: 10:54:44 PM USER: Julie.Ross
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland.OH\Oi_Projects\ODOT\District2\82382\400-Engineering\Engineering\Drainage\EngData\Exhibits\Drainage Report Exhibits\82382_Report Exhibits-Ditch-Inlet.dgn




| ID | AREA (ACRES) | C RUNOFF COEFFICIENT |
|---|---|---|
| 45 | 0.26 | 0.90 |
| 46 | 0.07 | 0.90 |
| 47 | 0.08 | 0.90 |
| 48 | 0.11 | 0.90 |
| 49 | 0.16 | 0.90 |
| 50 | 0.22 | 0.90 |
| 51 | 0.18 | 0.90 |
| 52 | 0.16 | 0.90 |
| 53 | 0.08 | 0.90 |
| 54 | 0.00 | 0.00 |
| 55 | 0.00 | 0.00 |
| 56 | 0.08 | 0.90 |
| 57 | 0.03 | 0.90 |
| 58 | 0.05 | 0.90 |
| 59 | 0.12 | 0.90 |
| 64 | 0.08 | 0.90 |
| 65 | 0.07 | 0.90 |
| 66 | 0.66 | 0.66 |
| 67 | 0.05 | 0.89 |
| 69 | 0.13 | 0.77 |
| 70 | 0.20 | 0.73 |
| 71 | 0.22 | 0.76 |
| 72 | 0.05 | 0.74 |
| 73 | 0.09 | 0.77 |
| 74 | 0.06 | 0.89 |
| 75 | 0.09 | 0.85 |
| 76 | 0.12 | 0.86 |
| 77 | 0.02 | 0.90 |
| 78 | 0.16 | 0.90 |
| 79 | 0.17 | 0.90 |
| 80 | 0.14 | 0.90 |
| 90 | 0.16 | 0.90 |
| 91 | 0.27 | 0.84 |
| 92 | 0.00 | 0.90 |
| 93 | 0.24 | 0.76 |
| 94 | 0.13 | 0.86 |
| 95 | 0.20 | 0.79 |
| 96A | 0.09 | 0.90 |
| 96B | 0.04 | 0.90 |
| 97 | 0.01 | 0.90 |
| 98A | 0.09 | 0.90 |
| 98B | 0.04 | 0.90 |
| 99 | 0.01 | 0.90 |
| 100 | 0.20 | 0.90 |
| 101 | 0.30 | 0.82 |
| 102 | 0.05 | 0.71 |
| 103 | 0.28 | 0.74 |
| 104 | 0.34 | 0.83 |
| 105 | 0.25 | 0.84 |
| 106 | 0.18 | 0.78 |
| 107 | 0.20 | 0.77 |
| 108 | 0.02 | 0.84 |
| 109 | 0.07 | 0.73 |
| 110 | 0.20 | 0.82 |
| 111 | 0.00 | 0.77 |
| 112 | 0.70 | 0.65 |
| 113 | 0.13 | 0.63 |
| 114 | 0.09 | 0.67 |
| 115 | 0.20 | 0.79 |
| 116 | 0.29 | 0.79 |
| 117 | 0.27 | 0.73 |
| 118 | 0.01 | 0.66 |
| 119 | 0.36 | 0.70 |
| 120 | 0.30 | 0.69 |
| 121 | 0.22 | 0.67 |
| 122 | 0.06 | 0.90 |
| 123 | 0.16 | 0.90 |
| 146A | 0.309 | 0.90 |
| 146B | 0.010 | 0.90 |
| 146C | 0.192 | 0.90 |
| 146D | 0.010 | 0.90 |
| 147A | 0.306 | 0.90 |
| 147B | 0.010 | 0.90 |
| 147C | 0.177 | 0.90 |
| 147D | 0.010 | 0.90 |

HORIZONTAL SCALE IN FEET
0 50 100 200

# DRAINAGE AREA MAP
## INLET SPACING 2 OF 3: CARNEGIE/MIDTOWN/E. 22ND

DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER JAR
REVIEWER KGJ 09-30-21
PROJECT ID 82382
SUBSET 0 TOTAL 0
SHEET P.0 TOTAL 0

CTY-RTE-SECTION


MODEL: Sheet - Corn Inlet Spacing PAPERSIZE: 17x11(in.) DATE: 1/6/2024 TIME: 10:54:47 PM USER: Julie.Ross
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\0001\District2\82382\400-Engineering\Drainage\EngData\Exhibits\Drainage Report Exhibits\82382_Report Exhibits-Ditch-Inlet.dgn

| ID | AREA (ACRES) | C RUNOFF COEFFICIENT |
|---|---|---|
| 60 | 0.34 | 0.90 |
| 61 | 0.24 | 0.83 |
| 62 | 0.23 | 0.71 |
| 63 | 0.10 | 0.75 |
| 124 | 0.26 | 0.70 |
| 125 | 0.39 | 0.73 |
| 126 | 0.34 | 0.88 |
| 127 | 0.17 | 0.71 |
| 128 | 0.10 | 0.63 |
| 129 | 0.03 | 0.64 |
| 130 | 0.01 | 0.67 |
| 131 | 0.11 | 0.74 |
| 132 | 0.35 | 0.63 |
| 133 | 0.13 | 0.62 |
| 134 | 0.21 | 0.61 |
| 135 | 0.13 | 0.78 |
| 136 | 0.15 | 0.76 |
| 137 | 0.03 | 0.81 |
| 138 | 0.50 | 0.71 |
| 139 | 0.01 | 0.57 |
| 140 | 0.09 | 0.68 |
| 141 | 0.31 | 0.71 |




HORIZONTAL SCALE IN FEET
0 50 100 200

# DRAINAGE AREA MAP
## INLET SPACING 3 OF 3: E. 14TH

CTY-RTE-SECTION

MODEL: Sheet - E 14th PAPERSIZE: 17x11(in.) DATE: 1/16/2024 TIME: 10:54:49 PM USER: Julie.Ross
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District12\82382\400-Engineering\Drainage\EngData\Exhibits\Drainage Report Exhibits\82382_Report Exhibits-Ditch-Inlet.dgn

DESIGN AGENCY
Michael Baker INTERNATIONAL

| | |
|---|---|
| DESIGNER | JAR |
| REVIEWER | KGJ 09-30-21 |
| PROJECT ID | 82382 |
| SUBSET | 0 |
| TOTAL | 0 |
| SHEET | P.0 |
| TOTAL | 0 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/09/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :**I-90 EB LT - STA 173+12 TO 178+97 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 173+12 | Begin | | | | | | | | | | | | | | | | | | |
| 1A | 176+10 | I-3D | 298.00 | 0.90 | 0.16 | 1.00 | 5.28 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 4.94 | 0.70 | 0.00 | 0.70 | 0.216 | 5.41 | |
| 1B | 176+85 | I-3D | 75.00 | 0.90 | 0.05 | 1.00 | 1.69 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 4.94 | ****** | ****** | 0.22 | 0.140 | 3.51 | Sag |
| | 178+97 | Begin | | | | | | | | | | | | | | | | | | |
| 2B | 177+70 | I-3D | 127.00 | 0.90 | 0.16 | 1.00 | 2.15 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 4.94 | 0.72 | 0.00 | 0.72 | 0.218 | 5.46 | |
| 2A | 176+85 | I-3D | 85.00 | 0.90 | 0.11 | 1.00 | 1.57 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 4.94 | ****** | ****** | 0.48 | 0.188 | 4.70 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.71 **Ponded Depth (ft.) :** 0.081 **Spread on Pavement (ft.) :** 1.49

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/27/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB LT - STA 178+97 TO 3013+42 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 178+97 | Begin | | | | | | | | | | | | | | | | | | |
| 3A | 182+00 | I-3D | 303.00 | 0.90 | 0.24 | 1.00 | 2.17 | 10.00 | 0.0135 | 0.0470 | 0.0470 | 12.00 | 0.1700 | 4.94 | 1.08 | 0.00 | 1.08 | 0.188 | 4.01 | |
| 3B | 184+00 | I-3D | 200.00 | 0.90 | 0.22 | 1.00 | 1.45 | 10.00 | 0.0135 | 0.0470 | 0.0470 | 12.00 | 0.1700 | 4.94 | 0.98 | 0.00 | 0.98 | 0.182 | 3.87 | |
| 4A | 185+47 | I-3D | 147.00 | 0.90 | 0.16 | 1.00 | 1.07 | 10.00 | 0.0180 | 0.0400 | 0.0338 | 12.00 | 0.1700 | 4.94 | 0.72 | 0.00 | 0.72 | 0.144 | 3.61 | |
| 4B | 189+25 | I-3D | 378.00 | 0.90 | 0.38 | 1.00 | 1.75 | 10.00 | 0.0350 | 0.0400 | 0.0160 | 12.00 | 0.1700 | 4.94 | 1.36 | 0.34 | 1.70 | 0.176 | 4.40 | |
| 5A | 193+53 | I-3B | 428.00 | 0.90 | 0.23 | 1.00 | 2.15 | 10.00 | 0.0350 | 0.0400 | 0.0488 | 9.50 | 0.1700 | 4.94 | 1.18 | 0.17 | 1.35 | 0.161 | 4.03 | |
| 5B | 199+18 | I-3B | 565.00 | 0.90 | 0.21 | 1.00 | 3.66 | 10.00 | 0.0212 | 0.0400 | 0.0400 | 12.00 | 0.1700 | 4.94 | 1.08 | 0.00 | 1.08 | 0.163 | 4.08 | |
| 6A | 3005+97 | I-3C | 594.00 | 0.90 | 0.62 | 1.00 | 3.53 | 10.00 | 0.0118 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 4.94 | 2.32 | 0.42 | 2.74 | 0.285 | 5.48 | |
| 6B | 3006+29 | I-3C | 32.00 | 0.90 | 0.04 | 1.00 | 0.29 | 10.00 | 0.0114 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 4.94 | 0.58 | 0.00 | 0.58 | 0.160 | 3.09 | |
| 7 | 3007+42 | I-3C | 113.00 | 0.90 | 0.13 | 1.00 | 1.88 | 10.00 | 0.0020 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 4.94 | ****** | ****** | 0.57 | 0.221 | 4.25 | Sag |
| | 3013+42 | Begin | | | | | | | | | | | | | | | | | | |
| 9 | 3012+88 | I-3C | 54.00 | 0.90 | 0.06 | 1.00 | 0.73 | 10.00 | 0.0064 | 0.0469 | 0.0469 | 6.50 | 0.1700 | 4.94 | 0.24 | 0.00 | 0.24 | 0.124 | 2.65 | |
| 8B | 3008+05 | I-3C | 483.00 | 0.90 | 0.34 | 1.00 | 4.24 | 10.00 | 0.0063 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 4.94 | 1.52 | 0.00 | 1.52 | 0.257 | 4.94 | |
| 8A | 3007+42 | I-3C | 63.00 | 0.90 | 0.07 | 1.00 | 1.23 | 10.00 | 0.0020 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 4.94 | ****** | ****** | 0.30 | 0.173 | 3.33 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.87 **Ponded Depth (ft.) :** 0.093 **Spread on Pavement (ft.) :** 1.37

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/27/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :**I-90 EB LT - STA 178+97 TO 3013+42 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 178+97 | Begin | | | | | | | | | | | | | | | | | | |
| 3A | 182+00 | I-3D | 303.00 | 0.90 | 0.24 | 1.00 | 2.07 | 10.00 | 0.0135 | 0.0470 | 0.0470 | 12.00 | 0.1700 | 6.13 | 1.34 | 0.00 | 1.34 | 0.204 | 4.35 | |
| 3B | 184+00 | I-3D | 200.00 | 0.90 | 0.22 | 1.00 | 1.38 | 10.00 | 0.0135 | 0.0470 | 0.0470 | 12.00 | 0.1700 | 6.13 | 1.21 | 0.00 | 1.21 | 0.197 | 4.19 | |
| 4A | 185+47 | I-3D | 147.00 | 0.90 | 0.16 | 1.00 | 1.02 | 10.00 | 0.0180 | 0.0400 | 0.0338 | 12.00 | 0.1700 | 6.13 | 0.89 | 0.00 | 0.89 | 0.156 | 3.91 | |
| 4B | 189+25 | I-3D | 378.00 | 0.90 | 0.38 | 1.00 | 1.67 | 10.00 | 0.0350 | 0.0400 | 0.0160 | 12.00 | 0.1700 | 6.13 | 1.55 | 0.56 | 2.10 | 0.191 | 4.77 | |
| 5A | 193+53 | I-3B | 428.00 | 0.90 | 0.23 | 1.00 | 2.01 | 10.00 | 0.0350 | 0.0400 | 0.0488 | 9.50 | 0.1700 | 6.13 | 1.41 | 0.40 | 1.81 | 0.180 | 4.51 | |
| 5B | 199+18 | I-3B | 565.00 | 0.90 | 0.21 | 1.00 | 3.38 | 10.00 | 0.0212 | 0.0400 | 0.0400 | 12.00 | 0.1700 | 6.13 | 1.37 | 0.17 | 1.53 | 0.186 | 4.65 | |
| 6A | 3005+97 | I-3C | 594.00 | 0.90 | 0.62 | 1.00 | 3.32 | 10.00 | 0.0118 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 6.13 | 2.76 | 0.80 | 3.56 | 0.314 | 6.04 | |
| 6B | 3006+29 | I-3C | 32.00 | 0.90 | 0.04 | 1.00 | 0.26 | 10.00 | 0.0114 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 6.13 | 1.00 | 0.00 | 1.00 | 0.197 | 3.78 | |
| 7 | 3007+42 | I-3C | 113.00 | 0.90 | 0.13 | 1.00 | 1.79 | 10.00 | 0.0020 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 6.13 | ****** | ****** | 0.71 | 0.240 | 4.61 | Sag |
| | 3013+42 | Begin | | | | | | | | | | | | | | | | | | |
| 9 | 3012+88 | I-3C | 54.00 | 0.90 | 0.06 | 1.00 | 0.69 | 10.00 | 0.0064 | 0.0469 | 0.0469 | 6.50 | 0.1700 | 6.13 | 0.30 | 0.00 | 0.30 | 0.135 | 2.87 | |
| 8B | 3008+05 | I-3C | 483.00 | 0.90 | 0.34 | 1.00 | 4.02 | 10.00 | 0.0063 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 6.13 | 1.89 | 0.00 | 1.89 | 0.279 | 5.36 | |
| 8A | 3007+42 | I-3C | 63.00 | 0.90 | 0.07 | 1.00 | 1.17 | 10.00 | 0.0020 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 6.13 | ****** | ****** | 0.37 | 0.188 | 3.61 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.08 **Ponded Depth (ft.) :** 0.107 **Spread on Pavement (ft.) :** 1.59

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/10/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB SHOULDER STA 185+55 TO 189+00 RT **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 185+55 | Begin | | | | | | | | | | | | | | | | | |
| 10 | 189+00 | CB-3A | 345.00 | 0.90 | 0.16 | 1.00 | 2.05 | 10.00 | 0.0330 | 0.0400 | 0.0160 | 12.00 | 0.1700 | 4.94 | 0.67 | 0.02 | 0.69 | 0.127 | 3.18 |

Total flow off the bridge with no MSE wall is less than 0.75 cfs. Used sodded flume.

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/20/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 WB LT - RAMP A2 STA 432+20 TO STA 4012+87 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 432+20 | Begin | | | | | | | | | | | | | | | | | | |
| 11 | 435+75 | I-3C | 355.00 | 0.90 | 0.12 | 1.00 | 2.30 | 10.00 | 0.0329 | 0.0368 | 0.0368 | 12.00 | 0.1700 | 4.94 | 0.54 | 0.00 | 0.54 | 0.113 | 3.06 | |
| 12A | 201+00 | CB-3A | 595.00 | 0.76 | 0.67 | 1.00 | 2.53 | 10.00 | 0.0350 | 0.0400 | 0.0265 | 12.00 | 0.0417 | 4.94 | 1.71 | 0.80 | 2.51 | 0.204 | 5.09 | |
| 12B | 4004+00 | CB-3 | 414.00 | 0.81 | 0.74 | 1.00 | 2.23 | 10.00 | 0.0125 | 0.0510 | 0.0510 | 12.00 | 0.0417 | 4.94 | 2.81 | 0.95 | 3.77 | 0.315 | 6.18 | |
| 13A | 4005+97 | I-3C | 197.00 | 0.84 | 0.41 | 1.00 | 1.48 | 10.00 | 0.0065 | 0.0510 | 0.0510 | 10.10 | 0.1700 | 4.94 | 2.43 | 0.22 | 2.66 | 0.313 | 6.13 | |
| 13B | 4006+58 | I-3C | 61.00 | 0.90 | 0.09 | 1.00 | 1.03 | 10.00 | 0.0020 | 0.0510 | 0.0510 | 10.00 | 0.1700 | 4.94 | ****** | ****** | 0.61 | 0.224 | 4.39 | Sag |
| | 4012+87 | Begin | | | | | | | | | | | | | | | | | | |
| 16 | 4009+00 | CB-3A | 387.00 | 0.80 | 1.05 | 1.00 | 1.52 | 10.00 | 0.0254 | 0.0510 | 0.0510 | 6.00 | 0.0417 | 4.94 | 2.66 | 1.49 | 4.15 | 0.286 | 5.61 | |
| 15 | 4007+25 | I-3C | 175.00 | 0.83 | 0.11 | 1.00 | 1.44 | 10.00 | 0.0070 | 0.0510 | 0.0510 | 10.80 | 0.1700 | 4.94 | 1.92 | 0.03 | 1.95 | 0.274 | 5.38 | |
| 14 | 4006+58 | I-3C | 67.00 | 0.90 | 0.06 | 1.00 | 1.34 | 10.00 | 0.0020 | 0.0510 | 0.0510 | 10.00 | 0.1700 | 4.94 | ****** | ****** | 0.28 | 0.169 | 3.31 | End |

## SUMP DATA

**Total Flow (cfs) :** 0.89 **Ponded Depth (ft.) :** 0.094 **Spread on Pavement (ft.) :** 1.38

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/20/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 WB LT - RAMP A2 STA 432+20 TO STA 4012+87 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 432+20 | Begin | | | | | | | | | | | | | | | | | | |
| 11 | 435+75 | I-3C | 355.00 | 0.90 | 0.12 | 1.00 | 2.19 | 10.00 | 0.0329 | 0.0368 | 0.0368 | 12.00 | 0.1700 | 6.13 | 0.67 | 0.00 | 0.67 | 0.122 | 3.31 | |
| 12A | 201+00 | CB-3A | 595.00 | 0.76 | 0.67 | 1.00 | 2.40 | 10.00 | 0.0350 | 0.0400 | 0.0265 | 12.00 | 0.0417 | 6.13 | 1.99 | 1.12 | 3.11 | 0.221 | 5.52 | |
| 12B | 4004+00 | CB-3 | 414.00 | 0.81 | 0.74 | 1.00 | 2.10 | 10.00 | 0.0125 | 0.0510 | 0.0510 | 12.00 | 0.0417 | 6.13 | 3.36 | 1.44 | 4.80 | 0.345 | 6.77 | |
| 13A | 4005+97 | I-3C | 197.00 | 0.84 | 0.41 | 1.00 | 1.39 | 10.00 | 0.0065 | 0.0510 | 0.0510 | 10.10 | 0.1700 | 6.13 | 2.99 | 0.56 | 3.55 | 0.349 | 6.84 | |
| 13B | 4006+58 | I-3C | 61.00 | 0.90 | 0.09 | 1.00 | 0.92 | 10.00 | 0.0020 | 0.0510 | 0.0510 | 10.00 | 0.1700 | 6.13 | ****** | ****** | 1.04 | 0.274 | 5.37 | Sag |
| | 4012+87 | Begin | | | | | | | | | | | | | | | | | | |
| 16 | 4009+00 | CB-3A | 387.00 | 0.80 | 1.05 | 1.00 | 1.44 | 10.00 | 0.0254 | 0.0510 | 0.0510 | 6.00 | 0.0417 | 6.13 | 3.11 | 2.05 | 5.15 | 0.310 | 6.09 | |
| 15 | 4007+25 | I-3C | 175.00 | 0.83 | 0.11 | 1.00 | 1.34 | 10.00 | 0.0070 | 0.0510 | 0.0510 | 10.80 | 0.1700 | 6.13 | 2.39 | 0.23 | 2.62 | 0.307 | 6.01 | |
| 14 | 4006+58 | I-3C | 67.00 | 0.90 | 0.06 | 1.00 | 1.17 | 10.00 | 0.0020 | 0.0510 | 0.0510 | 10.00 | 0.1700 | 6.13 | ****** | ****** | 0.55 | 0.216 | 4.23 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.59 **Ponded Depth (ft.) :** 0.138 **Spread on Pavement (ft.) :** 2.03

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/21/2021 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90WB LEFT STA 179+90 TO 190+47 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 179+90 | Begin | | | | | | | | | | | | | | | | | |
| 17 | 187+08 | I-3D | 718.00 | 0.90 | 0.86 | 1.00 | 5.77 | 10.00 | 0.0050 | 0.0448 | 0.0448 | 12.00 | 0.1700 | 4.94 | 3.16 | 0.68 | 3.84 | 0.359 | 8.02 |
| 18 | 190+47 | CB-3A | 339.00 | 0.90 | 0.41 | 1.00 | 1.67 | 10.00 | 0.0240 | 0.0400 | 0.0160 | 12.00 | 0.0420 | 4.94 | 1.67 | 0.85 | 2.52 | 0.219 | 5.47 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/27/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 WB RT - STA 173+67 TO 4006+44 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 173+67 | Begin | | | | | | | | | | | | | | | | | | |
| 19 | 187+08 | I-3D | 1341.00 | 0.90 | 0.54 | 1.00 | 13.49 | 14.49 | 0.0050 | 0.0400 | 0.0452 | 9.50 | 0.1700 | 4.20 | 1.95 | 0.07 | 2.02 | 0.271 | 6.77 | |
| 20 | 195+16 | I-3B | 808.00 | 0.90 | 0.90 | 1.00 | 2.93 | 10.00 | 0.0350 | 0.0480 | 0.0480 | 12.00 | 0.1700 | 4.94 | 2.43 | 1.64 | 4.07 | 0.262 | 5.45 | |
| 21 | 201+00 | I-3B | 584.00 | 0.90 | 1.11 | 1.00 | 1.97 | 10.00 | 0.0350 | 0.0400 | 0.0265 | 12.00 | 0.1700 | 4.94 | 2.98 | 3.57 | 6.55 | 0.292 | 7.30 | |
| 22 | 4005+70 | I-3C | 594.00 | 0.90 | 0.21 | 1.00 | 3.82 | 10.00 | 0.0093 | 0.0400 | 0.0400 | 10.06 | 0.1700 | 4.94 | 3.07 | 1.43 | 4.50 | 0.325 | 8.13 | |
| 23 | 4006+00 | I-2-10 | 30.00 | 0.90 | 0.01 | 1.00 | 0.46 | 10.00 | 0.0020 | 0.0400 | 0.0400 | 9.17 | 0.1700 | 4.94 | ****** | ****** | 1.47 | 0.285 | 7.13 | Sag |
| | 4006+44 | Begin | | | | | | | | | | | | | | | | | | |
| 24 | 4006+00 | I-2-10 | 44.00 | 0.90 | 0.01 | 1.00 | 1.04 | 10.00 | 0.0050 | 0.0400 | 0.0400 | 9.17 | 0.1700 | 4.94 | ****** | ****** | 0.04 | 0.065 | 1.62 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.51 **Ponded Depth (ft.) :** 0.134 **Spread on Pavement (ft.) :** 2.29

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 06/01/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP A2 RT STA 420+62 TO STA 408+72 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 420+62 | Begin | | | | | | | | | | | | | | | | | |
| 25 | 410+19 | I-3D | 1043.00 | 0.90 | 0.07 | 1.00 | 7.71 | 10.00 | 0.0321 | 0.0490 | 0.0490 | 12.00 | 0.1700 | 4.94 | 0.33 | 0.00 | 0.33 | 0.104 | 2.13 |
| 26 | 408+72 | CB-3A | 147.00 | 0.90 | 0.14 | 1.00 | 1.13 | 10.00 | 0.0142 | 0.0540 | 0.0490 | 12.00 | 0.0417 | 4.94 | 0.61 | 0.02 | 0.63 | 0.161 | 2.97 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 06/01/2022 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Ramp A2 Left Sta 420+62 to Sta 410+19 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 4.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 420+62 | Begin | | | | | | | | | | | | | | | | | |
| 27 | 410+19 | I-3D | 1043.00 | 0.90 | 0.04 | 0.01 | 9.80 | 10.00 | 0.0323 | 0.0400 | 0.0600 | 4.00 | 0.1700 | 4.94 | 0.16 | 0.00 | 0.16 | 0.074 | 1.84 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/27/2021 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP A2 STA 403+50 TO STA 408+30 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 408+30 | Begin | | | | | | | | | | | | | | | | | |
| 28 | 403+50 | CB-3A | 480.00 | 0.90 | 0.09 | 1.00 | 7.05 | 10.00 | 0.0050 | 0.0400 | 0.0160 | 12.00 | 0.0417 | 4.94 | 0.39 | 0.02 | 0.41 | 0.149 | 3.72 |

CALCULATION IS FOR CHECKING SPREAD. SPREAD IS ACCEPTABLE.

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/06/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** RAMP B6 Left - 1607+79 to 1611+64 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1611+64 | Begin | | | | | | | | | | | | | | | | | |
| 29 | 1607+79 | CB-3A | 385.00 | 0.90 | 0.21 | 5.00 | 3.57 | 10.00 | 0.0100 | 0.0400 | 0.0190 | 6.00 | 0.1700 | 4.94 | 0.83 | 0.10 | 0.93 | 0.178 | 4.44 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 01/08/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Ramp B6 Left - 1611+64 to 33+39 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1611+64 | Begin | | | | | | | | | | | | | | | | | | |
| 30 | 1620+63 | CB-3 | 899.00 | 0.90 | 0.25 | 1.00 | 15.73 | 16.73 | 0.0020 | 0.0400 | 0.0250 | 6.00 | 0.0417 | 3.91 | ****** | ****** | 0.87 | 0.235 | 5.86 | Sag |
| | 33+39 | Begin | | | | | | | | | | | | | | | | | | |
| 31 | 1620+63 | CB-3 | 164.00 | 0.90 | 0.11 | 1.00 | 3.11 | 10.00 | 0.0020 | 0.0400 | 0.0160 | 6.00 | 0.0417 | 4.94 | ****** | ****** | 0.48 | 0.187 | 4.69 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.35 **Ponded Depth (ft.) :** 0.116 **Spread on Pavement (ft.) :** 3.25

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/06/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** RAMP B6 Right - 1607+18 to 1611+64 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1611+64 | Begin | | | | | | | | | | | | | | | | | |
| 32 | 1607+18 | CB-3A | 446.00 | 0.90 | 0.10 | 1.00 | 4.85 | 10.00 | 0.0100 | 0.0400 | 0.0190 | 8.00 | 0.1700 | 4.94 | 0.44 | 0.00 | 0.44 | 0.134 | 3.34 |

Total flow off the bridge with no MSE wall is less than 0.75 cfs. Used sodded flume.

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 01/08/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** RAMP B6/B6A Right - 1611+64 to 1802+75 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1611+64 | Begin | | | | | | | | | | | | | | | | | |
| 33 | 1802+75 | CB-3A | 905.00 | 0.90 | 0.30 | 1.00 | 4.03 | 10.00 | 0.0500 | 0.0400 | 0.0300 | 8.00 | 0.0417 | 4.94 | 1.08 | 0.25 | 1.33 | 0.150 | 3.75 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 06/01/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**Ramp H5 Lt 1078+43 to 990+54 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 2.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1078+43 | Begin | | | | | | | | | | | | | | | | | | |
| 34 | 987+00 | I-3D | 919.30 | 0.90 | 0.16 | 1.00 | 7.65 | 10.00 | 0.0160 | 0.0400 | 0.0160 | 5.20 | 0.1667 | 4.94 | 0.71 | 0.00 | 0.71 | 0.147 | 3.68 | |
| 35A | 987+91 | I-3D | 92.10 | 0.90 | 0.01 | 1.00 | 1.78 | 10.00 | 0.0070 | 0.0400 | 0.0160 | 4.00 | 0.1667 | 4.94 | 0.06 | 0.00 | 0.06 | 0.069 | 1.72 | |
| 35B | 988+54 | I-3D | 50.00 | 0.90 | 0.01 | 1.00 | 2.01 | 10.00 | 0.0020 | 0.0400 | 0.0418 | 2.00 | 0.1667 | 4.94 | ****** | ****** | 0.02 | 0.059 | 1.48 | Sag |
| | 990+54 | Begin | | | | | | | | | | | | | | | | | | |
| 36 | 988+54 | I-3D | 198.10 | 0.90 | 0.02 | 1.00 | 6.60 | 10.00 | 0.0020 | 0.0400 | 0.0418 | 2.00 | 0.1667 | 4.94 | ****** | ****** | 0.07 | 0.089 | 2.22 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.09 **Ponded Depth (ft.) :** 0.020 **Spread on Pavement (ft.) :** 0.16

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 04/29/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP H5 STA 990+64 (RAMP H5) TO STA 198+85 (I-90 EB) RT **Designer :** DMH

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 990+64 | Begin | | | | | | | | | | | | | | | | | |
| 38A | 193+52 | CB-3 | 445.37 | 0.81 | 0.64 | 1.00 | 1.76 | 10.00 | 0.0320 | 0.0570 | 0.0570 | 12.00 | 0.0400 | 4.94 | 2.19 | 0.37 | 2.56 | 0.238 | 4.18 |
| 38B | 193+88 | CB-3 | 36.00 | 0.78 | 0.10 | 1.00 | 0.19 | 10.00 | 0.0338 | 0.0570 | 0.0570 | 12.00 | 0.0400 | 4.94 | 0.75 | 0.00 | 0.75 | 0.149 | 2.61 |
| 38C | 198+85 | CB-3 | 497.00 | 0.82 | 1.23 | 1.00 | 2.05 | 10.00 | 0.0235 | 0.0400 | 0.0389 | 12.00 | 0.0400 | 4.94 | 3.13 | 1.85 | 4.97 | 0.284 | 7.09 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/02/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**Ramp H6 Right - 1185+89 to 1188+48 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1185+89 | Begin | | | | | | | | | | | | | | | | | | |
| 39A | 1186+72 | CB-3 | 83.00 | 0.67 | 0.19 | 1.00 | 1.31 | 10.00 | 0.0020 | 0.0570 | 0.0570 | 10.00 | 0.0417 | 4.94 | ****** | ****** | 0.63 | 0.237 | 4.16 | Sag |
| | 1188+48 | Begin | | | | | | | | | | | | | | | | | | |
| 39B | 1186+72 | CB-3 | 176.00 | 0.69 | 0.37 | 1.00 | 2.38 | 10.00 | 0.0020 | 0.0570 | 0.0570 | 10.00 | 0.0417 | 4.94 | ****** | ****** | 1.25 | 0.306 | 5.37 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.88 **Ponded Depth (ft.) :** 0.153 **Spread on Pavement (ft.) :** 3.35

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/02/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**Ramp H6 Rt 1188+48 to 1192+99 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 4.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1188+48 | Begin | | | | | | | | | | | | | | | | | | |
| 40 | 1190+78 | CB-3A | 224.90 | 0.65 | 0.62 | 1.00 | 1.61 | 10.00 | 0.0080 | 0.0534 | 0.0533 | 8.88 | 0.0417 | 4.94 | 1.51 | 0.49 | 2.00 | 0.275 | 5.15 | |
| 41 | 1191+28 | CB-3 | 50.00 | 0.56 | 0.34 | 1.00 | 0.71 | 10.00 | 0.0020 | 0.0430 | 0.0430 | 6.90 | 0.0000 | 4.94 | ****** | ****** | 1.42 | 0.289 | 6.73 | Sag |
| | 1192+99 | Begin | | | | | | | | | | | | | | | | | | |
| 44 | 1192+20 | CB-3A | 70.80 | 0.86 | 0.18 | 1.00 | 0.54 | 10.00 | 0.0150 | 0.0400 | 0.0241 | 4.00 | 0.0417 | 4.94 | 0.67 | 0.10 | 0.77 | 0.154 | 3.84 | |
| 43 | 1191+78 | CB-3A | 40.33 | 0.56 | 0.24 | 1.00 | 0.39 | 10.00 | 0.0080 | 0.0400 | 0.0328 | 4.88 | 0.0417 | 4.94 | 0.65 | 0.10 | 0.75 | 0.171 | 4.27 | |
| 42 | 1191+28 | CB-3 | 50.11 | 0.61 | 0.18 | 1.00 | 0.85 | 10.00 | 0.0020 | 0.0430 | 0.0430 | 6.90 | 0.0000 | 4.94 | ****** | ****** | 0.65 | 0.216 | 5.01 | End |

**SUMP DATA**

**Total Flow (cfs) :** 2.07 **Ponded Depth (ft.) :** 0.166 **Spread on Pavement (ft.) :** 5.25

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/30/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Carnegie Lt - 50+59 to 52+91 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 17.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50+59 | Begin | | | | | | | | | | | | | | | | | | |
| 45 | 52+40 | CB-3 | 184.00 | 0.90 | 0.26 | 1.00 | 3.44 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 1.02 | 0.191 | 9.57 | Sag |
| | 52+91 | Begin | | | | | | | | | | | | | | | | | | |
| 46 | 52+40 | CB-3 | 51.00 | 0.90 | 0.07 | 1.00 | 1.28 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.27 | 0.117 | 5.85 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.29 **Ponded Depth (ft.) :** 0.111 **Spread on Pavement (ft.) :** 4.86

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/30/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Carnegie Lt 52+91 to E 22nd Lt 28+40 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 14.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 52+91 | Begin | | | | | | | | | | | | | | | | | |
| 47 | 28+40 | CB-3A | 65.00 | 0.90 | 0.08 | 1.00 | 0.91 | 10.00 | 0.0120 | 0.0120 | 0.0120 | 1.00 | 0.0417 | 4.41 | 0.23 | 0.09 | 0.32 | 0.073 | 6.08 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/30/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Carnegie Lt - 53+80 to 55+70 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.50 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 53+80 | Begin | | | | | | | | | | | | | | | | | | |
| 48 | 54+46 | CB-3 | 75.50 | 0.90 | 0.11 | 1.00 | 1.69 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.45 | 0.141 | 7.04 | Sag |
| | 55+70 | Begin | | | | | | | | | | | | | | | | | | |
| 49 | 54+46 | CB-3 | 125.60 | 0.90 | 0.16 | 1.00 | 2.62 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.63 | 0.160 | 8.00 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.08 **Ponded Depth (ft.) :** 0.094 **Spread on Pavement (ft.) :** 4.02

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/17/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Carnegie Ave Lt - 55+70 to 65+50 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 55+70 | Begin | | | | | | | | | | | | | | | | | | |
| 50 | 57+30 | CB-3 | 160.00 | 0.90 | 0.22 | 1.00 | 2.35 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.72 | 0.17 | 0.88 | 0.160 | 7.98 | |
| 51 | 57+85 | CB-3 | 55.00 | 0.90 | 0.18 | 1.00 | 0.80 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.71 | 0.17 | 0.88 | 0.159 | 7.97 | |
| 52 | 58+35 | CB-3 | 50.00 | 0.90 | 0.16 | 1.00 | 0.75 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.67 | 0.14 | 0.80 | 0.154 | 7.69 | |
| 53 | 58+84 | CB-3 | 49.00 | 0.90 | 0.08 | 1.00 | 0.86 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.41 | 0.02 | 0.44 | 0.123 | 6.13 | |
| 54 | 64+15 | CB-3A | 30.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0031 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.33 | 0.08 | 0.41 | 0.126 | 6.29 | |
| 55 | 64+50 | CB-3 | 35.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.33 | 0.126 | 6.31 | Sag |
| | 65+50 | Begin | | | | | | | | | | | | | | | | | | |
| 57 | 65+10 | CB-3A | 35.00 | 0.90 | 0.03 | 1.00 | 1.11 | 10.00 | 0.0040 | 0.0065 | 0.0065 | 1.00 | 0.0417 | 4.41 | 0.09 | 0.03 | 0.11 | 0.049 | 7.49 | |
| 56 | 64+50 | CB-3 | 34.00 | 0.90 | 0.08 | 1.00 | 0.82 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.32 | 0.125 | 6.23 | End |

## SUMP DATA

**Total Flow (cfs) :** 0.66 **Ponded Depth (ft.) :** 0.056 **Spread on Pavement (ft.) :** 2.12

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/18/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Carnegie Lt - 65+50 to 67+24 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 65+50 | Begin | | | | | | | | | | | | | | | | | | |
| 58 | 65+95 | CB-3 | 45.50 | 0.90 | 0.05 | 1.00 | 1.27 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.18 | 0.100 | 4.99 | Sag |
| | 67+24 | Begin | | | | | | | | | | | | | | | | | | |
| 59 | 65+95 | CB-3 | 128.90 | 0.90 | 0.12 | 1.00 | 2.87 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.49 | 0.146 | 7.29 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.67 **Ponded Depth (ft.) :** 0.057 **Spread on Pavement (ft.) :** 2.19

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/16/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Carnegie Rt 35+46 to E 14th SB Lt 39+65 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.60 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 35+46 | Begin | | | | | | | | | | | | | | | | | |
| 60 | 37+61 | CB-3A | 213.00 | 0.90 | 0.34 | 1.00 | 2.17 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.75 | 0.58 | 1.33 | 0.163 | 8.17 |
| 61 | 39+65 | CB-3A | 161.00 | 0.83 | 0.24 | 1.00 | 1.46 | 10.00 | 0.0110 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.80 | 0.64 | 1.44 | 0.158 | 7.92 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/01/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**Carnegie Ave Rt - 39+69 to 24+34 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 39+69 | Begin | | | | | | | | | | | | | | | | | | |
| 62 | 40+92 | CB-3 | 122.70 | 0.71 | 0.23 | 1.00 | 1.66 | 10.00 | 0.0055 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.73 | 0.140 | 6.98 | Sag |
| | 24+34 | Begin | | | | | | | | | | | | | | | | | | |
| 63 | 40+92 | CB-3 | 41.50 | 0.75 | 0.10 | 1.00 | 0.67 | 10.00 | 0.0055 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.33 | 0.104 | 5.22 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.06 **Ponded Depth (ft.) :** 0.093 **Spread on Pavement (ft.) :** 3.94

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/26/2021 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** CARNEGIE - 48+50 to 49+33 RT **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 6.67 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 48+50 | Begin | | | | | | | | | | | | | | | | | | |
| 64 | 49+09 | CB-3 | 58.00 | 0.90 | 0.08 | 1.00 | 0.86 | 10.00 | 0.0070 | 0.0200 | 0.0200 | 2.00 | 0.0420 | 4.41 | ****** | ****** | 0.33 | 0.100 | 4.98 | Sag |
| | 49+34 | Begin | | | | | | | | | | | | | | | | | | |
| 65 | 49+09 | CB-3 | 27.00 | 0.90 | 0.07 | 1.00 | 0.25 | 10.00 | 0.0270 | 0.0200 | 0.0200 | 2.00 | 0.0420 | 4.41 | ****** | ****** | 0.26 | 0.071 | 3.53 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.59 **Ponded Depth (ft.) :** 0.050 **Spread on Pavement (ft.) :** 1.86

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/17/2023 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Carnegie Ave Rt 50+59 to 52+76 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 20.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50+59 | Begin | | | | | | | | | | | | | | | | | | |
| 66 | 52+38 | CB-3 | 179.00 | 0.66 | 0.66 | 1.00 | 2.16 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 1.93 | 0.214 | 10.69 | Sag |
| | 52+76 | Begin | | | | | | | | | | | | | | | | | | |
| 67 | 52+38 | CB-3 | 39.00 | 0.89 | 0.05 | 1.00 | 0.80 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.21 | 0.093 | 4.64 | End |

**SUMP DATA**

**Total Flow (cfs) :** 2.14 **Ponded Depth (ft.) :** 0.170 **Spread on Pavement (ft.) :** 7.82

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/17/2023 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**CARNEGIE AVE RT - 53+69 to 55+70 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 53+69 | Begin | | | | | | | | | | | | | | | | | | |
| 69 | 54+46 | CB-3 | 71.00 | 0.77 | 0.13 | 1.00 | 1.58 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.45 | 0.141 | 7.06 | Sag |
| | 55+70 | Begin | | | | | | | | | | | | | | | | | | |
| 70 | 54+46 | CB-3 | 124.00 | 0.73 | 0.20 | 1.00 | 2.57 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.64 | 0.161 | 8.05 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.09 **Ponded Depth (ft.) :** 0.095 **Spread on Pavement (ft.) :** 4.07

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/30/2021 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** Crnegie Rt 55+70 to Midtown Connector Lt 513+61 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 55+70 | Begin | | | | | | | | | | | | | | | | | | |
| 71 | 57+00 | CB-3 | 129.70 | 0.76 | 0.22 | 1.00 | 1.97 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.63 | 0.12 | 0.75 | 0.150 | 7.50 | |
| 72 | 57+30 | CB-3 | 30.00 | 0.74 | 0.05 | 1.00 | 0.59 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.29 | 0.00 | 0.29 | 0.105 | 5.27 | |
| 73 | 57+85 | CB-3 | 55.00 | 0.77 | 0.09 | 1.00 | 1.05 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.29 | 0.00 | 0.29 | 0.105 | 5.24 | |
| 74 | 63+62 | CB-3 | 62.00 | 0.89 | 0.06 | 1.00 | 1.23 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.25 | 0.00 | 0.25 | 0.099 | 4.95 | |
| 75 | 64+50 | CB-3 | 88.00 | 0.85 | 0.09 | 1.00 | 1.81 | 10.00 | 0.0030 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.34 | 0.118 | 5.91 | Sag |
| | 513+61 | Begin | | | | | | | | | | | | | | | | | | |
| 76 | 64+50 | CB-3 | 73.40 | 0.86 | 0.12 | 1.00 | 1.40 | 10.00 | 0.0030 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.45 | 0.130 | 6.52 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.79 **Ponded Depth (ft.) :** 0.069 **Spread on Pavement (ft.) :** 2.77

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/25/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Carnegie Rt 65+76 to 67+24 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 67+24 | Begin | | | | | | | | | | | | | | | | | | |
| 78 | 65+95 | CB-3 | 129.00 | 0.90 | 0.16 | 1.00 | 2.06 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.62 | 0.140 | 6.98 | Sag |
| | 65+76 | Begin | | | | | | | | | | | | | | | | | | |
| 77 | 65+95 | CB-3 | 19.00 | 0.90 | 0.02 | 1.00 | 0.47 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.10 | 0.069 | 3.46 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.71 **Ponded Depth (ft.) :** 0.062 **Spread on Pavement (ft.) :** 2.40

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/23/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Carnegie Rt 65+76 to Midtown Connector Rt 511+69 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 9.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 65+76 | Begin | | | | | | | | | | | | | | | | | | |
| 79 | 512+99 | CB-3 | 137.30 | 0.90 | 0.17 | 1.00 | 2.92 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 3.00 | 0.0417 | 3.68 | ****** | ****** | 0.58 | 0.155 | 7.74 | Sag |
| | 511+69 | Begin | | | | | | | | | | | | | | | | | | |
| 80 | 512+99 | CB-3 | 145.70 | 0.90 | 0.14 | 1.00 | 3.28 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 3.00 | 0.0417 | 3.68 | ****** | ****** | 0.47 | 0.143 | 7.15 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.04 **Ponded Depth (ft.) :** 0.091 **Spread on Pavement (ft.) :** 3.88

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/16/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP A1 LEFT STA 430+84 TO 311+44 **Designer :** DMH

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 430+84 | Begin | | | | | | | | | | | | | | | | | | |
| 81 | 308+34 | CB-3A | 620.00 | 0.90 | 0.34 | 1.00 | 5.72 | 10.00 | 0.0070 | 0.0400 | 0.0160 | 6.00 | 0.1667 | 4.94 | 1.17 | 0.33 | 1.50 | 0.227 | 5.68 | |
| 82 | 308+90 | CB-3A | 56.00 | 0.90 | 0.03 | 1.00 | 1.11 | 10.00 | 0.0020 | 0.0400 | 0.0195 | 6.00 | 0.1667 | 4.94 | ****** | ****** | 0.47 | 0.186 | 4.65 | Sag |
| | 311+44 | Begin | | | | | | | | | | | | | | | | | | |
| 84 | 309+50 | CB-3A | 194.00 | 0.90 | 0.14 | 1.00 | 2.06 | 10.00 | 0.0076 | 0.0400 | 0.0376 | 6.00 | 0.1667 | 4.94 | 0.61 | 0.02 | 0.62 | 0.161 | 4.02 | |
| 83 | 308+90 | CB-3A | 60.00 | 0.90 | 0.03 | 1.00 | 1.45 | 10.00 | 0.0020 | 0.0400 | 0.0196 | 6.00 | 0.1667 | 4.94 | ****** | ****** | 0.17 | 0.126 | 3.16 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.64 **Ponded Depth (ft.) :** 0.067 **Spread on Pavement (ft.) :** 2.02

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/21/2021 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP A1 RIGHT STA 303+50 TO 311+44 **Designer :** DMH

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 4.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 303+50 | Begin | | | | | | | | | | | | | | | | | | |
| 85 | 308+78 | I-3D | 528.00 | 0.90 | 0.06 | 0.00 | 13.06 | 13.06 | 0.0020 | 0.0400 | 0.0400 | 4.00 | 0.1667 | 4.41 | ****** | ****** | 0.22 | 0.139 | 3.49 | Sag |
| | 311+44 | Begin | | | | | | | | | | | | | | | | | | |
| 86 | 308+78 | I-3D | 266.00 | 0.90 | 0.04 | 1.00 | 6.86 | 10.00 | 0.0020 | 0.0400 | 0.0400 | 4.00 | 0.1667 | 4.94 | ****** | ****** | 0.17 | 0.127 | 3.17 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.39 **Ponded Depth (ft.) :** 0.054 **Spread on Pavement (ft.) :** 0.66

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 04/28/2022 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** Ramp IJ3/I-77 S Rt - 101+83 to 403+52 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 13.00 **Allowable Depth (ft.)** 0.50

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 403+52 | Begin | | | | | | | | | | | | | | | | | |
| 87 | 93+87 | I-3B | 500.00 | 0.90 | 0.70 | 1.00 | 4.39 | 10.00 | 0.0042 | 0.0470 | 0.0470 | 1.00 | 0.1667 | 4.94 | 2.82 | 0.31 | 3.12 | 0.350 | 7.44 |
| 88 | 95+61 | I-3B | 170.00 | 0.90 | 0.29 | 1.00 | 1.43 | 10.00 | 0.0065 | 0.0510 | 0.0510 | 1.00 | 0.1667 | 4.94 | 1.59 | 0.00 | 1.59 | 0.258 | 5.06 |
| 89 | 101+83 | CB-3A | 600.00 | 0.90 | 0.60 | 1.00 | 2.26 | 10.00 | 0.0380 | 0.0530 | 0.0530 | 1.00 | 0.1667 | 4.94 | 2.08 | 0.59 | 2.67 | 0.228 | 4.31 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 04/17/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** E 22nd Lt - 24+60 to 29+95 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24+60 | Begin | | | | | | | | | | | | | | | | | | |
| 90 | 26+67 | CB-3A | 207.00 | 0.90 | 0.16 | 1.00 | 1.52 | 10.00 | 0.0310 | 0.0200 | 0.0200 | 6.00 | 0.0417 | 4.41 | 0.46 | 0.16 | 0.62 | 0.095 | 4.76 | |
| 90A | 29+14 | CB-3A | 247.00 | 0.90 | 0.22 | 1.00 | 2.74 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 0.00 | 0.0417 | 4.41 | 0.63 | 0.40 | 1.03 | 0.148 | 7.42 | |
| 91 | 29+93 | CB-3 | 79.00 | 0.84 | 0.06 | 1.00 | 1.05 | 10.00 | 0.0080 | 0.0180 | 0.0180 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.62 | 0.118 | 6.56 | Sag |
| | 29+95 | Begin | | | | | | | | | | | | | | | | | | |
| 92 | 29+93 | CB-3 | 2.00 | 0.90 | 0.00 | 1.00 | 0.09 | 10.00 | 0.0080 | 0.0180 | 0.0180 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.00 | 0.018 | 0.98 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.63 **Ponded Depth (ft.) :** 0.053 **Spread on Pavement (ft.) :** 2.03

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 01/08/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** E 22nd Lt - 31+00 to 32+18 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 16.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 32+18 | Begin | | | | | | | | | | | | | | | | | |
| 93 | 31+00 | CB-3A | 120.00 | 0.76 | 0.24 | 1.00 | 1.21 | 10.00 | 0.0130 | 0.0160 | 0.0200 | 12.00 | 0.0417 | 4.41 | 0.48 | 0.31 | 0.79 | 0.113 | 7.05 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 01/08/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**E 22nd St Lt - 35+55 TO 36+86 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 35+55 | Begin | | | | | | | | | | | | | | | | | | |
| 94 | 36+29 | CB-3 | 74.00 | 0.86 | 0.13 | 1.00 | 1.63 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.47 | 0.144 | 7.19 | Sag |
| | 36+86 | Begin | | | | | | | | | | | | | | | | | | |
| 95 | 36+29 | CB-3 | 66.00 | 0.79 | 0.20 | 1.00 | 1.31 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.69 | 0.166 | 8.29 | End |

EXTRA AREA TO ACCOUNT FOR SCUPPER BYPASS

**SUMP DATA**

**Total Flow (cfs) :** 1.17 **Ponded Depth (ft.) :** 0.101 **Spread on Pavement (ft.) :** 4.38

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/28/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** E 22nd Ct-L - 26+57 to 30+06 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26+57 | Begin | | | | | | | | | | | | | | | | | | |
| 96A | 28+96 | CB-3A | 239.00 | 0.90 | 0.09 | 1.00 | 2.00 | 10.00 | 0.0200 | 0.0400 | 0.0400 | 0.00 | 0.0417 | 4.41 | 0.36 | 0.01 | 0.37 | 0.110 | 2.76 | |
| 96B | 29+93 | CB-3A | 97.00 | 0.90 | 0.03 | 1.00 | 2.55 | 10.00 | 0.0080 | 0.0050 | 0.0050 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.12 | 0.040 | 7.99 | Sag |
| | 30+06 | Begin | | | | | | | | | | | | | | | | | | |
| 97 | 29+93 | CB-3A | 13.00 | 0.90 | 0.01 | 1.00 | 0.63 | 10.00 | 0.0043 | 0.0050 | 0.0050 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.02 | 0.024 | 4.82 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.15 **Ponded Depth (ft.) :** 0.000 **Spread on Pavement (ft.) :** 0.00

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/28/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** E 22nd Ct-R - 26+57 to 30+06 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26+57 | Begin | | | | | | | | | | | | | | | | | | |
| 98A | 28+96 | CB-3A | 239.00 | 0.90 | 0.09 | 1.00 | 2.09 | 10.00 | 0.0230 | 0.0270 | 0.0270 | 0.00 | 0.0417 | 4.41 | 0.34 | 0.03 | 0.37 | 0.093 | 3.43 | |
| 98B | 29+93 | CB-3A | 97.00 | 0.80 | 0.03 | 1.00 | 2.48 | 10.00 | 0.0080 | 0.0053 | 0.0053 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.14 | 0.042 | 7.99 | Sag |
| | 30+06 | Begin | | | | | | | | | | | | | | | | | | |
| 99 | 29+93 | CB-3A | 13.00 | 0.80 | 0.02 | 1.00 | 0.41 | 10.00 | 0.0080 | 0.0047 | 0.0047 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.05 | 0.028 | 6.02 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.19 **Ponded Depth (ft.) :** 0.000 **Spread on Pavement (ft.) :** 0.00

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 04/17/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** E 22nd Rt - 24+45 to 30+20 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24+45 | Begin | | | | | | | | | | | | | | | | | | |
| 100 | 26+67 | CB-3A | 222.00 | 0.90 | 0.20 | 1.00 | 1.65 | 10.00 | 0.0260 | 0.0200 | 0.0200 | 0.00 | 0.0417 | 4.41 | 0.54 | 0.24 | 0.78 | 0.107 | 5.36 | |
| 100A | 28+96 | CB-3A | 229.00 | 0.90 | 0.16 | 1.00 | 2.67 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 0.00 | 0.0417 | 4.41 | 0.56 | 0.31 | 0.87 | 0.139 | 6.97 | |
| 101 | 29+93 | CB-3 | 97.00 | 0.82 | 0.13 | 1.00 | 1.19 | 10.00 | 0.0080 | 0.0175 | 0.0175 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.78 | 0.127 | 7.27 | Sag |
| | 30+20 | Begin | | | | | | | | | | | | | | | | | | |
| 102 | 29+93 | CB-3 | 27.00 | 0.71 | 0.05 | 1.00 | 0.80 | 10.00 | 0.0020 | 0.0175 | 0.0175 | 0.00 | 0.0417 | 4.41 | ****** | ****** | 0.16 | 0.090 | 5.16 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.94 **Ponded Depth (ft.) :** 0.082 **Spread on Pavement (ft.) :** 3.71

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 01/08/2024 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** E 22nd Rt 30+99 to Midtown Connector RT 500+62 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 18.50 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 500+62 | Begin | | | | | | | | | | | | | | | | | |
| 103 | 30+99 | CB-3A | 170.00 | 0.74 | 0.28 | 1.00 | 1.57 | 10.00 | 0.0130 | 0.0200 | 0.0200 | 0.00 | 0.0417 | 4.41 | 0.59 | 0.33 | 0.92 | 0.130 | 6.50 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** E 22ND RT 33+39 TO MIDTOWN CONNECTOR LT 505+41 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 14.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 33+39 | Begin | | | | | | | | | | | | | | | | | | |
| 104 | 502+58 | CB-3 | 306.00 | 0.83 | 0.34 | 1.00 | 5.86 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 1.04 | 0.193 | 9.66 | Sag |
| | 505+41 | Begin | | | | | | | | | | | | | | | | | | |
| 105 | 502+58 | CB-3 | 283.00 | 0.84 | 0.25 | 1.00 | 5.84 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.77 | 0.173 | 8.64 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.82 **Ponded Depth (ft.) :** 0.149 **Spread on Pavement (ft.) :** 6.75

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 01/08/2024 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**E 22nd St Rt - 35+70 TO 37+04 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 35+70 | Begin | | | | | | | | | | | | | | | | | | |
| 106 | 36+29 | CB-3 | 59.00 | 0.78 | 0.18 | 1.00 | 1.20 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.63 | 0.160 | 8.01 | Sag |
| | 37+04 | Begin | | | | | | | | | | | | | | | | | | |
| 107 | 36+29 | CB-3 | 80.00 | 0.77 | 0.20 | 1.00 | 1.61 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.68 | 0.165 | 8.23 | End |

EXTRA AREA TO ACCOUNT FOR SCUPPER BYPASS

**SUMP DATA**

**Total Flow (cfs) :** 1.31 **Ponded Depth (ft.) :** 0.113 **Spread on Pavement (ft.) :** 4.94

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/25/2021 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** Cedar Rt - 402+05 to 402+78 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 13.75 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 402+05 | Begin | | | | | | | | | | | | | | | | | | |
| 108 | 402+16 | CB-3A | 14.10 | 0.84 | 0.02 | 1.00 | 0.51 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 7.75 | 0.0417 | 3.68 | ****** | ****** | 0.06 | 0.066 | 3.29 | Sag |
| | 402+78 | Begin | | | | | | | | | | | | | | | | | | |
| 109 | 402+16 | CB-3A | 61.70 | 0.73 | 0.07 | 1.00 | 1.69 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 7.75 | 0.0417 | 3.68 | ****** | ****** | 0.19 | 0.102 | 5.11 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.25 **Ponded Depth (ft.) :** 0.005 **Spread on Pavement (ft.) :** 1.45

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** Midtown Connector Lt - 505+41 to 507+66 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 14.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 505+41 | Begin | | | | | | | | | | | | | | | | | | |
| 110 | 507+63 | CB-3A | 222.00 | 0.82 | 0.20 | 1.00 | 4.80 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.60 | 0.157 | 7.87 | Sag |
| | 507+66 | Begin | | | | | | | | | | | | | | | | | | |
| 111 | 507+63 | CB-3A | 3.00 | 0.77 | 0.00 | 1.00 | 0.17 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.01 | 0.032 | 1.59 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.61 **Ponded Depth (ft.) :** 0.064 **Spread on Pavement (ft.) :** 2.49

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** Midtown Connector Lt - 507+66 to 513+61 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 9.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 507+98 | Begin | | | | | | | | | | | | | | | | | | |
| 112 | 512+25 | CB-3A | 409.00 | 0.65 | 0.70 | 1.00 | 5.32 | 10.00 | 0.0040 | 0.0200 | 0.0200 | 3.00 | 0.0417 | 3.68 | 0.87 | 0.80 | 1.68 | 0.203 | 10.14 | |
| 113 | 512+99 | CB-3 | 70.00 | 0.63 | 0.13 | 1.00 | 1.32 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 3.00 | 0.0417 | 3.68 | ****** | ****** | 1.11 | 0.198 | 9.90 | Sag |
| | 513+61 | Begin | | | | | | | | | | | | | | | | | | |
| 114 | 512+99 | CB-3 | 60.00 | 0.67 | 0.09 | 1.00 | 1.59 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 3.00 | 0.0417 | 3.68 | ****** | ****** | 0.21 | 0.107 | 5.34 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.33 **Ponded Depth (ft.) :** 0.114 **Spread on Pavement (ft.) :** 5.00

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** Midtown Connector Rt - STA 500+62 to 505+41 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 14.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 500+62 | Begin | | | | | | | | | | | | | | | | | | |
| 115 | 502+58 | CB-3 | 196.00 | 0.79 | 0.20 | 1.00 | 4.24 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.58 | 0.156 | 7.78 | Sag |
| | 505+41 | Begin | | | | | | | | | | | | | | | | | | |
| 116 | 502+80 | CB-3 | 261.00 | 0.79 | 0.29 | 1.00 | 5.20 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.86 | 0.179 | 8.97 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.44 **Ponded Depth (ft.) :** 0.122 **Spread on Pavement (ft.) :** 5.42

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** Midtown Connector Rt - 505+41 to 507+66 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 14.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 505+41 | Begin | | | | | | | | | | | | | | | | | | |
| 117 | 507+63 | CB-3A | 222.00 | 0.73 | 0.27 | 1.00 | 4.57 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.73 | 0.169 | 8.45 | Sag |
| | 507+66 | Begin | | | | | | | | | | | | | | | | | | |
| 118 | 507+63 | CB-3A | 3.00 | 0.66 | 0.01 | 1.00 | 0.16 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 8.00 | 0.0417 | 3.68 | ****** | ****** | 0.01 | 0.036 | 1.82 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.74 **Ponded Depth (ft.) :** 0.080 **Spread on Pavement (ft.) :** 3.30

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** Midtown Connector Rt 507+66 to Cedar Rt 402+05 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 507+66 | Begin | | | | | | | | | | | | | | | | | | |
| 119 | 510+00 | CB-3A | 239.00 | 0.70 | 0.36 | 1.00 | 3.30 | 10.00 | 0.0047 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 3.68 | 0.58 | 0.34 | 0.91 | 0.157 | 7.84 | |
| 120 | 400+68 | CB-3 | 163.00 | 0.69 | 0.30 | 1.00 | 3.01 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 3.68 | ****** | ****** | 1.11 | 0.198 | 9.88 | Sag |
| | 402+05 | Begin | | | | | | | | | | | | | | | | | | |
| 121 | 400+68 | CB-3 | 144.50 | 0.67 | 0.22 | 1.00 | 3.13 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 3.68 | ****** | ****** | 0.54 | 0.151 | 7.57 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.65 **Ponded Depth (ft.) :** 0.137 **Spread on Pavement (ft.) :** 6.18

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/25/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** Midtown Connector Rt 511+69 to Cedar Rt 402+78 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 511+69 | Begin | | | | | | | | | | | | | | | | | | |
| 122 | 400+68 | CB-3 | 40.90 | 0.90 | 0.06 | 1.00 | 1.10 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 3.68 | ****** | ****** | 0.20 | 0.103 | 5.16 | Sag |
| | 402+78 | Begin | | | | | | | | | | | | | | | | | | |
| 123 | 400+68 | CB-3 | 198.70 | 0.90 | 0.16 | 1.00 | 4.42 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 3.68 | ****** | ****** | 0.53 | 0.150 | 7.48 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.72 **Ponded Depth (ft.) :** 0.063 **Spread on Pavement (ft.) :** 2.44

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 07/21/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** E 14th NB Rt - 60+94 to 57+75 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60+94 | Begin | | | | | | | | | | | | | | | | | |
| 125 | 59+00 | CB-3A | 164.80 | 0.73 | 0.39 | 1.00 | 1.24 | 10.00 | 0.0180 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.74 | 0.50 | 1.24 | 0.137 | 6.83 |
| 124 | 57+75 | CB-3A | 125.00 | 0.70 | 0.26 | 1.00 | 0.96 | 10.00 | 0.0180 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.77 | 0.54 | 1.31 | 0.139 | 6.97 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/13/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :**E 14th NB - 301+99 to 24+86 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 301+99 | Begin | | | | | | | | | | | | | | | | | | |
| 126 | 53+50 | CB-3A | 466.00 | 0.88 | 0.34 | 1.00 | 4.15 | 10.00 | 0.0130 | 0.0400 | 0.0200 | 2.00 | 0.0417 | 4.41 | 0.88 | 0.43 | 1.31 | 0.179 | 6.96 | |
| 127 | 54+75 | CB-3A | 134.50 | 0.71 | 0.17 | 1.00 | 1.27 | 10.00 | 0.0130 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.61 | 0.36 | 0.97 | 0.133 | 6.63 | |
| 128 | 55+13 | CB-3A | 40.10 | 0.63 | 0.10 | 1.00 | 0.51 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.45 | 0.19 | 0.64 | 0.124 | 6.22 | |
| 129 | 55+64 | CB-3 | 51.60 | 0.64 | 0.03 | 1.00 | 1.39 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.27 | 0.117 | 5.83 | Sag |
| | 24+86 | Begin | | | | | | | | | | | | | | | | | | |
| 135 | 24+25 | CB-3A | 89.80 | 0.78 | 0.13 | 1.00 | 1.32 | 10.00 | 0.0060 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.35 | 0.10 | 0.45 | 0.115 | 5.76 | |
| 134 | 23+50 | CB-3A | 75.00 | 0.61 | 0.21 | 1.00 | 0.77 | 10.00 | 0.0120 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.47 | 0.20 | 0.67 | 0.117 | 5.87 | |
| 133 | 23+00 | CB-3A | 50.00 | 0.62 | 0.13 | 1.00 | 0.55 | 10.00 | 0.0120 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.42 | 0.15 | 0.56 | 0.110 | 5.49 | |
| 132 | 57+00 | CB-3A | 207.10 | 0.63 | 0.35 | 1.00 | 1.85 | 10.00 | 0.0130 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.67 | 0.43 | 1.11 | 0.139 | 6.96 | |
| 131 | 56+14 | CB-3A | 85.60 | 0.74 | 0.11 | 1.00 | 1.02 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | 0.53 | 0.27 | 0.81 | 0.135 | 6.76 | |
| 130 | 55+64 | CB-3 | 51.60 | 0.67 | 0.01 | 1.00 | 1.37 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.31 | 0.122 | 6.12 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.58 **Ponded Depth (ft.) :** 0.048 **Spread on Pavement (ft.) :** 1.85

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 08/13/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** E 14th NB - 301+99 to 24+86 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 7.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 301+99 | Begin | | | | | | | | | | | | | | | | | | |
| 126 | 53+50 | CB-3A | 466.00 | 0.88 | 0.34 | 1.00 | 3.85 | 10.00 | 0.0130 | 0.0400 | 0.0200 | 2.00 | 0.0417 | 6.13 | 1.10 | 0.73 | 1.82 | 0.200 | 7.99 | |
| 127 | 54+75 | CB-3A | 134.50 | 0.71 | 0.17 | 1.00 | 1.15 | 10.00 | 0.0130 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.82 | 0.66 | 1.48 | 0.155 | 7.77 | |
| 128 | 55+13 | CB-3A | 40.10 | 0.63 | 0.10 | 1.00 | 0.45 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.64 | 0.42 | 1.06 | 0.150 | 7.50 | |
| 129 | 55+64 | CB-3 | 51.60 | 0.64 | 0.03 | 1.00 | 1.19 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | ****** | ****** | 0.53 | 0.150 | 7.50 | Sag |
| | 24+86 | Begin | | | | | | | | | | | | | | | | | | |
| 135 | 24+25 | CB-3A | 89.80 | 0.78 | 0.13 | 1.00 | 1.22 | 10.00 | 0.0060 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.45 | 0.19 | 0.63 | 0.130 | 6.52 | |
| 134 | 23+50 | CB-3A | 75.00 | 0.61 | 0.21 | 1.00 | 0.71 | 10.00 | 0.0120 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.62 | 0.36 | 0.98 | 0.135 | 6.75 | |
| 133 | 23+00 | CB-3A | 50.00 | 0.62 | 0.13 | 1.00 | 0.50 | 10.00 | 0.0120 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.57 | 0.30 | 0.87 | 0.129 | 6.46 | |
| 132 | 57+00 | CB-3A | 207.10 | 0.63 | 0.35 | 1.00 | 1.70 | 10.00 | 0.0130 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.88 | 0.76 | 1.64 | 0.161 | 8.06 | |
| 131 | 56+14 | CB-3A | 85.60 | 0.74 | 0.11 | 1.00 | 0.92 | 10.00 | 0.0080 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | 0.73 | 0.54 | 1.27 | 0.161 | 8.03 | |
| 130 | 55+64 | CB-3 | 51.60 | 0.67 | 0.01 | 1.00 | 1.17 | 10.00 | 0.0020 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 6.13 | ****** | ****** | 0.59 | 0.156 | 7.82 | End |

**SUMP DATA**

**Total Flow (cfs) :** 1.12 **Ponded Depth (ft.) :** 0.098 **Spread on Pavement (ft.) :** 4.20

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 06/24/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** E 14TH NB RT - ORANGE AVE TO 298+81 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 5.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 250+00 | Begin | | | | | | | | | | | | | | | | | | |
| 136 | 298+43 | CB-3 | 130.00 | 0.76 | 0.15 | 0.45 | 2.44 | 10.00 | 0.0030 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.50 | 0.136 | 6.79 | Sag |
| | 298+81 | Begin | | | | | | | | | | | | | | | | | | |
| 137 | 298+43 | CB-3 | 40.00 | 0.81 | 0.03 | 1.00 | 1.05 | 10.00 | 0.0030 | 0.0200 | 0.0200 | 1.00 | 0.0417 | 4.41 | ****** | ****** | 0.12 | 0.080 | 4.00 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.62 **Ponded Depth (ft.) :** 0.052 **Spread on Pavement (ft.) :** 1.94

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/13/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** E 14th SB Lt 37+77 to IJ3 Lt 109+25 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 16.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 37+77 | Begin | | | | | | | | | | | | | | | | | | |
| 140 | 209+01 | CB-3A | 172.10 | 0.68 | 0.09 | 1.00 | 1.86 | 10.00 | 0.0123 | 0.0400 | 0.0200 | 9.00 | 0.0417 | 4.41 | 0.27 | 0.00 | 0.27 | 0.108 | 2.70 | |
| N/A | 208+65 | CB-3 | 36.00 | 0.90 | 0.00 | 1.00 | 2.22 | 10.00 | 0.0020 | 0.0400 | 0.0200 | 8.30 | 0.0417 | 4.41 | ****** | ****** | 0.00 | 0.031 | 0.78 | Sag |
| | 109+25 | Begin | | | | | | | | | | | | | | | | | | |
| 138 | 208+25 | CB-3A | 316.10 | 0.71 | 0.50 | 1.00 | 2.24 | 10.00 | 0.0120 | 0.0400 | 0.0200 | 6.70 | 0.0417 | 4.41 | 1.15 | 0.42 | 1.57 | 0.209 | 5.22 | |
| 139 | 208+65 | CB-3 | 33.00 | 0.57 | 0.01 | 1.00 | 0.67 | 10.00 | 0.0020 | 0.0400 | 0.0200 | 8.30 | 0.0417 | 4.41 | ****** | ****** | 0.45 | 0.184 | 4.59 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.46 **Ponded Depth (ft.) :** 0.035 **Spread on Pavement (ft.) :** 1.72

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/13/2021 **Project :** CUY-90-16.28 **Location :** Cleveland, Ohio

**Description :** E 14th SB Lt 37+77 to IJ3 Lt 109+25 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 16.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 37+77 | Begin | | | | | | | | | | | | | | | | | | |
| 140 | 209+01 | CB-3A | 172.10 | 0.68 | 0.09 | 1.00 | 1.72 | 10.00 | 0.0123 | 0.0400 | 0.0200 | 9.00 | 0.0417 | 6.13 | 0.37 | 0.01 | 0.38 | 0.122 | 3.05 | |
| N/A | 208+65 | CB-3 | 36.00 | 0.90 | 0.00 | 1.00 | 1.68 | 10.00 | 0.0020 | 0.0400 | 0.0200 | 8.30 | 0.0417 | 6.13 | ****** | ****** | 0.01 | 0.051 | 1.27 | Sag |
| | 109+25 | Begin | | | | | | | | | | | | | | | | | | |
| 138 | 208+25 | CB-3A | 316.10 | 0.71 | 0.50 | 1.00 | 2.07 | 10.00 | 0.0120 | 0.0400 | 0.0200 | 6.70 | 0.0417 | 6.13 | 1.46 | 0.73 | 2.19 | 0.236 | 5.91 | |
| 139 | 208+65 | CB-3 | 33.00 | 0.57 | 0.01 | 1.00 | 0.59 | 10.00 | 0.0020 | 0.0400 | 0.0200 | 8.30 | 0.0417 | 6.13 | ****** | ****** | 0.77 | 0.224 | 5.59 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.78 **Ponded Depth (ft.) :** 0.068 **Spread on Pavement (ft.) :** 2.07

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 09/13/2021 **Project :** CUY IR 090 16.28 CCG3A **Location :** Cleveland, Ohio

**Description :** E 14th SB Lt - 301+99 to 206+25 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 13.00 **Allowable Depth (ft.)** 0.42

| ID | STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 301+99 | Begin | | | | | | | | | | | | | | | | | |
| 141 | 206+25 | CB-3A | 429.50 | 0.71 | 0.31 | 1.00 | 3.61 | 10.00 | 0.0110 | 0.0400 | 0.0400 | 6.00 | 0.0417 | 4.41 | 0.80 | 0.18 | 0.98 | 0.178 | 4.45 |

Michael Baker INTERNATIONAL

# RUNOFF COEFFICIENTS

PROJECT: CUY-90-16.28
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22
Page: 1 of 1

## WEIGHTED RUNOFF COEFFICIENTS

**I-90EB STA 196+75 TO STA 198+85 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 196+75 | 198+80 | R | 0.770 | 0.853 | | | | 1.2901 | 1.623 | 0.79 |

**I-90WB STA 432+20 TO STA 4006+58 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 432+20 | 435+75 | L | 0.122 | | | | | 0.1098 | 0.122 | 0.90 |
| 435+75 | 201+00 | L | 0.191 | 0.477 | | | | 0.5058 | 0.668 | 0.76 |
| 201+00 | 4000+42 | L | 0.023 | 0.025 | 0.012 | | | 0.0442 | 0.060 | 0.74 |
| 4000+42 | 4004+20 | L | 0.480 | 0.304 | 0.025 | | | 0.6573 | 0.809 | 0.81 |
| 4004+20 | 4005+97 | L | 0.231 | 0.059 | 0.024 | | | 0.2612 | 0.314 | 0.83 |
| 4005+97 | 4006+58 | L | 0.066 | | | | | 0.0594 | 0.066 | 0.90 |
| 4006+58 | 4007+20 | L | 0.035 | | | | | 0.0315 | 0.035 | 0.90 |
| 4007+20 | 4009+00 | L | 0.061 | | | | | 0.0549 | 0.061 | 0.90 |
| 4009+00 | 4012+87 | L | 0.478 | 0.149 | | | | 0.5345 | 0.627 | 0.85 |
| | | | | | | | | 2.2586 | 2.762 | 0.82 |

Michael Baker INTERNATIONAL

# RUNOFF COEFFICIENTS

PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


## WEIGHTED RUNOFF COEFFICIENTS

**RAMP H5 STA 990+64 TO I.R. 90 EB STA 198+85 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 990+64 | 193+52 | R | 0.491 | | 0.149 | | | 0.5164 | 0.640 | 0.81 |
| 193+52 | 193+88 | R | 0.070 | | 0.029 | | | 0.0775 | 0.099 | 0.78 |
| 193+88 | 198+85 | R | 0.978 | | 0.249 | | | 1.0047 | 1.227 | 0.82 |
| | | | | | | | | 1.5986 | 1.966 | 0.81 |

**RAMP H6 STA 1185+89 TO STA 1188+48 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1185+89 | 1186+72 | R | 0.083 | | 0.107 | | | 0.1282 | 0.190 | 0.67 |
| 1188+48 | 1186+72 | R | 0.174 | | 0.192 | | | 0.2526 | 0.366 | 0.69 |
| | | | | | | | | 0.3808 | 0.556 | 0.68 |

**RAMP H6 STA 1188+48 TO STA 1192+99 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 1188+48 | 1190+78 | R | 0.227 | | 0.397 | | | 0.4028 | 0.624 | 0.65 |
| 1190+78 | 1191+28 | R | 0.049 | | 0.287 | | | 0.1876 | 0.336 | 0.56 |
| 1191+28 | 1191+78 | R | 0.050 | | 0.131 | | | 0.1105 | 0.181 | 0.61 |
| 1191+78 | 1192+20 | R | 0.033 | | 0.202 | | | 0.1307 | 0.235 | 0.56 |
| 1192+20 | 1192+99 | R | 0.162 | | 0.020 | | | 0.1558 | 0.182 | 0.86 |
| | | | | | | | | 0.9874 | 1.558 | 0.63 |

**CARNEGIE AVE STA 35+46 TO E 14th NB STA 39+65 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 35+46 | 37+61 | R | 0.336 | | | | | 0.3024 | 0.336 | 0.90 |
| 37+61 | 39+65 | L | 0.192 | | 0.043 | | | 0.1943 | 0.235 | 0.83 |
| | | | | | | | | 0.4967 | 0.571 | 0.87 |

**CARNEGIE AVE STA 39+69 TO STA 24+34 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 39+69 | 40+92 | R | 0.122 | | 0.110 | | | 0.1648 | 0.232 | 0.71 |
| 24+34 | 40+92 | R | 0.063 | | 0.038 | | | 0.0757 | 0.101 | 0.75 |
| | | | | | | | | 0.2405 | 0.333 | 0.72 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


**CARNEGIE AVE STA 50+59 TO STA 52+76 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 50+59 | 52+38 | R | 0.262 | | 0.402 | | | 0.4368 | 0.664 | 0.66 |
| 52+38 | 52+76 | R | 0.052 | | 0.001 | | | 0.0473 | 0.053 | 0.89 |
| | | | | | | | | 0.4841 | 0.717 | 0.68 |

**CARNEGIE AVE STA 53+69 TO STA 55+70 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 53+69 | 54+46 | R | 0.091 | | 0.042 | | | 0.1029 | 0.133 | 0.77 |
| 54+46 | 55+70 | R | 0.115 | | 0.084 | | | 0.1455 | 0.199 | 0.73 |
| | | | | | | | | 0.2484 | 0.332 | 0.75 |

**CARNEGIE STA 55+70 TO MIDTOWN CONNECTOR STA 513+61 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 55+70 | 57+00 | R | 0.143 | | 0.081 | | | 0.1692 | 0.224 | 0.76 |
| 57+00 | 57+30 | R | 0.033 | | 0.021 | | | 0.0402 | 0.054 | 0.74 |
| 57+30 | 57+85 | R | 0.057 | | 0.028 | | | 0.0653 | 0.085 | 0.77 |
| 63+00 | 63+62 | R | 0.062 | | 0.001 | | | 0.0563 | 0.063 | 0.89 |
| 63+62 | 64+50 | R | 0.080 | | 0.012 | | | 0.0780 | 0.092 | 0.85 |
| 64+50 | 513+61 | L | 0.105 | | 0.013 | | | 0.1010 | 0.118 | 0.86 |
| | | | | | | | | 0.5100 | 0.636 | 0.80 |

**E 22ND STA 24+60 TO STA 29+95 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 24+60 | 26+67 | L | 0.157 | | | | | 0.1413 | 0.157 | 0.90 |
| 26+67 | 29+93 | L | 0.229 | | 0.041 | | | 0.2266 | 0.270 | 0.84 |
| 29+93 | 29+95 | L | 0.001 | | | | | 0.0009 | 0.001 | 0.90 |
| | | | | | | | | 0.3688 | 0.428 | 0.86 |

**E 22ND STA 24+45 TO STA 30+20 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 24+45 | 26+77 | R | 0.197 | | | | | 0.1773 | 0.197 | 0.90 |
| 26+77 | 29+93 | R | 0.240 | | 0.061 | | | 0.2465 | 0.301 | 0.82 |
| 29+93 | 30+20 | R | 0.026 | | 0.024 | | | 0.0354 | 0.050 | 0.71 |
| | | | | | | | | 0.4592 | 0.548 | 0.84 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22
Page: 3 of 6

**E 22ND STA 31+00 TO STA 32+18 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 31+00 | 32+18 | L | 0.151 | | 0.085 | | | 0.1784 | 0.236 | 0.76 |
| | | | | | | | | 0.1784 | 0.236 | 0.76 |

**E 22ND STA 30+99 TO MIDTOWN CONNECTOR STA 500+62 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 30+99 | 500+62 | R | 0.169 | | 0.114 | | | 0.2091 | 0.283 | 0.74 |
| | | | | | | | | 0.2091 | 0.283 | 0.74 |

**E 22ND - MIDTOWN CONNECTOR STA 500+61 TO CENTRAL STA 26+00 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 500+61 | 32+25 | R | 0.216 | | 0.096 | | | 0.2424 | 0.312 | 0.78 |
| 32+25 | 31+75 | R | 0.087 | | 0.033 | | | 0.0948 | 0.120 | 0.79 |
| 31+75 | 31+25 | R | 0.057 | | 0.049 | | | 0.0758 | 0.106 | 0.72 |
| 31+25 | 31+00 | R | 0.077 | | 0.059 | | | 0.0988 | 0.136 | 0.73 |
| 31+00 | 26+00 | L | 0.139 | | 0.061 | | | 0.1556 | 0.200 | 0.78 |
| | | | | | | | | 0.6674 | 0.874 | 0.76 |

**E 22ND ST STA 35+70 TO STA 37+04 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 33+39 | 35+70 | R | Bypass flow pulled from scupper calculation | | | | | Q=0.17 | | |
| 35+70 | 36+29 | R | 0.094 | | 0.041 | | | 0.1051 | 0.135 | 0.78 |
| 36+29 | 37+04 | R | 0.137 | | 0.063 | | | 0.1548 | 0.200 | 0.77 |
| | | | | | | | | 0.2599 | 0.335 | 0.78 |

**E 22ND ST STA 35+55 TO STA 36+86 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 33+39 | 35+55 | L | Bypass flow pulled from scupper calculation | | | | | Q=0.12 | | |
| 35+55 | 36+29 | L | 0.084 | | 0.009 | | | 0.0801 | 0.093 | 0.86 |
| 36+29 | 36+86 | L | 0.145 | | 0.054 | | | 0.1575 | 0.199 | 0.79 |
| | | | | | | | | 0.2376 | 0.292 | 0.81 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22
Page: 4 of 6

**CEDAR STA 402+05 TO STA 402+78 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 402+05 | 402+16 | R | 0.016 | | 0.003 | | | 0.0159 | 0.019 | 0.84 |
| 402+16 | 402+78 | R | 0.041 | | 0.030 | | | 0.0519 | 0.071 | 0.73 |
| | | | | | | | | 0.0678 | 0.090 | 0.75 |

**MIDTOWN CONNECTOR - E 22ND ST STA 33+39 TO STA 505+41 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 33+39 | 502+58 | R/L | 0.279 | | 0.062 | | | 0.2821 | 0.341 | 0.83 |
| 502+58 | 505+41 | L | 0.211 | | 0.039 | | | 0.2094 | 0.250 | 0.84 |
| | | | | | | | | 0.4915 | 0.591 | 0.83 |

**MIDTOWN CONNECTOR STA 505+41 TO STA 507+66 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 505+41 | 507+63 | L | 0.161 | | 0.039 | | | 0.1644 | 0.200 | 0.82 |
| 507+63 | 507+66 | L | 0.002 | | 0.001 | | | 0.0023 | 0.003 | 0.77 |
| | | | | | | | | 0.1667 | 0.203 | 0.82 |

**MIDTOWN CONNECTOR STA 507+66 TO STA 513+61 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 507+66 | 512+25 | L | 0.261 | | 0.440 | | | 0.4549 | 0.701 | 0.65 |
| 512+25 | 512+99 | L | 0.042 | | 0.090 | | | 0.0828 | 0.132 | 0.63 |
| 512+99 | 513+61 | L | 0.036 | | 0.051 | | | 0.0579 | 0.087 | 0.67 |
| | | | | | | | | 0.5956 | 0.920 | 0.65 |

**MIDTOWN CONNECTOR STA 500+62 TO STA 505+41 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 500+62 | 502+58 | R | 0.144 | | 0.057 | | | 0.1581 | 0.201 | 0.79 |
| 502+58 | 505+41 | R | 0.211 | | 0.083 | | | 0.2314 | 0.294 | 0.79 |
| | | | | | | | | 0.3895 | 0.495 | 0.79 |

**MIDTOWN CONNECTOR STA 505+41 TO STA 507+66 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 505+41 | 507+85 | R | 0.157 | | 0.114 | | | 0.1983 | 0.271 | 0.73 |
| 507+85 | 507+66 | R | 0.002 | | 0.003 | | | 0.0033 | 0.005 | 0.66 |
| | | | | | | | | 0.2016 | 0.276 | 0.73 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22


**MIDTOWN CONNECTOR STA 507+66 TO CEDAR STA 402+05 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 507+98 | 510+00 | R | 0.177 | | 0.178 | | | 0.2483 | 0.355 | 0.70 |
| 510+00 | 400+68 | R | 0.145 | | 0.158 | | | 0.2095 | 0.303 | 0.69 |
| 400+68 | 402+05 | R | 0.092 | | 0.128 | | | 0.1468 | 0.220 | 0.67 |
| | | | | | | | | 0.6046 | 0.878 | 0.69 |

**E 14TH STA 60+94 TO STA 57+75 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 60+94 | 59+00 | R | 0.226 | | 0.159 | | | 0.2829 | 0.385 | 0.73 |
| 59+00 | 57+75 | R | 0.128 | | 0.134 | | | 0.1822 | 0.262 | 0.70 |
| | | | | | | | | 0.4651 | 0.647 | 0.72 |

**E 14TH NB STA 301+99 TO STA 24+86 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 301+99 | 53+50 | R | 0.324 | | 0.014 | | | 0.2986 | 0.338 | 0.88 |
| 53+50 | 54+75 | R | 0.091 | | 0.083 | | | 0.1234 | 0.174 | 0.71 |
| 54+75 | 55+13 | R | 0.034 | | 0.069 | | | 0.0651 | 0.103 | 0.63 |
| 55+13 | 55+64 | R | 0.010 | | 0.019 | | | 0.0185 | 0.029 | 0.64 |
| 55+64 | 56+14 | R | 0.005 | | 0.007 | | | 0.0080 | 0.012 | 0.67 |
| 56+14 | 56+14 | R | 0.059 | 0.019 | 0.036 | | | 0.0844 | 0.114 | 0.74 |
| 57+00 | 56+14 | R | 0.105 | 0.015 | 0.225 | | | 0.2175 | 0.345 | 0.63 |
| 23+00 | 56+14 | R | 0.039 | | 0.094 | | | 0.0821 | 0.133 | 0.62 |
| 23+50 | 56+14 | R | 0.058 | | 0.155 | | | 0.1297 | 0.213 | 0.61 |
| 24+25 | 24+86 | R | 0.091 | | 0.041 | | | 0.1024 | 0.132 | 0.78 |
| | | | | | | | | 1.1297 | 1.593 | 0.71 |

**E 14TH NB - ORANGE AVE TO STA 298+81 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 250+00 | 298+43 | R | 0.098 | | 0.051 | | | 0.1137 | 0.149 | 0.76 |
| 298+43 | 298+81 | R | 0.026 | | 0.008 | | | 0.0274 | 0.034 | 0.81 |
| | | | | | | | | 0.1411 | 0.183 | 0.77 |

**E 14TH SB STA 37+77 TO IJ3 STA 109+25 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 37+77 | 209+01 | L | 0.040 | | 0.051 | | | 0.0615 | 0.091 | 0.68 |
| 209+01 | 208+65 | L | 0.000 | | 0.000 | | | 0.0000 | 0.000 | 0.00 |
| 208+65 | 208+25 | L | 0.002 | | 0.010 | | | 0.0068 | 0.012 | 0.57 |
| 208+25 | 109+25 | L | 0.166 | 0.200 | 0.136 | | | 0.3574 | 0.502 | 0.71 |
| | | | | | | | | 0.4257 | 0.605 | 0.70 |

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY IR 90 16.28 CCG3A
PID: 82382

Computed by: JAR Date: 06/24/22
Checked by: KGJ Date: 06/24/22
Page: 6 of 6

**E 14th SB STA 301+99 TO STA 206+25 (INLET SPACING)**

| STA | STA | SIDE | SURFACE AREA (ACRES) | | | | | C*A | TOTAL AREA (ACRES) | WEIGHTED C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PAVEMENT | SLOPES STEEPER THAN 4:1 | SLOPES 4:1 OR FLATTER | CULTIVATED | WOODS | | | |
| | | | 0.9 | 0.7 | 0.5 | 0.4 | 0.3 | | | |
| 301+99 | 206+25 | Lt | 0.167 | | 0.146 | | | 0.2233 | 0.313 | 0.71 |

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix E

Scupper Calculations

Michael Baker INTERNATIONAL

Michael Baker INTERNATIONAL

# SCUPPER/BRIDGE BYPASS CALCULATIONS

PROJECT: CUY-90-16.28

PID: 82382

Computed by: JAR Date: 5/16/22
Checked by: KGJ Date: 6/1/22


## Spread and Scupper Bypass

Ramp A2

| Criteria | | Reference | Notes |
|---|---|---|---|
| Rainfall Area | A | Per L&D Vol II, Figure 1101-3 | |
| Design Storm | 10 | Per L&D Vol II, 1103.2 | Freeway |

Allowable Spread: Shoulder Width — Per L&D Vol II, Table 1103-1

| RIGHT SIDE FORWARD | Station* (ft) | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Shoulder Width (ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 420+62 | | | | | | | | | | | |
| Scupper | 428+88 | 0.05000 | Variable Deck Width, See Area | 1.116 | 4.94 | 4.96 | 0.0258 | 8.95 | 8.1 | 4 | 0.84 | 0.81 |
| Scupper | 428+98 | 0.05000 | | 0.014 | 4.94 | 0.87 | 0.0240 | 8.83 | 4.4 | 4 | 1.00 | 0.00 |
| Scupper | 429+18 | 0.05000 | | 0.029 | 4.94 | 0.13 | 0.0204 | 8.59 | 2.4 | 4 | 1.00 | 0.00 |
| Scupper | 429+28 | 0.05000 | | 0.014 | 4.94 | 0.06 | 0.0204 | 8.47 | 1.8 | 4 | 1.00 | 0.00 |
| Scupper | 430+40 | 0.05000 | | 0.162 | 4.94 | 0.72 | 0.0160 | 5.50 | 5.3 | 4 | 0.98 | 0.02 |
| Scupper | 430+75 | 0.05000 | | 0.051 | 4.94 | 0.24 | 0.0160 | 4.50 | 3.5 | 4 | 1.00 | 0.00 |
| End Curb | 431+44 | 0.05000 | | 0.102 | 4.94 | 0.45 | 0.0208 | 4.00 | 3.8 | | 0.00 | 0.45 |

Allowable Spread: 12.0 — Per L&D Vol II, Table 1103-1

| RIGHT SIDE REAR | Station* (ft) | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Shoulder Width (ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 420+62 | | | | | | | | | | | |
| Scupper | 417+90 | 0.03400 | 56.0 | 0.350 | 4.94 | 1.55 | 0.0583 | 12.00 | 3.4 | 4 | 1.00 | 0.00 |
| Scupper | 417+80 | 0.03400 | 56.0 | 0.013 | 4.94 | 0.06 | 0.0563 | 12.00 | 1.0 | 4 | 1.00 | 0.00 |
| Scupper | 410+95 | 0.03400 | Variable Deck Width, See Area | 0.844 | 4.94 | 3.75 | 0.0490 | 12.00 | 5.2 | 4 | 0.98 | 0.08 |
| Scupper | 410+85 | 0.03400 | | 0.011 | 4.94 | 0.13 | 0.0490 | 12.00 | 1.5 | 4 | 1.00 | 0.00 |
| I-3D | 410+19 | 0.03210 | | 0.074 | 4.94 | 0.33 | 0.0488 | 12.00 | 2.1 | 2 | 1.00 | 0.00 |
| CB-3A | 408+72 | 0.01420 | | 0.141 | 4.94 | 0.63 | 0.0545 | 12.00 | 3.0 | 2 | 0.95 | 0.03 |
| End Curb | 408+60 | 0.01270 | | 0.011 | 4.94 | 0.08 | 0.0569 | 12.00 | 1.4 | | 0.00 | 0.08 |

