MVRHS - MVC/HW Peer Review Response

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2 attachments (16 MB)
HAI-MVRHS-MVC PeerReview 092820 (FINAL).pdf; Marthas Vineyard RHS Stormwater report Rev 091620.pdf;

Alex, Adam & Anne, Attached you will find an electronic copy of our response to the peer review letter from Horsely Witten dated 8/13/20. The complete response includes the attached letter, updated plan set and updated stormwater report. As these documents are rather large I will be sending them in two emails. Attached to this email you will find our written response to the 8/13 review, and a copy of the updated stormwater report. I will send a second email with the updated plan set. Please let me know that both came through on your end.

As the attached includes a significant amount of information, I would offer to make my team available to review the documents together in advance of the 10/19 LUPC meeting. Let me know if you would like to set something up.

Thanks, and I look forward to continuing our review process together.

Chris

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HUNTRESS ASSOCIATES
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September 28, 2020

VIA EMAIL
Mr. Adam Turner
Martha's Vineyard Commission
PO Box 1447
Oak Bluffs, MA 02557

Re: Martha's Vineyard Regional High School – Athletic Field Improvements
Horsley Witten Group - Peer Review, dated August 13, 2020.

Dear Mr. Turner.

On August 26, 2020 we received correspondence from the MVC's peer review agent, Horsley Witten Group (HWG), dated August 13, 2020, regarding the MVRHS's Application for an amended DRI, as referenced above. I have coordinated our reply with the MVRPS and project team. The following is a listing of HWG's questions and our collective responses.

1. The proposed stormwater management plan generally meets state stormwater standards; however, there are several deficiencies in the drainage report and missed opportunities for innovation (e.g. nitrogen reduction, water reuse, and education). The Stormwater Report (dated January 22, 2020) provides a brief description of the proposed stormwater management approach; summarizes compliance with each of the state stormwater standards; and contains existing and proposed drainage area maps, soils information, peak flow calculations using Hydraflow, and an operations and maintenance plan. Based on our review of the report and the site plans, we have several comments:

A. The proposed stormwater management system provides no nitrogen load reduction benefit. The site sits on the border between Lagoon Pond Watershed and Sengekontacket Pond Watershed, which have nitrogen impairments and reduction targets. Current and proposed stormwater management at the site relies completely on infiltration via leaching catch basins (existing parking lot) and infiltration chambers (proposed track and field). Without some form of pretreatment, these practices provide no nitrogen removal. Nitrogen removal can be better achieved through vegetative filters (bioretention, tree filters, grassed swales, etc.) and practices that are designed with continuously saturated conditions, such as a wet swale. New landscaped areas being proposed in the reconfigured parking lot and around the buildings, entrance, and walkways may provide opportunities for treatment of runoff prior to infiltration.

   Response: (Marchionda Associates, LP.) As noted in the information provided in the response to the review comment #5 (pg.16), the introduction of a synthetic turf would result in an annual 263.96 lbs. nitrogen load reduction. To further improve nitrogen reduction the three proposed drywells have also been changed to vegetated "bioretention" cells.

B. Despite the abundance of groundwater, MVC's island plan promotes limiting water consumption where possible (Island Plan Strategy W1-5). Rainwater harvesting and water reuse are not part of the proposed stormwater management system. Given the proposed

irrigation demands for landscaping and the remaining natural grass fields at the school, it may be worth considering options for collecting and storing runoff for non-potable reuse (e.g., convert a section of the recharge chambers into storage tanks, or use cisterns to collect rooftop runoff from the proposed fieldhouse and press box).

Response: Thank you for your suggestion. We will review rainwater harvesting opportunities with our team and the staff at MVRHS and report back at the public hearing.

C. Students in the area are already involved in various projects to fight climate change, including initiatives to reduce plastic bottle and straw use, and may also be interested in measures to improve water quality. A highly visible surface practice or rainwater harvesting system could become an educational resource for environmental science classes and an educational opportunity for members of the public attending sports events. Students could take ownership of their campus through volunteer maintenance of the plants and the monitoring of practice performance and runoff volume reduction.

Response: Thank you for your suggestion. We will review environmental education opportunities with our team and the staff at MVRHS and report back at the public hearing.

D. The test pit logs indicated soils and depth to groundwater are suitable for infiltration as proposed by the applicant, and we concur that drainage controls are likely to function as described. There is missing, incorrect, or inconsistent information presented in the Stormwater Report, however, that the Applicant may want to correct for the public record:

i. Recharge. The applicant has not provided the recharge calculations to satisfy MA Stormwater Management Standard # 3, although we believe the intent of this standard has been met. Other than the location and label shown on Grading and Drainage plan sheet L-2, there is little information provided on the design of the infiltration trench with two Cultech recharge chambers (330XLHD). The applicant should show chamber dimensions, distribution piping, and access ports/observation wells on the layout plan. The applicant should also provide a detail showing surface cover material and depth, bedding material, geotextile fabric (if any), depth of chambers, etc. The applicant should confirm what the bottom elevation of 81.2 shown on plan sheet refers to (i.e. bottom of chamber or stone bedding). In addition, the Applicant should provide sizing calculations for the infiltration chambers.

Response: (Marchionda Associates, LP.) Additional construction details have been included in the plan set on Sheet L3.2. Calculations showing the static storage volumes provided by Infiltration BMP's to the meet the recharge requirements have been added to the revised Stormwater Report.

ii. Erosion Control. Some erosion control measures are shown on the Site Preparation Plan (SP-1) and details on sheet SP-2. The plan includes locations for inlet protection and silt socks but does not show the location of the construction entrance, tree protection, dewatering area, or erosion control blankets that are

shown on the detail sheet. Stockpiling and staging areas are not shown. No erosion control plan is provided for the soccer field renovation. There is no identification of specific trees that are to be removed, although there is a note about clearing and grubbing with in the limit of work.

Response:

1. Construction Vehicle Entrance: *The location of the construction vehicle entrance is shown on sheet SP-1 and is just north of the existing snack hut.*

2. Tree Protection Detail & Tree Removal: *The grading plan was adjusted to reduce the impact to existing vegetation and balance cut/fill volumes. The only trees being removed are the four (4) existing trees in the parking lot landscape islands which are being adjusted to accommodate a new bus drop-off. New trees have been included in the new islands, as shown on sheet L-3 Landscape Plan. We have added a limit of tree protection along the edge of grading to the existing vegetative buffer separating the new 400m track from Edgartown Vineyard Haven Roadway. Please refer to the updated sheet SP-1 for additional detail, attached.*

3. Dewatering and Erosion Control Blanket Details: *These details are included in case they are needed throughout construction. Given the sandy soils, depth of groundwater and gentle grades they may not be required, but we would prefer to keep them as typical details should they be needed at any point during the construction process.*

4. Stockpiling & Staging Areas: *Throughout construction we anticipate that all stockpiling and staging will occur within the limit of the new 400m running track and grandstand, as shown on SP-1. We have added notes clarifying the staging and stockpiling limits to the updated plan. As the project nears completion the staging of new athletic surfacing materials may be stored temporarily within the limits of the renovated parking area for short periods of time.*

5. Erosion Control at Field #2 (Natural Grass Field): *We have added notes that require erosion control at the limit of work for Field #2. Please refer to the updated sheet L-13, attached.*

iii. Discharges in groundwater/wellhead protection areas. The applicant incorrectly states that the project does not create a discharge within a Zone II area. The proposed recharge chambers are the discharge point, which is allowable per Standard 6.

Response: (Marchionda Associates, LP.) The Stormwater Report has been corrected as noted.

iv. Long-term O&M. The applicant has not included maintenance of the infiltration chambers as part of the Operations and Maintenance Plan in Appendix 4 of the

stormwater report. To meet Standard 9, the applicant should address chamber maintenance and show the location of clean outs and observation ports in the plan set. In addition, there is no estimated annual maintenance budget for stormwater practices.

Response: (Marchionda Associates, LP.) The infiltration chamber system has been added to project's Operation and Maintenance (O & M) Plan. The O & M Plan has been updated to include an approximate budget for maintenance of the storm water BMP's. The revised construction details for the chambers system includes information on the proposed clean outs and observation ports.

v. Peak Discharge. The Applicant likely meets Standard 2, however there are some technical issues with the Hydraflow calculations.

a. The post-development watershed (proposed drainage area) map does not match the Grading and Drainage plan (sheet L-2) provided. Elevations appear to be off >1 ft and the parking lot reconfiguration is not shown. The applicant has stated that the hydrologic calculations are current, however elevations in Hydraflow summaries also do not match elevations in the Grading and Drainage plan. No revised mapping or modeling information was provided that allow us to verify that the modeling has been updated. The Applicant should provide an up-to-date drainage map and Hydraflow calculations.

Response: (Marchionda Associates, LP.) The hydrologic calculations have been updated to match the latest project site plans. The revised report and sub catchment plan also reflect the changes.

b. The drainage calculations do not include information about the natural grass soccer field. Even though this part of the project does not ultimately change existing grass surfacing, it does involve changing existing grades, the addition of underdrains, and changes to study points/discharge locations. In addition, there is no information provided on the existing "basin" where the soccer field underdrains will discharge, for example, so we are unable to evaluate system capacity or verify the assertion that the proposed conditions would be identical to current conditions.

Response: We have updated the plans to better mimic the existing condition in the proposed design of the natural grass field. We have removed the underdrains and eliminated the change to "study points/discharge locations" by eliminating the overflow pipe to the existing basin. Please refer to updated sheet L-13 Field #2 Grading & Drainage Plan, attached.

The proposed improvements to the natural grass field are now limited to re-establishing the mid-field crown, improving the topsoil composition and adding infiltration trenches at the edges of the field. With the underlying soil conditions being as well drained as they are, we feel we can rely upon infiltration in the

subgrade, as is the case presently. In light of those revisions, we respectfully request a waiver from preparing a full drainage study related to the improvements on Field #2 (Natural Grass).

c. The project description states that approximately 79,500 sf (approximately 1.82 acres) of new impervious area will be built. Curve number calculations state that the new impervious area will be 4.26 acres. An expanded narrative clarifying which surfaces are considered impervious could help explain conservative modeling and recharge requirements.

   Response: (Marchionda Associates, LP.) The stormwater report narrative has been updated with the total impervious coverage area that is depicted on the latest project plans. In an effort to model the field's drainage system in the most conservative method, the field turf area (2.42 acres) was considered as impervious and draining directly to the subsurface system through the panel drains. Not credit was taken for the interaction (infiltration) of stormwater between the gravel subbase and the natural subgrade.

d. The Time of Concentration calculation for drainage area P-2 includes a Manning's n-value of 0.4 for the sheet flow, which is the value for light underbrush. According to the post development watershed map, drainage area P-2 does not contain any forested or underbrush areas. Applicant should revise this calculation to reflect the site conditions in that area. Additionally, the Time of Concentration calculation for drainage area P-3 (the field), has a sheet flow of 90 ft through forest and underbrush. Over 75% of P-3 is impervious area with immediate access to field drains or catch basins, so HW recommends a shorter time of concentration in this area.

   Response: (Marchionda Associates, LP.) As recommended, the time of concentrations for Sub catchments P-2 and P-3 have been revised. These changes are reflected in the revised Stormwater report.

e. The applicant should confirm outflows from hydrographs #7 and #6 are correctly accounted for in Hydrograph #8 (i.e., the curves could be overlapping and difficult to see or it is not correctly modeling inflow).

   Response: (Marchionda Associates, LP.) We can confirm that in the original Stormwater Report Hydrograph #8 (Flow to Chambers) was the combined flow of the Hydrograph #6 (Sub catchment P-4) and Hydrograph #7 (Field Outflow). In the revised report the original Hydrograph #8 is now referred to as Hydrograph #9 and Hydrographs #6 and #7 are now Hydrographs #6 and #8 respectively.

f. The Pond Report for Pond 2 (chamber system) shows a total discharge of 0 cfs between stages 1.85 ft and 2.4 ft (approx.). The applicant should explain how this is possible.

Response: (Marchionda Associates, LP.) The zero-discharge issue has been corrected in the revised Stormwater Report.

g. The applicant used an exfiltration rate of 8.24 in/hr for both Pond 1 and 2. While we do not believe this will make a significant difference, the standard exfiltration rate for sand is 8.27 in/hr. For Pond 1 (the field), infiltrating stormwater must pass through the turf system and filter fabric, making an exfiltration rate of 8.24 in/hr unlikely.

Response: (Marchionda Associates, LP.) The exfiltration rate for sand has been corrected to 8.27 in/hr in the revised Stormwater Report. As stated in response to Comment 1.D.v.b., the field turf surface was considered as impervious in the modelling with direct conveyance to the field's drainage system. It is our understanding that Field Turf porosity is typically around 20 in/hr and would drain rapidly to the subbase and panel drains.

E. The system is designed to back up into the field under higher rainfall. Due to inconsistencies between Hydraflow and the grading & drainage plan, we cannot confirm the estimated levels of ponding. Can the applicant confirm that there will be no issues with floating of the pine infill product? In addition, the applicant should confirm that the synthetic field drainage is sufficient to prevent freezing in the winter.

Response:

1. Brock Fill Infill Material: *The following response was provided by* **Mr. Tom Murphy, Ph.D. Senior Materials Engineer - Brock USA, LLC**

Regarding the floating/buoyancy: Once BrockFILL is fully saturated with water, it is denser than water and will sink (there may be a few small pieces of bark that are lower-density than the wood itself and may float, but this is a tiny percentage of the material). Saturation happens quickly, since BrockFILL readily absorbs water and has a small particle size. We have done experiments to demonstrate the rapid water uptake and to compare the floating behavior to rubber. Even rubber, which itself is denser than water, will float due to air bubbles trapped on the surface of the particles. BrockFILL will be better in terms of floating/migration than most other alternative infills (cork, for instance) and likely better, or at least not any worse, than other common infills like rubber. The anecdotal reports from BrockFILL field owners after storms have all said that floating/migration has not been an issue, and we have done 70+ BrockFILL fields to date.

2. Freezing Conditions: *The drainage capacity of the synthetic turf system (Turf, Infill & Pad) and the dynamic stone used in the 12" subbase is typically in excess of 20" per hour. Although the proposed organic infill, BrockFILL, may freeze during extremely cold conditions, similar to a natural grass system, the benefit of a free draining subbase and the thaw condition provided by natural sunlight will help keep the field in playable condition throughout the year.*

2. Insufficient data exists to definitively conclude that there are/are not impacts to human health or the environmental from the Greenfields MX Elite Woven Synthetic Turf Carpet, Brock YSR Shock Pad and Brock BrockFill Organic Infill. A more detailed report of our review of the readily available analytical information is attached. Based on our review, we recommend:

A.1 In addition to the testing and evaluation proposed by Cooperstown Environmental, Total Oxidizable Precursor Assay (TOP) and Total extractable organofluorine (TEO) analysis should be conducted.

Response: We have engaged Cooperstown Environmental, a licensed and registered LSP firm in the Commonwealth of Massachusetts, to identify a scope of services to accurately and correctly test the synthetic turf, resilient underlayment (shock pad), and organic infill for the impact to human health via exposure to the turf system from inhalation, ingestion, and direct (dermal) contact as well as for the potential impact on groundwater quality from the turf. The proposed scope of work includes the following product tests:

SCOPE OF SERVICES

Task 1 – Develop Acceptance Testing Protocols and Guideline Values
We propose to develop acceptance testing protocols and guideline values for the impact to human health via exposure to the turf system from inhalation, ingestion, and direct (dermal) contact as well as for the potential impact on groundwater quality from the turf. Guideline values for human exposure will be developed with reference to standards issued by the United States Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (DEP), the Massachusetts Contingency Plan (MCP), or other recognized standards. The acceptance testing protocols, and guideline values will be developed for total and leachable metals (MCP 14 metals and hexavalent chromium), total and leachable polycyclic aromatic hydrocarbons (PAHs), and total and leachable PFAS.

Task 2 – Laboratory Testing of Synthetic Turf Components
We will oversee laboratory testing of the three components of the turf system (carpet, shock pad, and infill). Specifically, we will request the manufacturers direct-ship virgin product samples to Alpha Analytical Laboratory (Alpha) of Westborough, MA using chain-of-custody protocols as follows

Greenfields MX Elite Woven Synthetic Turf Carpet (1 square foot)

Brock YSR Shock Pad (1 square foot)

Brock BrockFill Organic Infill (1 kilogram)

Under contract to Cooperstown, we will request that Alpha analyze each sample as follows:

1. *Total MCP 14 metals and hexavalent chromium using EPA Methods 6020B, 7471B, and 7196A.*

2. *Leachable MCP 14 metals and hexavalent chromium using EPA Methods 1311, 6020B, 7471B, and 7196A.*

3. *Total PAHs using EPA Method 8270D-SIM (where possible, dependent on whether the sample can be dissolved by the extraction process);*

4. *Leachable PAHs using EPA Methods 1311 and 8270D;*

5. *Total PFAS (24 compounds) by EPA Method 537M (where possible, dependent on whether the sample can be dissolved by the extraction process); and Leachable PFAS (24 compounds) by EPA Methods 1312 and 537M.*

The laboratory analyses will be requested for a standard turnaround time of 10 business days, however, because PFAS analyses are sometimes delayed due to high demand at the lab, this time is not guaranteed.

Task 3 – Baseline Testing of Soil and Groundwater

Baseline testing of current conditions at the field site including both soil and groundwater quality would be useful for identifying existing levels of potential contaminants in soil and groundwater so that future risks to human health and groundwater quality may be assessed and measured over time in order to quantify impacts of the turf. This testing should be completed prior to construction. Following standard MassDEP sampling protocols, we will collect four surficial (0-1 foot depth) grab soil samples from the area where the field will be installed and analyze each sample for:

1. *Total MCP 14 metals and hexavalent chromium using EPA Methods 6020B, 7471B, and 7196A;*

2. *Total PAHs using EPA Method 8270D-SIM; and*

3. *Total PFAS (24 compounds) by EPA Method 537M.*

As a cost-saving measure, we could collect the four grab samples and composite them into one laboratory sample. We will utilize the existing monitoring well at the site and collect a sample of groundwater using low flow sampling protocols and analyze the sample for:

4. *Dissolved MCP 14 metals and hexavalent chromium using EPA Methods 6020B, 7471B, and*

5. *7196A; Total PAHs using EPA Method 8270D-SIM; and Nitrates using EPA Method 353.2.*

6. *All samples would be analyzed by Alpha using standard turnaround time of 1-2 weeks.*

Task 4 – Risk Characterization
Cooperstown will compare the laboratory analytical results for the product samples and soil and groundwater samples to the risk-based guideline values developed in Task 1 to assess the potential risks under both current and proposed conditions to human health and the groundwater resource.

Task 5 – Report
Cooperstown will produce a summary report describing the work conducted, the analytical data, the results of the risk characterization, and recommended next steps, if any.

Huntress Associates and MVRPS take the issues of human health and environmental protection very seriously. We, like you, want to ensure that the materials meet widely recognized environmental testing standards before including them in the project specifications.

The scope of work proposed by Cooperstown Environmental LLC was based on the standards found in California Proposition 65 and the EPA 537 testing protocols, both of which are significantly more stringent than the standards required by the Massachusetts DEP.

The Total Oxidizable Precursor Assay (TOP) and Total Extractable Organofluorine (TEO) analysis (also known as Total Organofluorines or TOF), as requested by HWG, are not presently used by Massachusetts DEP, California Prop 65, or EPA 537 in determining the presence of PFAS or other chemicals as outlined above. It is for this reason that we object to including those tests in the scope of work for this project.

A.2 It is possible that wood infill could also be a source of nitrogen. Depending on the total volume of infill expected to be used, testing BrockFill for soluble nitrogen may be informative.

Response: The following response was provided by **Mr. Tom Murphy, Ph.D. Senior Materials Engineer - Brock USA, LLC**

"The only nitrogen-related concerns I've ever come across were related to what would happen when disposing of BrockFILL. Wood chips themselves don't contain much nitrogen, so the microorganisms that decompose wood will temporarily scavenge nitrogen from the soil (since the wood doesn't have enough nitrogen) as they break down the wood, giving it back to the soil after those organisms die off. Questions like this are often asked about using wood as mulch or in compost piles, but the concern is never that the wood will add nitrogen to the soil – it is the opposite (at least in the short term). I have never heard any concerns about wood chips themselves being a significant nitrogen source, so we have not done any testing for this.

A.3 The applicant is proposing to include product testing as part of the construction contract. Earlier testing results may be more useful to the school and permitting authorities.

Response: We have no objection to earlier product testing as outlined in the testing scope provided by Cooperstown Environmental, dated May 22, 2020, and as otherwise outlined in our response above.

B. If the project is approved, we recommend adding a condition to the approval requiring the owner to conduct effluent monitoring within the field's subsurface drainage system (in the inlet structures to the infiltration chamber, for example). In this case, a monitoring plan should be developed that includes locations and designs for sample collection and analysis.

Response: We have no objection to effluent monitoring within the field's subsurface drainage system. We have added a 2' sump to the Drain Manholes (DMH #5 & DMH #6) to serve as collection points for the subsurface system. Refer to the updated Detail #5, sheet L-8 for additional detail.

C. Crumb rubber is often the source of microplastic contamination from synthetic fields reported in the literature and that product is not being proposed. Some information was found estimating microplastic generation from the deterioration of synthetic carpets, but not necessarily the specific Greenfields product being proposed. Additional testing of the carpet product would be needed to evaluate fraying and rate of deterioration. Arguably, older installations exposed to longer periods of UV and stress would be more prone to deterioration than newer installations. There is emerging evidence that microplastics have been found in bedrock aquifers suggesting mobility in groundwater. There is emerging evidence that microplastics have been found in bedrock aquifers suggesting mobility in groundwater. Consideration should be given to filtering alternatives to trap inevitable microplastics and minimize dispersal of particulates into the environment. The applicant could consider the addition of a filter insert (i.e., 0.45 micron filter cartridge) in the track channel drain at the edge of the field or at other key junctions in the drainage system to capture loose particles from runoff and, to some degree, wind. Plastic fragments collected in the filters could be removed during annual maintenance and properly disposed.

Response: We have reviewed the proposed 400m track trench drain detail provided by HWG's 8/13 letter and have no objection to the use of Sportfix®Clean drainage system and channel filter as manufactured by Hauraton for use on the MVRHS 400m Track project. We agree that the 0.45-micron filter sock at the edge of the track surface will provide a benefit to the project. The project specifications will be amended to include the above referenced product as the pre-approved trench drain system.

3. The maintenance practices recommended by the manufacturer for the synthetic field are more extensive than the maintenance program proposed in the Huntress Q&A dated April 3, 2020. Neither maintenance plan includes specific disinfection procedures to prevent COVID-19. In the Q&A dated April 3, 2030, the applicant's maintenance plan for the synthetic turf field includes weekly inspections and monthly brushing/grooming and disinfecting. However, the

manufacturer's guidance provided in the master plan indicate that even with low use, the synthetic field requires weekly infill refill and releveling with total surface brushing every two weeks (at a minimum). It is conceivable that during heavy use periods, field inspection and maintenance may be required more frequently. The applicant should:

A. Confirm the frequency of maintenance activities and ensure the budget estimates are consistent with those activities. The applicant has provided a 10 and a 20-year Estimate of Probable Long-Term Costs for the synthetic field (included in Master Plan, page 85), which includes estimated maintenance costs of $7,454.28 per year. The annual budget assumes 36 hours of field grooming and sweeping; 16 hours of topdressing and leveling infill; and lump sum costs for seam repair, Gmax testing and Deep Tine Cleaning two times/yr.

Response: The following are the estimated costs for maintaining a competition synthetic turf athletic field for high school sports, similar to the proposed Stadium Field, at MVRHS.

ITEM	Hours	Cost/hour	Product Cost	TOTAL
SYNTHETIC TURF FIELD - ESTIMATED ANNUAL MAINTENANCE COSTS				
Field Grooming & Sweeping (16 time @ 2.25 hours ea)	36	$42.39	$0.00	$1,526.04
Topdressing and leveling Infill	16	$42.39	$1,000.00	$1,678.24
Seam repair and warranty issues (no charge for the first eight years)	-	$0.00	$500.00	$500.00
Gmax Impact Testing (one time annually)	-	$0.00	$1,250.00	$1,250.00
Deep Tine Cleaning (two times annually)	-	$0.00	$2,500.00	$2,500.00
TOTAL	**52**	**$42.39**	**$5,250.00**	**$7,454.28**

* Based upon actual employee cost/hour provided by MVRHS.

The above costs represent an annual field grooming cycle from March through November (9 months) during which time the field is groomed and swept on average every 2-3 weeks, depending on use. The costs also include 16 hours annually for topdressing and leveling low spots that can occur at the goal areas. This effort is typically done by hand and takes one individual approximately 15-20 minutes to complete.

B. Ensure that the maintenance budget includes not only routine maintenance, but also line items for comprehensive (annual) and special maintenance (field markings, stain removal, spills, vehicle protection), as well as maintenance of the drainage infrastructure.

Response: The maintenance budget outlined above includes routine maintenance. In conversations with the MVRHS athletic and facilities staff we would expect all sports lining to be permanently inlaid, and not require annual maintenance. Stain removal, spills and vehicle protection are not regularly occurring tasks, and would be covered during the training program provided by the synthetic turf manufacturer. Those items would typically be handled on an as-needed basis by in-house staff and are included in the 2.25 hours allocated to field grooming and sweeping.

C. Provide a more detailed disinfection plan to account for COVID19 and other viruses. A review of industry-based disinfection guidelines suggests spraying a disinfectant (products based on manufacturers recommendations) on the field after each use. The disinfection plan should include proposed products (such as mPerial), equipment needed, and

application frequency in order to better evaluate the cost implications and any potential for groundwater contamination from active ingredients.

Response: Recommended disinfectant plans for youth sports, school and recreational facilities should follow the recommended guidelines established by the Center for Disease Control (CDC). According to the CDC website "There is little evidence that large-scale use (e.g., spraying or fogging rooms or surfaces) of disinfectants will prevent…infections more effectively than a more targeted approach of cleaning frequently-touched surfaces." [1] *The CDC goes further by also recommending that schools "prioritize outdoor, as opposed to indoor, practice and play as much as possible."* [2]

Additionally, the chemical product mPerial, as recommended by HWG, is a concentrated and highly dilutable detergent, disinfectant and sanitizer specifically formulated for use on hard, common, non-porous surfaces. Although this chemical product is effective at containing infection and eliminating multiple viruses, it also raises concerns regarding groundwater contamination and unknown long-term impacts to the Lagoon Pond and Sengekontacket Pond Watersheds.

HAI is encouraging our clients to continue to follow the recommendations of the CDC for disinfecting all school facilities, including athletic fields, running tracks, tennis courts and playgrounds. Specifically, the CDC recommends schools and youth sports organizations consider implementing several strategies to maintain healthy operations, as outlined below.

- ***Cleaning and Disinfection***
  - *Clean and disinfect frequently touched surfaces on the field, court, or play surface (e.g., drinking fountains) at least daily, or between uses as much as possible. Use of shared objects and equipment (e.g., balls, bats, gymnastics equipment) should be limited, or cleaned between use by each individual if possible.*
- ***Shared Objects***
  - *Discourage sharing of items that are difficult to clean, sanitize, or disinfect. Do not let players share towels, clothing, or other items they use to wipe their faces or hands.*
  - *Make sure there are adequate supplies of shared items to minimize sharing of equipment to the extent possible (e.g., protective gear, balls, bats, water bottles); otherwise, limit use of supplies and equipment to one group of players at a time and clean and disinfect between use.*
    - *Keep each player's belongings separated from others' and in individually labeled containers, bags, or areas.*
- ***Modified Layouts and Social (Physical) Distancing***

[1] https://www.cdc.gov/mrsa/community/environment/athletic-facilities.html

[2] https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/youth-sports.html#environments

- *Identify adult staff members or volunteers to help maintain social distancing among youth, coaches, umpires/referees, and spectators (if state and local directives allow for spectators).*
- *Space players at least 6 feet apart on the field while participating in the sport (e.g., during warmup, skill building activities, simulation drills)*
- *Discourage unnecessary physical contact, such as high fives, handshakes, fist bumps, or hugs.*
- *Prioritize outdoor, as opposed to indoor, practice and play as much as possible.*
- *Create distance between players when explaining drills or the rules of the game.*
- *If keeping physical distance is difficult with players in competition or group practice, consider relying on individual skill work and drills.*

- ***Physical Barriers and Guides***
  - *Provide physical guides, such as signs and tape on floors or playing fields, to make sure that coaches and players remain at least 6 feet apart.*
- ***Communal Spaces***
  - *Close shared spaces such as locker rooms, if possible; otherwise, stagger use and clean and disinfect between use.*
  - *Limit the number of players sitting in confined player seating areas (e.g., players benches) by allowing players to spread out into spectator areas if more space is available (e.g., if spectators are not allowed).*

The above information is a sample of the facility recommendations provided by the CDC. Additional information may be found at:

https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/youth-sports.html#environments

D. Confirm that the proposed maintenance plan and long-term cost estimate are sufficient to maintain a safe, quality field and can be implemented within the school's annual facility's budget.

Response: In my professional opinion, the proposed maintenance plan and long-term estimates are sufficient to maintain a safe, high quality field. The reduced costs associated with maintaining a synthetic turf field make the plan attainable within the school's existing annual field facility budget.

E. The maintenance budget for Phase I should include estimates for maintaining the natural grass soccer field and underdrain.

Response: The following are the estimated costs for maintaining a competition natural grass athletic field for high school sports, similar to the proposed Field #2, at MVRHS.

ITEM	Hours	Cost/hour	Product Cost	TOTAL
NATURAL GRASS FIELD - ESTIMATED ANNUAL MAINTENANCE COSTS				
Mowing & Trimming (28 cuttings @ 2.25 hours ea)	63	$42.39	$0.00	$2,670.57
Aeration, 5 times per year	40	$42.39	$0.00	$1,695.60
Fertilizer @ 3.0#s N / Year	12	$42.39	$2,295.00	$2,803.68
Soil Amendments	3	$42.39	$551.04	$678.21
Herbicide Applications	3	$42.39	$45.32	$172.49
Pre-emergent	3	$42.39	$158.65	$285.82
Weed Control - spot spray	3	$42.39	$40.00	$167.17
Game Day Prep - Soccer (1.5 hours x 6 games)	9	$42.39	$500.00	$881.51
Game Day Prep - Football (2.5 hours x 6 games)	15	$42.39	$750.00	$1,385.85
Weekly Practice Prep - All Sports (6.0 hours x 28 weeks)	168	$42.39	$500.00	$7,621.52
Overseeding	30	$42.39	$1,710.00	$2,981.70
Insecticide Applications	8	$42.39	$623.10	$962.22
Irrigation (Operation & Repair)	8	$42.39	$1,500.00	$1,839.12
Verti-drain Decompaction	8	$42.39	$600.00	$939.12
TOTAL	**373**	**$42.39**	**$9,273.11**	**$25,084.58**

* Based upon actual employee cost/hour provided by MVRHS.

4. There is currently no facility that can provide a practical alternative for end-of-life recycling. While the Greenfields promotional materials claim that the USA MX Elite Woven synthetic turf carpet is fully recyclable, the applicant has not demonstrated the practicality of recycling the materials that are proposed at MVRHS. Objective 4 of the Master Plan is to "Draft a specification that requires end-of-life recycling, including chain of custody certification for all products" (page 16), but only presents a single option for recycling facility to be operated by ReMatch Turf Recycling in Pennsylvania. HW was unable to confirm that this facility will be open in the next few years or confirm the availability of any other such accessible recycling plant. This does not preclude the opening of a facility in the next 7-10 years, which is the likely life span, depending on several factors. If there are other options for recycling or reuse, the applicant should provide alternative plans or more evidence of successful synthetic field recycling in the area.

Response: My office has previously provided documentation to the MVC regarding the projects requirements for recycling and outlining Greenfields USA and Tencate's ability to reclaim and recycle the synthetic turf proposed at Martha's Vineyard High School. Please refer to the following attached documents regarding discussions, commitments and specifications for end-of-life reclamation and recycling available to this project.

1. *Letter to Adam Turner from Joe Fields, President of Tencate Grass Americas (dba Greenfields USA), dated and sent February 4, 2020.*

2. *Tencate Press Release dated July 14, 2020 confirming that the construction of their synthetic turf recycling facility is complete, and the machines are running.*

3. *Email to Alex Elvin, MVC General Planner, dated 7/16/20 with attachments of both the 2/4/20 letter from Joe field and the 7/14/20 press release referenced above.*

4. *Section 32 18 23.29 Synthetic Field Sports Surfacing specification dated July 30, 2020 and prepared by Huntress Associates, Inc. This document was previously provided to the MVC and HWG on July 27, 2020 with regard to questions raised in their initial review process. Please refer specifically to paragraph 1.06A(1)m for requirements related to the*

turf product lifetime recycle/reuse program and requirements that all materials must be able to be cradle-to-cradle certified and demonstrate 100% closed loop recyclability.

5. *Finally, please refer to Section 4 of the above referenced synthetic turf specification which outline the end-of-life requirements of the selected turf manufacturer. I have copied the information below for your convenience:*

PART 4 – REMOVAL & RECYCLING

4.01 GENERAL

A. The Synthetic Turf System Vendor shall be responsible to remove, reclaim and recycle the synthetic turf system at the end of its useful life at no additional cost to the owner. The Synthetic Turf System Vendor shall provide a signed affidavit at the time of bid that, at the end of the synthetic turf system's useful life, 100% of the turf product will be removed, reclaimed and recycled as outlined below.

B. The Synthetic Turf System Vendor must provide documentation outlining their product lifetime recycle / reuse program. All material must be able to be cradle-to-cradle certified and demonstrate 100% closed loop recyclability, ***recycling for energy not acceptable.***

C. Prior to final acceptance of the synthetic turf field, the Synthetic Turf System Vendor shall set up an Escrow-Secured Guarantee by placing $50,000 into an Escrow Account at an FDIC insured institution, the account to be held jointly by the Owner and the Synthetic Turf Manufacturer-Installer. All funds in the account shall be released by the Owner to the Manufacturer-Installer (at the recommendation of the Architect) upon the successful recycling of the turf at the end of its useful life, per the provisions outlined herein. Should the Manufacturer be unable for any reason to recycle the turf field as per the provisions of the specifications, the Owner shall be entitled to the funds, including interest, for the purpose or recycling the turf properly by other means and other parties.

D. All removal and recycling operations shall be performed by personnel fully familiar with the materials and their application, under the full-time direction and supervision of a qualified technical supervisor employed by the Vendor of the Infilled Synthetic Turf System. Installation supervisors shall have a minimum of 3 years of experience.

E. The removal, reclamation and recycling process shall include the following:

1. *No less than 95% of infill is extracted from synthetic turf.*
2. *Synthetic turf is cut, rolled tightly and secured.*
3. *Synthetic turf rolls are steel banded and stacked into containers.*
4. *Synthetic Turf Vendor will maintain chain-of-custody, including the following information:*

a. *Project Name and site location.*

b. *Serial number of all containers.*

c. *Synthetic Turf System Vendor will be responsible for the cost to transport all containers to and from the project site, as well as freight to the selected synthetic turf recycling facility.*

d. *Synthetic Turf System Vendor shall provide to the Owner documentation pertaining to the date all containers arrive and depart from site, Date of arrival at turf recycling facility, and Date of final processing into post-consumer products.*

e. *Issuance of Certificate of Compliance Once synthetic turf has been received and processed, a Certificate of Compliance will be issued with reference to job name, site location, date turf products left the site, serial number of container, date received at plant and date processed into post-consumer products. Synthetic Turf System Vendor will be responsible for confirming 100% of the synthetic turf was recycled into post-consumer products.*

5. The proposed fertilization plan for the renovated soccer field (and other natural turf fields) will likely result in an increase in nutrients applied to the grass fields but meets criteria of the local regulations. The Applicant has provided a fertilization program for the natural grass fields that recommends an application of nitrogen at a rate of 2.84 lbs per 1000 square feet. Oak Bluffs regulations limit nitrogen application to 3 lbs per 1000 square feet per year. The applicant could provide a nitrogen budget comparing current vs. proposed nitrogen load applications on the site in order to claim some nitrogen reduction benefit by the conversion of one natural field to synthetic turf. Current fertilization efforts at MVRHS, however, are likely less than the proposed application rate and frequency.

Response: As stated in our July 27, 2020 response to HWG, we reviewed the existing fertilization schedule with Mike Taus, Facilities Director at MVRHS, as we drafted our recommended turf maintenance guidelines. Mr. Taus verified that MVRHS was in compliance with the Oak Bluffs Board of Health Regulations for application of fertilizer (SECTION 21.0) and confirmed that cumulative applications of Fertilizer did not exceed 3.0 pounds of nitrogen per 1000 square feet of Turf per year.

Based on the question raised above, we confirmed with Mr. Taus on August 28, 2020 that the existing Field #2, the Bus Lot Field, presently receives approximately 3 lbs of nitrogen per 1000 square feet annually, as allowed in the MVC/OB fertilizer Regulations. The continued application of 3 lbs of nitrogen per 1000 sf on the renovated natural grass field will not result in an overall increase in nutrients applied to the site. MVRHS presently uses Sports Turf Specialties, Inc out of Wrentham, Massachusetts to apply fertilizer and nutrients to the high school campus. We have

confirmed with STS that their equipment is calibrated to account for the limits imposed by the MVC/OB Fertilizer Regulations.

As also suggested by HWG, we have prepared an analysis to better understand both the anticipated nutrient load and the irrigation demand when comparing a natural grass and synthetic turf surface of the same size at MVRHS. As shown in the table below, the introduction of a synthetic turf surface within the 400m track infield would result in the reduction of 1036.72 lbs of fertilizer, 263.96 lbs of nitrogen and save approximately 1.18 million gallons of water annually. The calculations below mirror the maintenance requirements proposed in our annual Turf Maintenance Program submitted under separate cover and are compliant with the MVC/OB Fertilization Regulations.

MVRHS - Athletic Field Fertilization Rates & Water Usage

MVRHS - Athletic Field	**Field Size (sf)**	**N-P-K**	**N Rate**	**Total Lbs Nitrogen**	**Total Lbs Fertilizer**
Multi-purpose Synthetic Turf Field (One Field)	105,252	n/a	n/a	0	0
Fertilizer Rates (If Natural Grass)*	**Field Size (sf)**	**N-P-K****	**N Rate**	**Total Lbs Nitrogen**	**Total Lbs Fertilizer**
Early Spring (April 15 - June 1)	105,252	30-0-4	0.75 lbs/1000sf	78.94	263.13
Late Spring (May 15 - June 15)	105,252	28-0-3	0.50 lbs/1000sf	53.04	189.45
Late Summer (August 25 - September 20)	105,252	20-0-8	0.75 lbs/1000sf	78.94	394.69
Fall (October 15 - November 15)	105,252	28-0-6	0.50 lbs/1000sf	53.04	189.45
Annual Total			**2.5 lbs/1000sf**	**263.96**	**1036.72**
* Conforms to the MVC/OB Fertilizer Regulations					
** N-P-K value could change based upon actual soil test results. Refer to annual maintenance plan for details.					
Water Usage Analysis (If Natural Grass)***	**Field Size (sf)**	**H_20/week**	**H_20 gal/sf**	**H_2O gal/week**	**H_2O gal/year**
Multi-purpose Synthetic Turf Field (One Field)	105,252	1.0 inch	0.623	65,572	1,180,295.93
*** Assumes 18 weeks of watering					

HUNTRESS *Sports* 9-Jun-20

6. Additional information is needed to confirm that noise and lighting meeting the environmental performance standards of the Town of Oak Bluffs Zoning By-Laws.

A. We were unable to find information on the expected noise levels associated with the new field. Presumably, by installing a new track and synthetic field, the existing track and field adjacent to the residential area on the western part of the property will be used less frequently (or abandoned) and noise will decrease at that location. However, because the applicant has not provided specific information about the additional noise levels associated with the new field sound system, larger grandstand, etc. we are unable to confirm this is the case. A sound system layout plan is provided on sheet L-8 of the plan set.

Response: According to Mark McCarthy, MVRHS Athletic Director, the present varsity game field adjacent to Edgartown-Vineyard Haven Road has a sound system that is currently used for both game and practice events. No noise complaints have been made regarding use of the existing sound system. The new proposed sound system will be similar in amperage, and include pairs of speakers that can be individually controlled to

allow the operator to reduce volume or shut down pairs of speakers to help control the sound levels in any given direction, at any time. The system is also equipped with pre-set limit on volume controls. These volume limits can be set by the MVRPS staff and cannot be overridden in the field without staff permission.

HWG is also correct that moving the 400m track to be adjacent to Edgartown-Vineyard Haven Road will reduce noise impact to the most sensitive residential abutters in the adjacent Deer Run neighborhoods.

B. Replacing the existing field lighting system with a more efficient system will provide some energy conservation benefit, but a comparison of current and proposed electrical use was not provided. The applicant should provide additional information on the lighting design, including lighting control system. While outdoor sports lighting is counter to some of the principles of dark sky friendly lighting, the International Dark Sky Association (IDA) has created a Community Friendly Sports Lighting Program with guidelines for minimizing impact, and the applicant states the lighting plan is in compliance with these guidelines. HW recommends the applicant apply for certification from the IDA to ensure compliance throughout the design and construction process. The certification consists of two phases, a review of plans (costing $1,000) and a field verification once construction is complete (costing $3,000).

Response:

1. ***Cost of Ownership:*** *Attached you will find the cost of ownership evaluation prepared by Musco Sports Lighting. This analysis is specific to the energy consumption for the existing sports lighting at the MVRHS game field and shows an anticipated savings of $119,760 over the specified 25-year warranty period. The conversion to LED sports lighting at MVRHS also has the added benefit of reducing CO2 emissions by 98 tons over the same period. That is the equivalent of taking 21 cars off the road for one year.*

2. ***Lighting Design & Lighting Control System.*** *Please refer to the attached lighting design and lighting control system information provided by Musco Sports Lighting.*

3. ***IDA Community Friendly Sports Lighting Program.*** *As you are aware, the proposed sports lighting system is being designed and manufactured by Musco Sports Lighting. Musco has reviewed the plans, details and specifications and certified to the MVRPS that the system is complaint with IDA Community Friendly Sports Lighting Standards. Although we are confident in Musco's certification that the IDA standards have been met, the MVRPS is willing to formally submit the system to IDA, and incur the additional $4,000.00 expense, if requested by the MVC or OBPB to do so.*

C. Also, the lighting plan shown on page 24 of the Q&A between Huntress and HW shows lumens extending beyond the track perimeter and limit of work. The applicant should confirm that the increased lumens anticipated at the boundary with the Edgartown-Vineyard Haven Road will not have any adverse effects on traffic or pedestrians.

Response: The plan referenced above is the Zero Grid Photometric Analysis prepared by Musco Sports Lighting, dated July 23, 2020. This plan shows the anticipated "worst case" limits of foot-candle readings on the ground plane but does not take into account vertical elements that would exist above the ground plane, such as vegetation or buildings. The readings shown to project into Edgartown-Vineyard haven road in a worst-case scenario range from 0.1 to 0.4 foot-candles. These readings would not have adverse effect on vehicles or pedestrians and would likely be much lower given the significant vegetative buffer that exists between the proposed field and the property line.

7. The proposed short-term wastewater management is feasible, but not an ideal or sustainable long-term solution. The applicant is proposing 21 new toilets generating a total of 83,211 gallons/year to replace 5 permanent and 3 portable toilets that are currently on site. The Oak Bluffs Wastewater Treatment Facility does not have capacity to handle the flow at this time, the applicant proposes to store sewage in a 18,000 gallon tight tank that will be pumped on average every 30 days for 9 months of the year and hauled to the Edgartown Wastewater Treatment Facility. The applicant provided calculations for an annual wastewater flow and the tight tank design, which would be used until capacity is available at the Oak Bluffs Wastewater Treatment Plant. The annual wastewater calculation showed the flow for the Fall and Spring events and the average flow per month to the tight tank, which indicated that the tight tank may need to be pumped more frequent in the Fall than the Spring. While this information may be sufficient for the current stage of the application, the applicant will ultimately need to provide an average daily flow in gallons per day for the future sewer connection to Oak Bluffs sewer system. Additional comments (comments provide by F.P Lee, PE) about the tight tank design include:

Response: Due to the cost of effluent pumping the applicant has elected not to construct the building until such time as it can be serviced by an approved wastewater connection. We would respectfully request that the MVC continue to review the building as part of this application and include a condition in any DRI approval that requires a connection to the municipal system, or other such system as approved by the Oak Bluffs Board of Health, prior to issuance of a building permit.

Further, we have confirmed with Mike Ciancio, Oak Bluffs Plumbing Inspector, that no additional plumbing review will be required if the proposed seating capacity does not exceed the existing seating at the present varsity game field. Spectators will continue to use the existing facilities in the High School and two (2) additional port-potties, as they do today. The size of the proposed grandstand will be reduced to match the existing seats at the current field. We will be resubmitting the grandstand plans and details at a future date, under separate cover.