Allowable Spread: 4.0 — Per L&D Vol II, Table 1103-1

| LEFT SIDE FORWARD | Station* (ft) | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Shoulder Width (ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 420+62 | | | | | | | | | | | |
| Scupper | 430+74 | 0.05000 | 4.0 | 0.093 | 4.94 | 0.41 | 0.0400 | 4.00 | 2.4 | 4 | 1.00 | 0.00 |
| Scupper | 430+84 | 0.05000 | 4.0 | 0.001 | 4.94 | 0.00 | 0.0400 | 4.00 | 0.4 | 4 | 1.00 | 0.00 |
| End of Bridge | 431+29 | 0.05000 | 4.0 | 0.004 | 4.94 | 0.02 | 0.0400 | 6.00 | 0.8 | | 0.00 | 0.02 |

Allowable Spread: 4.0 — Per L&D Vol II, Table 1103-1

| LEFT SIDE REAR | Station* (ft) | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Shoulder Width (ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 420+62 | | | | | | | | | | | |
| Scupper | 417+90 | 0.02990 | Variable Deck Width, See Area | 0.035 | 4.94 | 0.16 | 0.0400 | 4.00 | 1.8 | 4 | 1.00 | 0.00 |
| Scupper | 417+80 | 0.03400 | | 0.001 | 4.94 | 0.00 | 0.0400 | 4.00 | 0.5 | 4 | 1.00 | 0.00 |
| Scupper | 410+83 | 0.03400 | | 0.161 | 4.94 | 0.72 | 0.0400 | 4.00 | 3.2 | 4 | 1.00 | 0.00 |
| Scupper | 410+74 | 0.03890 | | 0.006 | 4.94 | 0.03 | 0.0400 | 4.00 | 0.9 | 4 | 1.00 | 0.00 |
| I-3D | 410+19 | 0.03230 | | 0.036 | 4.94 | 0.16 | 0.0400 | 4.00 | 1.8 | 2 | 1.00 | 0.00 |

= input required
i.e.; enter 22+50 as 2250
see L&D Vol. 2 Fig. 1101-2 & 1101-3

*Equations:*

$Q = ciA$ where c=0.9

$E = 1 - \left(1 - \frac{W}{T}\right)^{2.67}$

$Q_b = Q(1 - E)$

$T = \left(\frac{Qn}{0.56\, S_x^{1.67} S^{0.5}}\right)^{0.375}$ where n=0.015

Michael Baker INTERNATIONAL

# SCUPPER/BRIDGE BYPASS CALCULATIONS

PROJECT: CUY-90-16.28
PID: 82382

Computed by: KGJ Date: 7/13/23
Checked by: SM Date: 8/3/23


## Spread and Scupper Bypass

E 22nd - Bridge 13

| Criteria | | Reference | Notes |
|---|---|---|---|
| Rainfall Area | A | Per L&D Vol II, Figure 1101-3 | |
| Design Storm | 5 | Per L&D Vol II, 1103.2 | High Volume Highway |
| Allowable Spread | 8 | Per L&D Vol II, Table 1103-1 | 8' of 11' travelled lane |

**LEFT SIDE REAR**

| | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) | Design Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 33+39 | | | | | | | | | | | | NO SCUPPER REQUIRED FOR SPREAD, ADD ONE FOR INTERSECTION/RAMP NEEDS |
| | 32+48 | | 0.01300 | 50.3 | 0.120 | 4.41 | 0.48 | 0.0200 | 5.1 | | | | |

Allowable Spread 8 — Per L&D Vol II, Table 1103-1 — 8' of 11' travelled lane

**RIGHT SIDE REAR**

| | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 33+39 | | | | | | | | | | | | |
| | 32+70 | | 0.01300 | 71.0 | 0.114 | 4.41 | 0.45 | 0.0200 | 5.0 | | | | NO SCUPPER REQUIRED |

Allowable Spread 8 — Per L&D Vol II, Table 1103-1 — 8' of 12' travelled lane

**LEFT SIDE FORWARD**

| | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 33+39 | | | | | | | | | | | | |
| | 36+05 | | 0.00730 | 50.3 | 0.307 | 4.41 | 1.22 | 0.0200 | 8.0 | | | | SCUPPER REQUIRED. SEE NEXT SHEET. |

Allowable Spread 8 — Per L&D Vol II, Table 1103-1 — 8' of 12' travelled lane

**RIGHT SIDE FORWARD**

| | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 33+39 | | | | | | | | | | | | |
| | 36+15 | | 0.00730 | 71.0 | 0.450 | 4.41 | 1.79 | 0.0200 | 9.3 | | | | SCUPPER REQUIRED. SEE NEXT SHEET. |

*Notes:*

= input required

* i.e.; enter 22+50 as 2250

** see L&D Vol. 2 Fig. 1101-2 & 1101-3

*Equations:*

$$E = 1 - \left(1 - \frac{W}{T}\right)^{2.67} \qquad T = \left(\frac{Qn}{0.56\, S_x^{1.67} S^{0.5}}\right)^{0.375}$$

$$Q_b = Q(1 - E)$$

where n=0.015

Michael Baker INTERNATIONAL

# SCUPPER/BRIDGE BYPASS CALCULATIONS

PROJECT: CUY-90-16.28
PID: 82382

Computed by: KGJ Date: 7/13/23
Checked by: SM Date: 8/3/23


## Spread and Scupper Bypass

E 22nd - Bridge 13

| Criteria | | Reference | Notes |
|---|---|---|---|
| Rainfall Area | A | Per L&D Vol II, Figure 1101-3 | |
| Design Storm | 5 | Per L&D Vol II, 1103.2 | High Volume Highway |

Allowable Spread 8 Per L&D Vol II, Table 1103-1 8' of 12' travelled lane

| LEFT SIDE FORWARD | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 33+39 | | | | | | | | | | | |
| Scupper | 35+45 | | 0.00730 | 50.3 | 0.238 | 4.41 | 0.94 | 0.0200 | 7.3 | 1.83 | 0.54 | 0.44 |
| Scupper | 35+55 | | 0.00730 | 50.3 | 0.012 | 4.41 | 0.48 | 0.0200 | 5.7 | 1.83 | 0.65 | 0.17 |
| End | 36+05 | | 0.00730 | 50.3 | 0.058 | 4.41 | 0.40 | 0.0200 | 5.3 | 1.83 | 0.68 | 0.13 |

Allowable Spread 8 Per L&D Vol II, Table 1103-1 8' of 12' travelled lane

| RIGHT SIDE FORWARD | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 33+39 | | | | | | | | | | | |
| Scupper | 34+50 | | 0.00730 | 71.0 | 0.181 | 4.41 | 0.72 | 0.0200 | 6.6 | 1.83 | 0.58 | 0.30 |
| Scupper | 34+60 | | 0.00730 | 71.0 | 0.016 | 4.41 | 0.37 | 0.0200 | 5.1 | 1.83 | 0.69 | 0.11 |
| Scupper | 35+60 | | 0.00730 | 71.0 | 0.163 | 4.41 | 0.76 | 0.0200 | 6.7 | 1.83 | 0.57 | 0.33 |
| Scupper | 35+70 | | 0.00730 | 71.0 | 0.016 | 4.41 | 0.39 | 0.0200 | 5.2 | 1.83 | 0.68 | 0.12 |
| End | 36+15 | | 0.00730 | 71.0 | 0.073 | 4.41 | 0.42 | 0.0200 | 5.4 | 1.83 | 0.67 | 0.14 |

Scupper required too far from abutment, add two to pier and two at abutment

*Notes:*

= input required

* i.e.; enter 22+50 as 2250

** see L&D Vol. 2 Fig. 1101-2 & 1101-3

*Equations:*

$$E = 1 - \left(1 - \frac{W}{T}\right)^{2.67} \qquad T = \left(\frac{Qn}{0.56\, S_x^{1.67} S^{0.5}}\right)^{0.375}$$

$Q_b = Q(1 - E)$

where n=0.015

Michael Baker INTERNATIONAL

# SCUPPER/BRIDGE BYPASS CALCULATIONS

PROJECT: CUY-90-16.28
PID: 82382

Computed by: KGJ Date: 9/1/21
Checked by: SM Date: 9/20/21Page: 1 of 1

## Spread and Scupper Bypass

Carnegie Road

| Criteria | | Reference | Notes |
|---|---|---|---|
| Rainfall Are | A | Per L&D Vol II, Figure 1101-3 | |
| Design Stor | 5 | Per L&D Vol II, 1103.2 | High Volume Highway |
| Allowable S | 8 | Per L&D Vol II, Table 1103-1 | 8' of 12' travelled lane |

| LEFT SIDE | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) | Design Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 58+87 | | | | | | | | | | | | |
| A-1 | 61+90 | | 0.00400 | 44.0 | 0.306 | 4.41 | 1.21 | 0.0200 | 9.0 | 1.83 | 0.46 | 0.66 | |
| A-2 | 62+00 | | 0.00400 | 44.0 | 0.010 | 4.41 | 0.70 | 0.0200 | 7.3 | 1.83 | 0.54 | 0.33 | |
| B-3 | 63+75 | | 0.00400 | 44.0 | 0.177 | 4.41 | 1.03 | 0.0200 | 8.4 | 1.83 | 0.48 | 0.54 | |
| B-4 | 63+85 | | 0.00400 | 44.0 | 0.010 | 4.41 | 0.58 | 0.0200 | 6.8 | 1.83 | 0.57 | 0.25 | |
| CB | 64+50 | | 0.00400 | 44.0 | 0.066 | 4.41 | 0.51 | 0.0200 | 6.5 | | 0.00 | 0.51 | *Put CB in approach slab for future intersection constrction Sta 64+15 |

| Allowable S | 8 | Per L&D Vol II, Table 1103-1 | 8' of 12' travelled lane |
|---|---|---|---|

| RIGHT SIDE | Station* (ft) | | Longitudinal Slope S (ft/ft) | Contributing Drainage Width (ft) | Area A (acres) | intensity** i (in/hr) | Gutter Flow Q (cfs) | Cross Slope $S_x$ (ft/ft) | Spread T (ft) | Grate Width W (ft) | Efficiency E | Bypass Flow $Q_b$ (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Begin | 57+84 | | | | | | | | | | | |
| C-1 | 60+90 | | 0.00400 | 44.0 | 0.309 | 4.41 | 1.23 | 0.0200 | 9.0 | 1.83 | 0.45 | 0.67 |
| C-2 | 61+00 | | 0.00400 | 44.0 | 0.010 | 4.41 | 0.71 | 0.0200 | 7.3 | 1.83 | 0.53 | 0.33 |
| D-3 | 62+90 | | 0.00400 | 44.0 | 0.192 | 4.41 | 1.09 | 0.0200 | 8.6 | 1.83 | 0.47 | 0.58 |
| D-4 | 63+00 | | 0.00400 | 44.0 | 0.010 | 4.41 | 0.62 | 0.0200 | 7.0 | 1.83 | 0.56 | 0.28 |
| CB | 63+65 | | 0.00400 | 44.0 | 0.066 | 4.41 | 0.54 | 0.0200 | 6.6 | | 0.00 | 0.54 |

*Notes:*

= input required
* i.e.; enter 22+50 as 2250
** see L&D Vol. 2 Fig. 1101-2 & 1101-3

*Equations:*

$$Q = ciA$$

where c=0.9

$$E = 1 - \left(1 - \frac{W}{T}\right)^{2.67}$$

$$Q_b = Q(1 - E)$$

$$T = \left(\frac{Qn}{0.56\, S_x^{1.67} S^{0.5}}\right)^{0.375}$$

where n=0.015

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix F

## Storm Sewer Area Maps & Calculations

Michael Baker INTERNATIONAL

D-701
D-701A
D-703
D-700
D-401
D-620
D-710
D-611
D-612
D-621
D-640
D-711
D-643
D-261
D-644
D-639
D-623
D-264A
D-602
D-641
D-624
D-636
D-610
D-627
D-628
D-608
D-607
D-530
D-200
D-626
D-600
D-530A
D-614
D-531
D-601
D-636A
D-613
D-629
D-635
D-202B
D-605
D-201
D-634
D-616
D-202C
D-630
D-550
D-670
D-202
D-603
D-550A
D-638
D-551
DO-3
D-203
D-631
D-604
D-204
D-518
D-508
D-512
D-516
D-514
D-507
D-517
D-515
D-513
D-511
D-509
D-632
D-510
D-633
D-652
D-190
D-191
D-194
D-193
D-409
D-506
D-500
D-410
D-501
D-421
D-420
D-408
D-650
D-411
D-502
D-422
D-503
D-651
D-411A
D-411B
D-410A
D-323
D-322
D-325
D-326
D-324
D-316
D-328
D-327
D-315
D-321
D-320
D-318

MATCH LINE SEE SHEET 2

HORIZONTAL SCALE IN FEET
0 50 100 200

# DRAINAGE AREA MAP
# STORM SEWER 1 OF 2

CTY-RTE-SECTION

MODEL: Sheet - Storm Sewer | PAPERSIZE: 17x11(in.) DATE: 1/16/2024 TIME: 10:29:13 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland.OH\01_Projects\0007\District2\82382\400-Engineering\Drainage\EngData\Exhibits\Drainage Report Exhibits\Report Exhibits-Storm_Sewer.dgn

DESIGN AGENCY
Michael Baker INTERNATIONAL

| | |
|---|---|
| DESIGNER | DMH |
| REVIEWER | KGJ 09-30-21 |
| PROJECT ID | 82382 |
| SUBSET | 0 |
| TOTAL | 0 |
| SHEET | P.0 |
| TOTAL | 0 |

HORIZONTAL SCALE IN FEET
0 50 100 200

# DRAINAGE AREA MAP
## STORM SEWER 2 OF 2

MATCHLINE SEE SHEET 1

DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER DMH
REVIEWER KGJ 09-30-21
PROJECT ID 0
SUBSET 0 TOTAL 0
SHEET P.0 TOTAL 0

CTY-RTE-SECTION

MODEL: Sheet - Storm Sewer 2 PAPERSIZE: 17x11(in.) DATE: 1/16/2024 TIME: 10:38:25 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\400-Engineering\Drainage\EngData\Exhibits\Drainage Report Exhibits\Report Exhibits-Storm_Sewer.dgn

Michael Baker INTERNATIONAL

**STORM SEWER - ORD FLEX TABLES**
PROJECT: CUY-90-16.28 (CCG3A)
PID: 82380

Computed by: BT Date: 1/5/24
Checked by: KGJ Date: 1/7/24


| Model | Conduit Label | Start Node | Stop Node | Area (acres) | System Area (acres) | ∑C*A (acres) | Begin Time (min) | Rainfull Intensity - 10 yr (in/h) | Rainfull Intensity - 25 yr (in/h) | Discharge- 10 yr (cfs) | Discharge- 25 yr (cfs) | Size (in) | Pipe Length (ft) | Slope (%) | Invert (In) (ft) | Invert (Out) (ft) | Velocity (ft/s) | Just Full Capacity (cfs) | Friction Slope (%) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Cover (In) (ft) | Cover (Out) (ft) | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BD1014 | P-269 | D-269 | D-270 | 0.08 | 0.08 | 0.07 | 10.00 | 4.94 | 5.63 | 0.33 | 0.37 | 15 | 33.95 | 3.00 | 655.52 | 654.50 | 3.67 | 9.70 | 2.01 | 655.76 | 655.29 | 661.52 | 662.69 | |
| | P-271A | D-271A | D-271 | 0.62 | 0.62 | 0.56 | 10.00 | 4.94 | 5.63 | 2.77 | 3.16 | 15 | 9.66 | 1.04 | 660.57 | 660.47 | 4.61 | 5.70 | 1.02 | 661.29 | 661.31 | 666.99 | 668.17 | |
| | P-271 | D-271 | D-274 | 0.92 | 1.53 | 1.38 | 10.03 | 4.94 | 5.62 | 6.87 | 7.83 | 18 | 62.99 | 1.00 | 660.22 | 659.59 | 5.66 | 9.10 | 1.00 | 661.31 | 660.71 | 668.17 | 670.90 | |
| | P-274 | D-274 | D-265 | (N/A) | 1.66 | 1.49 | 10.22 | 4.90 | 5.59 | 7.36 | 8.39 | 18 | 164.24 | 3.97 | 659.59 | 653.07 | 9.73 | 18.14 | 3.97 | 660.71 | 653.79 | 670.90 | 676.28 | |
| | P-272 | D-272 | D-274 | 0.12 | 0.12 | 0.11 | 10.00 | 4.94 | 5.63 | 0.54 | 0.62 | 15 | 38.93 | 15.21 | 665.51 | 659.59 | 7.53 | 21.83 | 16.08 | 665.82 | 660.71 | 671.76 | 670.90 | |
| | P-270 | D-270 | D-281 | 0.68 | 0.77 | 0.68 | 10.15 | 4.91 | 5.60 | 3.37 | 3.84 | 15 | 48.84 | 1.00 | 654.50 | 654.01 | 4.78 | 5.61 | 1.01 | 655.29 | 654.77 | 662.69 | 665.79 | |
| | P-281 | D-281 | D-280 | (N/A) | 0.77 | 0.68 | 10.32 | 4.88 | 5.56 | 3.35 | 3.81 | 15 | 16.51 | 0.97 | 654.01 | 653.85 | 4.71 | 5.51 | 0.97 | 654.80 | 654.62 | 665.79 | 666.63 | |
| BD1015 | P-211 | D-211 | D-212 | 0.21 | 1.98 | 1.68 | 10.27 | 4.89 | 5.58 | 8.31 | 9.47 | 18 | 90.55 | 1.74 | 642.80 | 641.22 | 7.34 | 12.02 | 1.64 | 643.99 | 642.22 | 647.87 | 646.30 | |
| | P-212 | D-212 | D-213 | 1.62 | 3.60 | 2.98 | 10.48 | 4.85 | 5.53 | 14.55 | 16.59 | 24 | 10.29 | 0.97 | 640.72 | 640.62 | 6.76 | 19.33 | 0.97 | 642.34 | 642.31 | 646.30 | 646.09 | |
| | P-282 | D-282 | D-214 | 0.14 | 0.14 | 0.12 | 10.00 | 4.94 | 5.63 | 0.62 | 0.70 | 15 | 46.15 | 1.91 | 655.13 | 654.25 | 3.77 | 7.73 | 1.81 | 655.46 | 654.50 | 660.09 | 659.25 | |
| | P-214 | D-214 | D-215 | (N/A) | 0.14 | 0.12 | 10.20 | 4.90 | 5.59 | 0.61 | 0.70 | 15 | 243.89 | 3.49 | 654.25 | 645.75 | 4.65 | 10.45 | 3.43 | 654.58 | 645.97 | 659.25 | 650.75 | |
| | P-215 | D-215 | D-213 | (N/A) | 0.14 | 0.12 | 11.08 | 4.74 | 5.42 | 0.59 | 0.68 | 15 | 126.95 | 3.45 | 645.75 | 641.37 | 4.59 | 10.40 | 3.27 | 646.07 | 642.31 | 650.75 | 646.09 | |
| | P-213 | D-213 | D-216 | (N/A) | 3.74 | 3.10 | 11.54 | 4.66 | 5.33 | 14.55 | 16.65 | 24 | 24.41 | 0.98 | 640.62 | 640.38 | 6.79 | 19.44 | 0.81 | 642.31 | 642.21 | 646.09 | 645.61 | |
| | P-216 | D-216 | D-217 | (N/A) | 3.74 | 3.10 | 11.60 | 4.65 | 5.32 | 14.52 | 16.61 | 24 | 39.83 | 0.60 | 640.38 | 640.14 | 5.51 | 15.22 | 0.60 | 642.21 | 641.96 | 645.61 | 645.13 | |
| | P-218 | D-218 | H-216 | (N/A) | 3.98 | 3.32 | 12.04 | 4.57 | 5.23 | 15.29 | 17.49 | 24 | 45.46 | 0.68 | 639.51 | 639.20 | 5.86 | 16.19 | 0.72 | 641.23 | 640.71 | 643.90 | 638.90 | |
| | P-209 | D-209 | D-210 | 0.67 | 0.67 | 0.51 | 10.00 | 4.94 | 5.63 | 2.52 | 2.87 | 15 | 82.13 | 1.88 | 644.79 | 643.25 | 5.60 | 7.67 | 1.54 | 645.47 | 644.45 | 649.63 | 648.07 | |
| | P-210 | D-210 | D-211 | 1.10 | 1.77 | 1.50 | 10.24 | 4.90 | 5.58 | 7.40 | 8.44 | 15 | 10.87 | 1.84 | 643.25 | 643.05 | 7.05 | 7.59 | 1.72 | 644.45 | 644.18 | 648.07 | 647.87 | |
| | P-220 | D-220 | D-218 | 0.20 | 0.20 | 0.18 | 10.00 | 4.94 | 5.63 | 0.88 | 1.00 | 15 | 89.75 | 0.88 | 641.05 | 640.26 | 3.17 | 5.25 | 0.54 | 641.44 | 641.23 | 645.22 | 643.90 | |
| | P-217 | D-217 | D-218 | (N/A) | 3.78 | 3.14 | 11.72 | 4.63 | 5.29 | 14.64 | 16.76 | 24 | 104.82 | 0.60 | 640.14 | 639.51 | 5.51 | 15.20 | 0.61 | 641.96 | 641.23 | 645.13 | 643.90 | |
| | P-219 | D-219 | D-217 | 0.05 | 0.05 | 0.04 | 10.00 | 4.94 | 5.63 | 0.20 | 0.23 | 15 | 47.02 | 15.12 | 648.00 | 640.89 | 5.60 | 21.77 | 13.87 | 648.19 | 641.96 | 658.00 | 645.13 | |
| BD1016 | P-240 | D-240 | D-248 | 1.05 | 1.05 | 0.84 | 10.00 | 4.94 | 5.63 | 4.20 | 4.79 | 15 | 10.29 | 0.87 | 633.92 | 633.83 | 4.74 | 5.24 | 0.88 | 634.85 | 634.72 | 638.92 | 643.10 | |
| | P-230 | D-230 | D-231 | 0.25 | 0.25 | 0.22 | 10.00 | 4.94 | 5.63 | 1.12 | 1.28 | 15 | 54.00 | 3.37 | 642.27 | 640.45 | 5.49 | 10.28 | 3.27 | 642.72 | 641.04 | 648.60 | 647.10 | |
| | P-231 | D-231 | D-251 | 0.18 | 0.43 | 0.39 | 10.16 | 4.91 | 5.60 | 1.91 | 2.18 | 15 | 173.84 | 2.44 | 640.45 | 636.20 | 5.71 | 8.75 | 2.36 | 641.04 | 636.63 | 647.10 | 642.00 | |
| | P-251 | D-251 | D-232 | (N/A) | 0.43 | 0.39 | 10.67 | 4.81 | 5.50 | 1.87 | 2.14 | 15 | 97.36 | 2.39 | 636.20 | 633.87 | 5.63 | 8.66 | 2.12 | 636.78 | 635.02 | 642.00 | 639.80 | |
| | P-250 | D-250 | D-232 | 0.74 | 0.74 | 0.60 | 10.00 | 4.94 | 5.63 | 2.97 | 3.38 | 15 | 8.92 | 13.56 | 635.08 | 633.87 | 11.94 | 20.62 | 12.16 | 635.82 | 635.02 | 638.60 | 639.80 | |
| | P-232 | D-232 | D-233 | (N/A) | 1.17 | 0.98 | 10.96 | 4.76 | 5.44 | 4.71 | 5.38 | 15 | 193.16 | 0.79 | 633.87 | 632.34 | 4.62 | 4.98 | 0.80 | 635.02 | 633.28 | 639.80 | 635.83 | |
| | P-233 | D-233 | D-234 | 0.41 | 1.58 | 1.33 | 11.66 | 4.64 | 5.30 | 6.21 | 7.09 | 24 | 59.99 | 0.20 | 631.59 | 631.47 | 3.03 | 8.77 | 0.15 | 633.07 | 632.98 | 635.83 | 635.63 | |
| | P-234 | D-234 | D-235 | 0.14 | 1.72 | 1.46 | 11.99 | 4.58 | 5.24 | 6.73 | 7.70 | 24 | 65.87 | 0.15 | 631.47 | 631.37 | 2.74 | 7.64 | 0.18 | 632.98 | 632.85 | 635.63 | 635.81 | Vel < 3fps to reach project outlet |
| | P-235 | D-235 | D-246 | 0.11 | 1.84 | 1.55 | 12.39 | 4.51 | 5.16 | 7.06 | 8.07 | 24 | 98.51 | 0.15 | 631.37 | 631.22 | 2.76 | 7.65 | 0.22 | 632.85 | 632.59 | 635.81 | 636.71 | |
| | P-246 | D-246 | D-248 | (N/A) | 1.84 | 1.55 | 12.98 | 4.42 | 5.06 | 6.91 | 7.91 | 24 | 74.46 | 0.15 | 631.22 | 631.11 | 2.72 | 7.54 | 0.30 | 632.59 | 632.31 | 636.71 | 643.10 | |
| | P-248 | D-248 | D-252 | (N/A) | 2.89 | 2.39 | 13.44 | 4.35 | 4.98 | 10.50 | 12.03 | 30 | 24.46 | 0.16 | 630.60 | 630.56 | 3.20 | 14.37 | 0.17 | 632.31 | 632.27 | 643.10 | 643.60 | |
| | P-252 | D-252 | D-242 | (N/A) | 2.89 | 2.39 | 13.56 | 4.33 | 4.96 | 10.46 | 11.98 | 30 | 171.32 | 0.15 | 630.56 | 630.31 | 3.05 | 13.58 | 0.18 | 632.27 | 631.93 | 643.60 | 645.30 | |
| | P-242 | D-242 | D-243 | (N/A) | 2.89 | 2.39 | 14.50 | 4.20 | 4.82 | 10.13 | 11.63 | 30 | 146.77 | 0.15 | 630.31 | 630.09 | 3.07 | 13.76 | 0.21 | 631.93 | 631.60 | 645.30 | 647.00 | |
| | P-247 | DO-1 | D-245 | (N/A) | 0.00 | 0.00 | 10.00 | 4.94 | 5.63 | 5.90 | 6.42 | 15 | 247.61 | 0.49 | 633.25 | 632.03 | 4.81 | 3.93 | 1.10 | 636.42 | 633.05 | 636.25 | 648.75 | Basin outlet |
| | P-245 | D-245 | D-241 | 0.93 | 0.93 | 0.61 | 15.00 | 4.13 | 4.74 | 8.43 | 9.32 | 24 | 61.03 | 0.51 | 631.31 | 631.00 | 4.66 | 13.97 | 0.49 | 632.52 | 632.28 | 648.75 | 647.59 | |
| | P-236 | D-236 | D-237 | 0.82 | 0.82 | 0.74 | 10.00 | 4.94 | 5.63 | 3.69 | 4.21 | 15 | 31.52 | 1.21 | 633.82 | 633.44 | 5.24 | 6.15 | 1.04 | 634.65 | 634.51 | 638.82 | 638.44 | |
| | P-237 | D-237 | D-238 | 0.06 | 0.88 | 0.79 | 10.10 | 4.92 | 5.61 | 3.93 | 4.48 | 15 | 111.30 | 0.58 | 633.44 | 632.79 | 3.96 | 4.28 | 0.61 | 634.51 | 633.78 | 638.44 | 637.79 | |
| | P-238 | D-238 | D-239 | 0.20 | 1.08 | 0.97 | 10.57 | 4.83 | 5.51 | 4.71 | 5.38 | 18 | 62.07 | 0.31 | 632.54 | 632.35 | 3.24 | 5.04 | 0.37 | 633.78 | 633.54 | 637.79 | 638.00 | |
| | P-239 | D-239 | D-249 | 0.34 | 1.42 | 1.28 | 10.89 | 4.77 | 5.45 | 6.14 | 7.00 | 21 | 291.56 | 0.25 | 632.10 | 631.37 | 3.23 | 6.87 | 0.26 | 633.54 | 632.75 | 638.00 | 644.68 | |
| | P-249 | D-249 | D-241 | (N/A) | 1.42 | 1.28 | 12.39 | 4.51 | 5.16 | 5.80 | 6.64 | 21 | 186.36 | 0.25 | 631.37 | 630.91 | 3.18 | 6.82 | 0.24 | 632.75 | 632.28 | 644.68 | 647.59 | |
| | P-241 | D-241 | D-243 | 0.06 | 2.41 | 1.94 | 15.22 | 4.10 | 4.71 | 13.92 | 15.63 | 27 | 73.36 | 0.30 | 630.56 | 630.34 | 4.21 | 14.70 | 0.43 | 632.28 | 631.72 | 647.59 | 647.00 | |
| | P-243 | D-243 | D-244 | (N/A) | 5.30 | 4.34 | 15.51 | 4.06 | 4.66 | 23.66 | 26.80 | 34x53 | 291.47 | 0.15 | 629.76 | 629.32 | 3.82 | 34.16 | 0.16 | 631.60 | 631.12 | 647.00 | 646.00 | |
| | P-244 | D-244 | H-245 | 2.78 | 8.08 | 6.58 | 16.78 | 3.91 | 4.49 | 31.78 | 36.21 | 34x53 | 179.10 | 0.30 | 629.32 | 628.78 | 5.31 | 48.21 | 0.32 | 631.12 | 630.36 | 646.00 | 628.78 | |

| Model | Conduit Label | Start Node | Stop Node | Area (acres) | System Area (acres) | ∑C*A (acres) | Begin Time (min) | Rainfull Intensity - 10 yr (in/h) | Rainfull Intensity - 25 yr (in/h) | Discharge- 10 yr (cfs) | Discharge- 25 yr (cfs) | Size (in) | Pipe Length (ft) | Slope (%) | Invert (In) (ft) | Invert (Out) (ft) | Velocity (ft/s) | Just Full Capacity (cfs) | Friction Slope (%) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Cover (In) (ft) | Cover (Out) (ft) | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BD1017 | P-905 | D-905 | Y-465 | 0.35 | 0.35 | 0.28 | 10.00 | 4.94 | 5.63 | 1.41 | 1.61 | 12 | 30.08 | 1.10 | 664.33 | 664.00 | 3.98 | 3.23 | 1.07 | 664.87 | 664.50 | 668.85 | 668.94 | |
| | P-900 | D-900 | Y-460 | 0.24 | 0.24 | 0.18 | 10.00 | 4.94 | 5.63 | 0.90 | 1.02 | 12 | 44.03 | 1.45 | 665.37 | 664.73 | 3.90 | 3.72 | 1.39 | 665.79 | 665.09 | 669.37 | 669.75 | |
| | P-780 | D-780 | D-781 | (N/A) | 1.24 | 0.96 | 15.19 | 4.10 | 4.71 | 3.98 | 4.57 | 12 | 115.28 | 2.95 | 664.33 | 660.93 | 7.41 | 5.30 | 2.81 | 665.22 | 661.65 | 669.08 | 669.76 | |
| | P-752 | D-752 | D-780 | 0.50 | 0.50 | 0.39 | 10.00 | 4.94 | 5.63 | 1.95 | 2.22 | 12 | 19.72 | 3.55 | 665.03 | 664.33 | 6.67 | 5.82 | 2.94 | 665.67 | 665.22 | 668.69 | 669.08 | |
| | P-782 | D-782 | D-780 | 0.60 | 0.75 | 0.57 | 15.14 | 4.11 | 4.72 | 2.37 | 2.72 | 12 | 19.72 | 3.25 | 664.97 | 664.33 | 6.80 | 5.56 | 2.88 | 665.68 | 665.22 | 668.58 | 669.08 | |
| | P-750 | D-750 | D-782 | 0.15 | 0.15 | 0.08 | 15.00 | 4.13 | 4.74 | 0.32 | 0.36 | 12 | 29.30 | 2.63 | 665.75 | 664.98 | 3.56 | 5.01 | 1.46 | 666.00 | 665.68 | 668.77 | 668.58 | |
| | P-461 | D-461 | D-462 | 0.80 | 0.80 | 0.50 | 15.00 | 4.13 | 4.74 | 2.08 | 2.38 | 15 | 48.16 | 0.50 | 663.21 | 662.97 | 3.26 | 3.95 | 0.25 | 664.05 | 663.97 | 666.18 | 669.64 | |
| | P-462 | D-462 | Y-460 | (N/A) | 1.16 | 0.82 | 15.25 | 4.10 | 4.70 | 3.38 | 3.88 | 15 | 120.68 | 0.50 | 662.97 | 662.37 | 3.62 | 3.95 | 0.53 | 663.97 | 663.17 | 669.64 | 669.75 | |
| | P-460 | D-460 | D-462 | 0.36 | 0.36 | 0.32 | 10.00 | 4.94 | 5.63 | 1.59 | 1.82 | 15 | 85.66 | 2.14 | 664.97 | 663.14 | 5.17 | 8.18 | 2.01 | 665.51 | 663.97 | 671.47 | 669.64 | |
| | P-902 | D-902 | D-903 | 0.27 | 0.27 | 0.23 | 10.00 | 4.94 | 5.63 | 1.12 | 1.28 | 12 | 24.94 | 1.40 | 664.53 | 664.18 | 4.10 | 3.66 | 1.32 | 665.01 | 664.74 | 668.78 | 668.92 | |
| | P-901 | D-901 | Y-460 | 0.28 | 0.28 | 0.21 | 10.00 | 4.94 | 5.63 | 1.04 | 1.19 | 12 | 13.32 | 4.35 | 664.06 | 663.48 | 6.03 | 6.44 | 2.81 | 664.52 | 663.78 | 669.40 | 669.75 | |
| | P-781 | D-781 | Y-754 | (N/A) | 1.24 | 0.96 | 15.44 | 4.07 | 4.67 | 3.95 | 4.54 | 15 | 4.92 | 0.84 | 660.92 | 660.88 | 4.61 | 5.13 | 0.85 | 661.82 | 661.74 | 669.76 | 669.75 | |
| | P-465A | X-465 | Y-466 | (N/A) | 1.77 | 1.36 | 15.02 | 4.13 | 4.73 | 5.66 | 6.49 | 24 | 5.41 | 1.66 | 656.36 | 656.27 | 6.49 | 25.29 | 0.91 | 657.26 | 657.05 | 666.01 | 667.88 | |
| | P-463 | D-463 | X-465 | 1.77 | 1.77 | 1.36 | 15.00 | 4.13 | 4.74 | 5.66 | 6.49 | 12 | 13.62 | 4.63 | 662.39 | 661.76 | 9.50 | 6.64 | 3.42 | 663.36 | 662.61 | 665.64 | 666.01 | |
| | P-465B | Y-465 | Y-900 | (N/A) | 0.71 | 0.59 | 10.17 | 4.91 | 5.60 | 2.92 | 3.33 | 24 | 6.12 | 10.30 | 657.06 | 656.43 | 10.21 | 62.93 | 2.82 | 657.70 | 656.82 | 668.94 | 669.04 | |
| | P-903 | D-903 | Y-465 | 0.05 | 0.36 | 0.31 | 10.10 | 4.92 | 5.61 | 1.52 | 1.74 | 12 | 35.43 | 8.47 | 664.18 | 661.18 | 8.53 | 8.98 | 6.56 | 664.74 | 661.48 | 668.92 | 668.94 | |
| | P-464A | D-464 | D-464B | 0.30 | 0.30 | 0.27 | 10.00 | 4.94 | 5.63 | 1.34 | 1.53 | 15 | 11.66 | 8.15 | 674.12 | 673.17 | 7.91 | 15.98 | 4.22 | 674.61 | 673.45 | 681.62 | 678.41 | |
| | P-464B | D-464B | D-464C | (N/A) | 0.30 | 0.27 | 10.02 | 4.94 | 5.63 | 1.34 | 1.53 | 15 | 20.59 | 40.21 | 673.17 | 664.89 | 13.87 | 35.50 | 27.92 | 673.66 | 665.07 | 678.41 | 669.89 | |
| | P-464C | D-464C | Y-464 | (N/A) | 0.30 | 0.27 | 10.05 | 4.93 | 5.62 | 1.34 | 1.53 | 15 | 4.23 | 2.84 | 664.89 | 664.77 | 5.44 | 9.43 | 1.38 | 665.38 | 665.16 | 669.89 | 668.27 | |
| | P-904 | D-904 | D-903 | 0.05 | 0.05 | 0.04 | 10.00 | 4.94 | 5.63 | 0.20 | 0.23 | 12 | 16.09 | 4.79 | 665.77 | 665.00 | 3.85 | 6.75 | 4.16 | 665.97 | 665.13 | 669.02 | 668.92 | |
| | P-405 | D-405 | D-292 | 0.12 | 0.23 | 0.20 | 10.22 | 4.90 | 5.59 | 1.01 | 1.15 | 12 | 88.70 | 0.79 | 658.70 | 658.00 | 3.23 | 2.75 | 0.79 | 659.15 | 658.45 | 668.38 | 665.00 | |
| | P-406 | D-406 | D-405 | 0.10 | 0.10 | 0.09 | 10.00 | 4.94 | 5.63 | 0.46 | 0.53 | 12 | 40.22 | 1.24 | 659.20 | 658.70 | 3.06 | 3.44 | 1.06 | 659.50 | 659.15 | 668.28 | 668.38 | |
| BD1018 | P-302 | D-302 | D-314 | 0.24 | 0.24 | 0.21 | 10.00 | 4.94 | 5.63 | 1.07 | 1.22 | 12 | 200.00 | 1.48 | 669.10 | 666.13 | 4.12 | 3.76 | 1.39 | 669.57 | 666.92 | 672.53 | 669.56 | |
| | P-303 | D-303 | D-301 | 0.08 | 0.08 | 0.07 | 10.00 | 4.94 | 5.63 | 0.34 | 0.39 | 15 | 25.80 | 2.79 | 663.35 | 662.63 | 3.62 | 9.35 | 2.55 | 663.59 | 662.81 | 668.35 | 668.12 | |
| | P-306 | D-306 | D-307 | 0.07 | 0.83 | 0.72 | 15.00 | 4.13 | 4.74 | 2.98 | 3.42 | 15 | 58.00 | 0.95 | 660.42 | 659.87 | 4.55 | 5.46 | 0.77 | 661.17 | 660.92 | 670.20 | 669.88 | |
| | P-307 | D-307 | D-310 | (N/A) | 1.51 | 1.33 | 15.21 | 4.10 | 4.71 | 5.51 | 6.33 | 15 | 49.70 | 1.21 | 659.86 | 659.26 | 5.67 | 6.16 | 1.21 | 660.92 | 660.27 | 669.88 | 668.51 | |
| | X-310 | D-310 | Y-310 | (N/A) | 1.78 | 1.56 | 15.36 | 4.08 | 4.69 | 6.41 | 7.36 | 21 | 13.40 | 0.27 | 656.82 | 656.78 | 3.36 | 7.14 | 0.52 | 657.98 | 657.78 | 668.51 | 669.88 | |
| | P-305 | D-305 | D-306 | (N/A) | 0.76 | 0.68 | 10.90 | 4.77 | 5.45 | 3.27 | 3.74 | 15 | 9.70 | 0.70 | 660.49 | 660.42 | 4.13 | 4.69 | 0.74 | 661.32 | 661.20 | 669.99 | 670.20 | |
| | P-300 | D-300 | D-301 | 0.14 | 0.14 | 0.13 | 10.00 | 4.94 | 5.63 | 0.63 | 0.72 | 15 | 60.00 | 2.00 | 663.32 | 662.12 | 3.87 | 7.92 | 1.90 | 663.65 | 662.59 | 668.32 | 668.12 | |
| | P-301 | D-301 | D-304 | 0.06 | 0.28 | 0.25 | 10.26 | 4.89 | 5.58 | 1.25 | 1.42 | 15 | 56.50 | 1.00 | 662.12 | 661.56 | 3.67 | 5.60 | 0.70 | 662.59 | 662.34 | 668.12 | 668.32 | |
| | P-304 | D-304 | D-305 | 0.47 | 0.76 | 0.68 | 10.52 | 4.84 | 5.53 | 3.32 | 3.79 | 15 | 108.50 | 0.98 | 661.55 | 660.49 | 4.72 | 5.55 | 0.98 | 662.34 | 661.32 | 668.32 | 669.99 | |
| | P-313 | D-313 | Y-313 | 0.39 | 0.39 | 0.35 | 10.00 | 4.94 | 5.63 | 1.76 | 2.01 | 12 | 100.30 | 5.01 | 666.00 | 660.98 | 7.35 | 6.91 | 4.62 | 666.61 | 661.35 | 670.80 | 671.58 | |
| | P-311 | D-311 | D-310 | 0.10 | 0.10 | 0.09 | 10.00 | 4.94 | 5.63 | 0.45 | 0.51 | 12 | 24.10 | 7.51 | 664.36 | 662.56 | 5.71 | 8.46 | 6.32 | 664.66 | 662.72 | 668.36 | 668.51 | |
| | P-309 | D-309 | D-310 | 0.17 | 0.17 | 0.14 | 15.00 | 4.13 | 4.74 | 0.56 | 0.65 | 12 | 20.60 | 1.99 | 664.21 | 663.80 | 3.82 | 4.36 | 1.77 | 664.55 | 664.06 | 668.21 | 668.51 | |
| | P-314 | D-314 | D-307 | 0.45 | 0.68 | 0.62 | 10.81 | 4.79 | 5.47 | 2.98 | 3.40 | 12 | 33.80 | 10.44 | 666.13 | 662.60 | 11.09 | 9.98 | 6.93 | 666.92 | 663.01 | 669.56 | 669.88 | |
| | P-313A | D-313A | D-313B | 0.23 | 0.23 | 0.20 | 10.00 | 4.94 | 5.63 | 1.01 | 1.16 | 12 | 34.70 | 1.12 | 667.96 | 667.57 | 3.68 | 3.27 | 1.10 | 668.41 | 667.98 | 671.38 | 667.57 | |
| | P-313B | D-313B | D-313C | (N/A) | 0.23 | 0.20 | 10.16 | 4.91 | 5.60 | 1.01 | 1.15 | 12 | 5.80 | 69.44 | 667.57 | 663.51 | 15.88 | 25.73 | 69.41 | 668.02 | 663.99 | 667.57 | 672.16 | |
| | P-313C | D-313C | Y-313 | (N/A) | 0.23 | 0.20 | 10.16 | 4.91 | 5.60 | 1.01 | 1.15 | 12 | 7.70 | 0.65 | 663.51 | 663.46 | 3.01 | 2.50 | 0.68 | 663.99 | 663.91 | 672.16 | 671.58 | |
| BD1020 | P-512 | D-512 | D-513 | 0.19 | 0.19 | 0.16 | 10.00 | 4.94 | 5.63 | 0.80 | 0.92 | 15 | 43.12 | 0.97 | 666.82 | 666.40 | 3.21 | 5.53 | 0.91 | 667.20 | 666.87 | 672.13 | 671.81 | |
| | P-514 | D-514 | D-515 | 0.51 | 0.51 | 0.29 | 10.00 | 4.94 | 5.63 | 1.44 | 1.64 | 15 | 8.38 | 2.03 | 666.06 | 665.89 | 4.93 | 7.98 | 1.36 | 666.57 | 666.56 | 671.21 | 672.00 | |
| | P-515 | D-515 | D-517 | (N/A) | 0.93 | 0.58 | 15.25 | 4.10 | 4.70 | 2.40 | 2.75 | 15 | 42.54 | 1.13 | 665.89 | 665.41 | 4.58 | 5.95 | 0.96 | 666.56 | 666.28 | 672.00 | 672.10 | |
| | P-516 | D-516 | D-517 | 0.61 | 0.61 | 0.39 | 10.00 | 4.94 | 5.63 | 1.95 | 2.23 | 15 | 7.78 | 10.02 | 666.19 | 665.41 | 9.50 | 17.72 | 8.43 | 666.79 | 666.28 | 671.16 | 672.10 | |
| | P-517 | D-517 | D-518 | (N/A) | 1.54 | 0.97 | 15.40 | 4.08 | 4.68 | 4.00 | 4.59 | 15 | 213.98 | 1.50 | 665.41 | 662.21 | 5.79 | 6.85 | 1.47 | 666.28 | 662.96 | 672.10 | 675.82 | |
| | P-518 | D-518 | Y-518 | (N/A) | 1.54 | 0.97 | 16.02 | 4.00 | 4.59 | 3.92 | 4.50 | 15 | 122.59 | 1.80 | 662.21 | 660.00 | 6.19 | 7.52 | 1.73 | 663.07 | 660.70 | 675.82 | 669.88 | |
| | P-513 | D-513 | D-515 | 0.23 | 0.42 | 0.29 | 15.00 | 4.13 | 4.74 | 1.21 | 1.39 | 15 | 57.45 | 0.89 | 666.40 | 665.89 | 3.87 | 6.09 | 0.73 | 666.87 | 666.56 | 671.81 | 672.00 | |
| BD1021 | P-506 | D-506 | D-507 | 2.31 | 2.31 | 1.61 | 15.00 | 4.13 | 4.74 | 12.48 | 13.47 | 24 | 198.95 | 0.50 | 661.60 | 660.61 | 4.98 | 13.83 | 0.47 | 663.21 | 662.32 | 667.46 | 675.25 | |
| | P-507 | D-507 | D-508 | (N/A) | 2.31 | 1.61 | 15.67 | 4.04 | 4.64 | 12.34 | 13.31 | 24 | 11.48 | 0.52 | 660.61 | 660.55 | 5.08 | 14.17 | 0.42 | 662.32 | 662.27 | 675.25 | 672.28 | |
| | P-508 | D-508 | Y-508 | 0.54 | 2.84 | 1.98 | 15.70 | 4.04 | 4.64 | 13.82 | 15.01 | 24 | 110.36 | 0.50 | 660.55 | 660.00 | 5.02 | 13.84 | 0.57 | 662.27 | 661.40 | 672.28 | 672.36 | |

| Model | Conduit Label | Start Node | Stop Node | Area (acres) | System Area (acres) | ∑C*A (acres) | Begin Time (min) | Rainfull Intensity - 10 yr (in/h) | Rainfull Intensity - 25 yr (in/h) | Discharge- 10 yr (cfs) | Discharge- 25 yr (cfs) | Size (in) | Pipe Length (ft) | Slope (%) | Invert (In) (ft) | Invert (Out) (ft) | Velocity (ft/s) | Just Full Capacity (cfs) | Friction Slope (%) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Cover (In) (ft) | Cover (Out) (ft) | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BD1024 | P-500 | D-500 | D-501 | 0.11 | 0.11 | 0.10 | 10.00 | 4.94 | 5.59 | 0.51 | 0.58 | 15 | 30.26 | 1.32 | 665.98 | 665.58 | 3.13 | 6.43 | 1.25 | 666.28 | 665.95 | 670.98 | 670.76 | |
| | P-501 | D-501 | D-502 | 0.06 | 0.17 | 0.16 | 10.16 | 4.91 | 5.59 | 0.77 | 0.88 | 15 | 57.36 | 0.96 | 665.58 | 665.03 | 3.15 | 5.48 | 0.50 | 665.95 | 665.80 | 670.76 | 670.90 | |
| | P-502 | D-502 | D-503 | 0.37 | 0.54 | 0.49 | 10.46 | 4.85 | 5.54 | 2.39 | 2.72 | 15 | 26.86 | 0.44 | 665.03 | 664.91 | 3.22 | 3.72 | 0.53 | 665.80 | 665.58 | 670.90 | 672.94 | |
| | X-503 | D-503 | Y-503 | (N/A) | 0.54 | 0.49 | 10.60 | 4.83 | 5.51 | 2.37 | 2.71 | 24 | 16.54 | 1.01 | 660.51 | 660.34 | 4.24 | 19.73 | 0.90 | 661.08 | 660.85 | 672.94 | 660.34 | |
| BD1025 | P-510 | D-510 | D-511 | 0.02 | 0.01 | 0.01 | 10.00 | 4.94 | 5.63 | 0.07 | 0.07 | 15 | 63.94 | 7.51 | 668.80 | 664.00 | 3.10 | 15.34 | 7.46 | 668.91 | 664.16 | 674.01 | 674.23 | |
| | P-511 | D-511 | Y-511 | 0.02 | 0.04 | 0.03 | 10.34 | 4.88 | 5.56 | 0.16 | 0.18 | 15 | 101.08 | 3.96 | 664.00 | 660.00 | 3.22 | 11.14 | 3.90 | 664.16 | 660.11 | 674.23 | 660.39 | |
| | P-509 | D-509 | Y-509 | 0.16 | 0.16 | 0.15 | 10.00 | 4.94 | 5.63 | 0.74 | 0.84 | 15 | 87.51 | 7.15 | 669.76 | 663.50 | 6.33 | 14.97 | 6.75 | 670.12 | 663.70 | 674.98 | 664.75 | |
| BD1028 | P-261 | D-261 | D-266 | 0.40 | 0.40 | 0.36 | 10.20 | 4.90 | 5.59 | 1.80 | 2.05 | 15 | 87.76 | 3.94 | 678.05 | 674.59 | 6.66 | 11.12 | 3.78 | 678.62 | 675.45 | 684.30 | 681.68 | |
| | P-262 | D-262 | D-265 | 0.38 | 1.28 | 1.12 | 15.00 | 4.13 | 4.74 | 4.65 | 5.33 | 15 | 173.08 | 1.00 | 672.11 | 670.39 | 5.09 | 5.59 | 1.00 | 673.09 | 671.32 | 679.80 | 676.35 | |
| | P-263 | D-263 | D-265 | 0.25 | 0.25 | 0.21 | 15.00 | 4.13 | 4.74 | 0.87 | 1.00 | 15 | 7.30 | 1.93 | 670.25 | 670.11 | 4.19 | 7.77 | 1.36 | 670.64 | 670.43 | 676.50 | 676.35 | |
| | P-264A | D-264A | D-266 | 0.49 | 0.49 | 0.44 | 10.00 | 4.94 | 5.63 | 2.20 | 2.51 | 15 | 98.83 | 1.29 | 675.86 | 674.59 | 4.70 | 6.35 | 1.19 | 676.49 | 675.45 | 679.94 | 681.68 | |
| | P-266 | D-266 | D-262 | (N/A) | 0.90 | 0.81 | 10.42 | 4.86 | 5.54 | 3.95 | 4.50 | 15 | 50.62 | 4.90 | 674.59 | 672.11 | 8.97 | 12.39 | 4.88 | 675.45 | 673.09 | 681.68 | 679.80 | |
| BD1029 | P-713 | D-713 | D-714 | 0.33 | 0.41 | 0.35 | 10.10 | 4.92 | 5.61 | 1.74 | 1.98 | 12 | 74.76 | 0.99 | 665.62 | 664.88 | 4.03 | 3.07 | 0.99 | 666.22 | 665.46 | 670.85 | 671.56 | |
| | P-723 | D-723 | D-724 | 0.08 | 0.08 | 0.07 | 10.00 | 4.94 | 5.63 | 0.36 | 0.41 | 12 | 62.02 | 2.00 | 663.53 | 662.29 | 3.36 | 4.37 | 1.95 | 663.80 | 662.50 | 670.53 | 670.90 | |
| | P-729 | D-729 | X-716 | 0.27 | 0.27 | 0.25 | 10.00 | 4.94 | 5.63 | 1.22 | 1.39 | 12 | 79.91 | 2.50 | 664.07 | 662.07 | 5.17 | 4.88 | 2.37 | 664.57 | 662.44 | 670.29 | 670.92 | |
| | P-726A | D-726 | X-716 | 0.33 | 0.33 | 0.23 | 10.00 | 4.94 | 5.63 | 1.16 | 1.32 | 12 | 64.78 | 1.00 | 664.07 | 663.42 | 3.65 | 3.09 | 1.00 | 664.56 | 663.88 | 670.31 | 670.92 | |
| | P-715 | D-715 | D-730 | 0.72 | 0.72 | 0.49 | 15.00 | 4.13 | 4.74 | 2.03 | 2.33 | 12 | 36.32 | 2.78 | 666.80 | 665.79 | 6.17 | 5.15 | 2.33 | 667.45 | 666.26 | 671.30 | 671.29 | |
| | P-783 | D-783 | D-728 | (N/A) | 0.72 | 0.49 | 15.10 | 4.12 | 4.72 | 2.02 | 2.32 | 12 | 60.84 | 4.88 | 665.79 | 662.82 | 7.57 | 6.82 | 4.81 | 666.44 | 663.62 | 671.29 | 670.43 | |
| | P-728 | D-728 | D-720 | 0.29 | 1.01 | 0.74 | 15.23 | 4.10 | 4.70 | 3.05 | 3.50 | 12 | 37.55 | 4.45 | 662.82 | 661.15 | 8.16 | 6.51 | 3.39 | 663.62 | 661.68 | 670.43 | 670.90 | |
| | P-727 | D-727 | D-720 | 0.38 | 0.38 | 0.30 | 10.00 | 4.94 | 5.63 | 1.49 | 1.70 | 12 | 15.87 | 4.22 | 661.82 | 661.15 | 6.60 | 6.34 | 2.74 | 662.37 | 661.52 | 670.32 | 670.90 | |
| | P-771 | D-771 | D-713 | 0.08 | 0.08 | 0.06 | 10.00 | 4.94 | 5.63 | 0.28 | 0.32 | 12 | 18.79 | 2.02 | 666.00 | 665.62 | 3.14 | 4.39 | 0.57 | 666.23 | 666.22 | 670.25 | 670.85 | |

| Model | Conduit Label | Start Node | Stop Node | Area (acres) | System Area (acres) | ∑C*A (acres) | Begin Time (min) | Rainfall Intensity - 10 yr (in/h) | Rainfall Intensity - 25 yr (in/h) | Discharge- 10 yr (cfs) | Discharge- 25 yr (cfs) | Size (in) | Pipe Length (ft) | Slope (%) | Invert (In) (ft) | Invert (Out) (ft) | Velocity (ft/s) | Just Full Capacity (cfs) | Friction Slope (%) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Cover (In) (ft) | Cover (Out) (ft) | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BD1030 | P-200 | D-200 | D-201 | 0.83 | 0.83 | 0.74 | 10.00 | 4.94 | 5.63 | 3.71 | 4.23 | 15 | 68.82 | 1.00 | 681.73 | 681.04 | 4.89 | 5.61 | 0.95 | 682.56 | 682.02 | 687.98 | 690.37 | |
| | P-201 | D-201 | D-202 | 0.54 | 1.36 | 1.23 | 15.00 | 4.13 | 4.74 | 5.10 | 5.85 | 15 | 11.40 | 2.02 | 681.04 | 680.81 | 6.88 | 7.95 | 1.48 | 682.02 | 681.65 | 690.37 | 689.67 | |
| | P-202 | D-202 | D-203 | 0.16 | 2.35 | 2.12 | 15.03 | 4.13 | 4.73 | 8.80 | 10.10 | 18 | 101.97 | 4.01 | 680.06 | 675.97 | 10.23 | 18.23 | 3.94 | 681.28 | 677.38 | 689.67 | 685.50 | |
| | P-203 | D-203 | D-603 | 1.60 | 4.15 | 3.25 | 15.19 | 4.10 | 4.71 | 13.46 | 15.44 | 18 | 137.13 | 11.56 | 675.97 | 660.12 | 16.91 | 30.95 | 9.53 | 677.38 | 660.87 | 685.50 | 665.91 | |
| | P-624 | D-624 | D-622 | 0.04 | 0.04 | 0.04 | 10.00 | 4.94 | 5.63 | 0.18 | 0.20 | 12 | 59.98 | 1.10 | 655.20 | 654.54 | 2.21 | 3.24 | 1.10 | 655.39 | 654.71 | 663.05 | 664.04 | Just Full Vel >3 fps: sag under bridge |
| | P-603 | D-603 | D-602 | (N/A) | 0.00 | 43.23 | 31.06 | 2.75 | 3.21 | 121.57 | 141.33 | 66 | 245.73 | 0.20 | 649.30 | 648.81 | 6.22 | 130.09 | 0.22 | 653.85 | 653.22 | 665.91 | 666.33 | |
| | P-616 | D-616 | D-613 | 0.50 | 0.50 | 0.31 | 15.00 | 4.13 | 4.74 | 1.30 | 1.49 | 12 | 42.02 | 1.00 | 657.60 | 657.18 | 3.76 | 3.09 | 1.00 | 658.12 | 657.71 | 663.84 | 663.99 | |
| | P-613 | D-613 | D-611 | (N/A) | 0.53 | 0.33 | 15.19 | 4.11 | 4.71 | 1.38 | 1.59 | 12 | 88.88 | 2.72 | 657.18 | 654.76 | 5.52 | 5.09 | 2.57 | 657.71 | 655.14 | 663.99 | 665.13 | |
| | P-610 | D-610 | D-602 | 0.09 | 0.09 | 0.06 | 10.00 | 4.94 | 5.63 | 0.32 | 0.36 | 12 | 47.16 | 2.01 | 657.65 | 656.70 | 3.25 | 4.38 | 1.95 | 657.90 | 656.89 | 663.94 | 666.33 | |
| | P-623 | D-623 | D-622 | 0.12 | 0.12 | 0.10 | 10.00 | 4.94 | 5.63 | 0.52 | 0.59 | 12 | 31.45 | 10.05 | 657.00 | 653.84 | 6.60 | 9.79 | 8.69 | 657.32 | 654.01 | 663.24 | 664.04 | |
| | P-621 | D-621 | D-620 | 0.35 | 0.34 | 0.22 | 10.00 | 4.94 | 5.63 | 1.08 | 1.23 | 12 | 40.34 | 1.29 | 657.05 | 656.53 | 3.94 | 3.51 | 1.25 | 657.52 | 656.94 | 664.40 | 665.24 | |
| | P-620 | D-620 | D-611 | (N/A) | 0.82 | 0.56 | 16.15 | 3.98 | 4.58 | 2.25 | 2.58 | 15 | 52.46 | 0.61 | 652.08 | 651.76 | 3.59 | 4.37 | 0.15 | 653.59 | 653.48 | 665.24 | 665.13 | |
| | P-612 | D-612 | D-611 | 0.04 | 0.04 | 0.02 | 15.00 | 4.13 | 4.74 | 0.08 | 0.09 | 12 | 19.67 | 4.52 | 657.65 | 656.76 | 2.80 | 6.57 | 4.28 | 657.77 | 656.84 | 663.85 | 665.13 | Just Full Vel >3 fps: ditch under bridge |
| | P-602 | D-602 | D-601 | (N/A) | 0.00 | 45.60 | 31.72 | 2.72 | 3.17 | 126.50 | 147.06 | 66 | 234.87 | 0.20 | 648.81 | 648.34 | 6.24 | 130.18 | 0.27 | 653.22 | 652.38 | 666.33 | 666.16 | |
| | P-607 | D-608 | D-607 | 0.69 | 0.69 | 0.52 | 15.00 | 4.13 | 4.74 | 2.18 | 2.50 | 15 | 93.77 | 0.50 | 656.54 | 656.07 | 3.31 | 3.96 | 0.43 | 657.26 | 656.93 | 660.32 | 661.56 | |
| | P-606 | D-607 | D-601 | 0.25 | 0.94 | 0.70 | 15.47 | 4.07 | 4.67 | 2.85 | 3.27 | 15 | 113.34 | 0.50 | 656.07 | 655.50 | 3.52 | 3.97 | 0.53 | 656.93 | 656.23 | 661.56 | 666.16 | |
| | P-601 | D-601 | D-600 | (N/A) | 0.00 | 46.29 | 32.34 | 2.69 | 3.13 | 126.86 | 147.53 | 66 | 90.13 | 0.20 | 648.34 | 648.16 | 6.24 | 130.05 | 0.35 | 652.38 | 651.76 | 666.16 | 667.55 | |
| | P-633 | D-633 | D-632 | 0.96 | 0.96 | 0.64 | 15.00 | 4.13 | 4.74 | 2.67 | 3.06 | 15 | 103.52 | 0.98 | 660.50 | 659.49 | 4.47 | 5.53 | 0.89 | 661.20 | 660.43 | 665.75 | 665.12 | |
| | P-632 | D-632 | D-604 | 0.87 | 1.83 | 1.14 | 15.39 | 4.08 | 4.68 | 4.68 | 5.38 | 15 | 79.91 | 2.00 | 659.49 | 657.89 | 6.72 | 7.92 | 1.86 | 660.43 | 658.65 | 665.12 | 666.54 | |
| | P-631 | D-631 | D-604 | 0.30 | 0.30 | 0.21 | 10.00 | 4.94 | 5.63 | 1.06 | 1.21 | 15 | 45.31 | 3.00 | 660.42 | 659.06 | 5.19 | 9.70 | 2.68 | 660.85 | 659.36 | 666.92 | 666.54 | |
| | P-630 | D-630 | D-604 | 0.11 | 0.11 | 0.06 | 15.00 | 4.13 | 4.74 | 0.24 | 0.27 | 15 | 26.19 | 2.25 | 658.00 | 657.41 | 3.00 | 8.40 | 2.13 | 658.20 | 657.56 | 664.18 | 666.54 | |
| | P-634 | D-634 | D-604 | 0.38 | 0.66 | 0.50 | 15.21 | 4.10 | 4.71 | 2.08 | 2.39 | 15 | 47.41 | 1.50 | 658.02 | 657.31 | 4.90 | 6.85 | 1.39 | 658.64 | 657.82 | 665.20 | 666.54 | |
| | P-604 | D-604 | D-603 | (N/A) | 0.00 | 39.97 | 30.81 | 2.77 | 3.22 | 113.10 | 131.43 | 66 | 91.53 | 0.20 | 649.48 | 649.30 | 6.13 | 129.06 | 0.19 | 654.03 | 653.85 | 666.54 | 665.91 | |
| | P-635 | D-635 | D-634 | 0.28 | 0.28 | 0.17 | 15.00 | 4.13 | 4.74 | 0.69 | 0.79 | 15 | 38.67 | 1.01 | 658.41 | 658.02 | 3.11 | 5.62 | 0.59 | 658.76 | 658.64 | 664.00 | 665.20 | |
| | P-551 | D-551 | D-604 | (N/A) | 0.00 | 37.38 | 30.38 | 2.79 | 3.25 | 106.78 | 124.02 | 66 | 158.73 | 0.20 | 649.80 | 649.48 | 6.13 | 130.67 | 0.17 | 654.31 | 654.03 | 668.28 | 666.54 | |
| | P-614 | D-614 | D-613 | 0.02 | 0.02 | 0.02 | 10.00 | 4.94 | 5.63 | 0.11 | 0.12 | 12 | 14.51 | 2.00 | 657.47 | 657.18 | 2.35 | 4.36 | 0.04 | 657.71 | 657.71 | 663.70 | 663.99 | Just Full Vel >3 fps: sag under bridge |
| | P-636 | D-636 | D-636A | 1.00 | 1.00 | 0.68 | 15.00 | 4.13 | 4.74 | 2.82 | 3.24 | 15 | 125.53 | 4.62 | 660.00 | 654.20 | 8.01 | 12.03 | 4.25 | 660.72 | 654.64 | 666.50 | 665.03 | |
| | P-628 | D-628 | D-627 | 0.13 | 0.13 | 0.09 | 10.00 | 4.94 | 5.63 | 0.46 | 0.52 | 12 | 40.14 | 3.69 | 657.50 | 656.02 | 4.48 | 5.93 | 3.39 | 657.80 | 656.22 | 663.70 | 663.30 | |
| | P-627 | D-627 | D-626 | 0.10 | 0.23 | 0.16 | 10.15 | 4.91 | 5.60 | 0.78 | 0.89 | 12 | 31.11 | 0.90 | 654.15 | 653.87 | 3.15 | 2.93 | 0.90 | 654.54 | 654.28 | 663.30 | 664.10 | |
| | P-629 | D-629 | D-626 | 0.09 | 0.09 | 0.05 | 15.00 | 4.13 | 4.74 | 0.19 | 0.21 | 12 | 35.25 | 2.84 | 657.58 | 656.58 | 3.13 | 5.20 | 2.72 | 657.77 | 656.72 | 662.77 | 664.10 | |
| | P-611 | D-611 | D-602 | (N/A) | 1.39 | 0.91 | 16.39 | 3.95 | 4.52 | 3.63 | 4.16 | 15 | 48.01 | 1.00 | 651.76 | 651.28 | 4.85 | 5.60 | 0.42 | 653.48 | 653.22 | 665.13 | 666.33 | |
| | P-622 | D-622 | D-620 | (N/A) | 0.48 | 0.34 | 15.70 | 4.04 | 4.64 | 1.39 | 1.60 | 15 | 84.90 | 0.60 | 652.59 | 652.08 | 3.15 | 4.34 | 0.18 | 653.65 | 653.59 | 664.04 | 665.24 | |
| | P-626 | D-626 | D-622 | (N/A) | 0.32 | 0.20 | 15.19 | 4.11 | 4.71 | 0.84 | 0.96 | 12 | 102.90 | 1.00 | 653.87 | 652.84 | 3.34 | 3.09 | 1.00 | 654.28 | 653.65 | 664.10 | 664.04 | |
| | P-636A | D-636A | D-604 | (N/A) | 1.00 | 0.68 | 15.26 | 4.10 | 4.70 | 2.80 | 3.21 | 15 | 110.50 | 1.00 | 654.20 | 653.10 | 4.56 | 5.59 | 0.99 | 654.92 | 654.03 | 665.03 | 666.54 | |
| | P-639 | D-639 | D-641 | 1.15 | 1.15 | 1.04 | 10.00 | 4.94 | 5.63 | 5.17 | 5.89 | 15 | 15.60 | 21.03 | 663.00 | 659.72 | 16.36 | 25.67 | 7.89 | 663.98 | 660.19 | 666.79 | 666.22 | |
| | P-640 | D-640 | D-641 | 0.01 | 0.01 | 0.01 | 10.00 | 4.94 | 5.63 | 0.06 | 0.07 | 15 | 15.92 | 2.01 | 662.36 | 662.04 | 1.90 | 7.94 | 1.96 | 662.46 | 662.12 | 666.21 | 666.22 | Just Full Vel >3 fps: scupper |
| | P-641 | D-641 | D-602 | (N/A) | 1.55 | 1.39 | 10.63 | 4.82 | 5.51 | 6.77 | 7.73 | 15 | 48.92 | 2.04 | 654.04 | 653.04 | 7.31 | 8.00 | 1.89 | 655.14 | 654.03 | 666.22 | 666.33 | |
| | P-642 | D-642 | D-644 | 0.15 | 0.15 | 0.13 | 10.00 | 4.94 | 5.63 | 0.65 | 0.74 | 15 | 74.71 | 7.71 | 663.81 | 658.05 | 6.25 | 15.54 | 7.55 | 664.15 | 658.60 | 668.81 | 669.59 | |
| | P-643 | D-643 | D-644 | 0.24 | 0.24 | 0.21 | 10.00 | 4.94 | 5.63 | 1.06 | 1.21 | 15 | 30.31 | 36.89 | 671.73 | 660.55 | 12.58 | 34.00 | 30.11 | 672.16 | 660.71 | 676.73 | 669.59 | |
| | P-644 | D-644 | D-641 | (N/A) | 0.38 | 0.34 | 10.20 | 4.90 | 5.59 | 1.70 | 1.94 | 15 | 146.86 | 2.73 | 658.05 | 654.04 | 5.75 | 9.25 | 2.48 | 658.60 | 655.14 | 669.59 | 666.22 | |
| | P-550 | D-550 | D-551 | 47.32 | 0.00 | 37.38 | 30.00 | 2.81 | 3.27 | 107.60 | 124.92 | 66 | 139.39 | 0.20 | 650.08 | 649.80 | 6.13 | 130.43 | 0.18 | 654.56 | 654.31 | 665.00 | 668.28 | |
| | P-204 | D-204 | D-203 | 0.21 | 0.21 | 0.19 | 10.00 | 4.94 | 5.63 | 0.93 | 1.06 | 15 | 64.72 | 19.75 | 689.00 | 676.22 | 9.70 | 24.88 | 18.81 | 689.41 | 677.38 | 695.50 | 685.50 | |
| | P-202C | D-202C | D-202B | 0.61 | 0.61 | 0.55 | 10.00 | 4.94 | 5.63 | 2.72 | 3.10 | 15 | 197.35 | 1.50 | 687.67 | 684.71 | 5.26 | 6.86 | 1.49 | 688.38 | 685.53 | 694.17 | 691.37 | |
| | P-202B | D-202B | D-202 | 0.22 | 0.83 | 0.75 | 10.63 | 4.82 | 5.50 | 3.62 | 4.13 | 15 | 144.80 | 3.04 | 684.71 | 680.31 | 7.37 | 9.76 | 3.02 | 685.53 | 681.28 | 691.37 | 689.67 | |
| | P-638 | D-638 | D-670 | 1.35 | 1.35 | 1.15 | 15.00 | 4.13 | 4.74 | 4.79 | 5.49 | 15 | 93.28 | 16.80 | 676.10 | 660.43 | 14.78 | 22.94 | 16.80 | 677.05 | 661.41 | 683.50 | 667.97 | |
| | P-608 | D-605 | D-670 | 0.14 | 0.14 | 0.10 | 15.00 | 4.13 | 4.74 | 0.42 | 0.48 | 15 | 175.35 | 1.92 | 663.80 | 660.43 | 3.37 | 7.76 | 1.59 | 664.07 | 661.41 | 672.00 | 667.97 | |
| BD1033 | P-816 | D-816 | D-817 | 0.52 | 0.52 | 0.36 | 10.00 | 4.94 | 5.63 | 1.81 | 2.06 | 12 | 18.82 | 2.13 | 660.10 | 659.70 | 5.42 | 4.50 | 1.70 | 660.71 | 660.18 | 666.62 | 667.15 | |
| | P-818 | D-818 | Y-818 | 0.09 | 0.09 | 0.07 | 10.00 | 4.94 | 5.63 | 0.33 | 0.38 | 12 | 19.24 | 1.88 | 663.00 | 662.64 | 3.22 | 4.24 | 1.74 | 663.26 | 662.84 | 668.08 | 668.90 | |
| | P-815 | D-815 | D-817 | 0.22 | 0.22 | 0.20 | 10.00 | 4.94 | 5.63 | 0.98 | 1.12 | 12 | 22.14 | 0.99 | 659.92 | 659.70 | 3.48 | 3.08 | 0.99 | 660.36 | 660.19 | 666.50 | 667.15 | |
| | P-817 | D-817 | Y-818 | (N/A) | 0.74 | 0.56 | 10.11 | 4.92 | 5.61 | 2.78 | 3.17 | 15 | 131.41 | 0.75 | 659.45 | 658.47 | 4.08 | 4.83 | 0.75 | 660.19 | 659.19 | 667.15 | 668.90 | |

Michael Baker INTERNATIONAL

**STORM SEWER - ORD FLEX TABLES**
PROJECT: CUY-90-16.28 (CCG3A)
PID: 82380

Computed by: BT Date: 1/5/24
Checked by: KGJ Date: 1/7/24


| Model | Conduit Label | Start Node | Stop Node | Area (acres) | System Area (acres) | ∑C*A (acres) | Begin Time (min) | Rainfull Intensity - 10 yr (in/h) | Rainfull Intensity - 25 yr (in/h) | Discharge- 10 yr (cfs) | Discharge- 25 yr (cfs) | Size (in) | Pipe Length (ft) | Slope (%) | Invert (In) (ft) | Invert (Out) (ft) | Velocity (ft/s) | Just Full Capacity (cfs) | Friction Slope (%) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Cover (In) (ft) | Cover (Out) (ft) | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BD1034 | P-812 | D-812 | D-813 | 0.22 | 0.22 | 0.14 | 10.00 | 4.94 | 5.63 | 0.70 | 0.80 | 12 | 24.73 | 1.87 | 662.21 | 661.75 | 3.97 | 4.22 | 0.20 | 663.11 | 663.09 | 667.04 | 667.30 | |
| | P-814 | D-814 | D-813 | 0.32 | 0.32 | 0.28 | 10.00 | 4.94 | 5.63 | 1.41 | 1.61 | 12 | 19.74 | 0.81 | 661.91 | 661.75 | 3.56 | 2.78 | 0.22 | 663.15 | 663.09 | 666.74 | 667.30 | |
| | P-813 | D-813 | Y-813 | (N/A) | 1.23 | 0.88 | 10.37 | 4.87 | 5.55 | 4.32 | 4.92 | 12 | 122.01 | 2.25 | 661.75 | 659.00 | 6.70 | 4.64 | 2.21 | 663.09 | 660.00 | 667.30 | 657.00 | |
| | P-810 | D-810 | Y-810 | 0.20 | 0.20 | 0.17 | 10.00 | 4.94 | 5.63 | 0.83 | 0.94 | 12 | 61.22 | 1.00 | 659.11 | 658.50 | 3.33 | 3.08 | 0.99 | 659.52 | 658.92 | 669.25 | 663.25 | |
| | P-811 | D-811 | Y-811 | 0.28 | 0.28 | 0.20 | 10.00 | 4.94 | 5.63 | 1.00 | 1.14 | 12 | 61.76 | 2.66 | 662.82 | 661.18 | 5.00 | 5.03 | 2.48 | 663.27 | 661.50 | 669.25 | 664.00 | |
| | P-822 | D-822 | D-813 | 0.70 | 0.70 | 0.46 | 10.00 | 4.94 | 5.63 | 2.27 | 2.58 | 12 | 77.95 | 0.60 | 664.29 | 663.82 | 3.47 | 2.40 | 0.65 | 665.17 | 664.51 | 667.33 | 667.30 | |
| | P-823 | D-823 | X-824 | 0.36 | 0.35 | 0.23 | 10.00 | 4.94 | 5.63 | 1.15 | 1.31 | 12 | 57.62 | 2.73 | 664.44 | 662.87 | 5.24 | 5.10 | 2.51 | 664.92 | 663.21 | 668.37 | 669.04 | |
| BD1035 | P-758 | D-758 | Y-759 | 0.17 | 0.17 | 0.15 | 10.00 | 4.94 | 5.63 | 0.76 | 0.86 | 12 | 100.39 | 3.43 | 660.50 | 657.06 | 5.05 | 5.72 | 3.28 | 660.89 | 657.32 | 667.72 | 653.72 | |
| | P-755 | D-755 | D-754 | 0.21 | 0.21 | 0.18 | 10.00 | 4.94 | 5.63 | 0.88 | 1.00 | 12 | 9.63 | 1.04 | 662.19 | 662.09 | 3.43 | 3.15 | 0.98 | 662.61 | 662.48 | 667.19 | 667.64 | |
| | P-756 | D-756 | D-754 | 0.11 | 0.15 | 0.13 | 10.18 | 4.91 | 5.60 | 0.66 | 0.75 | 12 | 58.38 | 1.28 | 660.75 | 660.00 | 3.42 | 3.50 | 1.26 | 661.11 | 660.32 | 667.47 | 667.64 | |
| | P-760a | D-760a | Y-759 | 0.18 | 0.18 | 0.16 | 10.00 | 4.94 | 5.63 | 0.81 | 0.92 | 12 | 76.78 | 3.00 | 661.29 | 658.99 | 4.91 | 5.34 | 2.84 | 661.69 | 659.27 | 667.68 | 653.72 | |
| | P-757 | D-757 | Y-759 | 0.03 | 0.03 | 0.03 | 10.00 | 4.94 | 5.63 | 0.13 | 0.15 | 12 | 58.13 | 9.00 | 660.86 | 655.63 | 4.21 | 9.26 | 8.72 | 661.02 | 655.72 | 667.73 | 653.72 | |
| | P-751 | D-751 | D-754 | 0.07 | 0.07 | 0.06 | 10.00 | 4.94 | 5.63 | 0.31 | 0.35 | 12 | 71.92 | 1.68 | 662.51 | 661.30 | 3.02 | 4.00 | 1.65 | 662.75 | 661.50 | 667.51 | 667.64 | |
| | P-753 | D-753 | D-756 | 0.03 | 0.03 | 0.03 | 10.00 | 4.94 | 5.63 | 0.15 | 0.17 | 12 | 35.72 | 3.92 | 662.15 | 660.75 | 3.29 | 6.11 | 3.56 | 662.32 | 661.11 | 667.34 | 667.47 | |
| BD1036 | P-730 | D-730 | D-731 | 0.22 | 0.22 | 0.17 | 10.00 | 4.94 | 5.63 | 0.85 | 0.97 | 12 | 30.00 | 0.84 | 665.68 | 665.43 | 3.15 | 2.83 | 0.84 | 666.10 | 665.83 | 670.19 | 670.07 | |
| | P-731 | D-731 | Y-731 | 0.05 | 0.28 | 0.21 | 10.16 | 4.91 | 5.60 | 1.04 | 1.19 | 12 | 21.73 | 24.40 | 665.00 | 659.70 | 11.10 | 15.25 | 17.49 | 665.46 | 659.89 | 670.07 | 659.70 | |
| | P-733 | D-733 | D-732 | 0.22 | 0.22 | 0.20 | 10.00 | 4.94 | 5.63 | 1.00 | 1.14 | 12 | 47.30 | 2.80 | 665.65 | 664.33 | 5.09 | 5.17 | 2.55 | 666.10 | 664.64 | 670.07 | 670.35 | |
| | P-736 | D-736 | D-735 | 0.18 | 0.18 | 0.16 | 10.00 | 4.94 | 5.63 | 0.81 | 0.92 | 12 | 46.10 | 0.93 | 665.34 | 664.92 | 3.22 | 2.97 | 0.92 | 665.75 | 665.30 | 670.34 | 670.50 | |
| | P-734 | D-734 | D-735 | 0.09 | 0.08 | 0.07 | 10.00 | 4.94 | 5.63 | 0.32 | 0.37 | 12 | 22.18 | 2.91 | 665.34 | 664.70 | 3.72 | 5.27 | 2.61 | 665.59 | 664.88 | 669.85 | 670.50 | |
| | P-738 | D-738 | D-737 | 0.08 | 0.08 | 0.07 | 10.00 | 4.94 | 5.63 | 0.34 | 0.39 | 12 | 48.26 | 1.90 | 665.21 | 664.29 | 3.23 | 4.26 | 1.64 | 665.47 | 664.76 | 669.46 | 669.65 | |
| | P-737 | D-737 | D-735 | 0.16 | 0.24 | 0.21 | 10.25 | 4.89 | 5.58 | 1.06 | 1.21 | 12 | 64.19 | 1.01 | 664.29 | 663.64 | 3.58 | 3.11 | 1.01 | 664.76 | 664.08 | 669.65 | 670.50 | |
| BD1038 | X-700 | D-700 | Y-700 | 0.38 | 0.38 | 0.34 | 10.00 | 4.94 | 5.63 | 1.70 | 1.93 | 12 | 7.07 | 12.20 | 667.49 | 666.63 | 10.01 | 10.79 | 4.29 | 668.08 | 666.97 | 671.14 | 671.73 | |
| | P-701 | D-701 | D-701A | 0.19 | 0.19 | 0.16 | 10.00 | 4.94 | 5.63 | 0.79 | 0.90 | 12 | 58.64 | 4.95 | 663.00 | 660.10 | 5.83 | 6.87 | 4.68 | 663.40 | 660.77 | 669.24 | 669.86 | |
| | P-703 | D-703 | D-701A | 0.39 | 0.39 | 0.28 | 10.00 | 4.94 | 5.63 | 1.40 | 1.60 | 12 | 88.43 | 2.00 | 661.87 | 660.10 | 4.95 | 4.37 | 1.95 | 662.41 | 660.77 | 668.38 | 669.86 | |
| | X-707 | D-707 | Y-707 | 0.34 | 0.34 | 0.24 | 10.00 | 4.94 | 5.63 | 1.20 | 1.37 | 12 | 8.00 | 1.65 | 663.45 | 663.32 | 4.43 | 3.97 | 1.28 | 663.95 | 663.74 | 668.66 | 665.84 | |
| | P-708A | D-708 | D-708A | 0.04 | 0.04 | 0.04 | 10.00 | 4.94 | 5.63 | 0.19 | 0.22 | 12 | 25.56 | 2.79 | 662.30 | 661.59 | 3.13 | 5.16 | 2.63 | 662.50 | 661.73 | 666.83 | 667.69 | |
| | P-710 | D-710 | D-711 | 0.56 | 0.56 | 0.37 | 10.00 | 4.94 | 5.63 | 1.84 | 2.10 | 15 | 29.61 | 4.53 | 662.50 | 661.16 | 7.04 | 11.91 | 3.32 | 663.08 | 661.52 | 666.00 | 666.85 | |
| | P-706 | D-706 | D-704 | 0.13 | 0.13 | 0.10 | 10.00 | 4.94 | 5.63 | 0.51 | 0.58 | 12 | 45.07 | 1.87 | 661.00 | 660.16 | 3.64 | 4.22 | 1.79 | 661.32 | 660.41 | 668.19 | 668.69 | |
| | P-712 | D-712 | D-709 | 0.23 | 0.23 | 0.20 | 10.00 | 4.94 | 5.63 | 1.01 | 1.16 | 12 | 42.38 | 4.37 | 659.86 | 658.01 | 5.99 | 6.45 | 3.79 | 660.31 | 658.30 | 666.28 | 666.87 | |
| | P-702 | D-702 | D-709 | 0.27 | 0.27 | 0.24 | 10.00 | 4.94 | 5.63 | 1.20 | 1.36 | 12 | 44.65 | 9.88 | 659.91 | 655.50 | 8.41 | 9.70 | 8.32 | 660.40 | 655.75 | 666.34 | 666.87 | |
| | P-701A | D-701A | Y-681 | (N/A) | 0.58 | 0.44 | 10.30 | 4.89 | 5.57 | 2.17 | 2.47 | 12 | 62.34 | 2.82 | 660.10 | 658.34 | 6.31 | 5.19 | 2.55 | 660.77 | 658.83 | 669.86 | 664.10 | |
| | P-705A | D-705 | D-705B | 0.17 | 0.17 | 0.10 | 10.00 | 4.94 | 5.63 | 0.51 | 0.58 | 12 | 14.22 | 2.03 | 662.91 | 662.62 | 3.74 | 4.40 | 1.72 | 663.23 | 662.87 | 667.44 | 668.14 | |
| | P-705C | D-705C | D-704 | (N/A) | 0.17 | 0.10 | 10.07 | 4.93 | 5.62 | 0.51 | 0.58 | 12 | 6.91 | 0.58 | 658.20 | 658.16 | 2.39 | 2.35 | 0.61 | 658.54 | 658.48 | 668.28 | 668.69 | Low pipe of broken back, vel will be high |
| | P-705B | D-705B | D-705C | (N/A) | 0.17 | 0.10 | 10.06 | 4.93 | 5.62 | 0.51 | 0.58 | 12 | 5.85 | 75.54 | 662.62 | 658.20 | 13.28 | 26.84 | 75.51 | 662.94 | 658.54 | 668.14 | 668.28 | |
| | P-708B | D-708A | D-708B | (N/A) | 0.04 | 0.04 | 10.14 | 4.92 | 5.60 | 0.19 | 0.22 | 12 | 5.34 | 75.09 | 661.59 | 657.58 | 9.81 | 26.75 | 75.05 | 661.78 | 657.79 | 667.69 | 667.58 | |
| | P-708C | D-708B | D-709 | (N/A) | 0.04 | 0.04 | 10.15 | 4.92 | 5.60 | 0.19 | 0.22 | 12 | 7.06 | 0.57 | 657.58 | 657.54 | 1.78 | 2.32 | 0.60 | 657.79 | 657.73 | 667.58 | 666.87 | Low pipe of broken back, vel will be high |
| BD1039 | P-194 | D-194 | X-194 | 0.14 | 0.42 | 0.38 | 10.62 | 4.82 | 5.50 | 1.83 | 2.08 | 18 | 18.58 | 0.22 | 688.80 | 688.76 | 2.30 | 4.22 | 0.40 | 689.46 | 689.30 | 697.06 | 697.83 | Ex 18" pipe |
| | P-190 | D-190 | D-191 | 0.14 | 0.14 | 0.13 | 10.00 | 4.94 | 5.63 | 0.65 | 0.74 | 15 | 75.00 | 2.00 | 692.70 | 691.20 | 3.89 | 7.92 | 1.93 | 693.04 | 691.67 | 697.70 | 697.20 | |
| | P-191 | D-191 | D-194 | 0.13 | 0.28 | 0.25 | 10.32 | 4.88 | 5.57 | 1.22 | 1.39 | 15 | 85.00 | 2.00 | 691.20 | 689.50 | 4.68 | 7.92 | 1.91 | 691.67 | 689.85 | 697.20 | 697.06 | |
| | P-193 | D-193 | X-193 | 0.18 | 0.18 | 0.17 | 10.00 | 4.94 | 5.63 | 0.83 | 0.94 | 15 | 207.71 | 0.89 | 688.50 | 686.66 | 3.13 | 5.27 | 0.88 | 688.88 | 687.02 | 692.99 | 686.66 | |
| | P-422 | D-422 | D-421 | 0.14 | 0.14 | 0.13 | 10.00 | 4.94 | 5.63 | 0.64 | 0.73 | 15 | 22.71 | 4.49 | 669.00 | 667.98 | 5.16 | 11.86 | 3.67 | 669.33 | 668.19 | 673.52 | 672.95 | |
| | P-420 | D-420 | D-421 | 2.10 | 2.10 | 1.36 | 15.00 | 4.13 | 4.74 | 5.68 | 6.51 | 15 | 46.60 | 1.44 | 667.76 | 667.09 | 6.13 | 6.71 | 1.40 | 668.79 | 668.08 | 671.26 | 672.95 | |
| | P-411B | D-411B | D-411A | 0.36 | 0.36 | 0.32 | 10.00 | 4.94 | 5.63 | 1.60 | 1.82 | 15 | 51.01 | 1.00 | 676.40 | 675.89 | 3.93 | 5.60 | 1.00 | 676.94 | 676.45 | 682.90 | 684.66 | |
| | P-411A | D-411A | D-411 | 0.03 | 0.39 | 0.35 | 10.22 | 4.90 | 5.59 | 1.74 | 1.98 | 15 | 40.30 | 1.02 | 675.89 | 675.48 | 4.05 | 5.65 | 0.99 | 676.45 | 675.99 | 684.66 | 686.00 | |
| | P-411 | D-411 | Y-411 | (N/A) | 3.61 | 2.40 | 16.00 | 4.00 | 4.60 | 9.69 | 11.14 | 18 | 139.88 | 2.13 | 657.75 | 654.77 | 8.21 | 13.29 | 2.01 | 659.03 | 655.82 | 686.00 | 678.31 | |
| | P-410A | D-410A | D-411 | (N/A) | 3.22 | 2.05 | 15.80 | 4.03 | 4.62 | 8.32 | 9.56 | 18 | 87.92 | 1.72 | 659.26 | 657.75 | 7.30 | 11.93 | 1.70 | 660.46 | 659.03 | 681.75 | 686.00 | |
| | P-410 | D-410 | D-410A | 1.39 | 3.22 | 2.05 | 15.48 | 4.07 | 4.67 | 8.41 | 9.65 | 18 | 139.85 | 1.72 | 661.67 | 659.26 | 7.32 | 11.95 | 1.66 | 662.87 | 660.28 | 668.50 | 681.75 | |
| | P-409 | D-409 | D-410 | 1.83 | 1.83 | 1.21 | 15.00 | 4.13 | 4.74 | 5.02 | 5.75 | 15 | 162.74 | 1.25 | 665.12 | 663.09 | 5.66 | 6.25 | 1.24 | 666.09 | 664.04 | 668.62 | 668.50 | |
| | P-408 | D-408 | H-408 | 0.60 | 0.60 | 0.54 | 10.00 | 4.94 | 5.63 | 2.71 | 3.08 | 15 | 66.50 | 2.54 | 677.69 | 676.00 | 6.38 | 8.92 | 2.27 | 678.40 | 676.51 | 683.54 | 676.00 | |