A. Applicant has not provided calculations for daily peak wastewater flow during the spring and fall seasons, nor the calculation for frequency of pumping during those seasons. The average monthly flow (9,245 gallons/month) includes the winter months, when usage would likely be much lower. Therefore, pumping every 30 days is not reasonable for the busier seasons of fall and spring. Applicant should provide those materials for further review. *Response: Please refer to our response to item #7, above.*

B. Applicant has not provided information on the party responsible for tight tank operation. *Response: Please refer to our response to item #7, above.*

C. The discharge pipe should be at least 3-inch in diameter to handle any solid passing through. *Response: Please refer to our response to item #7, above.*

D. The discharge pipe inside the pump chamber (or wetwell) and vault should be ductile iron pipe and fittings. If this setup is for a short period of time, schedule 80 PVC is acceptable. *Response: Please refer to our response to item #7, above.*

E. A valve vault should be provided to isolate each pump. No operator will enter to pump chamber (or wetwell) to make any valve adjustment. *Response: Please refer to our response to item #7, above.*

F. The wetwell and tight tank are classified as Class 1 Division 1. *Response: Please refer to our response to item #7, above.*

G. The float switches in wetwell and tight tank should be connected to junction boxes aboveground with proper electrical seal on all conduits from wetwell and tight tank. There is a seal wye showed on the pump chamber. *Response: Please refer to our response to item #7, above.*

8. Even though proposed landscaping is not integrated with stormwater management, it does showcase native species and offers an opportunity for replanting of species that may be cleared from the site in the future. The landscape plan includes new plantings around the perimeter of the new track, landscaped areas at the entrance to the field and track, and trees in the new islands within the parking lot. Several comments are provided below and on attached annotated PDF (comments from Brian Laverriere):

A. It appears that the cluster of trees proposed along the southern edge of the field are in close proximity to the proposed recharge chambers. The applicant should confirm that sufficient distance from the infiltration trench/recharge chambers is maintained.

Response: We have updated the plant list to include the suggestions noted above. Please refer to updated sheet L-3 Landscape Plan, attached.

B. Consider planting additional tree and shrub species that are likely to be cleared from the site during future phases of the master plan.

Response: The applicant is not proposing any work beyond that shown on the record plans entitled "Athletic Field Improvements – Phase One" by Huntress Associates, Inc, dated January 22, 2020 and revised May 18, 2020. Should work in that area be considered in the future we would expect to comply with the regulations and procedures in place at that time.

C. Consider planting more vegetation to create a better buffer between the site and the

Edgartown-Vineyard Haven Road.

Response: We have updated the plant list to include the suggestions noted above. Please refer to updated sheet L-3 Landscape Plan, attached.

D. Maples are used in several locations, including adjacent to the entrance area and in the islands within the parking lot. Maples have a relatively shallow root system and when planted next to paved areas may cause heaving over time. Nyssa, Liquidambar or Bur Oak may be a good substitute.

Response: We have updated the plant list to include the suggestions noted above. Please refer to updated sheet L-3 Landscape Plan, attached.

E. One of the grasses proposed is Miscanthus, which has invasive tendencies. HW recommends using Muhlenbergia instead, which is native. In addition to Miscanthus, the applicant proposed three other non-native grasses. HW recommends the applicant replace these grasses with native species. These plantings are also very public and are an opportunity to expose students and visitors alike to native species.

Response: We have updated the plant list to include the suggestions noted above. Please refer to updated sheet L-3 Landscape Plan, attached.

F. Provide an estimated budget for landscape maintenance.

Response: The estimated budget for maintaining the landscape planting areas shown on sheet L-3, details #2, #3 & #4 would range from $6500-$7500 in total, annually. As these are highly visible locations the MVRHS should consider engaging the business community in adopting the care of these spaces in exchange for small and simple signage acknowledging the contribution. We have found other clients to have considerable success using this model on high visibility locations.

9. Several options in the master plan require clearing of mature forest in the southeast corner of the site, which is within BioMap 2 Core Habitat. This area was identified in 2008 as priority habitat by NHESP but was subsequently excluded during the 2017 update when the area was aligned with the property boundary. The southwest corner of the athletic field complex is now part of the Core Habitat for species of conservation concern (Figure 1). If this area is to be considered for clearing, we recommend the applicant conduct a more thorough inventory of the species present and the number of trees that will be removed. It is unclear if development of this portion of the site will conflict with open space requirements for the property as a whole, or if mitigation could be offered. This area is part of the forested corridor connecting critical habitats on the north and south side of the road. Further clearing will add to fragmentation issues, habitat loss, and increased invasive species.

Response: The area shown on Figure 1 in the HWG peer review letter dated 8/13 and identified as BioMap2 Core Habitat is outside the limit of work associated with this application. The applicant is not proposing any work beyond that shown on the record plans entitled "Athletic Field

Improvements – Phase One" by Huntress Associates, Inc, dated January 22, 2020 and revised May 18, 2020. Should work in that area be considered in the future we would expect to comply with the regulations and procedures in place at that time.

Thank you for your time and consideration. Please let me know if you have any questions or require any additional information to complete your review.

Sincerely.
Huntress Associates, Inc.

Christian C. Huntress
President

Cc: Alex Elvin, General Planner, MVC
Anne Kitchell – Horsley Witten Group
Matthew D'Andrea – MVRPS Superintendent
Richard Smith – MVRPS Asst. Superintendent
Kimberly Kirk – Chair, MVRHS School Committee
Joseph Sullivan – Daedalus Projects, Inc.
Oak Bluffs Planning Board

Att:
1. Updated Plan Set: Athletic Field Improvements – Phase One (Rev 9.23.20)
2. Updated Stormwater Report – Revised 9/16/20
3. Letter to Adam Turner from Joe Fields dated February 4, 2020.
4. Tencate Press Release dated July 14, 2020.
5. Email to Alex Elvin, MVC General Planner, dated 7/16/20
6. Musco Sports Lighting – Cost of Ownership
7. Musco Sports Lighting – Lighting Design & Control

GreenFields
HIGH PERFORMANCE TURF

North America

4 February 2020

Mr. Adam Turner, Director
Martha's Vineyard Commission
PO Box 1447
Oak Bluffs, MA 02557

Dear Mr. Turner,

I am writing to highlight Tencate Grass's commitment to recycling synthetic turf and to also explain why our newest product, Ironturf™ by Greenfields, can be considered a cradle-to-cradle recyclable product.

First, in May 2019 Tencate Grass announced our participation in a joint venture agreement with GBN, a leading European recycling company, to build a facility dedicated to completely recycling used synthetic turf from all sources. Construction of this facility began at the port of Amsterdam in the Netherlands last summer. Being located at the port enables us to receive turf from virtually any location in the world. This facility has the capacity to recycle 1,000 athletic fields per year and will be fully operational in April, 2020. Our recycling process will be monitored and certified by Kiwa, a third-party leader in that field in Europe.

For perspective, a typical 85,000 sq ft athletic field and the accompanying infill materials can be shipped to Amsterdam quite easily. So, we will have the capability to completely recycle any synthetic turf, from any source, anywhere in the world, this spring.

This is a link to a video that describes the recycling process: https://youtu.be/rEmkXYLL0xg

Second, we are very excited about the product that has been specified for your project, Ironturf ™, by Greenfields. Our woven Ironturf ™ is unique in that is not only recyclable, as is other synthetic turf, but it affords us the opportunity to achieve a cradle-to-cradle certification where other turf products cannot reach this standard. Stated simply, our woven Ironturf ™ is made of components that are all part of the polyolefin family and can therefore be re-pelletized and put back into the exact same production stream to create the fibers for new synthetic turf fields.

The Ironturf ™ woven product is unique because it is mechanically bound together (think of a Persian rug), while all other turf products are tufted through a polyester backing material and then coated with polyurethane (think of a bathmat) creating a chemical bond. Since the woven Ironturf ™ does not rely on a coating for its structural integrity, it requires no polyurethane coating and contains no polyester backing so the woven product, when recycled, produces a homogenous resin that can be used in making fibers for new synthetic turf fields. At present, only our woven turf can meet the demands of cradle to cradle certification. While tufted turf may be recycled and converted into resin pellets that can then be used in other

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products (like plastic lumber, plastic injection molded pallets, etc.), the recycled resin from traditional tufted turf cannot be used in homogeneous products like the fibers used in producing new synthetic turf. To be clear, we have not yet achieved that cradle-to-cradle certification because none of our woven fields are close to end of life and we have not yet had the need to recycle one, but our aim is to achieve that certification.

Separately, not only does the woven product have the chemical makeup to achieve cradle-to-cradle recyclability certification, it is demonstrably stronger and is more durable than standard tufted synthetic turf (again the construction is the key and the aforementioned analogy between the Persian Rug and bathmat is applicable).

We can guarantee that ANY synthetic turf field that is installed at Martha's Vineyard can be recycled through our process at our new joint venture plant in the Netherlands and we are willing to provide chain-of-custody documentation at the time of removal. Furthermore, we are in the planning stages for a similar recycling facility in the US and we are confident that our US-based recycling facility will be on-line within the next 24 months.

Please feel free to contact me with any questions.

Best Regards,

Joe Fields
President, Tencate Grass Americas
dba Greenfields
Mobile: +1 (770)710 8982

Cc: Chris Huntress

July 14, 2020

Sports company Rotterdam sees its own artificial turf rolls roll through the process of GBN AGR!

In July 2019, CSC Sport renovated various synthetic turf pitches for Sportbedrijf Rotterdam.
The old artificial grass fields that were released were then transported to the (emergency) storage location of GBN Artificial Grass Recycling. Sports company Rotterdam then "followed" the mats to ensure that their artificial grass was stored in a licensed location and then recycled. Sportbedrijf Rotterdam also had an important requirement in the specifications; the artificial grass had to be fully recycled within 1 year after being rolled up.

It is now July 2020. A year later. The construction of the GBN AGR synthetic turf recycling factory is finished and the machines are running. Time to invite Sportbedrijf Rotterdam again!

Because each synthetic turf field is given a separate waste flow number / batch number at GBN AGR, it is also possible to trace the rolls one year after collection. This allowed Sportbedrijf Rotterdam to see for themselves how their own artificial grass was recycled.

Ed van der Burg, Sportbedrijf Rotterdam: *"As Sportbedrijf Rotterdam, we would like 100% certainty that our depreciated synthetic turf mats are processed in a responsible manner. We have set ourselves the obligation to follow the recycling process, so that we were sure that the artificial grass would not, for example, still be in intermediate storage after a year. Fortunately, we have seen that the artificial grass at GBN AGR is all neatly recycled! "*

(From left to right: Wilko Zuidema (Technisch Bureau Zuidema), Ed van der Burg (Sports company Rotterdam), Eric van Roekel (GBN AGR), André Ceelen (CSC Sport), Don Lauritsen (GBN AGR)

GBN AGR stands for transparent recycling and therefore warmly invited Sportbedrijf Rotterdam to show the entire process.
Sports company Rotterdam, thank you for your confidence and have fun with the new synthetic turf pitches!

Share this article:

From: Chris Huntress
To: Alex Elvin; Lucy Morrison
Cc: Smith Richie; Kimberly Kirk
Subject: FW: MVRHS staff report questions
Date: Thursday, July 16, 2020 9:24:00 AM

Alex, Below is the reply from Greenfields with regard to your question about the recycling facility in the Netherlands and US. As you will see, they have attached a press release dated 7/14/20 that confirms the Netherlands facility is up and running. They have also started that there plans for a US facility are still on track. Let me know if you have any further questions.

Thanks

Chris

Christian C. Huntress, RLA
President

HUNTRESS *Sports*

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www.sportsfieldaerials.com

From: Curran, Mark <m.curran@greenfieldsusa.com>
Sent: Thursday, July 16, 2020 9:09 AM
To: Chris Huntress <chris@huntressassociates.com>
Subject: RE: MVRHS staff report questions

Chris,

The link below is a press release from 7/14/2020 announcing the opening of the GBN facility in the Netherlands. It is in Dutch. I have attached a screen shot provided by Erica which translates the first page. GBN is our partner in this undertaking.
I have asked a friend in Amsterdam if she could translate the entire link for me.
Regarding the plant here in the USA, plans are still on track. There is no clear date as of today. I wouldn't want to mislead anyone by saying otherwise. COVID 19 has changed immediate priorities. However, TenCate is committed to the recycling of turf here in the US.

http://tcgrwebgrfieu.azurewebsites.net/

Thanks, Mark

Mark Curran
Northeast Sales, Business Development
304 Naples RD
Harrison, ME. 04040
m.curran@greenfieldsusa.com
Cell: 978-761-5340

From: Chris Huntress <chris@huntressassociates.com>
Sent: Wednesday, July 15, 2020 6:42 PM
To: Curran, Mark <m.curran@greenfieldsusa.com>
Subject: RE: MVRHS staff report questions

***** INFORMATION: This is an external mail originating outside the TenCate Grass mail system.**

Mark, two things…First, please ignore any email you got from me today concerning an RFP. My email was hacked and the note is spam. Sorry.
Second, please let me know if you hear back from Joe or can provide an update on the recycling facilities mentioned in his February letter, attached.

Thanks

Chris

Christian C. Huntress, RLA
President

HUNTRESS *Sports*

17 Tewksbury Street
Andover, MA 01810
c: 978.758.6290
p. 978.470.8882
f. 978.470.8890

www.huntressassociates.com
www.sportsfieldaerials.com

From: Curran, Mark <m.curran@greenfieldsusa.com>
Sent: Tuesday, July 14, 2020 8:52 PM
To: Chris Huntress <chris@huntressassociates.com>
Subject: RE: MVRHS staff report questions

Just sent to Joe, want to get this right.

From: Chris Huntress <chris@huntressassociates.com>
Sent: Tuesday, July 14, 2020 8:42 PM
To: Curran, Mark <m.curran@greenfieldsusa.com>
Subject: FW: MVRHS staff report questions

***** INFORMATION: This is an external mail originating outside the TenCate Grass mail system.**

Mark, I hope all is well…and I have another question for you regarding the Vineyard Project. Can you please refer to question #2 below and let me know if you, or someone at Greenfields/Tencate, could answer those. They are referring to the recycling facilities mentioned in Joe Field original letter to Adam Turner.

Thanks, and have a great night.

Chris

Christian C. Huntress, RLA
President

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Andover, MA 01810
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p. 978.470.8882
f. 978.470.8890

www.huntressassociates.com
www.sportsfieldaerials.com

From: Alex Elvin <elvin@mvcommission.org>
Sent: Tuesday, July 14, 2020 6:44 PM
To: Chris Huntress <chris@huntressassociates.com>; rsmith@mvyps.org
Subject: MVRHS staff report questions

Hi Chris,

We are finishing up the Athletic Fields DRI staff report, and I had couple quick questions.

1 - Can you send a version of L5 from the Athletic Fields Master Plan that shows the current phase 1 for Option B?

2 - Has the recycling facility in the Netherlands already been built, and is the one in Georgia still on track?

Thanks,

Alex

Alex Elvin
General Planner
Martha's Vineyard Commission
The Olde Stone Building
33 New York Avenue
Oak Bluffs, MA 02557
(413) 884-3289

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If the disclaimer doesn't appear as a live link, just copy and paste the link in your browser.

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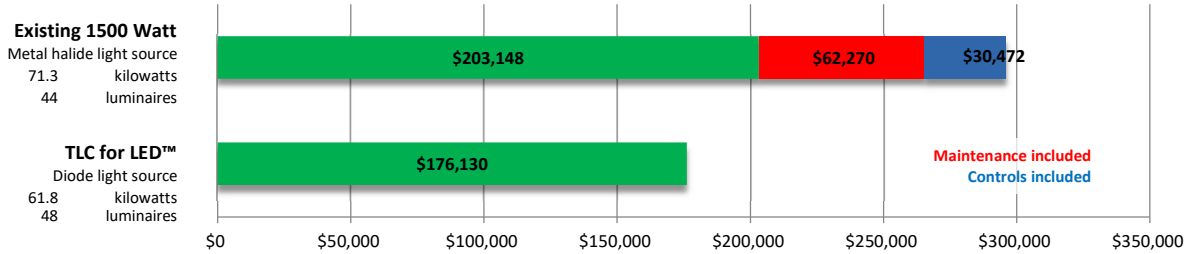
If the disclaimer doesn't appear as a live link, just copy and paste the link in your browser.

25-Year Cost of Ownership Comparison

Martha's Vineyard McCarthy Field

Prepared For:

Chris Huntress



Energy Maintenance Controls

How is this possible? Musco's 40 years of developing systems, light control, and application expertise puts more available lumens per watt on the field. Our services team provides all on/off operation, monitoring, and maintenance.

For your budget . . . for the environment

Musco LED

25-Year Ownership Savings

$119,760

CO2 reduction

98 tons**

** Equivalent to taking **21** cars off the road for one year

Assumptions

Annual operating hours	600
Energy:	
Energy cost per kilowatt hour	$0.19
Demand charge per kilowatt hour	$0.00
Maintenance:	
Group relamp - cost per luminaire	$266
Spot maintenance over 25 years	$3,750
Controls:	
Labor - turning lights on & off	$0.00
Lights on extra time without controls	15%

We Make It Happen.

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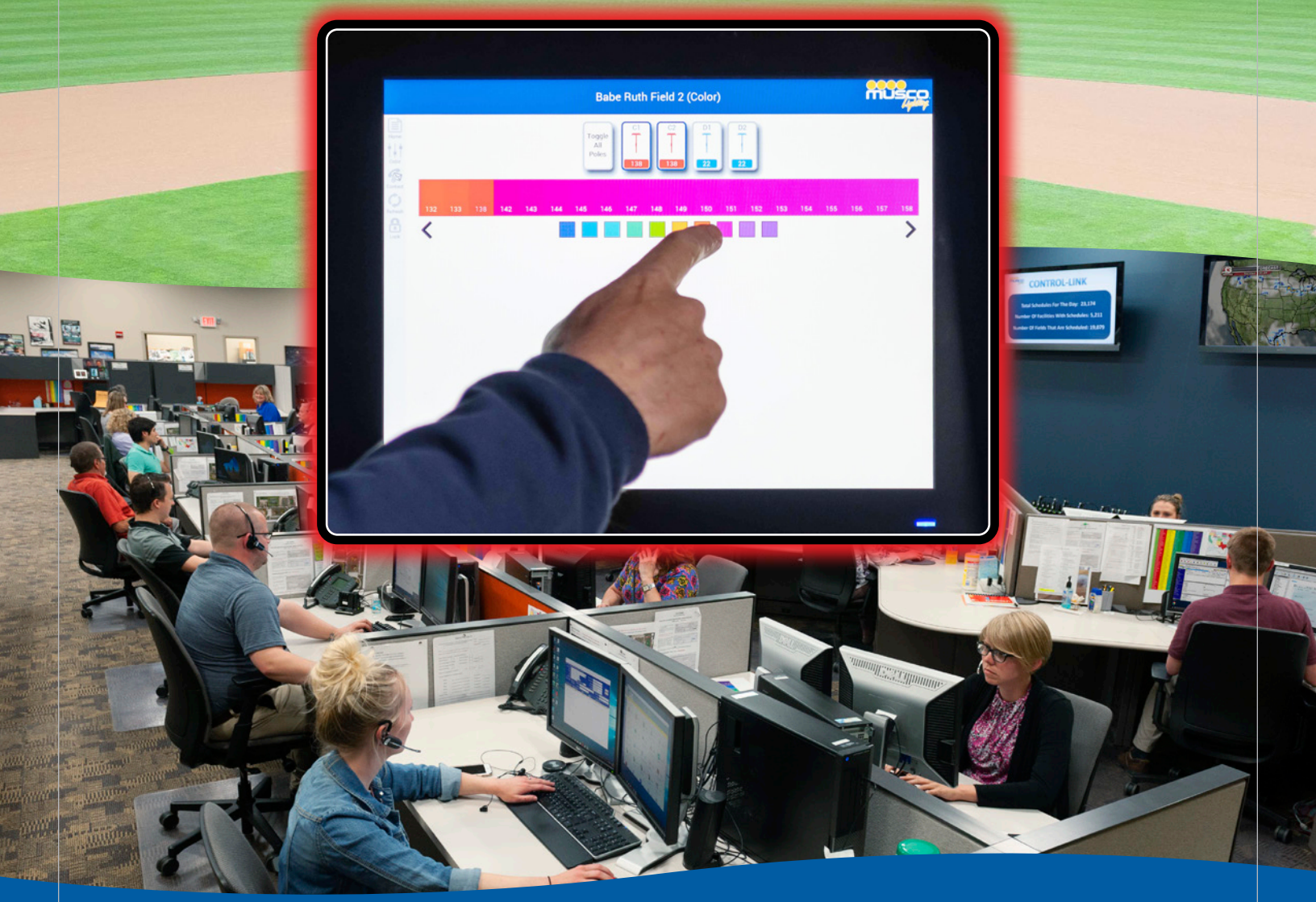
179299

Musco Control Solutions

24/7/365 monitoring and support

Control·Link® control and monitoring system

Show·Light™ entertainment package



We Make It Happen®

Making Facility Management Easy Since 1999

The most innovative solutions are developed in response to real-world problems. In 1999 Musco introduced Control-Link® as a first-of-its-kind light management system to help customers who were getting calls from neighbors at 2 a.m. about lights left on, to help cut energy costs, and save staff time.

Since that first introduction, Musco has installed thousands of control systems from fully automated unmanned recreational sites to complex theatrical solutions for many of the largest stadiums in the world.

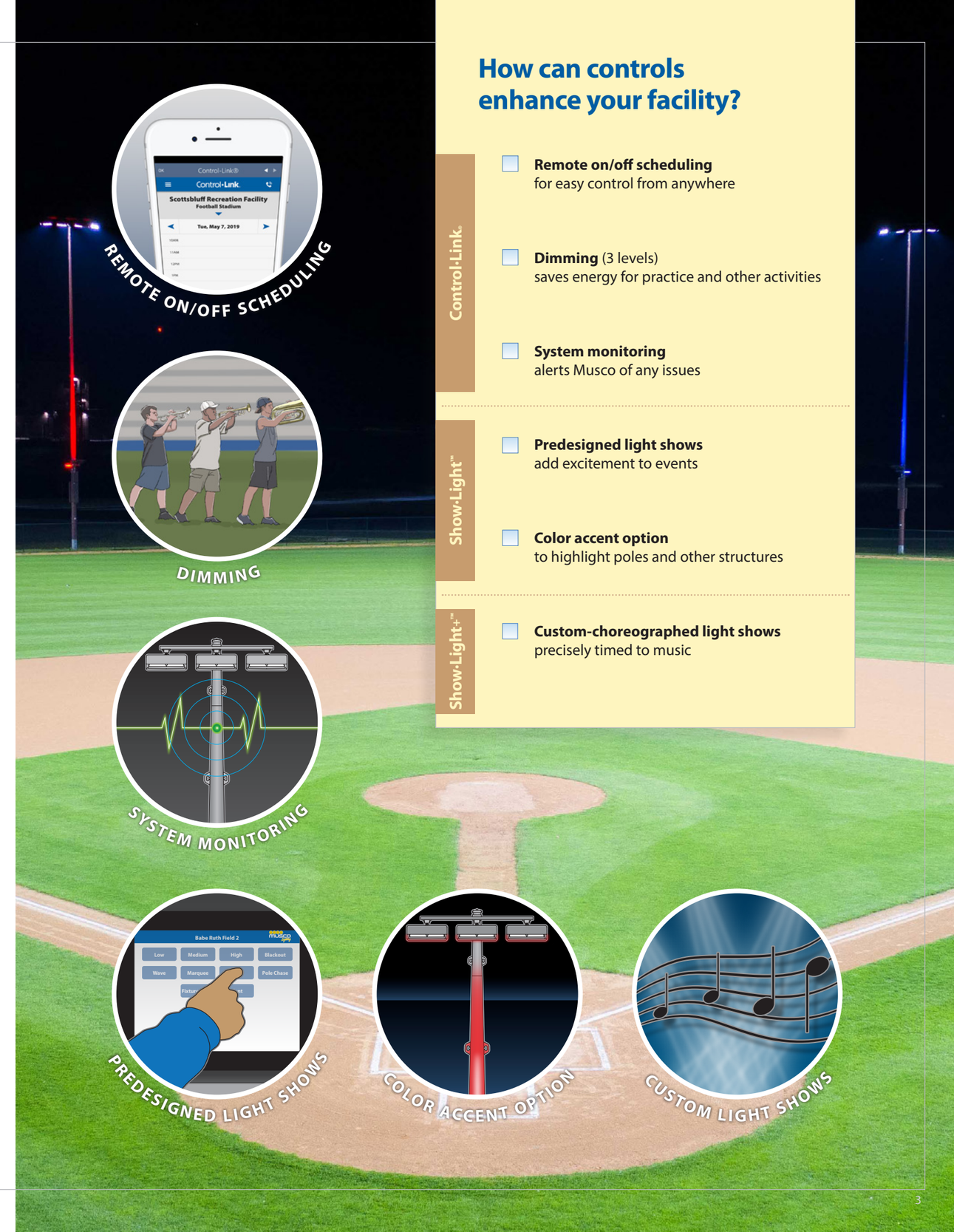
Anytime, Anywhere . . . Control-Link management tools allow you to access and manage your lights instantly, from anywhere via a cellular internet connection.

A Real, Live Voice . . . Control-Link Central™ team will monitor, schedule, and help manage your lights 24/7/365, and a real live voice will be on the other end of the phone when you call.

Factory Wired, Programmed, and Tested . . . our unique system approach streamlines installation and assures that your controls, from basic on/off to professional level light shows, will be ready to work on day one.

5.8 million
schedules managed and monitored by our Control-Link Central™ Team last year

360,000
calls fielded to assist customers last year



How can controls enhance your facility?

Control-Link®

- **Remote on/off scheduling** for easy control from anywhere
- **Dimming** (3 levels) saves energy for practice and other activities
- **System monitoring** alerts Musco of any issues

Show-Light™

- **Predesigned light shows** add excitement to events
- **Color accent option** to highlight poles and other structures

Show-Light+™

- **Custom-choreographed light shows** precisely timed to music

Flexible Control, Solid Management

Your Control-Link® control and monitoring system offers efficient, cost-effective tools that are both cutting-edge and simple to use.

Musco will have your back 24/7/365 to ensure your lights are only on when needed, keeping neighbors and taxpayers happy. Because more than anything, it's about your peace of mind.

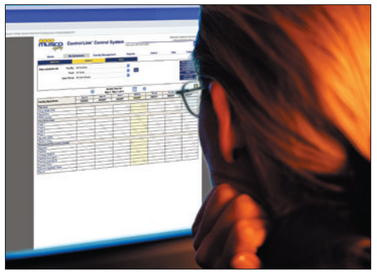
The Control-Link system provides comprehensive scheduling assistance, system monitoring, secure password-protected access, automated equipment controls, and valuable usage data.

Flexible and Reliable . . . remote scheduling and controls mean no more staffing headaches, tracking multiple sets of keys, or late-night hours being on-site to turn your lights off.

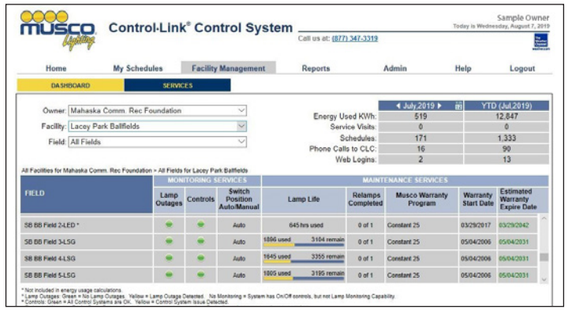
24/7/365 Monitoring . . . our Team will monitor your system's performance at the luminaire level, so if an issue arises we'll likely know about it before you do.

Better for Your Budget . . . automated operation of your lights, as well as three levels of dimming that come standard, will reduce energy consumption and cut staffing costs.

Data You Can Use . . . we'll help create usage reports and analytics for your facilities from the extensive data we store, which will help improve operational efficiencies and future planning.



Enter schedules up to 10 years in advance.



Dashboard tracking allows you to see the operation and service status of your fields.

Musco Control-Link Usage Report (Auto Only)
By Facility, Field
Usage Type of Light Usage
June, 2019

Summary by Facility

Facility	Total Auto Hours Usage	Total Hours Saved from Early Offs
Cowley	112:50	17:08
Dunbar	64:53	29:46
Garland Parklet	49:48	0:00
Herschel Field	256:47	26:05
Total:	**484:18**	**72:59**

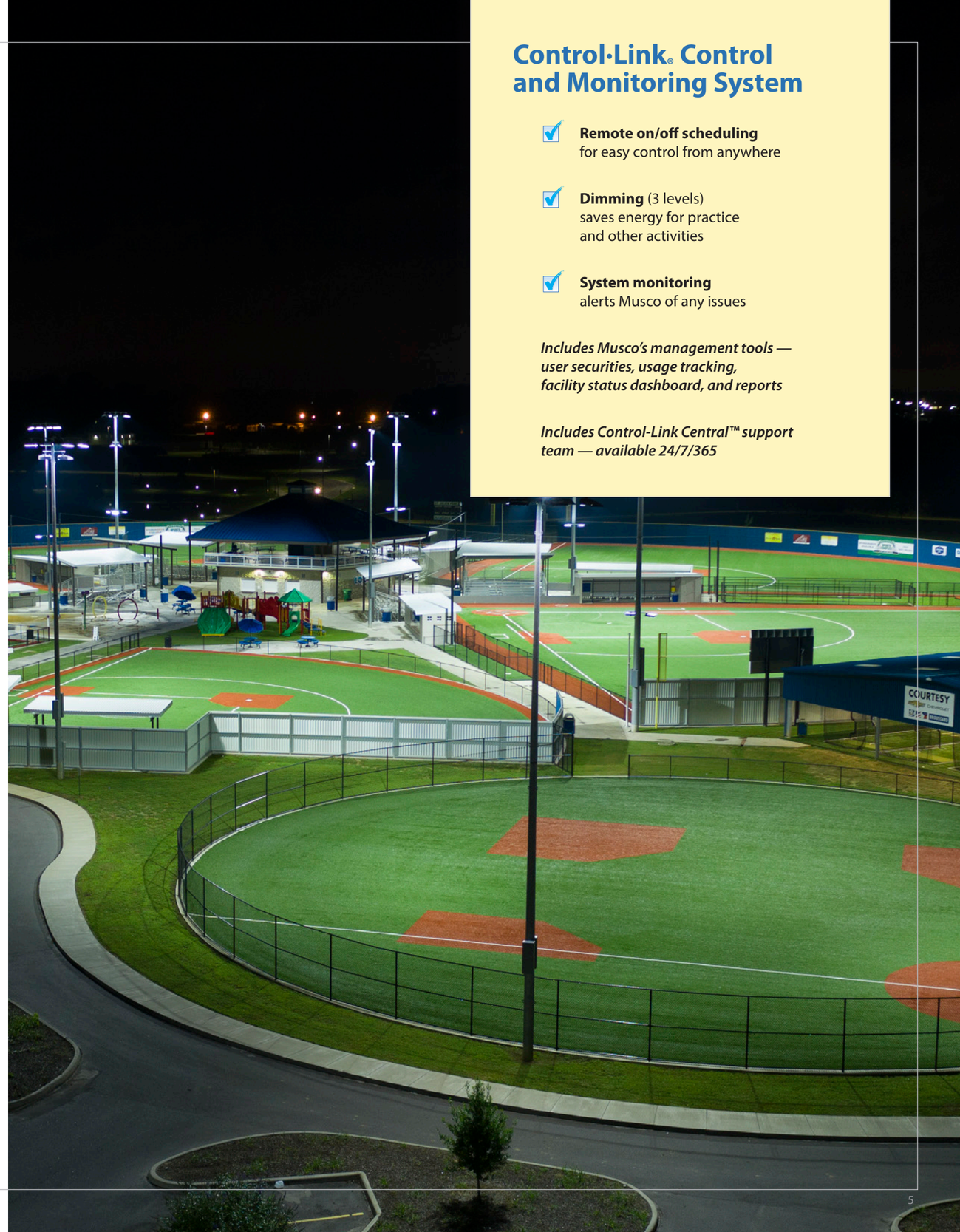
Summary by Facility, Field

Facility	Field	Total Auto Hours Usage	Total Hours Saved from Early Offs
Cowley	Baseball	63:04	17:08
Cowley	Basketball	49:46	0:00

Control-Link Central database stores usage data by field and user group.

"In the past, a light could've gone out and our guys wouldn't see it for two to three weeks or until a whole pole went dark. Now if one light goes out we get an e-mail notice immediately from Musco's Control-Link Central."

– Chuck Vones, Parks and Recreation Director
Pembroke Pines, Florida



Control·Link® Control and Monitoring System

- **Remote on/off scheduling** for easy control from anywhere
- **Dimming** (3 levels) saves energy for practice and other activities
- **System monitoring** alerts Musco of any issues

Includes Musco's management tools — user securities, usage tracking, facility status dashboard, and reports

Includes Control-Link Central™ support team — available 24/7/365

Big Time Light Shows at Hometown Fields

Our Show-Light™ entertainment package provides a cost-effective way for you to bring professional light shows to your facility. From pre-game introductions, to halftime shows, to celebrating big plays and big wins, this special effects lighting will energize players and fans and take your game atmosphere to a new level.

Special effects light shows aren't just for the pros anymore.

Musco's Show-Light technology utilizes instant on/off and the advanced control capabilities of LED, is easy to use, and delivers both predesigned and customized light shows.

Set the Scene . . . you'll get preprogrammed light shows that will set the scene and excite players and fans through the entire game night experience.

Plenty of Options . . . you can choose from Musco's library of light shows or work with our design engineers to create customized shows and scenes.

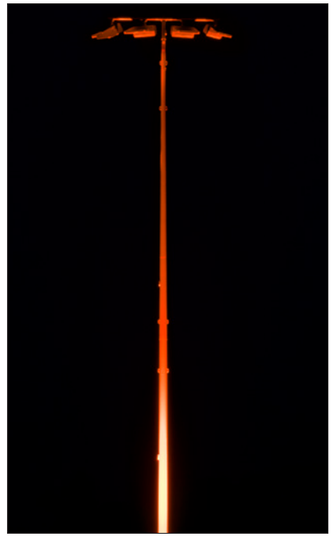
As Easy as a Touchscreen . . . you'll be provided an industrial grade 15-inch smart device with touchscreen to start and stop shows, select dimming levels, and adjust optional accent colors.

Reliable and Versatile . . . your light shows will be stored on site and backed up at Control-Link Central™ data center.

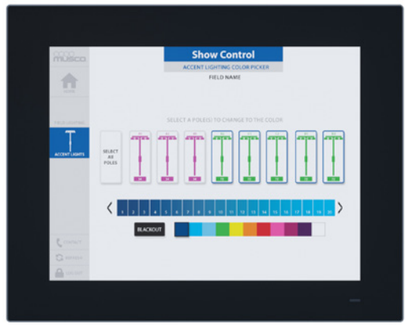
Color Changing Technology Option . . . by adding optional color changing luminaires you can enhance shows with pops of color, color wash, or accent lighting.

"The people Musco has answering the phones and adjusting the schedule are the most friendly and accommodating of any phone service I have ever called. They are always extremely friendly and professional, the service could not be better."

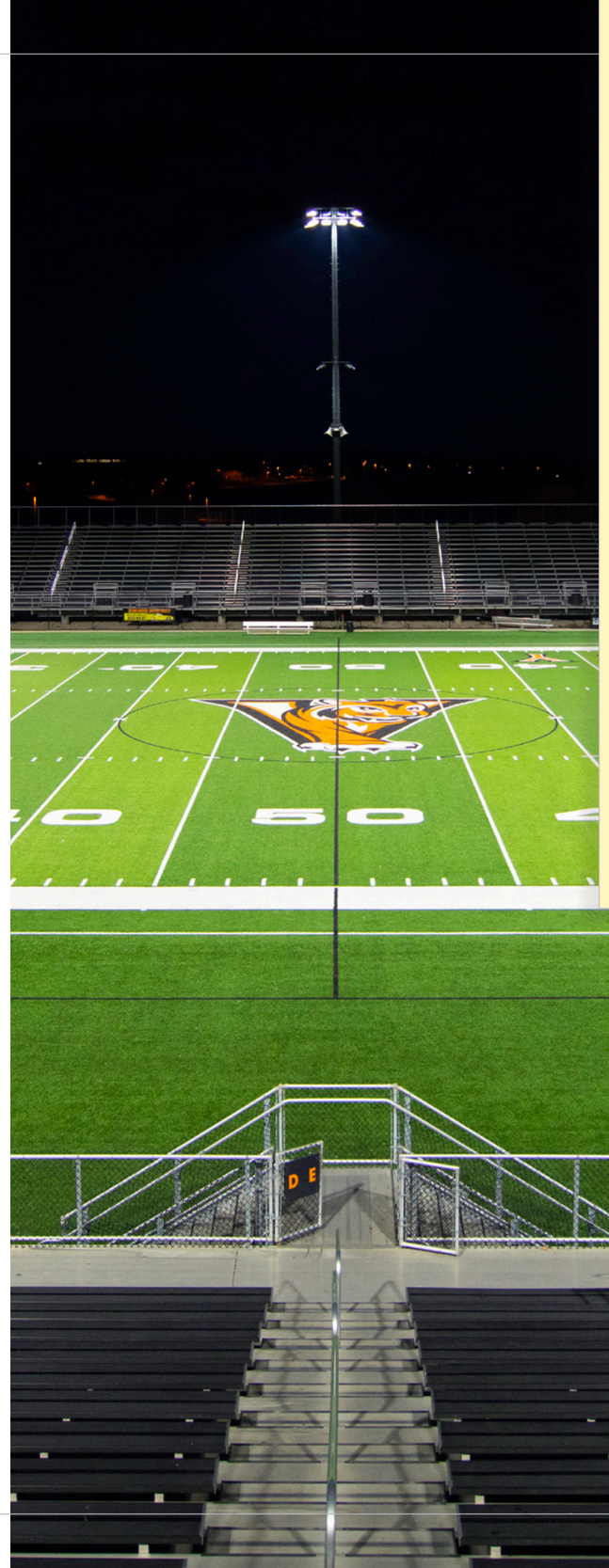
– Mark Buggins, Head Baseball Coach (retired)
Sitka High School



Optional color accent lighting highlights poles or other structures.



With optional color changing luminaires you can choose from over 100 color options to show your team color, highlight special events, or enhance light shows.



Show·Light™ Entertainment Package

- **Remote on/off scheduling** for easy control from anywhere
- **Dimming** (3 levels) saves energy for practice and other activities
- **System monitoring** alerts Musco of any issues
- **Predesigned light shows** add excitement to events
- **Color accent option** to highlight poles and other structures

Includes industrial grade touchscreen tablet for easy control

Includes Control-Link Central™ support team — available 24/7/365

See West Des Moines Valley High School's light shows in action.

Take Your Light Shows to the Next Level

With our Show-Light+™ entertainment package, you'll tap into advanced customization capabilities and more complex light shows that incorporate music along with the special effects lighting. The Show-Light+ system is easy to use and will provide an even more memorable game night experience.

Light and sound shows that mirror what's seen at the biggest and best professional stadiums.

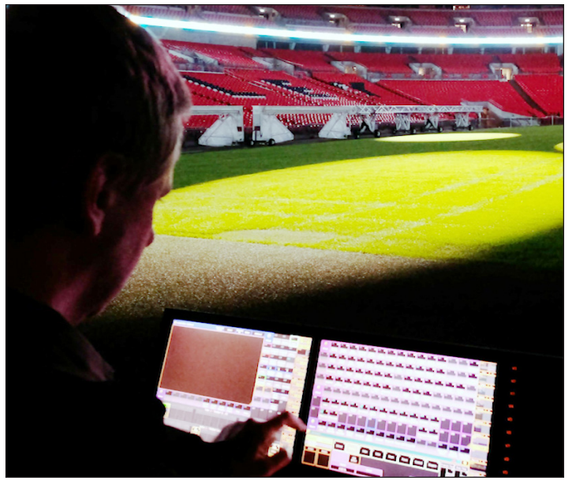
The equipment you'll be supplied with, and the light shows it will deliver, are exactly the same as what we provide our NFL, MLB, NBA, and NHL customers.

Light and Sound . . . in addition to the preprogrammed light shows from the base Show-Light package, you'll get three shows with lights synchronized to your music for an amazing visual and audio experience.

Easy to Use . . . for each light show Musco's design engineers will align lighting cues with audio files played through an on-site server, you just start and stop the shows with an easy-to-use touchscreen device.

Streamlined Solution . . . if you already have a DMX system, Show-Light+ equipment will act as a fully integrated extension of that system.

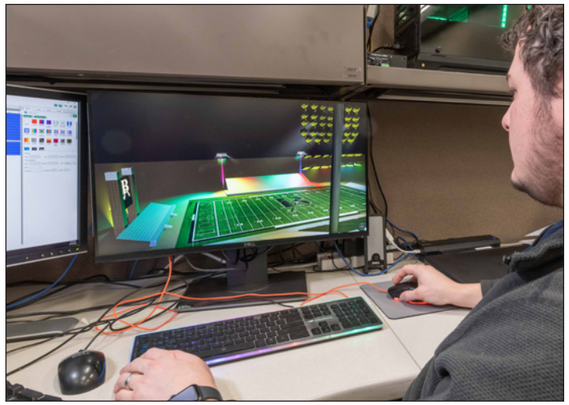
Musco's field lighting shows can interface with your separate controller for other show features, such as pyrotechnics.



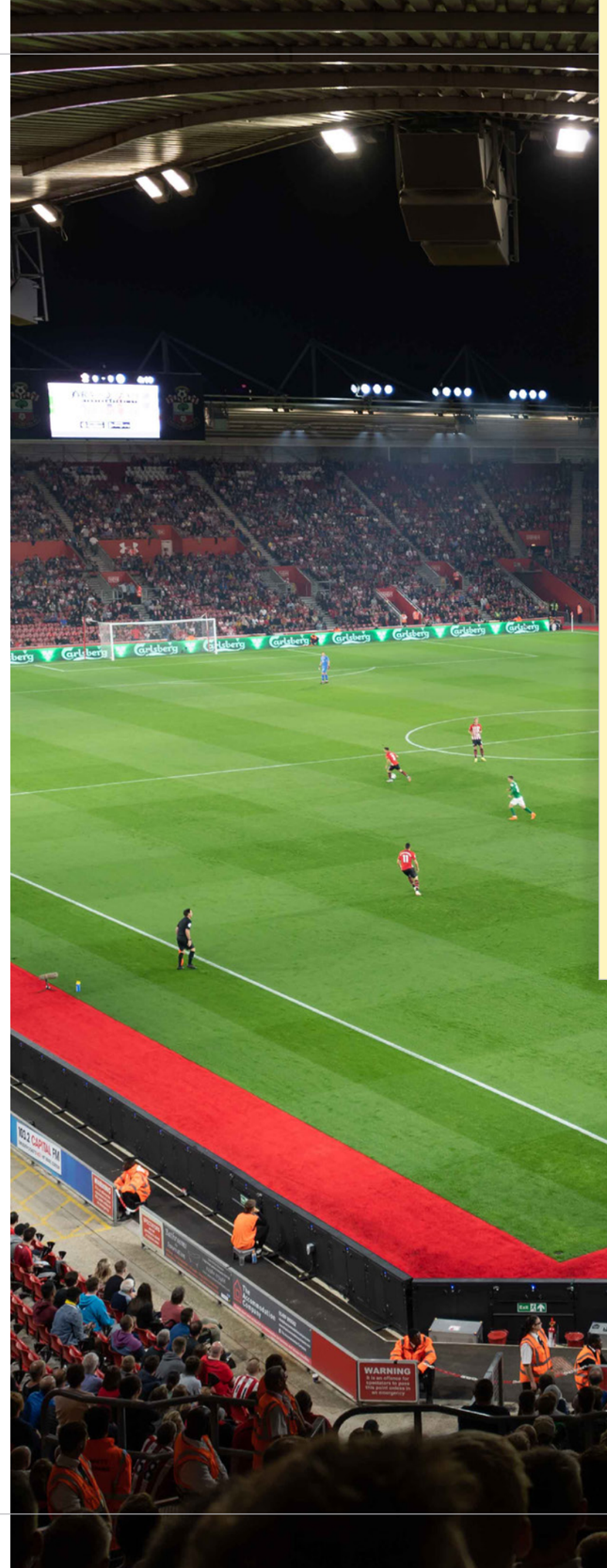
Light shows are operated via an easy-to-use touchscreen.

"The fan reaction has been great. I look for the lights to be as much of an entertainment vehicle as I do fireworks — seventh inning stretch, when we hit a home run, when we win the game. Everybody loves it, particularly when we make the lights flash and dance to the music."

– Sam Bernabe, President & General Manager
Iowa Cubs



Musco's light show programming specialists will custom time shows to your music.



Show·Light+™ Entertainment Package

- ☑ **Remote on/off scheduling** for easy control from anywhere
- ☑ **Dimming** (3 levels) saves energy for practice and other activities
- ☑ **System monitoring** alerts Musco of any issues
- ☑ **Predesigned light shows** add excitement to events
- ☑ **Color accent option** to highlight poles and other structures
- ☑ **Custom-choreographed light shows** precisely timed to music

Includes DMX controller and cue server

Includes Control-Link Central™ support team — available 24/7/365

See Southampton's light shows in action.