Michael Baker
INTERNATIONAL

**STORM SEWER - ORD FLEX TABLES**
PROJECT: CUY-90-16.28 (CCG3A)
PID: 82380

Computed by: BT Date: 1/5/24
Checked by: KGJ Date: 1/7/24


| Model | Conduit Label | Start Node | Stop Node | Area (acres) | System Area (acres) | ∑C*A (acres) | Begin Time (min) | Rainfull Intensity - 10 yr (in/h) | Rainfull Intensity - 25 yr (in/h) | Discharge- 10 yr (cfs) | Discharge- 25 yr (cfs) | Size (in) | Pipe Length (ft) | Slope (%) | Invert (In) (ft) | Invert (Out) (ft) | Velocity (ft/s) | Just Full Capacity (cfs) | Friction Slope (%) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) | Cover (In) (ft) | Cover (Out) (ft) | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BD1040 | P-327 | D-327 | D-328 | 0.46 | 0.46 | 0.33 | 10.00 | 4.94 | 5.63 | 1.67 | 1.90 | 12 | 16.71 | 2.75 | 672.71 | 672.25 | 5.83 | 5.12 | 2.00 | 673.30 | 672.68 | 675.92 | 675.99 | |
| | X-328 | D-328 | Y-328 | (N/A) | 0.46 | 0.33 | 10.05 | 4.93 | 5.62 | 1.66 | 1.90 | 12 | 5.00 | 1.00 | 672.25 | 672.20 | 4.01 | 3.09 | 0.96 | 672.84 | 672.77 | 675.99 | 693.29 | |
| | P-315 | D-315 | D-316 | 0.01 | 0.01 | 0.01 | 10.00 | 4.94 | 5.63 | 0.04 | 0.04 | 15 | 71.82 | 4.14 | 697.98 | 695.01 | 2.08 | 11.38 | 3.86 | 698.06 | 695.32 | 704.48 | 701.51 | Just Full Vel >3 fps: downstream scupper |
| | P-316 | D-316 | D-321 | 0.12 | 0.13 | 0.11 | 10.57 | 4.83 | 5.52 | 0.56 | 0.64 | 15 | 32.91 | 15.22 | 695.01 | 690.00 | 7.59 | 21.84 | 14.76 | 695.32 | 690.56 | 701.51 | 700.55 | |
| | P-321 | D-321 | D-322 | (N/A) | 0.40 | 0.36 | 10.81 | 4.79 | 5.47 | 1.76 | 2.01 | 15 | 89.52 | 6.00 | 690.00 | 684.63 | 7.68 | 13.71 | 5.45 | 690.56 | 684.95 | 700.55 | 693.29 | |
| | P-322 | D-322 | D-323 | (N/A) | 0.40 | 0.36 | 11.00 | 4.75 | 5.43 | 1.75 | 1.99 | 15 | 118.52 | 14.03 | 684.63 | 668.00 | 10.35 | 20.97 | 13.03 | 685.19 | 668.26 | 693.29 | 675.30 | |
| | P-323 | D-323 | Y-651 | (N/A) | 0.40 | 0.36 | 11.19 | 4.72 | 5.39 | 1.73 | 1.98 | 15 | 68.27 | 6.59 | 666.00 | 661.50 | 7.91 | 14.37 | 5.79 | 666.56 | 661.81 | 675.30 | 693.29 | |
| | P-324 | D-324 | D-326 | 0.09 | 0.09 | 0.08 | 10.00 | 4.94 | 5.63 | 0.41 | 0.47 | 15 | 41.99 | 2.38 | 670.00 | 669.00 | 3.62 | 8.64 | 1.13 | 670.27 | 669.92 | 676.65 | 675.50 | |
| | P-325 | D-325 | D-326 | 0.91 | 0.91 | 0.82 | 10.00 | 4.94 | 5.63 | 4.09 | 4.66 | 15 | 18.01 | 5.55 | 670.00 | 669.00 | 9.48 | 13.19 | 5.54 | 670.88 | 669.92 | 677.10 | 675.50 | |
| | P-326 | D-326 | Y-326 | (N/A) | 1.00 | 0.90 | 10.19 | 4.91 | 5.59 | 4.47 | 5.09 | 15 | 8.19 | 12.21 | 669.00 | 668.00 | 12.93 | 19.56 | 3.52 | 669.92 | 668.55 | 675.50 | 674.43 | |
| | P-320 | D-320 | D-318 | 0.13 | 0.13 | 0.12 | 10.00 | 4.94 | 5.63 | 0.58 | 0.66 | 15 | 70.60 | 1.20 | 692.47 | 691.62 | 3.15 | 6.14 | 1.11 | 692.79 | 692.09 | 697.75 | 697.86 | |
| | P-318 | D-318 | D-321 | 0.15 | 0.28 | 0.25 | 10.37 | 4.87 | 5.56 | 1.22 | 1.40 | 15 | 109.33 | 1.48 | 691.62 | 690.00 | 4.20 | 6.81 | 1.46 | 692.09 | 690.56 | 697.86 | 700.55 | |
| BD1043 | P-531 | D-531 | Y-531 | (N/A) | 0.13 | 0.09 | 10.65 | 4.82 | 5.50 | 0.43 | 0.49 | 15 | 166.20 | 2.97 | 664.93 | 660.00 | 3.94 | 9.64 | 2.92 | 665.20 | 660.19 | 672.50 | 663.00 | |
| | P-530 | D-530 | D-530A | 0.13 | 0.13 | 0.09 | 10.00 | 4.94 | 5.63 | 0.44 | 0.50 | 15 | 76.44 | 1.50 | 666.75 | 665.60 | 3.13 | 6.87 | 1.48 | 667.02 | 665.83 | 670.00 | 674.44 | |
| | P-530A | D-530A | D-531 | (N/A) | 0.13 | 0.09 | 10.41 | 4.86 | 5.55 | 0.43 | 0.49 | 15 | 44.81 | 1.50 | 665.60 | 664.93 | 3.11 | 6.85 | 1.45 | 665.87 | 665.16 | 674.44 | 672.50 | |

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix G

## NEORSD Peak Flows & Detention

Michael Baker INTERNATIONAL

LEGEND

- RUNOFF COEFFICIENT, C = 0.9
- RUNOFF COEFFICIENT, C = 0.7
- RUNOFF COEFFICIENT, C = 0.5
- CSO SEWERSHED BOUNDARY
- CCG3A CONSTRUCTION LIMITS
- CCG3B CONSTRUCTION LIMITS
- E. 14TH/WOODLAND DIVIDE

CSO-95

CSO-97

CSO-201

CSO-94

E 14TH

WOODLAND

HORIZONTAL SCALE IN FEET

0 100 200 400

# NEORSD PEAK FLOW MAPS - EXISTING AREAS CSO-94, CSO-95, & CSO-201

CTY-RTE-SECTION

MODEL: Existing CSO Cs (Sheet) PAPERSIZE: 17x11(in) DATE: 1/16/2024 TIME: 4:19:06 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\0001\District2\82382\999-Scratch\Baker\KathyJohnson\82382_B0201i.dgn

DESIGN AGENCY

Michael Baker INTERNATIONAL

| | |
|---|---|
| DESIGNER | KGJ |
| REVIEWER | SM 9/27/21 |
| PROJECT ID | 0 |
| SHEET | P.0 |
| TOTAL | 0 |

CUY-90-16.28 (CCG3A)

MODEL: Existing CSO Cs Trench (Sheet) PAPERSIZE: 17x11(In.) DATE: 1/16/2024 TIME: 3:54:33 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD2201.dgn


| SHEET | TOTAL |
|---|---|
| P.0 | 0 |

PROJECT ID: 0

REVIEWER: SM 9/27/21

DESIGNER: KGJ

Michael Baker INTERNATIONAL

DESIGN AGENCY

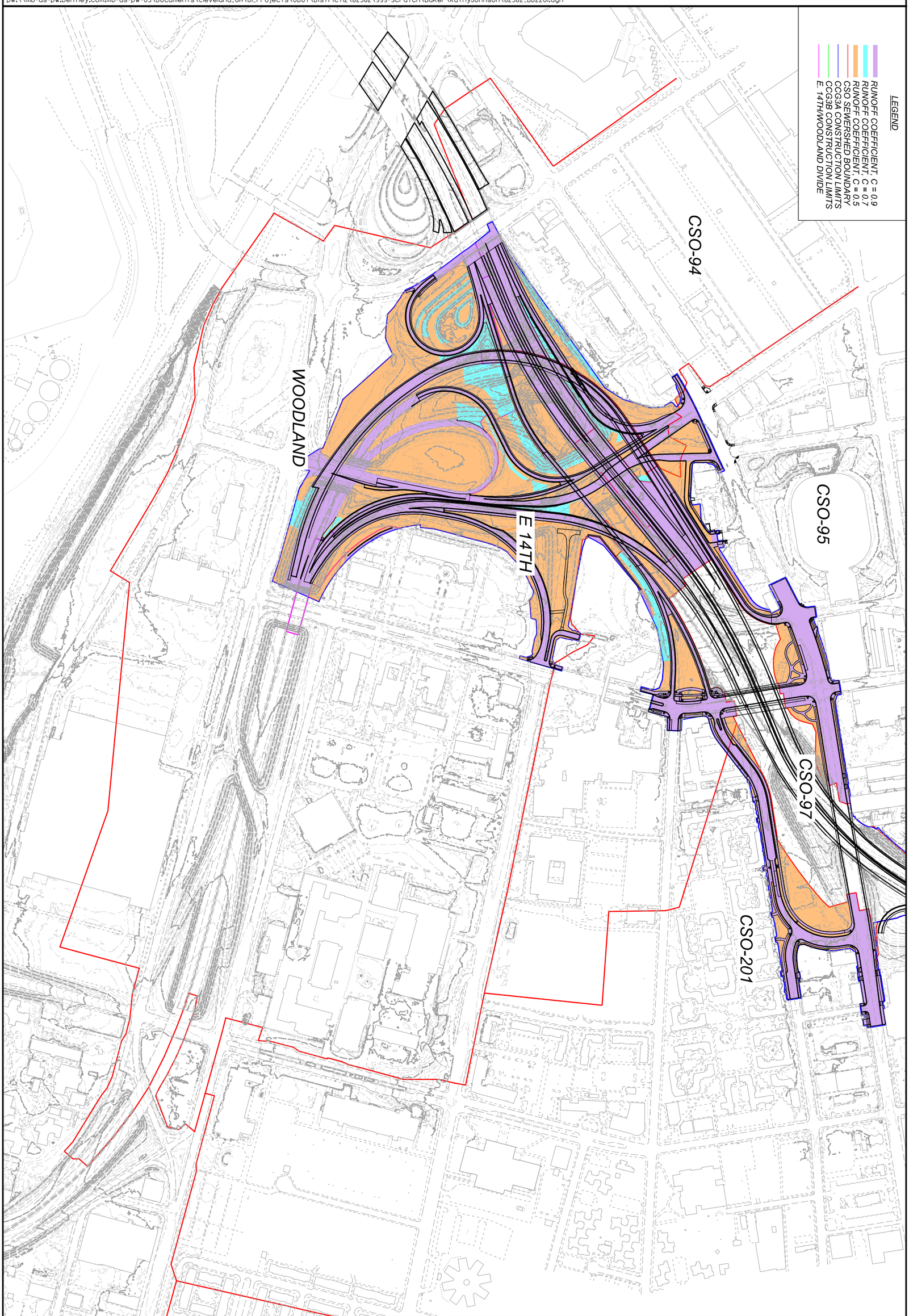
# NEORSD PEAK FLOW MAPS - EXISTING AREAS
# CSO-97

HORIZONTAL SCALE IN FEET

0 200
100 400

CTY-RTE-SECTION

MODEL: Proposed CSO Cs CCG3A (Sheet) PAPERSIZE: 17x11(in.) DATE: 1/16/2024 TIME: 8:20:03 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD2201.dgn




| SHEET | TOTAL |
|---|---|
| P.0 | 0 |

PROJECT ID: 0

REVIEWER: SM 9/27/21

DESIGNER: KGJ

Michael Baker INTERNATIONAL

DESIGN AGENCY

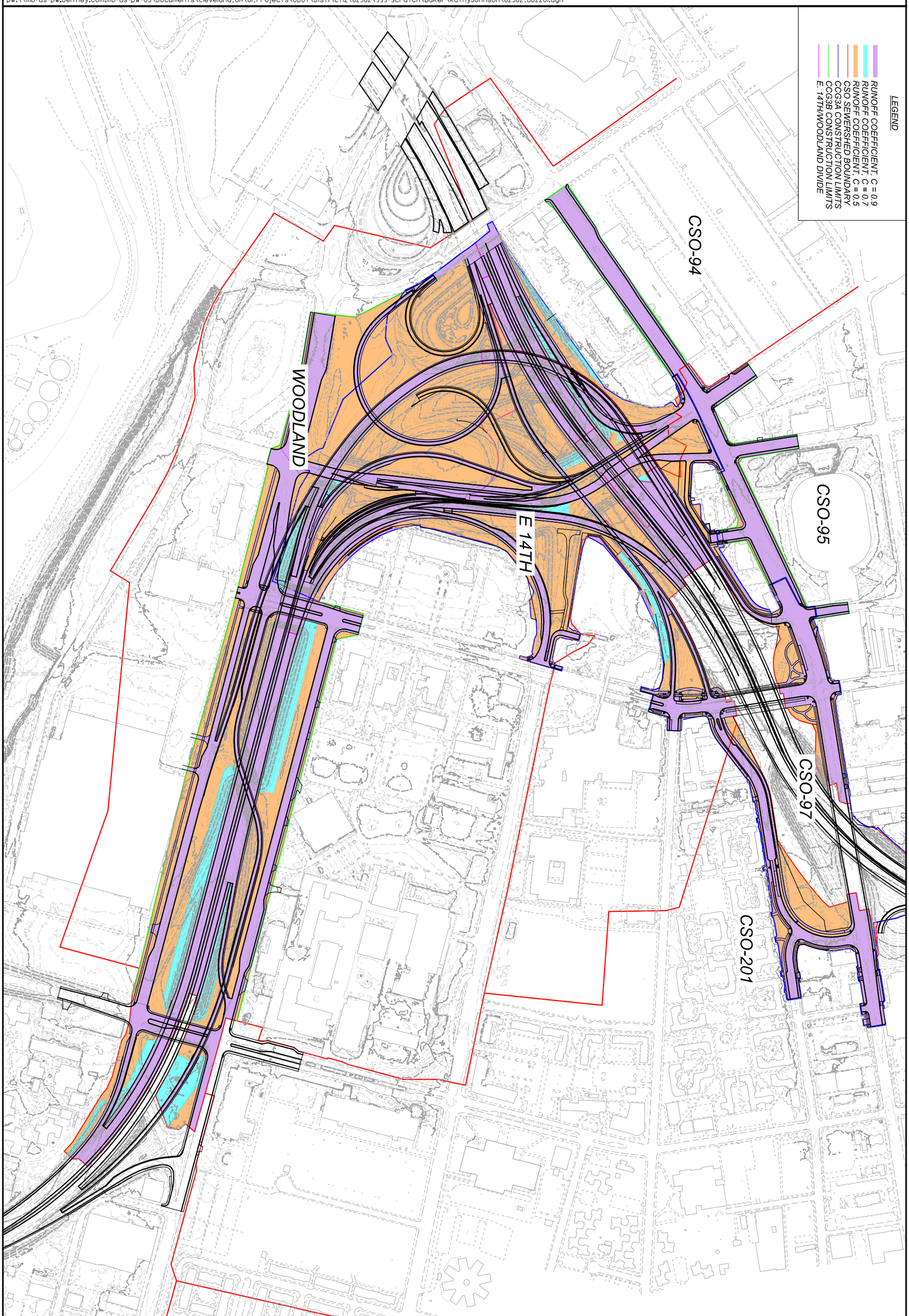
# NEORSD PEAK FLOW MAPS - CCG3A PROPOSED AREAS
## CSO-94, CSO-95, & CSO-201

HORIZONTAL SCALE IN FEET

0 200
100 400

CTY-RTE-SECTION

MODEL: Proposed CSO Cs CCG3B (Sheet) PAPERSIZE: 17x11(In.) DATE: 1/16/2024 TIME: 8:13:31 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD2201.dgn



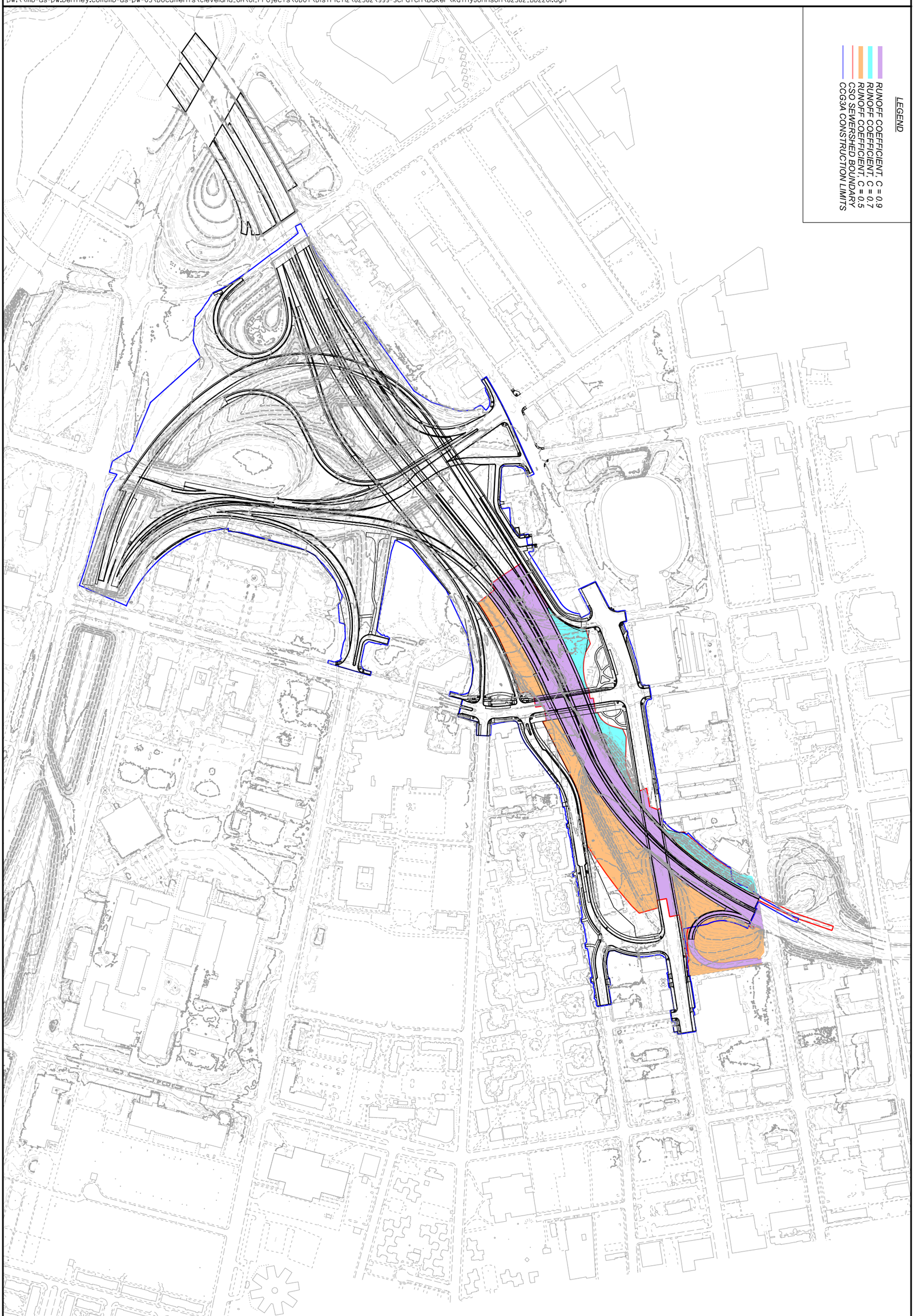

NEORSD PEAK FLOW MAPS - CCG3 PROPOSED AREAS
CSO-94, CSO-95, & CSO-201

HORIZONTAL SCALE IN FEET
0 200
100 400

| SHEET | TOTAL | PROJECT ID | REVIEWER | DESIGNER | DESIGN AGENCY |
|---|---|---|---|---|---|
| P.0 | 0 | 0 | SM 9/27/21 | KGJ | Michael Baker INTERNATIONAL |

CTY-RTE-SECTION

MODEL: Proposed CSO Cs Trench (Sheet) PAPERSIZE: 17x11(In.) DATE: 1/16/2024 TIME: 8:57:00 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD2201.dgn




| SHEET | TOTAL |
|---|---|
| P.0 | 0 |

PROJECT ID: 0

REVIEWER: SM 9/27/21

DESIGNER: KGJ

Michael Baker INTERNATIONAL

DESIGN AGENCY

# NEORSD PEAK FLOW MAPS - PROPOSED AREAS
# CSO-97

HORIZONTAL SCALE IN FEET

0 200
100 400

Michael Baker INTERNATIONAL

Project: CUY-90-16.28
PID: 82382
Subject: NEORSD PEAK DISCHARGE QUANTITIES

Computed by: KGJ Date: 8/16/23
Checked by: SM Date: 8/16/23


# CCG3 DRAINAGE RUNOFF COEFFICIENTS BY NEORSD CSO OUTFALL/NEORSD INTERCEPTOR

| Outfall | Runoff Coefficient | Pre-construction Drainage Area (acres) | Post-construction Drainage Area (acres) | Change in Area | Pre-construction Runoff Coefficient | Post-construction Runoff Coefficient | Pre-construction C*A | Post-construction C*A | C*A CHANGE |
|---|---|---|---|---|---|---|---|---|---|
| **CSO-94 (REG E-18) E. 12TH BRANCH FULL BUILD** | 0.9 | 40.13 | 39.57 | | **0.74** | **0.72** | **57.47** | **56.36** | **-1.11** |
| | 0.7 | 13.51 | 5.70 | | | | | | |
| | 0.5 | 24.02 | 33.01 | | | | | | |
| | Total | **77.66** | **78.28** | **0.62** | | | | | |
| **CSO-95 (REG E-13) E. 21ST BRANCH** | 0.9 | 17.24 | 13.66 | | **0.83** | **0.81** | **17.79** | **14.35** | **-3.45** |
| | 0.7 | 0.43 | 0.42 | | | | | | |
| | 0.5 | 3.77 | 3.63 | | | | | | |
| | Total | **21.44** | **17.71** | **-3.73** | | | | | |
| **CSO-201 (REG E-03) E. 30TH BRANCH** | 0.9 | 6.61 | 3.43 | | **0.87** | **0.75** | **6.24** | **4.10** | **-2.14** |
| | 0.7 | 0.00 | 0.00 | | | | | | |
| | 0.5 | 0.56 | 2.03 | | | | | | |
| | Total | **7.17** | **5.46** | **-1.71** | | | | | |
| **CSO-97 DOWNSTREAM OF REGULATOR I-90 TRENCH** | 0.9 | 5.00 | 8.16 | | **0.73** | **0.73** | **7.95** | **11.48** | **3.53** |
| | 0.7 | 2.70 | 1.53 | | | | | | |
| | 0.5 | 3.19 | 6.04 | | | | | | |
| | Total | **10.89** | **15.73** | **4.84** | | | | | |

**CCG3A IMPACTS TO E. 12TH BRANCH**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CSO-94 (REG E-18) E. 12TH BRANCH CCG3A** | 0.9 | 16.77 | 17.59 | | **0.71** | **0.70** | **27.83** | **27.64** | **-0.20** |
| | 0.7 | 8.15 | 3.51 | | | | | | |
| | 0.5 | 14.28 | 18.38 | | | | | | |
| | Total | **39.20** | **39.48** | **0.28** | | | | | |

**CCG3A IMPACTS TO E. 14TH AND WOODLAND BRANCHES OF E. 12TH INTERCEPTOR**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CSO-94 E. 14TH BRANCH CCG3A** | 0.9 | 6.26 | 10.80 | | **0.72** | **0.72** | **9.80** | **15.48** | **5.68** |
| | 0.7 | 2.44 | 1.52 | | | | | | |
| | 0.5 | 4.91 | 9.18 | | | | | | |
| | Total | **13.61** | **21.50** | **7.89** | | | | | |
| **CSO-94 WOODLAND BRANCH CCG3A** | 0.9 | 10.51 | 6.79 | | **0.71** | **0.67** | **18.17** | **12.05** | **-6.12** |
| | 0.7 | 5.71 | 1.99 | | | | | | |
| | 0.5 | 9.37 | 9.20 | | | | | | |
| | Total | **25.59** | **17.98** | **-7.61** | | | | | |

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

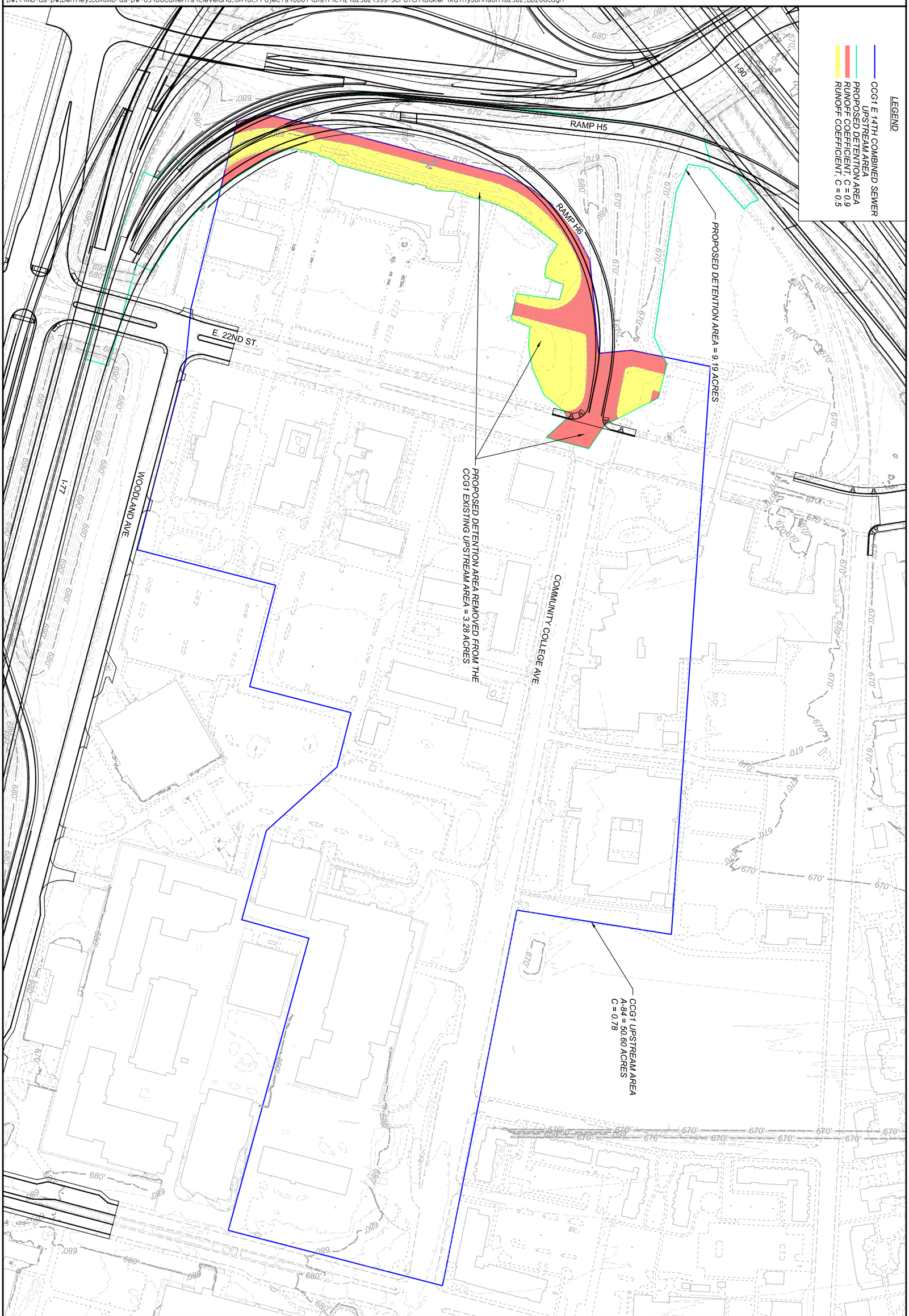
# Appendix H

## E. 14th Peak Flows & Detention

Michael Baker INTERNATIONAL

CTY-RTE-SECTION

MODEL: Proposed H5 Existing (Sheet) PAPERSIZE: 17x11(in.) DATE: 9/29/2021 TIME: 4:21:41 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD2001.dgn




| SHEET | TOTAL |
|---|---|
| P.0 | 0 |

PROJECT ID: 0

REVIEWER: SM 9/27/21

DESIGNER: KGJ

Michael Baker INTERNATIONAL

DESIGN AGENCY

# DRAINAGE AREA MAP
# E. 14TH COMBINED SEWER DETENTION

HORIZONTAL SCALE IN FEET

0 100
50 200

Michael Baker INTERNATIONAL

**RUNOFF COEFFICIENTS**
PROJECT: CUY-90-16.28
PID: 82382

Computed by: KGJ Date: 9/22/21
Checked by: SM Date: 9/28/21


**E. 14TH COMBINED SEWER ANALYSIS - UPDATES CCG1 WALL I 66" PIPE REHABILITATION PACKAGE (8/29/2011)**

| | SURFACE AREA (ACRES) | | | | TOTAL AREA (ACRES) | WEIGHTED CN | WEIGHTED C |
|---|---|---|---|---|---|---|---|
| | PAVEMENT | FAIR ROW GRASS >10:1 | FAIR ROW GRASS <10:1 | | | | |
| CN, CURVE NUMBER | 98 | 82 | 69 | | | | |
| C, RUNOFF COEFFICIENT | 0.9 | 0.7 | 0.3 | | | | |
| A84 CCG1 CONDITIONS | 40.18 | | 10.42 | | 50.60 | 92 | 0.78 |
| EX AREA REMOVED- INTO DETENTION | 1.44 | | 1.84 | | 3.28 | 82 | 0.56 |
| **REVISED A84** | **38.74** | | **8.58** | | **47.32** | **93** | **0.79** |

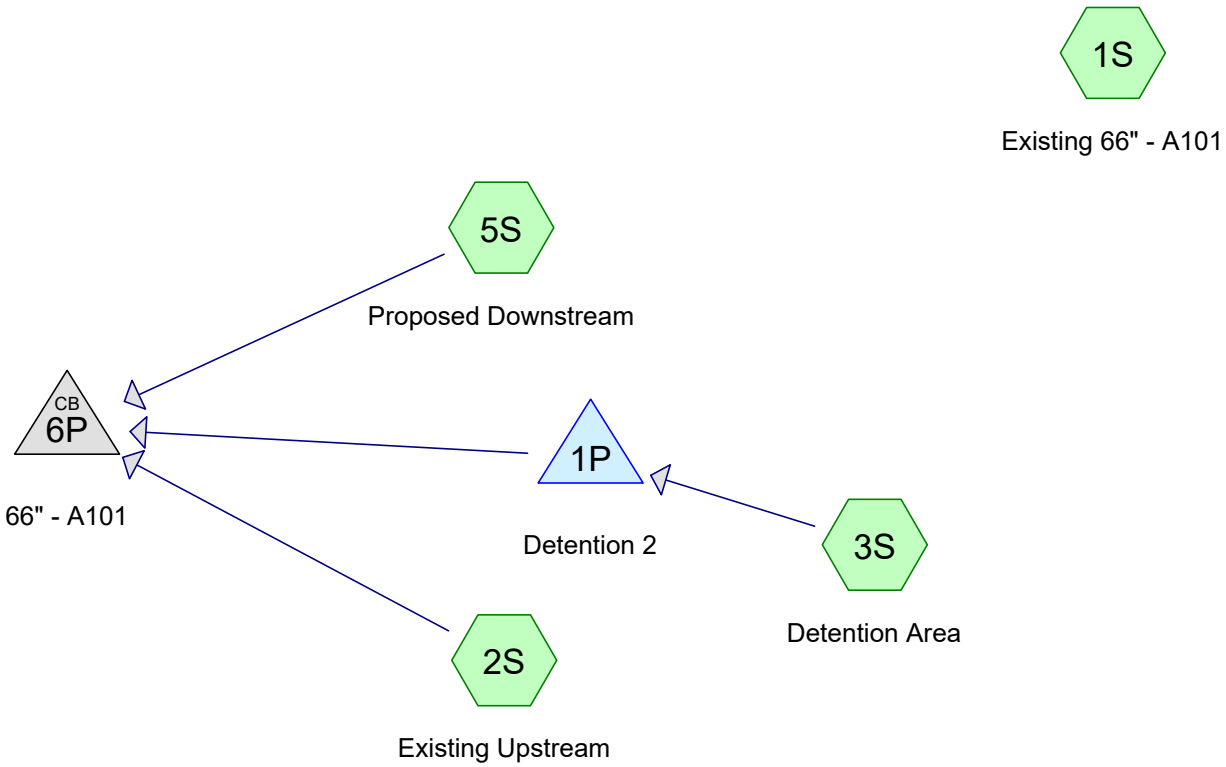
Michael Baker INTERNATIONAL

Project: CUY-90-16.28
PID: 82382
Subject: I-90 TRENCH PRE/POST COMPARISONS

Computed by: KGJ Date: 9/18/21
Checked by: SM Date: 9/27/21
Page: 1 of 1

## E 14TH OUTFALL @ 57" HOBAS LINER PRE/POST FLOWS

| | | EXISTING FLOW @ HOBAS A101 | | PROPOSED DETENTION 3 | | | PROPOSED FLOW @ HOBAS A101 | FLOW DIFFERENCE AT OUTFALL |
|---|---|---|---|---|---|---|---|---|
| | | CCG1 REPORT | HYDROCAD | IN | OUT | PEAK | | |
| PEAK FLOWS (CFS) | 1-YR | | 61.90 | 7.56 | 0.92 | 659.17 | 58.90 | -3.00 |
| | 2-YR | | 81.67 | 10.90 | 1.13 | 659.78 | 77.12 | -4.55 |
| | 5-YR | | 110.20 | 15.92 | 1.39 | 660.70 | 103.30 | -6.90 |
| | 10-YR | 141.8 | 132.72 | 20.05 | 1.56 | 661.41 | 123.99 | -8.73 |
| | 25-YR | 173.4 | 162.98 | 25.75 | 7.58 | 661.87 | 151.99 | -10.99 |
| | 50-YR | 184.4 | 187.19 | 30.35 | 10.03 | 662.16 | 178.40 | -8.79 |
| | 100-YR | | 211.93 | 35.06 | 10.69 | 662.68 | 205.69 | -6.24 |




Subcat Reach Pond Link

**Routing Diagram for H5-Alt1**
Prepared by Michael Baker, Printed 9/28/2021
HydroCAD® 10.10-5a s/n 11925 © 2020 HydroCAD Software Solutions LLC

## Project Notes

Copied 7 events from OH-CLE 24-hr S1 storm

## Rainfall Events Listing

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|---|---|---|---|---|---|---|---|---|
| 1 | 1-yr | OH-CLE 24-hr S1 | 1-yr | Default | 24.00 | 1 | 1.96 | 2 |
| 2 | 2-yr | OH-CLE 24-hr S1 | 2-yr | Default | 24.00 | 1 | 2.35 | 2 |
| 3 | 5-yr | OH-CLE 24-hr S1 | 5-yr | Default | 24.00 | 1 | 2.93 | 2 |
| 4 | 10-yr | OH-CLE 24-hr S1 | 10-yr | Default | 24.00 | 1 | 3.40 | 2 |
| 5 | 25-yr | OH-CLE 24-hr S1 | 25-yr | Default | 24.00 | 1 | 4.08 | 2 |
| 6 | 50-yr | OH-CLE 24-hr S1 | 50-yr | Default | 24.00 | 1 | 4.65 | 2 |
| 7 | 100-yr | OH-CLE 24-hr S1 | 100-yr | Default | 24.00 | 1 | 5.25 | 2 |

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 47.320 | 93 | Existing upstream determined from CCG1 (2S) |
| 50.600 | 92 | From CCG1 proposed (1S) |
| 11.380 | 89 | From CCG1 proposed (1S) |
| 6.310 | 90 | From CCG1 proposed (1S) |
| 2.988 | 74 | H5/H6 Gore (3S) |
| 2.282 | 74 | H6/H5/I-77 Interior Area (3S) |
| 13.111 | 83 | Proposed Drainage Area Downstream of Detention (5S) |
| 3.924 | 98 | Ramp H5/H6 Pavement (3S) |
| **137.915** | **91** | **TOTAL AREA** |

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>1.12"
Tc=32.5 min CN=91 Runoff=61.90 cfs 6.381 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>1.27"
Tc=30.0 min CN=93 Runoff=50.75 cfs 5.011 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>0.71"
Tc=15.0 min CN=84 Runoff=7.56 cfs 0.546 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>0.66"
Tc=19.4 min CN=83 Runoff=8.69 cfs 0.726 af

**Pond 1P: Detention 2** Peak Elev=659.17' Storage=0.265 af Inflow=7.56 cfs 0.546 af
Outflow=0.92 cfs 0.514 af

**Pond 6P: 66" - A101** Peak Elev=649.36' Inflow=58.90 cfs 6.251 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=58.90 cfs 6.251 af

**Total Runoff Area = 137.915 ac Runoff Volume = 12.664 af Average Runoff Depth = 1.10"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

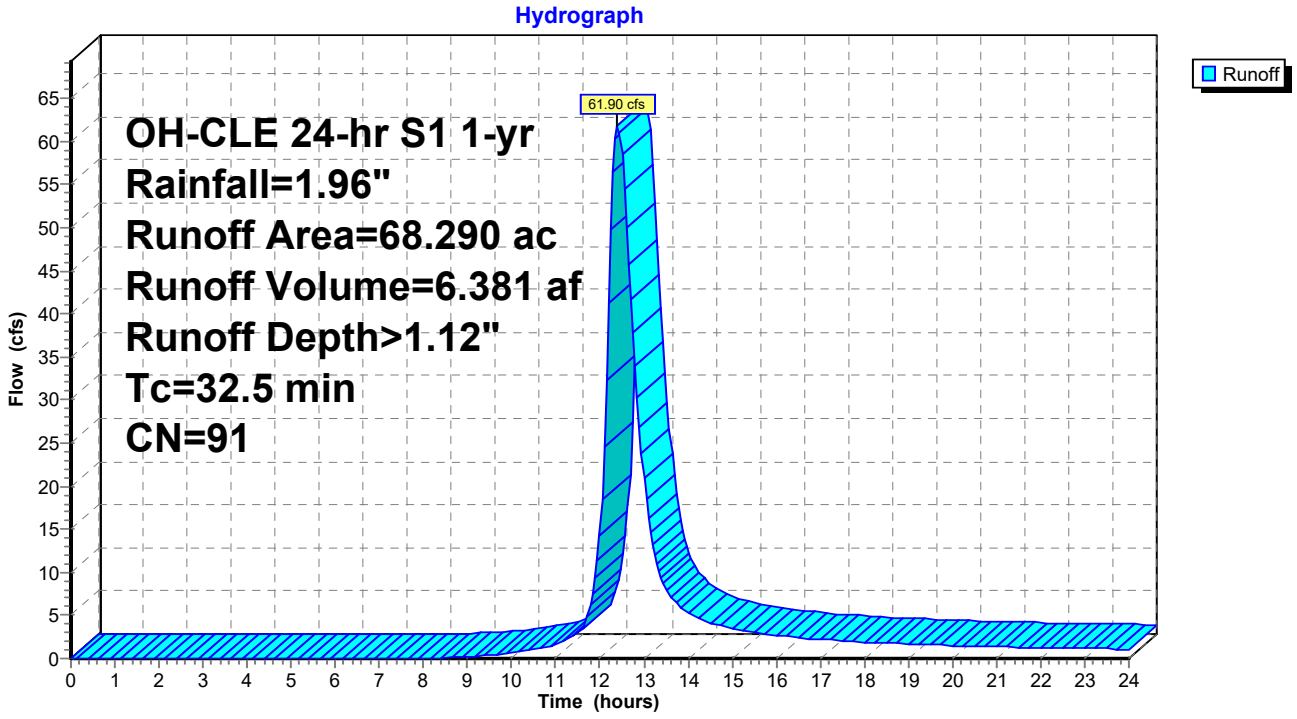
Runoff = 61.90 cfs @ 12.41 hrs, Volume= 6.381 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

## Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

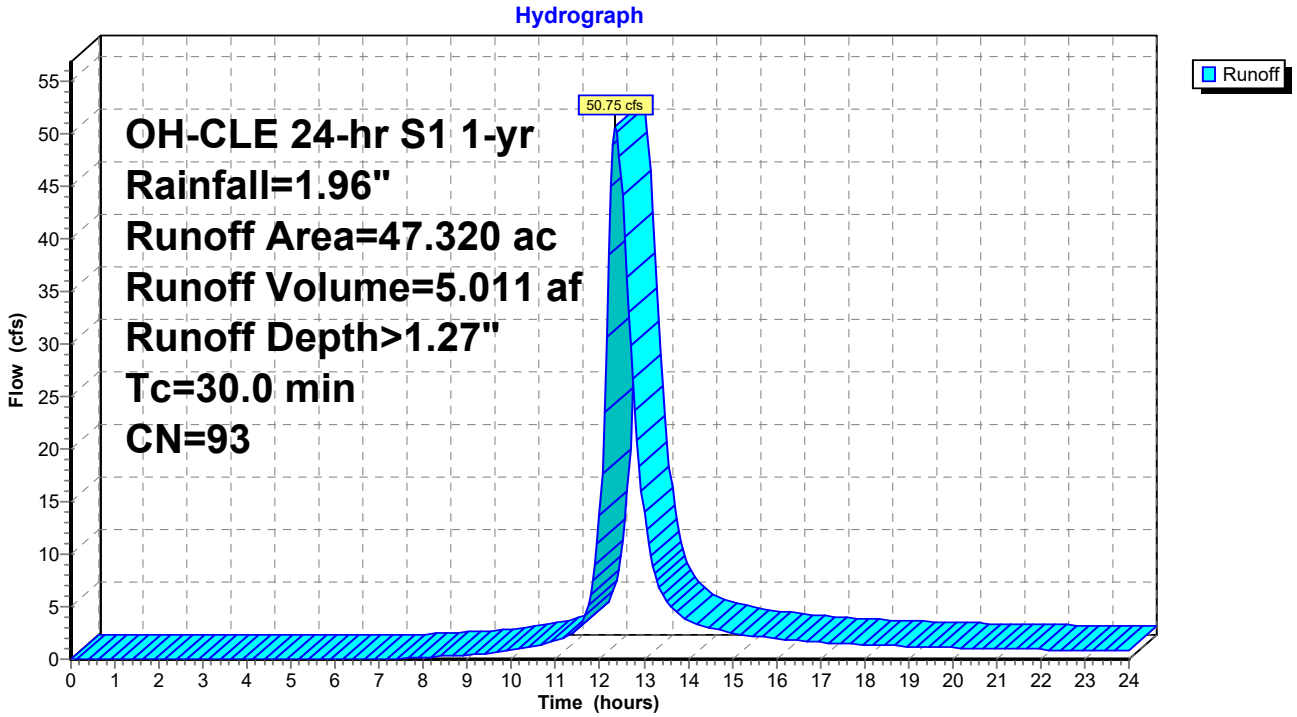
Runoff = 50.75 cfs @ 12.36 hrs, Volume= 5.011 af, Depth> 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

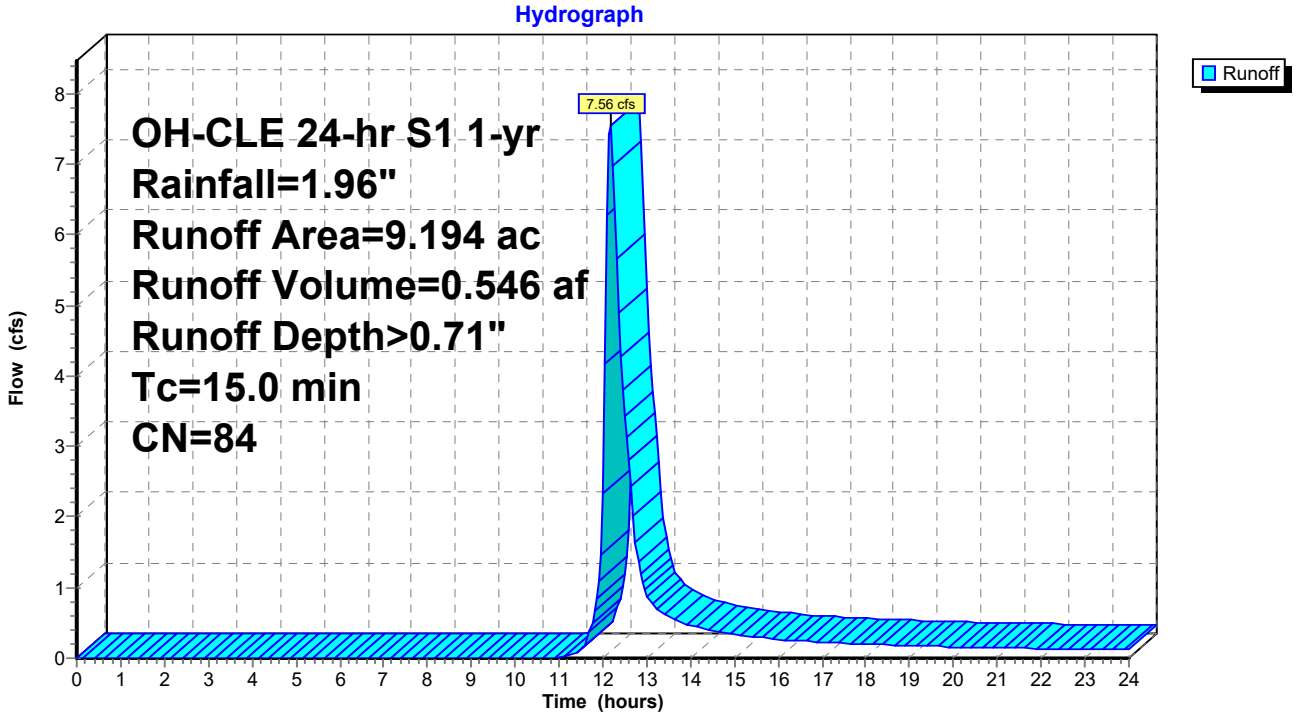
Runoff = 7.56 cfs @ 12.17 hrs, Volume= 0.546 af, Depth> 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

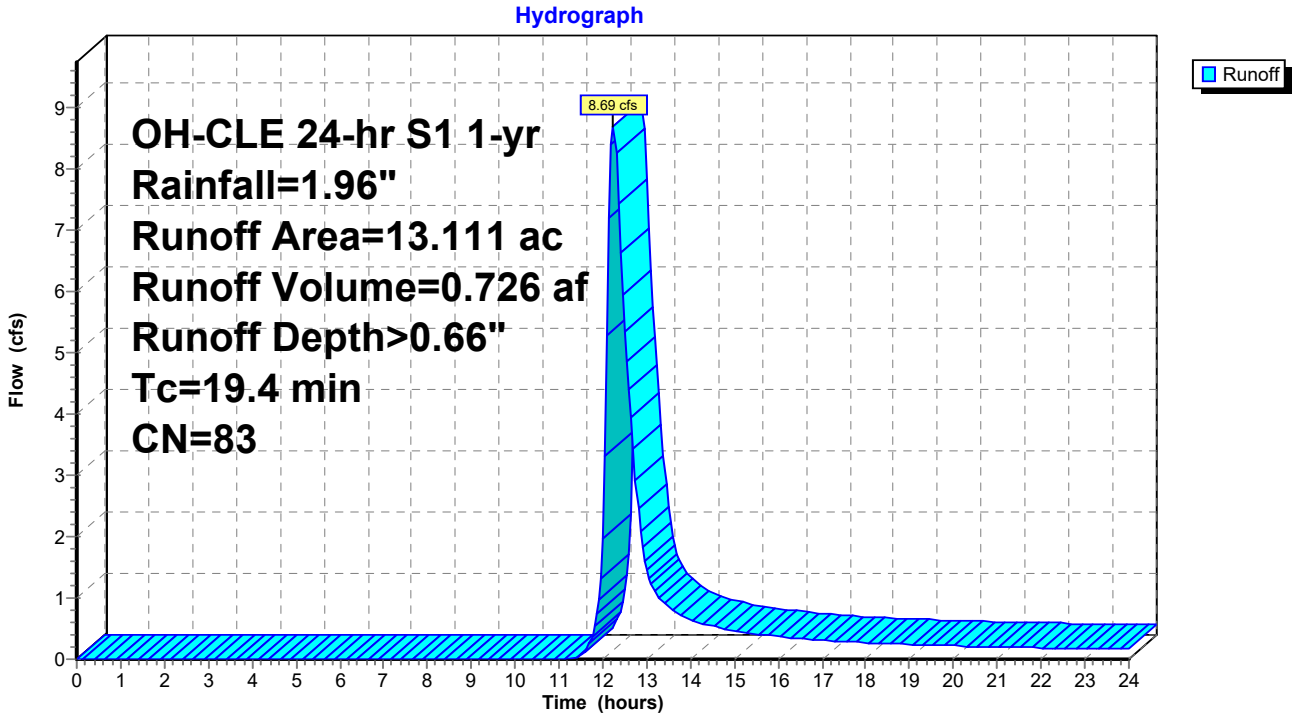
Runoff = 8.69 cfs @ 12.25 hrs, Volume= 0.726 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 0.71" for 1-yr event
Inflow = 7.56 cfs @ 12.17 hrs, Volume= 0.546 af
Outflow = 0.92 cfs @ 12.98 hrs, Volume= 0.514 af, Atten= 88%, Lag= 48.4 min
Primary = 0.92 cfs @ 12.98 hrs, Volume= 0.514 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 659.17' @ 12.98 hrs Surf.Area= 0.213 ac Storage= 0.265 af

Plug-Flow detention time= 162.8 min calculated for 0.513 af (94% of inflow)
Center-of-Mass det. time= 131.5 min ( 980.1 - 848.6 )

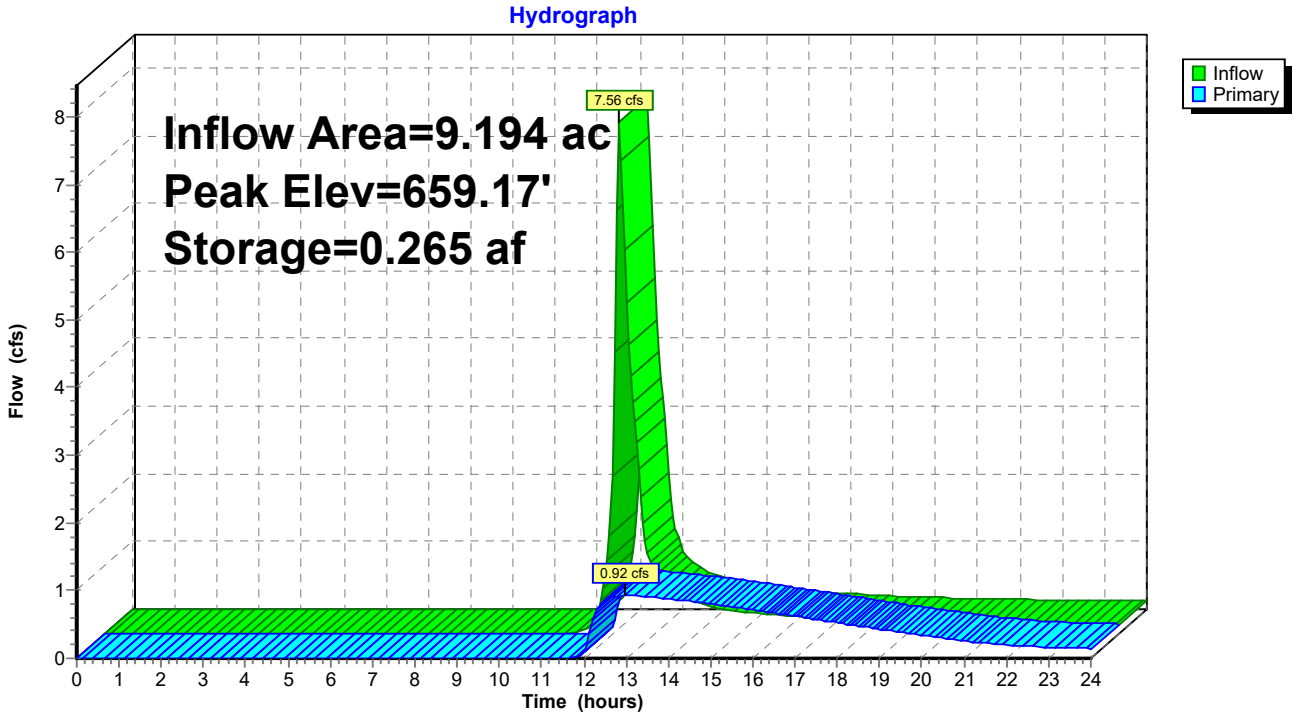
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=0.92 cfs @ 12.98 hrs HW=659.17' TW=647.97' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.92 cfs of 4.97 cfs potential flow)
  ├─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.92 cfs @ 5.29 fps)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 649.36' (Flood elevation advised)

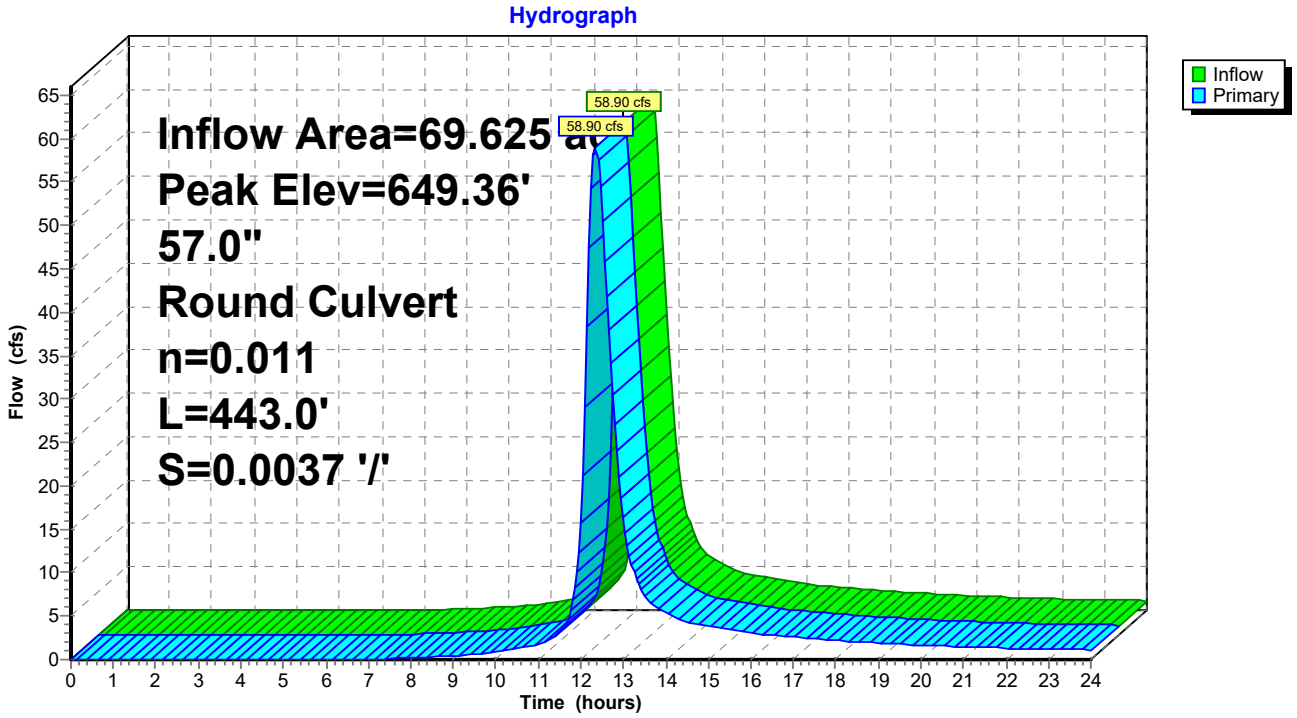
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 1.08" for 1-yr event
Inflow = 58.90 cfs @ 12.34 hrs, Volume= 6.251 af
Outflow = 58.90 cfs @ 12.34 hrs, Volume= 6.251 af, Atten= 0%, Lag= 0.0 min
Primary = 58.90 cfs @ 12.34 hrs, Volume= 6.251 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 649.36' @ 12.34 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=58.79 cfs @ 12.34 hrs HW=649.36' (Free Discharge)
└**1=Culvert** (Barrel Controls 58.79 cfs @ 7.68 fps)

### Pond 6P: 66" - A101



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>1.47"
Tc=32.5 min CN=91 Runoff=81.67 cfs 8.340 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>1.63"
Tc=30.0 min CN=93 Runoff=65.41 cfs 6.428 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>1.00"
Tc=15.0 min CN=84 Runoff=10.90 cfs 0.764 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>0.94"
Tc=19.4 min CN=83 Runoff=12.74 cfs 1.027 af

**Pond 1P: Detention 2** Peak Elev=659.78' Storage=0.400 af Inflow=10.90 cfs 0.764 af
Outflow=1.13 cfs 0.722 af

**Pond 6P: 66" - A101** Peak Elev=649.86' Inflow=77.12 cfs 8.176 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=77.12 cfs 8.176 af

**Total Runoff Area = 137.915 ac Runoff Volume = 16.559 af Average Runoff Depth = 1.44"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

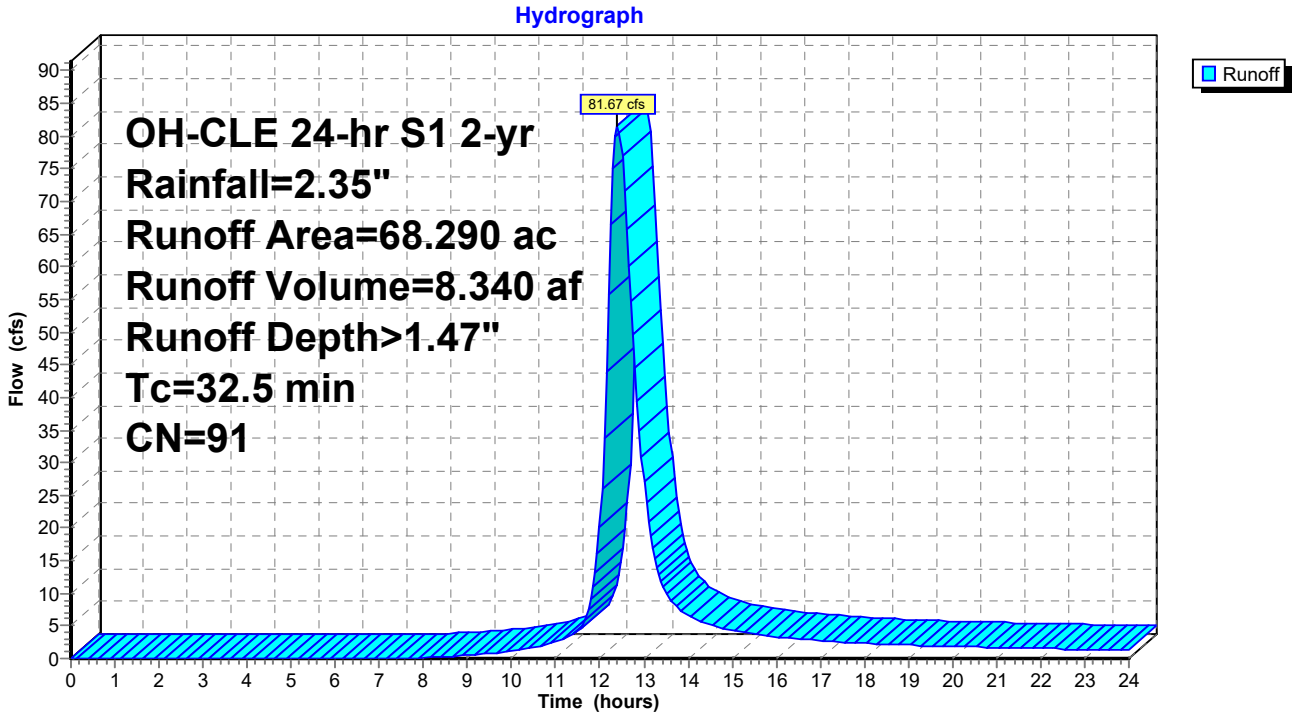
Runoff = 81.67 cfs @ 12.40 hrs, Volume= 8.340 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

## Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

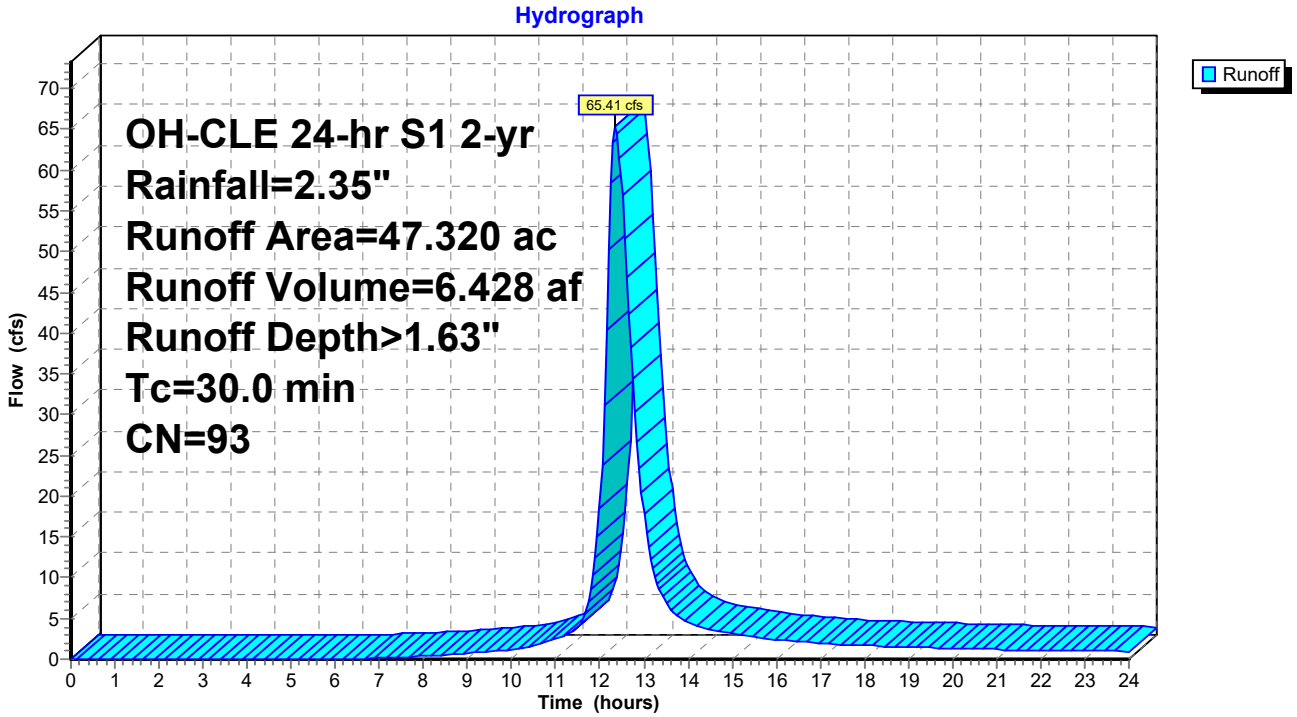
Runoff = 65.41 cfs @ 12.36 hrs, Volume= 6.428 af, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

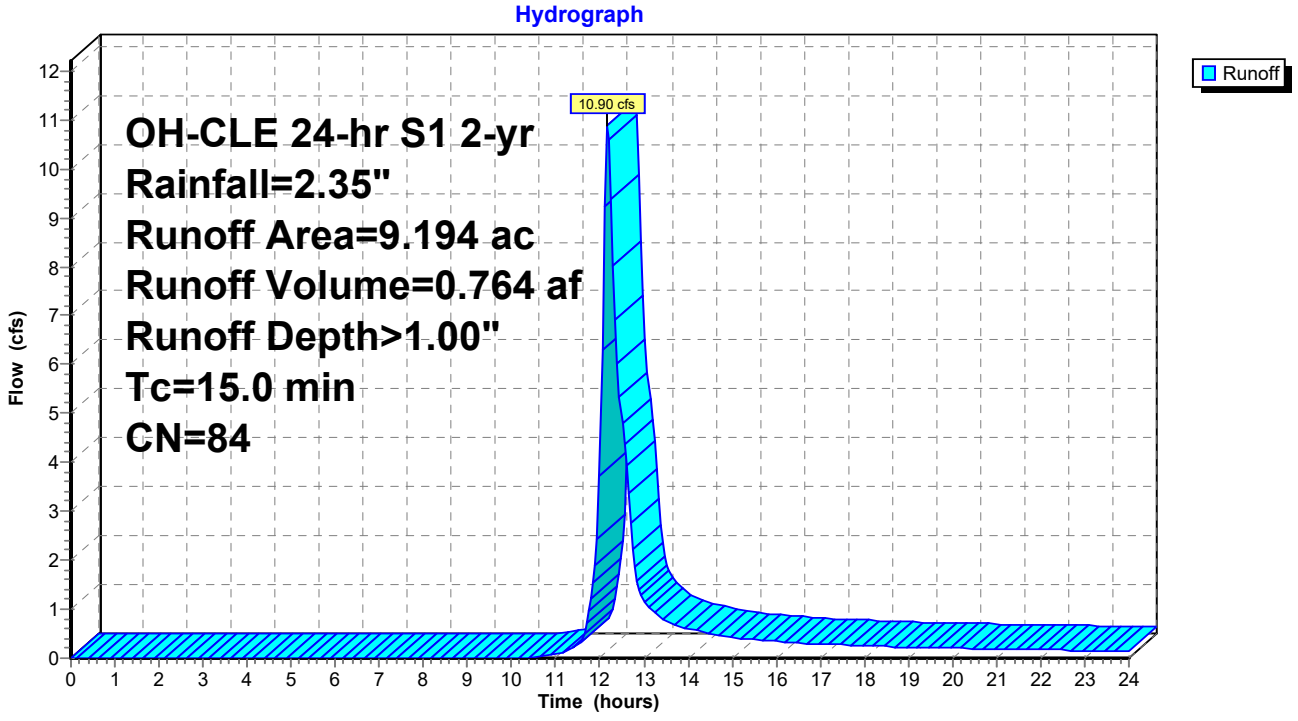
Runoff = 10.90 cfs @ 12.17 hrs, Volume= 0.764 af, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

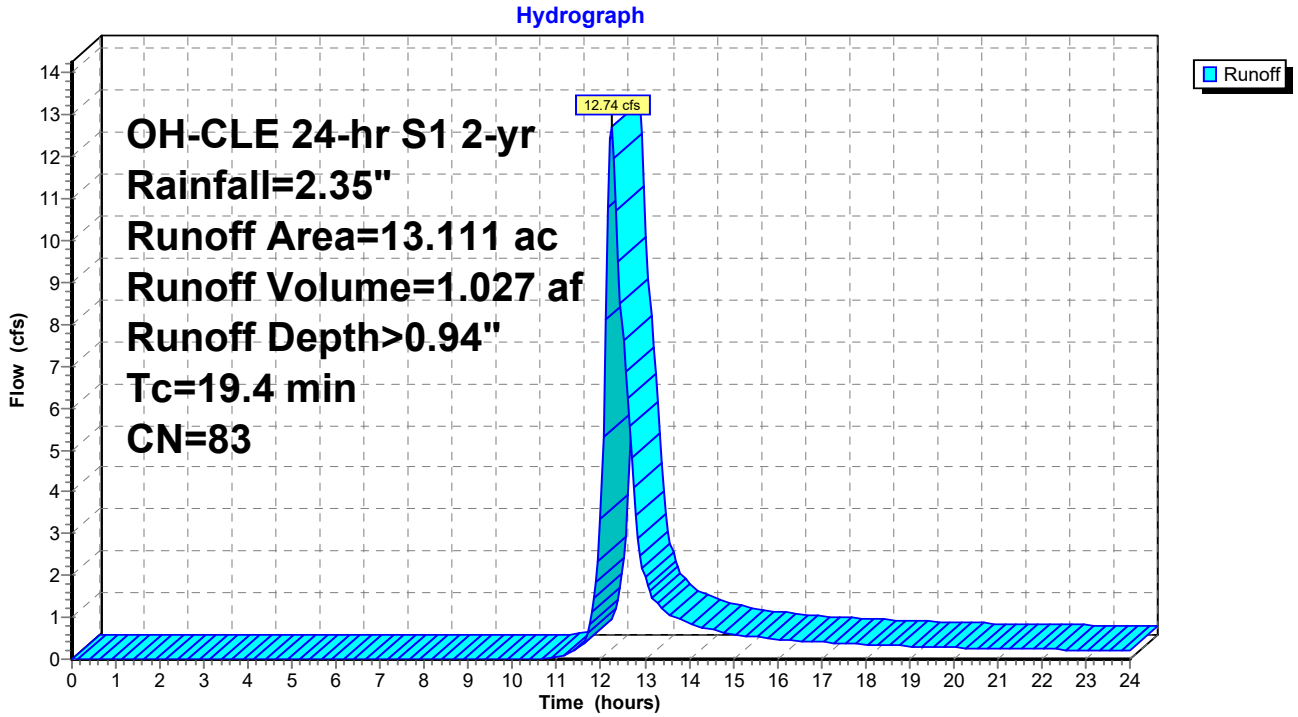
Runoff = 12.74 cfs @ 12.24 hrs, Volume= 1.027 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 1.00" for 2-yr event
Inflow = 10.90 cfs @ 12.17 hrs, Volume= 0.764 af
Outflow = 1.13 cfs @ 13.04 hrs, Volume= 0.722 af, Atten= 90%, Lag= 52.0 min
Primary = 1.13 cfs @ 13.04 hrs, Volume= 0.722 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 659.78' @ 13.04 hrs Surf.Area= 0.231 ac Storage= 0.400 af

Plug-Flow detention time= 193.1 min calculated for 0.722 af (94% of inflow)
Center-of-Mass det. time= 163.3 min ( 1,001.4 - 838.1 )

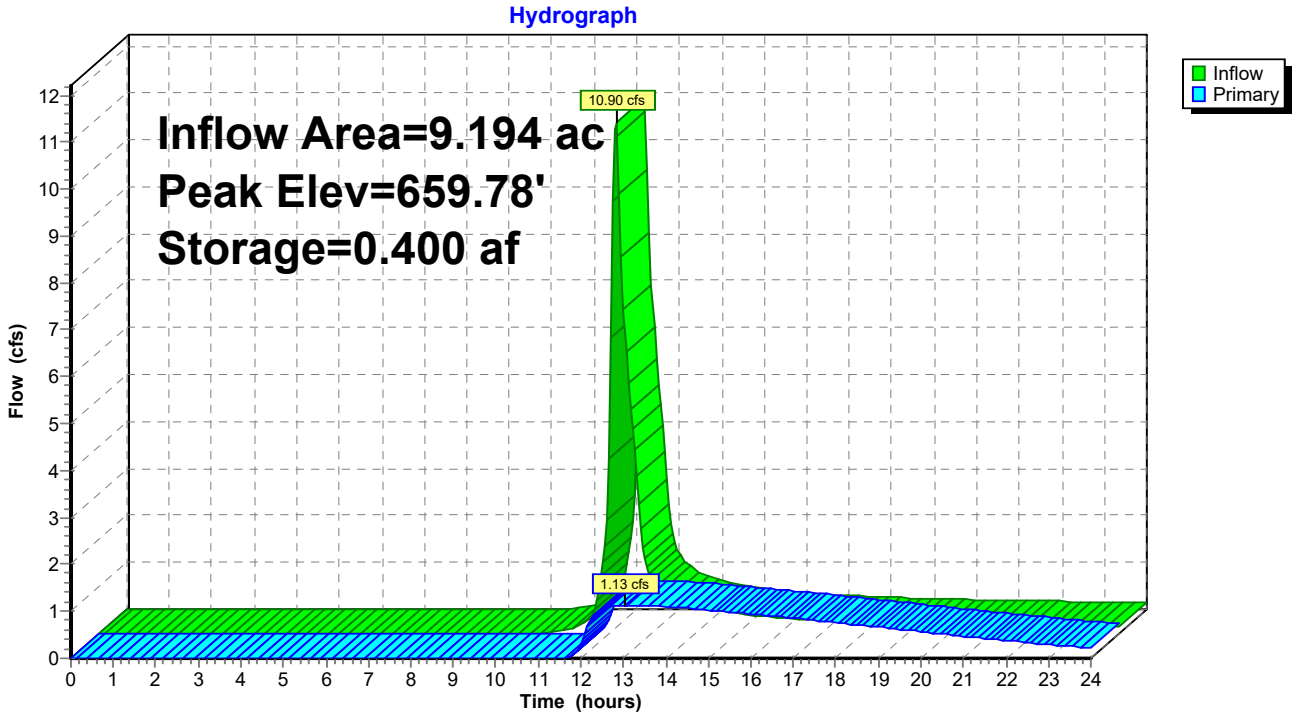
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=1.13 cfs @ 13.04 hrs HW=659.78' TW=648.05' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.13 cfs of 6.15 cfs potential flow)
  ├─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 1.13 cfs @ 6.49 fps)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 649.86' (Flood elevation advised)

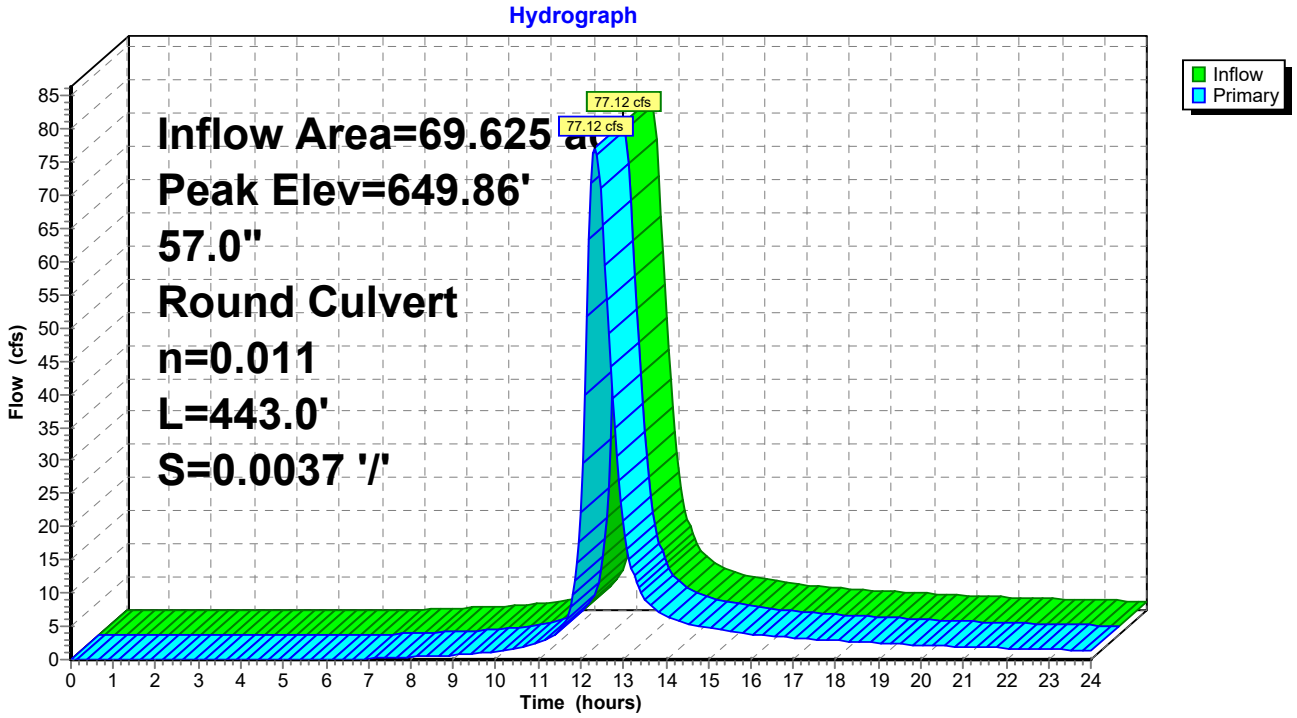
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 1.41" for 2-yr event
Inflow = 77.12 cfs @ 12.34 hrs, Volume= 8.176 af
Outflow = 77.12 cfs @ 12.34 hrs, Volume= 8.176 af, Atten= 0%, Lag= 0.0 min
Primary = 77.12 cfs @ 12.34 hrs, Volume= 8.176 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 649.86' @ 12.34 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=76.87 cfs @ 12.34 hrs HW=649.85' (Free Discharge)
**1=Culvert** (Barrel Controls 76.87 cfs @ 8.17 fps)

### Pond 6P: 66" - A101



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>1.99"
Tc=32.5 min CN=91 Runoff=110.20 cfs 11.351 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>2.18"
Tc=30.0 min CN=93 Runoff=86.14 cfs 8.582 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>1.45"
Tc=15.0 min CN=84 Runoff=15.92 cfs 1.114 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>1.38"
Tc=19.4 min CN=83 Runoff=18.95 cfs 1.513 af

**Pond 1P: Detention 2** Peak Elev=660.70' Storage=0.625 af Inflow=15.92 cfs 1.114 af
Outflow=1.39 cfs 1.022 af

**Pond 6P: 66" - A101** Peak Elev=650.54' Inflow=103.30 cfs 11.117 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=103.30 cfs 11.117 af

**Total Runoff Area = 137.915 ac Runoff Volume = 22.560 af Average Runoff Depth = 1.96"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

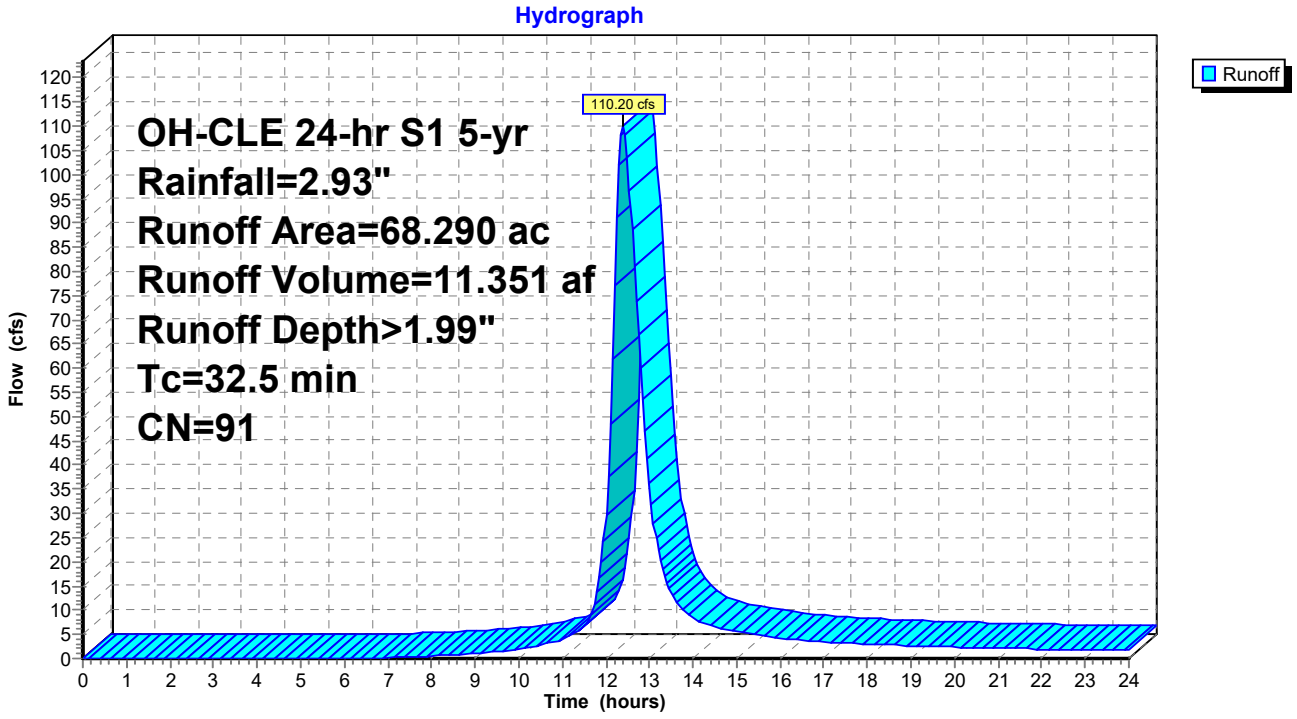
Runoff = 110.20 cfs @ 12.40 hrs, Volume= 11.351 af, Depth> 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

### Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

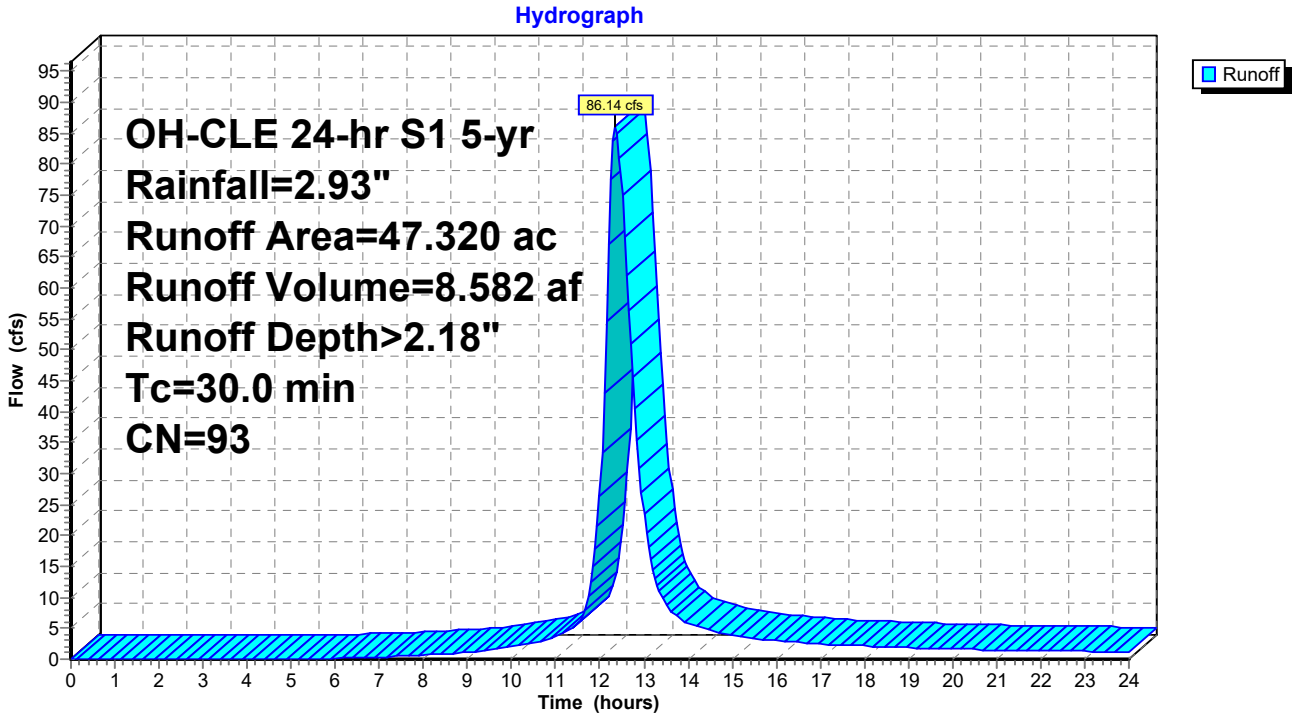
Runoff = 86.14 cfs @ 12.36 hrs, Volume= 8.582 af, Depth> 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

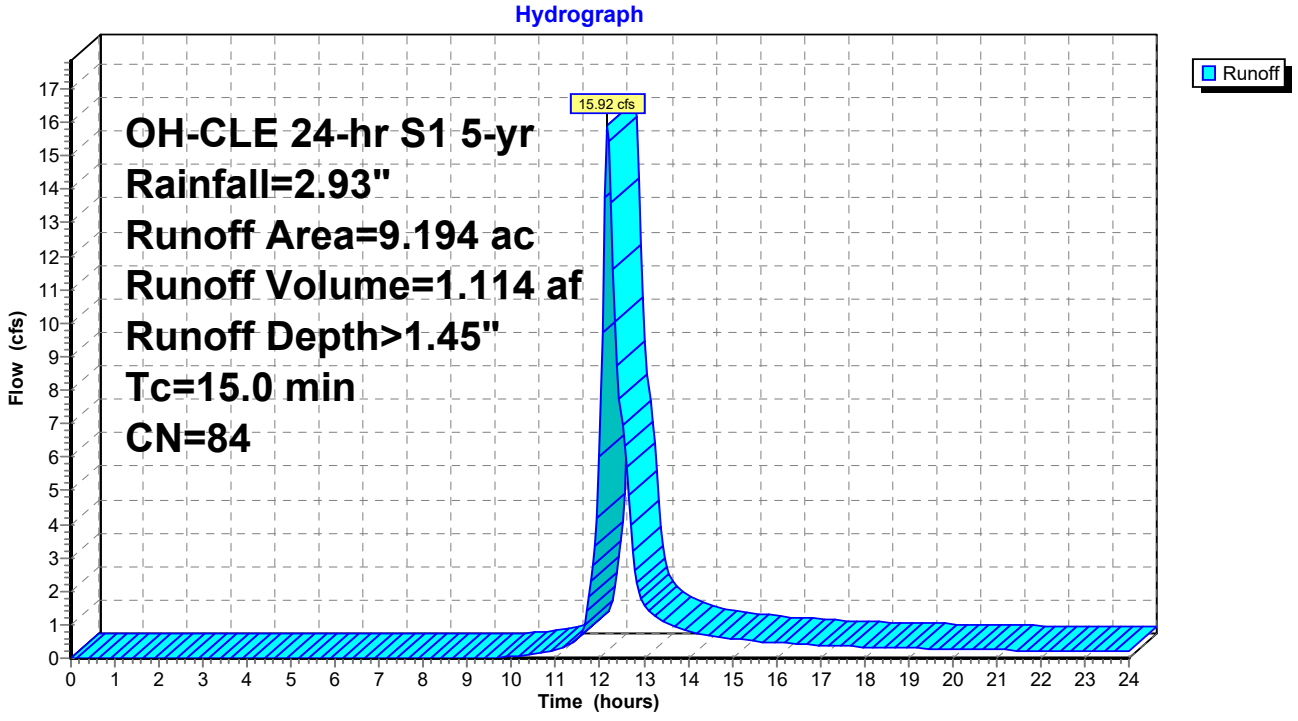
Runoff = 15.92 cfs @ 12.17 hrs, Volume= 1.114 af, Depth> 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

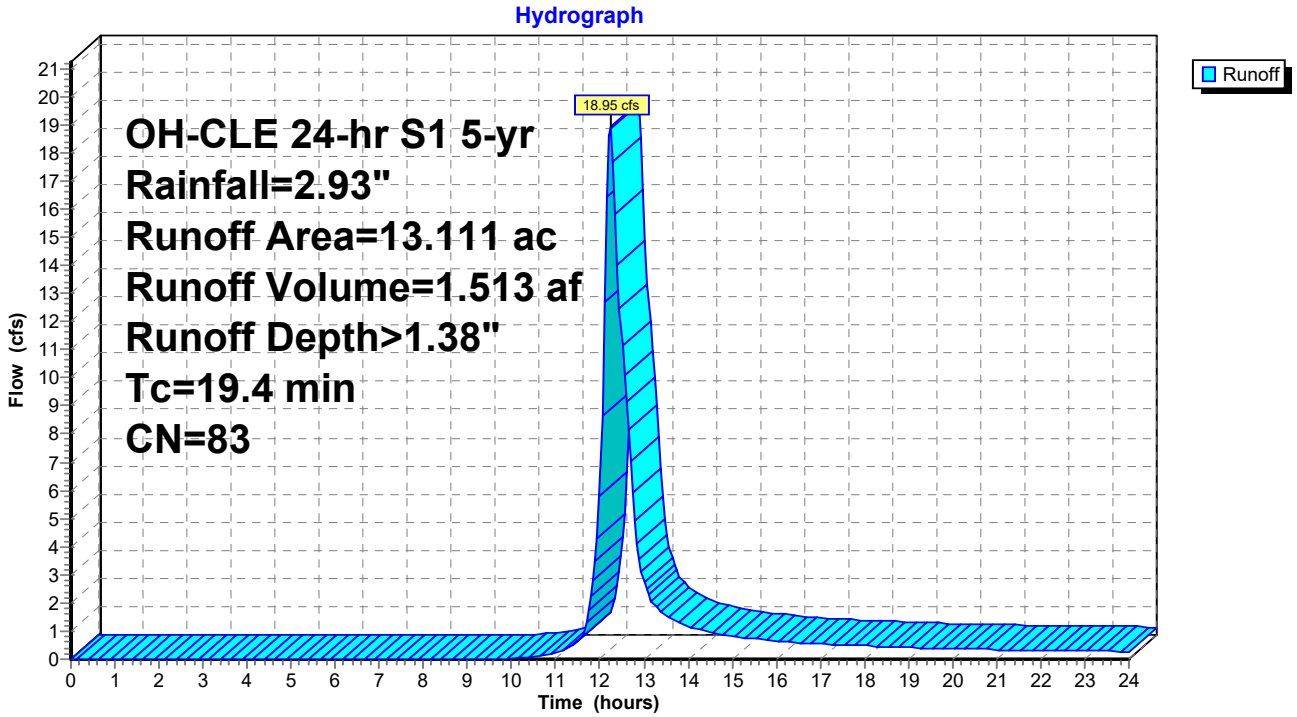
Runoff = 18.95 cfs @ 12.23 hrs, Volume= 1.513 af, Depth> 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 1.45" for 5-yr event
Inflow = 15.92 cfs @ 12.17 hrs, Volume= 1.114 af
Outflow = 1.39 cfs @ 13.14 hrs, Volume= 1.022 af, Atten= 91%, Lag= 58.2 min
Primary = 1.39 cfs @ 13.14 hrs, Volume= 1.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 660.70' @ 13.14 hrs Surf.Area= 0.260 ac Storage= 0.625 af