Innovative, Streamlined Communications Managed by Our Team 24/7/365

Each component of the Control-Link® system is designed, factory-built and tested for seamless operation and integration with your lighting system.

Proven Technology, Innovated . . . Musco's advanced powerline communication technology provides robust control and monitoring for the system.

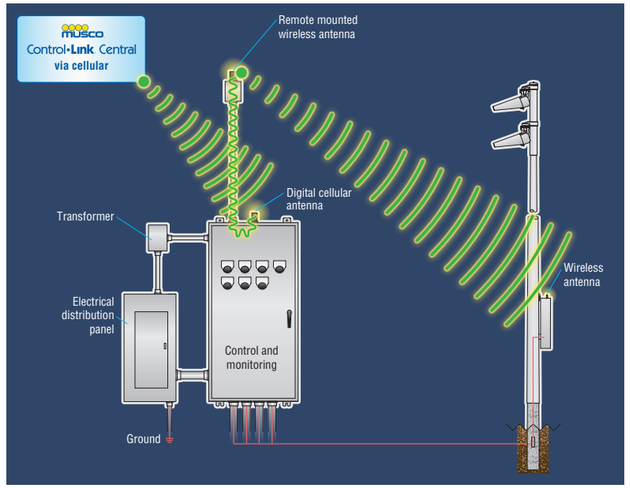
Reliable Installation and Operation . . . no added communication cable installation costs. Lights may be scheduled remotely or operated manually on site with a key switch.

Safety Features . . . electricity is only on when the system is in use, with built-in fusing and surge protection.

Monitoring and Support . . . our Control-Link Central™ Team monitors your system 24/7/365 to ensure schedules execute and to provide assistance.

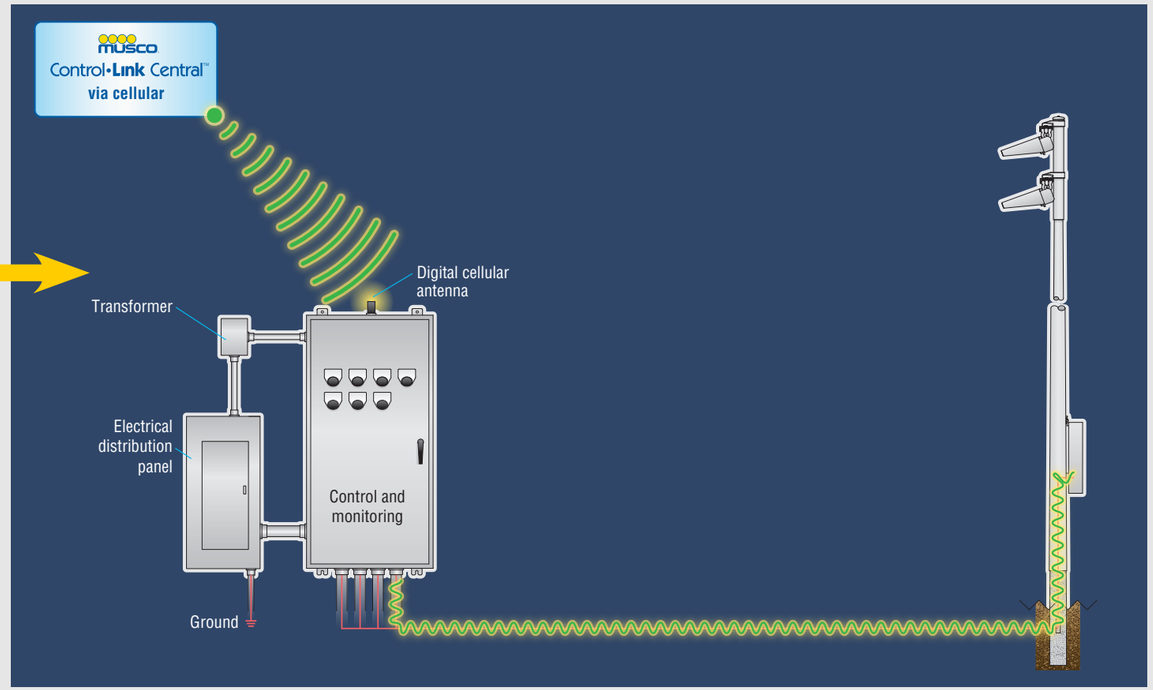
Wireless Communication

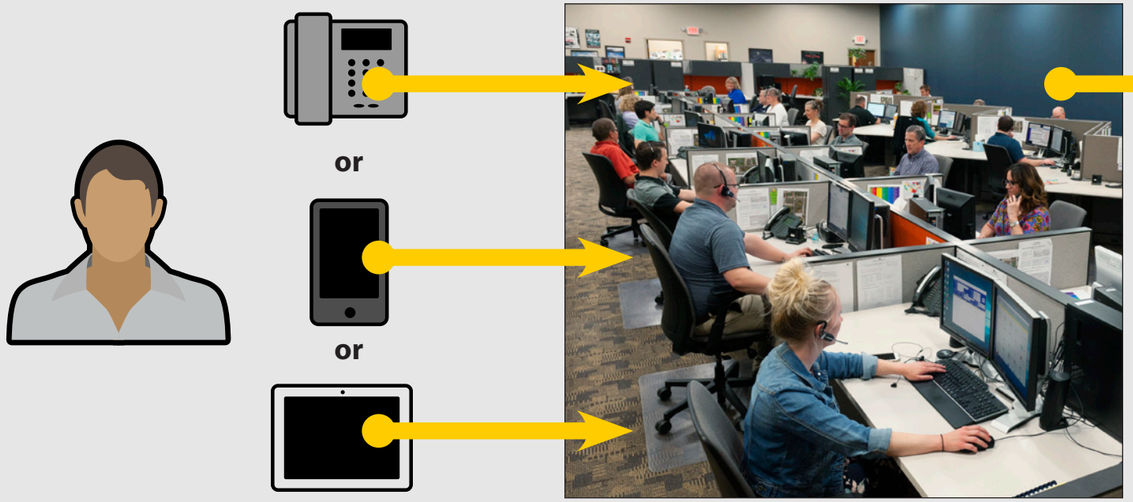
An optional wireless mesh network is available depending on your project requirements



Powerline Communication System™

Uses supply wiring for control commands and monitoring feedback





1) Enter schedules at your convenience

Based on security levels, users schedule field lighting and other equipment such as door locks, concession stands, and security lights from any location via website, smartphone app, or phone call.

2) Control-Link Central™ data center routes schedules, with 24/7/365 team member monitoring support

Schedules are received, routed to your site, and backed up at the Control-Link Central data center, where our staff provides scheduling support and verification, and monitors your lighting system operation.

3) Schedules are stored on-site

Schedules are transmitted to your facility via cellular technology and stored in the on-site equipment controller.

4) Equipment is controlled automatically with on-site show controls

Lights are operated per your schedules via Musco's Powerline Communication System technology. You can control optional Show-Light™ features with the on-site tablet.

5) Continuous monitoring

Entire system is monitored during operation and the Control-Link Central team is notified of any issues.

Unequaled performance . . .
for your budget, for the environment.

We Make It Happen

www.musco.com
e-mail: lighting@musco.com

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STORMWATER REPORT

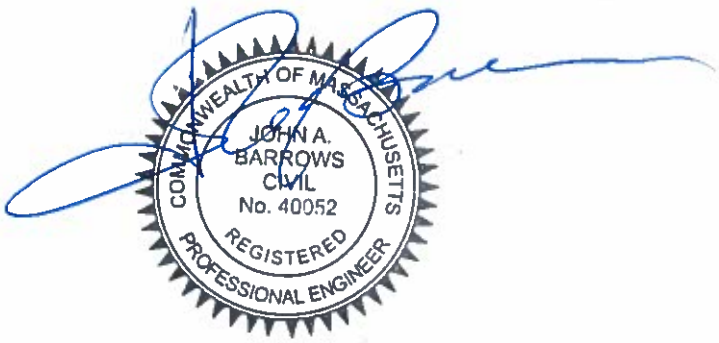
MARTHA'S VINEYARD REGIONAL HIGH SCHOOL
ATHLETIC FIELD INMPROVEMENTS
PHASE 1

OAK BLUFFS, MASSACHUSETTS

Prepared For:
HUNTRESS ASSOCIATES, INC.

Prepared By:
Marchionda & Associates, LP

January 22, 2020
Rev. 9/16/2020



MARTHA'S VINEYARD REGIONAL HIGH SCHOOL
ATHLETIC FIELD IMPROVEMENTS
PHASE 1
STORMWATER REPORT

January 22, 2020
Rev. 9/16/20

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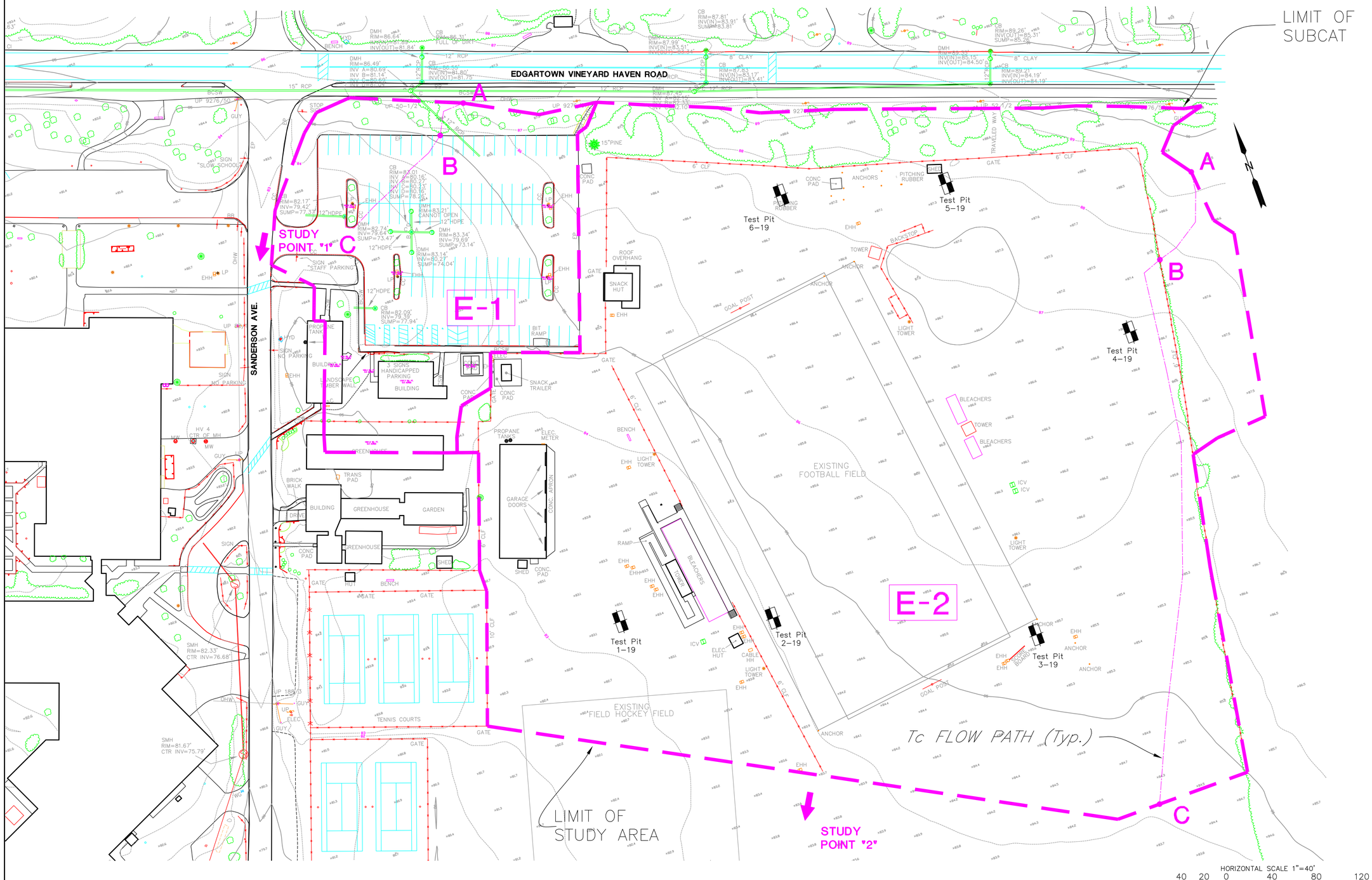

DRW:	DSG:	CHK:	REV.	DESCRIPTION	DATE

PRE-DEVELOPMENT WATERSHEDS

MARTHA'S VINEYARD REGIONAL HIGH SCHOOL

in

OAK BLUFFS, MA

Prepared For

HUNTRESS SPORTS

17 TEWKSBURY STREET
ANDOVER, MA 01810

Marchionda & Associates, L.P.
Engineering and Planning Consultants

62 Montvale Avenue
Suite I
Stoneham, MA 02180
TEL: (781) 438-6121
FAX: (781) 438-9654
Email: engineering@marchionda.com
Website: www.marchionda.com

DATE: 12/30/19

...\670-31 MVRHS\DRAINAGE\PRE-DEV.DWG

M. & A. NO.: 670-31 | SCALE: 1"=40'

SHEET 1 OF 1

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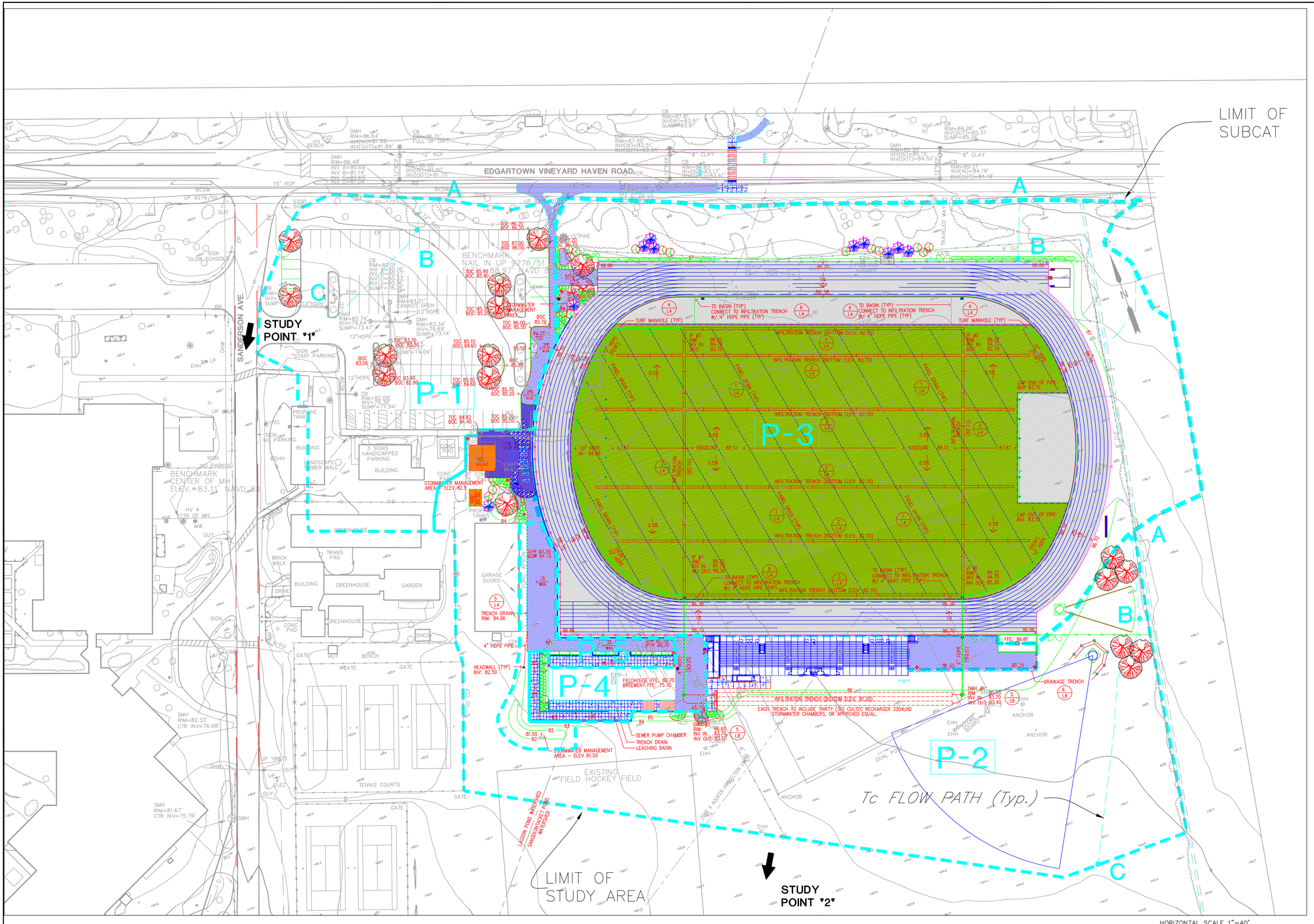

REV.	DESCRIPTION	DATE
1.	PEER REVIEW RESPONSE	9/16/20

DRW: DSG: CHK:

POST DEVELOPMENT WATERSHEDS

MARTHA'S VINEYARD REGIONAL HIGH SCHOOL

in

OAK BLUFFS, MA

Prepared For

HUNTRESS SPORTS

17 TEWKSBURY STREET
ANDOVER, MA 01810

Marchionda & Associates, L.P.
Engineering and Planning Consultants

62 Montvale Avenue
Suite I
Stoneham, MA 02180
TEL: (781) 438-6121
FAX: (781) 438-9654
Email: engineering@marchionda.com
Website: www.marchionda.com

DATE: 1/22/20

...\670-31 MVRHS\DRAINAGE\REV POST-DEV.DWG

M. & A. NO.: 670-31 | SCALE: 1"=40'

SHEET 1 OF 1

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APPENDIX 1

Standard 2 (Peak Flow)

SOILS INFORMATION

Map Scale: 1:5,090 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Dukes County, Massachusetts
Survey Area Data: Version 16, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Nov 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
288A	Riverhead sandy loam, 0 to 3 percent slopes	56.3	90.0%
288B	Riverhead sandy loam, 3 to 8 percent slopes	3.0	4.8%
602	Urban land	3.2	5.2%
Totals for Area of Interest		**62.5**	**100.0%**

Dukes County, Massachusetts

288A—Riverhead sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 98y1
Mean annual precipitation: 41 to 48 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 175 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Riverhead and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riverhead

Setting

Landform: Outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over loose sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 4 inches: sandy loam
H2 - 4 to 16 inches: sandy loam
H3 - 16 to 24 inches: loamy sand
H4 - 24 to 60 inches: stratified sand and gravel

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Tisbury
Percent of map unit: 5 percent
Hydric soil rating: No

Canton
Percent of map unit: 5 percent
Hydric soil rating: No

Haven
Percent of map unit: 5 percent
Hydric soil rating: No

Klej
Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Dukes County, Massachusetts
Survey Area Data: Version 16, Sep 12, 2019

Hydrologic Soil Group—Dukes County, Massachusetts

Map Scale: 1:5,090 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Dukes County, Massachusetts
Survey Area Data: Version 16, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Nov 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
288A	Riverhead sandy loam, 0 to 3 percent slopes	A	56.3	90.0%
288B	Riverhead sandy loam, 3 to 8 percent slopes	A	3.0	4.8%
602	Urban land		3.2	5.2%
Totals for Area of Interest			**62.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Commonwealth of Massachusetts
City/Town of OAK BLUFFS

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MVRHS

C. On-Site Review (continued)

Deep Observation Hole Number: TP 1-19

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
2	A	10YR 3/2	—			SL.	<5	<5	Gm.	VR	DISTURBED TOP SOIL
NO "B" HORIZON											
76	C-1	10YR 7/8	—			S	10	5	S.G.	LOOSE	STRAT. Med.
88	C-2	10YR 8/2	—			S	15	5	SG	LOOSE	STRAT M/C

Additional Notes:
HOLE OBSERVED BY J. BARROWS, MA SE #84 DATE: 11/21/19
NO H_2O OBSVD, ESHWT >88", SOME VERIGATED COLORING

Commonwealth of Massachusetts
City/Town of OAK BLUFFS

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MVRHS

C. On-Site Review (continued)

Deep Observation Hole Number: TP 2-19

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
3	A	10YR 3/2	—			SL	<5	<5	Grn.	VF	GRASS TOPSOIL
NO "B" HORIZON											
72	C-1	2.5Y 5/2	—			S	5	5	SG	LOOSE	STRAT, MED
96	C-2	10YR 7/8	—			S	10	5	SG	LOOSE	STRAT, M/C

Additional Notes:

HOLE OBSERVED BY: J. BARROWS, MA SE#84, DATE 11/21/19
NO H_2O OBSVD, ESHWT > 96"
SOME VERIGATED COLORING IN STRATIFIED LAYERS

Commonwealth of Massachusetts
City/Town of OAK BLUFFS

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MVRHS

C. On-Site Review (continued)

Deep Observation Hole Number: TP 3-19

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—			SL	<5	<5	Gm.	VF	FIELD TOPSOIL
— NO "B" HORIZON					—						
34	C-1	10YR 3/3	—			S	5	5	SG	Loose	STRAT. FINE
96	C-2	2.5Y 3/2	—			S	10	5	SG	Loose	STRAT M/C

Additional Notes:

HOLE OBSERVED BY: J. BARROWS, MA SE#84, DATE 11/21/19
NO H_2O OBSVD, ESHWT > 96
SOME VERIGATED COLORING IN STRATIFIED LAYERS

Commonwealth of Massachusetts
City/Town of OAK BLUFFS

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MVRHS

C. On-Site Review (continued)

Deep Observation Hole Number: TP 4-19

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7	A	10YR 3/2	-			SL	<5	<5	Gran.	VF	DIST. TOP SOIL
— No "B" HORIZON —											
37	C-1	2.5Y 7/8	-			S	5	5	SG	Loose	STRAT. FINE
96	C-2	2.5Y 8/3	-			S	10	5	SG	Loose	STRAT, M/C

Additional Notes:

HOLE OBSERVED BY: J. BARROWS, MA SE#84, DATE 11/21/19
NO H_2O OBSVD, ESHWT > 96"
SOME VERIGATED COLORING IN STRATIFIED LAYERS

Commonwealth of Massachusetts
City/Town of OAK BLUFFS

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MVRHS

C. On-Site Review (continued)

Deep Observation Hole Number: TP 5-19

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
8	A	10YR 3/2	—			SL	<5	<5	GRN.	VF	DRK TOP SOIL
—	NO "B"	HORIZON				—					
40	C-1	2.5Y 6/3	—			S	10	5	SG	Loose	STRAT MED
54	C-2	2.5Y 7/8	—			S	15	10	SG	Loose	STRAT COARSE
96	C-3	2.5Y 6/3	—			S	10	5	SG	Loose	STRAT F/M

Additional Notes:

HOLE OBSERVED BY: J. BARROWS, MA SE#84, DATE 11/21/19
NO H_2O OBSVD, ESHWT >96"
SOME VERIGATED COLORING IN STRATIFIED LAYERS

Commonwealth of Massachusetts
City/Town of OAK BLUFFS

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MVRHS

C. On-Site Review (continued)

Deep Observation Hole Number: TP 6-19

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—			SL	<5	<5	Gm.	VF	DIST. TOPSOIL
—	NO "B" HORIZON						—	—			
38	C-1	7.5YR 7/8	—				10	5	SG	Loose	STRAT. F/M
100	C-2	7.5YR 7/8	—				15	5	SG	Loose	STRAT MED.