Plug-Flow detention time= 238.4 min calculated for 1.020 af (92% of inflow)
Center-of-Mass det. time= 197.0 min ( 1,025.0 - 828.0 )

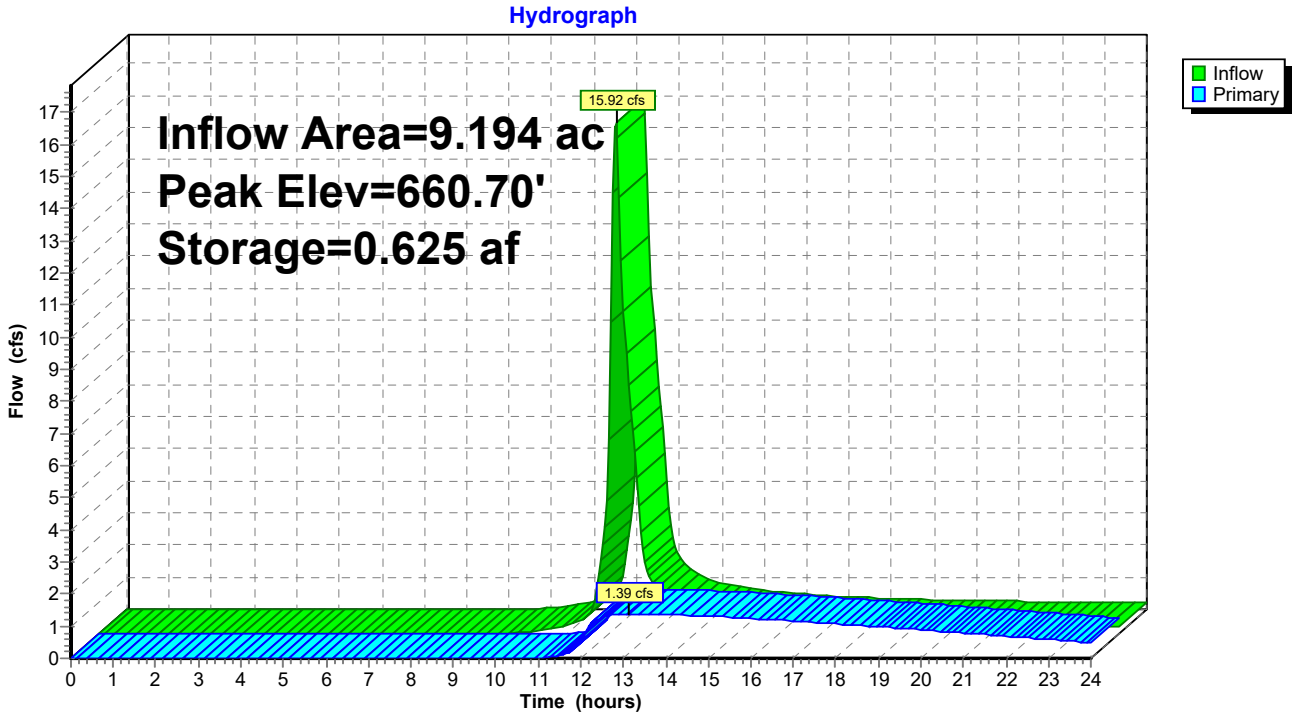
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=1.39 cfs @ 13.14 hrs HW=660.70' TW=648.09' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.39 cfs of 7.87 cfs potential flow)
  ├─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 1.39 cfs @ 7.96 fps)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 650.54' (Flood elevation advised)

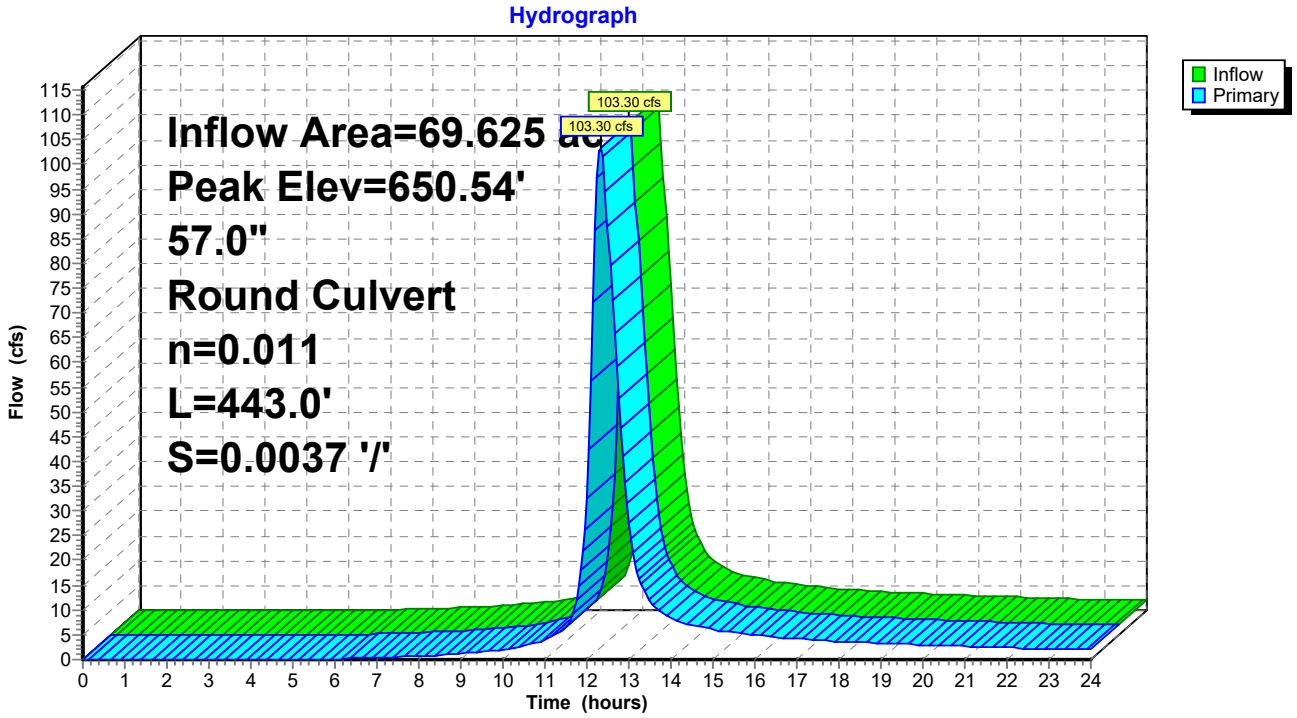
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 1.92" for 5-yr event
Inflow = 103.30 cfs @ 12.33 hrs, Volume= 11.117 af
Outflow = 103.30 cfs @ 12.33 hrs, Volume= 11.117 af, Atten= 0%, Lag= 0.0 min
Primary = 103.30 cfs @ 12.33 hrs, Volume= 11.117 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 650.54' @ 12.33 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=102.90 cfs @ 12.33 hrs HW=650.53' (Free Discharge)
└**1=Culvert** (Barrel Controls 102.90 cfs @ 8.73 fps)

### Pond 6P: 66" - A101



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>2.43"
Tc=32.5 min CN=91 Runoff=132.72 cfs 13.846 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>2.63"
Tc=30.0 min CN=93 Runoff=102.33 cfs 10.354 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>1.85"
Tc=15.0 min CN=84 Runoff=20.05 cfs 1.414 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>1.77"
Tc=19.4 min CN=83 Runoff=24.10 cfs 1.932 af

**Pond 1P: Detention 2** Peak Elev=661.41' Storage=0.820 af Inflow=20.05 cfs 1.414 af
Outflow=1.56 cfs 1.242 af

**Pond 6P: 66" - A101** Peak Elev=651.09' Inflow=123.99 cfs 13.527 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=123.99 cfs 13.527 af

**Total Runoff Area = 137.915 ac Runoff Volume = 27.545 af Average Runoff Depth = 2.40"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

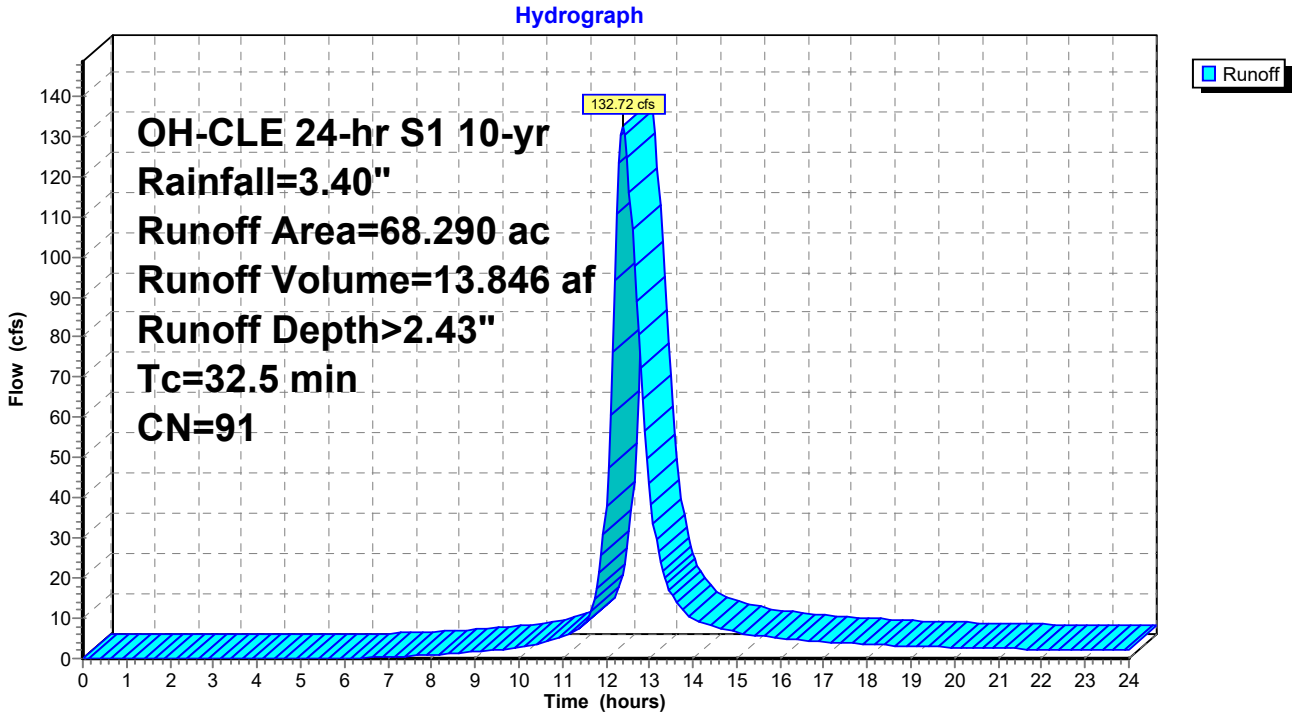
Runoff = 132.72 cfs @ 12.40 hrs, Volume= 13.846 af, Depth> 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

### Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

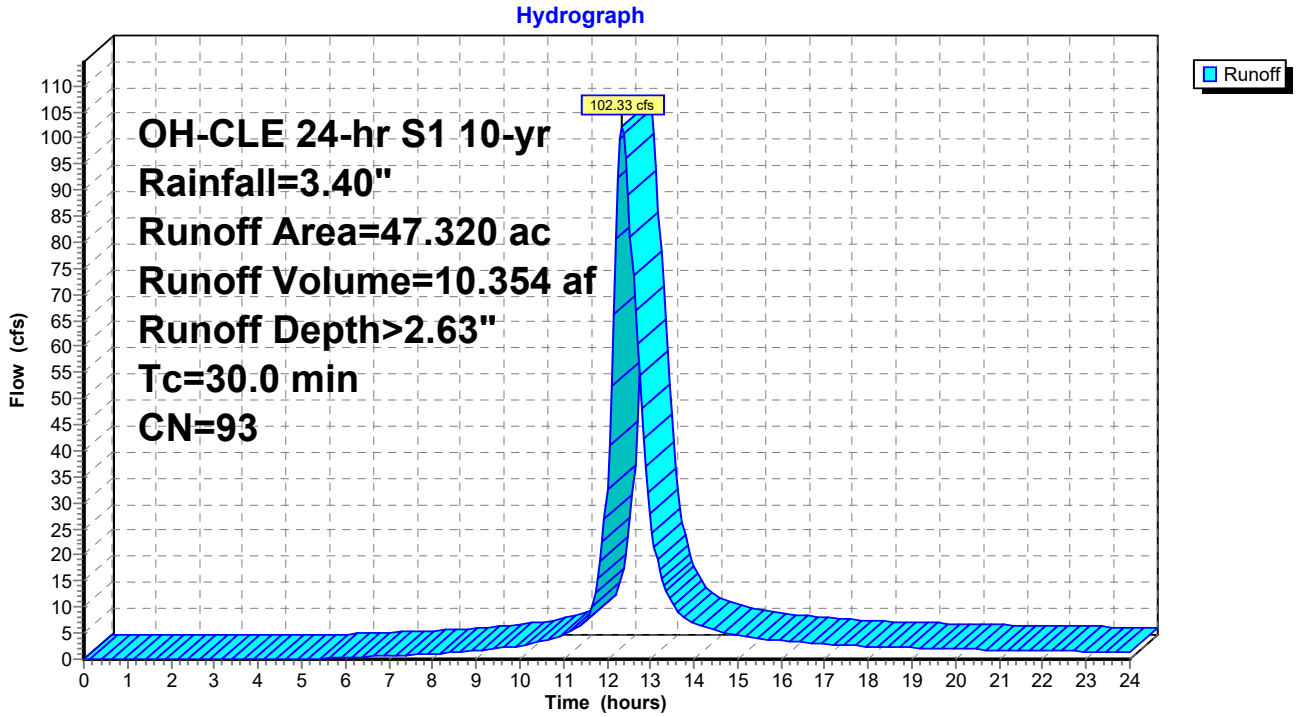
Runoff = 102.33 cfs @ 12.36 hrs, Volume= 10.354 af, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

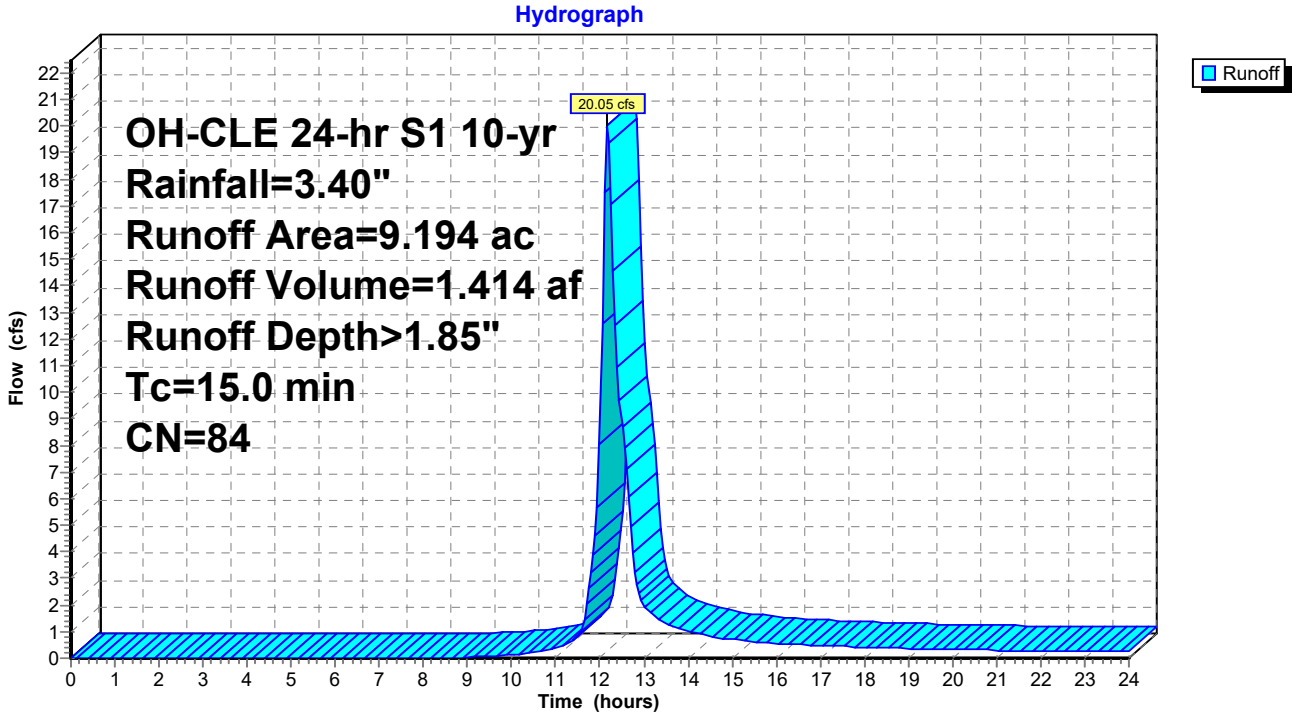
Runoff = 20.05 cfs @ 12.17 hrs, Volume= 1.414 af, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

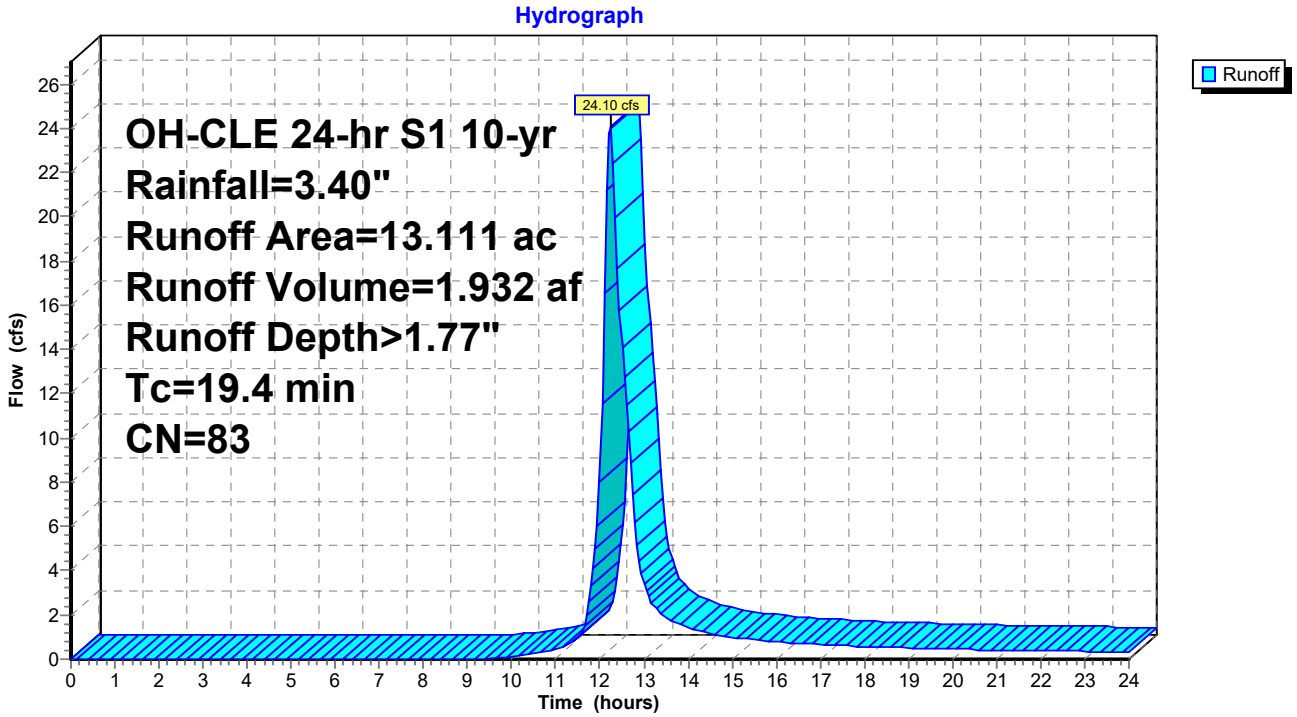
Runoff = 24.10 cfs @ 12.23 hrs, Volume= 1.932 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 1.85" for 10-yr event
Inflow = 20.05 cfs @ 12.17 hrs, Volume= 1.414 af
Outflow = 1.56 cfs @ 13.23 hrs, Volume= 1.242 af, Atten= 92%, Lag= 63.9 min
Primary = 1.56 cfs @ 13.23 hrs, Volume= 1.242 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 661.41' @ 13.23 hrs Surf.Area= 0.284 ac Storage= 0.820 af

Plug-Flow detention time= 268.3 min calculated for 1.242 af (88% of inflow)
Center-of-Mass det. time= 213.0 min ( 1,035.5 - 822.5 )

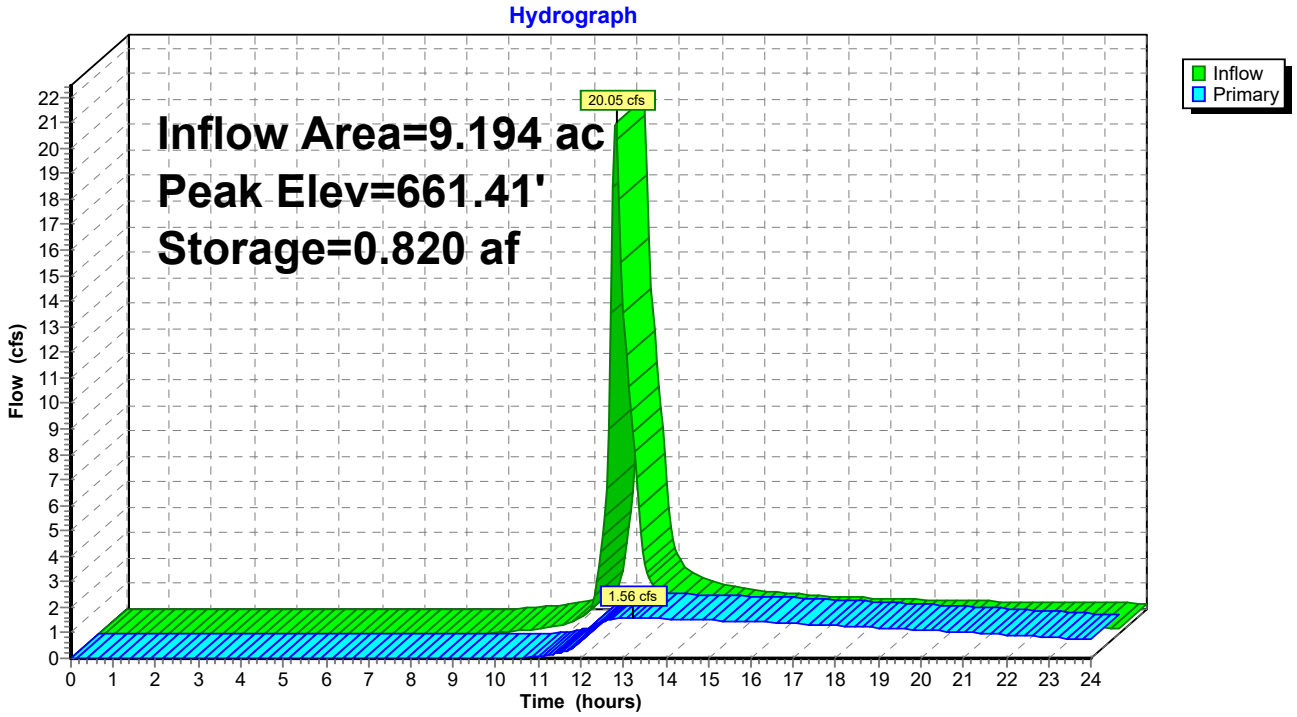
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=1.56 cfs @ 13.23 hrs HW=661.41' TW=648.09' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.56 cfs of 8.99 cfs potential flow)
  ├─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 1.56 cfs @ 8.94 fps)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 651.09' (Flood elevation advised)

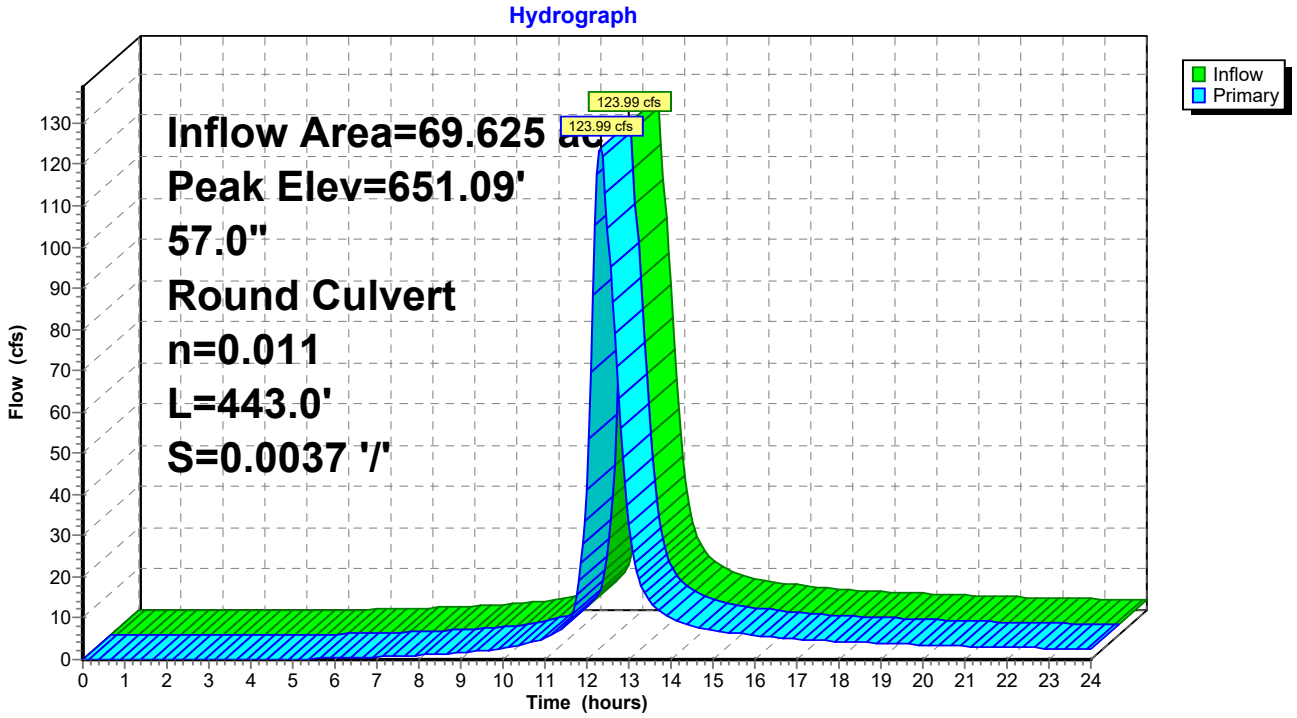
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 2.33" for 10-yr event
Inflow = 123.99 cfs @ 12.33 hrs, Volume= 13.527 af
Outflow = 123.99 cfs @ 12.33 hrs, Volume= 13.527 af, Atten= 0%, Lag= 0.0 min
Primary = 123.99 cfs @ 12.33 hrs, Volume= 13.527 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 651.09' @ 12.33 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=123.49 cfs @ 12.33 hrs HW=651.07' (Free Discharge)
└**1=Culvert** (Barrel Controls 123.49 cfs @ 9.08 fps)

### Pond 6P: 66" - A101



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>3.08"
Tc=32.5 min CN=91 Runoff=162.98 cfs 17.511 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>3.28"
Tc=30.0 min CN=93 Runoff=123.86 cfs 12.942 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>2.44"
Tc=15.0 min CN=84 Runoff=25.75 cfs 1.866 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>2.35"
Tc=19.4 min CN=83 Runoff=31.28 cfs 2.564 af

**Pond 1P: Detention 2** Peak Elev=661.87' Storage=0.953 af Inflow=25.75 cfs 1.866 af
Outflow=7.58 cfs 1.627 af

**Pond 6P: 66" - A101** Peak Elev=651.92' Inflow=151.99 cfs 17.133 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=151.99 cfs 17.133 af

**Total Runoff Area = 137.915 ac Runoff Volume = 34.883 af Average Runoff Depth = 3.04"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

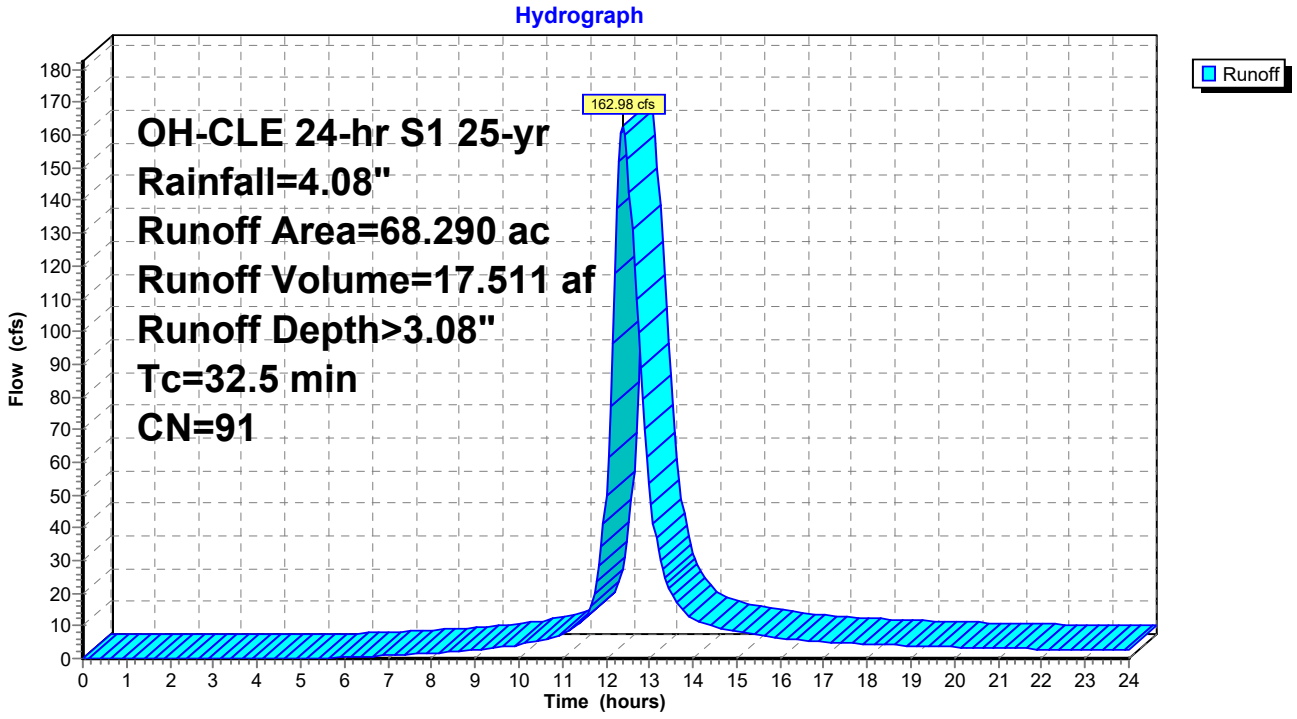
Runoff = 162.98 cfs @ 12.40 hrs, Volume= 17.511 af, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

### Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

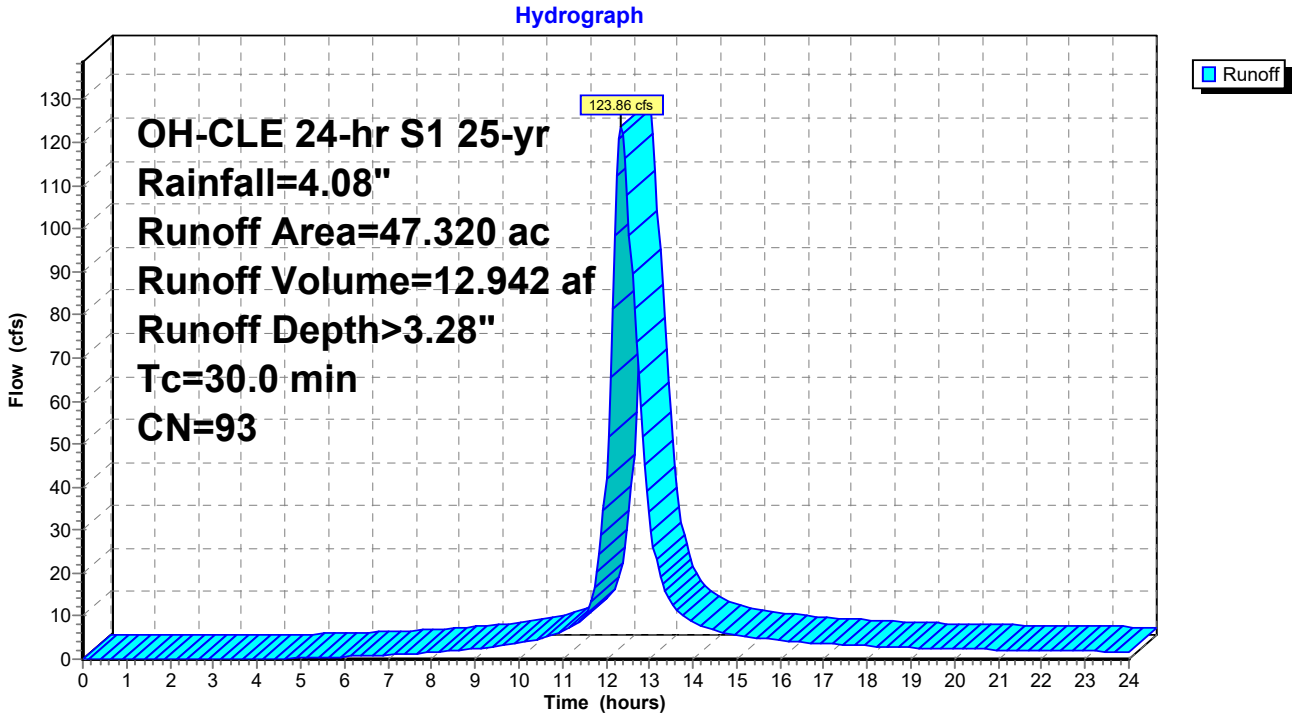
Runoff = 123.86 cfs @ 12.36 hrs, Volume= 12.942 af, Depth> 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

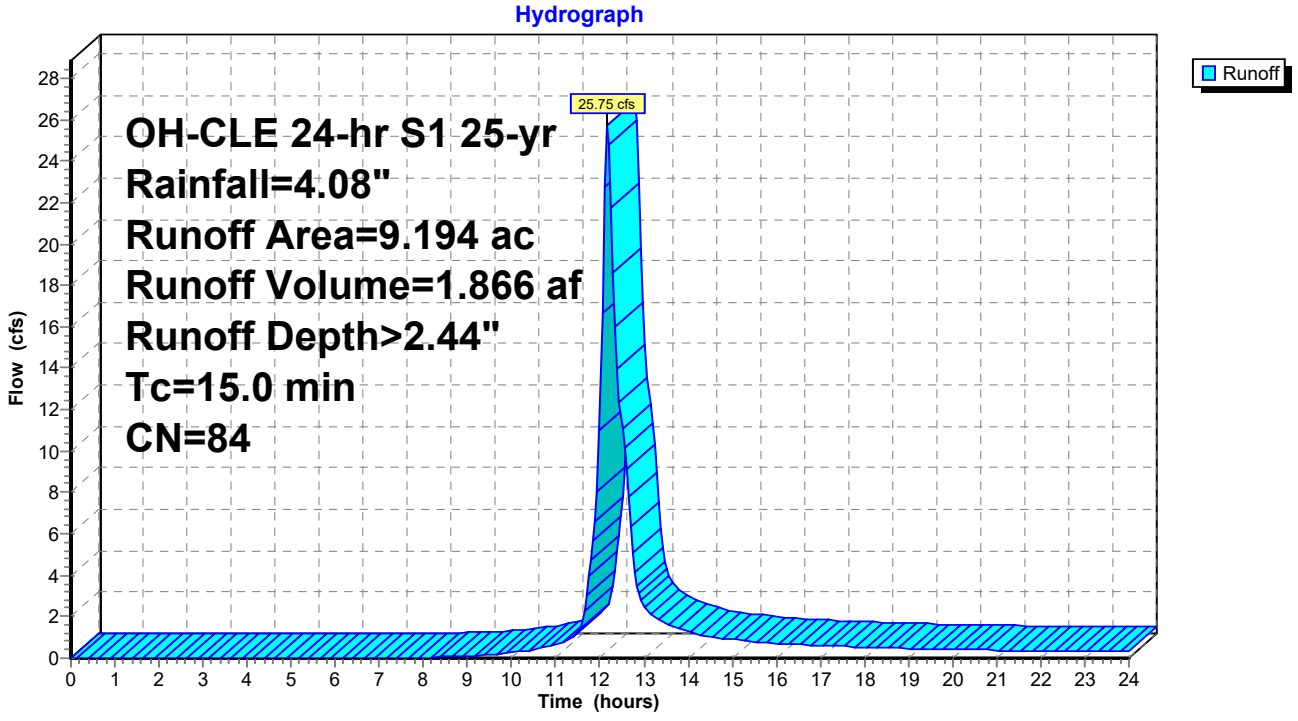
Runoff = 25.75 cfs @ 12.16 hrs, Volume= 1.866 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

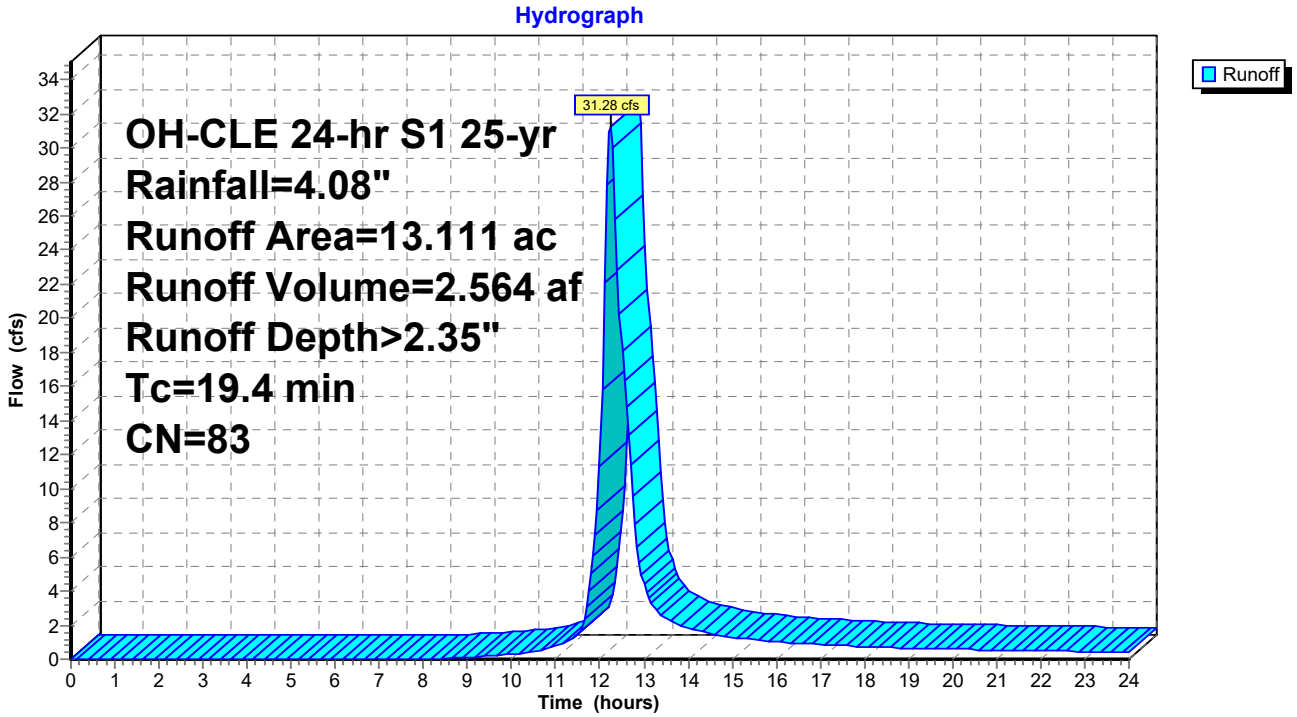
Runoff = 31.28 cfs @ 12.23 hrs, Volume= 2.564 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 2.44" for 25-yr event
Inflow = 25.75 cfs @ 12.16 hrs, Volume= 1.866 af
Outflow = 7.58 cfs @ 12.66 hrs, Volume= 1.627 af, Atten= 71%, Lag= 29.8 min
Primary = 7.58 cfs @ 12.66 hrs, Volume= 1.627 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 661.87' @ 12.66 hrs Surf.Area= 0.299 ac Storage= 0.953 af

Plug-Flow detention time= 232.3 min calculated for 1.627 af (87% of inflow)
Center-of-Mass det. time= 175.1 min ( 992.2 - 817.1 )

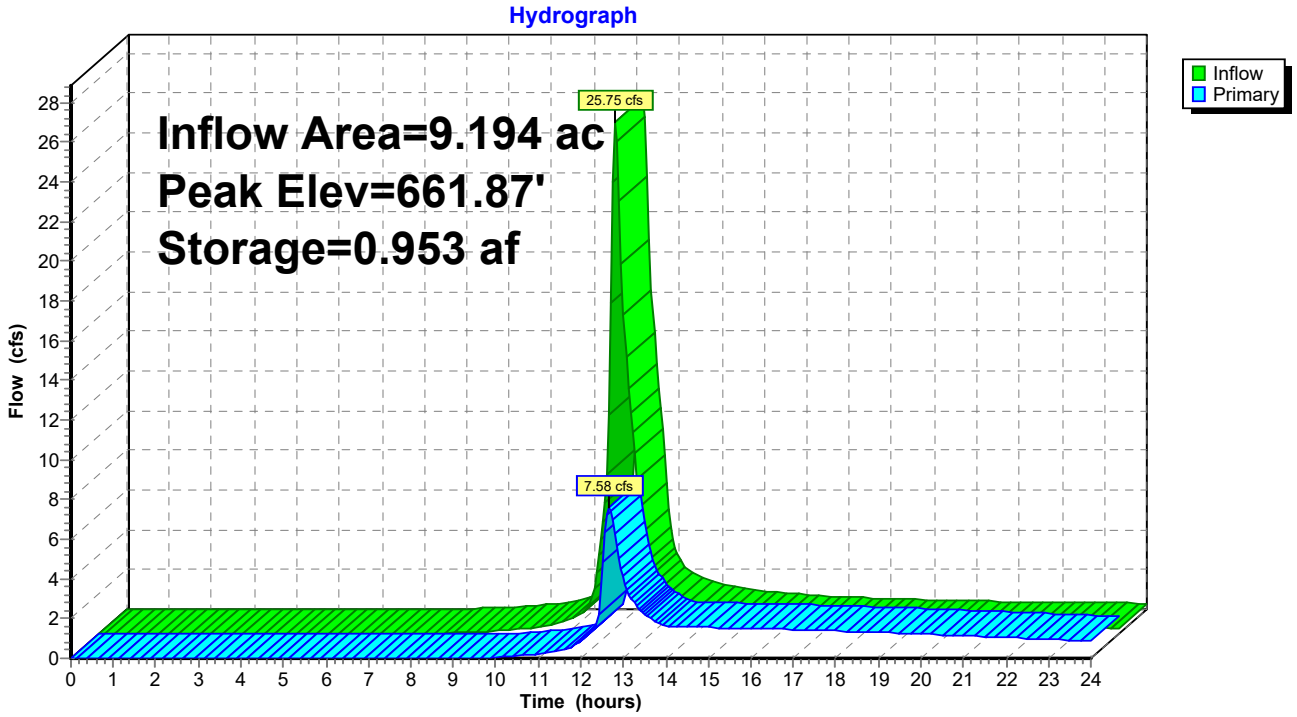
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=7.54 cfs @ 12.66 hrs HW=661.87' TW=650.46' (Dynamic Tailwater)
└─**1=Culvert** (Passes 7.54 cfs of 9.64 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 5.88 cfs @ 1.99 fps)
  └─**3=Orifice/Grate** (Orifice Controls 1.66 cfs @ 9.51 fps)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 651.92' (Flood elevation advised)

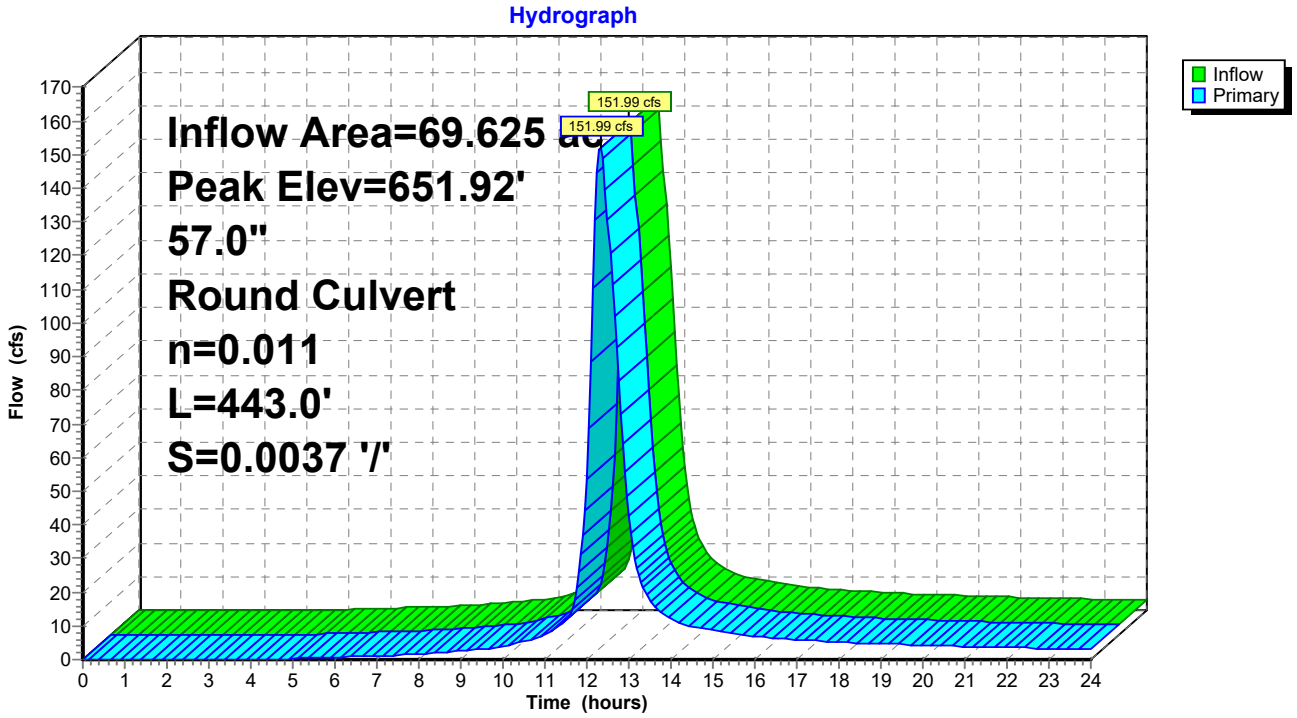
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 2.95" for 25-yr event
Inflow = 151.99 cfs @ 12.32 hrs, Volume= 17.133 af
Outflow = 151.99 cfs @ 12.32 hrs, Volume= 17.133 af, Atten= 0%, Lag= 0.0 min
Primary = 151.99 cfs @ 12.32 hrs, Volume= 17.133 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 651.92' @ 12.32 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=151.18 cfs @ 12.32 hrs HW=651.89' (Free Discharge)
└**1=Culvert** (Barrel Controls 151.18 cfs @ 9.45 fps)

### Pond 6P: 66" - A101



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>3.62"
Tc=32.5 min CN=91 Runoff=187.19 cfs 20.619 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>3.84"
Tc=30.0 min CN=93 Runoff=141.00 cfs 15.128 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>2.94"
Tc=15.0 min CN=84 Runoff=30.35 cfs 2.256 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>2.85"
Tc=19.4 min CN=83 Runoff=37.14 cfs 3.113 af

**Pond 1P: Detention 2** Peak Elev=662.16' Storage=1.040 af Inflow=30.35 cfs 2.256 af
Outflow=10.03 cfs 1.969 af

**Pond 6P: 66" - A101** Peak Elev=653.47' Inflow=178.40 cfs 20.209 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=178.40 cfs 20.209 af

**Total Runoff Area = 137.915 ac Runoff Volume = 41.114 af Average Runoff Depth = 3.58"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

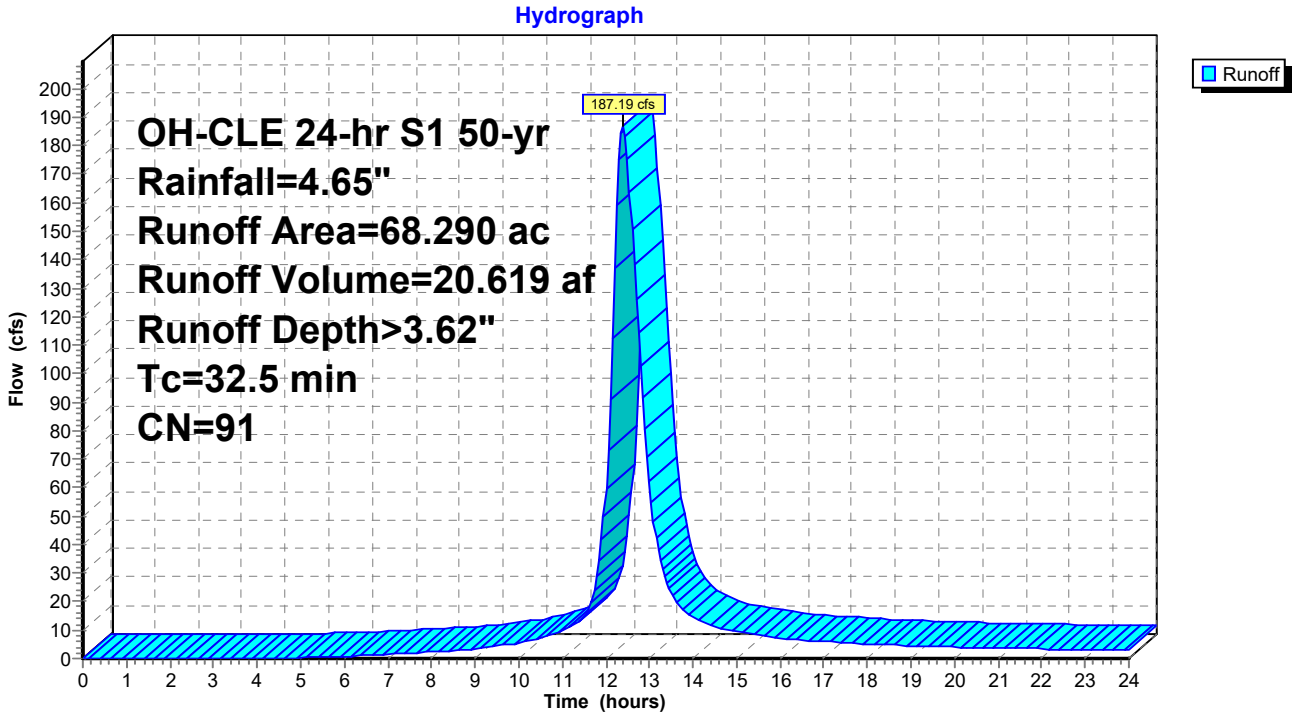
Runoff = 187.19 cfs @ 12.40 hrs, Volume= 20.619 af, Depth> 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

## Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

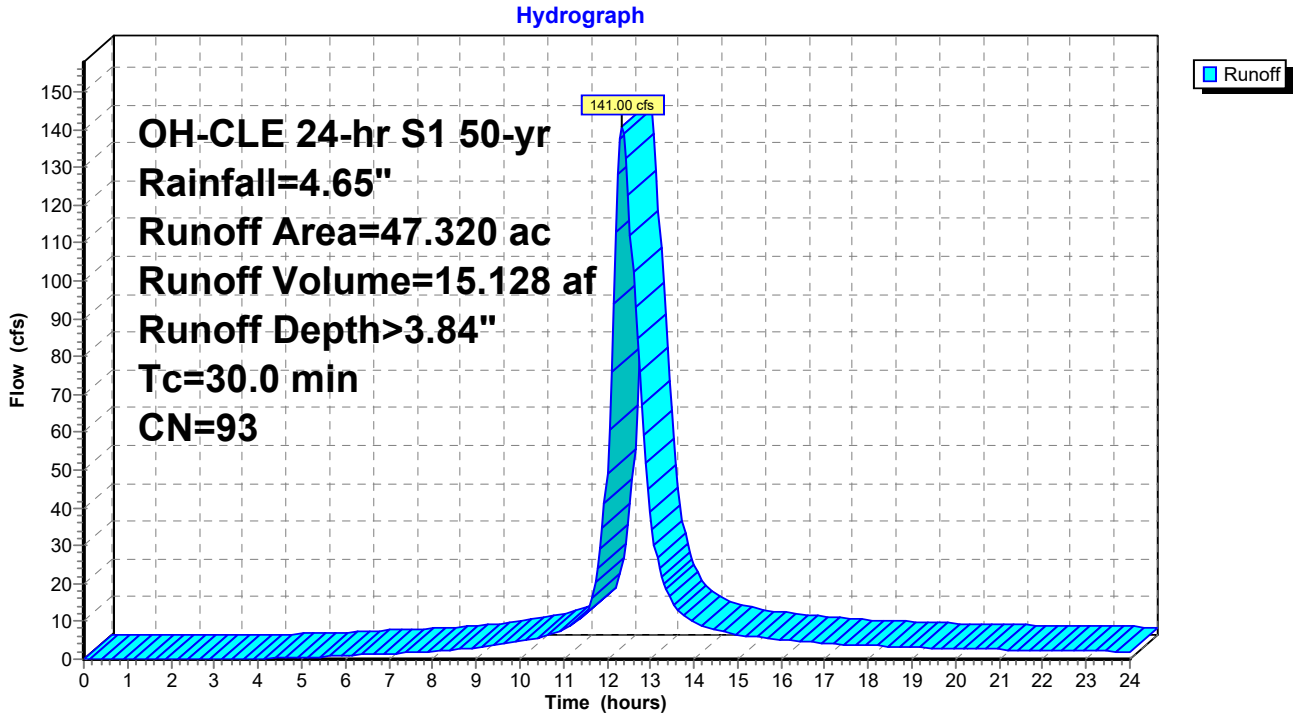
Runoff = 141.00 cfs @ 12.35 hrs, Volume= 15.128 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

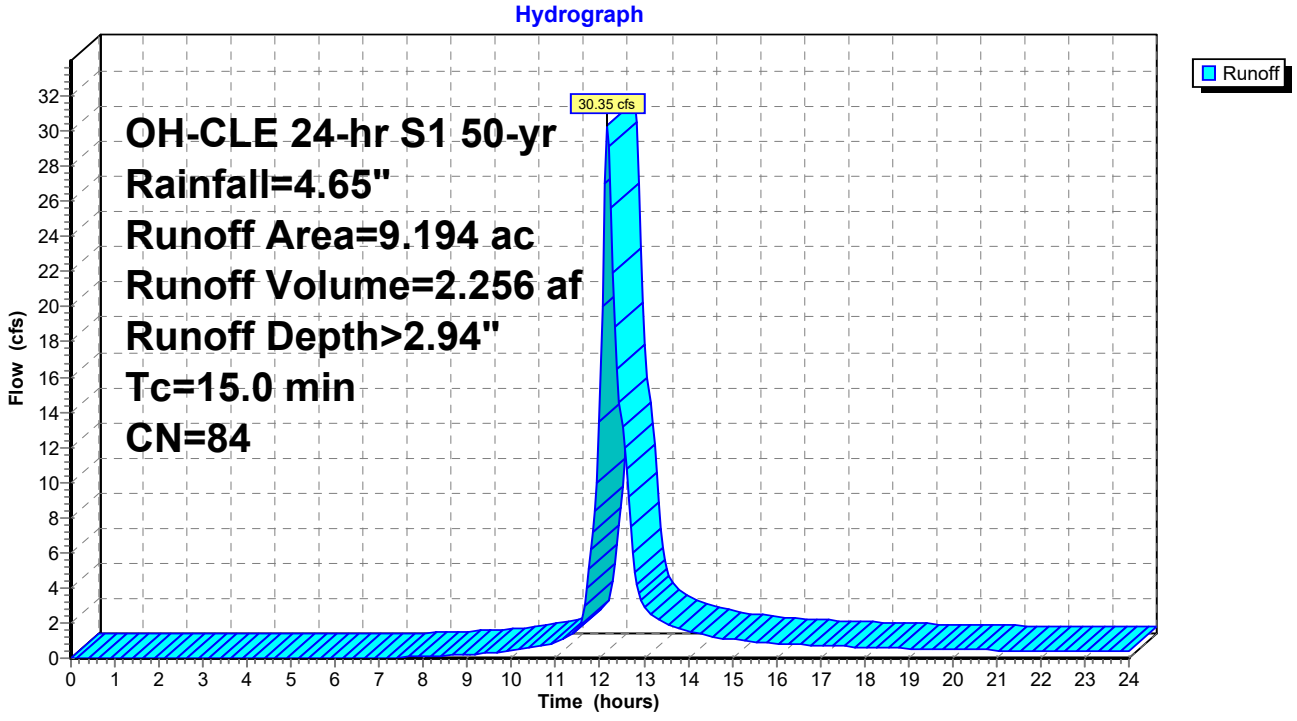
Runoff = 30.35 cfs @ 12.16 hrs, Volume= 2.256 af, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

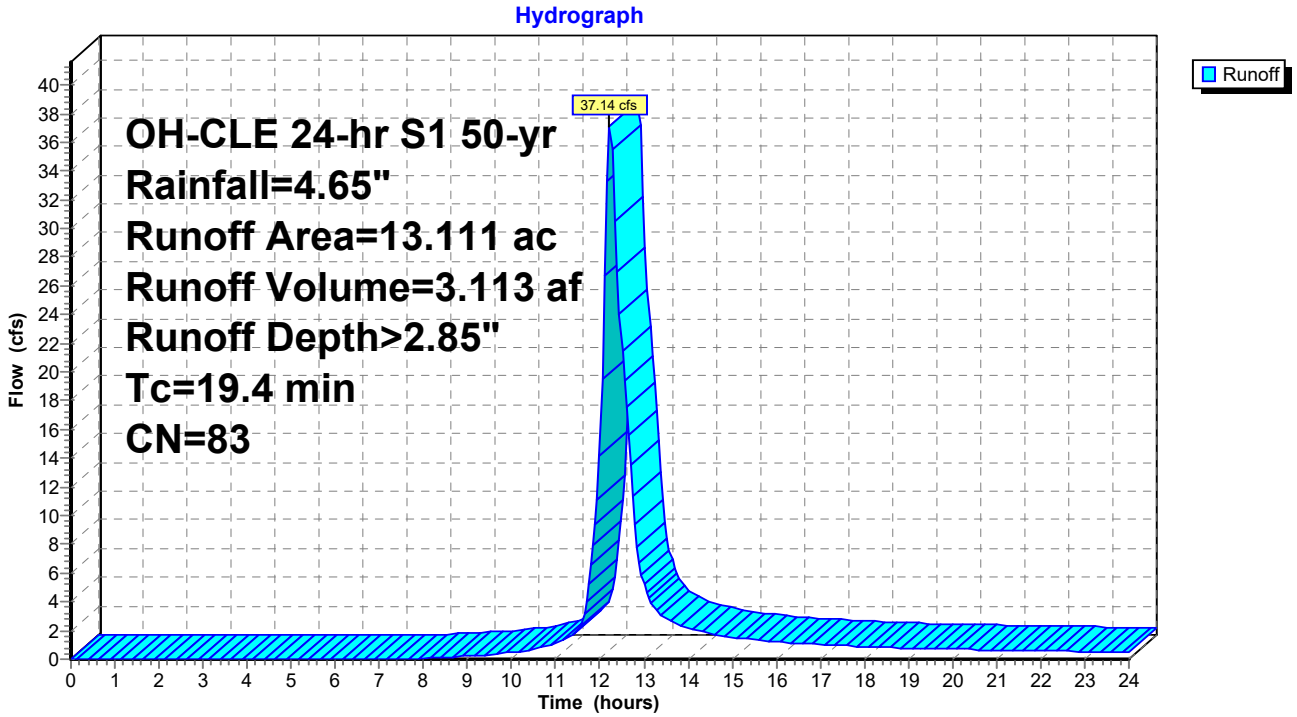
Runoff = 37.14 cfs @ 12.23 hrs, Volume= 3.113 af, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 2.94" for 50-yr event
Inflow = 30.35 cfs @ 12.16 hrs, Volume= 2.256 af
Outflow = 10.03 cfs @ 12.62 hrs, Volume= 1.969 af, Atten= 67%, Lag= 27.7 min
Primary = 10.03 cfs @ 12.62 hrs, Volume= 1.969 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 662.16' @ 12.62 hrs Surf.Area= 0.308 ac Storage= 1.040 af

Plug-Flow detention time= 203.2 min calculated for 1.965 af (87% of inflow)
Center-of-Mass det. time= 146.8 min ( 960.3 - 813.5 )

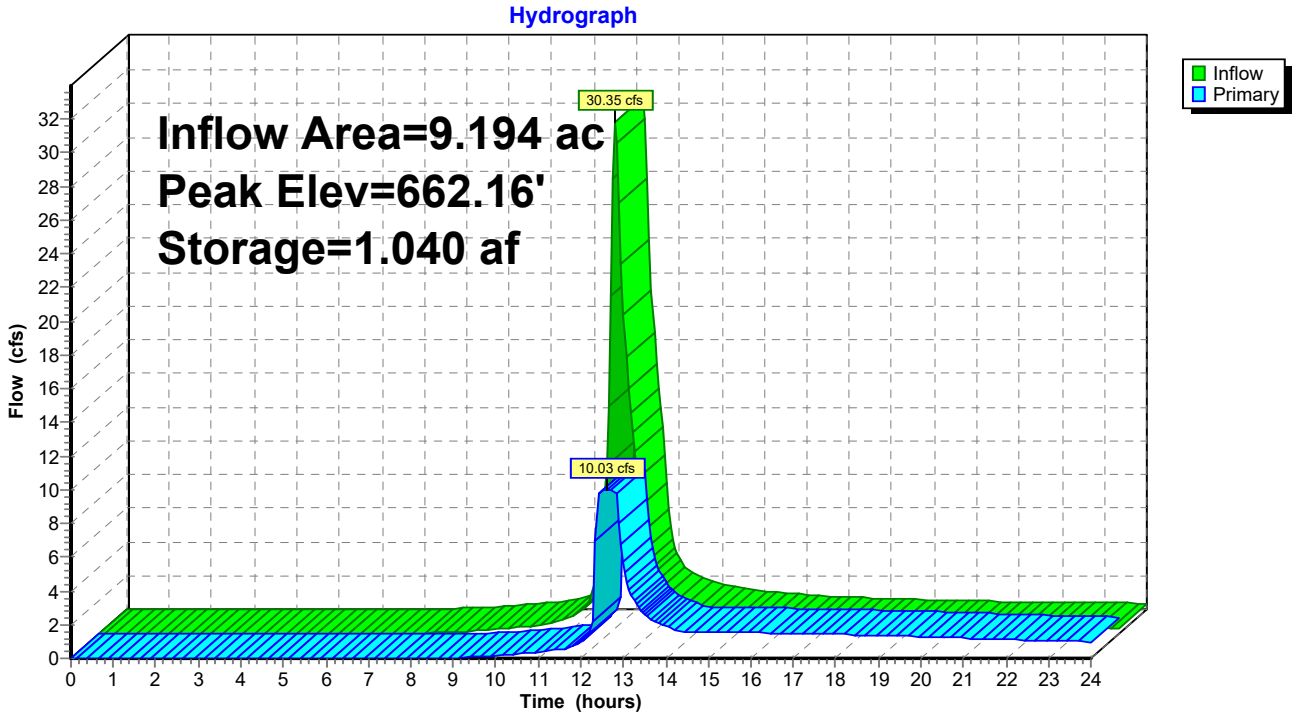
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=10.02 cfs @ 12.62 hrs HW=662.15' TW=651.11' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 10.02 cfs @ 8.17 fps)
  ├─**2=Orifice/Grate** (Passes < 13.86 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 1.72 cfs potential flow)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 653.47' (Flood elevation advised)

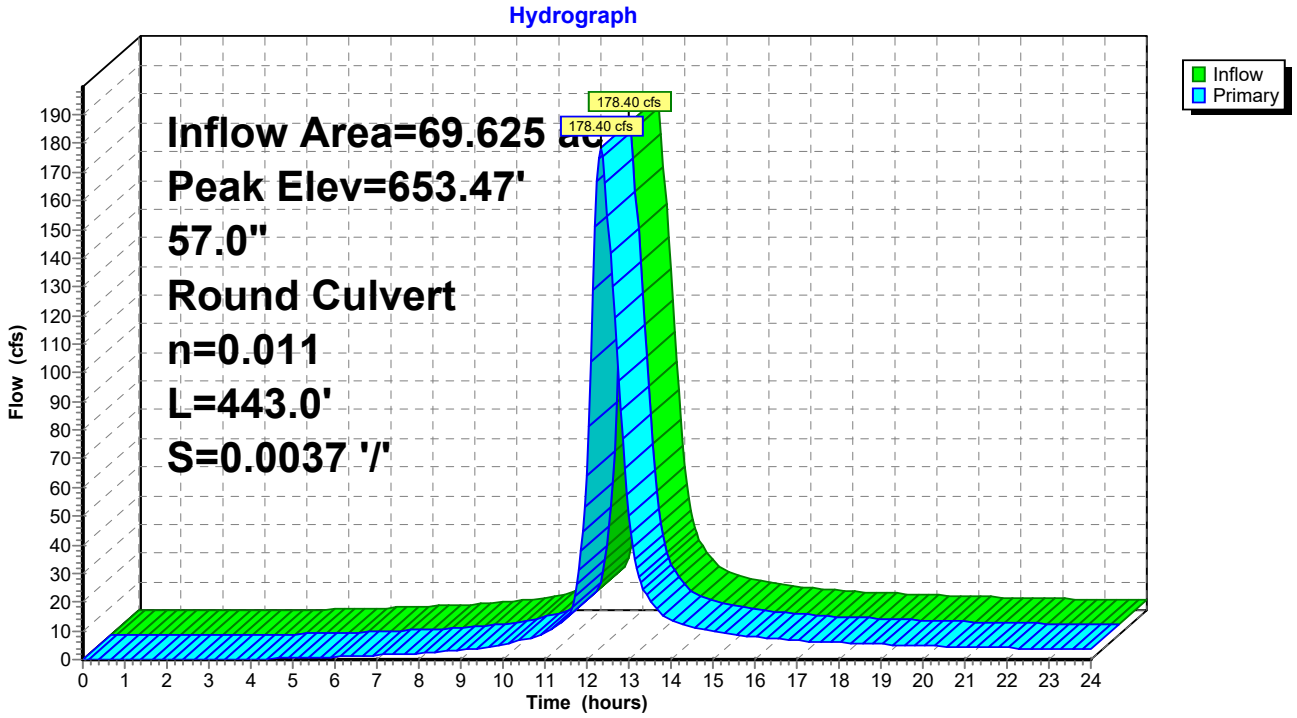
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 3.48" for 50-yr event
Inflow = 178.40 cfs @ 12.35 hrs, Volume= 20.209 af
Outflow = 178.40 cfs @ 12.35 hrs, Volume= 20.209 af, Atten= 0%, Lag= 0.0 min
Primary = 178.40 cfs @ 12.35 hrs, Volume= 20.209 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 653.47' @ 12.35 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=178.22 cfs @ 12.35 hrs HW=653.46' (Free Discharge)
**1=Culvert** (Barrel Controls 178.22 cfs @ 10.06 fps)

### Pond 6P: 66" - A101



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing 66" - A101** Runoff Area=68.290 ac 0.00% Impervious Runoff Depth>4.20"
Tc=32.5 min CN=91 Runoff=211.93 cfs 23.914 af

**Subcatchment2S: Existing Upstream** Runoff Area=47.320 ac 0.00% Impervious Runoff Depth>4.42"
Tc=30.0 min CN=93 Runoff=158.47 cfs 17.439 af

**Subcatchment3S: Detention Area** Runoff Area=9.194 ac 42.68% Impervious Runoff Depth>3.49"
Tc=15.0 min CN=84 Runoff=35.06 cfs 2.674 af

**Subcatchment5S: Proposed Downstream** Runoff Area=13.111 ac 0.00% Impervious Runoff Depth>3.39"
Tc=19.4 min CN=83 Runoff=43.28 cfs 3.703 af

**Pond 1P: Detention 2** Peak Elev=662.68' Storage=1.206 af Inflow=35.06 cfs 2.674 af
Outflow=10.69 cfs 2.338 af

**Pond 6P: 66" - A101** Peak Elev=654.74' Inflow=205.69 cfs 23.479 af
57.0" Round Culvert n=0.011 L=443.0' S=0.0037 '/' Outflow=205.69 cfs 23.479 af

**Total Runoff Area = 137.915 ac Runoff Volume = 47.730 af Average Runoff Depth = 4.15"**
**97.15% Pervious = 133.991 ac 2.85% Impervious = 3.924 ac**

## Summary for Subcatchment 1S: Existing 66" - A101

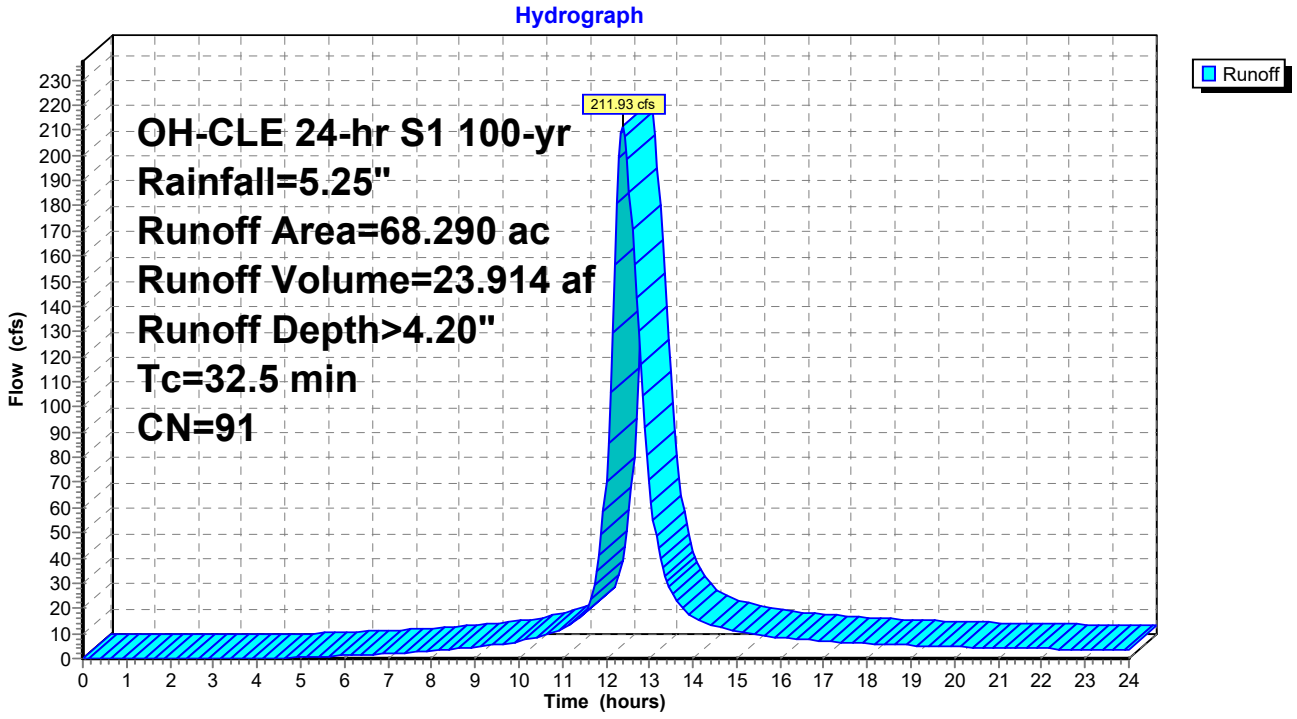
Runoff = 211.93 cfs @ 12.40 hrs, Volume= 23.914 af, Depth> 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 50.600 | 92 | From CCG1 proposed |
| * | 11.380 | 89 | From CCG1 proposed |
| * | 6.310 | 90 | From CCG1 proposed |
| | 68.290 | 91 | Weighted Average |
| | 68.290 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 32.5 | | | | | **Direct Entry, From CCG1 proposed storm** |

## Subcatchment 1S: Existing 66" - A101



## Summary for Subcatchment 2S: Existing Upstream

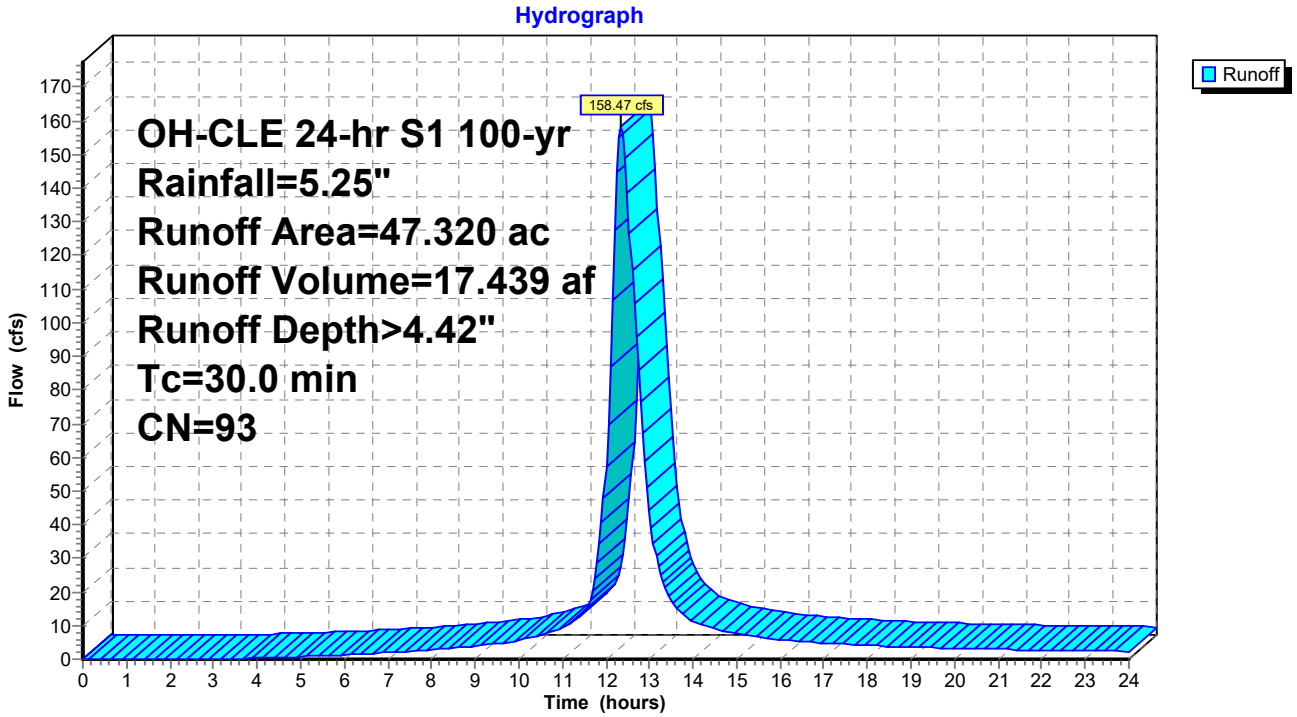
Runoff = 158.47 cfs @ 12.35 hrs, Volume= 17.439 af, Depth> 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 47.320 | 93 | Existing upstream determined from CCG1 |
| | 47.320 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 30.0 | | | | | **Direct Entry, From CCG1** |

## Subcatchment 2S: Existing Upstream



## Summary for Subcatchment 3S: Detention Area

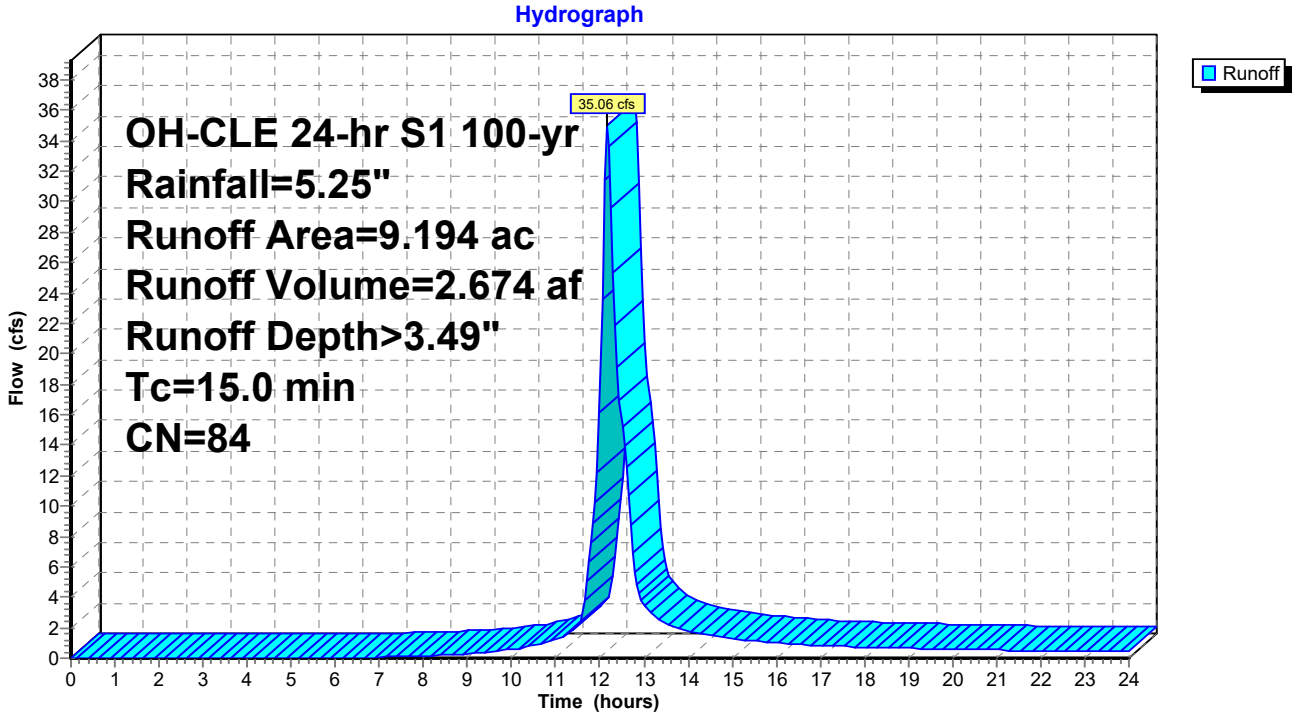
Runoff = 35.06 cfs @ 12.16 hrs, Volume= 2.674 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.988 | 74 | H5/H6 Gore |
| * | 2.282 | 74 | H6/H5/I-77 Interior Area |
| * | 3.924 | 98 | Ramp H5/H6 Pavement |
| | 9.194 | 84 | Weighted Average |
| | 5.270 | | 57.32% Pervious Area |
| | 3.924 | | 42.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 15.0 | | | | | **Direct Entry, Minimum Time** |

## Subcatchment 3S: Detention Area



## Summary for Subcatchment 5S: Proposed Downstream

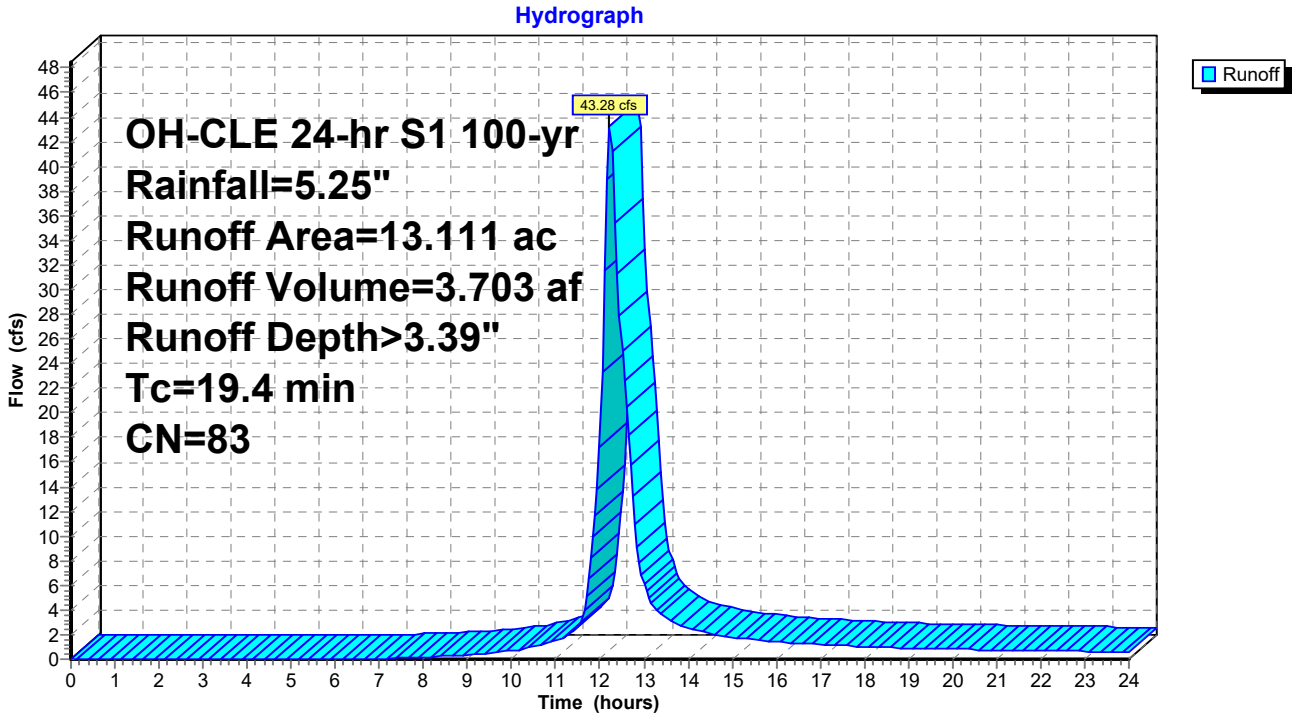
Runoff = 43.28 cfs @ 12.22 hrs, Volume= 3.703 af, Depth> 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 13.111 | 83 | Proposed Drainage Area Downstream of Detention |
| | 13.111 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 19.4 | | | | | **Direct Entry, From ORD** |

## Subcatchment 5S: Proposed Downstream



## Summary for Pond 1P: Detention 2

Inflow Area = 9.194 ac, 42.68% Impervious, Inflow Depth > 3.49" for 100-yr event
Inflow = 35.06 cfs @ 12.16 hrs, Volume= 2.674 af
Outflow = 10.69 cfs @ 12.65 hrs, Volume= 2.338 af, Atten= 70%, Lag= 29.3 min
Primary = 10.69 cfs @ 12.65 hrs, Volume= 2.338 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 662.68' @ 12.65 hrs Surf.Area= 0.326 ac Storage= 1.206 af

Plug-Flow detention time= 183.3 min calculated for 2.338 af (87% of inflow)
Center-of-Mass det. time= 126.7 min ( 936.8 - 810.1 )

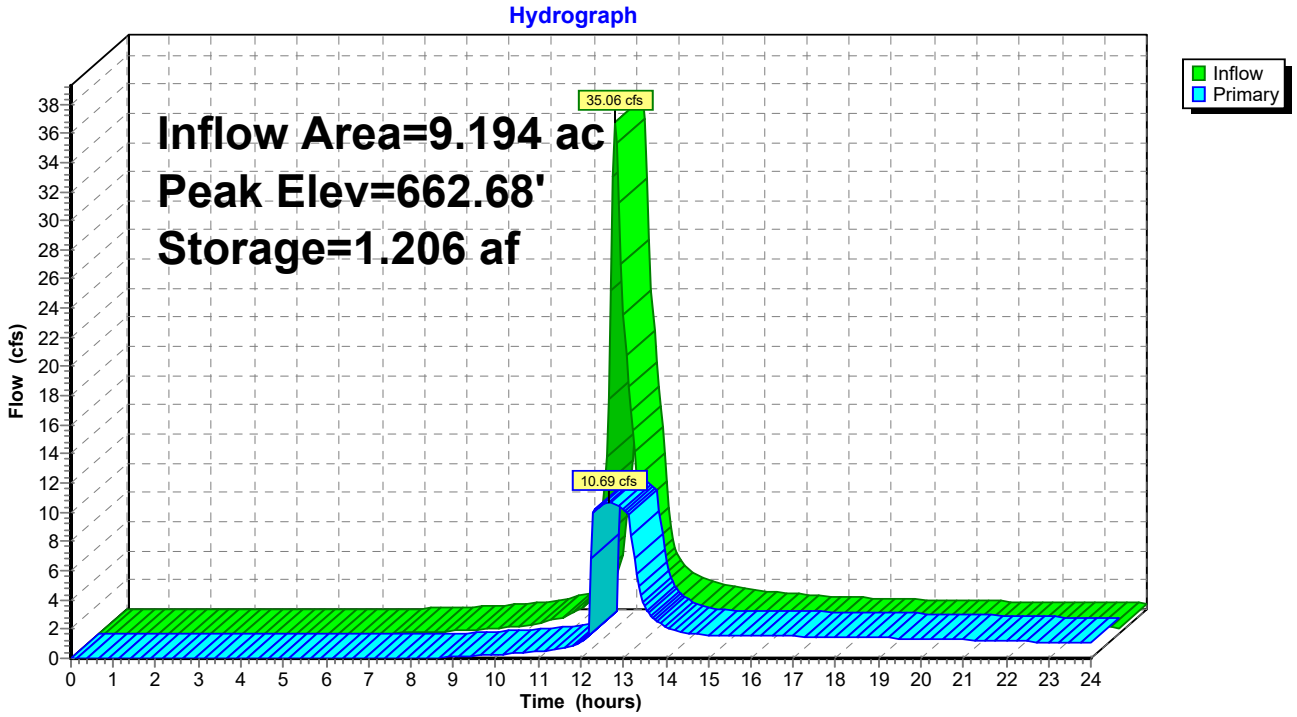
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 657.80' | 1.312 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 657.80 | 0.173 | 0.000 | 0.000 |
| 658.00 | 0.179 | 0.035 | 0.035 |
| 659.00 | 0.208 | 0.194 | 0.229 |
| 660.00 | 0.238 | 0.223 | 0.452 |
| 661.00 | 0.270 | 0.254 | 0.706 |
| 662.00 | 0.303 | 0.287 | 0.992 |
| 663.00 | 0.337 | 0.320 | 1.312 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 657.80' | **15.0" Round Culvert**<br>L= 70.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 657.80' / 657.10' S= 0.0100 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 661.50' | **24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 1 | 657.80' | **4.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=10.69 cfs @ 12.65 hrs HW=662.68' TW=651.38' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 10.69 cfs @ 8.71 fps)
  ├─**2=Orifice/Grate** (Passes < 20.93 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 1.82 cfs potential flow)

## Pond 1P: Detention 2



## Summary for Pond 6P: 66" - A101

[57] Hint: Peaked at 654.74' (Flood elevation advised)