Additional Notes:
HOLE OBSERVED BY: J. BARROWS, MA SE #84, DATE 11/21/19
NO H_2O OBSVD, ESHWT > 100
SOME VERGATED COLORING N STRATIFIED LAYERS

GEOTECHNICAL REPORT

MARTHA'S VINEYARD HIGH SCHOOL ATHLETIC FIELDS
OAK BLUFFS, MASSACHUSETTS

December 16, 2019

GSI Project No. 219252

Prepared for:

Mr. Chris Huntress
Huntress Sports
17 Tewksbury Street
Andover, MA 01810

Prepared by:

Geotechnical Services, Inc.
55 North Stark Highway
Weare, NH 03281

Geotechnical Services Inc.
Geotechnical Engineering ◣ Environmental Studies ◣ Materials Testing ◣ Construction Monitoring

GEOTECHNICAL SERVICES INC.

Geotechnical Engineering ◢ Environmental Studies ◢ Materials Testing ◢ Construction Monitoring

December 16, 2019

Mr. Chris Huntress
Huntress Sports
17 Tewksbury Street
Andover, MA 01810

Advanced via Email: chris@huntressassociates.com

RE: Geotechnical Investigation Report
Martha's Vineyard High School
Athletic Fields Improvements
Oak Bluffs, Massachusetts
GSI Project No. 219252

Dear Mr. Huntress:

Geotechnical Services, Inc. (GSI) is pleased to submit this report on the proposed design-development of the existing track and athletic fields at the Martha's Vineyard Regional High School located in Oak Bluffs, MA. The report consists of the subsurface data obtained through implementation of an exploration program, evaluation of the subsurface data, a summary of our understanding of the proposed development, and the results of an assessment for earthwork and foundation design options. The work has been undertaken in accordance with our proposal letter, dated January 9, 2019 and your subsequent authorization. The content of this report is subject to the **Limitations** stated in Appendix A.

PROJECT UNDERSTANDING

The project is located at the Martha's Vineyard Regional High School in Oak Bluffs, MA (See Figure 1). We understand that the planned development involves the following:

- A new 400M running track and multi-purpose synthetic turf field with associates features and structures including; a press box, bleachers, sports lighting, and walkways to replace the existing football stadium, and
- Improvements to the existing running track and multi-purpose natural grass turf field (Field #5)

We assume that the synthetic turf system will have a typical cross section consisting of the synthetic turf infill, an 8-in. thick layer of free draining gravel Subbase and a geotextile fabric placed over the existing subgrade soils. The grading for the new synthetic field is assumed to match that of the existing grades with the possibility of re-grading on the order of up to 2-ft (cut/fill).

SUBSURFACE EXPLORATION

Eight (8) test pits, designated as TP-1 to TP-8, were excavated at the site on November 21, 2019 by Farrissey Tele-Com, Inc. located in Oak Bluffs, MA. The test pits were excavated using a small track excavator and/or a vacuum truck under full supervision of a GSI engineer. The test pits were excavated to depths ranging from 6 to 8.4-ft below the existing grades. Each test pit excavation was observed by the GSI engineer and the soils encountered were classified in accordance with the Burmister Classification system. The approximate locations of the test pits are shown on Figures 2 for the proposed new track and synthetic turf field and Figure 3 for Field #5. The finalized logs for the test pits are included in Appendix B. Photographs of the test pits are provided as Appendix C.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the investigation are similar for both the Synthetic Turf Field/ 400M Track and Field #5. In general, the sites are underlain by the following soil units/deposits, described in order of increasing depth:

Topsoil: Topsoil was encountered at the ground surface in all the test pits. The topsoil was generally 2-in. to 19-in (TP-7) in thickness. In general, the nominal topsoil thickness was about 8-in.

Sand Deposits: All the test pits encountered the Sand Deposits. The Sand Deposits are generally described as a orange to brown, fine SAND with varying amounts of gravel and medium to coarse sand. With the exception of TP-1, all the test pits encountered a 2 to 3-ft thick layer of orange to brown, silty fine SAND immediately below the topsoil layer. All the test pits were terminated within the Sand Deposits.

Groundwater: Groundwater was not encountered in any of the test pits upon completion. Groundwater levels should be expected to vary with season, precipitation, snowmelt, and other factors. As a result, groundwater levels encountered during construction may differ from those encountered in the explorations.

GEOTECHNICAL DESIGN RECOMMENDATIONS

General

As a general guideline, foundation design and construction must conform to the applicable provisions of the Massachusetts Building Code, 9th Edition (Building Code).

Preliminary Light Pole Foundation Geotechnical Design Parameters

For preliminary design, the soil properties recommended for design of the proposed lighting pole foundations are provided as follow:

Sand Deposits

Unit Weight (pcf)	120.0
Submerged Unit Weight (pcf)	60.0
Internal Friction Angle (degrees):	30
Cohesion (psf):	0.0
Coefficient of Variation of Subgrade Reaction, f (tcf):	15.0

Pile deformation can be estimated assuming that the coefficient of subgrade reaction, K_H, increases linearly with increasing depth in accordance with:

$$K_H = (f)*(z)/D \qquad \text{(NAVFAC DM 7.2, p.235)}$$

Where:	K_H	=	coefficient of lateral subgrade reaction (tcf)
	f	=	coefficient of variation of subgrade reaction (tcf)
	z	=	depth (ft)
	D	=	width/diameter of loaded area (ft)

The base of the planned lighting pole foundations may be designed using a design bearing pressures of 3-ksf.

We recommend that the test borings be conducted at the planned light pole foundations to confirm the above design recommendations.

Foundation Recommendations for the Planned Press Box and Bleachers

Based on the subsurface investigation, the foundations for the press box and bleachers will bear upon the Sand Deposits. Specific foundation design recommendations are provided below:

- Footings with a least lateral dimension (width) of 3-ft may be designed using a design bearing pressures of 4.0 ksf.
- For footings with a lateral dimension less than 3-ft, the maximum allowable bearing pressure should be reduced to a value equal to one-third of the maximum allowable bearing pressure given above multiplied by the least lateral dimension of the footing, measured in feet. For example, a 1.5-ft wide footing should be designed using a reduced allowable bearing pressure equal to 1.5-ft x 1/3 x 4 ksf = 2.0-ksf.
- Bottoms of exterior footings should be positioned at least 4-ft below the lowest adjacent ground (finished grade) exposed to freezing temperatures. Footings at heated interior locations should bear at least 18-in. below the adjacent slab surface.

New Track and Synthetic Turf Field Subgrades

We anticipate that the construction of the track and new synthetic turf field will involve the following; stripping off the existing Topsoil, removing/relocating any existing utilities (drainage pipe, electric utilities and any other utilities), grading the track and field to the planned rough grade, proof-rolling the subgrade and constructing the track and synthetic turf system. The Sand Deposits are suitable for support of the synthetic turf system provided the subgrade is prepared using the recommendation provided herein.

Seismic Design Input

Seismic design parameters for the project site have been obtained from Commonwealth of Massachusetts, State Building Code, 9th Edition. Ground motion parameters at the project site (i.e., the design earthquake for the subject facility) are represented by S_s, 0.2 sec. (short period) Spectral Acceleration, and S_1, 1.0-second period Spectral Acceleration. These parameters have been obtained as:

$S_s = 0.144$ g

$S_1 = 0.053$ g

Site Class for the project site has been established as "Stiff soil profile" with the designation **Site Class D**. Site Coefficient for the Short Period has been established as $F_a = 1.6$, and Site Coefficient for the 1-sec Period has been established as $F_v = 2.4$. Parameters F_a, and F_v relate to the potential amplification of the earthquake induced shear stress waves traveling upward through the soil-rock profile underlying the project site. The soils within the project site are not considered liquefaction susceptible.

CONSTRUCTION CONSIDERATIONS

General

In general, all excavation, dewatering, and other construction activities should conform to the requirements of OSHA and all other applicable regulations. The site soils would typically be classified as Type C based on OSHA 29 CFR 1926.

Excavation

Typically, building foundation construction will involve stripping off any vegetation, topsoil, pavement and any other unsuitable soils, preparing subgrades, and then backfilling and filling to normal footing and subgrade design bearing levels.

We anticipate that the excavation for the planned construction and site grading can be accomplished with conventional earth-moving equipment.

Temporary cut soil slopes should, typically, be stable if constructed no steeper than about 1.5H:1V. Some sloughing and raveling should be anticipated in temporary earth slopes.

Construction Dewatering

Based on the available subsurface data it is anticipated that during the general site work, no significant dewatering measures will be necessary to conduct the construction "in-the-dry." It should be anticipated that groundwater control measure will be necessary for this site. Groundwater and surface water must be controlled as necessary to enable all final excavation and foundation construction to be conducted in-the-dry.

The Contractor should take measures to prevent groundwater and storm water to enter into excavated areas, and be prepared to remove ponded surface water by means of localized sumps and pumps. The Contractor should select whichever dewatering procedures may be effective to maintain dry, stable excavation bottoms. Dewatering, including its discharge, should be performed in accordance with all local, state, and federal regulations.

Preparation and Protection of Bearing Surfaces

Final excavation should be conducted in a manner that minimizes disturbance to the subgrade soils. As noted above, all final excavation and footing construction should be conducted in-the-dry. We recommend that the exposed subgrade soils be observed in the field by a geotechnical engineer to confirm the assumed foundation bearing conditions. It may be necessary to over-excavate and replace weak, disturbed or otherwise unacceptable foundation bearing materials.

Filling and Backfilling

Placement of compacted soil fills should not be conducted when air temperatures are low enough (approximately 30 degrees F, or below) to cause freezing of the moisture in the fill during or before placement. Fill materials should not be placed on snow, ice or uncompacted frozen soil. Compacted fill should not be placed on frozen soil. No fill should be allowed to freeze prior to compaction. At the end of each day's operations, the last lift of fill, after compaction, should be rolled by a smooth-wheeled roller to eliminate ridges of uncompacted soil.

Compaction

Minimum compaction requirements refer to percentages of the maximum dry density determined in accordance with ASTM D1557. Typical recommended compaction requirements are as follows:

Location	Minimum Compaction Requirements
Beneath and around footings, beneath slabs	95 %
Parking, roadways and sidewalks	92 % up to 3 ft below finished grade 95 % in the upper 3 ft
Landscaped areas	90 % nominal compaction

Fill and Backfill Materials

A. Crushed Stone

Crushed Stone should consist of durable crushed rock or crushed gravel stone obtained by breaking and crushing rock, or boulders, and it is free from a detrimental quantity of thin, flat, elongated or other objectionable pieces.

The ½-inch crushed stone should have the following gradation:

Sieve Size	Percent Finer by Weight
5/8 inch	100
½ inch	85-100
3/8 inch	15-45
No. 4	0-15
No. 8	0-5

B. Common Fill

Common fill should consist of mineral sandy soil, free from organic matter, plastic, metal, wood, ice, snow or other deleterious material and should have the characteristic that it can be readily placed and compacted. Common fill imported to the site should have a maximum of 80 percent passing the No. 40 sieve and a maximum of 30 percent finer than the No. 200 sieve. The largest particle size for common fill should not exceed 2/3 of the lift thickness. Silty common fill soils may require moisture control during placement and compaction. Common Fill should be placed and compacted in the manner described in "Filling and Backfilling."

C. Granular Fill

Granular Fill should consist of clean, sand and gravel, free of organic material, snow ice, or other objectionable materials and should be well-graded within the following limits:

Sieve Size	Percent Finer by Weight
6 in.	100
No. 4	30 – 90
No. 40	10 – 50
No. 200	0-10

Granular Fill should be placed in 9-inch loose lift thickness, unless otherwise specified. Cobbles exceeding 6 inch in size should be screened and removed prior to compaction. Compaction equipment should be selected to meet the requirements of that particular location in earthwork operation, thus the Contractor should provide both vibratory and static rollers, as well as hand-guided vibratory plate compactors. Where vibratory plate compactor is used the loose

lift thickness should not exceed 6 inch. A minimum of four systematic passes of the compaction equipment should be implemented to compact each lift.

CONSTRUCTION MONITORING

It is recommended that a geotechnical engineer or experienced technician be present during construction to:

- Confirm that soils used as fill and backfill are in accordance with the project plans and specifications, and make judgments on the suitability of excavated soils for reuse as fill.
- Monitor soil excavation.
- Observe preparation of bearing surfaces.
- Observe and test placement and compaction of compacted fills.
- Observe effectiveness of dewatering.

GSI is qualified and will be prepared to undertake such services, including the necessary field and laboratory sampling and testing. This will enable us to observe compliance with the design concepts and assumptions, and to facilitate design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

SPECIFICATIONS AND PLAN REVIEW

We recommend that GSI be provided the opportunity to review the final plans and specifications in order to confirm that the recommendations made in this report were interpreted and implemented as intended.

CLOSURE

GSI appreciates the opportunity to serve you on this project, and we look forward for its successful completion. In the meantime, if you have any questions on the content of this report or any related matter, please do not hesitate to contact us.

Very truly yours,
GEOTECHNICAL SERVICES, INC.

Glen V. Zoladz, P.E.
Project Manager

Harry K. Wetherbee, P.E.
Principal Engineer

Figure 1. Project Locus
Figure 2. Exploration Location Plan (New Football Field)
Figure 3. Exploration Location Plan (Field #5)

Appendix A. Limitations
Appendix B. Test Pit Logs
Appendix C. Photographs

FIGURE 1–PROJECT LOCUS

MARTHA'S VINEYARD HIGH SCHOOL
VINEYARD HAVEN, MA
GSI PROJECT NO. 219152

SCALE: NOT TO SCALE

LEGEND:

TP-1

TEST PIT I.D. AND APPROXIMATE LOCATION

FIGURE 2–EXPLORATION LOCATION PLAN

MARTHA'S VINEYARD HIGH SCHOOL
VINEYARD HAVEN, MA
GSI PROJECT NO. 219152

LEGEND:

TP-6

TEST PIT I.D. AND APPROXIMATE LOCATION

FIGURE 3–EXPLORATION LOCATION PLAN

MARTHA'S VINEYARD HIGH SCHOOL
VINEYARD HAVEN, MA
GSI PROJECT NO. 219152

APPENDIX A

LIMITATIONS

LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by Geotechnical Services, Inc.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of Huntress Sport in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by Geotechnical Services, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to evaluation considerations only.

APPENDIX B

TEST PIT LOGS

TEST PIT LOG

Test Pit No.
TP-1
Page 1 of 1

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Vaccum Truck	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
		~0.2	**-TOPSOIL-**	
1			Brown, fine SAND, little m/c sand, tr. gravel	
2				
3			**-SAND DEPOSITS-**	
4				
5				
6				
7			Bottom of Exploration at 7-ft. No groundwater encountered	
8				
9				

Standing Water in Completed Pit:	Boulders:		Test Pit Dimensions:			Survey Data:	
at depth - ft	Diameter (in.)	Number	Depth	7	ft	Ground El.	ft
Elapsed time after completion of pit:	12 to 24		Length	2	ft	El. Datum	
☐ hours ☐ min.	> 24	-	Width	2	ft		

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TEST PIT LOG

Test Pit No. TP-2

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Vaccum Truck	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
		~0.2	**-TOPSOIL-**	
1			Brown, fine SAND, TR. SILT	
2		~2		
			Brown, fine SAND, tr. gravel, m. sand **-SAND DEPOSITS-**	
3				
4				
5				
6				
			Brown, f/m SAND, tr. gravel	
7				
8				
			Bottom of Exploration at 8-ft. No groundwater encountered	
9				

Standing Water in Completed Pit:
at depth - ft
Elapsed time after completion of pit:
☐ hours ☐ min.

Boulders:

Diameter (in.)	Number
12 to 24	
> 24	-

Test Pit Dimensions:

Depth	8	ft
Length	2	ft
Width	2	ft

Survey Data:
Ground El. ft
El. Datum

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TEST PIT LOG

Test Pit No. TP-3

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Mini Track Excavator	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
		~0.5	**-TOPSOIL-**	
1			Brown, silty fine SAND	
2		~2.7		
3			Br. fine SAND, tr. gravel, m/c sand (higher percentage of coarser sand with depth) **-SAND DEPOSITS-**	
4				
5				
6				
7				
8			Bottom of Exploration at 8-ft. No groundwater encountered	
9				

Standing Water in Completed Pit:	**Boulders:**	**Test Pit Dimensions:**	**Survey Data:**
at depth - **ft**	**Diameter (in.)** **Number**	**Depth** 8 **ft**	**Ground El.** ft
Elapsed time after completion of pit:	**12 to 24**	**Length** 6 **ft**	**El. Datum**
☐ hours ☐ min.	**> 24** -	**Width** 2 **ft**	

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TEST PIT LOG

Test Pit No. TP-4

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Mini Track Excavator	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
			-TOPSOIL-	
		~0.7		
1			Brown, silty fine SAND	
2				
3		~3		
			Orange to br., fine SAND, little m/c sand, tr. gravel	
4			**-SAND DEPOSITS-**	
5				
6				
7				
8			Bottom of Exploration at 8-ft.	
			No groundwater encountered	
9				

Standing Water in Completed Pit:	**Boulders:**		**Test Pit Dimensions:**			**Survey Data:**	
at depth - **ft**	**Diameter (in.)**	**Number**	**Depth**	8	**ft**	**Ground El.**	ft
Elapsed time after completion of pit:	**12 to 24**		**Length**	6	**ft**	**El. Datum**	
☐ hours ☐ min.	**> 24**	-	**Width**	2	**ft**		

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TEST PIT LOG

Test Pit No.
TP-5
Page 1 of 1

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Mini Track Excavator	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
		~0.6	**-TOPSOIL-**	
1			Brown, silty fine SAND	
2		~2.5		
3			Orange to br., fine SAND, little m/c sand, tr. gravel	
4			**-SAND DEPOSITS-**	
5				
6				
7				
8			Bottom of Exploration at 8-ft. No groundwater encountered	
9				

Standing Water in Completed Pit:	Boulders:		Test Pit Dimensions:			Survey Data:	
at depth - ft	Diameter (in.)	Number	Depth	8	ft	Ground El.	ft
Elapsed time after completion of pit:	12 to 24		Length	6	ft	El. Datum	
☐ hours ☐ min.	> 24	-	Width	2	ft		

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TEST PIT LOG

Test Pit No.
TP-6
Page 1 of 1

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Mini Track Excavator	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
		~0.3	**-TOPSOIL-**	
1			Brown, silty fine SAND	
2				
3		~3.3		
			Orange to br., fine to medium SAND, tr. gravel (occasional cobbles)	
4			**-SAND DEPOSITS-**	
5				
6				
7				
8				
			Bottom of Exploration at 8.4-ft.	
9			No groundwater encountered	

Standing Water in Completed Pit:	Boulders:		Test Pit Dimensions:			Survey Data:	
at depth - ft	Diameter (in.)	Number	Depth	8.4	ft	Ground El.	ft
Elapsed time after completion of pit:	12 to 24		Length	6	ft	El. Datum	
☐ hours ☐ min.	> 24	-	Width	2	ft		

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TEST PIT LOG

Test Pit No.
TP-8
Page 1 of 1

Project	Martha's Vineyard High School	**Project No.**	219252
Location	Vineyard Haven, MA	**Project Manager**	G. Zoladz
Client	Huntress Sports	**Field Rep.**	G. Zoladz
Contractor	Farrissey Excavating	**Date**	11/21/19
Equipment	Mini Track Excavator	**Weather**	Sunny 40s

Depth (ft)	Sample ID	Stratum Change Depth (ft)	Description of Soils	Obstructions/Remarks
			-TOPSOIL-	
		~0.7		
1			Brown, silty fine SAND, little to tr. m-sand	
2		~2		
			Orange to br., fine to medium SAND, tr. gravel	
3				
4			**-SAND DEPOSITS-**	
5				
6			Bottom of Exploration at 6-ft.	
			No groundwater encountered	
7				
8				
9				

Standing Water in Completed Pit:	Boulders:		Test Pit Dimensions:			Survey Data:	
at depth - ft	Diameter (in.)	Number	Depth	6	ft	Ground El.	ft
Elapsed time after completion of pit:	12 to 24		Length	6	ft	El. Datum	
☐ hours ☐ min.	> 24	-	Width	2	ft		