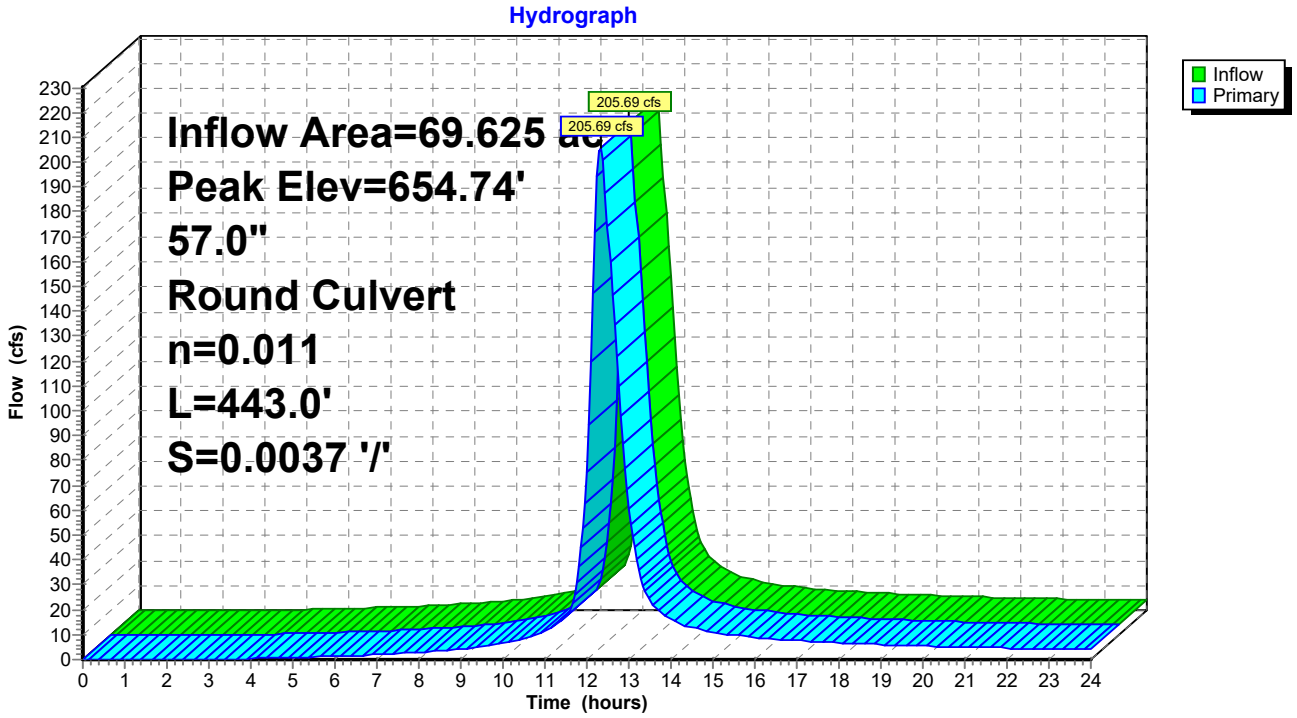
Inflow Area = 69.625 ac, 5.64% Impervious, Inflow Depth > 4.05" for 100-yr event
Inflow = 205.69 cfs @ 12.32 hrs, Volume= 23.479 af
Outflow = 205.69 cfs @ 12.32 hrs, Volume= 23.479 af, Atten= 0%, Lag= 0.0 min
Primary = 205.69 cfs @ 12.32 hrs, Volume= 23.479 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 654.74' @ 12.32 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 646.53' | **57.0" Round Culvert**<br>L= 443.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 646.53' / 644.87' S= 0.0037 '/' Cc= 0.900<br>n= 0.011, Flow Area= 17.72 sf |

**Primary OutFlow** Max=204.34 cfs @ 12.32 hrs HW=654.67' (Free Discharge)
└**1=Culvert** (Barrel Controls 204.34 cfs @ 11.53 fps)

### Pond 6P: 66" - A101

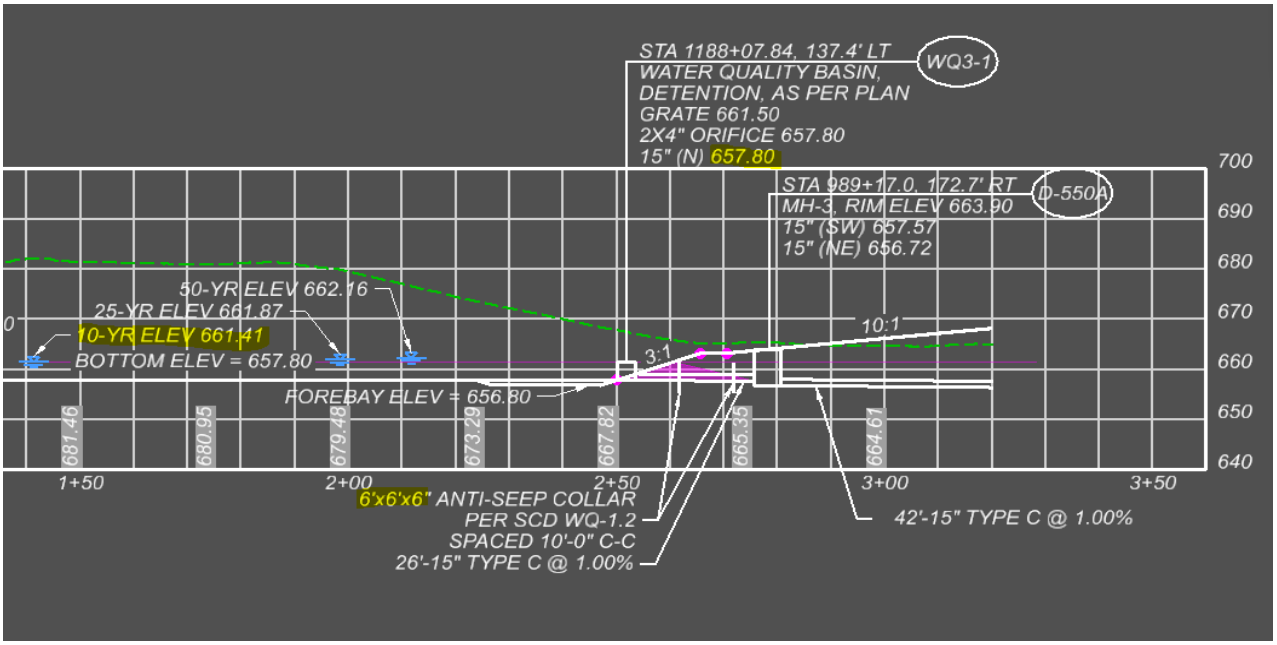


Michael Baker INTERNATIONAL

**CUY-90-16.28 (CCG3A)**
**PID 82382**
ANTI-SEEP COLLAR DESIGN FOR DENTION 3
PER L&D VOLUME 2 SECTION 1113.3.1.2

| | | |
|---|---|---|
| CALC | JLD | 6/23/2022 |
| CHECK | KGJ | 6/23/2022 |

| DESIGN PROCEDURE/NOTES | VARIABLE NAME | CALCULATED OR GIVEN? | EQUATION / REFERENCE | VALUE |
|---|---|---|---|---|
| **15" Type C Conduit from D-550A to WQ3-1** | | | | |
| Calculate saturated zone length along conduit (Ls) | Ls = Saturated zone length (ft) | CALCULATED | Ls = Y*(Z+4)*(1+S/(0.25-S)) | 26.33 |
| | Y = Depth of water at spillway crest, 10-year storm frequency (feet) | PER DESIGN | Detention 3 design | 3.61 |
| | Z = Slope of upstream face of embankment (Z feet Horiz : 1 foot Vert) | PER DESIGN | Detention 3 design | 3 |
| | S = Slope of the conduit (ft/ft) | PER DESIGN | 15" Type C Conduit from D-550A to WQ3-1 | 0.01 |
| Determine the required seepage length increase | ΔLs = required seepage length (ft) | CALCULATED | ΔLs = 0.15*Ls | 3.95 |
| Collar height selection | W = collar height | SELECTED | Round up Wmin to nearest foot | 6 |
| | Wmin = Minimum allowable collar height (ft) | CALCULATED | Wmin = 2 + D + 2 | 5.25 |
| | D = conduit diameter (ft) | PER DESIGN | 15" Type C Conduit from D-550A to WQ3-1 | 1.25 |
| Determine projection of collar | P = projection of collar (ft) | CALCULATED | P = W - D | 4.75 |
| Determine total number of anti-seep collars required | Nc = number of collars (each) | SELECTED | Nc = ΔLs / P | 2 |
| | Nmin = minimum number of collars (each) | CALCULATED | Nc = ΔLs / P | 0.84 |
| | NOTE: PER L&D VOL 2, EACH OUTLET CONDUIT MUST HAVE AT LEAST 2 COLLARS | | | |
| Anti-seep collar placement | Place at least one anti-seep collar in the saturation zone, ensuring top of collar is at least 6" from top of proposed ground. Minimum allowable spacing between collars is 10' and maximum allowable spacing is 25'. Saturation zone within 26.33' of front edge of berm | | | |
| | **Space first collar 10' back from water quality basin and second collar 10 from first.** | | | |

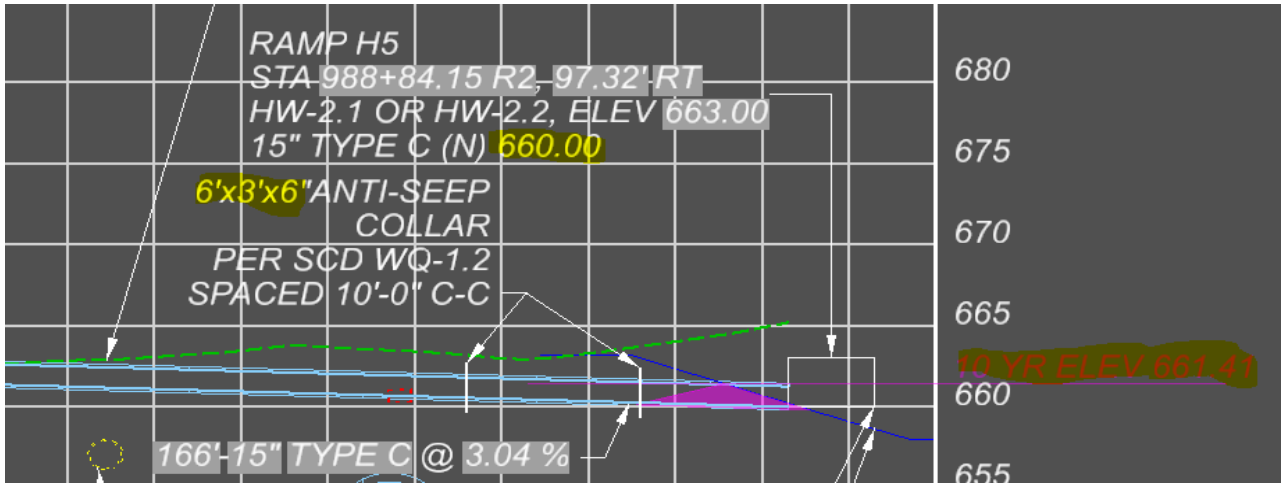


Michael Baker INTERNATIONAL

**CUY-90-16.28 (CCG3A)**
**PID 82382**
ANTI-SEEP COLLAR DESIGN FOR DENTION 3
PER L&D VOLUME 2 SECTION 1113.3.1.2

| | | |
|---|---|---|
| CALC | JLD | 6/23/2022 |
| CHECK | KGJ | 6/23/2022 |

| DESIGN PROCEDURE/NOTES | VARIABLE NAME | CALCULATED OR GIVEN? | EQUATION / REFERENCE | VALUE |
|---|---|---|---|---|
| **15" Type C Conduit from D-531 to Detention 3** | | | | |
| Calculate saturated zone length along conduit (Ls) | Ls = Saturated zone length (ft) | CALCULATED | Ls = Y*(Z+4)*(1+S/(0.25-S)) | 11.24 |
| | Y = Depth of water at spillway crest, 10-year storm frequency (feet) | PER DESIGN | Detention 3 design | 1.41 |
| | Z = Slope of upstream face of embankment (Z feet Horiz : 1 foot Vert) | PER DESIGN | Detention 3 design | 3 |
| | S = Slope of the conduit (ft/ft) | PER DESIGN | 15" Type C Conduit from D-531 to Detention 3 | 0.03 |
| Determine the required seepage length increase | ΔLs = required seepage length (ft) | CALCULATED | ΔLs = 0.15*Ls | 1.69 |
| Collar height selection | W = collar height | SELECTED | Round up Wmin to nearest foot | 3 |
| UNABLE TO ACHIEVE WITHOUT DAYLIGHTING COLLAR. THEREFORE, HEIGHT UPDATED TO MAXIMUM HEIGHT COLLAR THAT IS STILL 6" BELOW GROUND (CALCULATED VIA CAD) | Wmin = Minimum allowable collar height (ft) | CALCULATED | Wmin = 2 + D + 2 | 5.25 |
| | D = conduit diameter (ft) | PER DESIGN | 15" Type C Conduit from D-531 to Detention 3 | 1.25 |
| Determine projection of collar | P = projection of collar (ft) | CALCULATED | P = W - D | 1.75 |
| Determine total number of anti-seep collars required | Nc = number of collars (each) | SELECTED | Nc = ΔLs / P | 2 |
| | Nmin = minimum number of collars (each) | CALCULATED | Nc = ΔLs / P | 0.97 |
| | NOTE: PER L&D VOL 2, EACH OUTLET CONDUIT MUST HAVE AT LEAST 2 COLLARS | | | |
| Anti-seep collar placement | Place at least one anti-seep collar in the saturation zone, ensuring top of collar is at least 6" from top of proposed ground. Minimum allowable spacing between collars is 10' and maximum allowable spacing is 25'. Saturation zone within 11.24' of front edge of berm | | | |
| | **Space first collar at back of saturation zone and second collar 10 from first.** | | | |

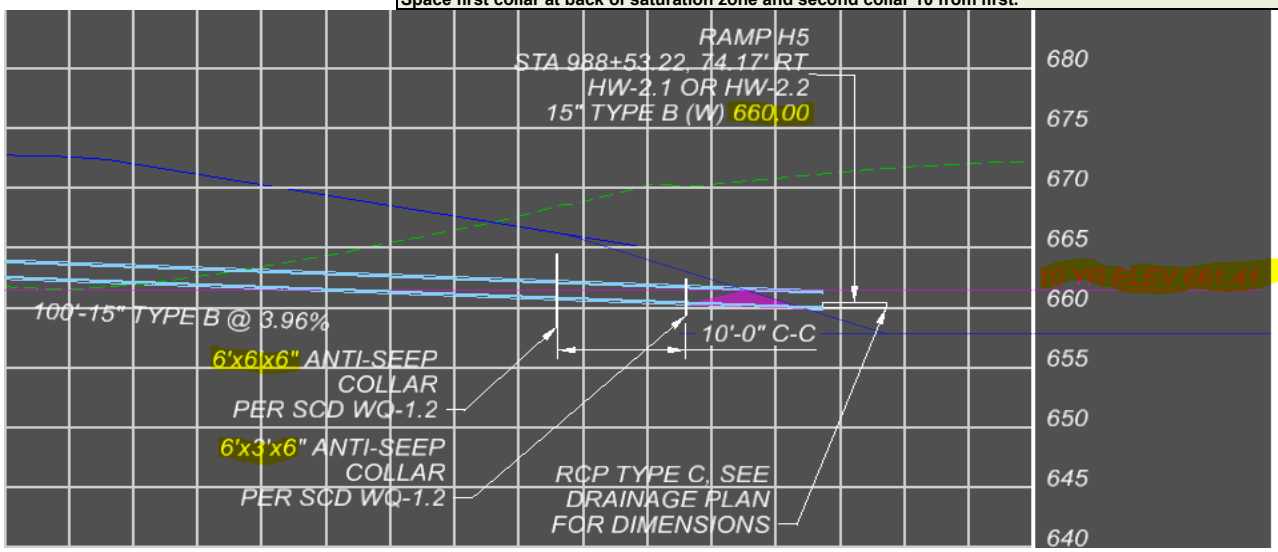


Michael Baker INTERNATIONAL

**CUY-90-16.28 (CCG3A)**
**PID 82382**
ANTI-SEEP COLLAR DESIGN FOR DENTION 3
PER L&D VOLUME 2 SECTION 1113.3.1.2

| | | |
|---|---|---|
| CALC | JLD | 6/23/2022 |
| CHECK | KGJ | 6/23/2022 |

| DESIGN PROCEDURE/NOTES | VARIABLE NAME | CALCULATED OR GIVEN? | EQUATION / REFERENCE | VALUE |
|---|---|---|---|---|
| **15" Type B Conduit from D-511 to Detention 3** | | | | |
| Calculate saturated zone length along conduit (Ls) | Ls = Saturated zone length (ft) | CALCULATED | Ls = Y*(Z+4)*(1+S/(0.25-S)) | 11.73 |
| | Y = Depth of water at spillway crest, 10-year storm frequency (feet) | PER DESIGN | Detention 3 design | 1.41 |
| | Z = Slope of upstream face of embankment (Z feet Horiz : 1 foot Vert) | PER DESIGN | Detention 3 design | 3 |
| | S = Slope of the conduit (ft/ft) | PER DESIGN | 15" Type B Conduit from D-511 to Detention 3 | 0.04 |
| Determine the required seepage length increase | ΔLs = required seepage length (ft) | CALCULATED | ΔLs = 0.15*Ls | 1.76 |
| Collar height selection | W = collar height | SELECTED | Round up Wmin to nearest foot | 3 |
| UNABLE TO ACHIEVE WITHOUT DAYLIGHTING COLLAR. THEREFORE, HEIGHT UPDATED TO MAXIMUM HEIGHT COLLAR THAT IS STILL 6" BELOW GROUND (CALCULATED VIA CAD) | Wmin = Minimum allowable collar height (ft) | CALCULATED | Wmin = 2 + D + 2 | 5.25 |
| | D = conduit diameter (ft) | PER DESIGN | 15" Type B Conduit from D-511 to Detention 3 | 1.25 |
| Determine projection of collar | P = projection of collar (ft) | CALCULATED | P = W - D | 1.75 |
| Determine total number of anti-seep collars required | Nc = number of collars (each) | SELECTED | Nc = ΔLs / P | 2 |
| | Nmin = minimum number of collars (each) | CALCULATED | Nc = ΔLs / P | 1.01 |
| | NOTE: PER L&D VOL 2, EACH OUTLET CONDUIT MUST HAVE AT LEAST 2 COLLARS | | | |
| Anti-seep collar placement | Place at least one anti-seep collar in the saturation zone, ensuring top of collar is at least 6" from top of proposed ground. Minimum allowable spacing between collars is 10' and maximum allowable spacing is 25'. Saturation zone within 11.73' of front edge of berm | | | |
| | **Space first collar at back of saturation zone and second collar 10 from first.** | | | |



Michael Baker INTERNATIONAL

**CUY-90-16.28 (CCG3A)**
**PID 82382**
ANTI-SEEP COLLAR DESIGN FOR DENTION 3
PER L&D VOLUME 2 SECTION 1113.3.1.2

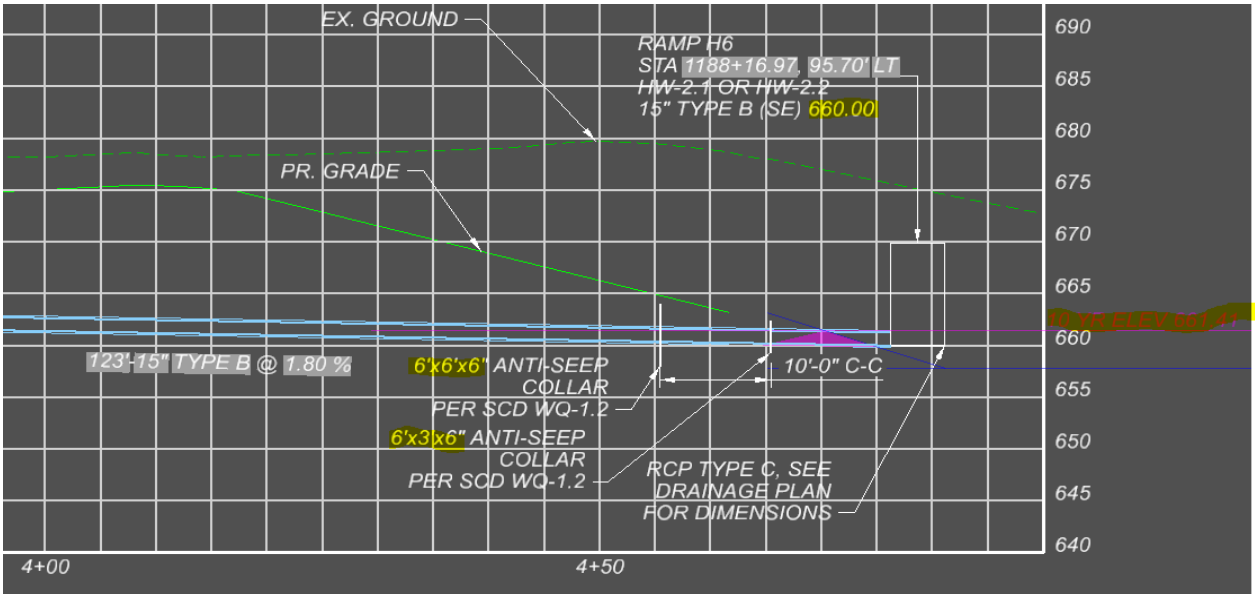
| | | |
|---|---|---|
| CALC | JLD | 6/23/2022 |
| CHECK | KGJ | 6/23/2022 |

| DESIGN PROCEDURE/NOTES | VARIABLE NAME | CALCULATED OR GIVEN? | EQUATION / REFERENCE | VALUE |
|---|---|---|---|---|
| **15" Type B Conduit from D-518 to Detention 3** | | | | |
| Calculate saturated zone length along conduit (Ls) | Ls = Saturated zone length (ft) | CALCULATED | Ls = Y*(Z+4)*(1+S/(0.25-S)) | 10.64 |
| | Y = Depth of water at spillway crest, 10-year storm frequency (feet) | PER DESIGN | Detention 3 design | 1.41 |
| | Z = Slope of upstream face of embankment (Z feet Horiz : 1 foot Vert) | PER DESIGN | Detention 3 design | 3 |
| | S = Slope of the conduit (ft/ft) | PER DESIGN | 15" Type B Conduit from D-518 to Detention 3 | 0.02 |
| Determine the required seepage length increase | ΔLs = required seepage length (ft) | CALCULATED | ΔLs = 0.15*Ls | 1.6 |
| Collar height selection | W = collar height | SELECTED | Round up Wmin to nearest foot | 3 |
| UNABLE TO ACHIEVE WITHOUT DAYLIGHTING COLLAR. THEREFORE, HEIGHT UPDATED TO MAXIMUM HEIGHT COLLAR THAT IS STILL 6" BELOW GROUND (CALCULATED VIA CAD) | Wmin = Minimum allowable collar height (ft) | CALCULATED | Wmin = 2 + D + 2 | 5.25 |
| | D = conduit diameter (ft) | PER DESIGN | 15" Type B Conduit from D-518 to Detention 3 | 1.25 |
| Determine projection of collar | P = projection of collar (ft) | CALCULATED | P = W - D | 1.75 |
| Determine total number of anti-seep collars required | Nc = number of collars (each) | SELECTED | Nc = ΔLs / P | 2 |
| | Nmin = minimum number of collars (each) | CALCULATED | Nc = ΔLs / P | 0.92 |
| | NOTE: PER L&D VOL 2, EACH OUTLET CONDUIT MUST HAVE AT LEAST 2 COLLARS | | | |

Anti-seep collar placement

Place at least one anti-seep collar in the saturation zone, ensuring top of collar is at least 6" from top of proposed ground. Minimum allowable spacing between collars is 10' and maximum allowable spacing is 25'.
Saturation zone within 10.64' of front edge of berm

**Space first collar at back of saturation zone and second collar 10 from first.**



Michael Baker INTERNATIONAL

**CUY-90-16.28 (CCG3A)**
**PID 82382**
ANTI-SEEP COLLAR DESIGN FOR DENTION 3
PER L&D VOLUME 2 SECTION 1113.3.1.2

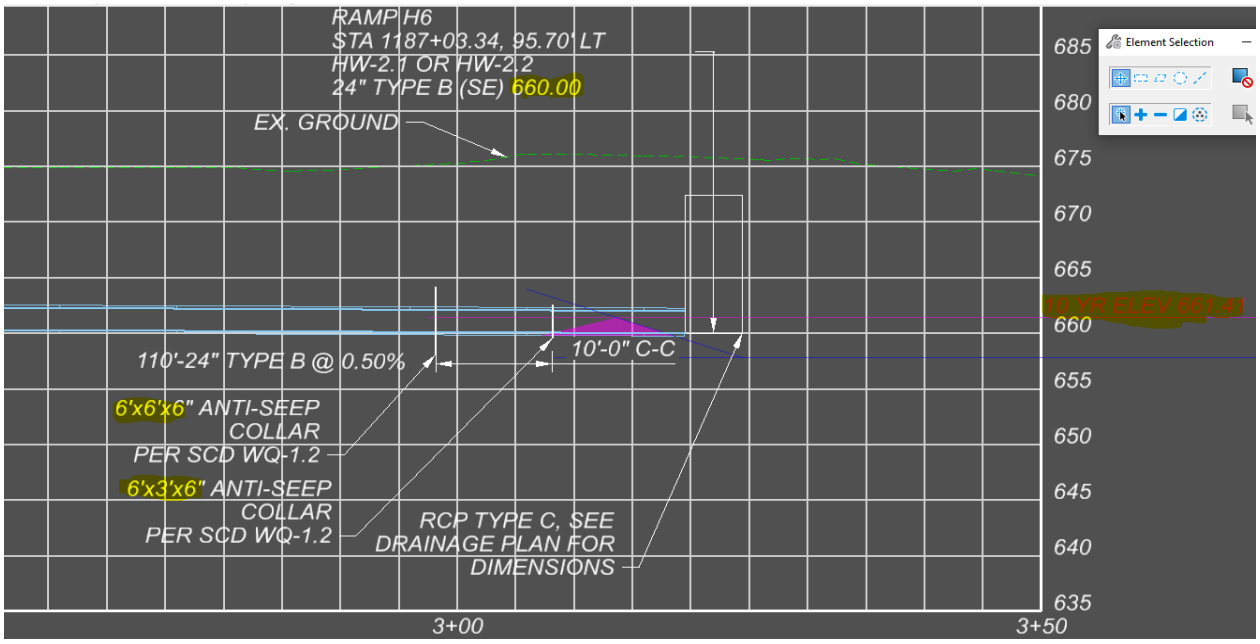
| | | |
|---|---|---|
| CALC | JLD | 6/23/2022 |
| CHECK | KGJ | 6/23/2022 |

| DESIGN PROCEDURE/NOTES | VARIABLE NAME | CALCULATED OR GIVEN? | EQUATION / REFERENCE | VALUE |
|---|---|---|---|---|
| **24" Type B Conduit from D-508 to Detention 3** | | | | |
| Calculate saturated zone length along conduit (Ls) | Ls = Saturated zone length (ft) | CALCULATED | Ls = Y*(Z+4)*(1+S/(0.25-S)) | 10.08 |
| | Y = Depth of water at spillway crest, 10-year storm frequency (feet) | PER DESIGN | Detention 3 design | 1.41 |
| | Z = Slope of upstream face of embankment (Z feet Horiz : 1 foot Vert) | PER DESIGN | Detention 3 design | 3 |
| | S = Slope of the conduit (ft/ft) | PER DESIGN | 24" Type B Conduit from D-508 to Detention 3 | 0.005 |
| Determine the required seepage length increase | ΔLs = required seepage length (ft) | CALCULATED | ΔLs = 0.15*Ls | 1.52 |
| Collar height selection | W = collar height | SELECTED | Round up Wmin to nearest foot | 3 |
| UNABLE TO ACHIEVE WITHOUT DAYLIGHTING COLLAR. THEREFORE, HEIGHT UPDATED TO MAXIMUM HEIGHT COLLAR THAT IS STILL 6" BELOW GROUND (CALCULATED VIA CAD) | Wmin = Minimum allowable collar height (ft) | CALCULATED | Wmin = 2 + D + 2 | 6 |
| | D = conduit diameter (ft) | PER DESIGN | 24" Type B Conduit from D-508 to Detention 3 | 2 |
| Determine projection of collar | P = projection of collar (ft) | CALCULATED | P = W - D | 1 |
| Determine total number of anti-seep collars required | Nc = number of collars (each) | SELECTED | Nc = ΔLs / P | 2 |
| | Nmin = minimum number of collars (each) | CALCULATED | Nc = ΔLs / P | 1.52 |
| | NOTE: PER L&D VOL 2, EACH OUTLET CONDUIT MUST HAVE AT LEAST 2 COLLARS | | | |

Anti-seep collar placement

Place at least one anti-seep collar in the saturation zone, ensuring top of collar is at least 6" from top of proposed ground. Minimum allowable spacing between collars is 10' and maximum allowable spacing is 25'.
Saturation zone within 10.08' of front edge of berm

**Space first collar at back of saturation zone and second collar 10 from first.**




# Cleveland Innerbelt Bridge
# Wall I 66 Inch Pipe Rehabilitation Package

PAGES FROM:

# DRAINAGE DESIGN REPORT

August 29, 2011

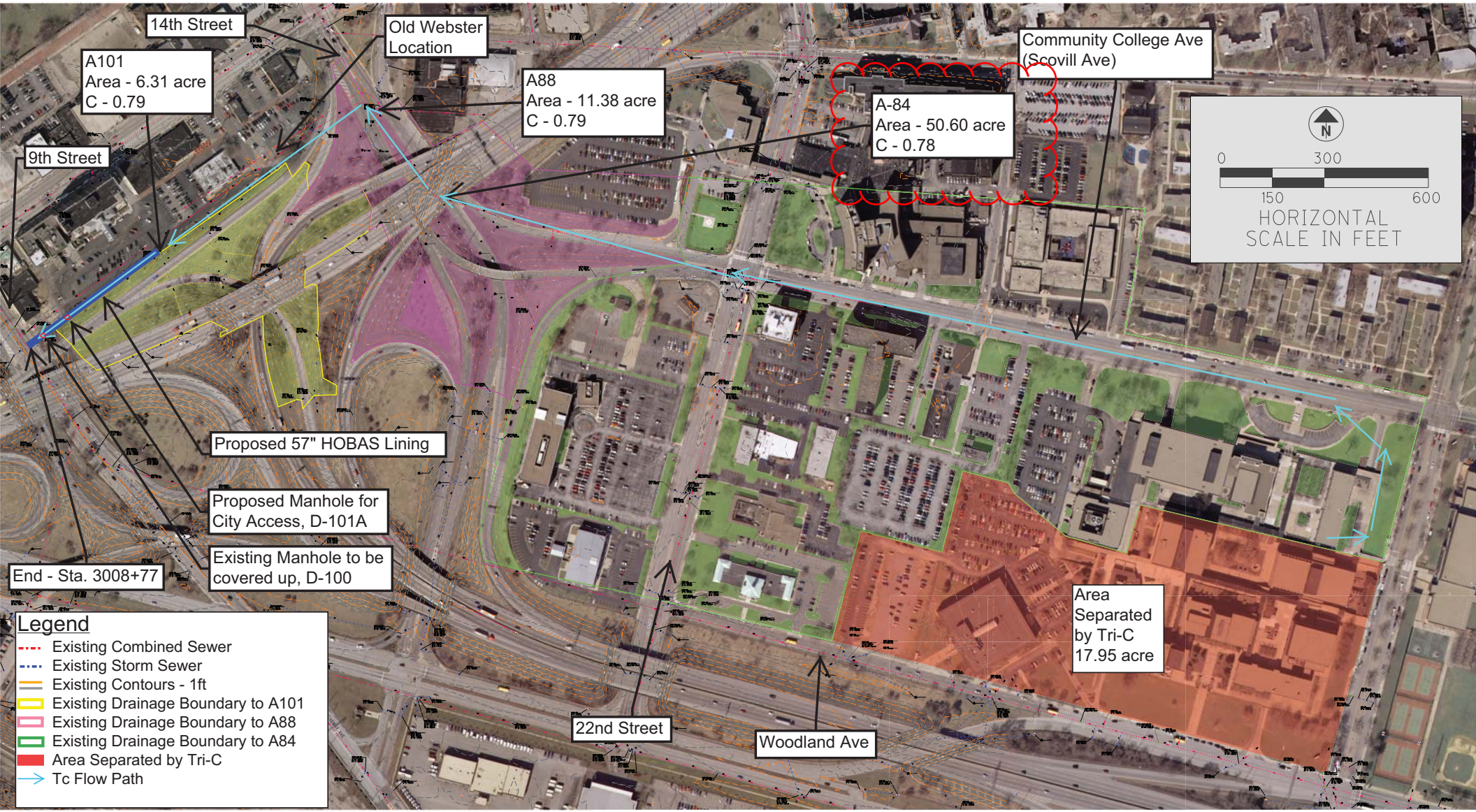
## Tabel 1 - 66 Inch Flow & HGL Analysis

| Pipe Segment | Q10 | Q25 | Q50 | Pipe of Concern (roughness) | Cover minus HGL - Q10 | Cover minus HGL - Q25 | Cover minus HGL - Q50 |
|---|---|---|---|---|---|---|---|
| **A84 to A88** | | | | | | | |
| 1959 (cfs) | 114.8 | 140.2 | 148.8 | 66" (0.013) | 10.62 | 10.30 | 10.19 |
| Pre-Project (cfs) | 110.2 | 134.6 | 142.8 | 66" (0.013) | 10.68 | 10.37 | 10.27 |
| Proposed 57" (cfs) | 110.2 | 134.6 | 142.8 | 66" (0.013) | 10.68 | 10.37 | 10.27 |
| | | | | | Cover minus crown = 8.70ft | | |
| **A88 to A102** | | | | | | | |
| 1959 (cfs) | 138.3 | 169.0 | 179.4 | 66” (0.013) | 16.15 | 15.72 | 15.36 |
| Pre-Project (cfs) | 133.7 | 163.4 | 173.5 | 66” (0.013) | 16.22 | 15.81 | 15.57 |
| Proposed 57” (cfs) | 133.7 | 163.4 | 173.5 | 66” (0.013) | 16.25 | 15.35 | 14.92 |
| | | | | | Cover minus crown = 13.88ft | | |
| **A102 to A101** | | | | | | | |
| 1959 (cfs) | 135.0 | 165.0 | 175.4 | 66” (0.013) | 17.69 | 17.24 | 17.06 |
| Pre-Project (cfs) | 130.5 | 159.5 | 169.5 | 66” (0.013) | 17.74 | 17.33 | 17.16 |
| Proposed 57” (cfs) | 130.5 | 159.5 | 169.5 | 66” (0.013) | 17.36 | 16.75 | 16.51 |
| | | | | | Cover minus crown = 16.37 | | |
| **A101 to A101A*** | | | | | | | |
| 1959 (cfs) | 134.4 | 164.3 | 174.6 | 66" (0.013) | 20.42 | 20.06 | 19.92 |
| Pre-Project (cfs) | 129.9 | 158.8 | 168.8 | 66" (0.013) | 20.46 | 20.13 | 20.00 |
| Proposed 57" (cfs) | 129.9 | 158.8 | 168.8 | 57" (0.011) | 20.08 | 19.56 | 19.35 |
| | | | | | Cover minus crown = 19.39, **20.01 | | |
| **A101A* to A100** | | | | | | | |
| 1959 (cfs) | 146.1 | 178.7 | 190.0 | 66" (0.013) | 27.06 | 26.94 | 26.89 |
| Pre-Project (cfs) | 141.6 | 173.2 | 184.2 | 66" (0.013) | 27.07 | 26.96 | 26.92 |
| Proposed 57" (cfs) | 141.8 | 173.4 | 184.4 | 57" (0.011) | 26.94 | 26.77 | 26.71 |
| | | | | | Cover minus crown = 26.79, **27.41 | | |
| **A100 to END** | | | | | | | |
| 1959 (cfs) | 145.5 | 178.0 | 189.3 | 66" (0.013) | 23.56 | 23.55 | 23.54 |
| Pre-Project (cfs) | 141.1 | 172.6 | 183.6 | 66" (0.013) | 23.57 | 23.55 | 23.54 |
| Proposed 57" (cfs) | 141.3 | 172.8 | 183.8 | 57" (0.011) | 23.55 | 23.52 | 23.51 |
| | | | | | Cover minus crown = 23.52, **24.14 | | |

*** - A101A was put into Exisitng models as a reference point for modeling purposes.**

**** - Cover minus crown is for 57” lining.**

# Figure 1 - Wall I 66 Inch Combined Sewer Analysis Drainage Map



HNTB

Made by: BH Date: 6/27/2011
Checked by: AKL Date: 6/27/2011

Job Number: 49633

Cleveland Innerbelt 66 inch Existing 1959, Pre-Project and Proposed Drainage Areas and Runoff Coefficients

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CN, Curve Number** | 82 | 69.00 | 98 | 98 | 74 | 94 | | | |
| **C, Rational Coefficient** | 0.7 | 0.30 | 0.9 | 0.9 | 0.5 | 0.8 | | | |
| **Terrain Description** | Fair ROW grass > 4:1 slopes | Fair ROW grass < 10:1 slopes | Pavement | Sidewalk | Dense Residentual | Industrial/ Commercial | Area | CN | C |
| **Pre-Project/Proposed** | | | | | | | | | |
| A84 - Existing Manhole - 22nd & Scovill-No. 7 (Broadway 14+50, 1350LT) | | 10.42 | 40.18 | | | | 50.600 | 92.03 | 0.78 |
| A88 - Existing Manhole - 14th-66" (14th 132+05, 10LT) | 5.33 | 0.40 | 5.65 | | | | 11.383 | 89.48 | 0.79 |
| A101 - Existing Manhole - Ramp A3/Webster Street - 66" (A3 3004+15, 60RT) | 3.32 | | 2.99 | | | | 6.310 | 89.58 | 0.79 |
| | | | | | | | | | |
| **Total A84, A88 & A101 Pre-Project Conditions** | **8.65** | **10.82** | **48.82** | | | | **68.293** | **91.38** | **0.78** |
| | | | | | | | | | |
| **Existing 1959 - A88 & A101 are same as Pre-Project/Proposed** | | | | | | | | | |
| A84 - Existing 1959 Conditions - Estimated 25% Impervious | | | 17.140 | | 51.41 | | 68.550 | 80.00 | 0.60 |
| | | | | | | | | | |
| **Total A84, A88 & A101 - Existing 1959 Conditions** | **8.65** | **0.400** | **25.780** | | **51.41** | | **86.240** | **81.95** | **0.64** |

| | | | | |
|---|---|---|---|---|
| HNTB | Made by: BAHess | | Date: | 8/2/2011 |
| | Checked by: ERJohnson | | Date: | 8/2/2011 |
| Job Number: 49633 | | | | |

**Cleveland Innerbelt 66inch Pre and Post Drainage Areas and Runoff Coefficients: TC CALCULATION/FLOW**

| Analysis Condition | | | Existing | Proposed |
|---|---|---|---|---|
| Outfall Name | A84 - Pre Project | A84 - 1959 Conditions | A101 | A101 |
| | | | | |
| **Sheetflow** | Grass | Grass | Grass | Grass |
| Runoff Coeffiecient | 0.300 | 0.300 | 0.700 | 0.700 |
| length, ft (<100) | 100.000 | 100.000 | 65.000 | 65.000 |
| dz, ft | 0.650 | 0.650 | 20.000 | 20.000 |
| slope | 0.007 | 0.007 | 0.308 | 0.308 |
| | | | | |
| Tt, min | 16.624 | 16.624 | 1.852 | 1.852 |
| | | | | |
| | | | | |
| **Shallow Concentrated** | | | Grass | Grass |
| length, ft | | | 215.000 | 215.000 |
| dz, ft | | | 9.500 | 9.500 |
| slope | | | 1.838 | 1.838 |
| Intercept Coefficient, k | | | 0.430 | 0.430 |
| avg velocity, ft/s | | | 2.753 | 2.753 |
| | | | | |
| Tt, min | | | 1.417 | 1.417 |
| | | | | |
| **Shallow Concentrated** | | | | |
| length, ft | | | | |
| dz, ft | | | | |
| slope | | | | |
| Intercept Coefficient, k | | | | |
| avg velocity, ft/s | | | | |
| | | | | |
| Tt, min | | | | |
| | | | | |
| **Pipe Flow** | | | | |
| length, ft | 3200.000 | 3200.000 | 385.000 | 385.000 |
| dz, ft | 9.000 | 9.000 | 1.630 | 1.630 |
| slope | 0.003 | 0.003 | 0.004 | 0.004 |
| Avg. Pipe Size | 24"-No.8 | 24"-No.8 | 12"-15" | 12"-15" |
| avg velocity, ft/s | 4.000 | 4.000 | 3.500 | 3.500 |
| | | | | |
| Tt, min | 13.333 | 13.333 | 1.833 | 1.833 |
| | | | | |
| **Channel flow** | | | | |
| side slope, X:1 | | | | |
| side slope, X:1 | | | | |
| bank full depth, ft | | | | |
| dz, ft | | | | |
| length, ft | | | | |
| manning's, n | | | | |
| cross-sectional area, $ft^2$ | | | | |
| wetted perimeter, ft | | | | |
| hydraulic radius, ft | | | | |
| slope | | | | |
| velocity, ft/s | | | | |
| | | | | |
| Tt, min | | | | |
| | | | | |
| **Total Tc, min** | 29.96 | 29.96 | 5.10 | 5.10 |
| **Regulated Total Tc, min** | 3.00 | 3.00 | 3.00 | 3.00 |
| | | | | |
| Area, acres | 50.600 | 68.550 | 6.310 | 6.470 |
| | | | | |
| C weighted | 0.78 | 0.60 | 0.79 | 0.82 |
| | | | | |
| | | | | |

# STORM SEWER SYSTEM

**PID :** 49633 **Date :** 08/16/2011 **Project :** Cleveland Innerbelt **Location :** I90 between E14th and E9th

**Description :**57" Proposed Condition-(Diff. Settlement Sag Calc-Positive HGL pushes water) **Designer :** BAHess

TO BE RELOCATED/REDESIGNED IN CCG3A

**Rainfall Area:** A **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 10

**Minimum Pipe Size :** 57.00 **Tailwater Elevation (ft.):** 650.16

| JUNCTION From | To | STATION From | To | ΔAREA ΣAREA (acres) | ΔCA ΣCA | BEGIN TIME (min.) | RAINFALL INTENSITY (10 yrs.) | (10 yrs.) | DISCHARGE (cfs.) (10 yrs.) | (10 yrs.) | PIPE DIAM. (in.) | LENGTH (ft.) | SLOPE (ft./ft.) | F/L PIPE IN / OUT (ft.) | MEAN VEL (fps.) | JUST FULL CAPACITY (cfs.) | FRICT SLOPE (ft./ft.) | HYGR EL. IN / OUT (ft.) | COVER IN / OUT (ft.) | COVER MINUS HY GR | COVER MINUS CROWN | INLET TYPE MANNING'S 'n' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A84 | A88 | 72+50 | | 50.60 | 39.47 | 30.00 | 2.79 | 2.76 | 110.2 | 108.9 | 66 | 276.0 | 0.0035 | 650.36 | 8.56 | 213.04 | 0.0011 | 653.88 | 664.56 | 10.68 | 8.70 | MH 3 |
| begin | | 71+83 | | 50.60 | 39.47 | | | | | | | | | 649.40 | | | | 653.59 | 668.76 | | | 0.013 |
| A88 | A102 | 71+83 | | 11.38 | 8.99 | 30.54 | 2.76 | 2.64 | 133.7 | 128.1 | 66 | 652.0 | 0.0040 | 649.38 | 9.46 | 228.68 | 0.0015 | 652.46 | 668.76 | 16.30 | 13.88 | MH 3 |
| | | 65+87 | | 61.98 | 48.46 | | | | | | | | | 646.77 | | | | 651.45 | 670.25 | | | 0.013 |
| A102 | A101 | 65+87 | | 0.00 | 0.00 | 31.69 | 2.69 | 2.64 | 130.5 | 128.1 | 66 | 122.0 | 0.0038 | 646.75 | 9.20 | 222.29 | 0.0015 | 651.45 | 668.75 | 17.30 | 16.50 | MH 3 |
| | | 3004+24 | | 61.98 | 48.46 | | | | | | | | | 646.28 | | | | 651.28 | 671.26 | | | 0.013 |
| A101 | 101A | 3004+24 | | 0.00 | 0.00 | 31.91 | 2.68 | 2.64 | 129.9 | 128.1 | 57 | 254.0 | 0.0040 | 646.53 | 10.53 | 182.09 | 0.0023 | 651.28 | 671.29 | 20.01 | 20.01 | MH 3 |
| | | 3006+93 | | 61.98 | 48.46 | | | | | | Warning | | | 645.52 | | | | 650.70 | 675.05 | | | 0.011 |
| 101A | A100 | 3006+93 | | 6.31 | 4.98 | 32.31 | 2.66 | 2.64 | 142.1 | 141.2 | 57 | 162.0 | 0.0040 | 645.52 | 10.74 | 182.92 | 0.0028 | 650.70 | 675.05 | 24.35 | 24.78 | MH 3 |
| | | 3008+48 | | 68.29 | 53.44 | | | | | | | | | 644.87 | | | | 650.25 | 673.76 | | | 0.011 |
| A100 | END | 3008+48 | | 0.00 | 0.00 | 32.56 | 2.65 | 2.64 | 141.4 | 141.2 | 55 | 27.0 | 0.0000 | 644.87 | 8.57 | 5.05 | 0.0033 | 650.25 | 673.76 | 23.51 | 24.31 | MH 3 |
| final | | 3008+77 | | 68.29 | 53.44 | | | | | | Warning | | | 644.87 | | | | 650.16 | 672.00 | | | 0.011 |

# STORM SEWER SYSTEM

**PID :** 49633 **Date :** 08/16/2011 **Project :** Cleveland Innerbelt **Location :** I90 between E14th and E9th

**Description :**57" Proposed Condition-(Diff. Settlement Sag Calc-Positive HGL pushes water) **Designer :** BAHess

**Rainfall Area:** A **Just Full Capacity Frequency (yrs.) :** 25 **ency (yrs.) :** 25

**Minimum Pipe Size :** 57.00 **Tailwater Elevation (ft.):** 650.16

TO BE RELOCATED/REDESIGNED IN CCG3A

| JUNCTION From | To | STATION From | To | ΔAREA ΣAREA (acres) | ΔCA ΣCA | BEGIN TIME (min.) | RAINFALL INTENSITY (25 yrs.) | (25 yrs.) | DISCHARGE (cfs.) (25 yrs.) | (25 yrs.) | PIPE DIAM. (in.) | LENGTH (ft.) | SLOPE (ft./ft.) | F/L PIPE IN / OUT (ft.) | MEAN VEL (fps.) | JUST FULL CAPACITY (cfs.) | FRICT SLOPE (ft./ft.) | HYGR EL. IN / OUT (ft.) | COVER IN / OUT (ft.) | COVER MINUS HY GR | COVER MINUS CROWN | INLET TYPE MANNING'S 'n' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A84 | A88 | 72+50 | | 50.60 | 39.47 | 30.00 | 3.41 | 3.37 | 134.6 | 133.1 | 66 | 276.0 | 0.0035 | 650.36 | 8.96 | 213.04 | 0.0016 | 654.19 | 664.56 | 10.37 | 8.70 | MH 3 |
| begin | | 71+83 | | 50.60 | 39.47 | | | | | | | | | 649.40 | | | | 653.75 | 668.76 | | | 0.013 |
| A88 | A102 | 71+83 | | 11.38 | 8.99 | 30.51 | 3.37 | 3.23 | 163.4 | 156.7 | 66 | 652.0 | 0.0040 | 649.38 | 9.87 | 228.68 | 0.0022 | 653.51 | 668.76 | 15.25 | 13.88 | MH 3 |
| | | 65+87 | | 61.98 | 48.46 | | | | | | | | | 646.77 | | | | 652.09 | 670.25 | | | 0.013 |
| A102 | A101 | 65+87 | | 0.00 | 0.00 | 31.61 | 3.29 | 3.23 | 159.6 | 156.7 | 66 | 122.0 | 0.0038 | 646.75 | 9.60 | 222.29 | 0.0022 | 652.09 | 668.75 | 16.66 | 16.50 | MH 3 |
| | | 3004+24 | | 61.98 | 48.46 | | | | | | | | | 646.28 | | | | 651.83 | 671.26 | | | 0.013 |
| A101 | 101A | 3004+24 | | 0.00 | 0.00 | 31.83 | 3.28 | 3.23 | 158.9 | 156.7 | 57 | 254.0 | 0.0040 | 646.53 | 10.86 | 182.09 | 0.0034 | 651.83 | 671.29 | 19.46 | 20.01 | MH 3 |
| | | 3006+93 | | 61.98 | 48.46 | | | | | | Warning | | | 645.52 | | | | 650.97 | 675.05 | | | 0.011 |
| 101A | A100 | 3006+93 | | 6.31 | 4.98 | 32.22 | 3.25 | 3.23 | 173.8 | 172.8 | 57 | 162.0 | 0.0040 | 645.52 | 10.92 | 182.92 | 0.0041 | 650.97 | 675.05 | 24.08 | 24.78 | MH 3 |
| | | 3008+48 | | 68.29 | 53.44 | | | | | | | | | 644.87 | | | | 650.30 | 673.76 | | | 0.011 |
| A100 | END | 3008+48 | | 0.00 | 0.00 | 32.46 | 3.24 | 3.23 | 172.9 | 172.8 | 55 | 27.0 | 0.0000 | 644.87 | 10.48 | 5.05 | 0.0050 | 650.30 | 673.76 | 23.46 | 24.31 | MH 3 |
| final | | 3008+77 | | 68.29 | 53.44 | | | | | | Warning | | | 644.87 | | | | 650.16 | 672.00 | | | 0.011 |

HGL FOR CCG3A

# STORM SEWER SYSTEM

**PID :** 49633 **Date :** 08/16/2011 **Project :** Cleveland Innerbelt **Location :** I90 between E14th and E9th

**Description :**57" Proposed Condition-(Diff. Settlement Sag Calc-Positive HGL pushes water) **Designer :** BAHess

**Rainfall Area:** A **Just Full Capacity Frequency (yrs.) :** 50 **Hydraulic Gradient Frequency (yrs.) :** 50

**Minimum Pipe Size :** 57.00 **Tailwater Elevation (ft.):** 650.16

| JUNCTION From | To | STATION From | To | ΔAREA ΣAREA (acres) | ΔCA ΣCA | BEGIN TIME (min.) | RAINFALL INTENSITY (50 yrs.) | (50 yrs.) | DISCHARGE (cfs.) (50 yrs.) | (50 yrs.) | PIPE DIAM. (in.) | LENGTH (ft.) | SLOPE (ft./ft.) | F/L PIPE IN / OUT (ft.) | MEAN VEL (fps.) | JUST FULL CAPACITY (cfs.) | FRICT SLOPE (ft./ft.) | HYGR EL. IN / OUT (ft.) | COVER IN / OUT (ft.) | COVER MINUS HY GR | COVER MINUS CROWN | INLET TYPE MANNING'S 'n' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A84 | A88 | 72+50 | | 50.60 | 39.47 | 30.00 | 3.62 | 3.44 | 142.8 | 135.7 | 66 | 276.0 | 0.0035 | 650.36 | 9.08 | 213.04 | 0.0016 | 654.40 | 664.56 | 10.16 | 8.70 | MH 3 |
| begin | | 71+83 | | 50.60 | 39.47 | | | | | | | | | 649.40 | | | | 653.95 | 668.76 | | | 0.013 |
| A88 | A102 | 71+83 | | 11.38 | 8.99 | 30.51 | 3.58 | 3.44 | 173.5 | 166.6 | 66 | 652.0 | 0.0040 | 649.38 | 9.97 | 228.68 | 0.0025 | 653.95 | 668.76 | 14.81 | 13.88 | MH 3 |
| | | 65+87 | | 61.98 | 48.46 | | | | | | | | | 646.77 | | | | 652.35 | 670.25 | | | 0.013 |
| A102 | A101 | 65+87 | | 0.00 | 0.00 | 31.60 | 3.50 | 3.44 | 169.6 | 166.6 | 66 | 122.0 | 0.0038 | 646.75 | 9.71 | 222.29 | 0.0025 | 652.35 | 668.75 | 16.40 | 16.50 | MH 3 |
| | | 3004+24 | | 61.98 | 48.46 | | | | | | | | | 646.28 | | | | 652.05 | 671.26 | | | 0.013 |
| A101 | 101A | 3004+24 | | 0.00 | 0.00 | 31.81 | 3.49 | 3.44 | 168.9 | 166.6 | 57 | 254.0 | 0.0040 | 646.53 | 10.89 | 182.09 | 0.0038 | 652.05 | 671.29 | 19.24 | 20.01 | MH 3 |
| | | 3006+93 | | 61.98 | 48.46 | | | | | | Warning | | | 645.52 | | | | 651.07 | 675.05 | | | 0.011 |
| 101A | A100 | 3006+93 | | 6.31 | 4.98 | 32.19 | 3.46 | 3.44 | 184.8 | 183.7 | 57 | 162.0 | 0.0040 | 645.52 | 10.43 | 182.92 | 0.0047 | 651.07 | 675.05 | 23.98 | 24.78 | MH 3 |
| | | 3008+48 | | 68.29 | 53.44 | | | | | | Warning | | | 644.87 | | | | 650.31 | 673.76 | | | 0.011 |
| A100 | END | 3008+48 | | 0.00 | 0.00 | 32.45 | 3.44 | 3.44 | 183.9 | 183.7 | 55 | 27.0 | 0.0000 | 644.87 | 11.14 | 5.05 | 0.0057 | 650.31 | 673.76 | 23.45 | 24.31 | MH 3 |
| final | | 3008+77 | | 68.29 | 53.44 | | | | | | Warning | | | 644.87 | | | | 650.16 | 672.00 | | | 0.011 |

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix I

## I-90 Peak Flows & Detention

Michael Baker INTERNATIONAL

CUY-90-16.28 (CCG3A)

MODEL: Proposed Trench Detention (Sheet) PAPERSIZE: 17x11(In.) DATE: 1/16/2024 TIME: 10:23:40 AM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD2201.dgn


DRAINAGE AREA MAP
I-90 FLOW RESTRICTION DETENTION

HORIZONTAL SCALE IN FEET
0 100 200 400

| SHEET | TOTAL | PROJECT ID | REVIEWER | DESIGNER | DESIGN AGENCY |
|---|---|---|---|---|---|
| P.0 | 0 | 0 | SM 8/16/23 | KGJ | Michael Baker INTERNATIONAL |

Michael Baker INTERNATIONAL

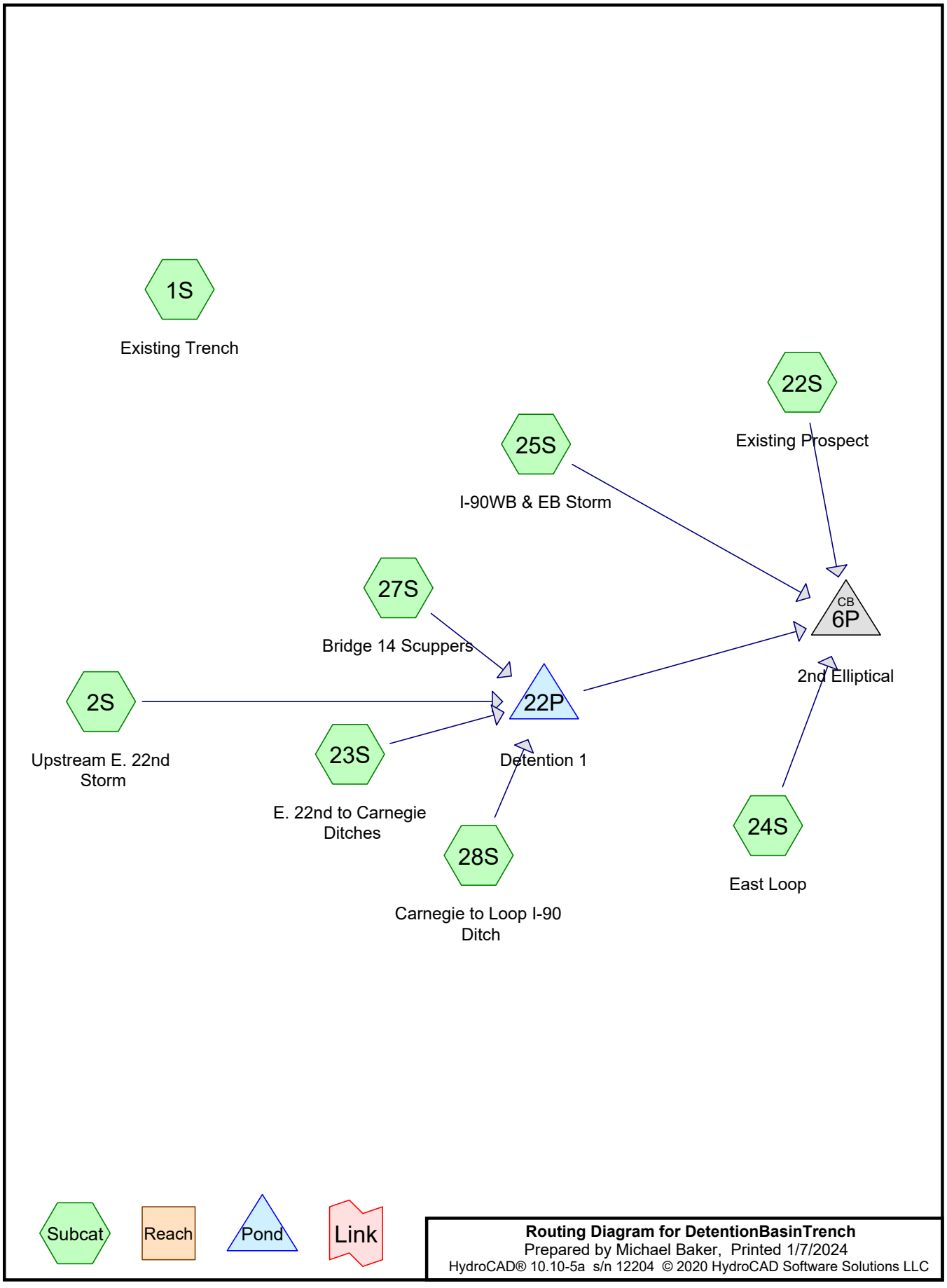
Project: CUY-90-16.28
PID: 82382
Subject: I-90 TRENCH PRE/POST COMPARISONS

Computed by: KGJ Date: 8/16/23
Checked by: SM Date: 8/16/23
Page: 1 of 1

## CSO-97 DOWNSTREAM OF REGULATOR I-90 TRENCH PRE/POST FLOWS

| | | EXISTING OUTFALL | PROPOSED DETENTION | | | PROPOSED OUTFALL | FLOW DIFFERENCE AT OUTFALL |
|---|---|---|---|---|---|---|---|
| | | | IN | OUT | PEAK ELEV | | |
| PEAK FLOWS (CFS) | 1-YR | 14.47 | 11.54 | 3.58 | 635.25 | 13.55 | -0.92 |
| | 2-YR | 20.21 | 15.54 | 4.79 | 635.53 | 18.43 | -1.78 |
| | 5-YR | 28.54 | 21.30 | 5.47 | 636.04 | 25.36 | -3.18 |
| | 10-YR | 35.28 | 25.97 | 5.90 | 636.47 | 30.51 | -4.77 |
| | 25-YR | 44.42 | 32.33 | 6.42 | 637.05 | 36.71 | -7.71 |
| | 50-YR | 51.68 | 37.42 | 6.80 | 637.52 | 41.58 | -10.10 |
| | 100-YR | 59.03 | 42.62 | 7.17 | 637.99 | 46.50 | -12.53 |
| AREA | (AC) | 12.39 | 9.13 | | | 17.20 | |

* TOTAL PROPOSED AREA TO OUTFALL IS LESS THAN DISPLAYED WITH THE INITIAL PRE-POST COMPARISON DUE TO CHANGES IN THE DRAINAGE PATTERN. INITIAL COMPARISON IS BASED STRICTLY ON SURFACE LAND USE. THE NUMBERS PRESENTED ABOVE ARE FOR THE DRAINAGE AREA TO A SPECIFIC POINT ON THE STORM LINE, WITH THE NUMBERS FOR THE EXISTING ABOVE BEING CONSERVATIVE.




**Routing Diagram for DetentionBasinTrench**
Prepared by Michael Baker, Printed 1/7/2024
HydroCAD® 10.10-5a s/n 12204 © 2020 HydroCAD Software Solutions LLC

## Rainfall Events Listing

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|---|---|---|---|---|---|---|---|---|
| 1 | 1-yr | OH-CLE 24-hr S1 | 1-yr | Default | 24.00 | 1 | 1.96 | 2 |
| 2 | 2-yr | OH-CLE 24-hr S1 | 2-yr | Default | 24.00 | 1 | 2.35 | 2 |
| 3 | 5-yr | OH-CLE 24-hr S1 | 5-yr | Default | 24.00 | 1 | 2.93 | 2 |
| 4 | 10-yr | OH-CLE 24-hr S1 | 10-yr | Default | 24.00 | 1 | 3.40 | 2 |
| 5 | 25-yr | OH-CLE 24-hr S1 | 25-yr | Default | 24.00 | 1 | 4.08 | 2 |
| 6 | 50-yr | OH-CLE 24-hr S1 | 50-yr | Default | 24.00 | 1 | 4.65 | 2 |
| 7 | 100-yr | OH-CLE 24-hr S1 | 100-yr | Default | 24.00 | 1 | 5.25 | 2 |

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 0.357 | 98 | Between E 22nd & Cedar (1S) |
| 1.052 | 98 | Bridge 14 Deck (27S) |
| 1.665 | 98 | E of Cedar (1S) |
| 1.214 | 79 | E of Cedar (1S) |
| 0.967 | 74 | E of Cedar (1S) |
| 0.603 | 74 | Flat Slopes (22S) |
| 0.574 | 74 | Loop Interior (24S) |
| 0.293 | 98 | Loop Pavement (24S) |
| 1.857 | 98 | N of Carnegie (1S) |
| 1.071 | 79 | N of Carnegie (1S) |
| 1.842 | 74 | N of Carnegie (1S) |
| 0.270 | 98 | Paved Shoulder (23S) |
| 2.650 | 98 | Pavement (2S) |
| 0.094 | 98 | Pavement - I-90EB Shoulder (28S) |
| 0.496 | 98 | Pavement - I90 & East Loop (22S) |
| 3.347 | 98 | Pavement I90 EB & WB (25S) |
| 0.525 | 98 | Prospect to I-90WB Loop (1S) |
| 0.212 | 79 | Prospect to I-90WB Loop (1S) |
| 0.758 | 74 | Prospect to I-90WB Loop (1S) |
| 3.274 | 74 | Slopes Flatter than 4:1 (23S, 28S) |
| 1.730 | 79 | Slopes Steeper than 4:1 (2S, 23S) |
| 1.077 | 78 | Slopes Steeper than 4:1 (25S, 28S) |
| 0.252 | 79 | Steep Slopes (22S) |
| 1.123 | 98 | W of E 22nd (1S) |
| 0.411 | 79 | W of E 22nd (1S) |
| 0.384 | 74 | W of E 22nd (1S) |
| 1.496 | 84 | West Loop Ramp - Mixed Use (22S) |
| **29.594** | **87** | **TOTAL AREA** |

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=0.82"
Tc=10.0 min CN=86 Runoff=14.47 cfs 0.845 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=1.20"
Tc=10.0 min CN=92 Runoff=7.06 cfs 0.398 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=0.72"
Tc=10.0 min CN=84 Runoff=2.83 cfs 0.170 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=0.43"
Tc=10.0 min CN=77 Runoff=1.57 cfs 0.113 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=0.62"
Tc=10.0 min CN=82 Runoff=0.72 cfs 0.045 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=1.28"
Tc=10.0 min CN=93 Runoff=8.23 cfs 0.465 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=1.73"
Tc=10.0 min CN=98 Runoff=2.53 cfs 0.152 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=0.43"
Tc=10.0 min CN=77 Runoff=0.45 cfs 0.033 af

**Pond 6P: 2nd Elliptical** Peak Elev=630.61' Inflow=13.55 cfs 1.371 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=13.55 cfs 1.371 af

**Pond 22P: Detention 1** Peak Elev=635.25' Storage=0.263 af Inflow=11.54 cfs 0.696 af
Outflow=3.58 cfs 0.691 af

**Total Runoff Area = 29.594 ac Runoff Volume = 2.221 af Average Runoff Depth = 0.90"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

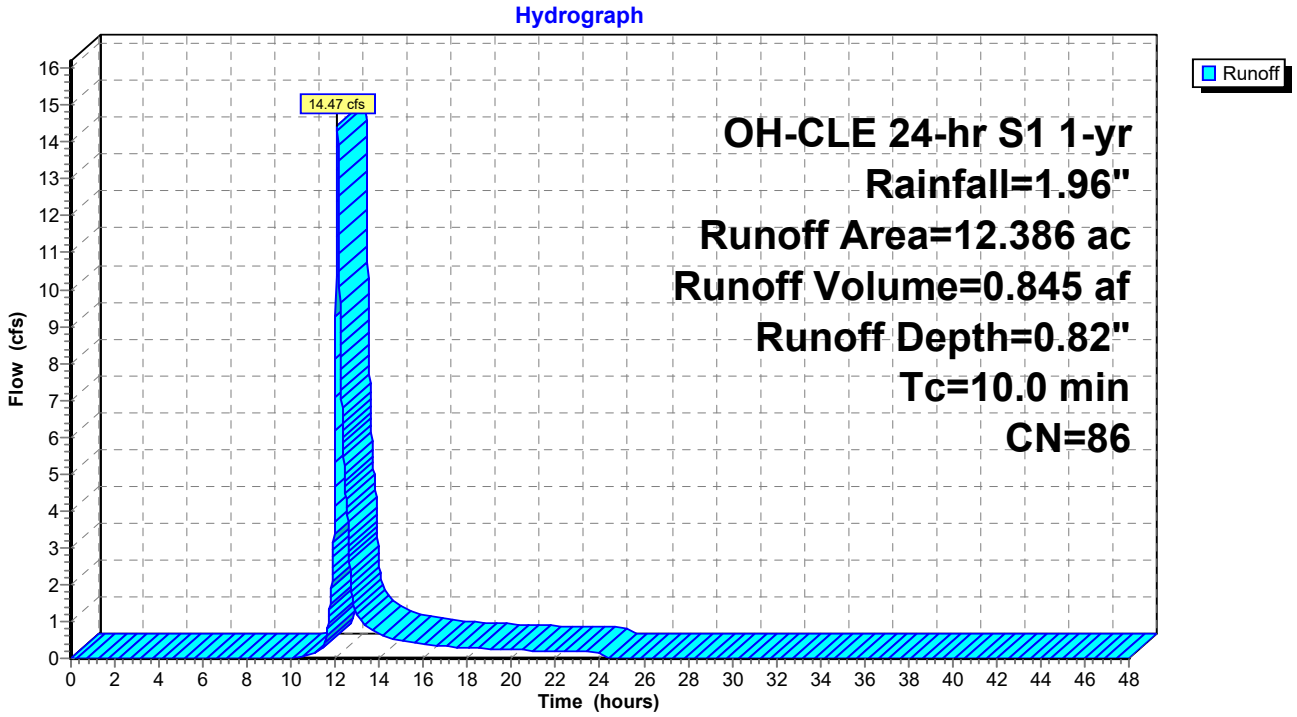
Runoff = 14.47 cfs @ 12.09 hrs, Volume= 0.845 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

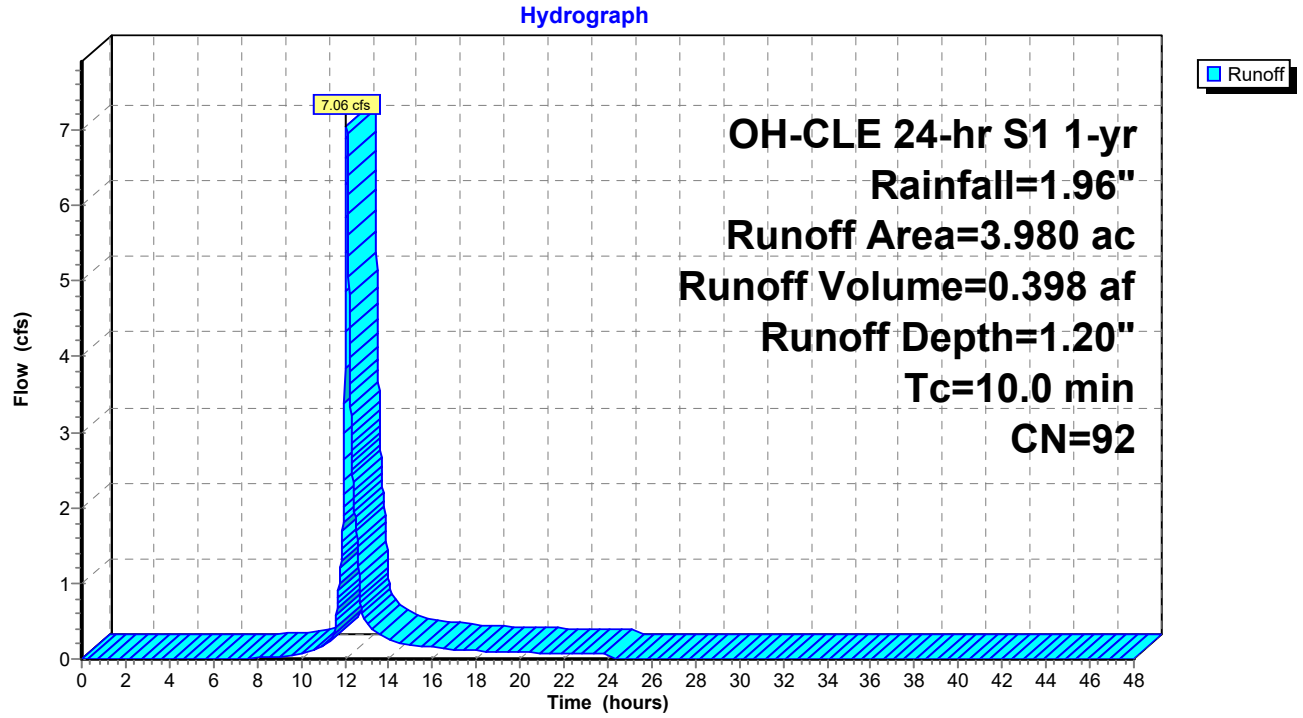
Runoff = 7.06 cfs @ 12.09 hrs, Volume= 0.398 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

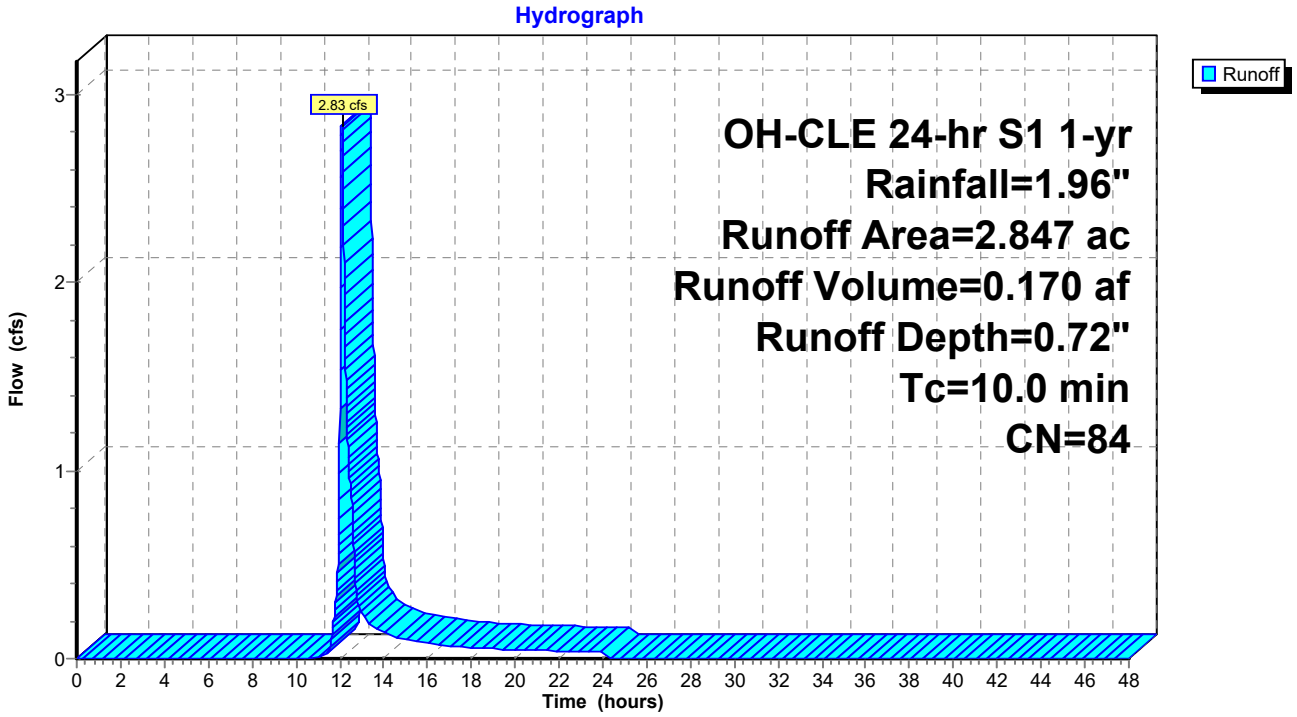
Runoff = 2.83 cfs @ 12.10 hrs, Volume= 0.170 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

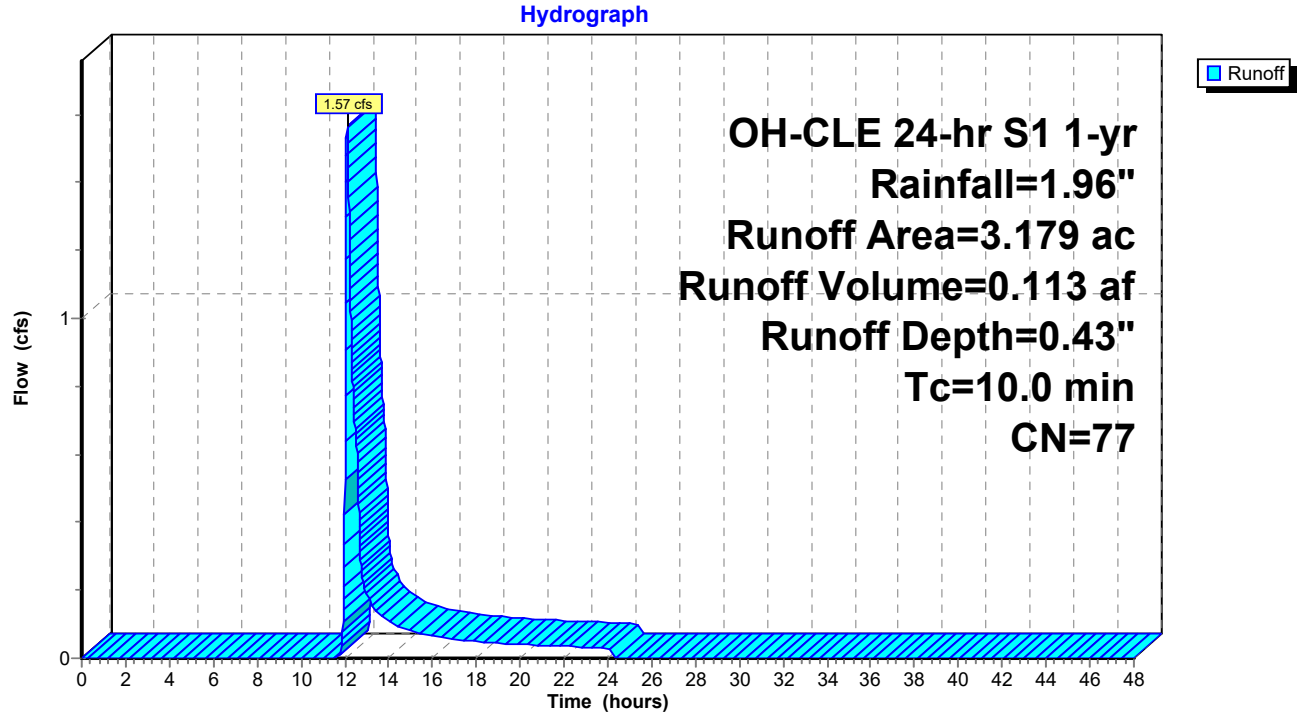
Runoff = 1.57 cfs @ 12.11 hrs, Volume= 0.113 af, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

## Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

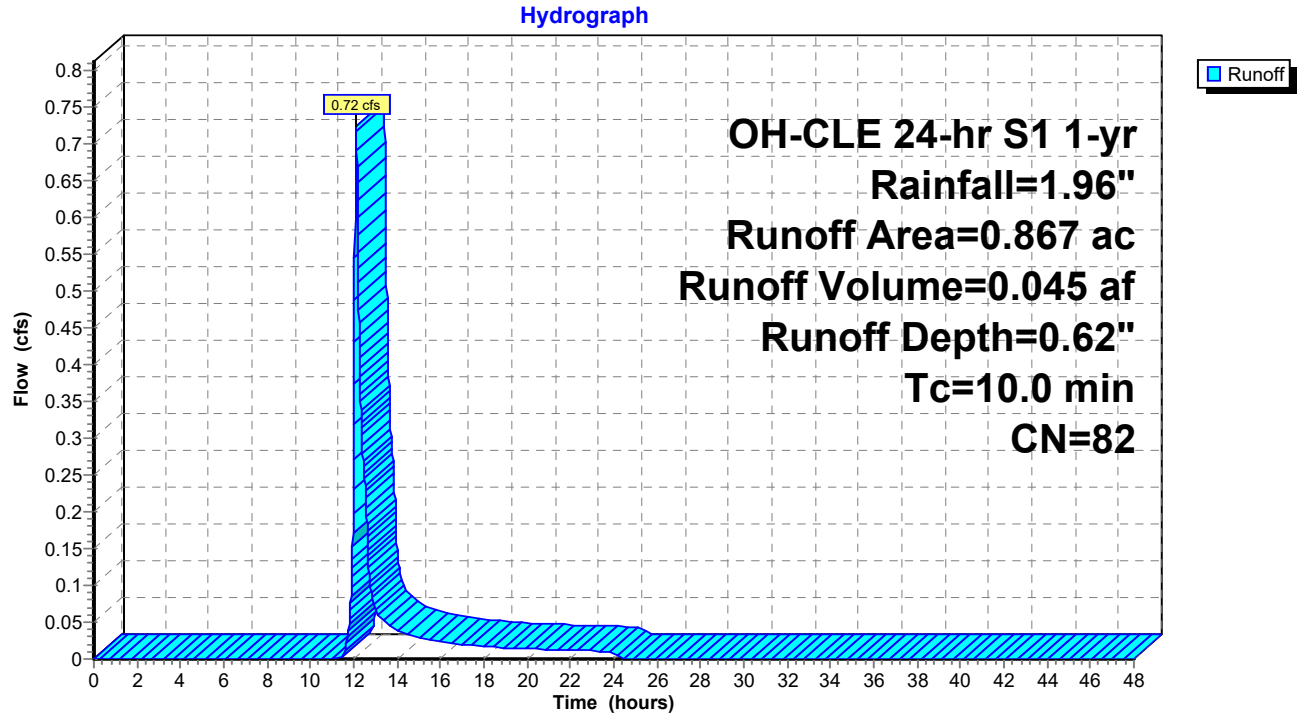
Runoff = 0.72 cfs @ 12.10 hrs, Volume= 0.045 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

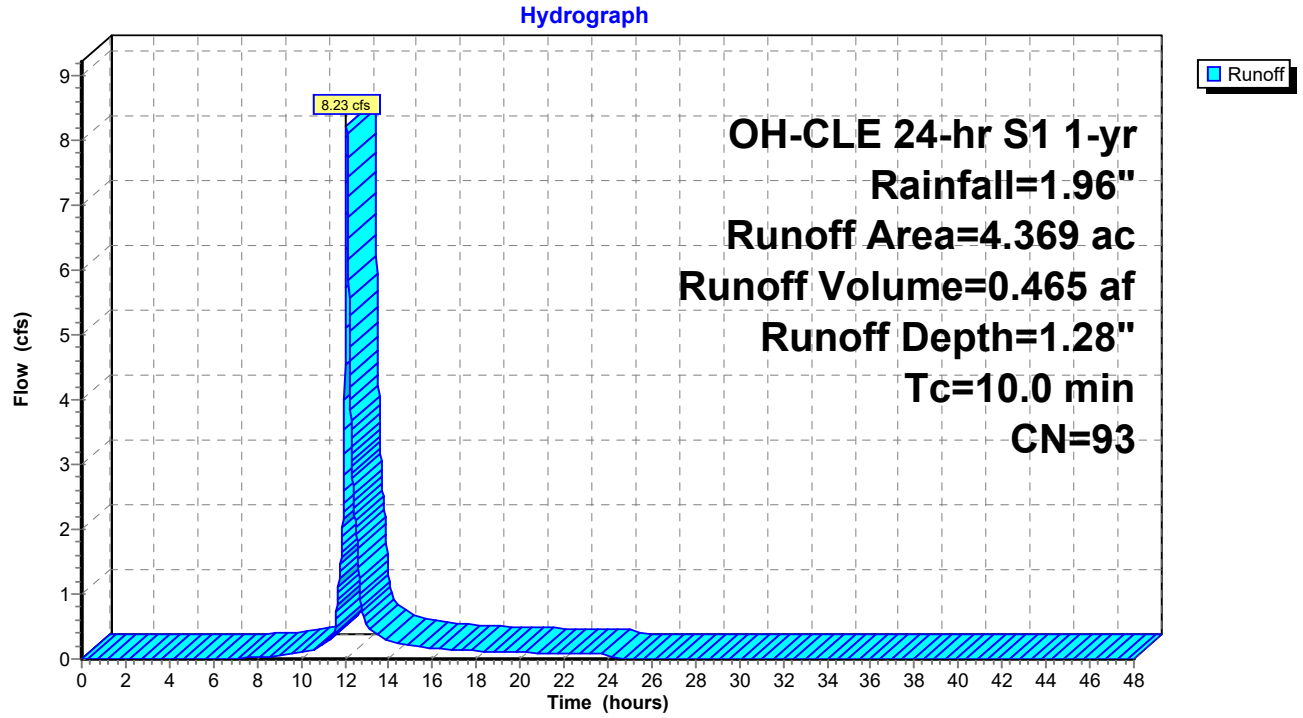
Runoff = 8.23 cfs @ 12.09 hrs, Volume= 0.465 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

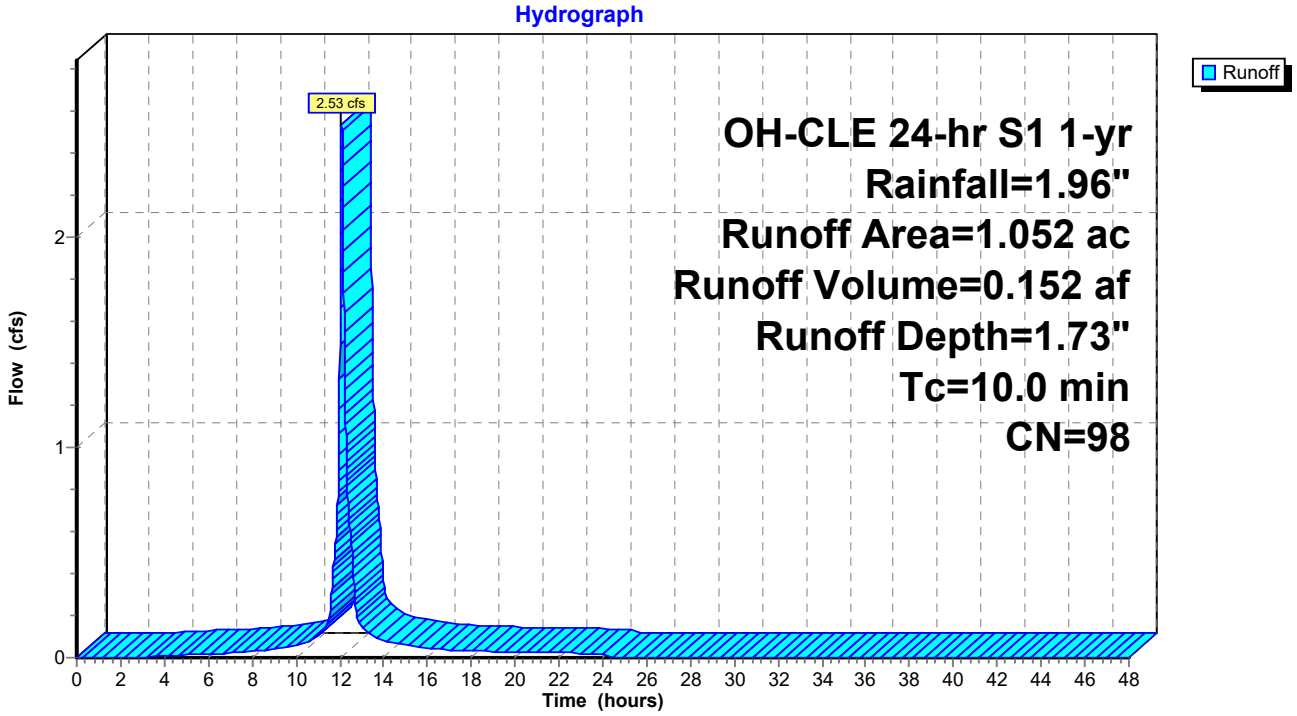
Runoff = 2.53 cfs @ 12.08 hrs, Volume= 0.152 af, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

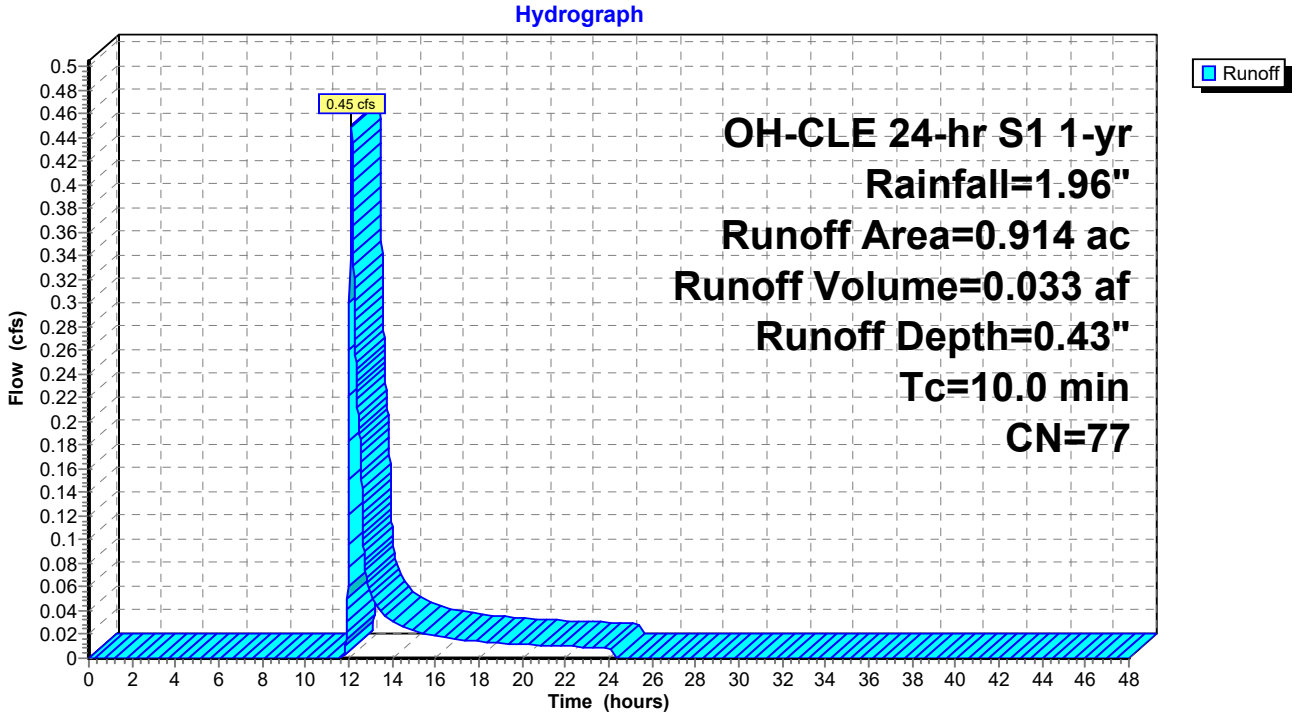
Runoff = 0.45 cfs @ 12.11 hrs, Volume= 0.033 af, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 1-yr Rainfall=1.96"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 630.61' (Flood elevation advised)