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APPENDIX C

PHOTOGRAPHS

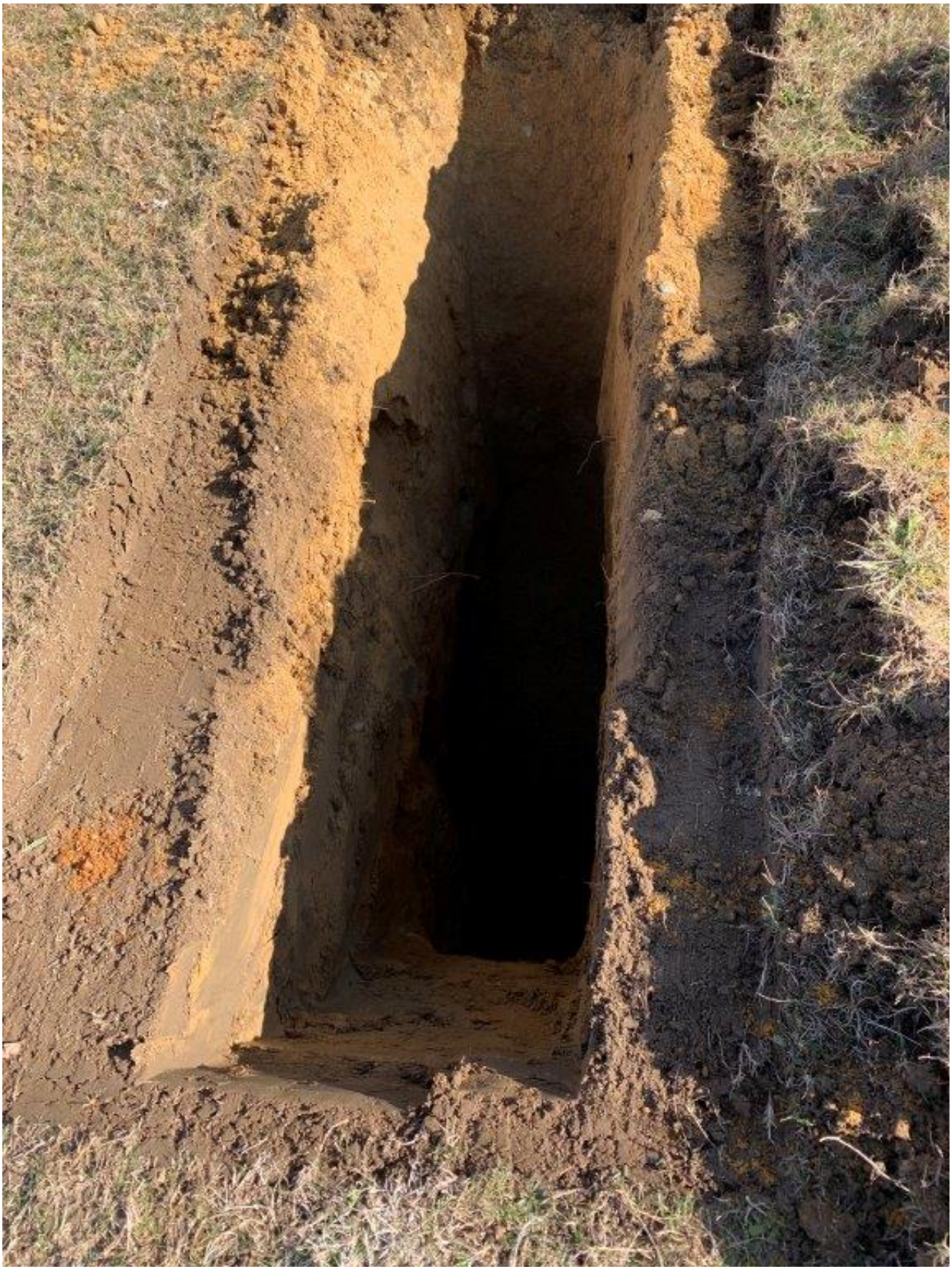


Photo 1 Test Pit No. 4

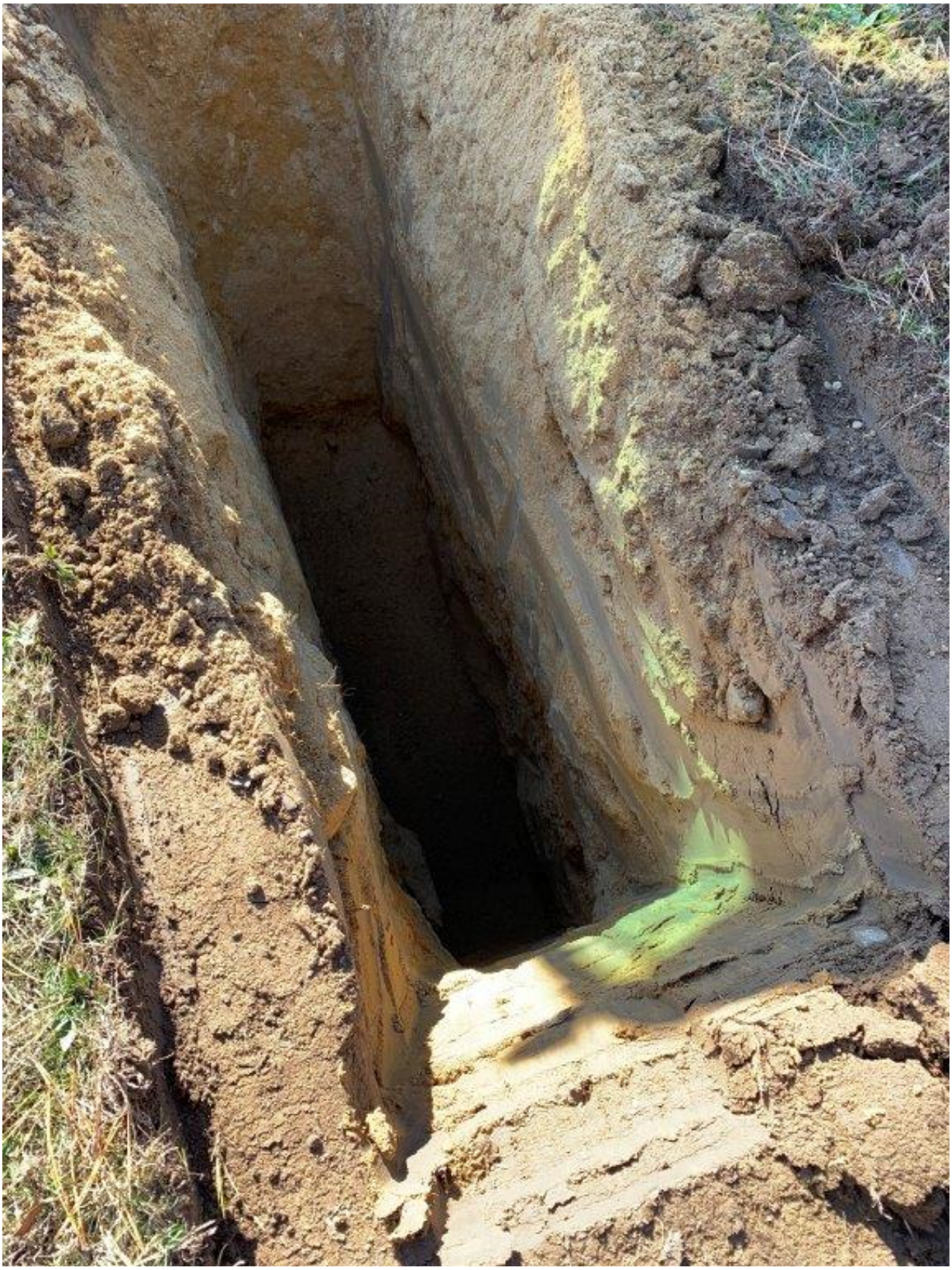


Photo 2 Test Pit No. 5

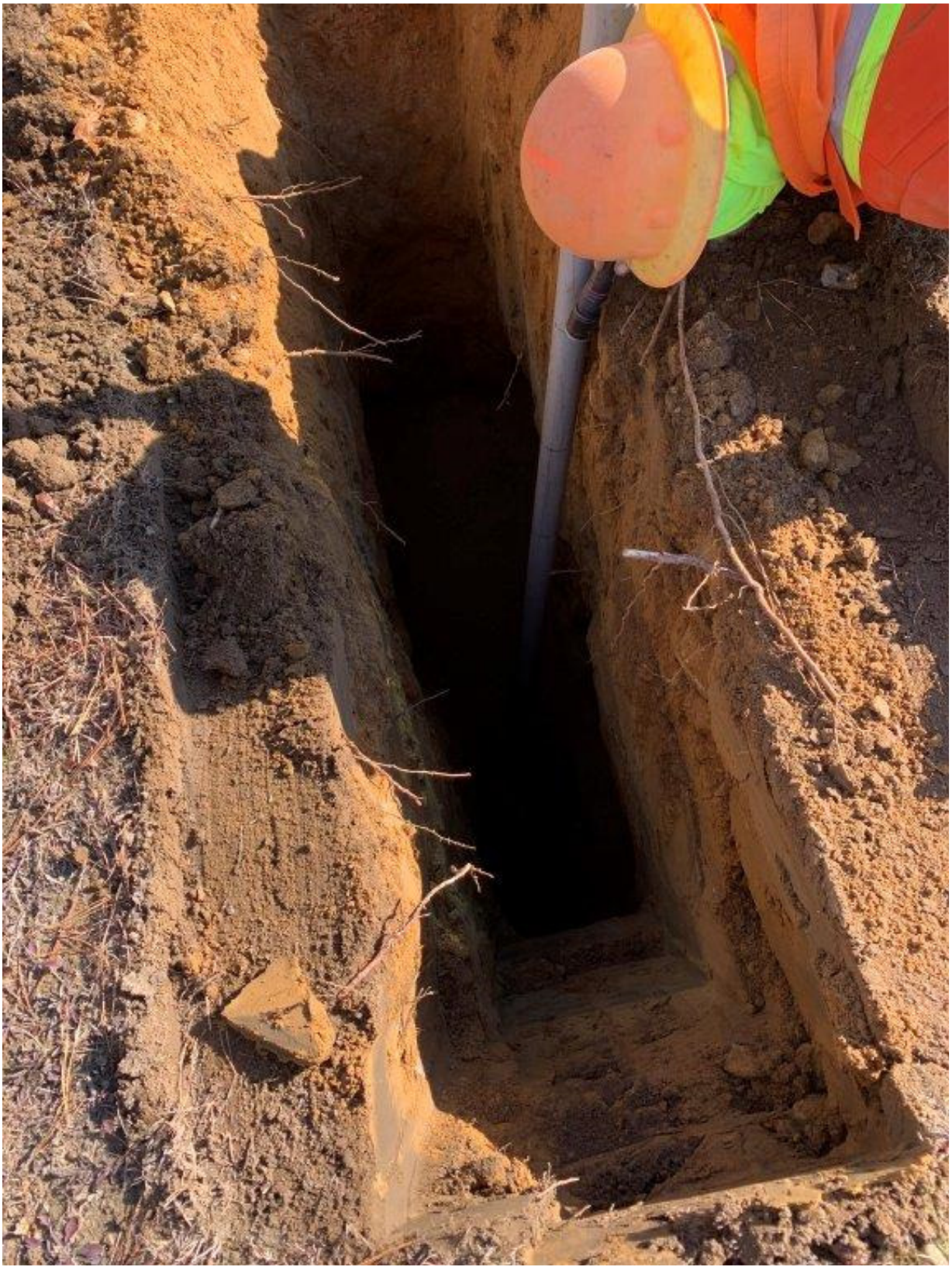


Photo 3 Test Pit No. 6

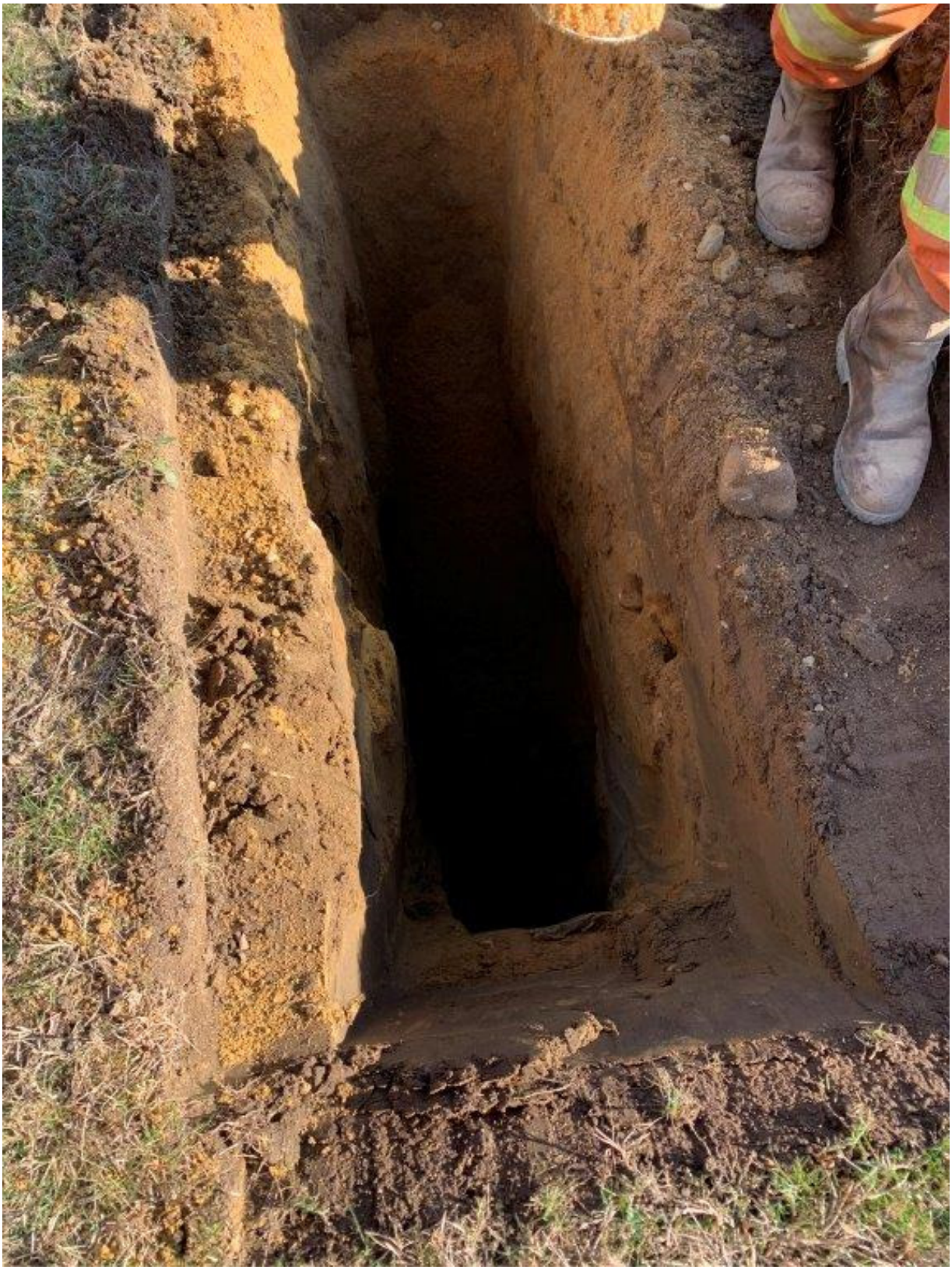


Photo 4 Test Pit No. 7

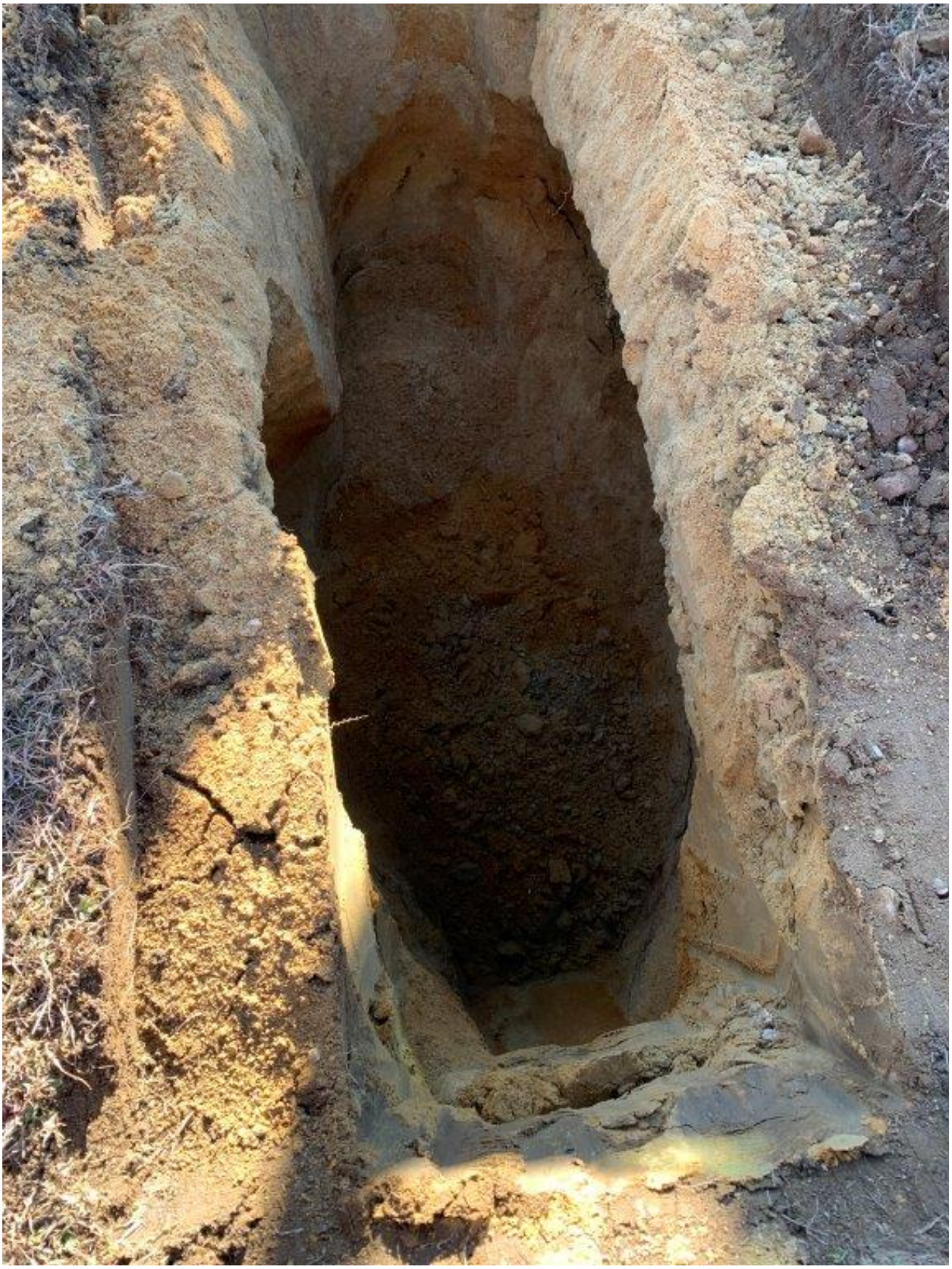


Photo 5 Test Pit No. 8

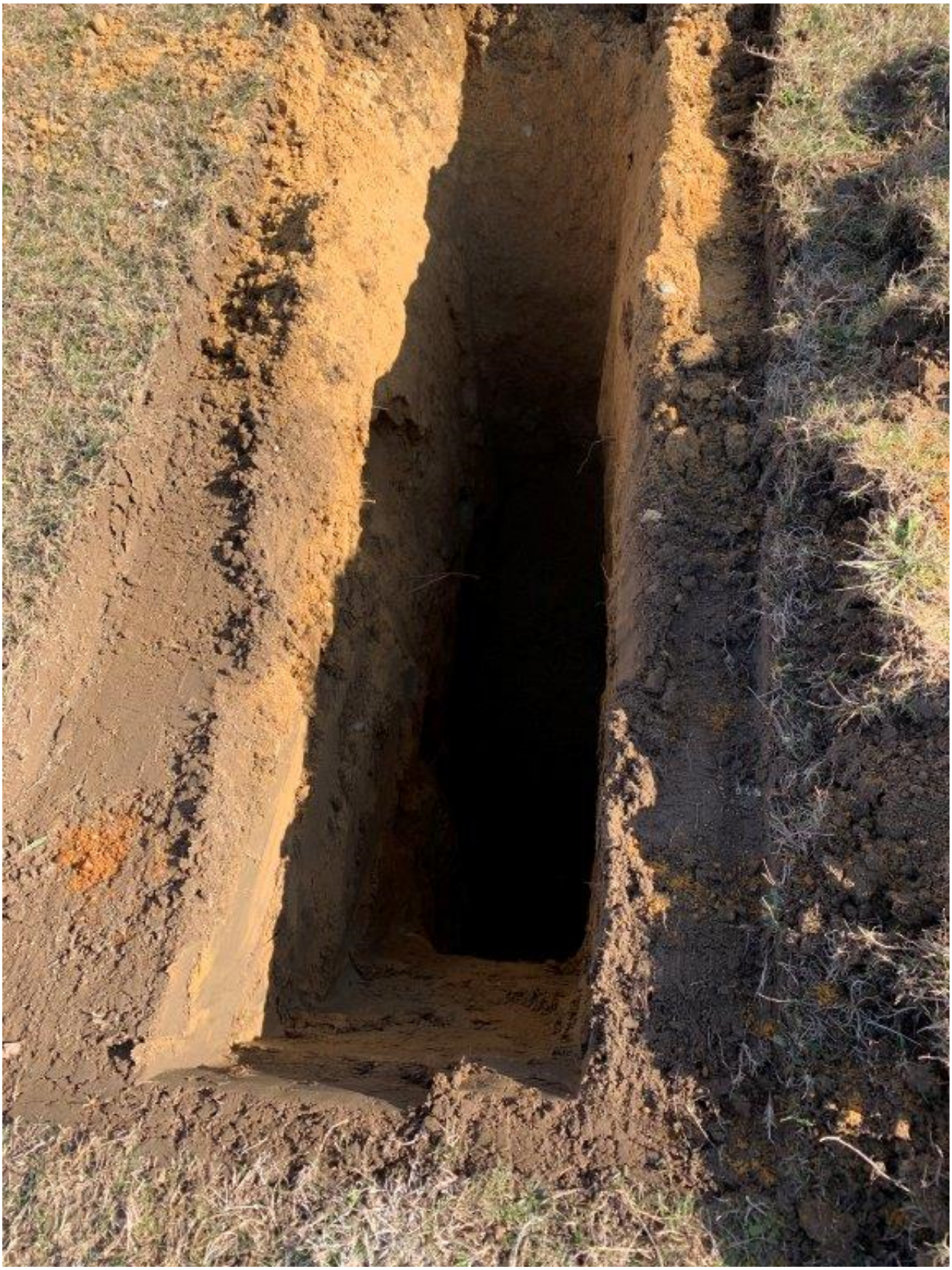
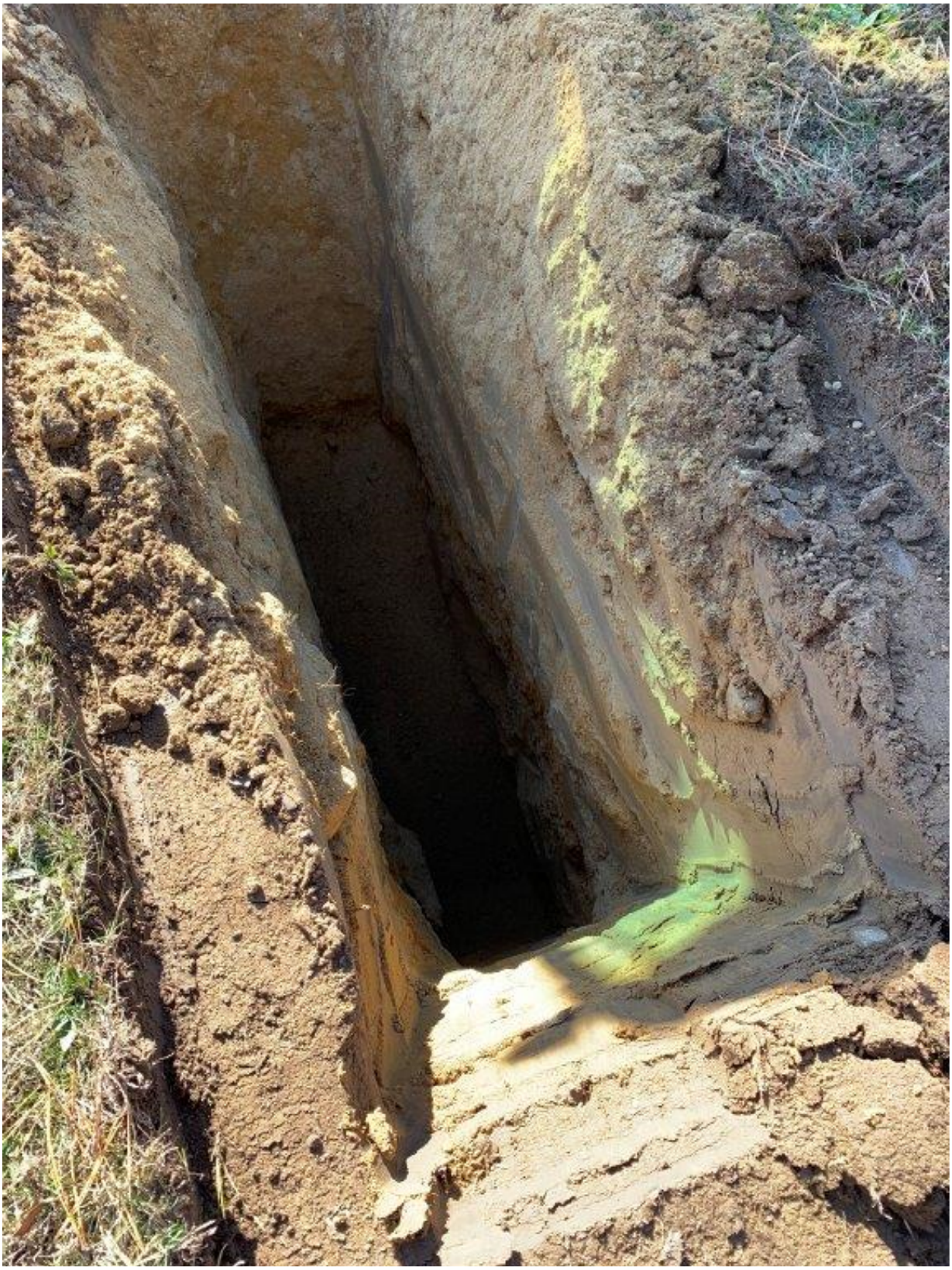