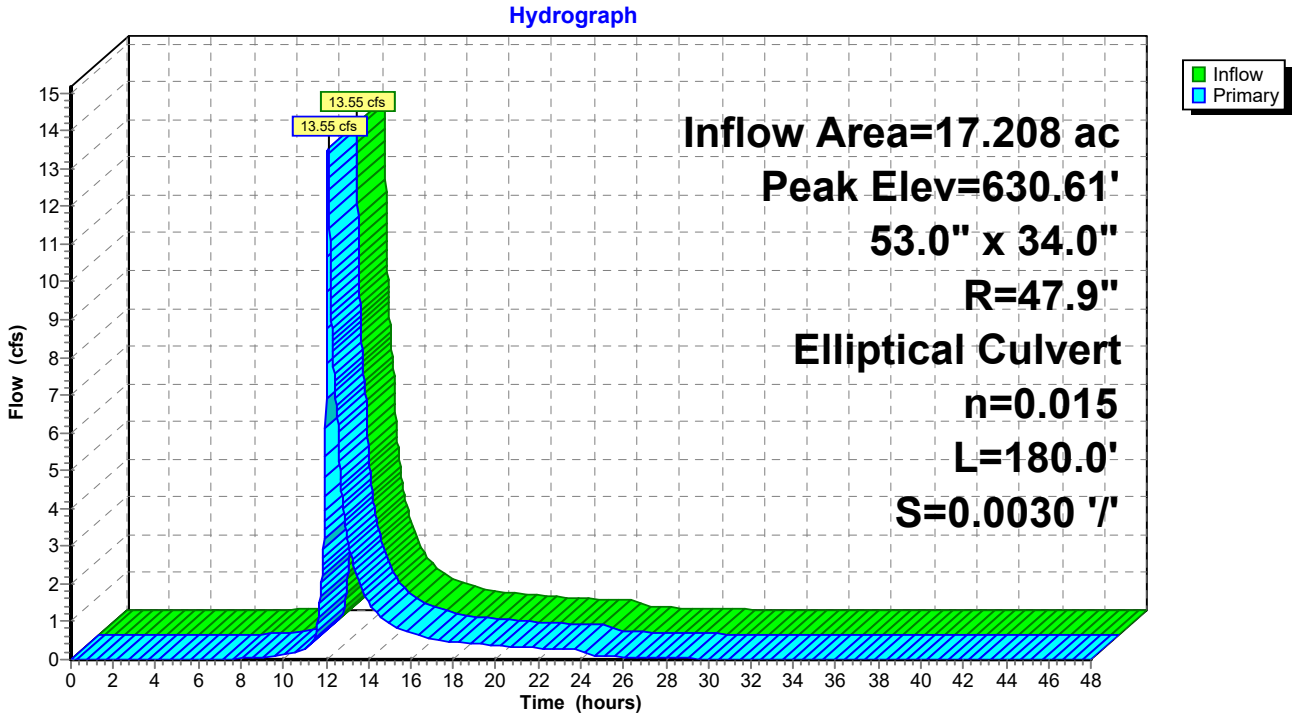
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth > 0.96" for 1-yr event
Inflow = 13.55 cfs @ 12.10 hrs, Volume= 1.371 af
Outflow = 13.55 cfs @ 12.10 hrs, Volume= 1.371 af, Atten= 0%, Lag= 0.0 min
Primary = 13.55 cfs @ 12.10 hrs, Volume= 1.371 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 630.61' @ 12.10 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=13.54 cfs @ 12.10 hrs HW=630.61' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 13.54 cfs @ 4.13 fps)

### Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 0.92" for 1-yr event
Inflow = 11.54 cfs @ 12.09 hrs, Volume= 0.696 af
Outflow = 3.58 cfs @ 12.44 hrs, Volume= 0.691 af, Atten= 69%, Lag= 20.8 min
Primary = 3.58 cfs @ 12.44 hrs, Volume= 0.691 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 635.25' @ 12.44 hrs Surf.Area= 0.290 ac Storage= 0.263 af

Plug-Flow detention time= 109.3 min calculated for 0.691 af (99% of inflow)
Center-of-Mass det. time= 104.8 min ( 921.2 - 816.4 )

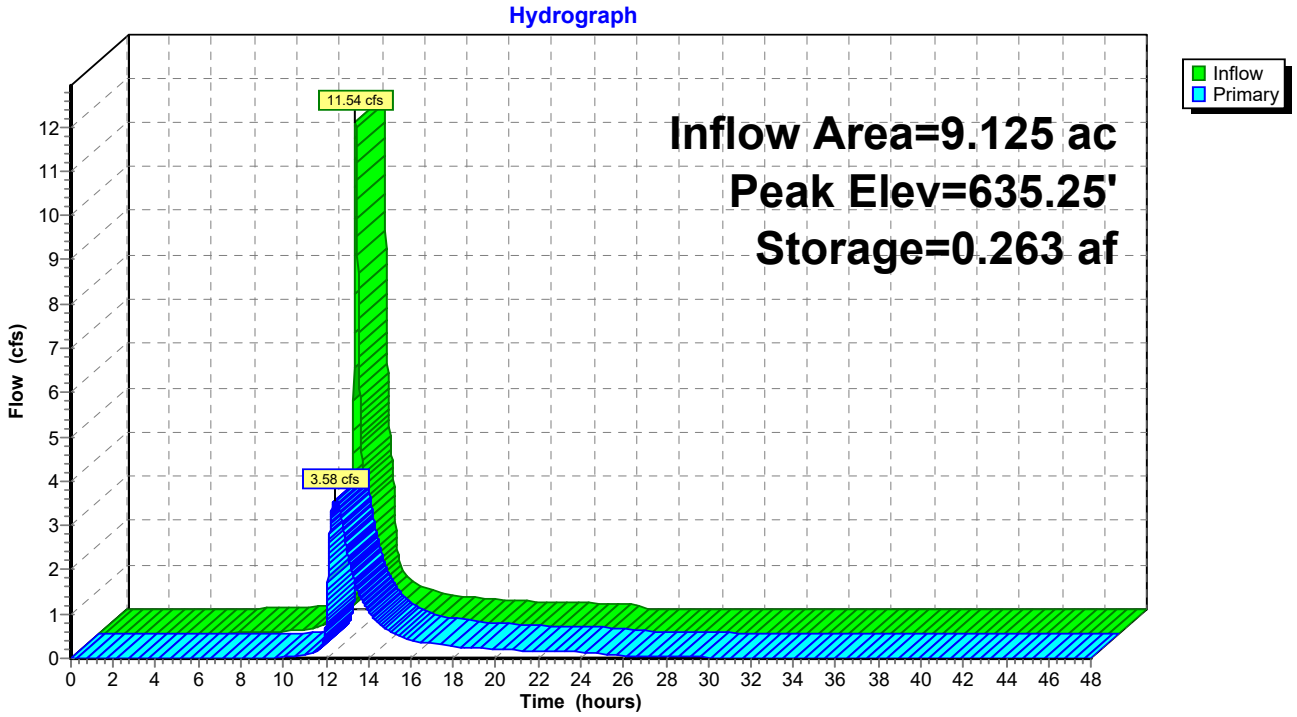
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=3.58 cfs @ 12.44 hrs HW=635.25' TW=630.24' (Dynamic Tailwater)
↑**1=FR-OUT** (Passes 3.58 cfs of 4.64 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 3.58 cfs @ 3.40 fps)
**3=Grate** ( Controls 0.00 cfs)

## Pond 22P: Detention 1



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=1.12"
Tc=10.0 min CN=86 Runoff=20.21 cfs 1.158 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=1.55"
Tc=10.0 min CN=92 Runoff=9.13 cfs 0.516 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=1.00"
Tc=10.0 min CN=84 Runoff=4.08 cfs 0.237 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=0.65"
Tc=10.0 min CN=77 Runoff=2.64 cfs 0.172 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=0.89"
Tc=10.0 min CN=82 Runoff=1.08 cfs 0.064 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=1.64"
Tc=10.0 min CN=93 Runoff=10.53 cfs 0.597 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=2.12"
Tc=10.0 min CN=98 Runoff=3.07 cfs 0.186 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=0.65"
Tc=10.0 min CN=77 Runoff=0.76 cfs 0.049 af

**Pond 6P: 2nd Elliptical** Peak Elev=630.86' Inflow=18.43 cfs 1.816 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=18.43 cfs 1.816 af

**Pond 22P: Detention 1** Peak Elev=635.53' Storage=0.347 af Inflow=15.54 cfs 0.923 af
Outflow=4.79 cfs 0.918 af

**Total Runoff Area = 29.594 ac Runoff Volume = 2.979 af Average Runoff Depth = 1.21"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

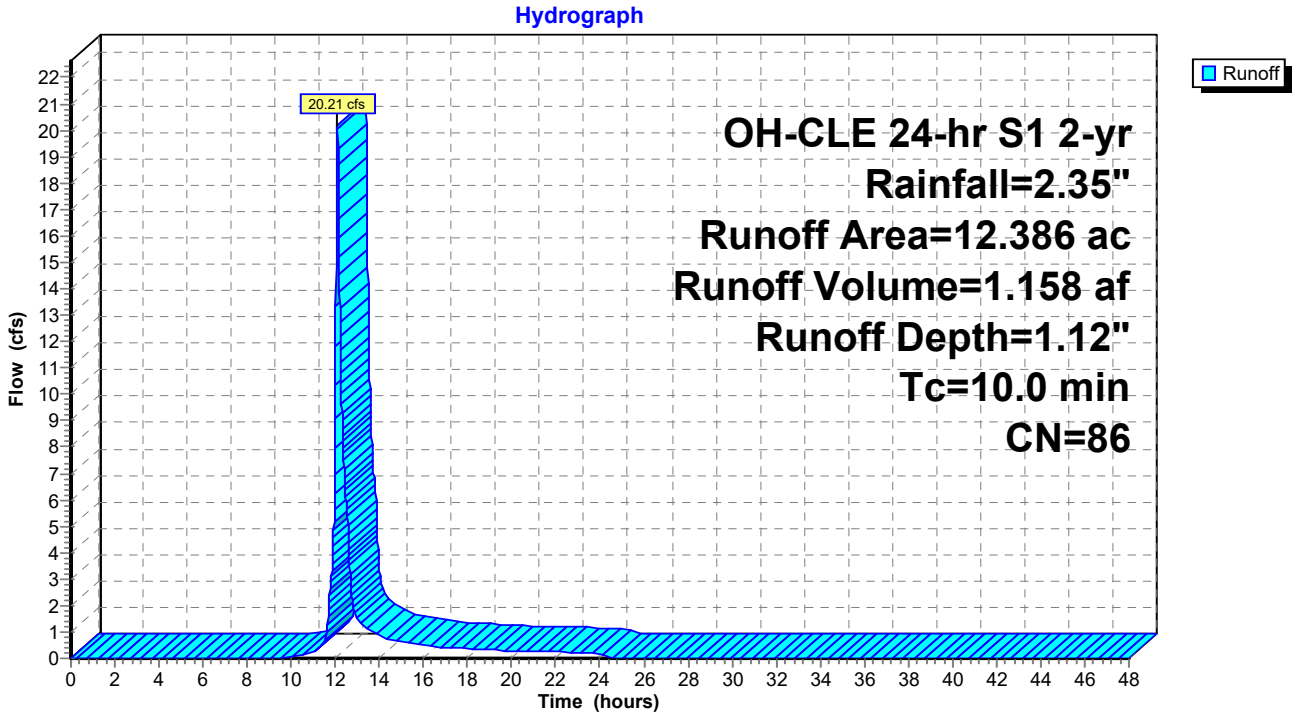
Runoff = 20.21 cfs @ 12.09 hrs, Volume= 1.158 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

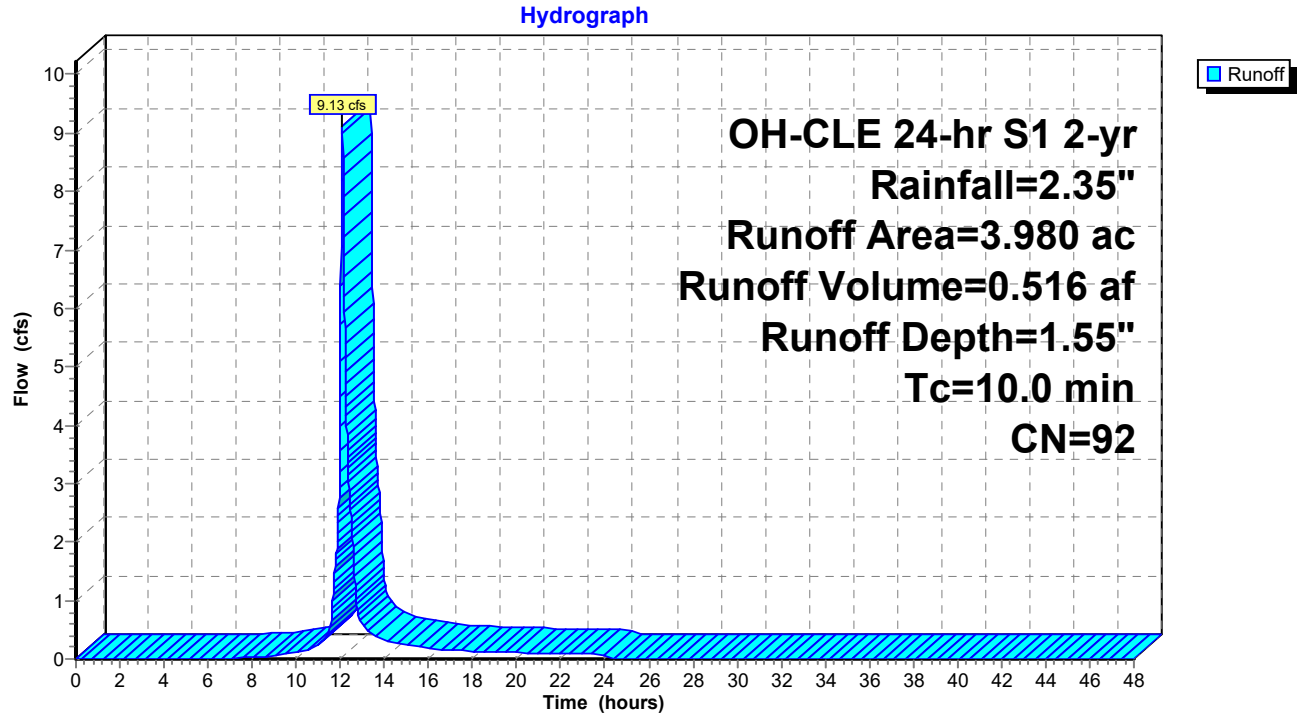
Runoff = 9.13 cfs @ 12.09 hrs, Volume= 0.516 af, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

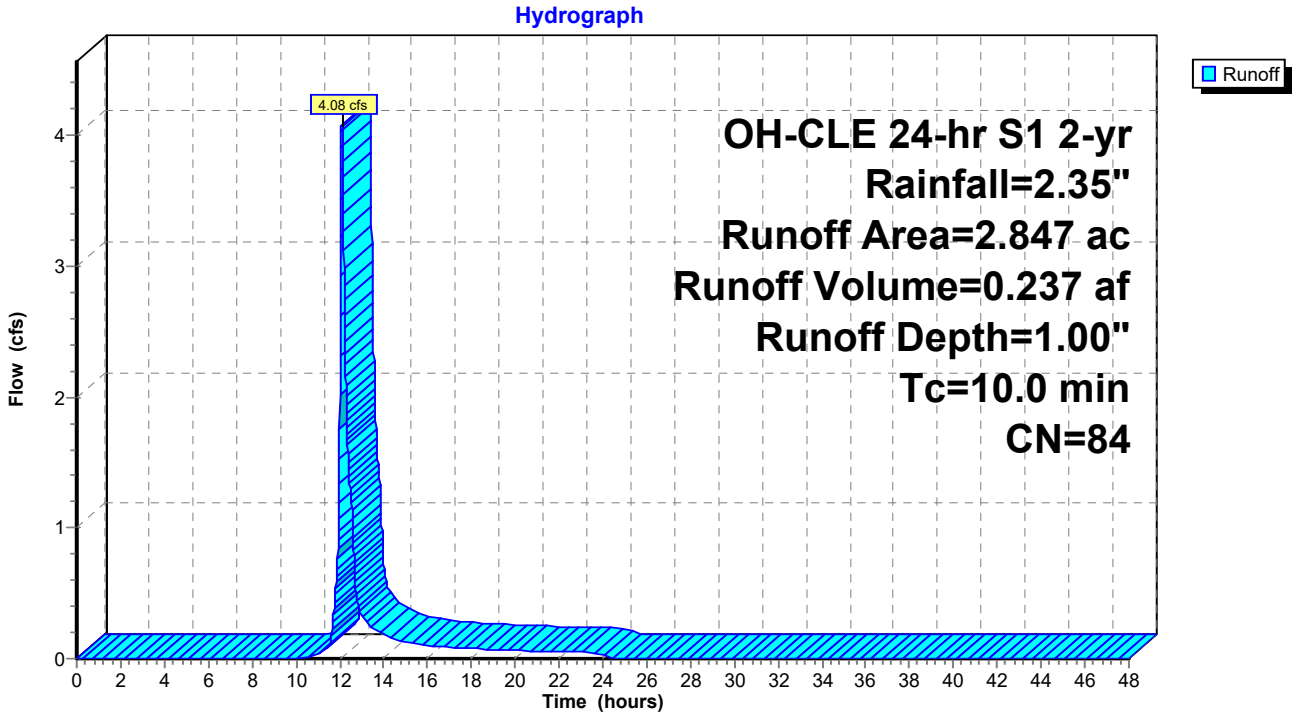
Runoff = 4.08 cfs @ 12.09 hrs, Volume= 0.237 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

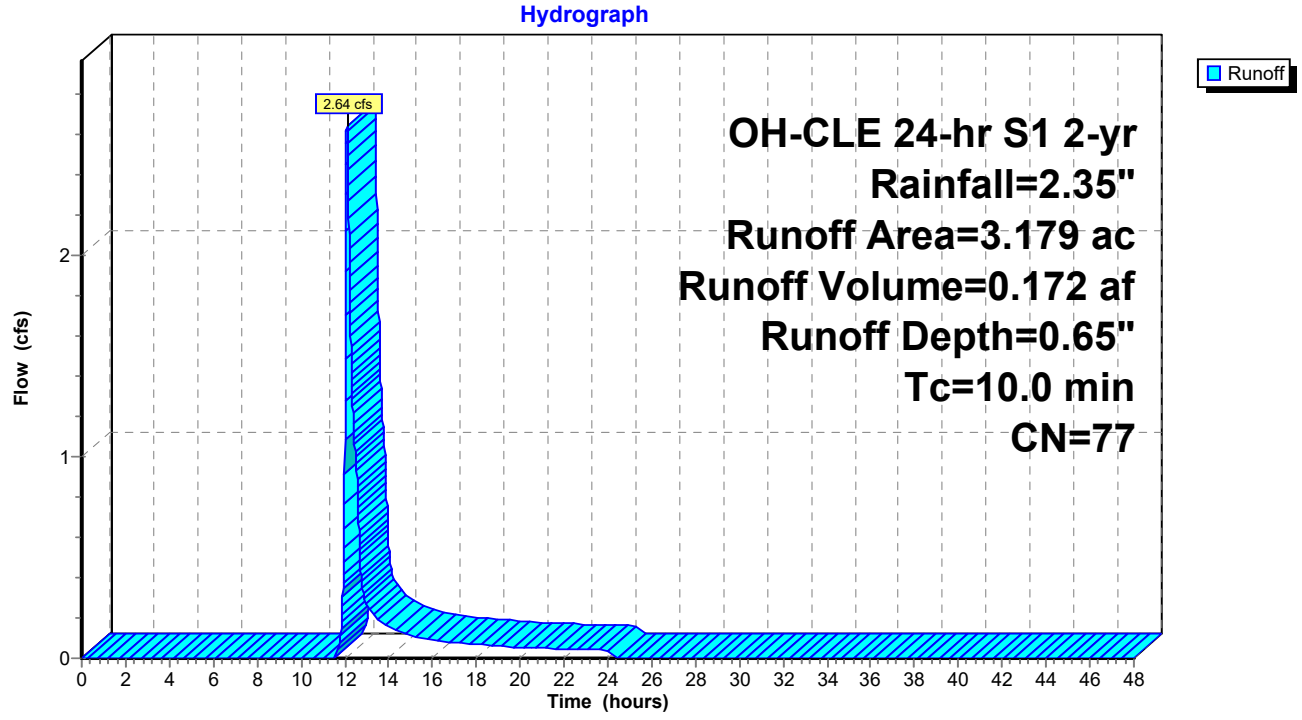
Runoff = 2.64 cfs @ 12.10 hrs, Volume= 0.172 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

## Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

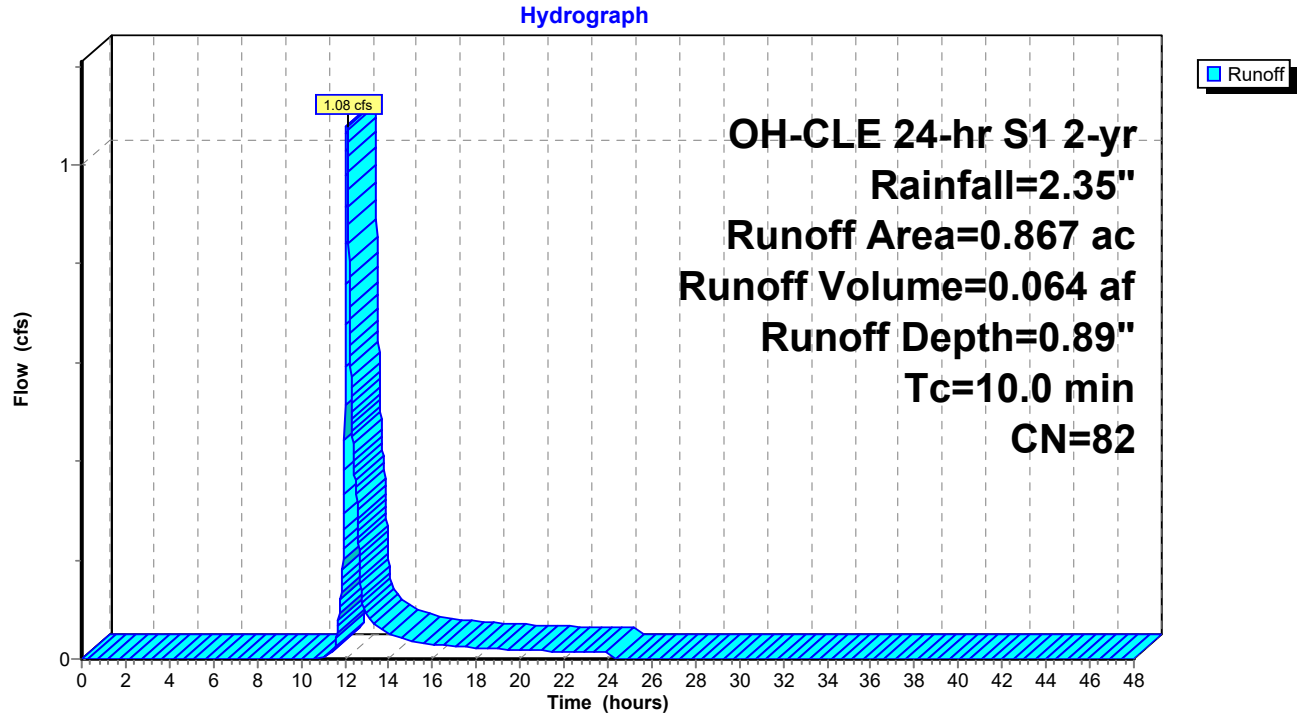
Runoff = 1.08 cfs @ 12.10 hrs, Volume= 0.064 af, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

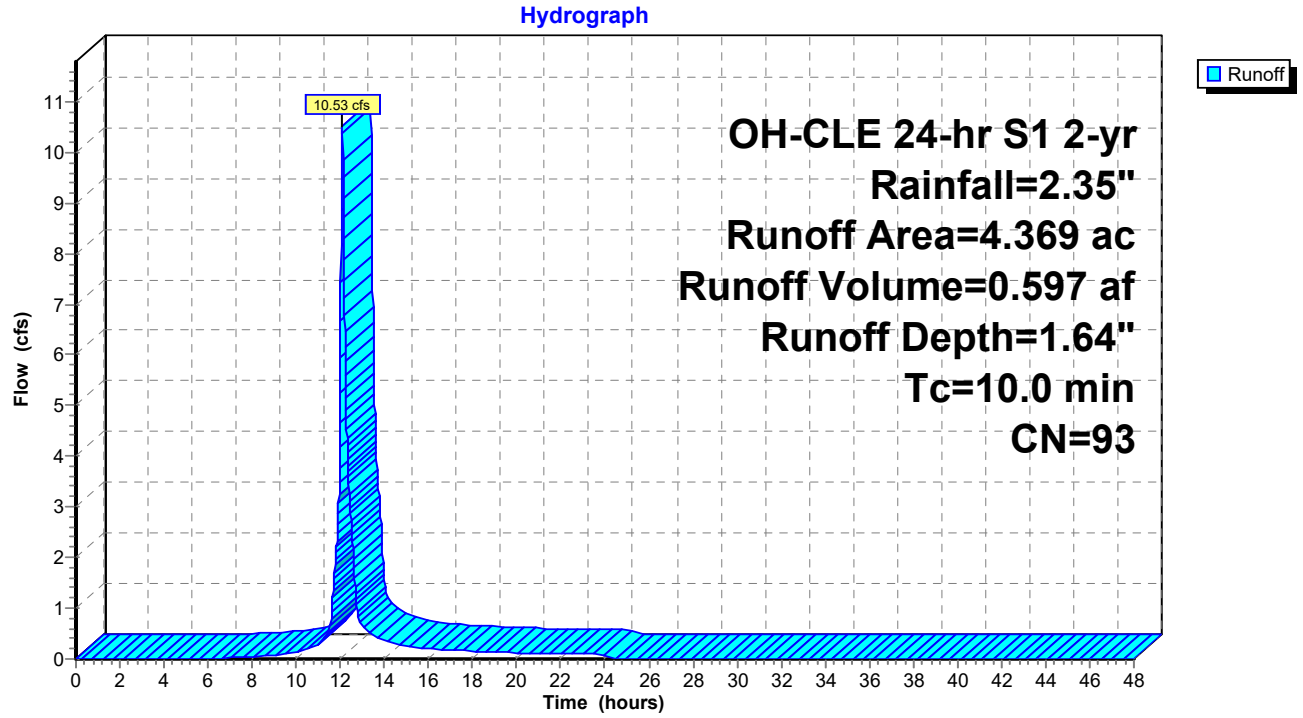
Runoff = 10.53 cfs @ 12.09 hrs, Volume= 0.597 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

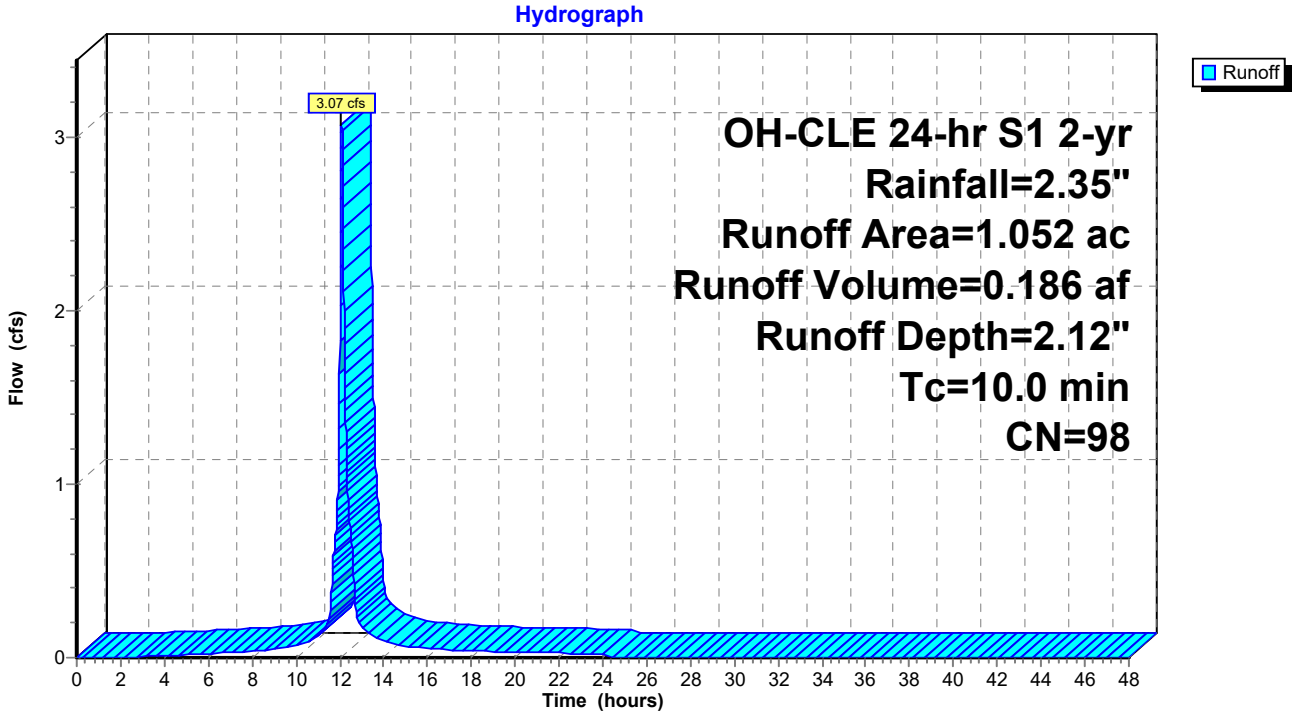
Runoff = 3.07 cfs @ 12.08 hrs, Volume= 0.186 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

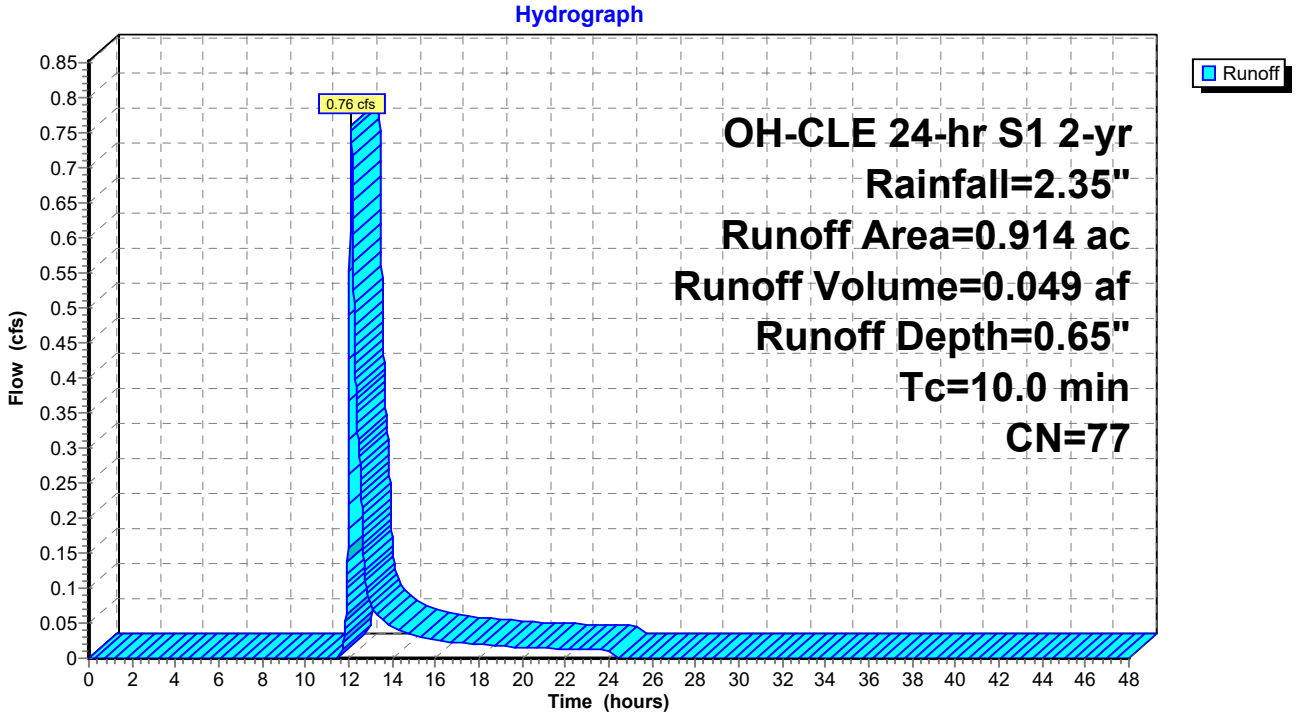
Runoff = 0.76 cfs @ 12.10 hrs, Volume= 0.049 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 630.86' (Flood elevation advised)

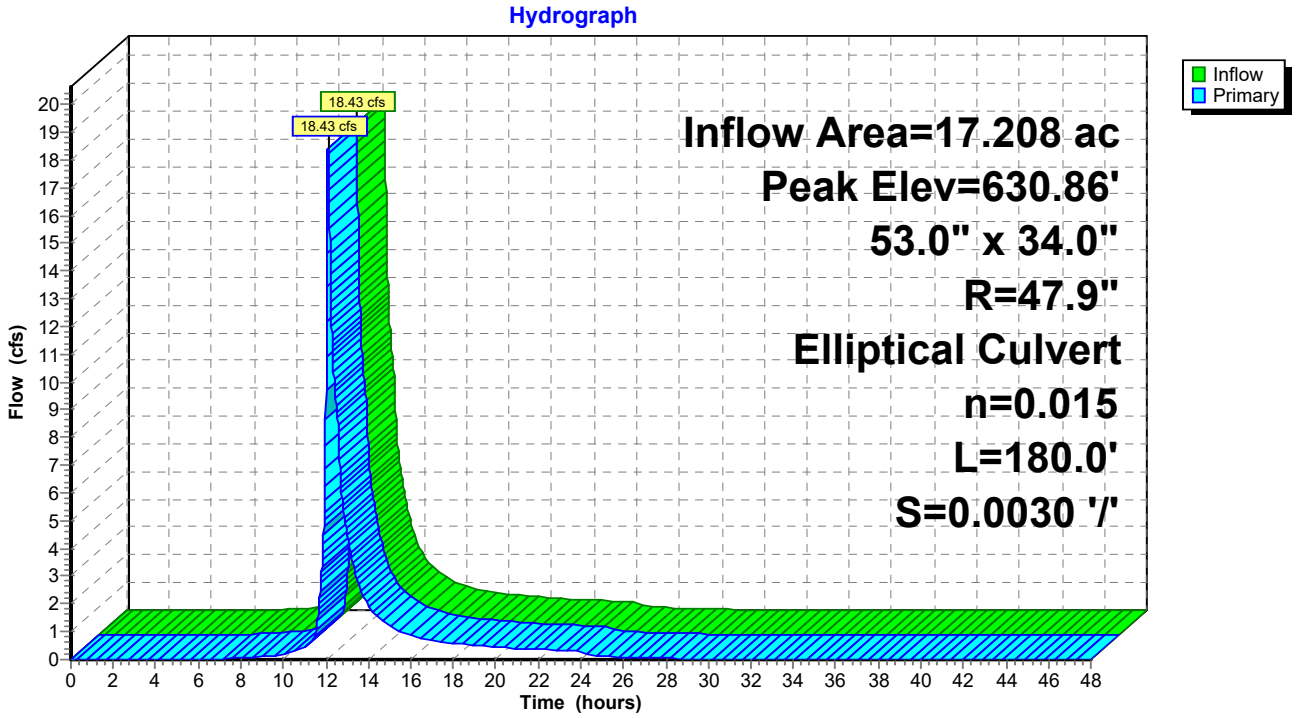
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth > 1.27" for 2-yr event
Inflow = 18.43 cfs @ 12.10 hrs, Volume= 1.816 af
Outflow = 18.43 cfs @ 12.10 hrs, Volume= 1.816 af, Atten= 0%, Lag= 0.0 min
Primary = 18.43 cfs @ 12.10 hrs, Volume= 1.816 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 630.86' @ 12.10 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=18.42 cfs @ 12.10 hrs HW=630.86' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 18.42 cfs @ 4.53 fps)

## Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 1.21" for 2-yr event
Inflow = 15.54 cfs @ 12.09 hrs, Volume= 0.923 af
Outflow = 4.79 cfs @ 12.44 hrs, Volume= 0.918 af, Atten= 69%, Lag= 21.1 min
Primary = 4.79 cfs @ 12.44 hrs, Volume= 0.918 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 635.53' @ 12.44 hrs Surf.Area= 0.305 ac Storage= 0.347 af

Plug-Flow detention time= 97.1 min calculated for 0.918 af (99% of inflow)
Center-of-Mass det. time= 93.6 min ( 903.7 - 810.1 )

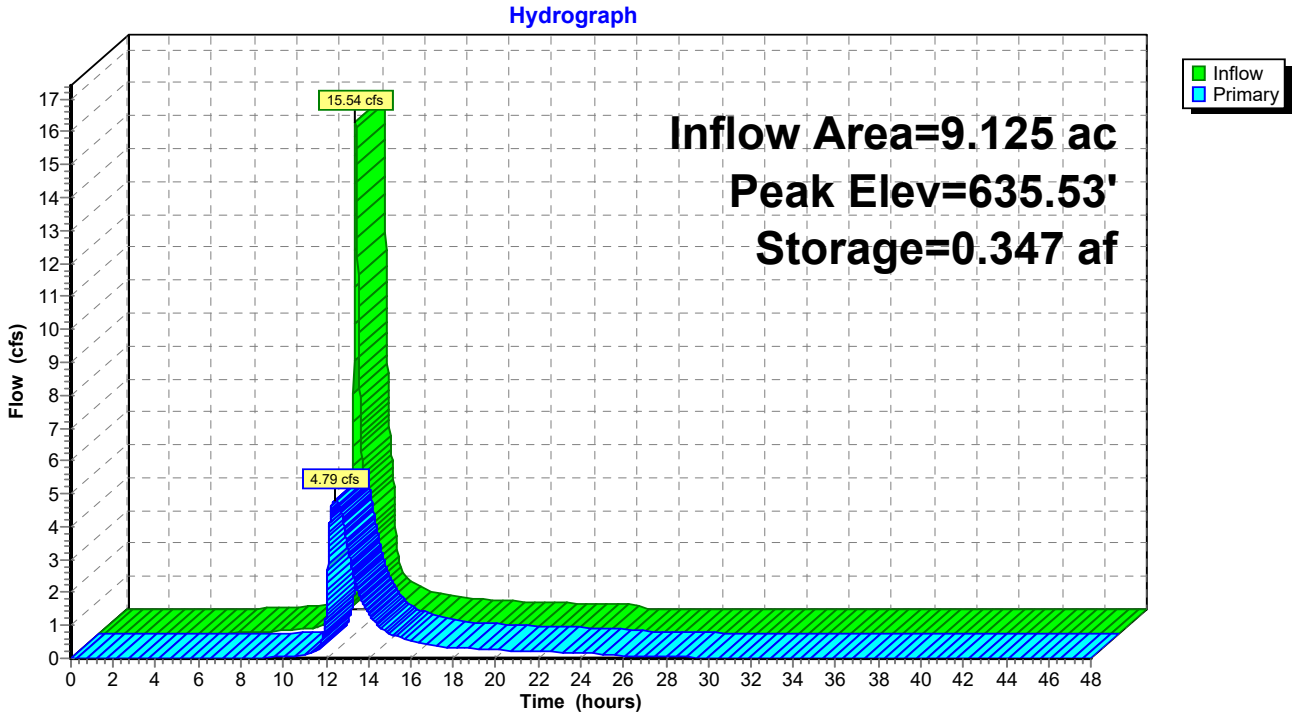
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=4.79 cfs @ 12.44 hrs HW=635.53' TW=630.38' (Dynamic Tailwater)
↑**1=FR-OUT** (Passes 4.79 cfs of 4.96 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 4.79 cfs @ 3.90 fps)
**3=Grate** ( Controls 0.00 cfs)

## Pond 22P: Detention 1



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=1.60"
Tc=10.0 min CN=86 Runoff=28.54 cfs 1.654 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=2.10"
Tc=10.0 min CN=92 Runoff=11.95 cfs 0.695 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=1.46"
Tc=10.0 min CN=84 Runoff=5.93 cfs 0.346 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=1.02"
Tc=10.0 min CN=77 Runoff=4.37 cfs 0.271 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=1.32"
Tc=10.0 min CN=82 Runoff=1.62 cfs 0.096 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=2.19"
Tc=10.0 min CN=93 Runoff=13.63 cfs 0.796 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=2.70"
Tc=10.0 min CN=98 Runoff=3.78 cfs 0.237 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=1.02"
Tc=10.0 min CN=77 Runoff=1.26 cfs 0.078 af

**Pond 6P: 2nd Elliptical** Peak Elev=631.17' Inflow=25.36 cfs 2.513 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=25.36 cfs 2.513 af

**Pond 22P: Detention 1** Peak Elev=636.04' Storage=0.507 af Inflow=21.30 cfs 1.280 af
Outflow=5.48 cfs 1.275 af

**Total Runoff Area = 29.594 ac Runoff Volume = 4.173 af Average Runoff Depth = 1.69"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

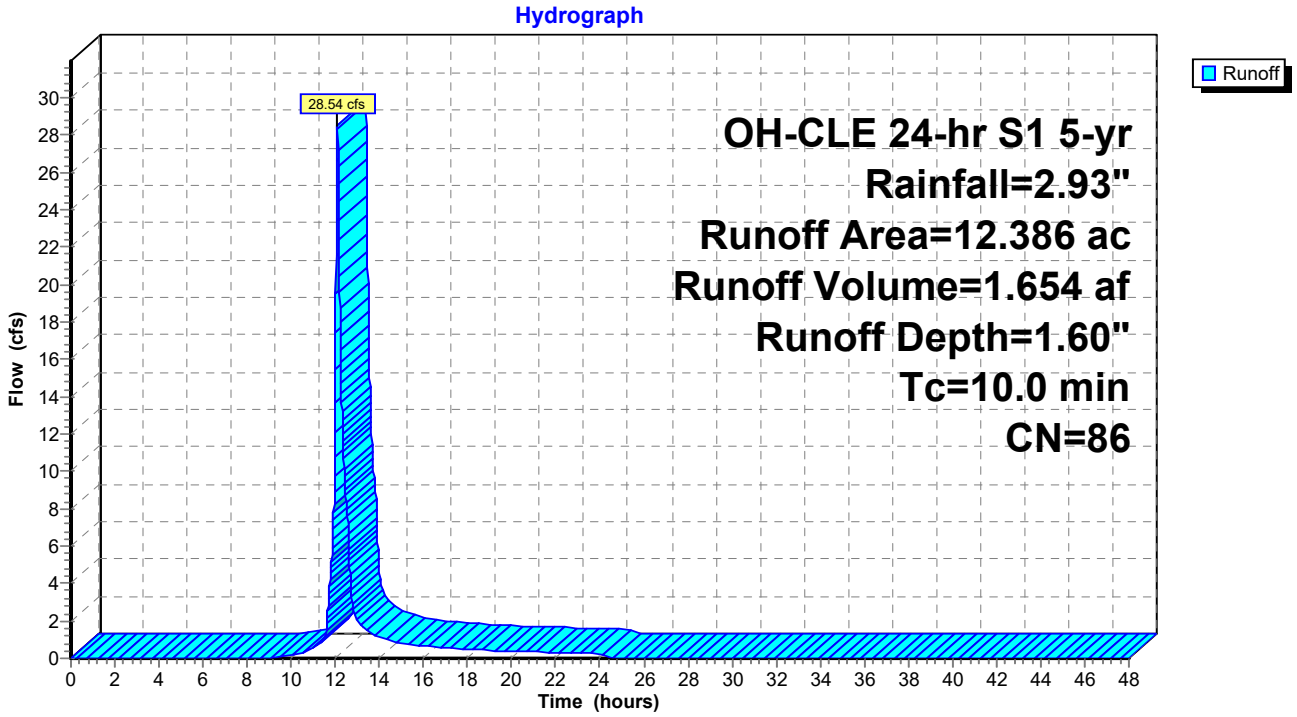
Runoff = 28.54 cfs @ 12.09 hrs, Volume= 1.654 af, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

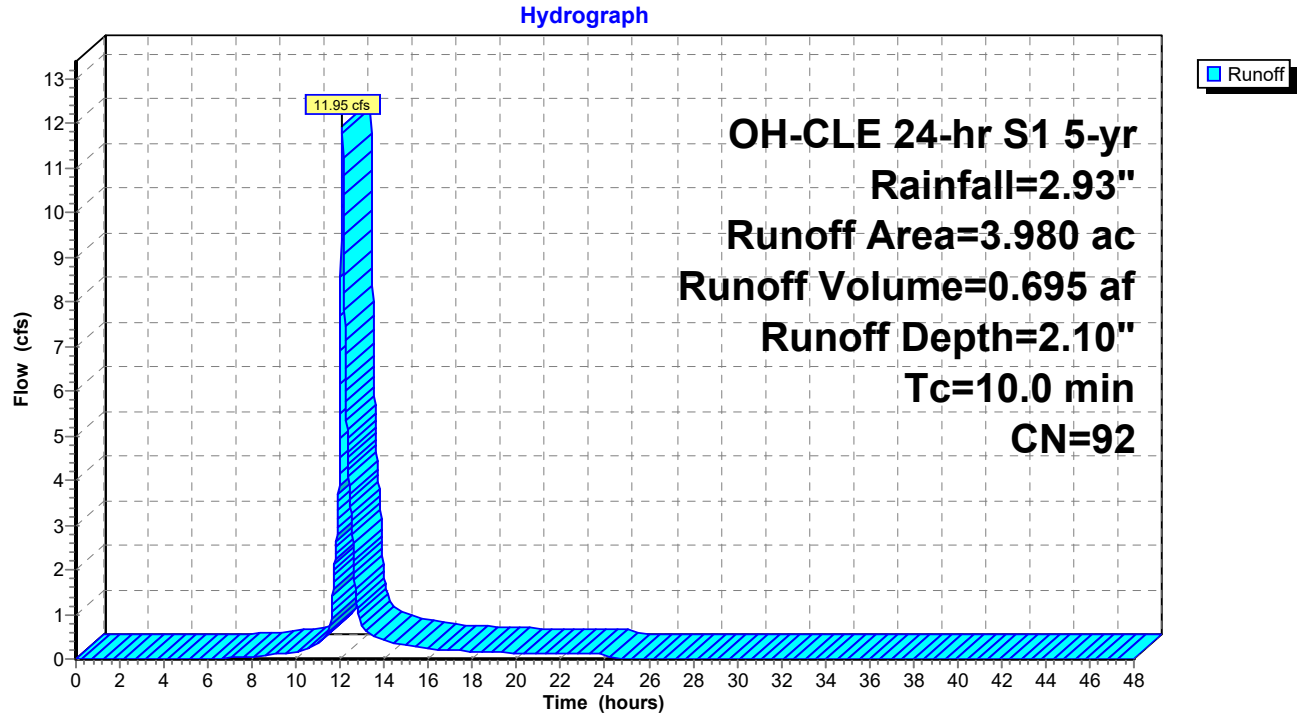
Runoff = 11.95 cfs @ 12.09 hrs, Volume= 0.695 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

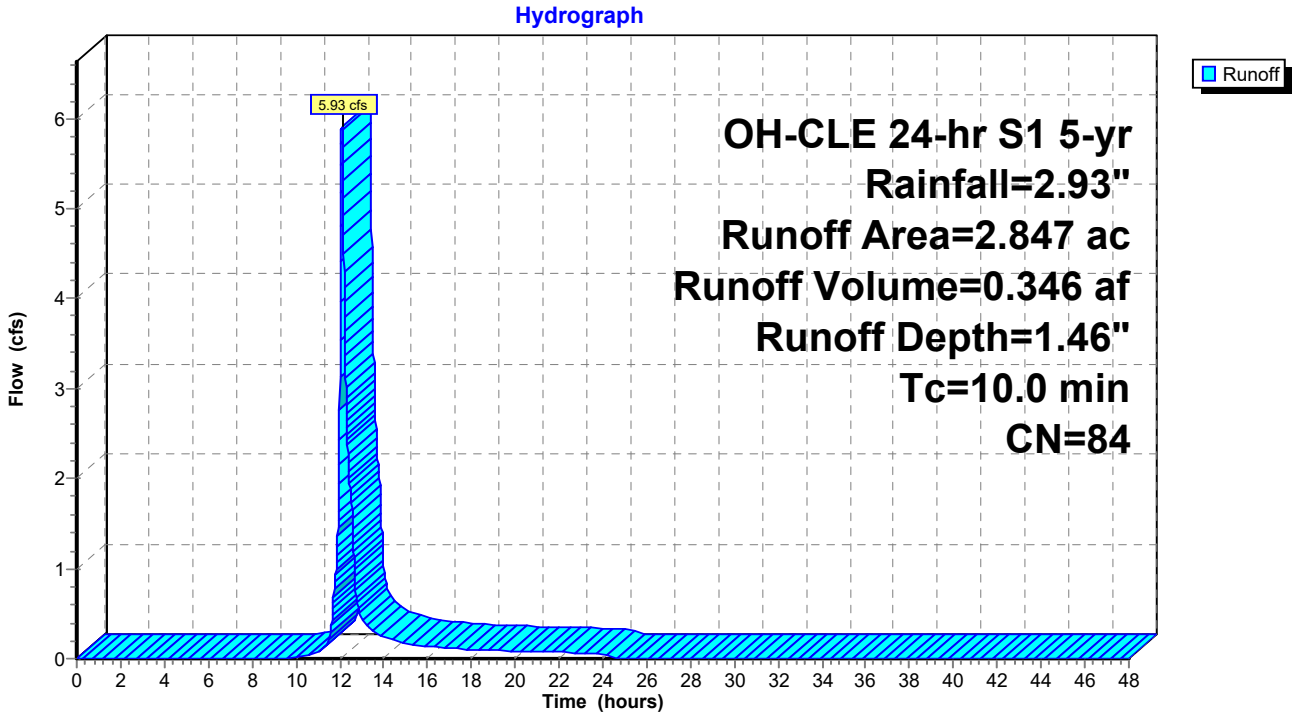
Runoff = 5.93 cfs @ 12.09 hrs, Volume= 0.346 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

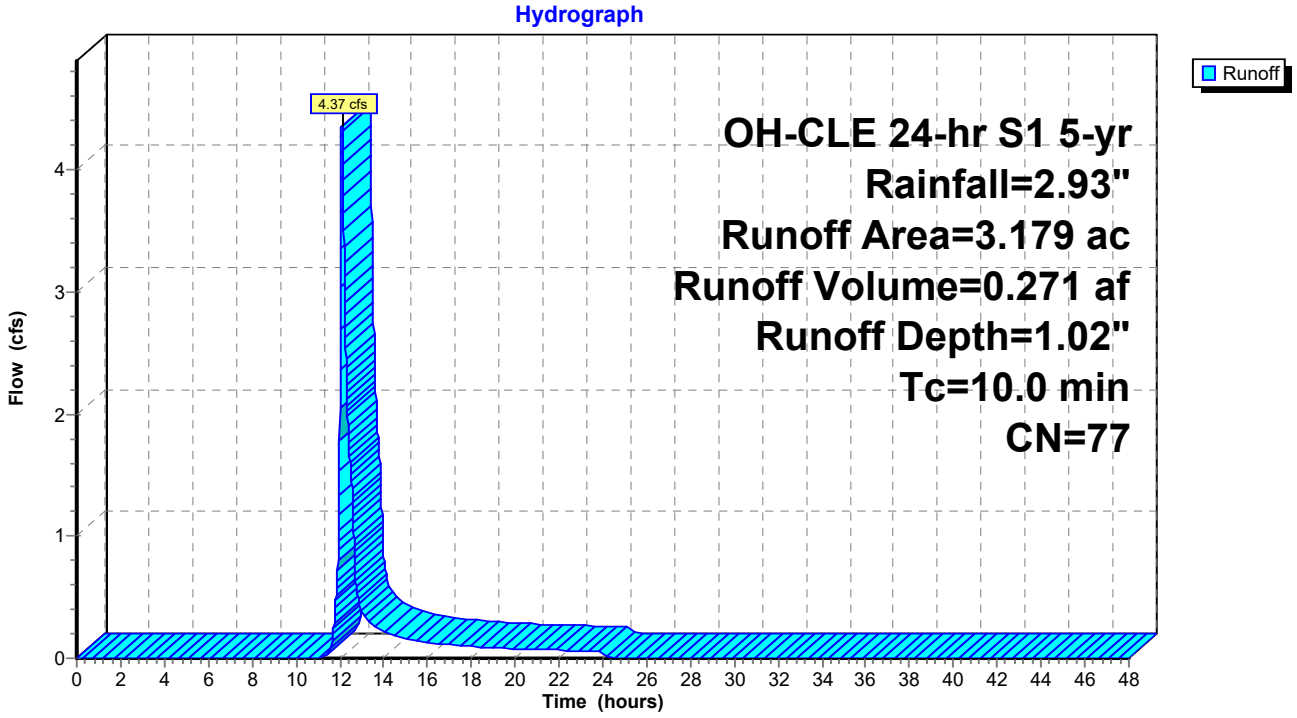
Runoff = 4.37 cfs @ 12.10 hrs, Volume= 0.271 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

### Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

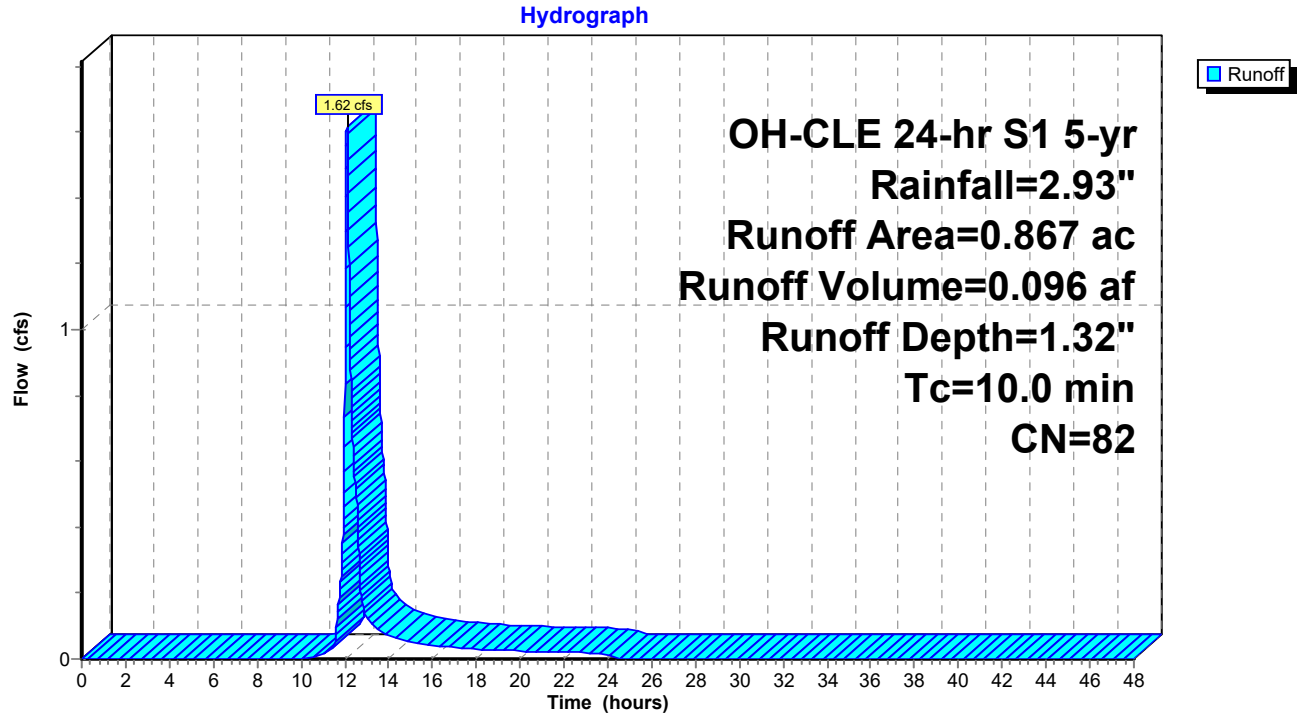
Runoff = 1.62 cfs @ 12.09 hrs, Volume= 0.096 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

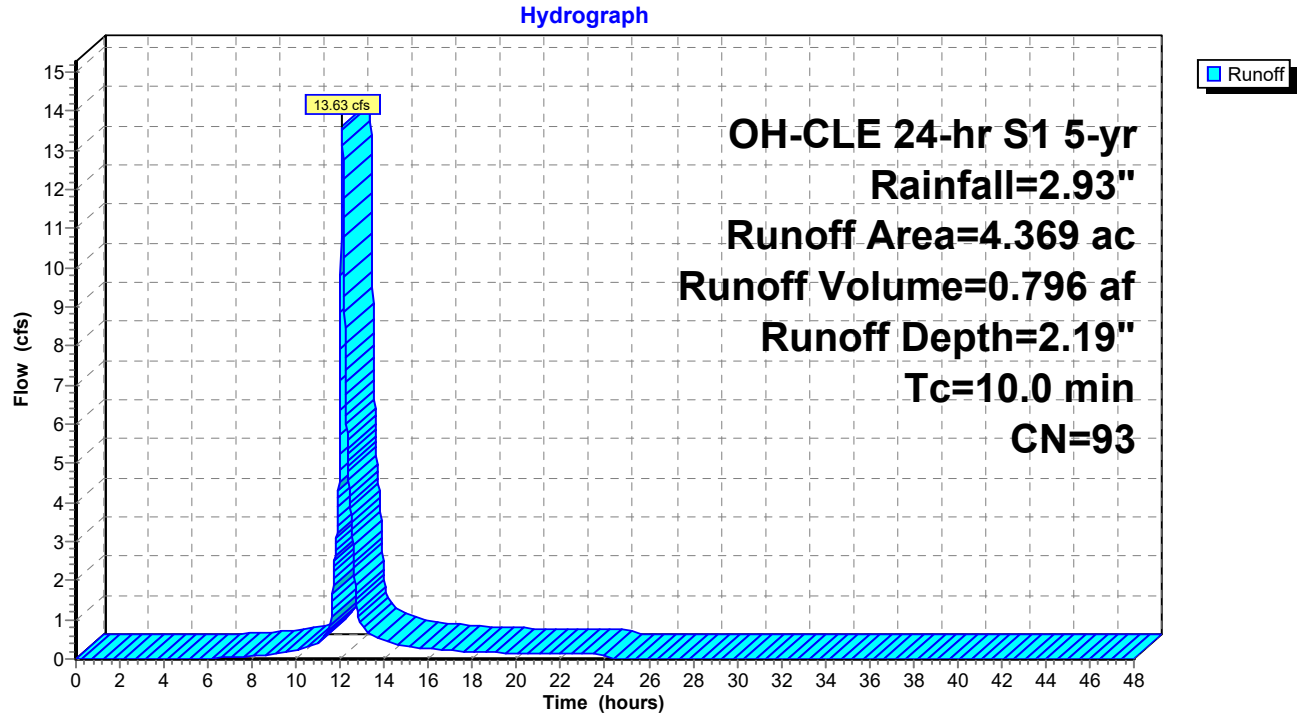
Runoff = 13.63 cfs @ 12.08 hrs, Volume= 0.796 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

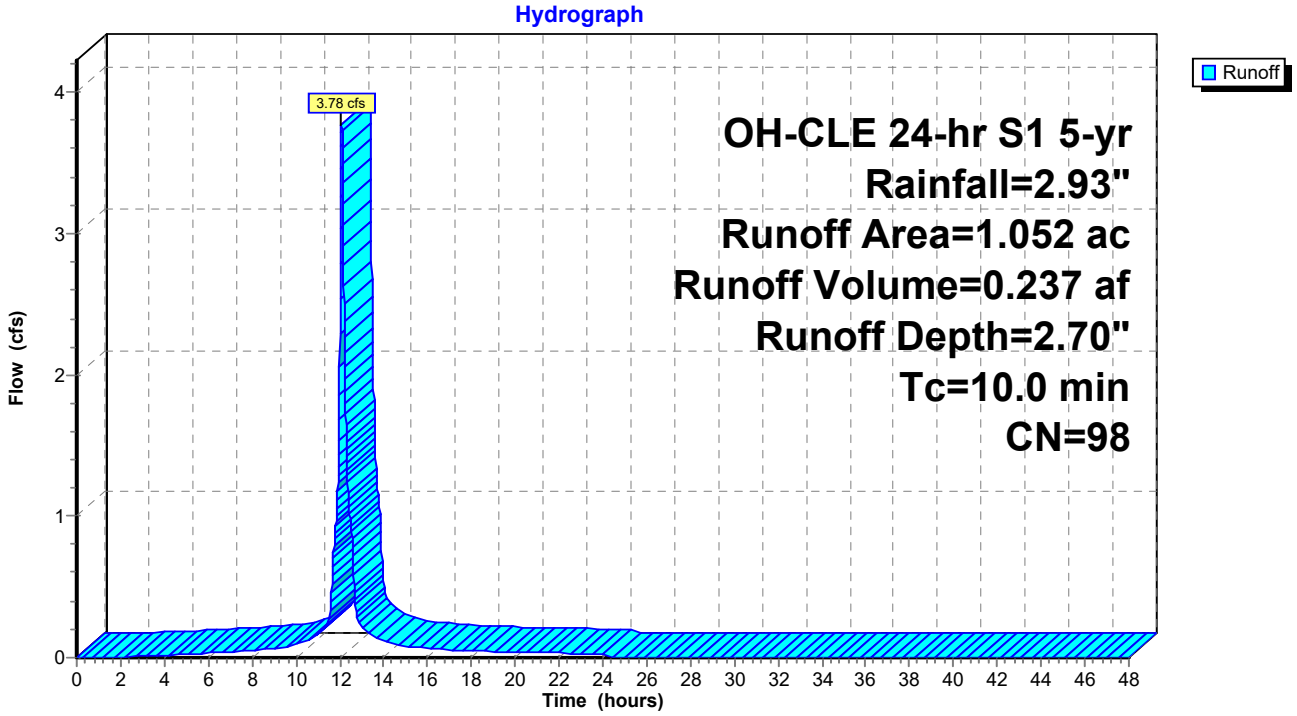
Runoff = 3.78 cfs @ 12.08 hrs, Volume= 0.237 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

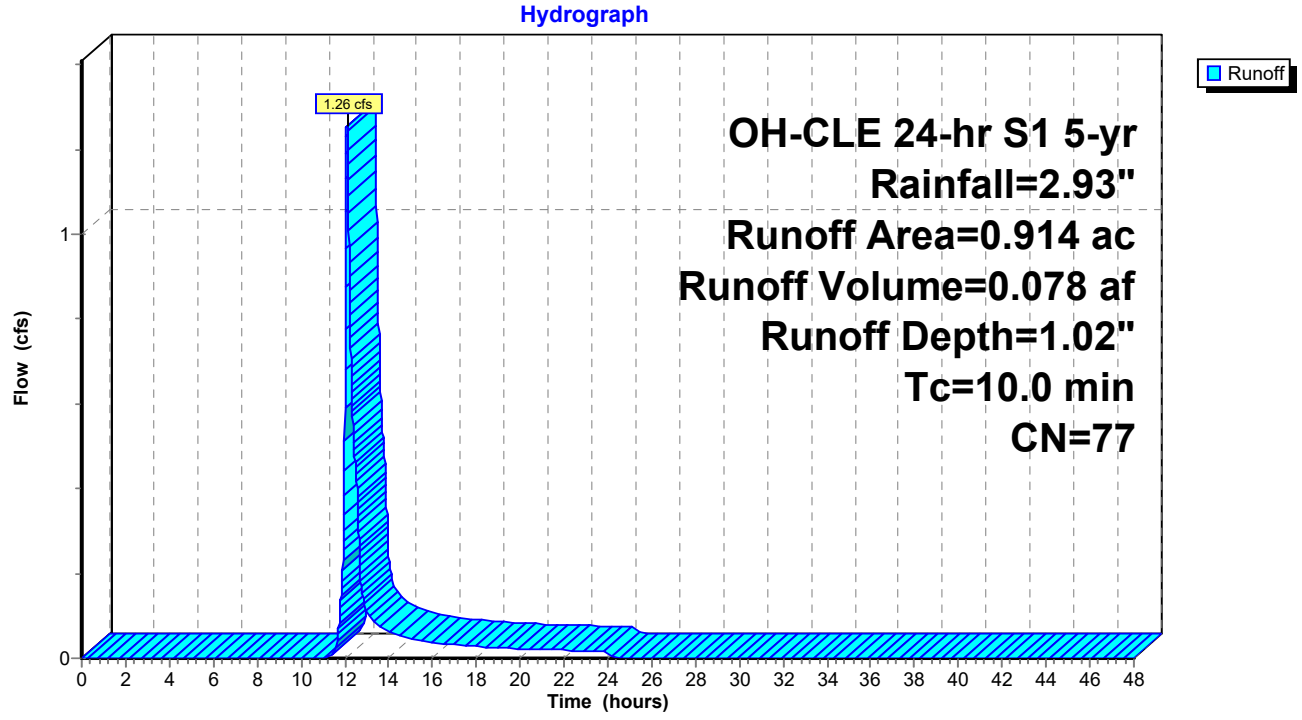
Runoff = 1.26 cfs @ 12.10 hrs, Volume= 0.078 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 5-yr Rainfall=2.93"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 631.17' (Flood elevation advised)

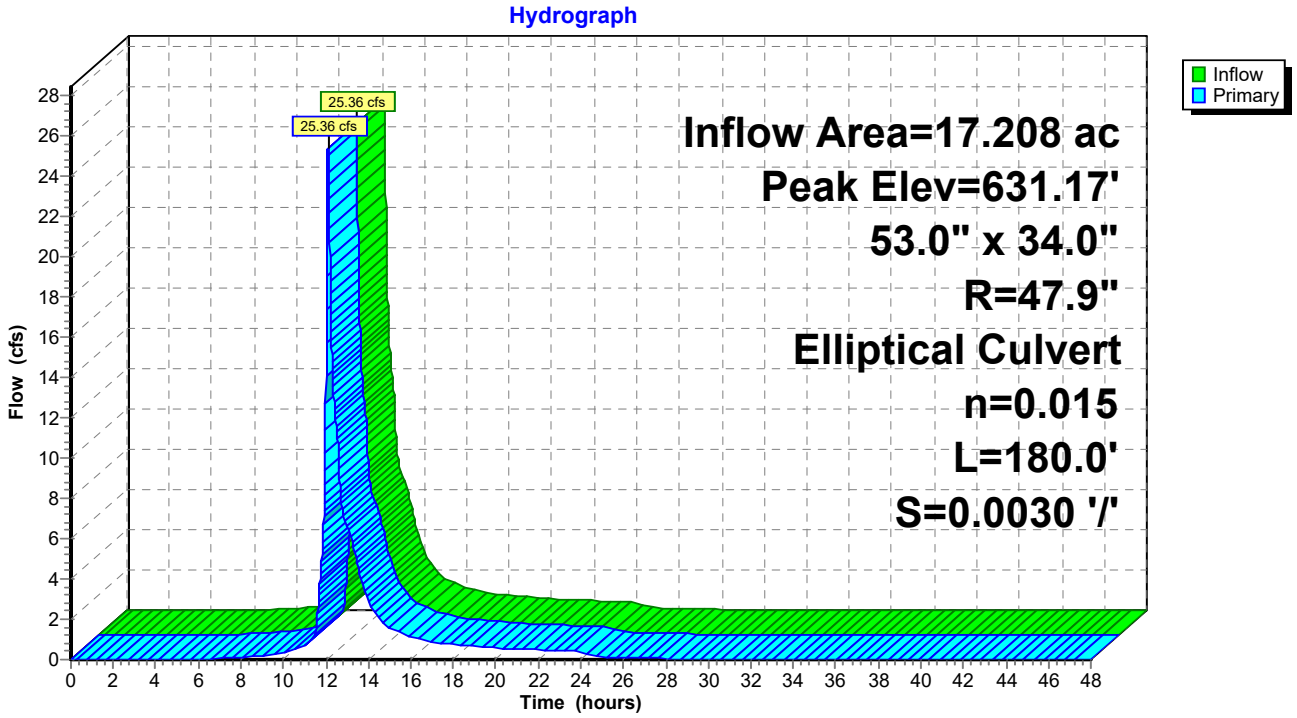
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth = 1.75" for 5-yr event
Inflow = 25.36 cfs @ 12.10 hrs, Volume= 2.513 af
Outflow = 25.36 cfs @ 12.10 hrs, Volume= 2.513 af, Atten= 0%, Lag= 0.0 min
Primary = 25.36 cfs @ 12.10 hrs, Volume= 2.513 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 631.17' @ 12.10 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=25.32 cfs @ 12.10 hrs HW=631.17' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 25.32 cfs @ 4.97 fps)

## Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 1.68" for 5-yr event
Inflow = 21.30 cfs @ 12.09 hrs, Volume= 1.280 af
Outflow = 5.48 cfs @ 12.56 hrs, Volume= 1.275 af, Atten= 74%, Lag= 28.1 min
Primary = 5.48 cfs @ 12.56 hrs, Volume= 1.275 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 636.04' @ 12.56 hrs Surf.Area= 0.331 ac Storage= 0.507 af

Plug-Flow detention time= 89.7 min calculated for 1.275 af (100% of inflow)
Center-of-Mass det. time= 87.1 min ( 890.8 - 803.6 )

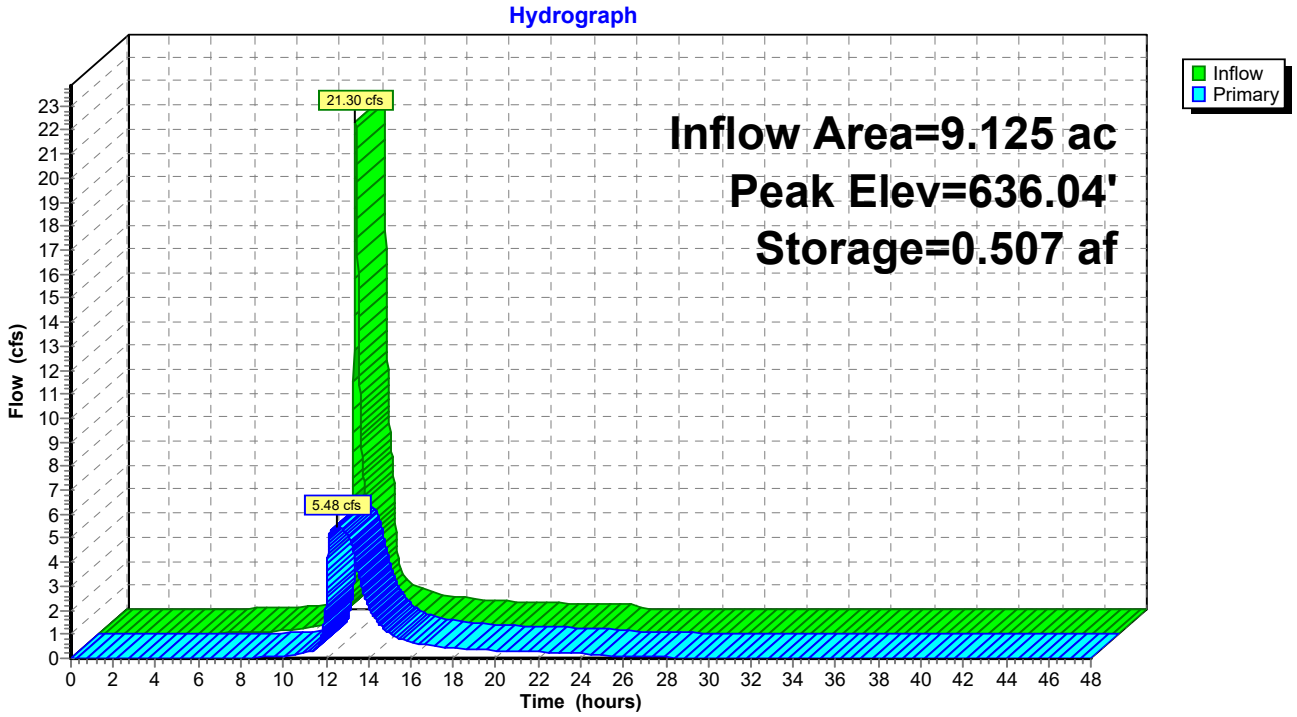
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=5.48 cfs @ 12.56 hrs HW=636.04' TW=630.46' (Dynamic Tailwater)
↑**1=FR-OUT** (Barrel Controls 5.48 cfs @ 4.47 fps)
↑**2=Orifice/Grate** (Passes 5.48 cfs of 6.36 cfs potential flow)
**3=Grate** ( Controls 0.00 cfs)

## Pond 22P: Detention 1



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=2.01"
Tc=10.0 min CN=86 Runoff=35.28 cfs 2.075 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=2.54"
Tc=10.0 min CN=92 Runoff=14.17 cfs 0.843 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=1.85"
Tc=10.0 min CN=84 Runoff=7.44 cfs 0.439 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=1.36"
Tc=10.0 min CN=77 Runoff=5.86 cfs 0.359 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=1.70"
Tc=10.0 min CN=82 Runoff=2.07 cfs 0.123 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=2.64"
Tc=10.0 min CN=93 Runoff=16.04 cfs 0.961 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=3.17"
Tc=10.0 min CN=98 Runoff=4.32 cfs 0.278 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=1.36"
Tc=10.0 min CN=77 Runoff=1.68 cfs 0.103 af

**Pond 6P: 2nd Elliptical** Peak Elev=631.38' Inflow=30.51 cfs 3.101 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=30.51 cfs 3.101 af

**Pond 22P: Detention 1** Peak Elev=636.47' Storage=0.656 af Inflow=25.97 cfs 1.583 af
Outflow=5.90 cfs 1.578 af

**Total Runoff Area = 29.594 ac Runoff Volume = 5.181 af Average Runoff Depth = 2.10"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

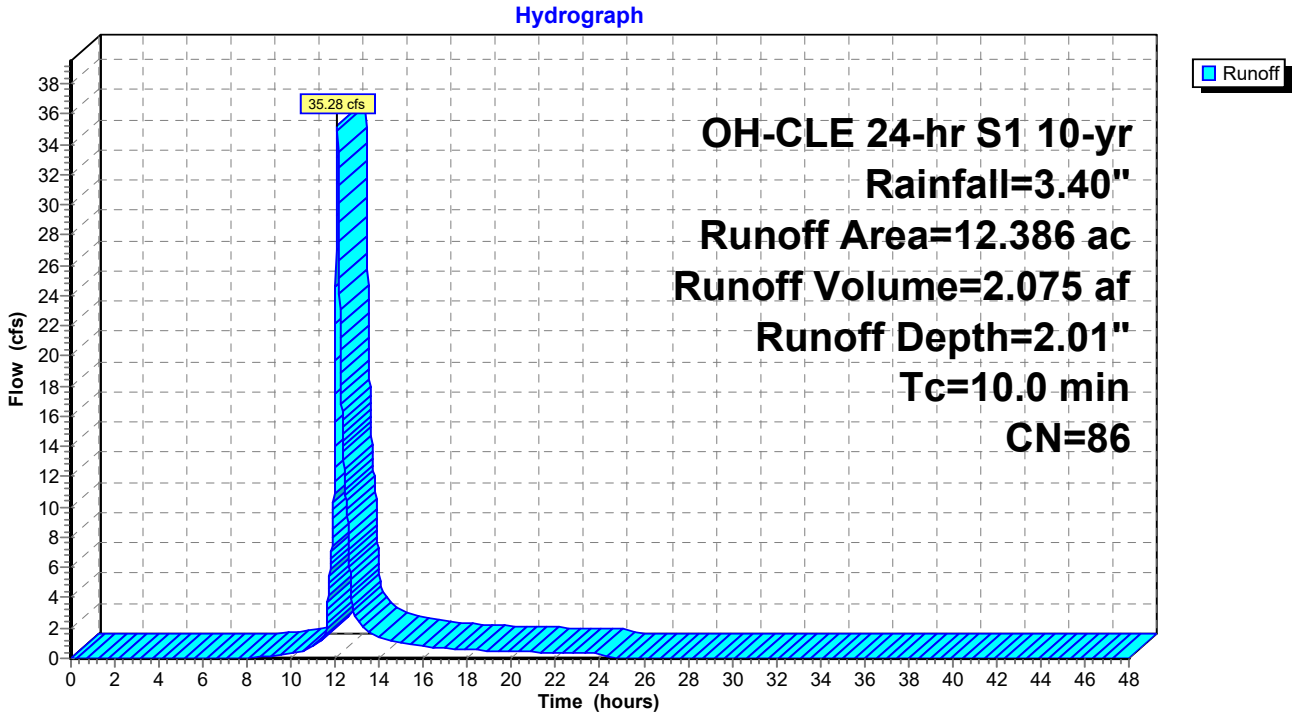
Runoff = 35.28 cfs @ 12.09 hrs, Volume= 2.075 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

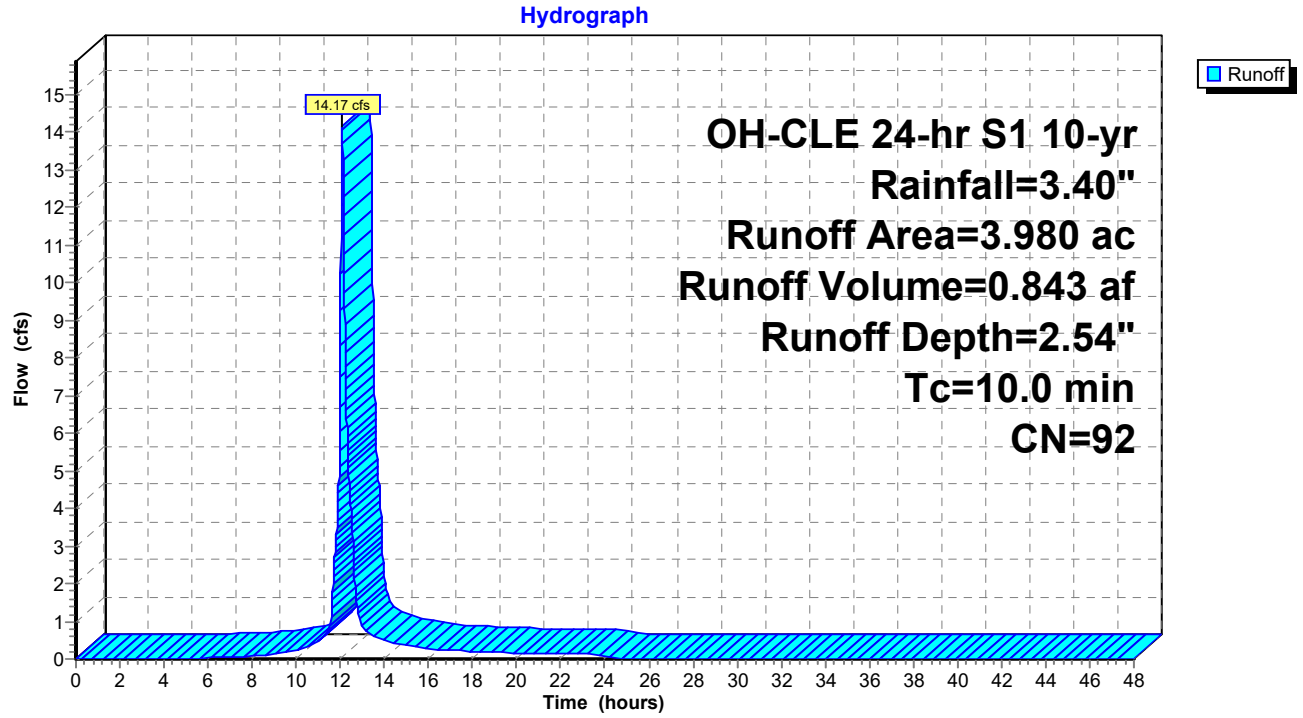
Runoff = 14.17 cfs @ 12.08 hrs, Volume= 0.843 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

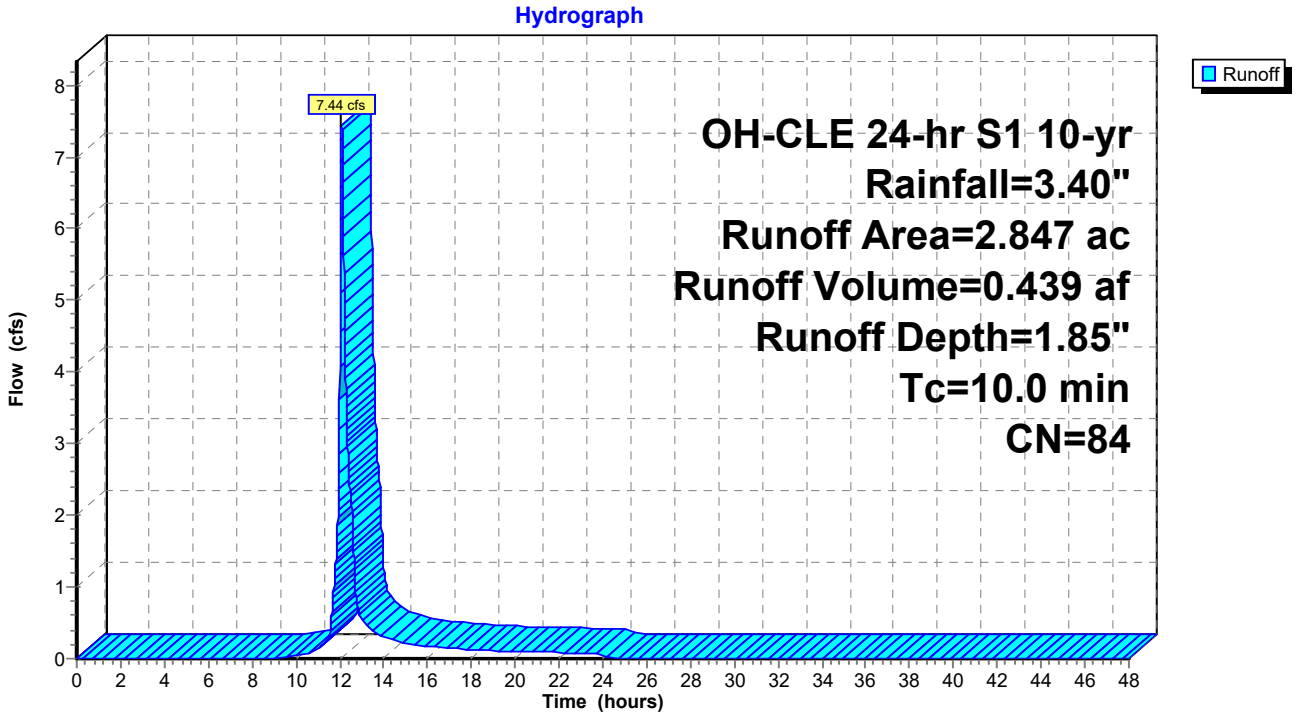
Runoff = 7.44 cfs @ 12.09 hrs, Volume= 0.439 af, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

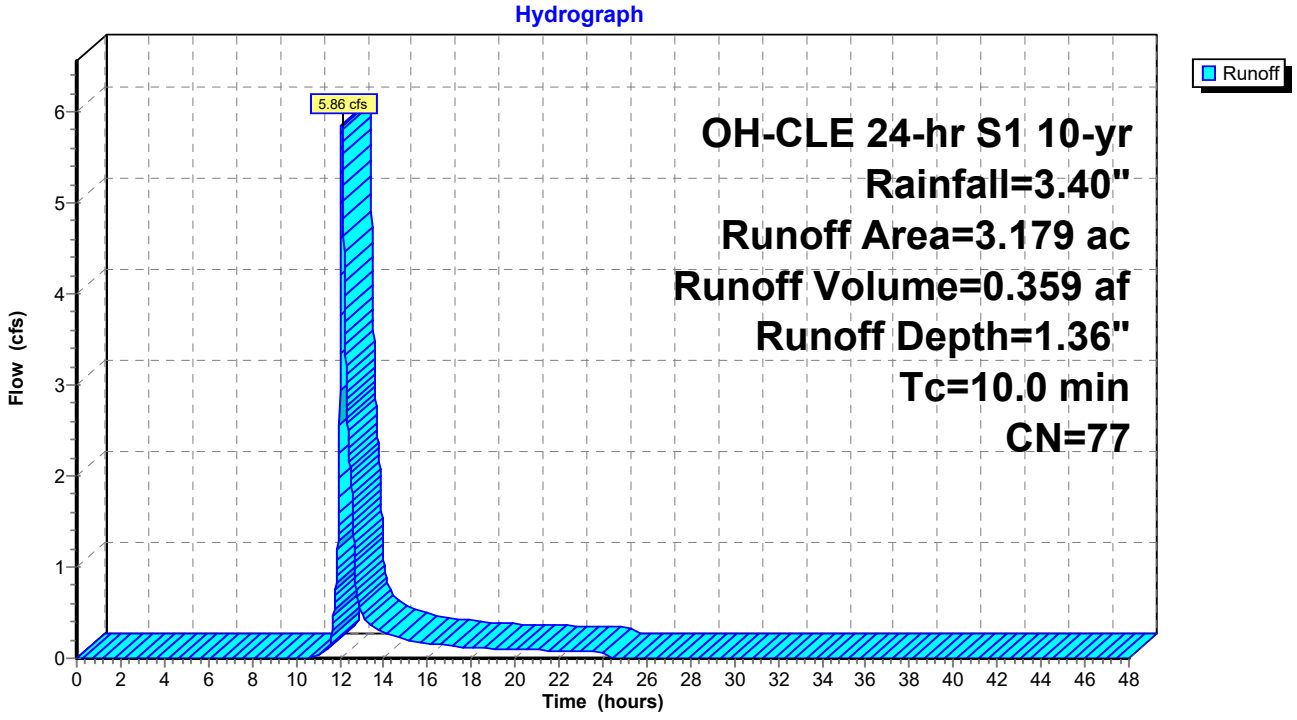
Runoff = 5.86 cfs @ 12.10 hrs, Volume= 0.359 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

## Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

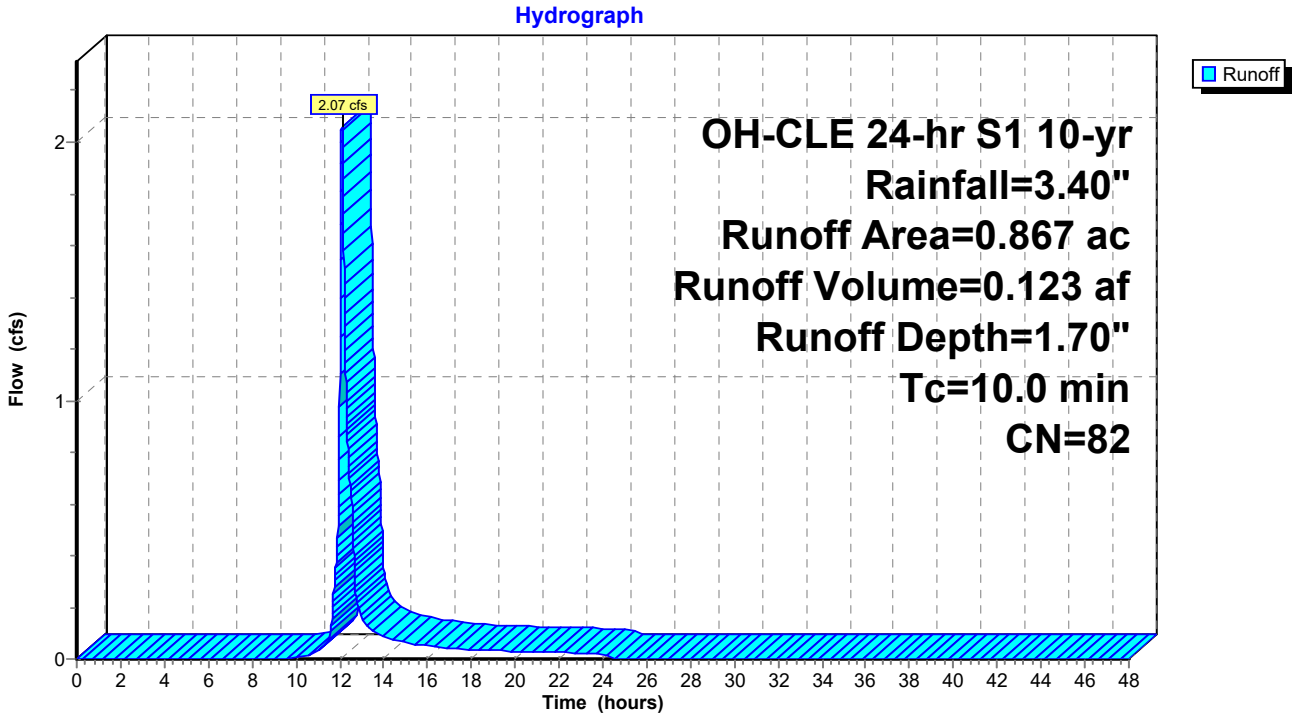
Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.123 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

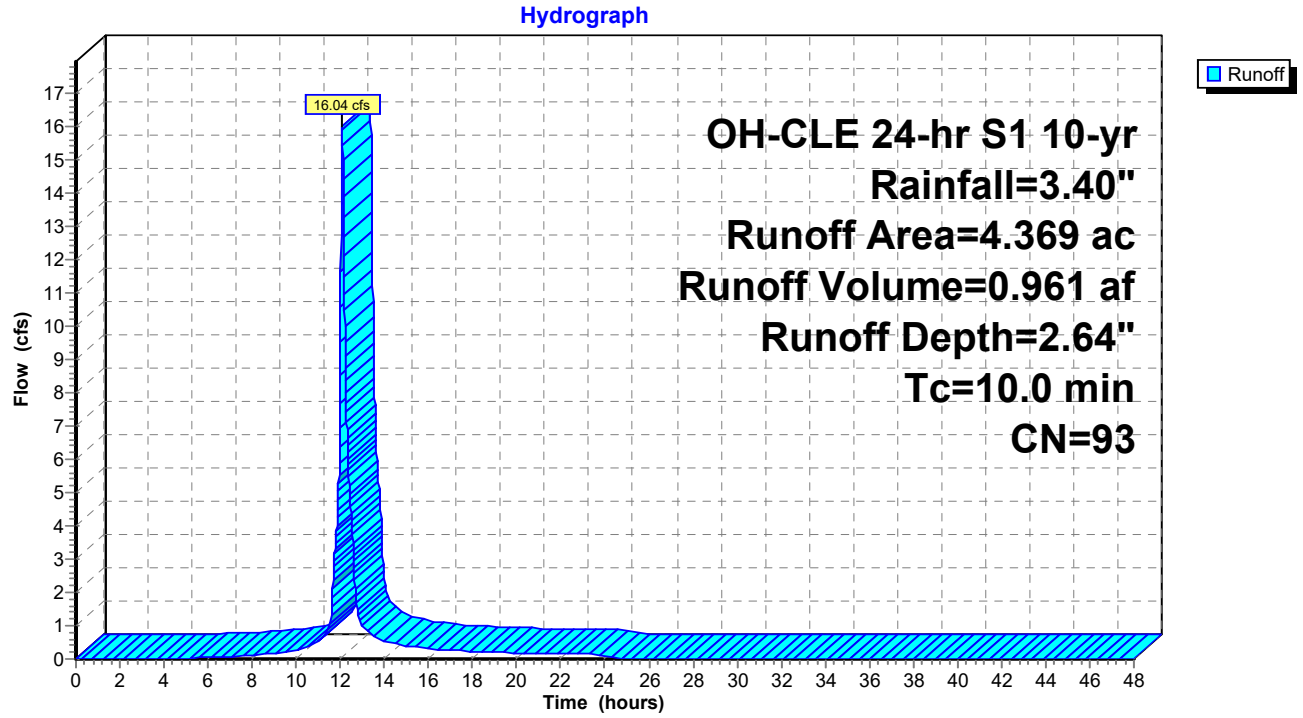
Runoff = 16.04 cfs @ 12.08 hrs, Volume= 0.961 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

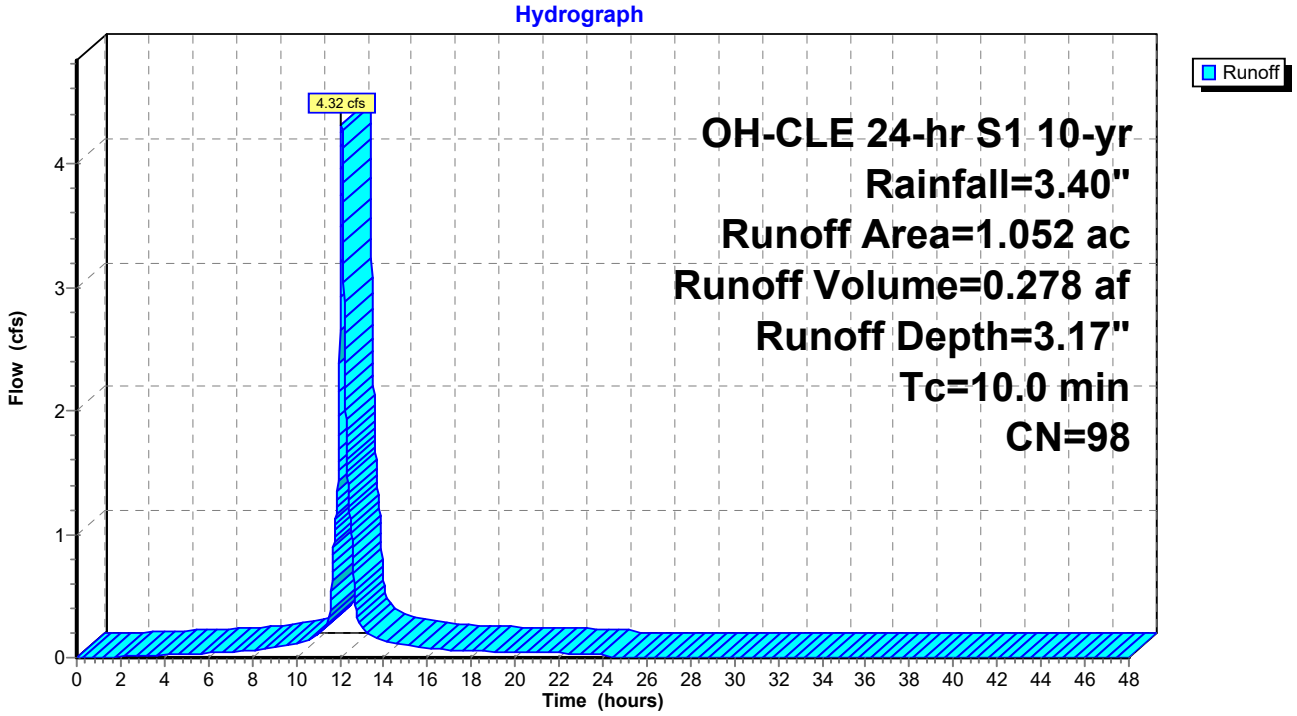
Runoff = 4.32 cfs @ 12.08 hrs, Volume= 0.278 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

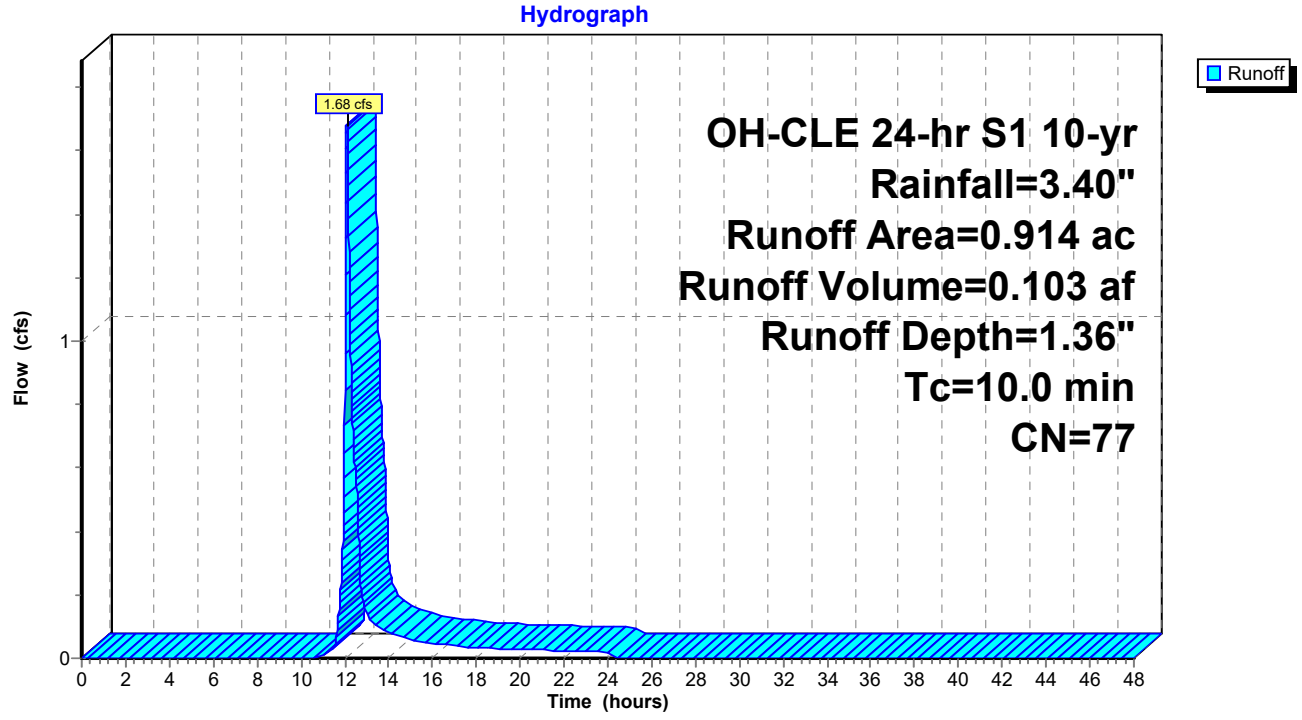
Runoff = 1.68 cfs @ 12.10 hrs, Volume= 0.103 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 10-yr Rainfall=3.40"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 631.38' (Flood elevation advised)

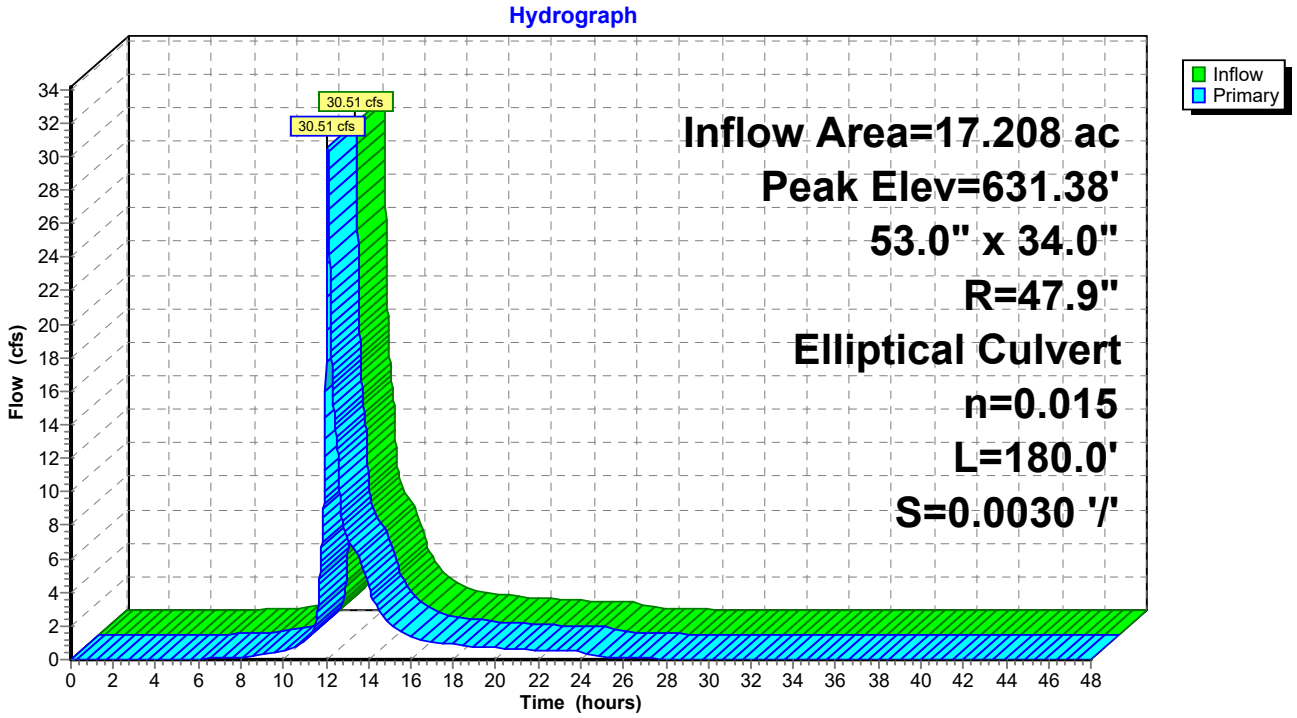
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth = 2.16" for 10-yr event
Inflow = 30.51 cfs @ 12.09 hrs, Volume= 3.101 af
Outflow = 30.51 cfs @ 12.09 hrs, Volume= 3.101 af, Atten= 0%, Lag= 0.0 min
Primary = 30.51 cfs @ 12.09 hrs, Volume= 3.101 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 631.38' @ 12.09 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=30.49 cfs @ 12.09 hrs HW=631.38' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 30.49 cfs @ 5.25 fps)

## Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 2.08" for 10-yr event
Inflow = 25.97 cfs @ 12.09 hrs, Volume= 1.583 af
Outflow = 5.90 cfs @ 12.60 hrs, Volume= 1.578 af, Atten= 77%, Lag= 30.5 min
Primary = 5.90 cfs @ 12.60 hrs, Volume= 1.578 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 636.47' @ 12.60 hrs Surf.Area= 0.354 ac Storage= 0.656 af

Plug-Flow detention time= 88.7 min calculated for 1.578 af (100% of inflow)
Center-of-Mass det. time= 86.6 min ( 886.5 - 799.9 )

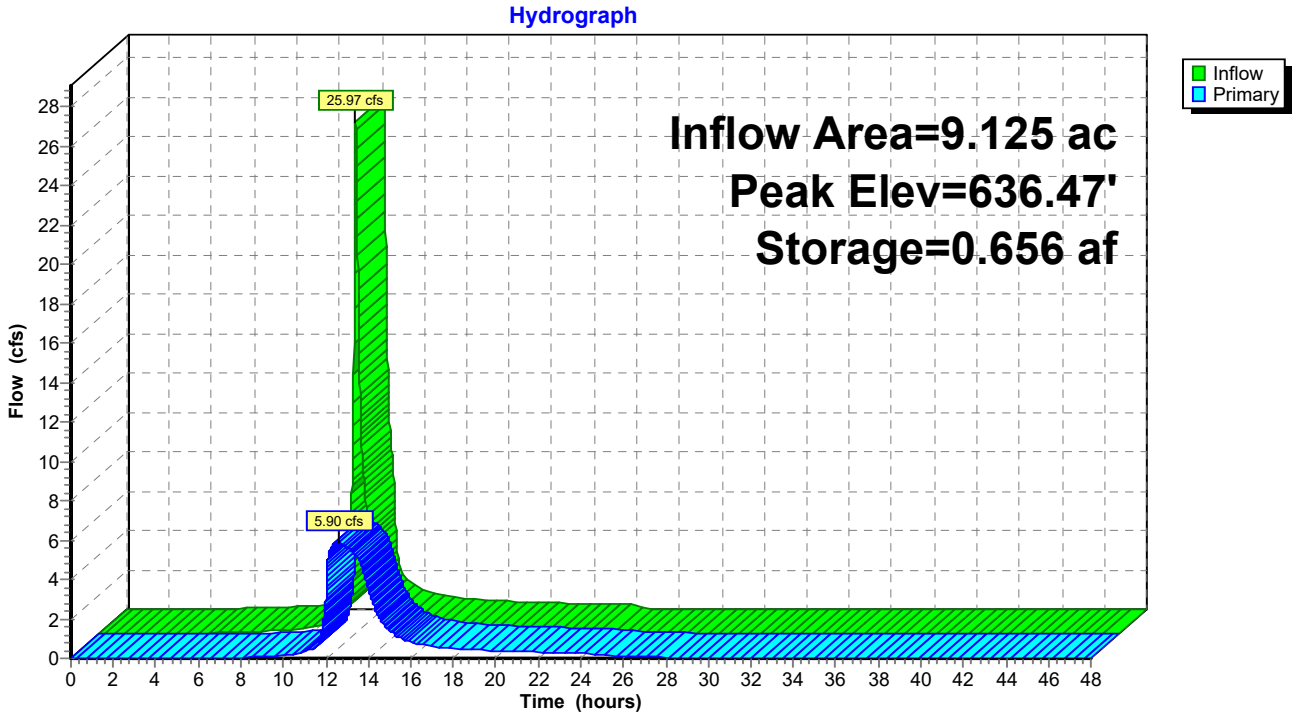
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=5.90 cfs @ 12.60 hrs HW=636.47' TW=630.50' (Dynamic Tailwater)
↑**1=FR-OUT** (Barrel Controls 5.90 cfs @ 4.81 fps)
↑**2=Orifice/Grate** (Passes < 7.46 cfs potential flow)
**3=Grate** (Passes < 2.65 cfs potential flow)

## Pond 22P: Detention 1



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=2.62"
Tc=10.0 min CN=86 Runoff=44.42 cfs 2.703 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=3.19"
Tc=10.0 min CN=92 Runoff=17.06 cfs 1.060 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=2.44"
Tc=10.0 min CN=84 Runoff=9.52 cfs 0.579 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=1.87"
Tc=10.0 min CN=77 Runoff=8.00 cfs 0.497 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=2.27"
Tc=10.0 min CN=82 Runoff=2.69 cfs 0.164 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=3.30"
Tc=10.0 min CN=93 Runoff=19.18 cfs 1.201 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=3.84"
Tc=10.0 min CN=98 Runoff=5.03 cfs 0.337 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=1.87"
Tc=10.0 min CN=77 Runoff=2.30 cfs 0.143 af

**Pond 6P: 2nd Elliptical** Peak Elev=631.64' Inflow=36.71 cfs 3.975 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=36.71 cfs 3.975 af

**Pond 22P: Detention 1** Peak Elev=637.05' Storage=0.872 af Inflow=32.33 cfs 2.036 af
Outflow=6.42 cfs 2.031 af

**Total Runoff Area = 29.594 ac Runoff Volume = 6.683 af Average Runoff Depth = 2.71"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

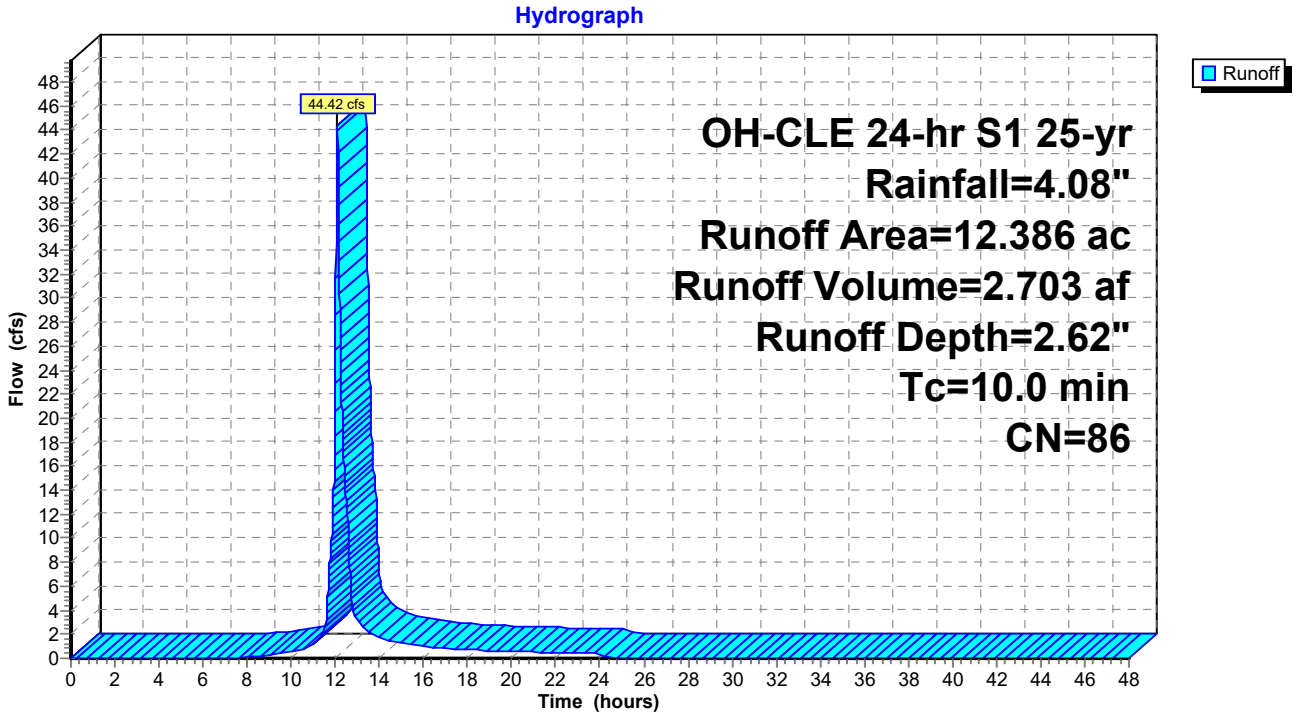
Runoff = 44.42 cfs @ 12.09 hrs, Volume= 2.703 af, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

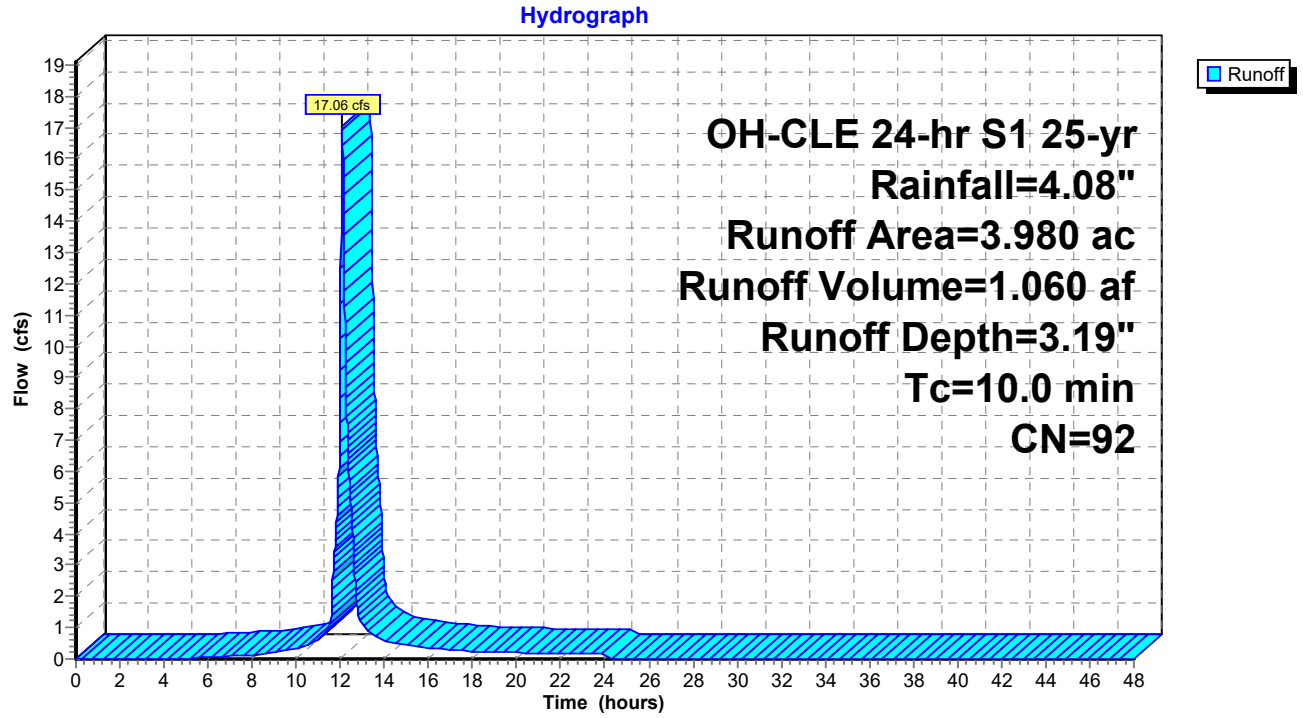
Runoff = 17.06 cfs @ 12.08 hrs, Volume= 1.060 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

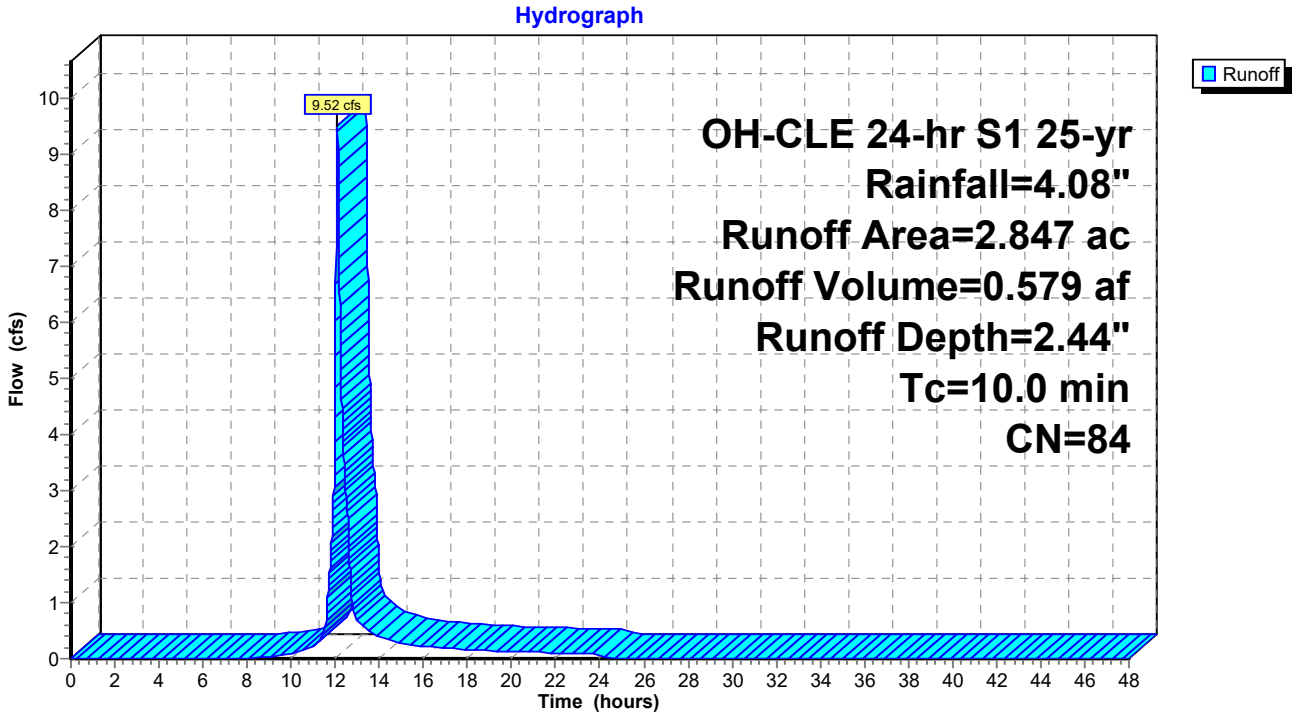
Runoff = 9.52 cfs @ 12.09 hrs, Volume= 0.579 af, Depth= 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

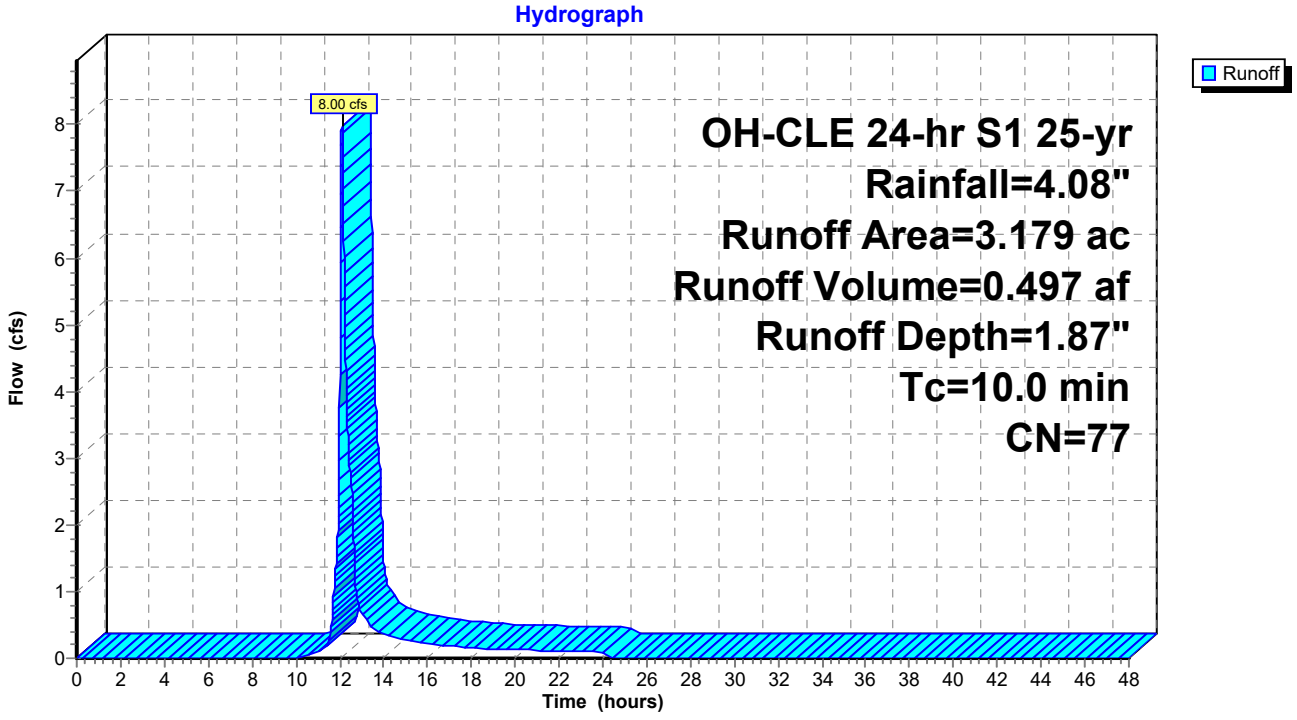
Runoff = 8.00 cfs @ 12.09 hrs, Volume= 0.497 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

### Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

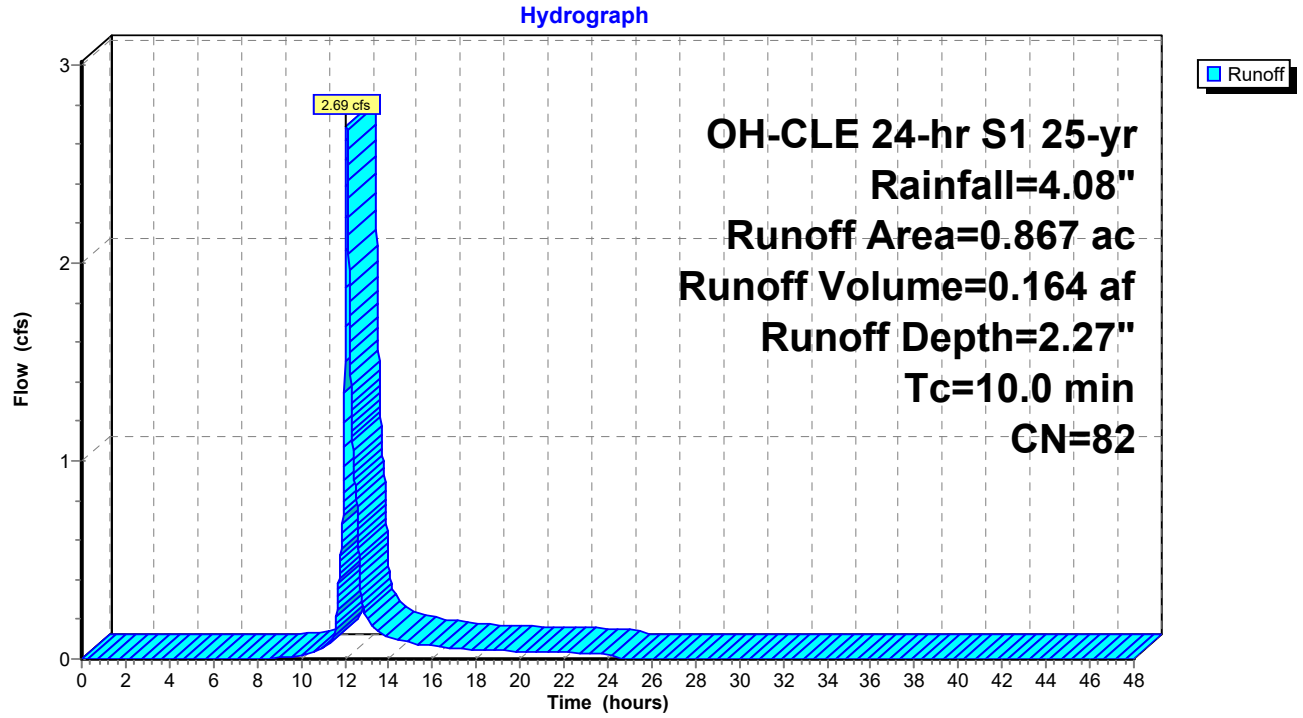
Runoff = 2.69 cfs @ 12.09 hrs, Volume= 0.164 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

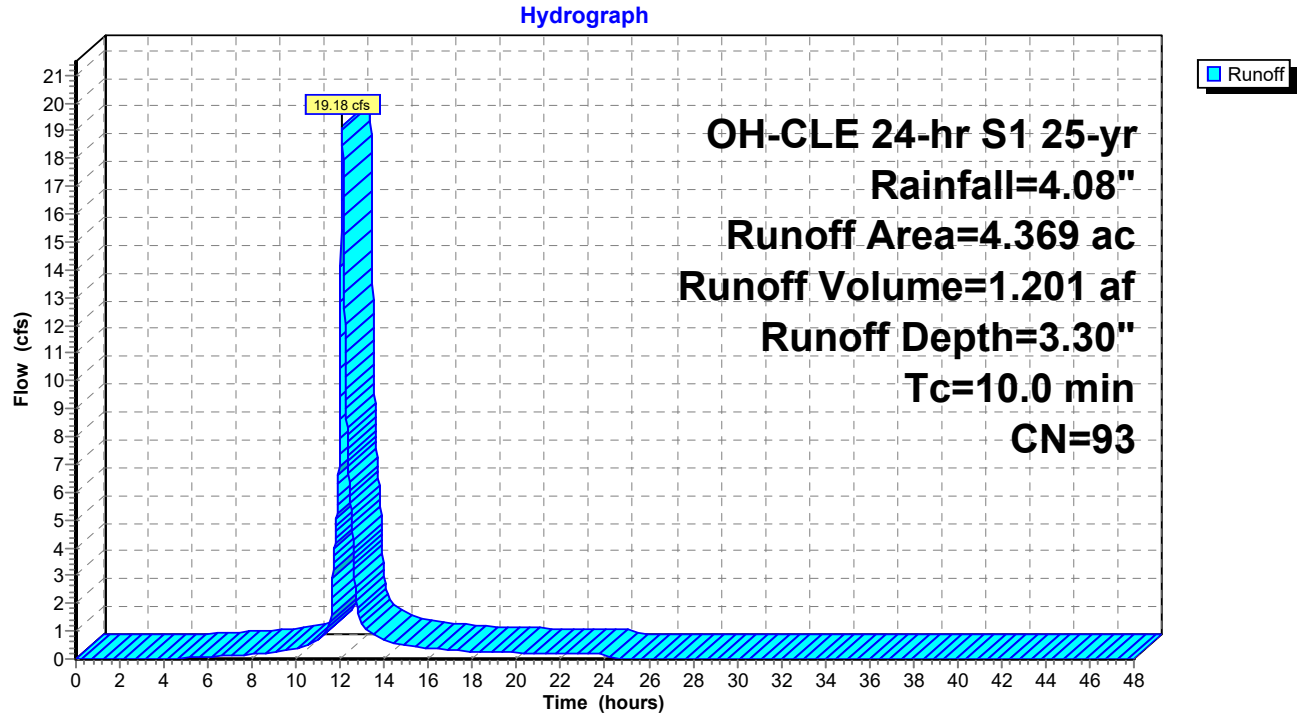
Runoff = 19.18 cfs @ 12.08 hrs, Volume= 1.201 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

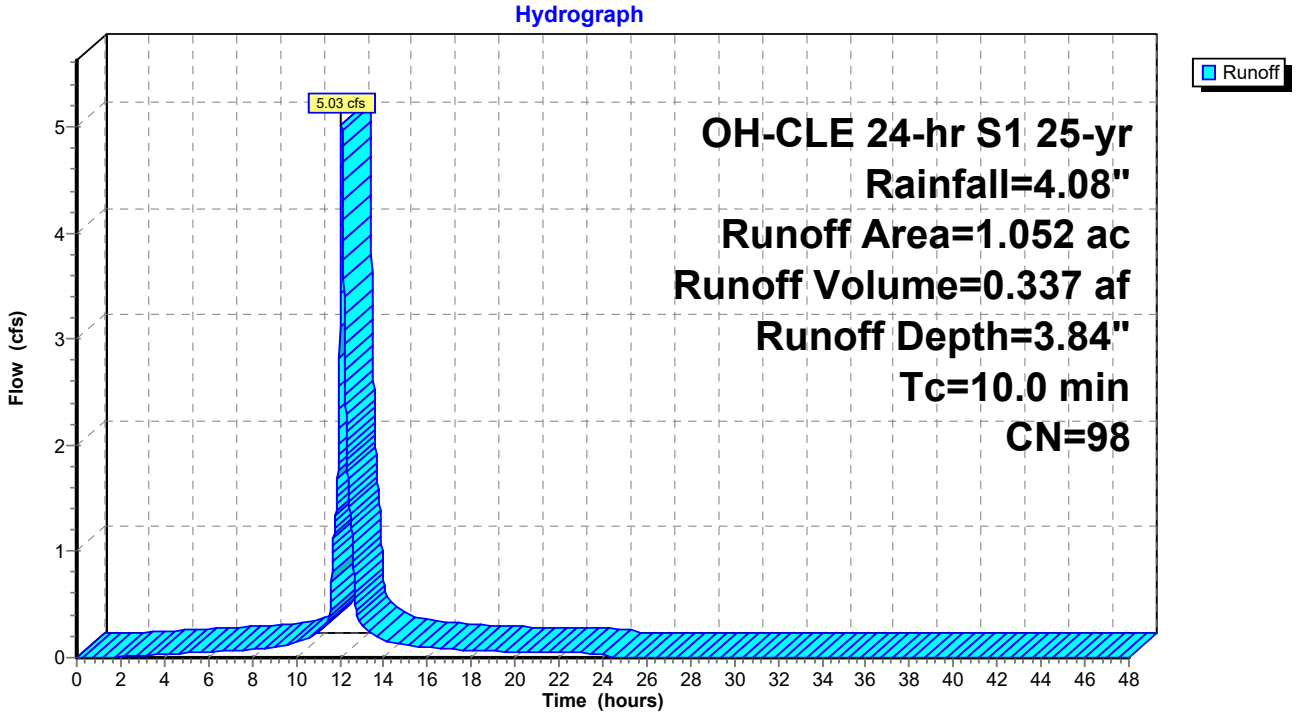
Runoff = 5.03 cfs @ 12.08 hrs, Volume= 0.337 af, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

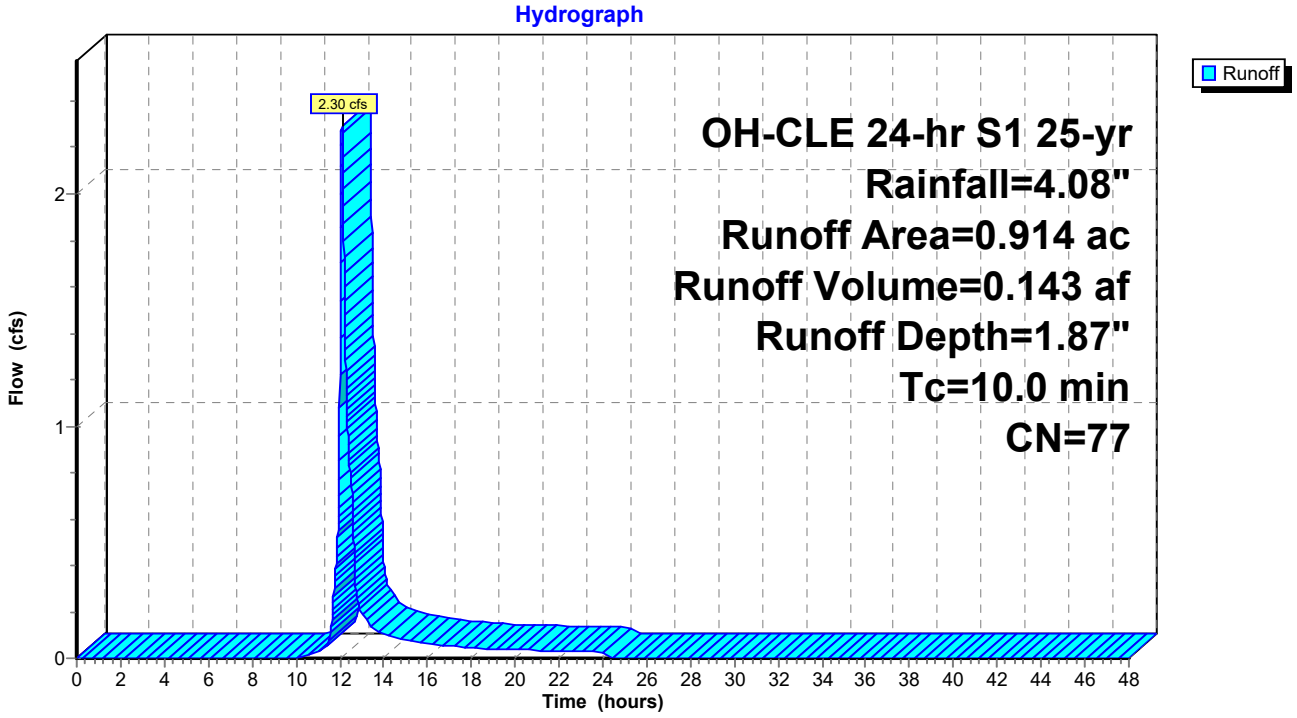
Runoff = 2.30 cfs @ 12.09 hrs, Volume= 0.143 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 25-yr Rainfall=4.08"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 631.64' (Flood elevation advised)

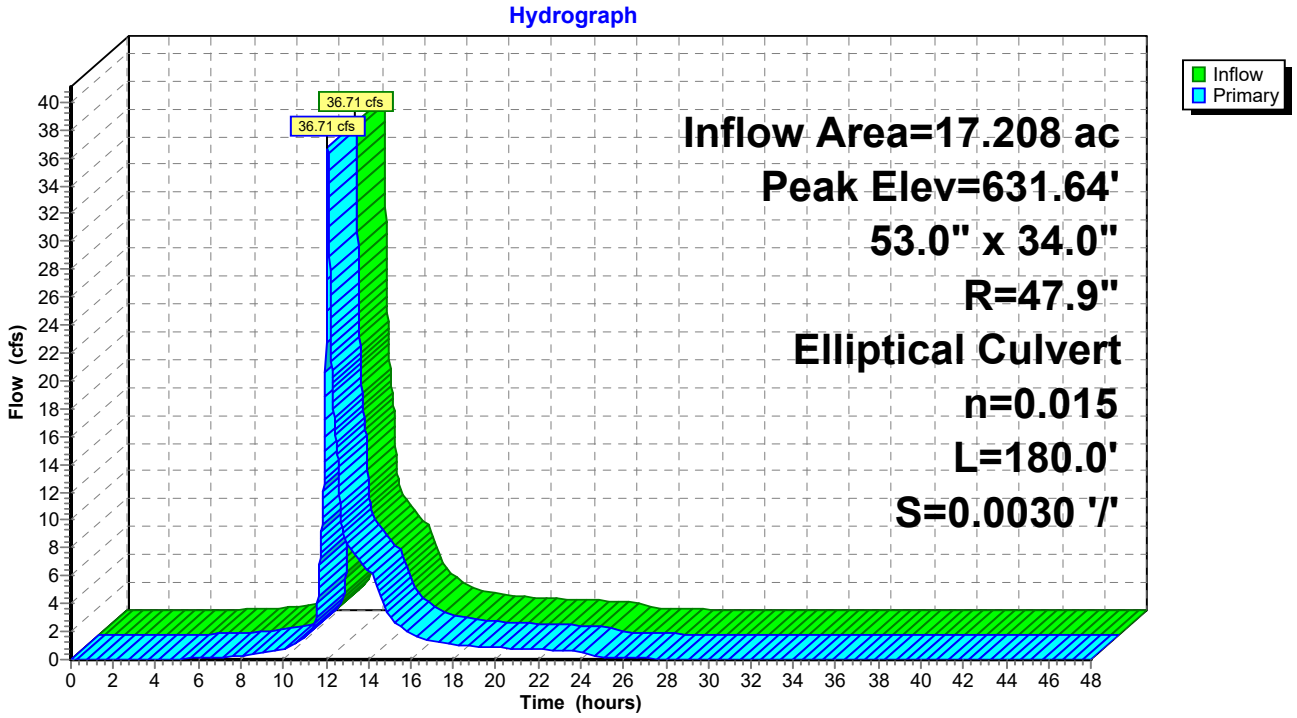
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth = 2.77" for 25-yr event
Inflow = 36.71 cfs @ 12.09 hrs, Volume= 3.975 af
Outflow = 36.71 cfs @ 12.09 hrs, Volume= 3.975 af, Atten= 0%, Lag= 0.0 min
Primary = 36.71 cfs @ 12.09 hrs, Volume= 3.975 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 631.64' @ 12.09 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=36.68 cfs @ 12.09 hrs HW=631.63' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 36.68 cfs @ 5.53 fps)

## Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 2.68" for 25-yr event
Inflow = 32.33 cfs @ 12.09 hrs, Volume= 2.036 af
Outflow = 6.42 cfs @ 12.62 hrs, Volume= 2.031 af, Atten= 80%, Lag= 32.2 min
Primary = 6.42 cfs @ 12.62 hrs, Volume= 2.031 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 637.05' @ 12.62 hrs Surf.Area= 0.385 ac Storage= 0.872 af

Plug-Flow detention time= 90.1 min calculated for 2.030 af (100% of inflow)
Center-of-Mass det. time= 88.7 min ( 885.0 - 796.3 )

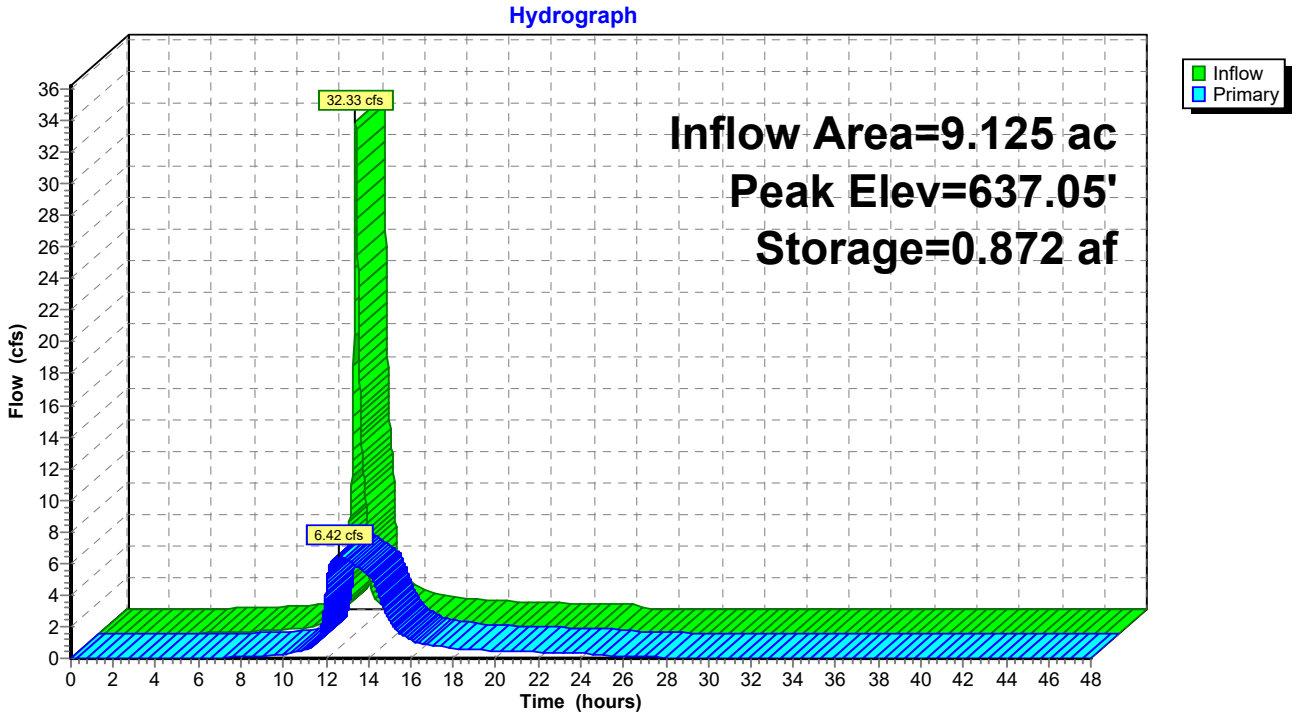
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=6.42 cfs @ 12.62 hrs HW=637.05' TW=630.55' (Dynamic Tailwater)
↑**1=FR-OUT** (Barrel Controls 6.42 cfs @ 5.23 fps)
↑**2=Orifice/Grate** (Passes < 8.72 cfs potential flow)
**3=Grate** (Passes < 17.26 cfs potential flow)

## Pond 22P: Detention 1



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=3.14"
Tc=10.0 min CN=86 Runoff=51.68 cfs 3.243 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=3.75"
Tc=10.0 min CN=92 Runoff=19.31 cfs 1.243 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=2.95"
Tc=10.0 min CN=84 Runoff=11.19 cfs 0.700 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=2.33"
Tc=10.0 min CN=77 Runoff=9.77 cfs 0.618 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=2.77"
Tc=10.0 min CN=82 Runoff=3.19 cfs 0.200 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=3.85"
Tc=10.0 min CN=93 Runoff=21.63 cfs 1.403 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=4.41"
Tc=10.0 min CN=98 Runoff=5.58 cfs 0.387 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=2.33"
Tc=10.0 min CN=77 Runoff=2.81 cfs 0.178 af

**Pond 6P: 2nd Elliptical** Peak Elev=631.83' Inflow=41.58 cfs 4.724 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=41.58 cfs 4.724 af

**Pond 22P: Detention 1** Peak Elev=637.52' Storage=1.058 af Inflow=37.42 cfs 2.426 af
Outflow=6.80 cfs 2.420 af

**Total Runoff Area = 29.594 ac Runoff Volume = 7.972 af Average Runoff Depth = 3.23"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

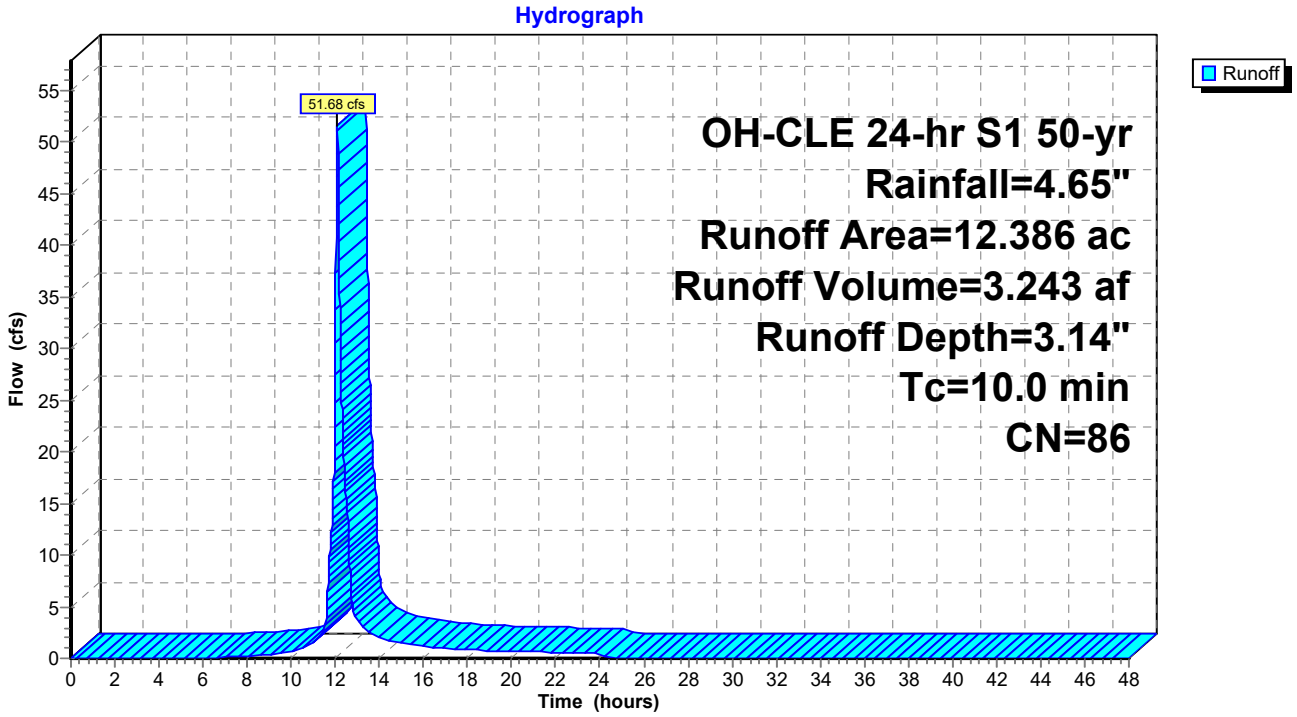
Runoff = 51.68 cfs @ 12.09 hrs, Volume= 3.243 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

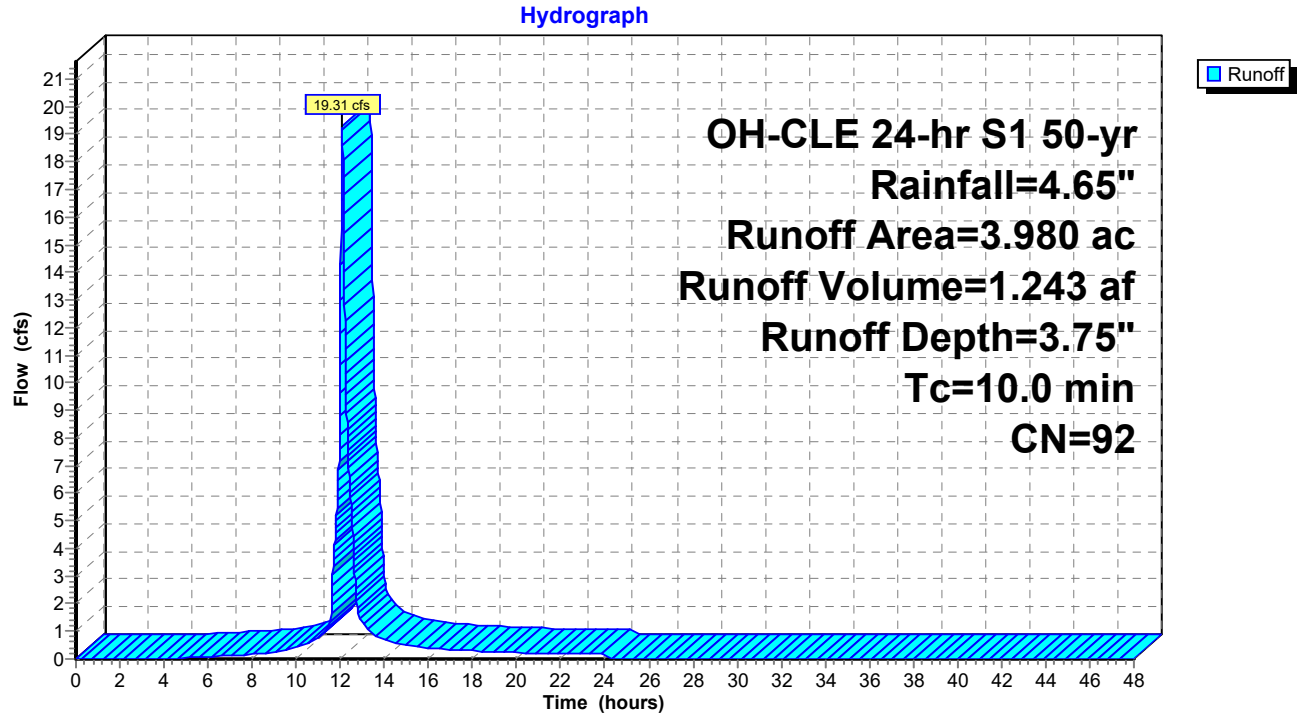
Runoff = 19.31 cfs @ 12.08 hrs, Volume= 1.243 af, Depth= 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

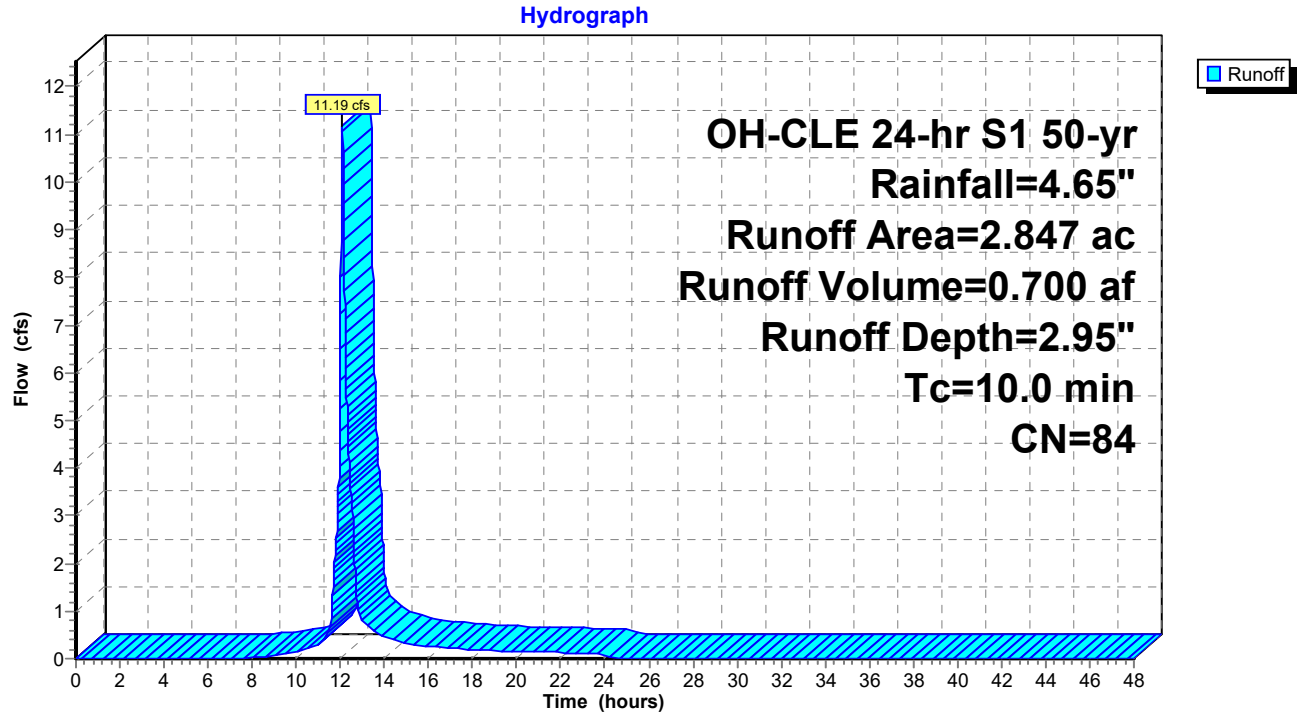
Runoff = 11.19 cfs @ 12.09 hrs, Volume= 0.700 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

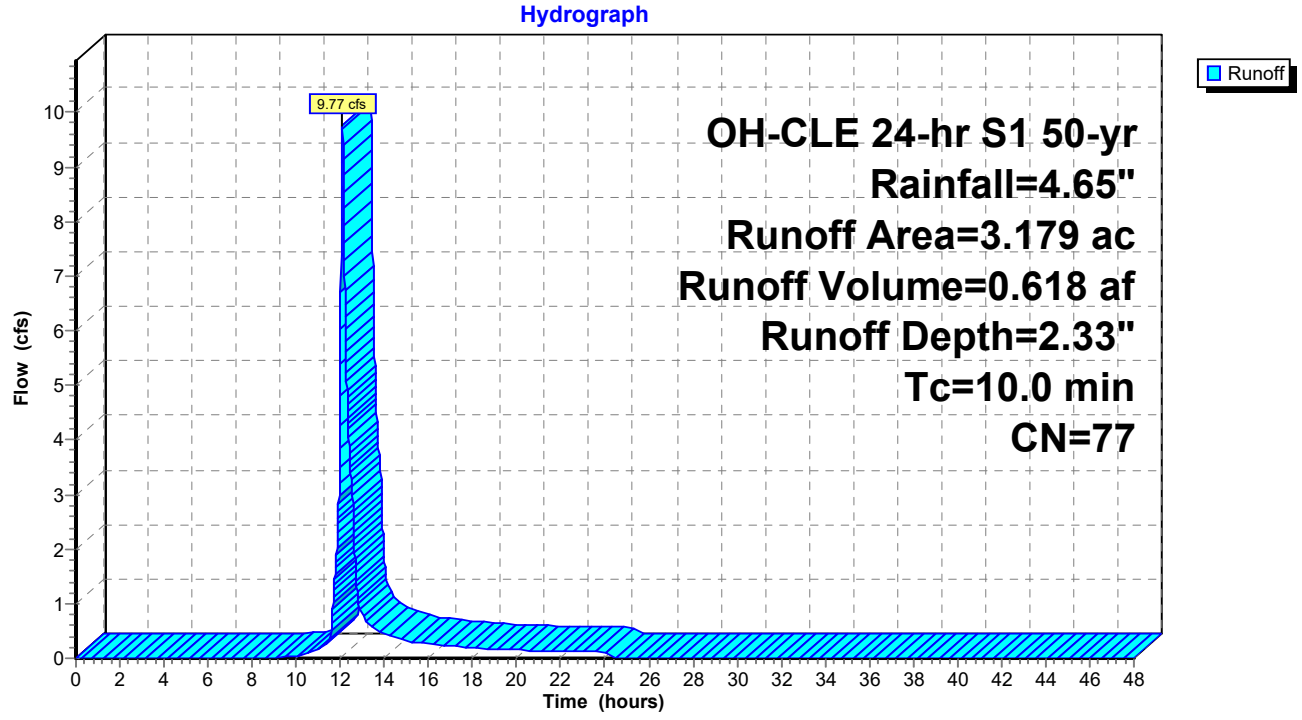
Runoff = 9.77 cfs @ 12.09 hrs, Volume= 0.618 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

## Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

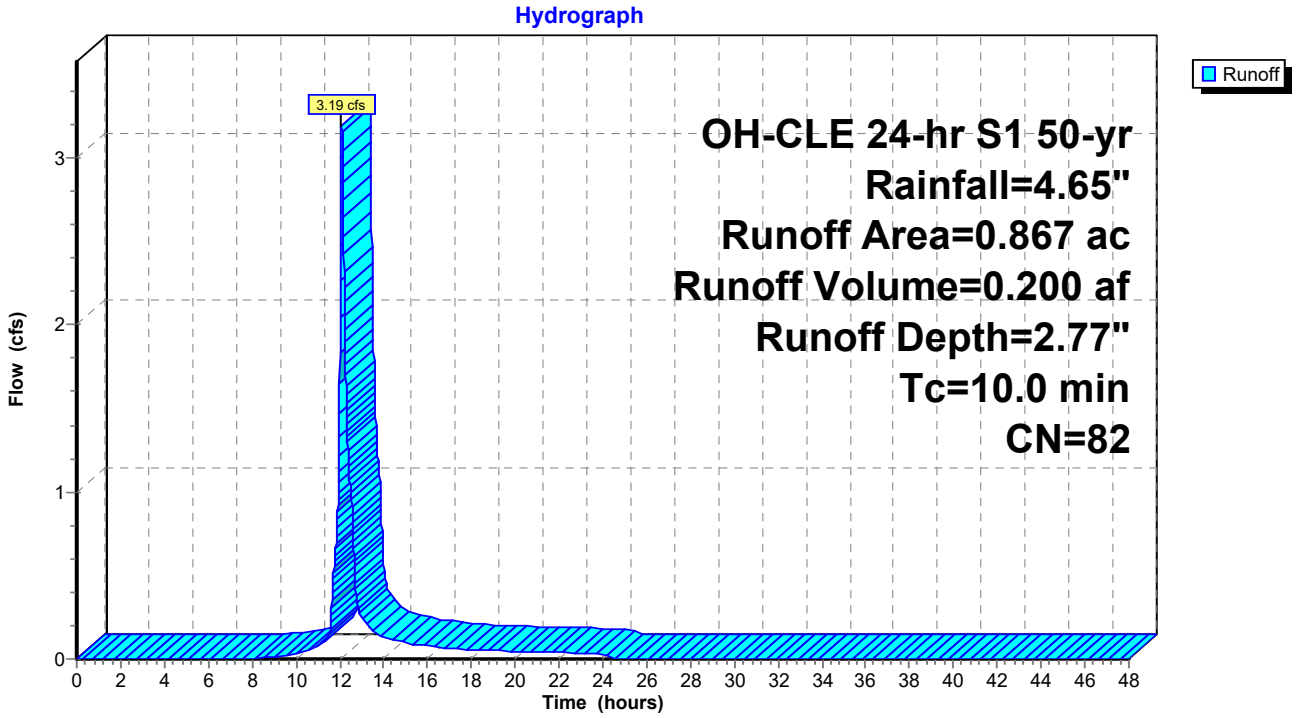
Runoff = 3.19 cfs @ 12.09 hrs, Volume= 0.200 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

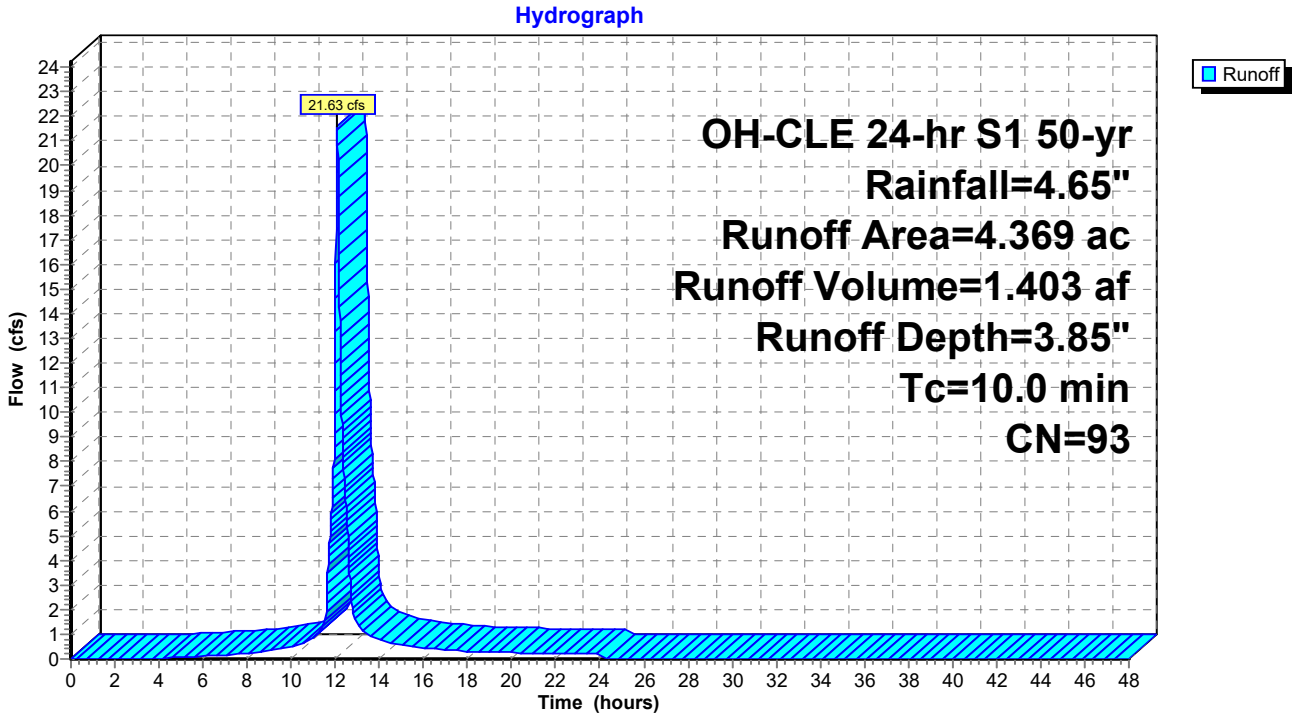
Runoff = 21.63 cfs @ 12.08 hrs, Volume= 1.403 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

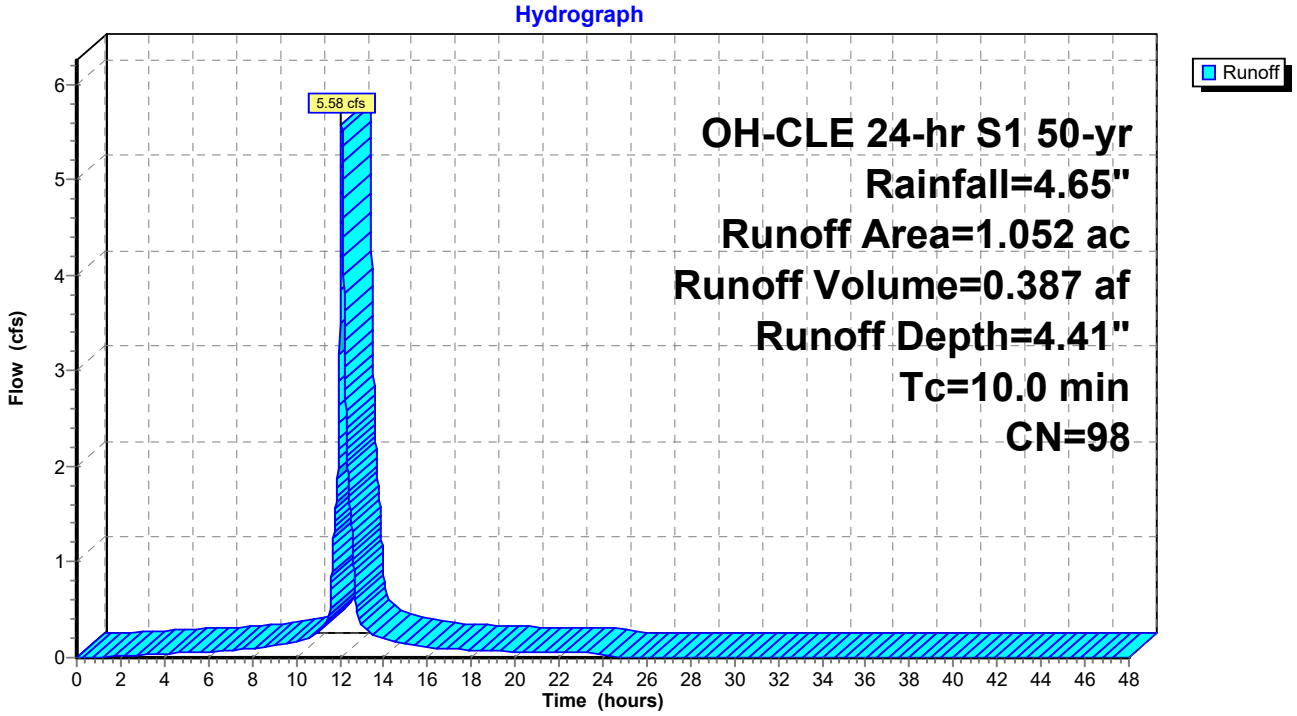
Runoff = 5.58 cfs @ 12.08 hrs, Volume= 0.387 af, Depth= 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

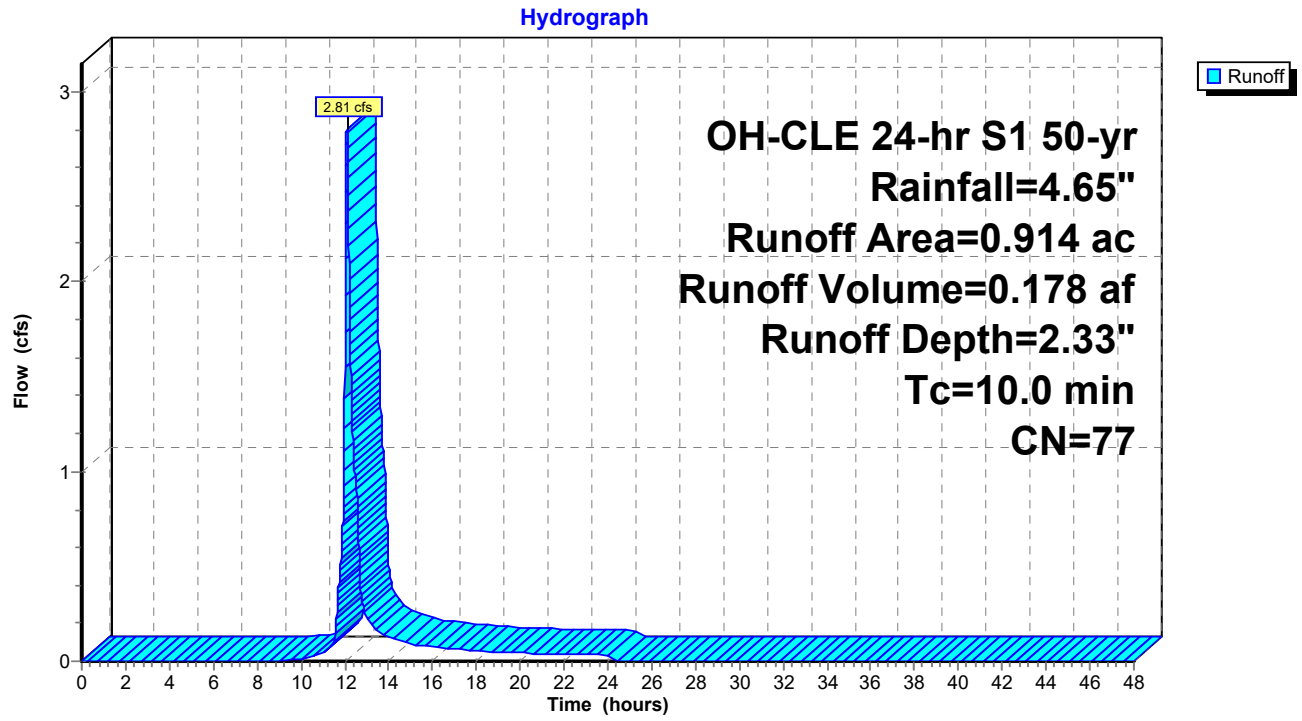
Runoff = 2.81 cfs @ 12.09 hrs, Volume= 0.178 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 50-yr Rainfall=4.65"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 631.83' (Flood elevation advised)

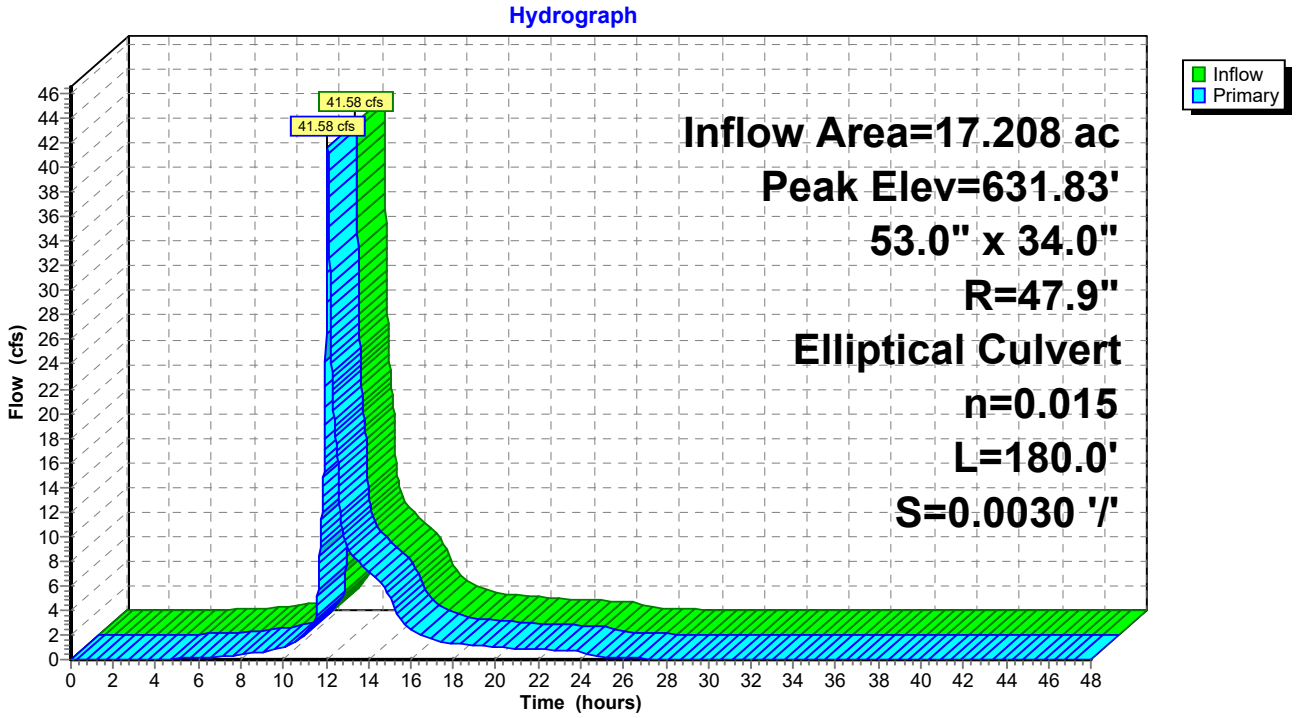
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth = 3.29" for 50-yr event
Inflow = 41.58 cfs @ 12.09 hrs, Volume= 4.724 af
Outflow = 41.58 cfs @ 12.09 hrs, Volume= 4.724 af, Atten= 0%, Lag= 0.0 min
Primary = 41.58 cfs @ 12.09 hrs, Volume= 4.724 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 631.83' @ 12.09 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=41.55 cfs @ 12.09 hrs HW=631.83' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 41.55 cfs @ 5.73 fps)

## Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 3.19" for 50-yr event
Inflow = 37.42 cfs @ 12.09 hrs, Volume= 2.426 af
Outflow = 6.80 cfs @ 12.64 hrs, Volume= 2.420 af, Atten= 82%, Lag= 33.3 min
Primary = 6.80 cfs @ 12.64 hrs, Volume= 2.420 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 637.52' @ 12.64 hrs Surf.Area= 0.410 ac Storage= 1.058 af

Plug-Flow detention time= 93.2 min calculated for 2.420 af (100% of inflow)
Center-of-Mass det. time= 91.8 min ( 885.5 - 793.8 )

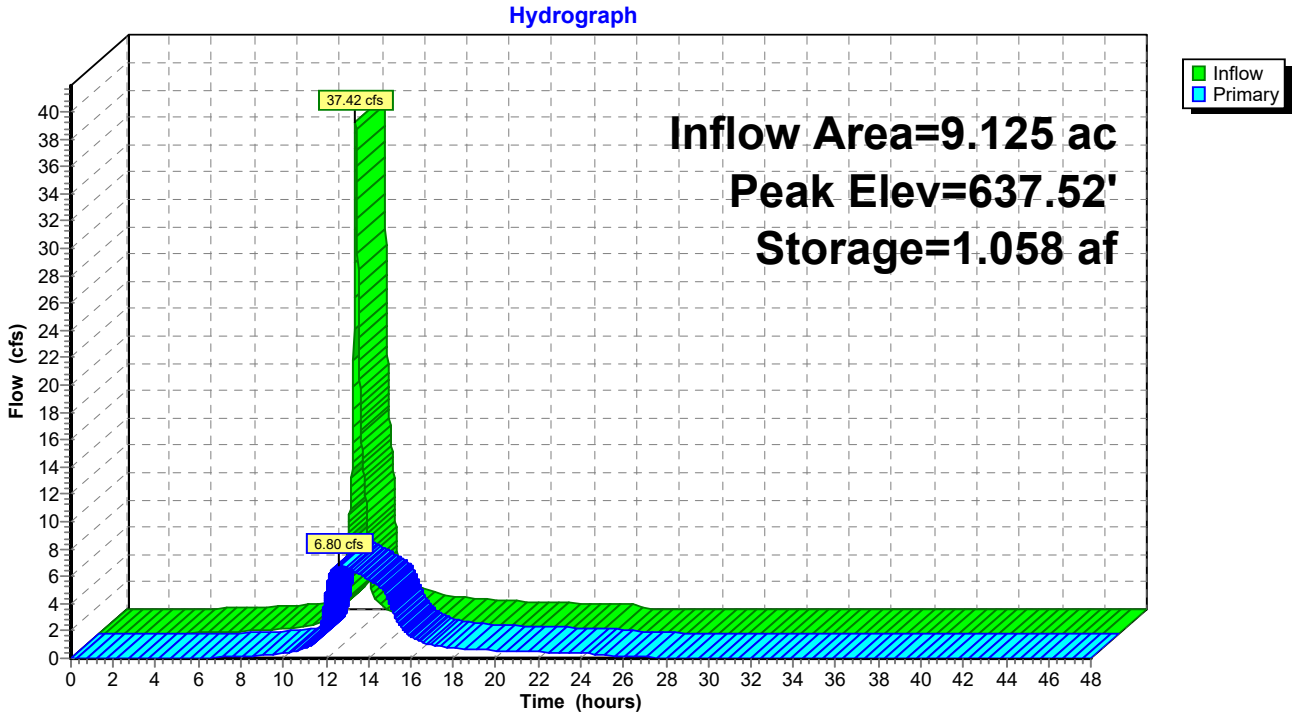
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=6.80 cfs @ 12.64 hrs HW=637.52' TW=630.59' (Dynamic Tailwater)
↑**1=FR-OUT** (Barrel Controls 6.80 cfs @ 5.54 fps)
↑**2=Orifice/Grate** (Passes < 9.61 cfs potential flow)
**3=Grate** (Passes < 21.70 cfs potential flow)

## Pond 22P: Detention 1



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=3.70"
Tc=10.0 min CN=86 Runoff=59.03 cfs 3.820 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=4.33"
Tc=10.0 min CN=92 Runoff=21.57 cfs 1.437 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=3.50"
Tc=10.0 min CN=84 Runoff=12.89 cfs 0.830 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=2.83"
Tc=10.0 min CN=77 Runoff=11.62 cfs 0.751 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=3.30"
Tc=10.0 min CN=82 Runoff=3.71 cfs 0.239 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=4.44"
Tc=10.0 min CN=93 Runoff=24.08 cfs 1.618 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=5.01"
Tc=10.0 min CN=98 Runoff=6.14 cfs 0.439 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=2.83"
Tc=10.0 min CN=77 Runoff=3.34 cfs 0.216 af

**Pond 6P: 2nd Elliptical** Peak Elev=632.03' Inflow=46.50 cfs 5.525 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=46.50 cfs 5.525 af

**Pond 22P: Detention 1** Peak Elev=637.99' Storage=1.257 af Inflow=42.62 cfs 2.843 af
Outflow=7.17 cfs 2.838 af

**Total Runoff Area = 29.594 ac Runoff Volume = 9.350 af Average Runoff Depth = 3.79"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

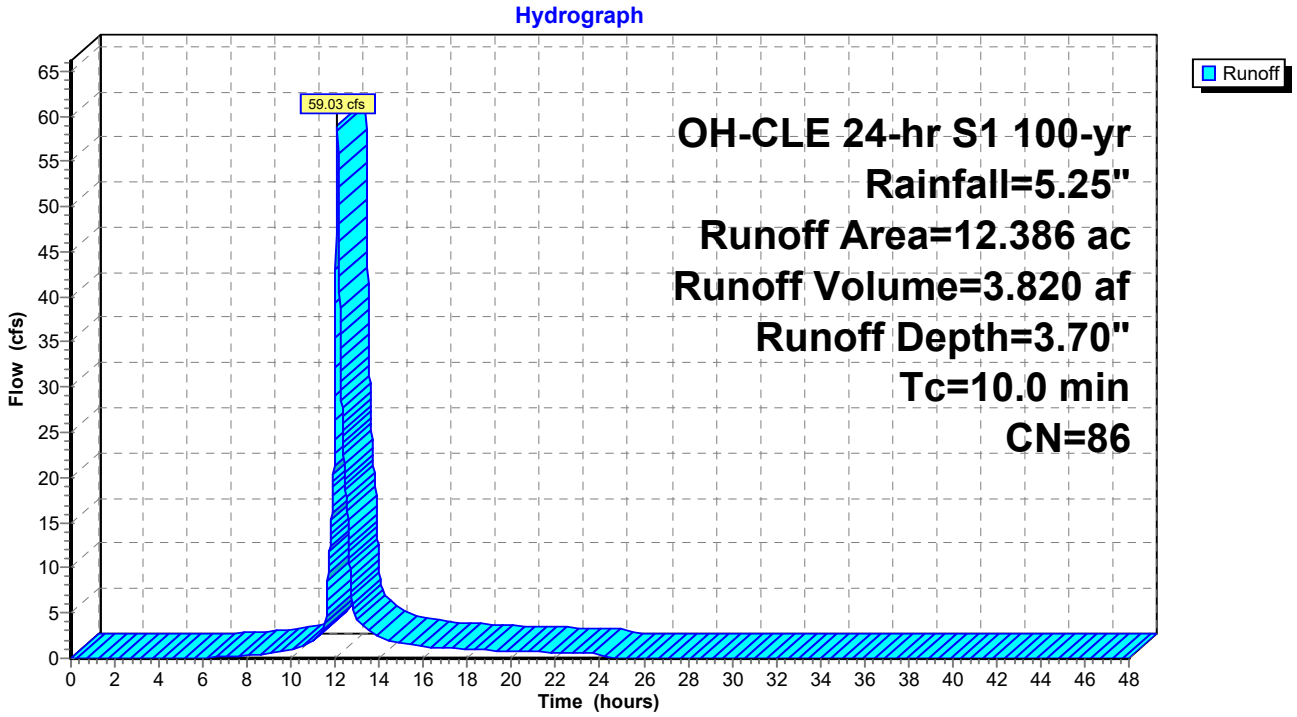
Runoff = 59.03 cfs @ 12.09 hrs, Volume= 3.820 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

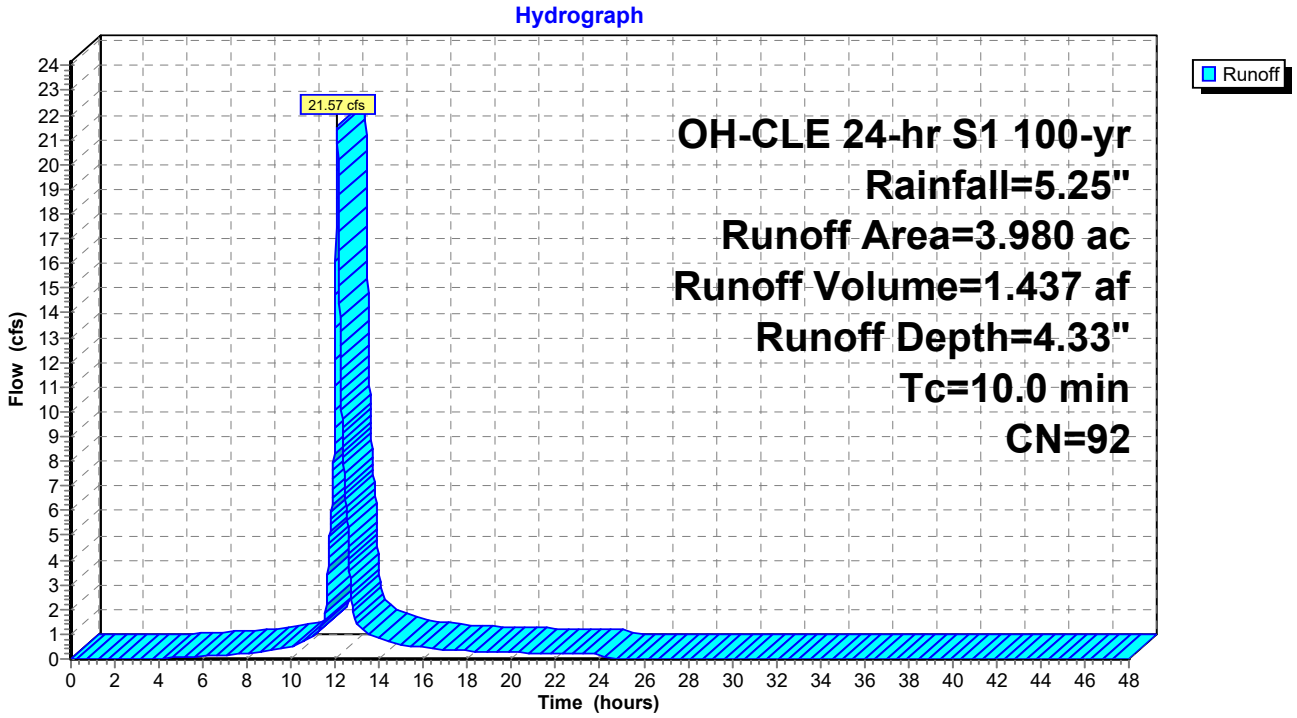
Runoff = 21.57 cfs @ 12.08 hrs, Volume= 1.437 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

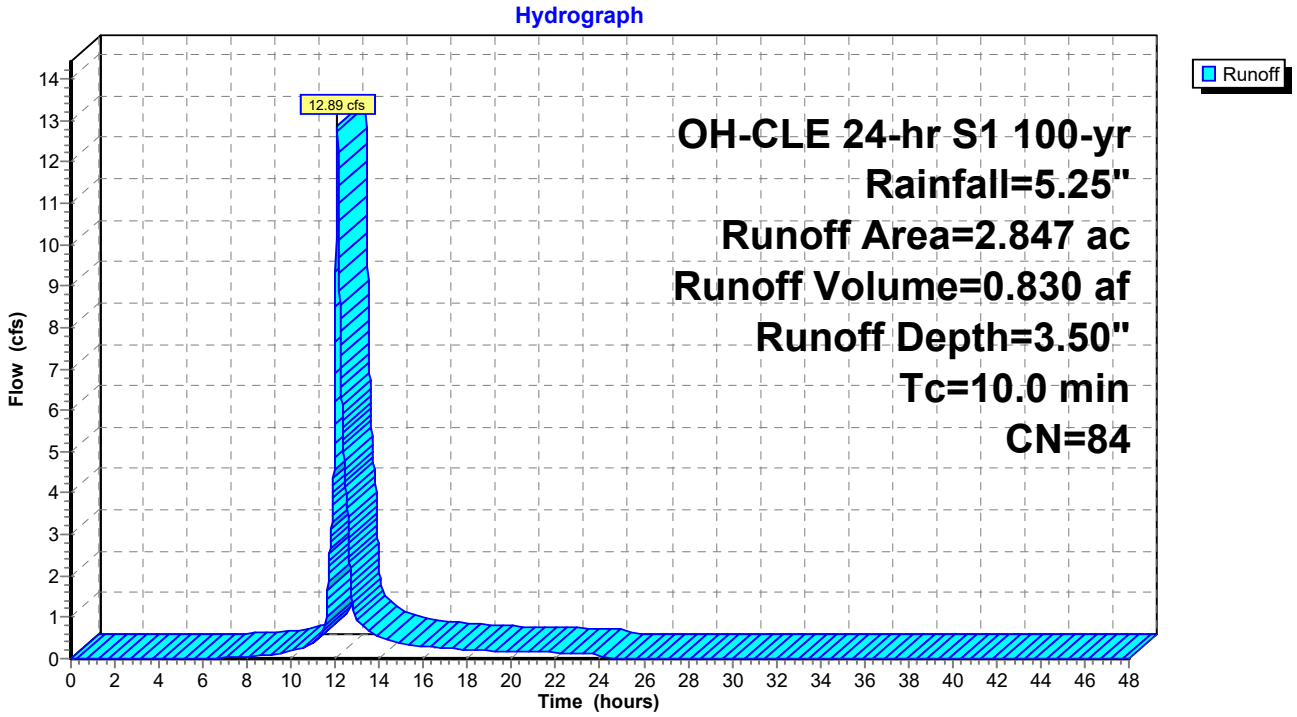
Runoff = 12.89 cfs @ 12.09 hrs, Volume= 0.830 af, Depth= 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

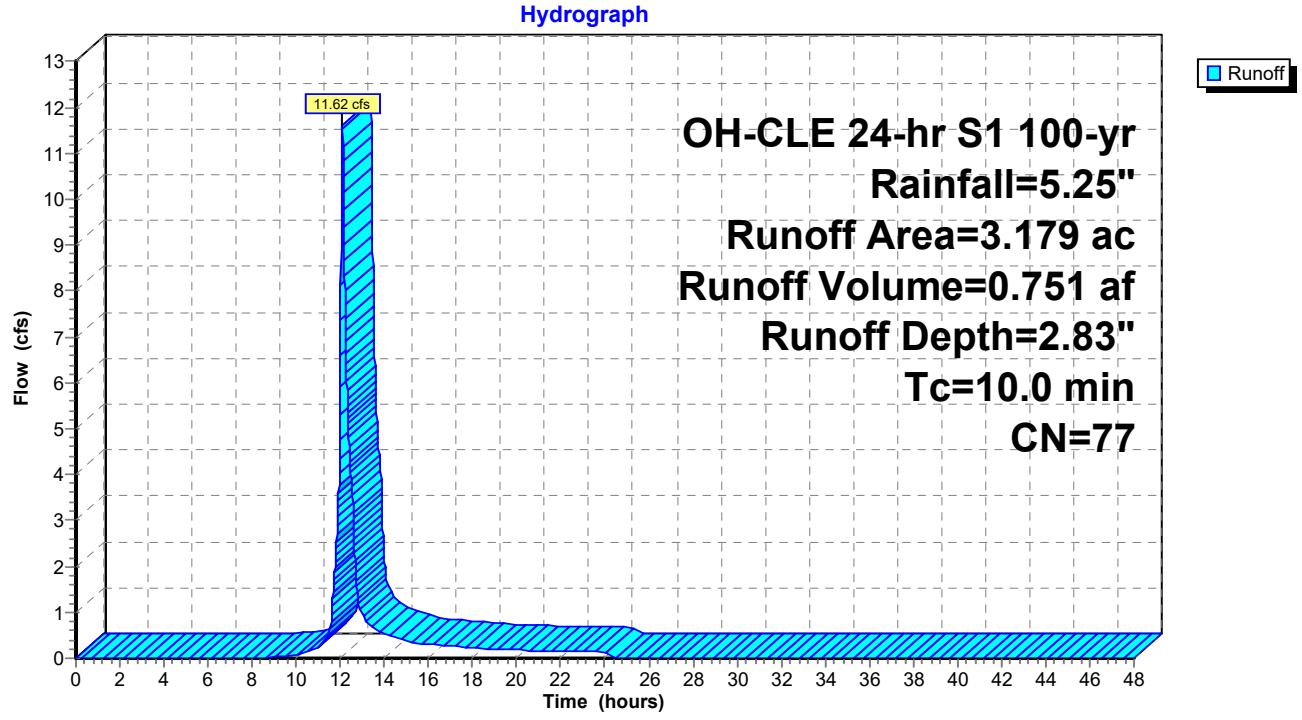
Runoff = 11.62 cfs @ 12.09 hrs, Volume= 0.751 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

## Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

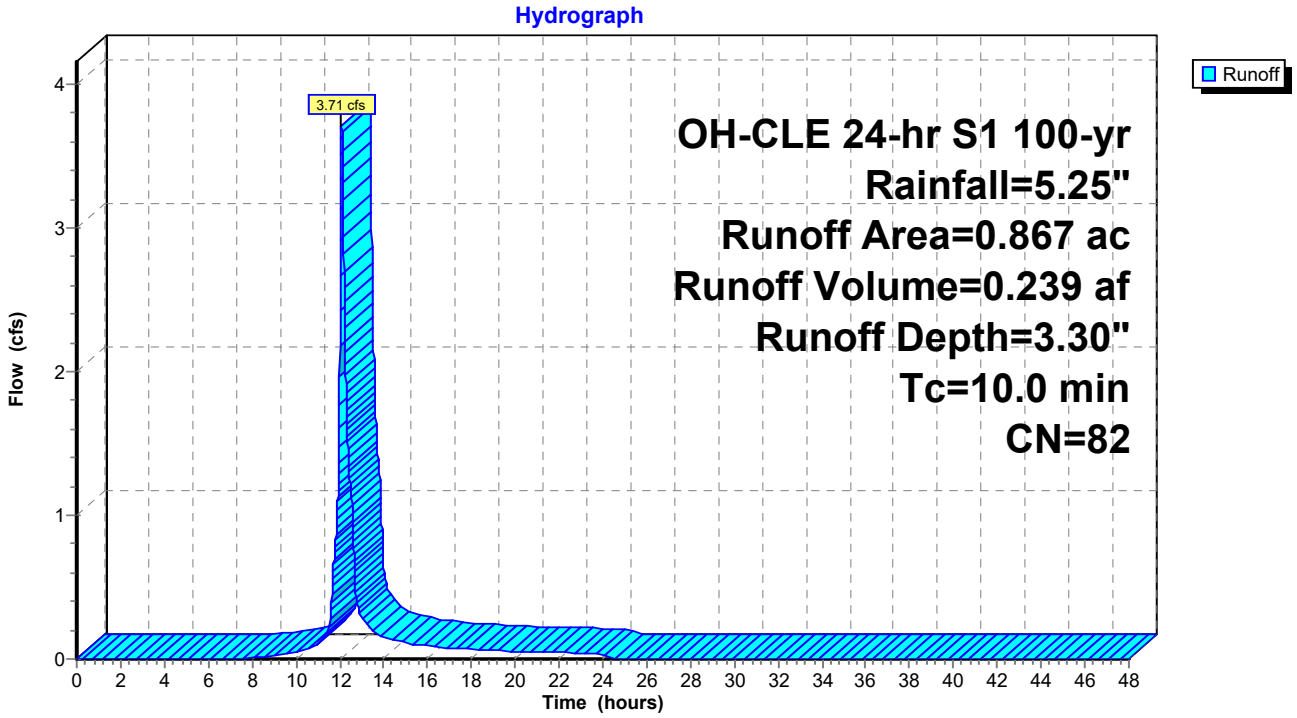
Runoff = 3.71 cfs @ 12.09 hrs, Volume= 0.239 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

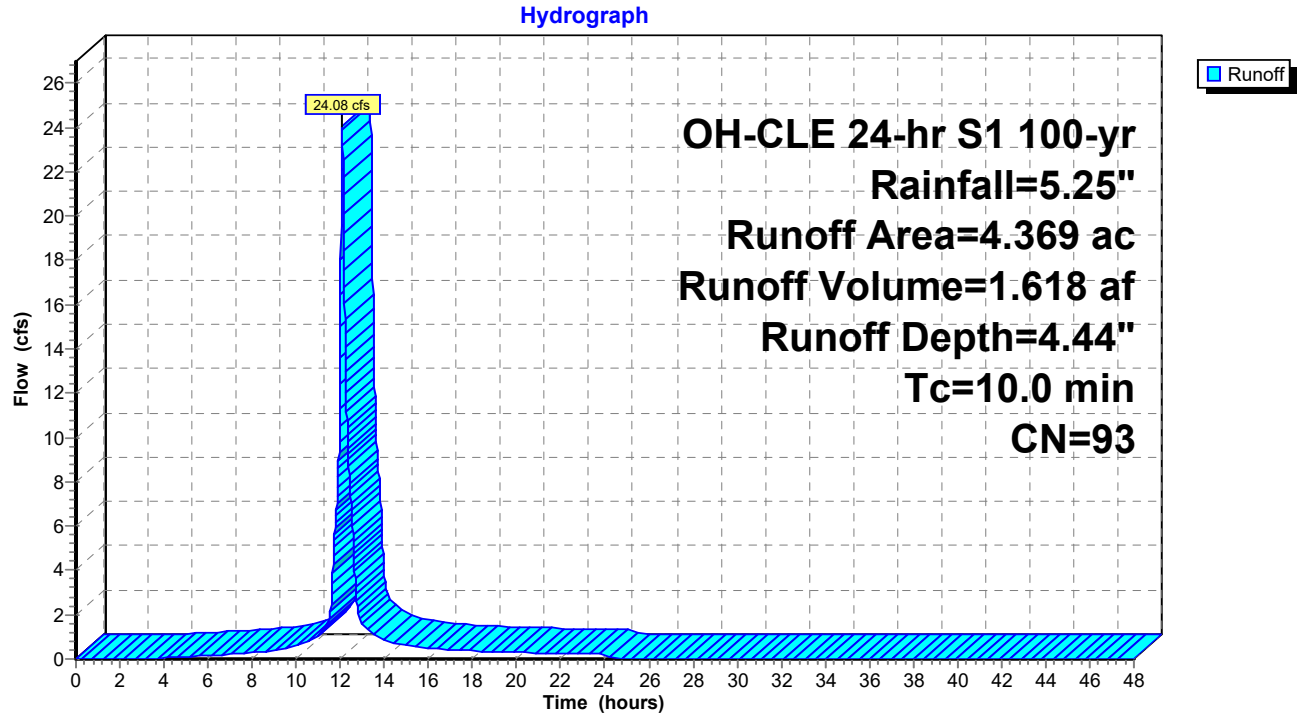
Runoff = 24.08 cfs @ 12.08 hrs, Volume= 1.618 af, Depth= 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

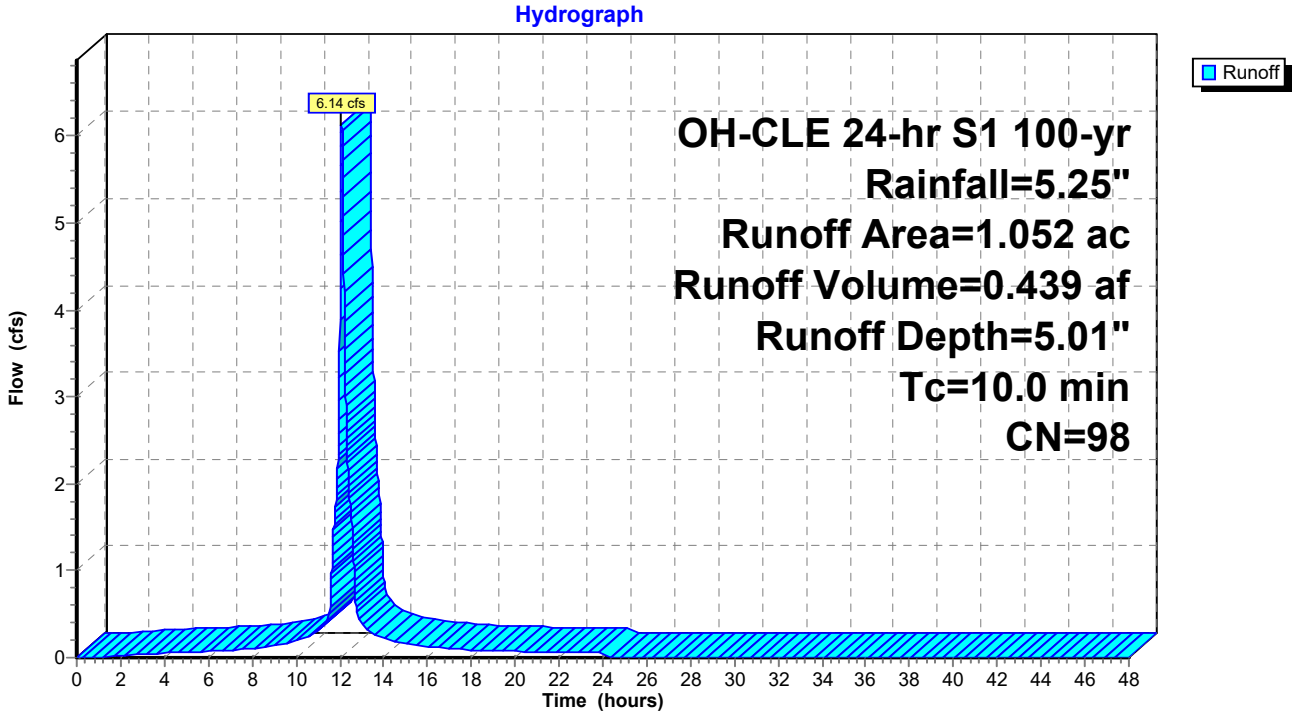
Runoff = 6.14 cfs @ 12.08 hrs, Volume= 0.439 af, Depth= 5.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

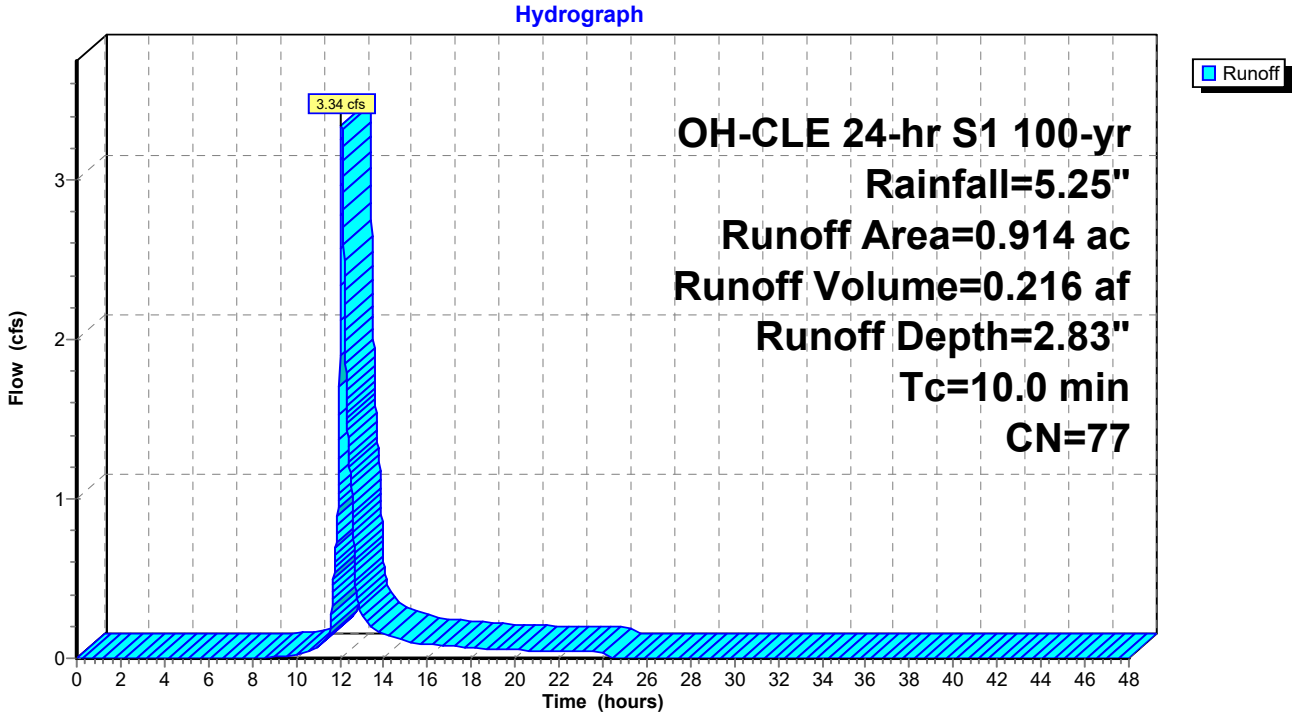
Runoff = 3.34 cfs @ 12.09 hrs, Volume= 0.216 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 100-yr Rainfall=5.25"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 632.03' (Flood elevation advised)

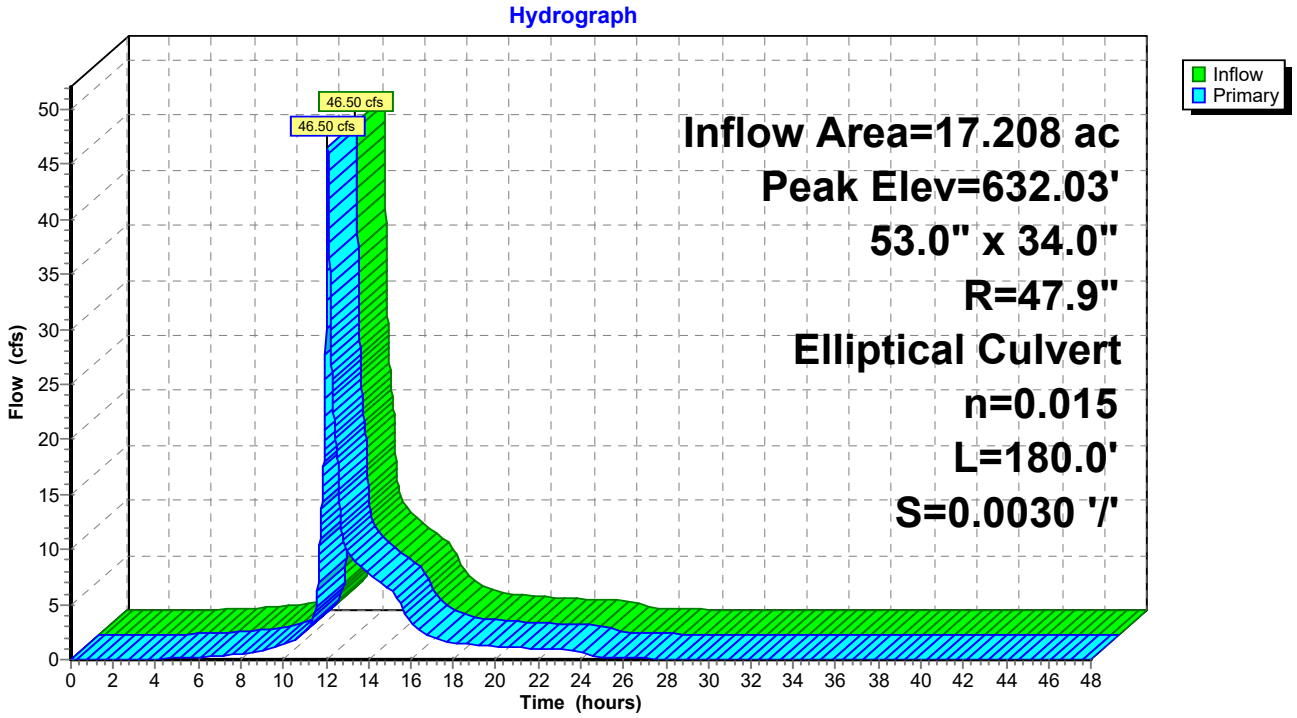
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth = 3.85" for 100-yr event
Inflow = 46.50 cfs @ 12.09 hrs, Volume= 5.525 af
Outflow = 46.50 cfs @ 12.09 hrs, Volume= 5.525 af, Atten= 0%, Lag= 0.0 min
Primary = 46.50 cfs @ 12.09 hrs, Volume= 5.525 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 632.03' @ 12.09 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=46.46 cfs @ 12.09 hrs HW=632.02' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 46.46 cfs @ 5.91 fps)

### Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

Inflow Area = 9.125 ac, 44.56% Impervious, Inflow Depth = 3.74" for 100-yr event
Inflow = 42.62 cfs @ 12.09 hrs, Volume= 2.843 af
Outflow = 7.17 cfs @ 12.66 hrs, Volume= 2.838 af, Atten= 83%, Lag= 34.3 min
Primary = 7.17 cfs @ 12.66 hrs, Volume= 2.838 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 637.99' @ 12.66 hrs Surf.Area= 0.437 ac Storage= 1.257 af

Plug-Flow detention time= 97.1 min calculated for 2.838 af (100% of inflow)
Center-of-Mass det. time= 95.9 min ( 887.2 - 791.3 )

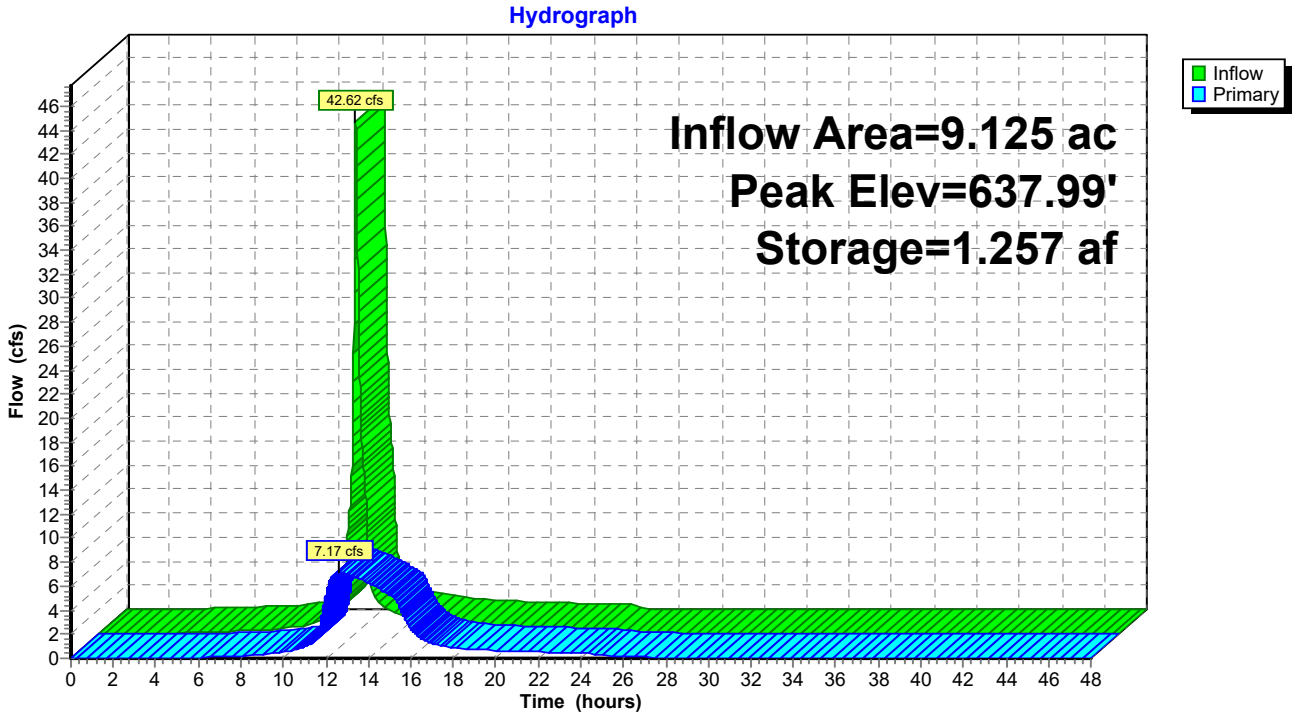
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=7.17 cfs @ 12.66 hrs HW=637.99' TW=630.63' (Dynamic Tailwater)
↑**1=FR-OUT** (Barrel Controls 7.17 cfs @ 5.84 fps)
↑**2=Orifice/Grate** (Passes < 10.43 cfs potential flow)
**3=Grate** (Passes < 25.40 cfs potential flow)

## Pond 22P: Detention 1



OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix J

## BMP Area Maps & Calculations

Michael Baker INTERNATIONAL

LEGEND

- TOTAL PROJECT EDA = 69.0 AC
- PROJECT EDA TO NEORSD = 55.0 AC
- PROJECT EDA TO STORM ONLY = 14.0 AC

HORIZONTAL SCALE IN FEET
0 100 200 400

# BMP DRAINAGE AREA MAP
# EARTH DISTURBED AREAS

CUY-90-16.28 (CCG3A)

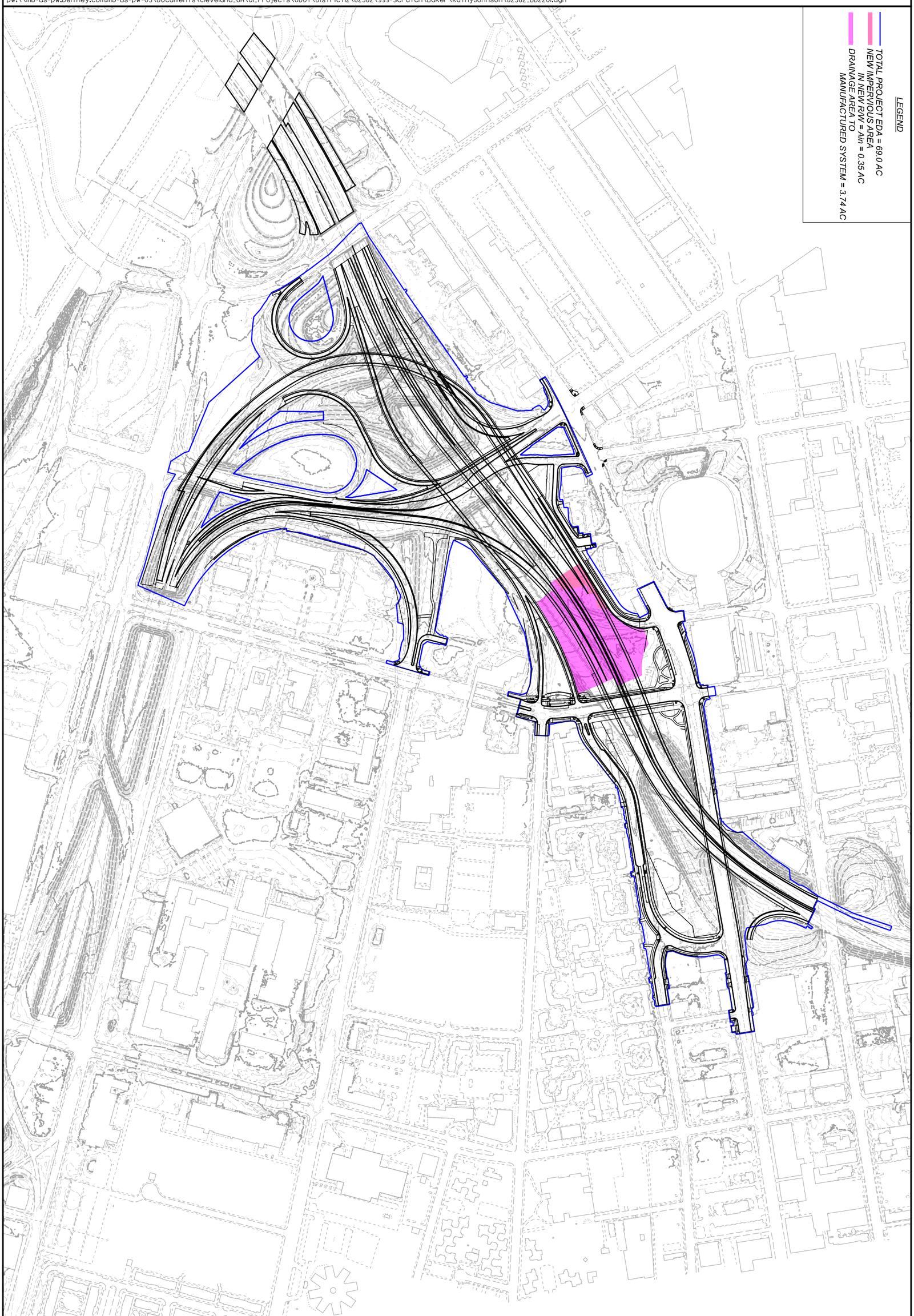
DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER KGJ
REVIEWER SM 8/14/23
PROJECT ID 0
SHEET P.0 TOTAL 0

MODEL: BMP EDA (Sheet) PAPERSIZE: 17x11(in.) DATE: 1/11/2024 TIME: 10:48:47 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\0001\District2\82382\999-Scratch\Baker\Kathy.Johnson\82382_BD220i.dgn

CTY-RTE-SECTION

MODEL: BMP T% (Sheet) PAPERSIZE: 17x11 (In.) DATE: 1/11/2024 TIME: 11:14:30 PM USER: Kathy.Johnson
pw:\\mb-us-pw.bentley.com:mb-us-pw-03\Documents\Cleveland_OH\01_Projects\ODOT\District2\82382\999-Scratch\Baker\KathyJohnson\82382_BD220I.dgn




BMP DRAINAGE AREA MAP
T% & TREATED AREA

HORIZONTAL SCALE IN FEET
0 200
100 400

| SHEET | TOTAL |
|---|---|
| P.0 | 0 |

PROJECT ID 0

REVIEWER SM 9/28/21

DESIGNER KGJ

Michael Baker INTERNATIONAL

DESIGN AGENCY

## PROJECT EDA

| | | | |
|---|---|---|---|
| TOTAL PROJECT EDA = | 69.0 | acres | Earth Disturbing Activity is any activity that exposes bare ground or an erodible material to storm water or anywhere Item 659 Seeding or Item 660 Sodding is being furnished |
| PROJECT EDA TO NEORSD | 55.0 | acres | Earth Disturbing Activity that drains to combined sewer and does not require coverage. |
| PROJECT EDA TO STORM ONLY | 14.0 | acres | Earth Disturbing Activity that drains to a storm only sewer. |

## POST-CONSTRUCTION BMP QUALITY VS QUANTITY

PROVIDE POST CONSTRUCTION BMP FOR ALL PROJECTS EXCEEDING 1 ACRE OF PROJECT EDA EXCEPT FOR ROUTINE MAINTENANCE PROJECTS AS DEFINED IN SECTION 1112.2 OF L&D VOL. 2

**POST-CONSTRUCTION BMP REQUIRED FOR WATER QUALITY => YES**

### IMPERVIOUS AREA

| | | | |
|---|---|---|---|
| Aix = | 13.65 | acres | Existing area in the right of way within the limits of the Project EDA |
| Ain = | 0.35 | acres | New impervious area in new permanent right of way within the limits of the Project EDA |

**POST-CONSTRUCTION BMP REQUIRED FOR WATER QUANTITY => NO**

**EXCLUDED FOR DISCHARGING TO LARGE RIVER? NO**

## REDEVELOPMENT VS NEW CONSTRUCTION

PROJECTS THAT DO NOT ADD NEW PAVEMENT OUTSIDE EXISTING RIGHT OF WAY ARE CONSIDERED REDEVELOPMENT

**REDEVELOPMENT OR NEW CONSTRUCTION => NEW CONSTRUCTION**

## TREATMENT PERCENT & REQUIREMENT

### TREATMENT PERCENT

$$T\% = \frac{(Aix * 20) + (Ain * 100)}{(Aix + Ain)}$$

$$T\% = \frac{308}{14}$$

**T% = 22.00**

### TREATMENT REQUIREMENT

TR = T% * EDA

**TR = 3.08 acres**

## MANUFACTURED SYSTEM CALCULATIONS

### WATER QUALITY FLOW (WQf) = CiA

**Time of Overland Flow**

| | | | | | |
|---|---|---|---|---|---|
| L = Distance = | 116 | ft | $t_o \approx \frac{1.8(1.1-C)L^{1/2}}{S^{1/3}}$ | $t_o$ = | 2.1 minutes |
| C = Runoff Coefficient = | 0.7 | | | | |
| S = Overland slope = | 50 | % | | | |

**Time of Shallow Concentrated Flow**

| | | | | | |
|---|---|---|---|---|---|
| k = Intercept Coefficient = | 0.619 | | $V = 3.3ks^{1/2}$ | | |
| s = Overland Slope = | 3.5 | % | | | |
| L = Flow Length = | 210 | ft | $t_s \text{ or } t_d = \frac{L}{60V}$ | $t_s$ = | 0.9 minutes |

**Time of Open Channel Flow**

| | | |
|---|---|---|
| N/A | $t_d$ = | 0 minutes |

**Time of Pipe Flow**

| | | |
|---|---|---|
| See Storm Sewer Calculations | $t_d$ = | 2 minutes |

Time of Concentration, $t_c$ = 5 minutes

Time of Concentration = less than the minimum 10 minutes, therefore use 10 minutes.

| | | |
|---|---|---|
| A = Drainage Area = | 3.74 | acres |
| C = Coefficient of Runoff = | 0.9 | all EX R/W and impervious |
| i = Rainfall Intensity = | 1.85 | in/hr (see Figure 1111-2) |

**WQf = 5.95 Use a Manufactured System Type 4**

**Table 1113-1**

| Manufactured Systems | | | |
|---|---|---|---|
| **Type** | **$WQ_F$ (cfs)** | **No. 3 Manhole Base ID (inches)** | **611-Type B Conduit Diameter (inches)** |
| 1 | 1 | 84 | 12 |
| 2 | 2 | 90 | 15 |
| 3 | 3 | 96 | 18 |
| 4 | 6 | 108 | 24 |

OHIO DEPARTMENT OF TRANSPORTATION

# CUY-90-16.28

**PID 82382 (Cleveland Innerbelt CCG3A)**

# Appendix K

## Maintenance of Traffic Calculations

Michael Baker INTERNATIONAL

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/01/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB LT 3012+10 EAST - PHASE 3 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 4.50 **Allowable Depth (ft.)** 0.00

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3012+10 | Begin | | | | | | | | | | | | | | | | | |
| 3015+65 | I-3C | 355.00 | 0.90 | 0.34 | 1.00 | 2.33 | 10.00 | 0.0144 | 0.0560 | 0.0560 | 6.00 | 0.0000 | 3.68 | 0.99 | 0.14 | 1.13 | 0.202 | 3.61 |
| 102+55 | I-3C | 280.00 | 0.90 | 0.42 | 1.00 | 1.70 | 10.00 | 0.0144 | 0.0560 | 0.0560 | 6.00 | 0.0000 | 3.68 | 1.25 | 0.28 | 1.53 | 0.227 | 4.05 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/01/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB LT 3012+10 EAST - PHASE 4 (WB CONTRAFLOW LANE) **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 4.00 **Allowable Depth (ft.)** 0.00

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3014+25 | Begin | existing | | | | | | | | | | | | | | | | |
| 3015+65 | I-3C | 140.00 | 0.90 | 0.07 | 1.00 | 1.34 | 10.00 | 0.0144 | 0.0560 | 0.0560 | 6.00 | 0.0000 | 3.68 | 0.23 | 0.00 | 0.23 | 0.112 | 2.00 |
| 102+55 | I-3C | 280.00 | 0.90 | 0.42 | 1.00 | 1.72 | 10.00 | 0.0144 | 0.0560 | 0.0560 | 6.00 | 0.0000 | 3.68 | 1.16 | 0.23 | 1.39 | 0.219 | 3.91 |
| 105+50 | CB-3A | 295.00 | 0.90 | 0.39 | 1.00 | 2.36 | 10.00 | 0.0072 | 0.0560 | 0.0560 | 6.00 | 0.0000 | 3.68 | 1.22 | 0.30 | 1.52 | 0.258 | 4.60 |

temporary CB to replace existing inlet within crossover

wider inside shoulder, 10' dry lane checks out

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/01/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB RT 173+50 to 177+25 - PHASE 4 **Designer :** KGJ

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 6.50 **Allowable Depth (ft.)** 0.00

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 173+50 | Begin | | | | | | | | | | | | | | | | | | |
| 176+00 | I-3D | 250.00 | 0.90 | 0.34 | 1.00 | 2.67 | 10.00 | 0.0050 | 0.0400 | 0.0200 | 8.00 | 0.0000 | 3.68 | 1.03 | 0.09 | 1.13 | 0.217 | 5.43 | |
| 176+25 | I-3D | 25.00 | 0.90 | 0.03 | 1.00 | 0.51 | 10.00 | 0.0030 | 0.0400 | 0.0200 | 8.00 | 0.0000 | 3.68 | ****** | ****** | 0.19 | 0.124 | 3.09 | Sag |
| 177+25 | Begin | | | | | | | | | | | | | | | | | | |
| 176+60 | I-3D | 65.00 | 0.90 | 0.08 | 1.00 | 0.97 | 10.00 | 0.0050 | 0.0400 | 0.0200 | 8.00 | 0.0000 | 3.68 | 0.27 | 0.00 | 0.27 | 0.126 | 3.16 | |
| 176+25 | I-3D | 35.00 | 0.90 | 0.04 | 1.00 | 0.87 | 10.00 | 0.0020 | 0.0400 | 0.0200 | 8.00 | 0.0000 | 3.68 | ****** | ****** | 0.13 | 0.116 | 2.89 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.33 **Ponded Depth (ft.) :** 0.048 **Spread on Pavement (ft.) :** 1.20

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/20/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 WB LT - RAMP A1 STA 432+20 TO STA 4012+87 - PHASE 5 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 432+20 | Begin | | | | | | | | | | | | | | | | | | |
| 435+75 | I-3C | 355.00 | 0.90 | 0.12 | 1.00 | 2.46 | 10.00 | 0.0329 | 0.0368 | 0.0368 | 12.00 | 0.1700 | 3.68 | 0.40 | 0.00 | 0.40 | 0.101 | 2.74 | |
| 201+00 | CB-3 | 595.00 | 0.76 | 0.67 | 1.00 | 2.70 | 10.00 | 0.0350 | 0.0400 | 0.0265 | 12.00 | 0.0417 | 3.68 | 1.54 | 0.33 | 1.87 | 0.182 | 4.56 | |
| 4004+00 | CB-3 | 414.00 | 0.81 | 0.74 | 1.00 | 2.42 | 10.00 | 0.0125 | 0.0510 | 0.0510 | 12.00 | 0.0417 | 3.68 | 2.09 | 0.45 | 2.54 | 0.272 | 5.33 | |
| 4005+97 | I-3C | 197.00 | 0.84 | 0.41 | 1.00 | 1.62 | 10.00 | 0.0065 | 0.0510 | 0.0510 | 10.10 | 0.1700 | 3.68 | 1.72 | 0.00 | 1.72 | 0.265 | 5.20 | |
| 4006+58 | I-3C | 61.00 | 0.90 | 0.09 | 1.00 | 1.19 | 10.00 | 0.0020 | 0.0510 | 0.0510 | 10.00 | 0.1700 | 3.68 | ****** | ****** | 0.28 | 0.169 | 3.31 | Sag |
| 4012+87 | Begin | | | | | | | | | | | | | | | | | | |
| 4009+00 | CB-3A | 387.00 | 0.80 | 1.05 | 1.00 | 1.61 | 10.00 | 0.0254 | 0.0510 | 0.0510 | 6.00 | 0.0417 | 3.68 | 2.15 | 0.94 | 3.09 | 0.256 | 5.03 | |
| 4007+25 | I-3C | 175.00 | 0.83 | 0.11 | 1.00 | 1.58 | 10.00 | 0.0070 | 0.0510 | 0.0510 | 10.80 | 0.1700 | 3.68 | 1.28 | 0.00 | 1.28 | 0.235 | 4.60 | |
| 4006+58 | I-3C | 67.00 | 0.90 | 0.06 | 1.00 | 1.44 | 10.00 | 0.0020 | 0.0510 | 0.0510 | 10.00 | 0.1700 | 3.68 | ****** | ****** | 0.19 | 0.146 | 2.86 | End |

new inlets added to permanent design

**SUMP DATA**

**Total Flow (cfs) :** 0.48 **Ponded Depth (ft.) :** 0.062 **Spread on Pavement (ft.) :** 0.91

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 12/04/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** RAMP IB5 RT STA 1703+17 TO 1707+08 - PHASE 7 **Designer :** KGJ

minimum at pinch point

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 5.40 **Allowable Depth (ft.)** 0.50

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1703+17 | Begin | | | | | | | | | | | | | | | | | | |
| 1705+85 | I-3D | 268.00 | 0.90 | 0.44 | 1.00 | 2.13 | 10.00 | 0.0090 | 0.0400 | 0.0200 | 8.00 | 0.1700 | 3.68 | 1.45 | 0.00 | 1.46 | 0.214 | 5.36 | |
| 1706+05 | I-3D | 20.00 | 0.90 | 0.02 | 1.00 | 0.33 | 10.00 | 0.0090 | 0.0400 | 0.0200 | 8.00 | 0.1700 | 3.68 | ****** | ****** | 0.07 | 0.068 | 1.71 | Sag |
| 1707+08 | Begin | | | | | | | | | | | | | | | | | | |
| 1706+38 | I-3D | 70.00 | 0.90 | 0.09 | 1.00 | 0.90 | 10.00 | 0.0068 | 0.0400 | 0.0200 | 8.00 | 0.1700 | 3.68 | 0.30 | 0.00 | 0.30 | 0.125 | 3.12 | |
| 1706+05 | I-3D | 33.00 | 0.90 | 0.04 | 1.00 | 0.51 | 10.00 | 0.0068 | 0.0400 | 0.0200 | 8.00 | 0.1700 | 3.68 | ****** | ****** | 0.13 | 0.092 | 2.30 | End |

**SUMP DATA**

**Total Flow (cfs) :** 0.20 **Ponded Depth (ft.) :** 0.035 **Spread on Pavement (ft.) :** 0.57

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/20/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90WB LEFT STA 179+90 TO 190+47 - PHASE 7 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.42

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 179+90 | Begin | | | | | | | | | | | | | | | | | |
| 187+08 | I-3D | 718.00 | 0.90 | 0.86 | 1.00 | 6.22 | 10.00 | 0.0050 | 0.0448 | 0.0448 | 12.00 | 0.1700 | 3.68 | 2.57 | 0.29 | 2.86 | 0.322 | 7.18 |
| 190+47 | CB-3A | 339.00 | 0.90 | 0.41 | 1.00 | 1.82 | 10.00 | 0.0240 | 0.0400 | 0.0160 | 12.00 | 0.0420 | 3.68 | 1.23 | 0.43 | 1.66 | 0.187 | 4.68 |

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 05/09/2022 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OHIO

**Description :** I-90 EB LT - STA 173+12 TO 178+97 - PHASE 8 **Designer :** JAR

**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 173+12 | Begin | | | | | | | | | | | | | | | | | | |
| 176+10 | I-3D | 298.00 | 0.90 | 0.08 | 1.00 | 6.84 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 3.68 | 0.27 | 0.00 | 0.27 | 0.150 | 3.75 | |
| 176+85 | I-3D | 75.00 | 0.90 | 0.05 | 1.00 | 1.79 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 3.68 | ****** | ****** | 0.17 | 0.126 | 3.14 | Sag |
| 178+97 | Begin | | | | | | | | | | | | | | | | | | |
| 177+70 | I-3D | 127.00 | 0.90 | 0.09 | 1.00 | 2.66 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 3.68 | 0.30 | 0.00 | 0.30 | 0.157 | 3.92 | |
| 176+85 | I-3D | 85.00 | 0.90 | 0.06 | 1.00 | 1.95 | 10.00 | 0.0020 | 0.0400 | 0.0036 | 12.00 | 0.1700 | 3.68 | ****** | ****** | 0.20 | 0.135 | 3.37 | End |

new inlets added to permanent design

**SUMP DATA**

**Total Flow (cfs) :** 0.36 **Ponded Depth (ft.) :** 0.052 **Spread on Pavement (ft.) :** 0.96

# INLET SPACING DESIGN

**PID :** 82382 **Date :** 11/25/2023 **Project :** CUY-90-16.28 **Location :** CLEVELAND, OH

**Description :** I-90 EB LT - STA 178+97 TO 3013+42 - Phase 8 **Designer :** KGJ

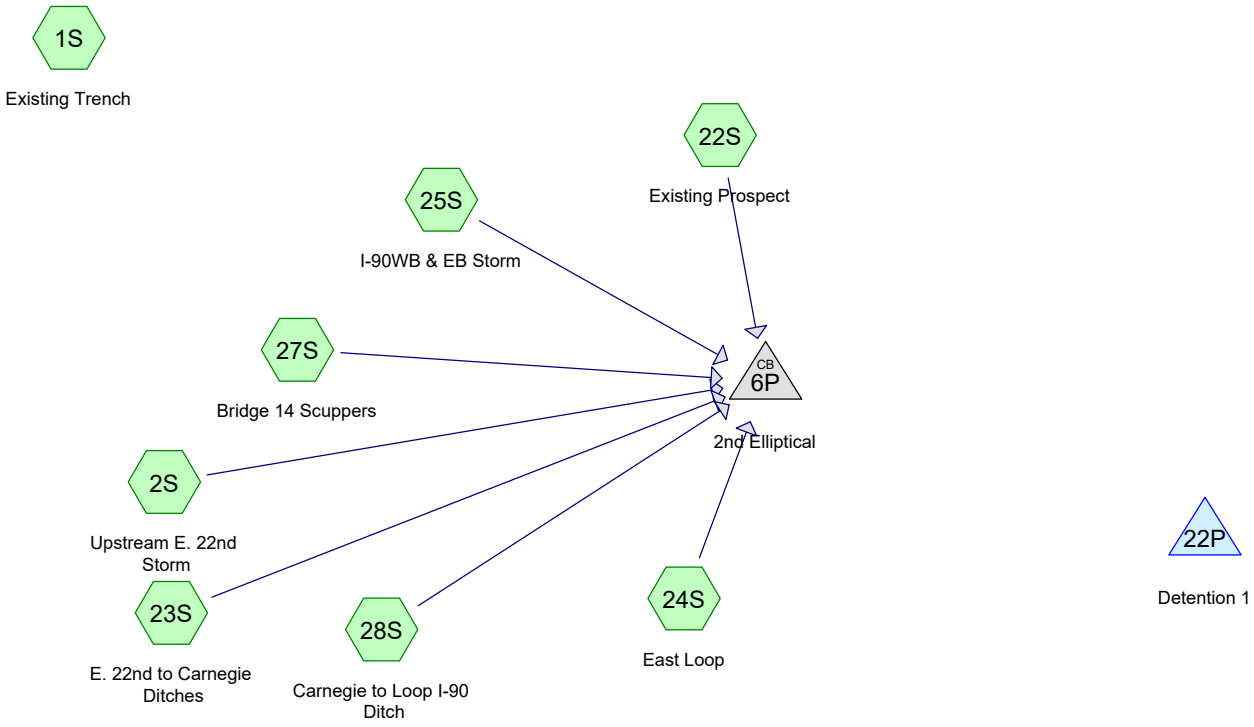
**Rainfall Area:** A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 5.00 **Allowable Depth (ft.)** 0.50

| STATION | C.B. Type | GUTTER LENGTH (ft.) | RUNOFF COEF | RUNOFF AREA (acres) | CONC. TIME (min.) | GUTTER TIME (min.) | TIME USED (min.) | LONG. SLOPE (ft./ft.) | GUTT. SLOPE (ft./ft.) | PAVT. SLOPE (ft./ft.) | GUTT. WIDTH (ft.) | LOCAL DEPRESS. (ft.) | RAIN FALL (in./hrs.) | INTERCPTD FLOW (cfs.) | BYPASS FLOW (cfs.) | TOTAL FLOW (cfs.) | DEPTH FLOW (ft.) | PAVT. SPREAD (ft.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 178+97 | Begin | | | | | | | | | | | | | | | | | | |
| 182+00 | I-3D | 303.00 | 0.90 | 0.24 | 1.00 | 2.32 | 10.00 | 0.0135 | 0.0470 | 0.0470 | 12.00 | 0.1700 | 3.68 | 0.80 | 0.00 | 0.80 | 0.169 | 3.59 | |
| 184+00 | I-3D | 200.00 | 0.90 | 0.22 | 1.00 | 1.54 | 10.00 | 0.0135 | 0.0470 | 0.0470 | 12.00 | 0.1700 | 3.68 | 0.73 | 0.00 | 0.73 | 0.163 | 3.46 | |
| 185+47 | I-3D | 147.00 | 0.90 | 0.16 | 1.00 | 1.14 | 10.00 | 0.0180 | 0.0400 | 0.0338 | 12.00 | 0.1700 | 3.68 | 0.53 | 0.00 | 0.53 | 0.129 | 3.23 | |
| 189+25 | I-3D | 378.00 | 0.90 | 0.38 | 1.00 | 1.86 | 10.00 | 0.0350 | 0.0400 | 0.0160 | 12.00 | 0.1700 | 3.68 | 1.13 | 0.13 | 1.26 | 0.157 | 3.94 | |
| 193+53 | I-3B | 428.00 | 0.90 | 0.23 | 1.00 | 2.36 | 10.00 | 0.0350 | 0.0400 | 0.0488 | 9.50 | 0.1700 | 3.68 | 0.88 | 0.00 | 0.88 | 0.138 | 3.44 | |
| 199+18 | I-3B | 565.00 | 0.90 | 0.21 | 1.00 | 4.07 | 10.00 | 0.0212 | 0.0400 | 0.0400 | 12.00 | 0.1700 | 3.68 | 0.68 | 0.00 | 0.68 | 0.137 | 3.43 | |
| 3005+97 | I-3C | 594.00 | 0.90 | 0.62 | 1.00 | 3.78 | 10.00 | 0.0118 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 3.68 | 1.89 | 0.15 | 2.04 | 0.255 | 4.90 | |
| 3006+29 | I-3C | 32.00 | 0.90 | 0.04 | 1.00 | 0.34 | 10.00 | 0.0114 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 3.68 | 0.27 | 0.00 | 0.27 | 0.120 | 2.31 | |
| 3007+42 | I-3C | 113.00 | 0.90 | 0.13 | 1.00 | 2.01 | 10.00 | 0.0020 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 3.68 | ****** | ****** | 0.43 | 0.198 | 3.81 | Sag |
| 3013+42 | Begin | | | | | | | | | | | | | | | | | | |
| 3012+88 | I-3C | 54.00 | 0.90 | 0.06 | 1.00 | 0.77 | 10.00 | 0.0064 | 0.0469 | 0.0469 | 6.50 | 0.1700 | 3.68 | 0.18 | 0.00 | 0.18 | 0.111 | 2.37 | |
| 3008+05 | I-3C | 483.00 | 0.90 | 0.34 | 1.00 | 4.55 | 10.00 | 0.0063 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 3.68 | 1.13 | 0.00 | 1.13 | 0.230 | 4.43 | |
| 3007+42 | I-3C | 63.00 | 0.90 | 0.07 | 1.00 | 1.30 | 10.00 | 0.0020 | 0.0520 | 0.0520 | 11.00 | 0.1700 | 3.68 | ****** | ****** | 0.22 | 0.155 | 2.98 | End |

new inlets added to permanent design

**SUMP DATA**

**Total Flow (cfs) :** 0.65 **Ponded Depth (ft.) :** 0.076 **Spread on Pavement (ft.) :** 1.13




Subcat Reach Pond Link

**Routing Diagram for DetentionBasinTrench-MOT**
Prepared by Michael Baker, Printed 1/7/2024
HydroCAD® 10.10-5a s/n 12204 © 2020 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 0.357 | 98 | Between E 22nd & Cedar (1S) |
| 1.052 | 98 | Bridge 14 Deck (27S) |
| 1.665 | 98 | E of Cedar (1S) |
| 1.214 | 79 | E of Cedar (1S) |
| 0.967 | 74 | E of Cedar (1S) |
| 0.603 | 74 | Flat Slopes (22S) |
| 0.574 | 74 | Loop Interior (24S) |
| 0.293 | 98 | Loop Pavement (24S) |
| 1.857 | 98 | N of Carnegie (1S) |
| 1.071 | 79 | N of Carnegie (1S) |
| 1.842 | 74 | N of Carnegie (1S) |
| 0.270 | 98 | Paved Shoulder (23S) |
| 2.650 | 98 | Pavement (2S) |
| 0.094 | 98 | Pavement - I-90EB Shoulder (28S) |
| 0.496 | 98 | Pavement - I90 & East Loop (22S) |
| 3.347 | 98 | Pavement I90 EB & WB (25S) |
| 0.525 | 98 | Prospect to I-90WB Loop (1S) |
| 0.212 | 79 | Prospect to I-90WB Loop (1S) |
| 0.758 | 74 | Prospect to I-90WB Loop (1S) |
| 3.274 | 74 | Slopes Flatter than 4:1 (23S, 28S) |
| 1.730 | 79 | Slopes Steeper than 4:1 (2S, 23S) |
| 1.077 | 78 | Slopes Steeper than 4:1 (25S, 28S) |
| 0.252 | 79 | Steep Slopes (22S) |
| 1.123 | 98 | W of E 22nd (1S) |
| 0.411 | 79 | W of E 22nd (1S) |
| 0.384 | 74 | W of E 22nd (1S) |
| 1.496 | 84 | West Loop Ramp - Mixed Use (22S) |
| **29.594** | **87** | **TOTAL AREA** |

## Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Width (inches) | Diam/Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6P | 629.28 | 628.74 | 180.0 | 0.0030 | 0.015 | 53.0 | 34.0 | 0.0 |
| 2 | 22P | 633.25 | 632.03 | 247.5 | 0.0049 | 0.015 | 0.0 | 15.0 | 0.0 |

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Existing Trench** Runoff Area=12.386 ac 44.62% Impervious Runoff Depth=1.12"
Tc=10.0 min CN=86 Runoff=20.21 cfs 1.158 af

**Subcatchment2S: Upstream E. 22nd Storm** Runoff Area=3.980 ac 66.58% Impervious Runoff Depth=1.55"
Tc=10.0 min CN=92 Runoff=9.13 cfs 0.516 af

**Subcatchment22S: Existing Prospect** Runoff Area=2.847 ac 17.42% Impervious Runoff Depth=1.00"
Tc=10.0 min CN=84 Runoff=4.08 cfs 0.237 af

**Subcatchment23S: E. 22nd to Carnegie** Runoff Area=3.179 ac 8.49% Impervious Runoff Depth=0.65"
Tc=10.0 min CN=77 Runoff=2.64 cfs 0.172 af

**Subcatchment24S: East Loop** Runoff Area=0.867 ac 33.79% Impervious Runoff Depth=0.89"
Tc=10.0 min CN=82 Runoff=1.08 cfs 0.064 af

**Subcatchment25S: I-90WB & EB Storm** Runoff Area=4.369 ac 76.61% Impervious Runoff Depth=1.64"
Tc=10.0 min CN=93 Runoff=10.53 cfs 0.597 af

**Subcatchment27S: Bridge 14 Scuppers** Runoff Area=1.052 ac 100.00% Impervious Runoff Depth=2.12"
Tc=10.0 min CN=98 Runoff=3.07 cfs 0.186 af

**Subcatchment28S: Carnegie to Loop I-90** Runoff Area=0.914 ac 10.28% Impervious Runoff Depth=0.65"
Tc=10.0 min CN=77 Runoff=0.76 cfs 0.049 af

**Pond 6P: 2nd Elliptical** Peak Elev=631.41' Inflow=31.21 cfs 1.821 af
53.0" x 34.0", R=47.9" Elliptical Culvert n=0.015 L=180.0' S=0.0030 '/' Outflow=31.21 cfs 1.821 af

**Pond 22P: Detention 1** Peak Elev=0.00' Storage=0.000 af
Primary=0.00 cfs 0.000 af

**Total Runoff Area = 29.594 ac Runoff Volume = 2.979 af Average Runoff Depth = 1.21"**
**53.61% Pervious = 15.865 ac 46.39% Impervious = 13.729 ac**

## Summary for Subcatchment 1S: Existing Trench

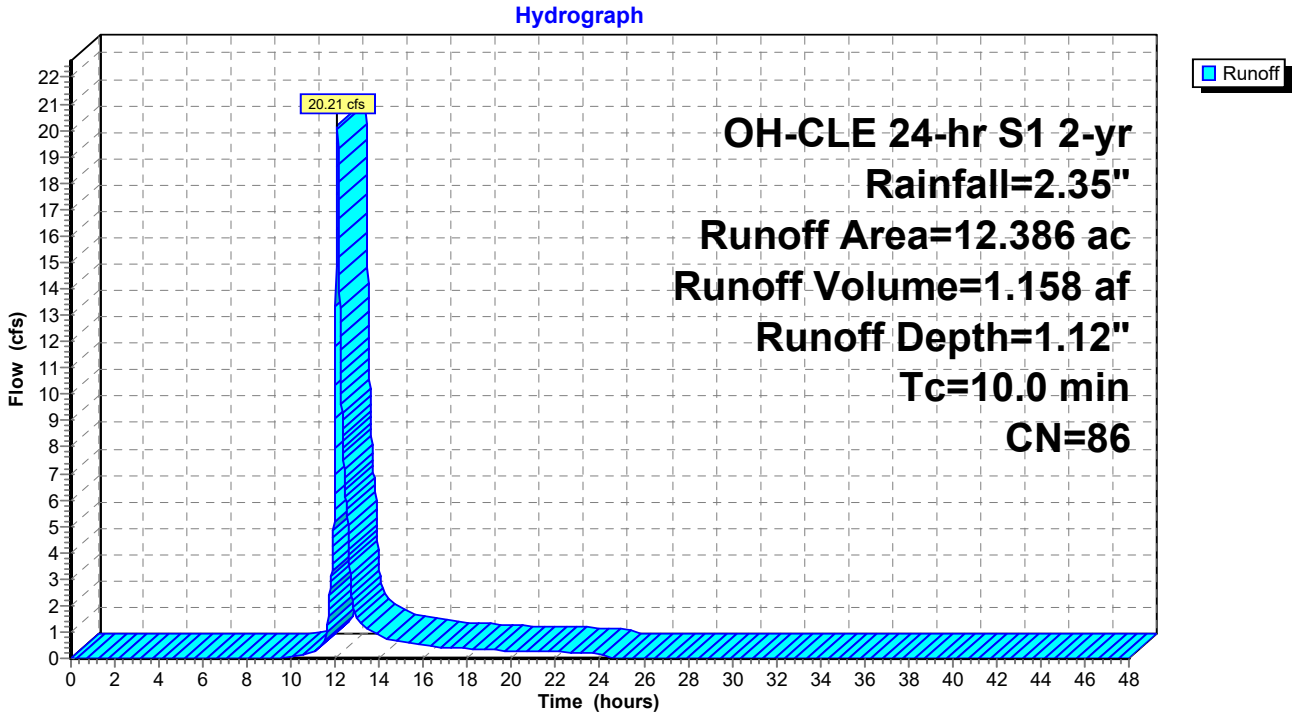
Runoff = 20.21 cfs @ 12.09 hrs, Volume= 1.158 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.123 | 98 | W of E 22nd |
| * | 0.411 | 79 | W of E 22nd |
| * | 0.384 | 74 | W of E 22nd |
| * | 0.357 | 98 | Between E 22nd & Cedar |
| * | 1.665 | 98 | E of Cedar |
| * | 1.214 | 79 | E of Cedar |
| * | 0.967 | 74 | E of Cedar |
| * | 1.857 | 98 | N of Carnegie |
| * | 1.071 | 79 | N of Carnegie |
| * | 1.842 | 74 | N of Carnegie |
| * | 0.525 | 98 | Prospect to I-90WB Loop |
| * | 0.212 | 79 | Prospect to I-90WB Loop |
| * | 0.758 | 74 | Prospect to I-90WB Loop |
| | 12.386 | 86 | Weighted Average |
| | 6.859 | | 55.38% Pervious Area |
| | 5.527 | | 44.62% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 1S: Existing Trench



## Summary for Subcatchment 2S: Upstream E. 22nd Storm

SC_Scratch7 in BD1300

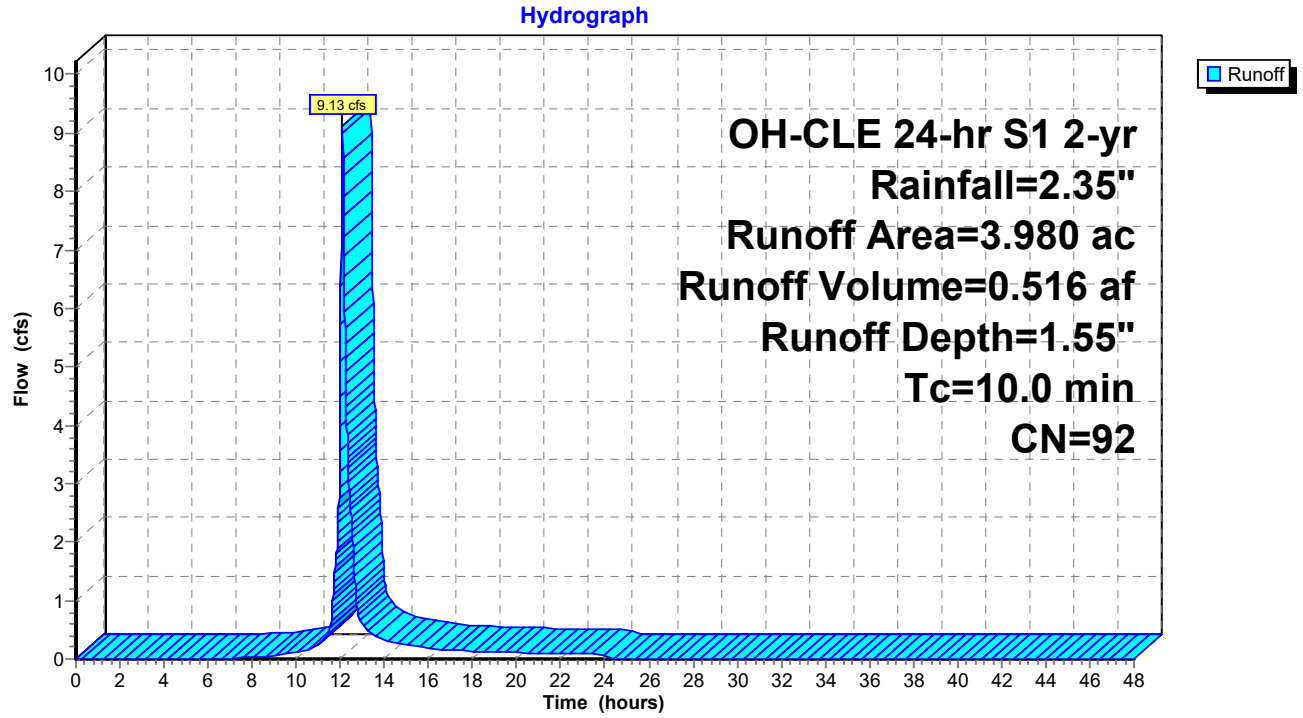
Runoff = 9.13 cfs @ 12.09 hrs, Volume= 0.516 af, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.650 | 98 | Pavement |
| * | 1.330 | 79 | Slopes Steeper than 4:1 |
| | 3.980 | 92 | Weighted Average |
| | 1.330 | | 33.42% Pervious Area |
| | 2.650 | | 66.58% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 2S: Upstream E. 22nd Storm



## Summary for Subcatchment 22S: Existing Prospect

SC_Scratch17 in BD1300

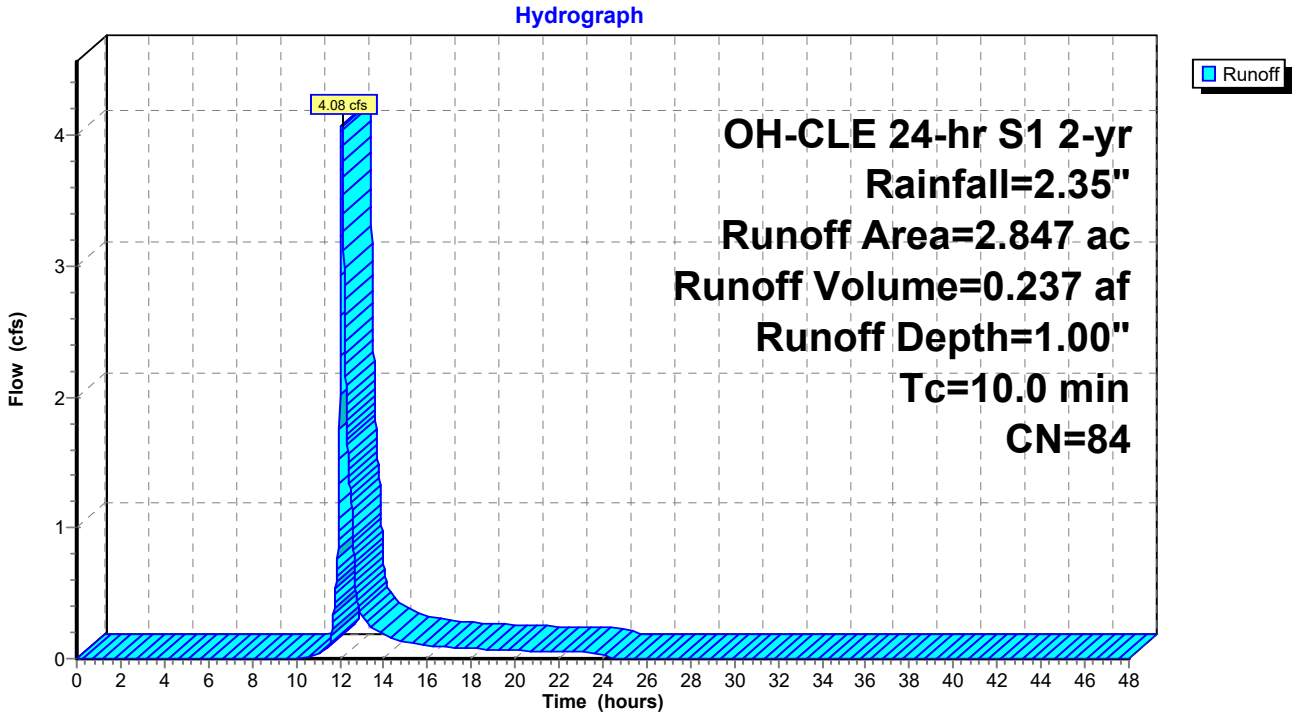
Runoff = 4.08 cfs @ 12.09 hrs, Volume= 0.237 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.603 | 74 | Flat Slopes |
| * | 0.252 | 79 | Steep Slopes |
| * | 0.496 | 98 | Pavement - I90 & East Loop |
| * | 1.496 | 84 | West Loop Ramp - Mixed Use |
| | 2.847 | 84 | Weighted Average |
| | 2.351 | | 82.58% Pervious Area |
| | 0.496 | | 17.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 22S: Existing Prospect



## Summary for Subcatchment 23S: E. 22nd to Carnegie Ditches

SC_Scratch6 in BD1300

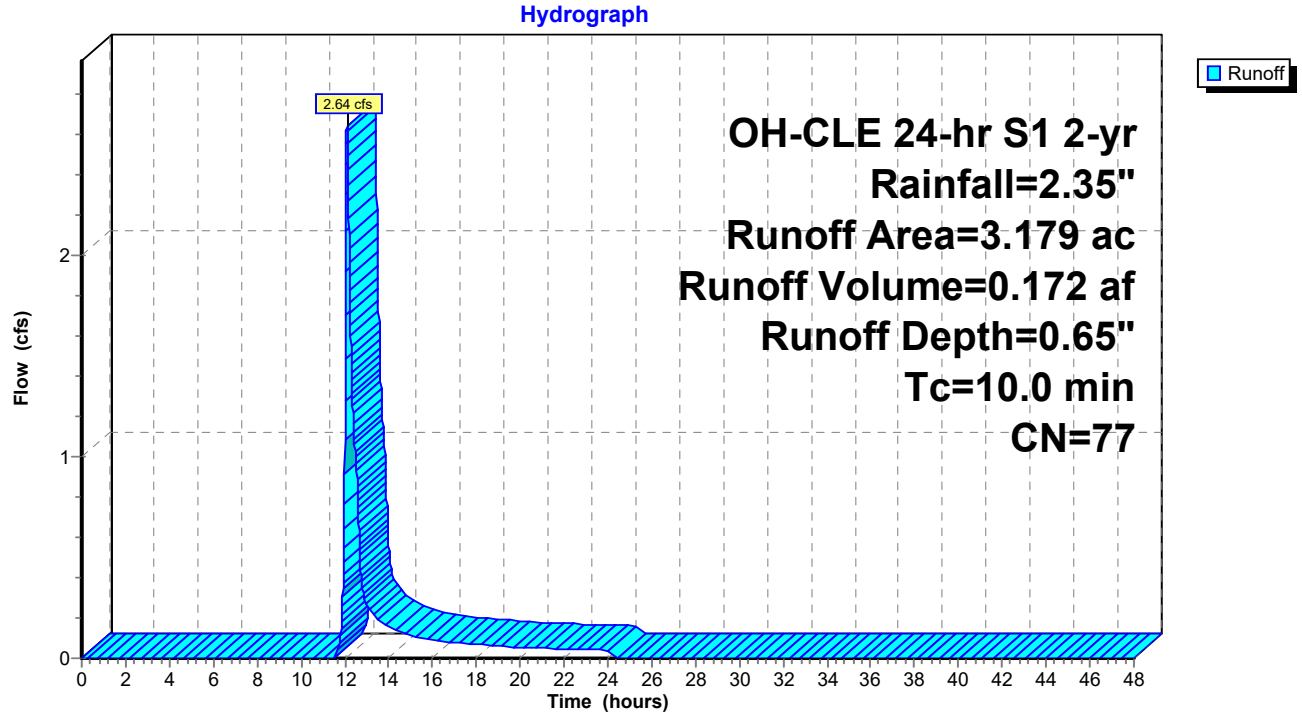
Runoff = 2.64 cfs @ 12.10 hrs, Volume= 0.172 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.270 | 98 | Paved Shoulder |
| * | 0.400 | 79 | Slopes Steeper than 4:1 |
| * | 2.509 | 74 | Slopes Flatter than 4:1 |
| | 3.179 | 77 | Weighted Average |
| | 2.909 | | 91.51% Pervious Area |
| | 0.270 | | 8.49% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum** |

## Subcatchment 23S: E. 22nd to Carnegie Ditches



## Summary for Subcatchment 24S: East Loop

SC_Scratch16 in BD1300

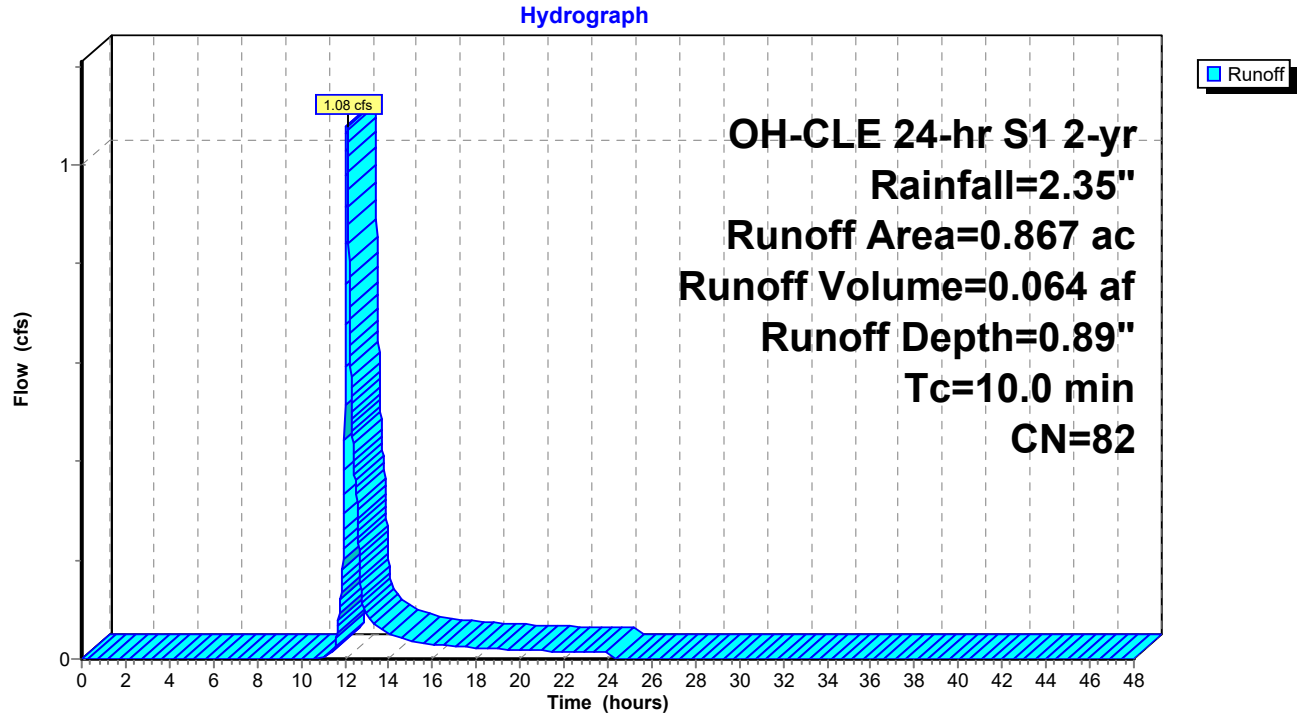
Runoff = 1.08 cfs @ 12.10 hrs, Volume= 0.064 af, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.574 | 74 | Loop Interior |
| * | 0.293 | 98 | Loop Pavement |
| | 0.867 | 82 | Weighted Average |
| | 0.574 | | 66.21% Pervious Area |
| | 0.293 | | 33.79% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry, Minimum Ditch** |

### Subcatchment 24S: East Loop



## Summary for Subcatchment 25S: I-90WB & EB Storm

SC_Scratch8 in BD1300

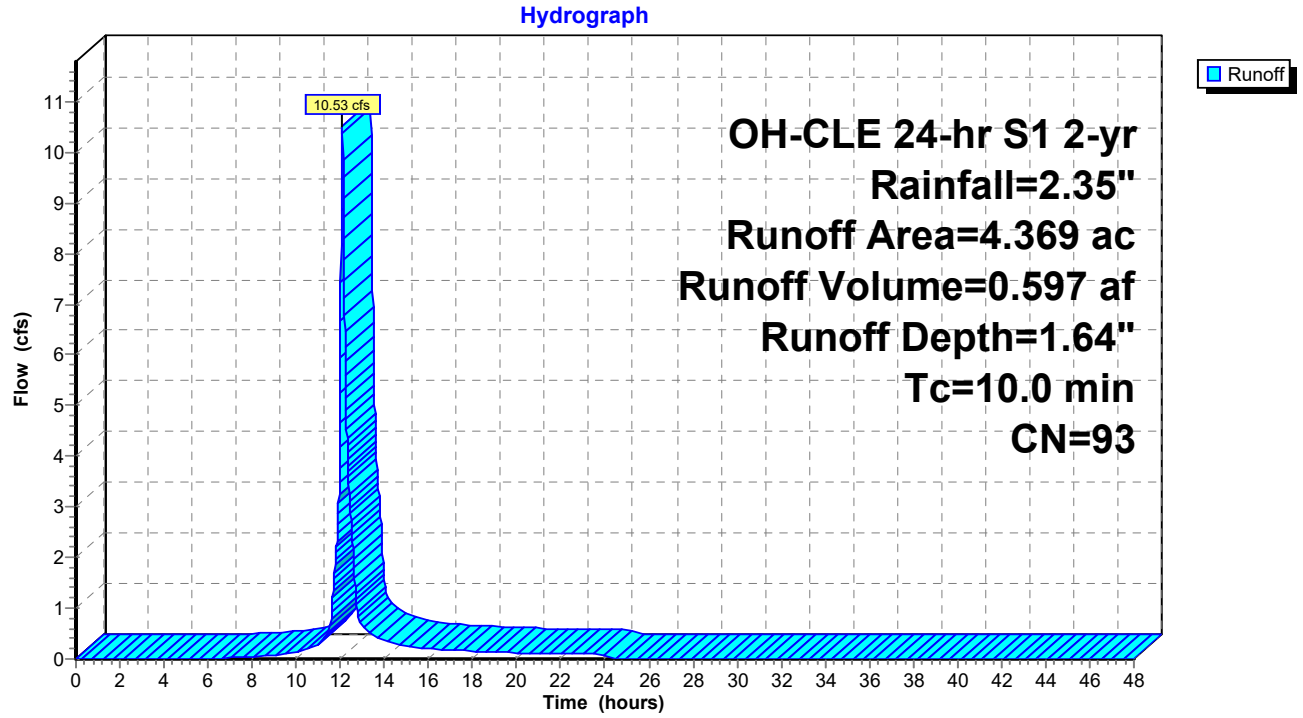
Runoff = 10.53 cfs @ 12.09 hrs, Volume= 0.597 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.347 | 98 | Pavement I90 EB & WB |
| * | 1.022 | 78 | Slopes Steeper than 4:1 |
| | 4.369 | 93 | Weighted Average |
| | 1.022 | | 23.39% Pervious Area |
| | 3.347 | | 76.61% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 25S: I-90WB & EB Storm



## Summary for Subcatchment 27S: Bridge 14 Scuppers

SC_Scratch9 in BD1300

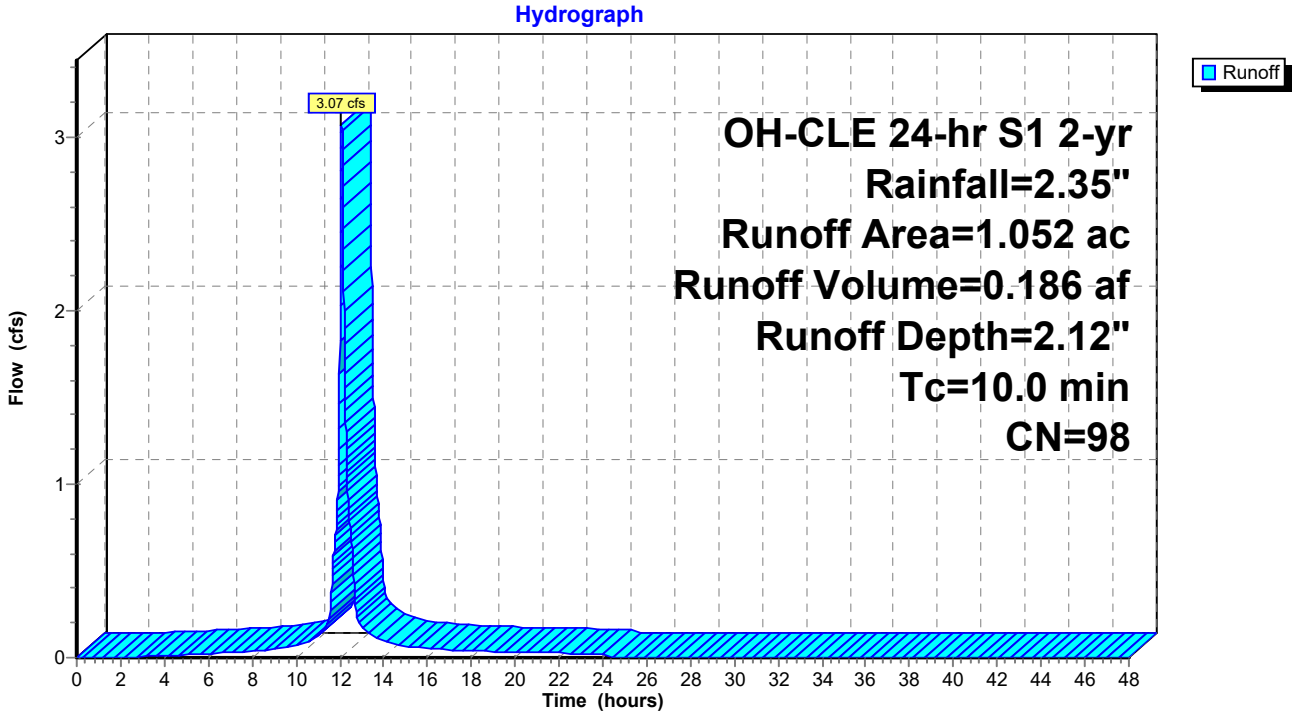
Runoff = 3.07 cfs @ 12.08 hrs, Volume= 0.186 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.052 | 98 | Bridge 14 Deck |
| | 1.052 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

### Subcatchment 27S: Bridge 14 Scuppers



## Summary for Subcatchment 28S: Carnegie to Loop I-90 Ditch

SC_Scratch10 in BD1300

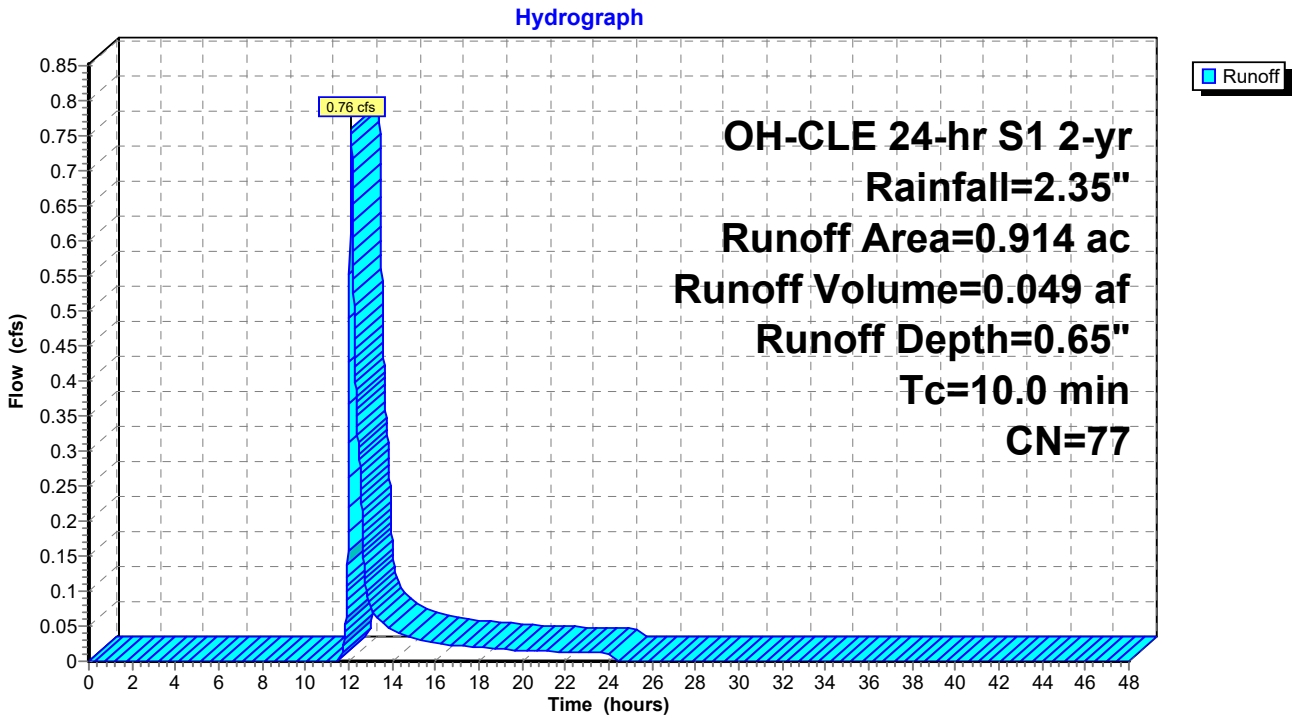
Runoff = 0.76 cfs @ 12.10 hrs, Volume= 0.049 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
OH-CLE 24-hr S1 2-yr Rainfall=2.35"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 0.094 | 98 | Pavement - I-90EB Shoulder |
| * | 0.055 | 78 | Slopes Steeper than 4:1 |
| * | 0.765 | 74 | Slopes Flatter than 4:1 |
| | 0.914 | 77 | Weighted Average |
| | 0.820 | | 89.72% Pervious Area |
| | 0.094 | | 10.28% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.0 | | | | | **Direct Entry,** |

## Subcatchment 28S: Carnegie to Loop I-90 Ditch



## Summary for Pond 6P: 2nd Elliptical

[57] Hint: Peaked at 631.41' (Flood elevation advised)

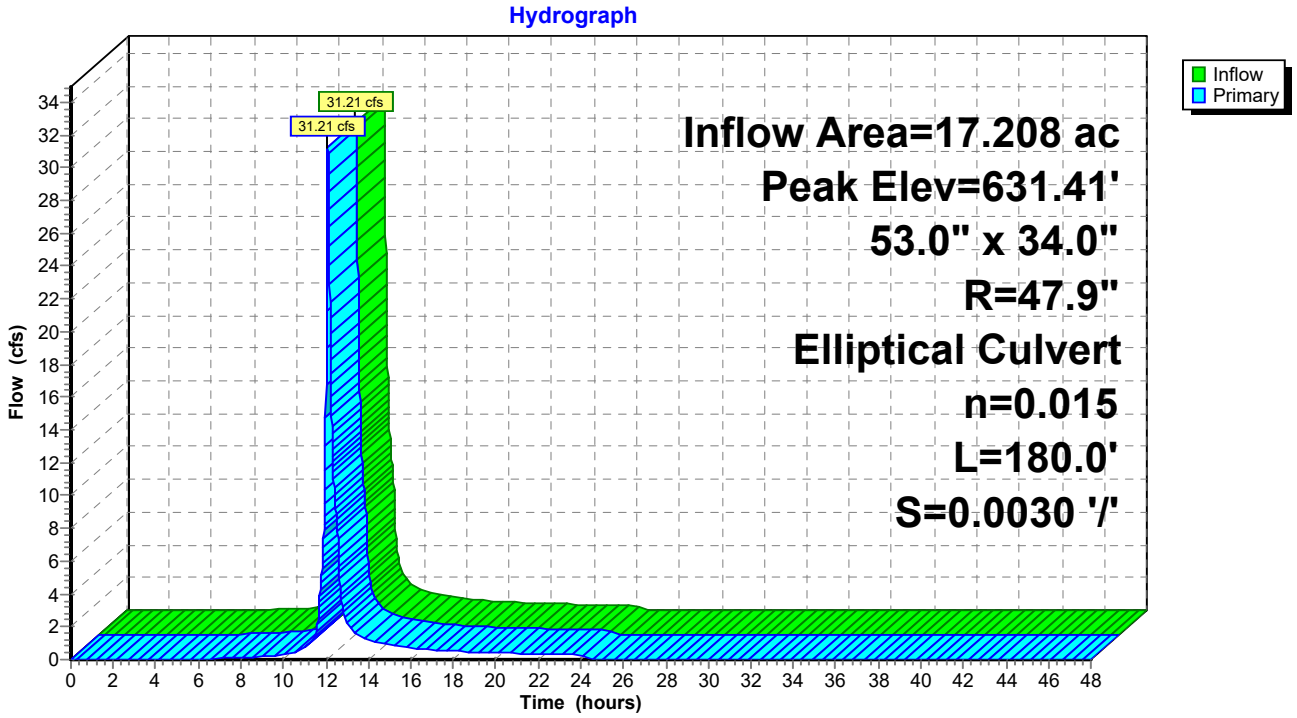
Inflow Area = 17.208 ac, 47.66% Impervious, Inflow Depth = 1.27" for 2-yr event
Inflow = 31.21 cfs @ 12.09 hrs, Volume= 1.821 af
Outflow = 31.21 cfs @ 12.09 hrs, Volume= 1.821 af, Atten= 0%, Lag= 0.0 min
Primary = 31.21 cfs @ 12.09 hrs, Volume= 1.821 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 631.41' @ 12.09 hrs

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 629.28' | **53.0" W x 34.0" H, R=47.9" Elliptical RCP_Elliptical 53x34**<br>L= 180.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 629.28' / 628.74' S= 0.0030 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 10.20 sf |

**Primary OutFlow** Max=31.20 cfs @ 12.09 hrs HW=631.41' (Free Discharge)
**1=RCP_Elliptical 53x34** (Barrel Controls 31.20 cfs @ 5.28 fps)

## Pond 6P: 2nd Elliptical



## Summary for Pond 22P: Detention 1

[43] Hint: Has no inflow (Outflow=Zero)

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 634.25' | 1.727 af | **Above Ground Detention (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 634.25 | 0.237 | 0.000 | 0.000 |
| 637.50 | 0.409 | 1.050 | 1.050 |
| 639.00 | 0.494 | 0.677 | 1.727 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 633.25' | **15.0" Round FR-OUT**<br>L= 247.5' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 633.25' / 632.03' S= 0.0049 '/' Cc= 0.900<br>n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf |
| #2 | Device 1 | 634.25' | **15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |
| #3 | Device 1 | 636.25' | **24.0" x 24.0" Horiz. Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑└─**1=FR-OUT** ( Controls 0.00 cfs)
↑ ├─**2=Orifice/Grate** ( Controls 0.00 cfs)
 └─**3=Grate** ( Controls 0.00 cfs)

## Pond 22P: Detention 1