Photo 1 Test Pit No. 4



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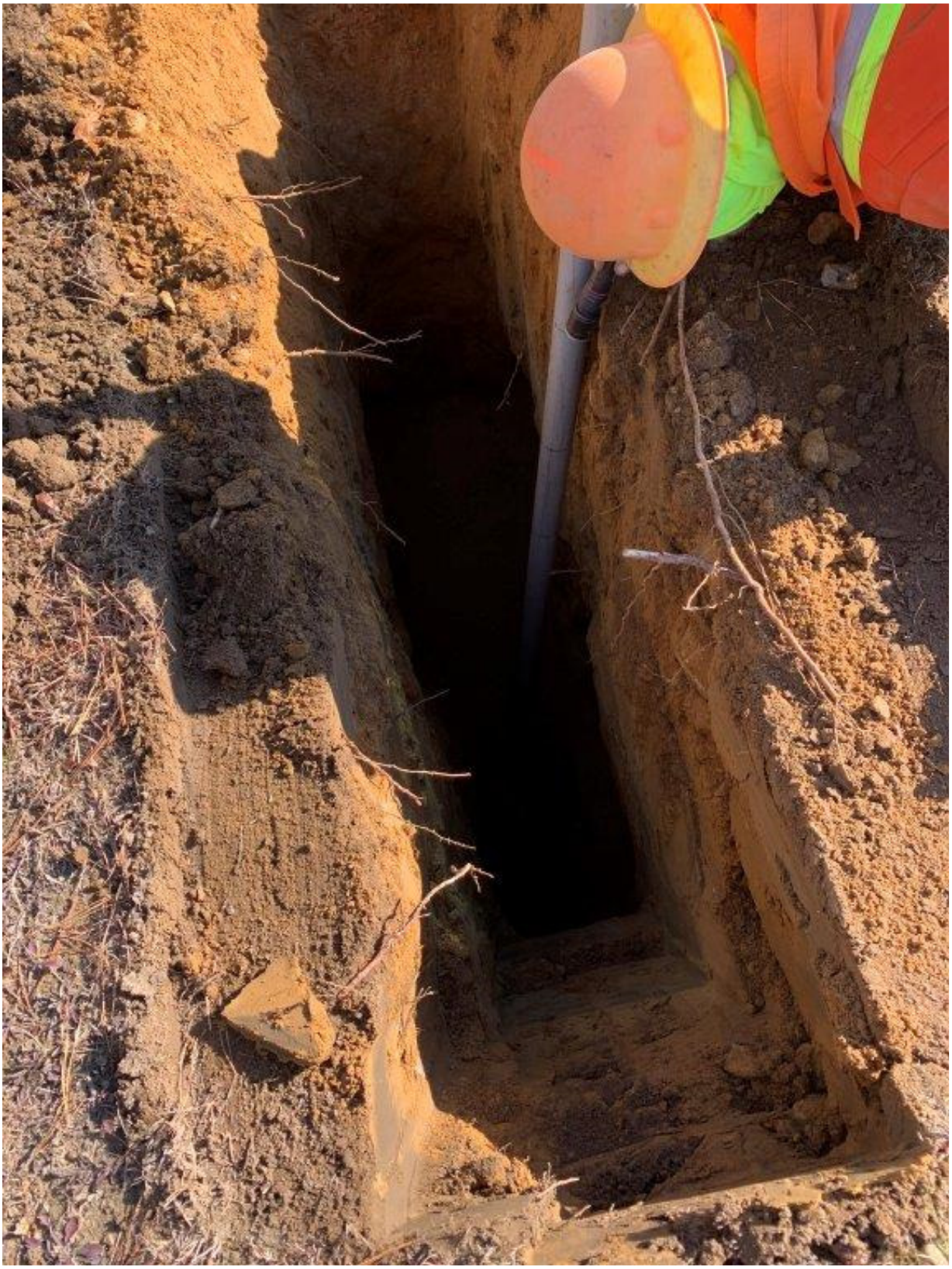


Photo 3 Test Pit No. 6

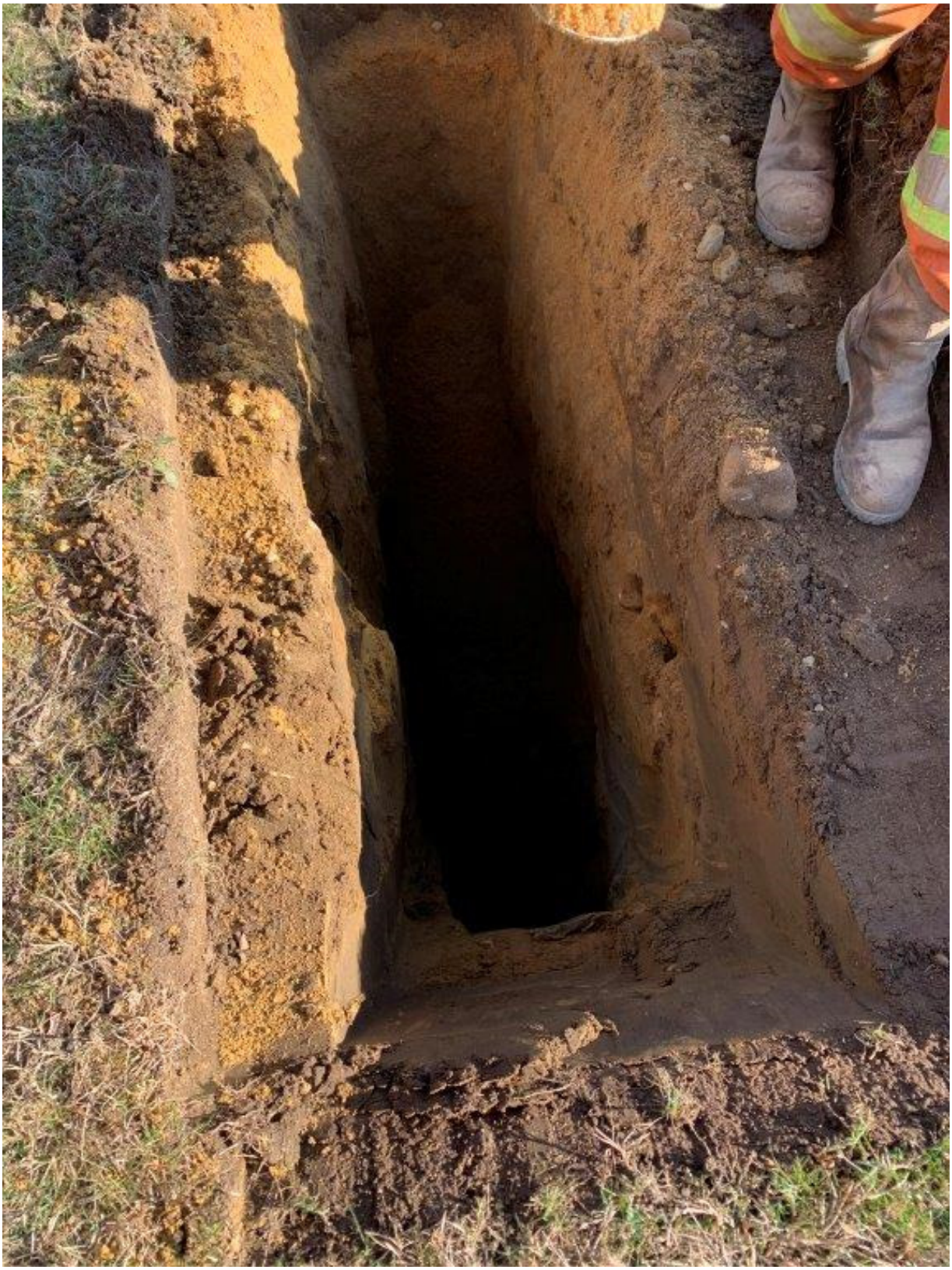


Photo 4 Test Pit No. 7

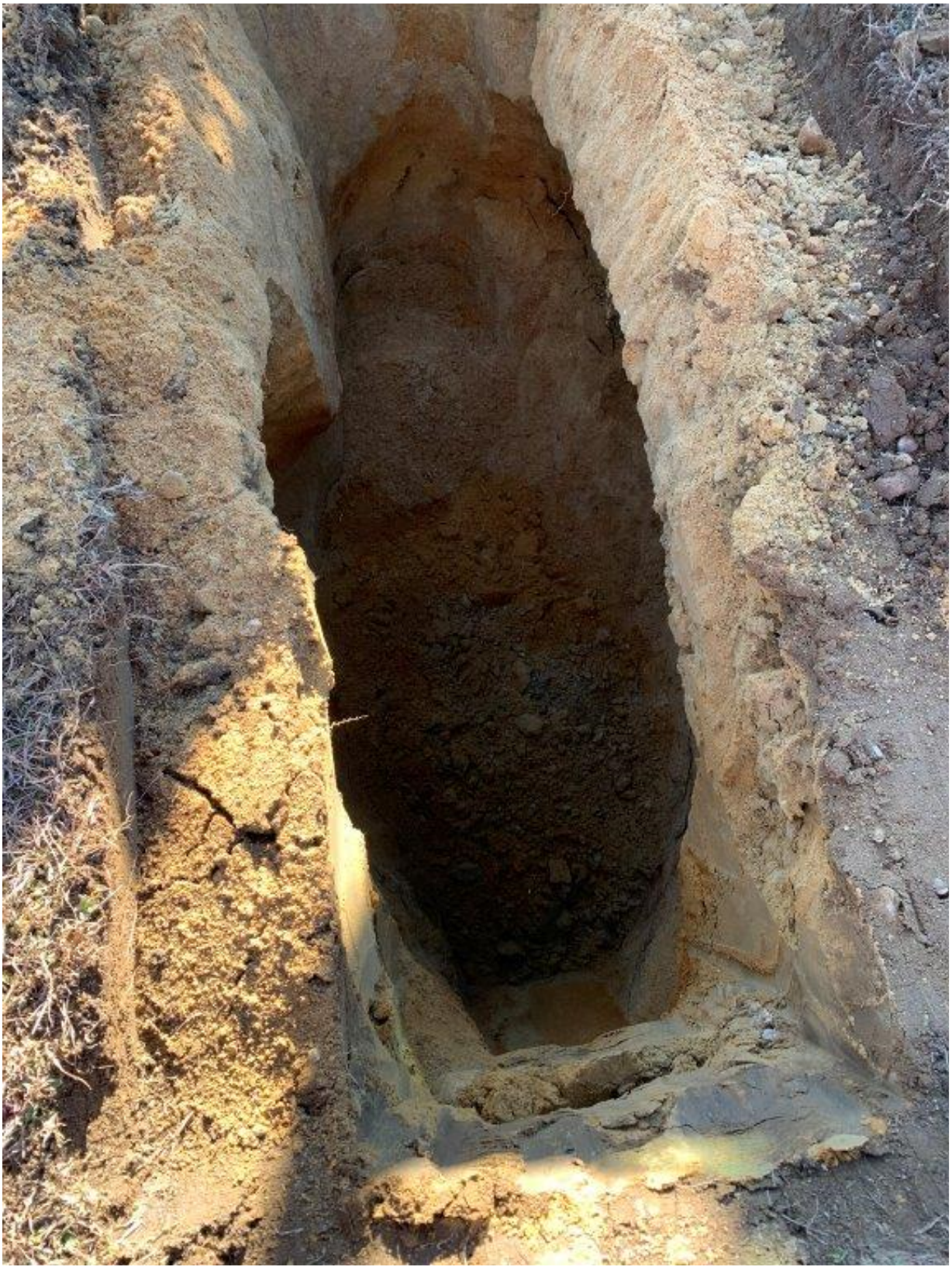


Photo 5 Test Pit No. 8

TIME OF CONCENTRATION

CALCULATIONS

TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No. 1

E-1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.400		0.011		0.011		
Flow length (ft)	=	40.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	3.80		0.00		0.00		
Travel Time (min)	**=**	**7.52**	**+**	**0.00**	**+**	**0.00**	**=**	**7.52**
Shallow Concentrated Flow								
Flow length (ft)	=	130.00		0.00		0.00		
Watercourse slope (%)	=	2.30		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	3.08		0.00		0.00		
Travel Time (min)	**=**	**0.70**	**+**	**0.00**	**+**	**0.00**	**=**	**0.70**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No. 2

E-2

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.400		0.011		0.011		
Flow length (ft)	=	90.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	1.80		0.00		0.00		
Travel Time (min)	**=**	**19.41**	**+**	**0.00**	**+**	**0.00**	**=**	**19.41**
Shallow Concentrated Flow								
Flow length (ft)	=	490.00		0.00		0.00		
Watercourse slope (%)	=	0.70		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.35		0.00		0.00		
Travel Time (min)	**=**	**6.05**	**+**	**0.00**	**+**	**0.00**	**=**	**6.05**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 25.50 min

TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No. 3

P-1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.400		0.011		0.011		
Flow length (ft)	=	40.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	3.80		0.00		0.00		
Travel Time (min)	**=**	**7.52**	**+**	**0.00**	**+**	**0.00**	**=**	**7.52**
Shallow Concentrated Flow								
Flow length (ft)	=	130.00		0.00		0.00		
Watercourse slope (%)	=	2.30		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	3.08		0.00		0.00		
Travel Time (min)	**=**	**0.70**	**+**	**0.00**	**+**	**0.00**	**=**	**0.70**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

TR55 Tc Worksheet

Hyd. No. 4

P-2

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	70.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.30		0.00		0.00		
Travel Time (min)	**=**	**21.60**	**+**	**0.00**	**+**	**0.00**	**=**	**21.60**
Shallow Concentrated Flow								
Flow length (ft)	=	235.00		0.00		0.00		
Watercourse slope (%)	=	0.60		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.25		0.00		0.00		
Travel Time (min)	**=**	**3.13**	**+**	**0.00**	**+**	**0.00**	**=**	**3.13**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 24.74 min

TR55 Tc Worksheet

Hyd. No. 5

P-3 (Field)

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	60.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	5.00		0.00		0.00		
Travel Time (min)	**=**	**6.20**	**+**	**0.00**	**+**	**0.00**	**=**	**6.20**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 6.20 min

CURVE NUMBER COMPUTATIONS

Worksheet 2: Runoff curve number and runoff

Project	By	Date
MVRHS	JB	12/11/19
Location	**Checked**	**Date**
OAK BLUFFS, MA		

Check one: ☑ Present ☐ Developed "E-1"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Figure 2-3	CN [1/] Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			1.05	102.90
A	OPEN SPACE (GOOD)	39			0.46	17.94

[1/] Use only one CN source per line

Totals ➡ 1.51 | 120.84

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{120.84}{1.51} = 80.0$; **Use CN** ➡ 80

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Worksheet 2: Runoff curve number and runoff

Project MVRHS	By JB	Date 12/11/19
Location OAKBLUFFS, MA	Checked	Date

Check one: ☑ Present ☐ Developed "E-2"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			0.2	19.60
A	OPEN SPACE (GOOD)	39			7.3	284.7
A	WOODS (GOOD)	30			0.9	27.0

1/ Use only one CN source per line

Totals ➡ 8.40 331.30

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{331.30}{8.40} = 39.4$; Use CN ➡ 39

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Worksheet 2: Runoff curve number and runoff

Project	By	Date
MVRHS	JB	12/11/19
Location	**Checked**	**Date**
OAK BLUFFS, MA		Rev. 9/16/20 ✓

Check one: ☐ Present ☑ Developed "P-1"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			1.04	101.92
A	OPEN SPACE (GOOD)	39			0.47	18.33

1/ Use only one CN source per line

Totals ➡ 1.51 | 120.25

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{120.25}{1.51} = 79.6$; **Use CN** ➡ 80

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Worksheet 2: Runoff curve number and runoff

Project MVRHS	By JB	Date 12/11/19
Location OAKBLUFFS, MA	Checked	Date Rev. 9/16/20

Check one: ☐ Present ☑ Developed P-2

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			0.11	10.78
A	OPEN SPACE (GOOD)	39			2.55	99.45

1/ Use only one CN source per line

Totals ➡ 2.66 | 110.23

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{110.23}{2.66} = 41.4$; Use CN ➡ 41

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Worksheet 2: Runoff curve number and runoff

Project	By	Date
MVRHS	JB	12/11/19
Location	**Checked**	**Date**
OAK BLUFFS, MA		

Check one: ☐ Present ☑ Developed P-3 (FIELD)

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			3.90	382.20
A	OPEN SPACE (GOOD)	39			0.46	17.94
A	WOODS (GOOD)	30			0.76	22.80

1/ Use only one CN source per line

Totals ➡ 5.12 | 422.80

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{422.80}{5.12} = 82.6$; **Use CN** ➡ 83

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Worksheet 2: Runoff curve number and runoff

Project	By	Date
MVRHS	JB	12/11/19
Location	**Checked**	**Date**
OAK BLUFFS, MA		

Check one: ☐ Present ☑ Developed "P-4"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Figure 2-3	CN [1/] Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			0.45	44.10
A	OPEN SPACE	39			0.02	0.78

[1/] Use only one CN source per line

Totals ➡ 0.47 44.88

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{44.88}{0.47} = 95.4$; **Use CN** ➡ 95

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Worksheet 2: Runoff curve number and runoff

Project MVRHS	By JB	Date 12/11/19
Location OAK BLUFFS, MA	Checked	Date Rev. 9/16/20

Check one: ☐ Present ☑ Developed "P-5"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Figure 2-3	CN [1/] Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			0.10	9.80
A	OPEN SPACE (GOOD)	39			0.05	1.95
					Totals ➡ 0.15	11.75

[1/] Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{11.75}{0.15} = 78.3$; Use CN ➡ 78

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

HYDROGRAPHS

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	-------	2.845	-------	-------	4.661	5.957	-------	8.037	E-1
2	SCS Runoff	-------	-------	0.019	-------	-------	0.216	0.960	-------	3.273	E-2
3	SCS Runoff	-------	-------	2.845	-------	-------	4.661	5.957	-------	8.037	P-1
4	SCS Runoff	-------	-------	0.011	-------	-------	0.143	0.487	-------	1.393	P-2
5	SCS Runoff	-------	-------	12.09	-------	-------	19.06	23.97	-------	31.79	P-3 (Field)
6	SCS Runoff	-------	-------	1.624	-------	-------	2.264	2.704	-------	3.395	P-4
7	SCS Runoff	-------	-------	0.285	-------	-------	0.479	0.619	-------	0.844	P-5
8	Reservoir	5	-------	0.700	-------	-------	0.747	0.766	-------	0.845	Field Outflow
9	Combine	6, 8	-------	1.624	-------	-------	2.824	3.460	-------	4.185	Flow to Chambers
10	Reservoir	9	-------	0.000	-------	-------	0.000	0.150	-------	1.128	Chamber outflow
11	Reservoir	7	-------	0.000	-------	-------	0.000	0.000	-------	0.000	Bio-Ret Outflow
12	Combine	4, 10, 11	-------	0.011	-------	-------	0.143	0.487	-------	2.394	Study Point 2

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	2.845	1	726	9,171	----	------	------	E-1
2	SCS Runoff	0.019	1	1336	425	----	------	------	E-2
3	SCS Runoff	2.845	1	726	9,171	----	------	------	P-1
4	SCS Runoff	0.011	1	1015	333	----	------	------	P-2
5	SCS Runoff	12.09	1	725	37,240	----	------	------	P-3 (Field)
6	SCS Runoff	1.624	1	724	5,344	----	------	------	P-4
7	SCS Runoff	0.285	1	725	884	----	------	------	P-5
8	Reservoir	0.700	1	758	2,474	5	85.69	15,239	Field Outflow
9	Combine	1.624	1	724	7,818	6, 8	------	------	Flow to Chambers
10	Reservoir	0.000	1	594	0	9	82.19	1,873	Chamber outflow
11	Reservoir	0.000	1	733	0	7	82.05	167	Bio-Ret Outflow
12	Combine	0.011	1	1015	333	4, 10, 11	------	------	Study Point 2

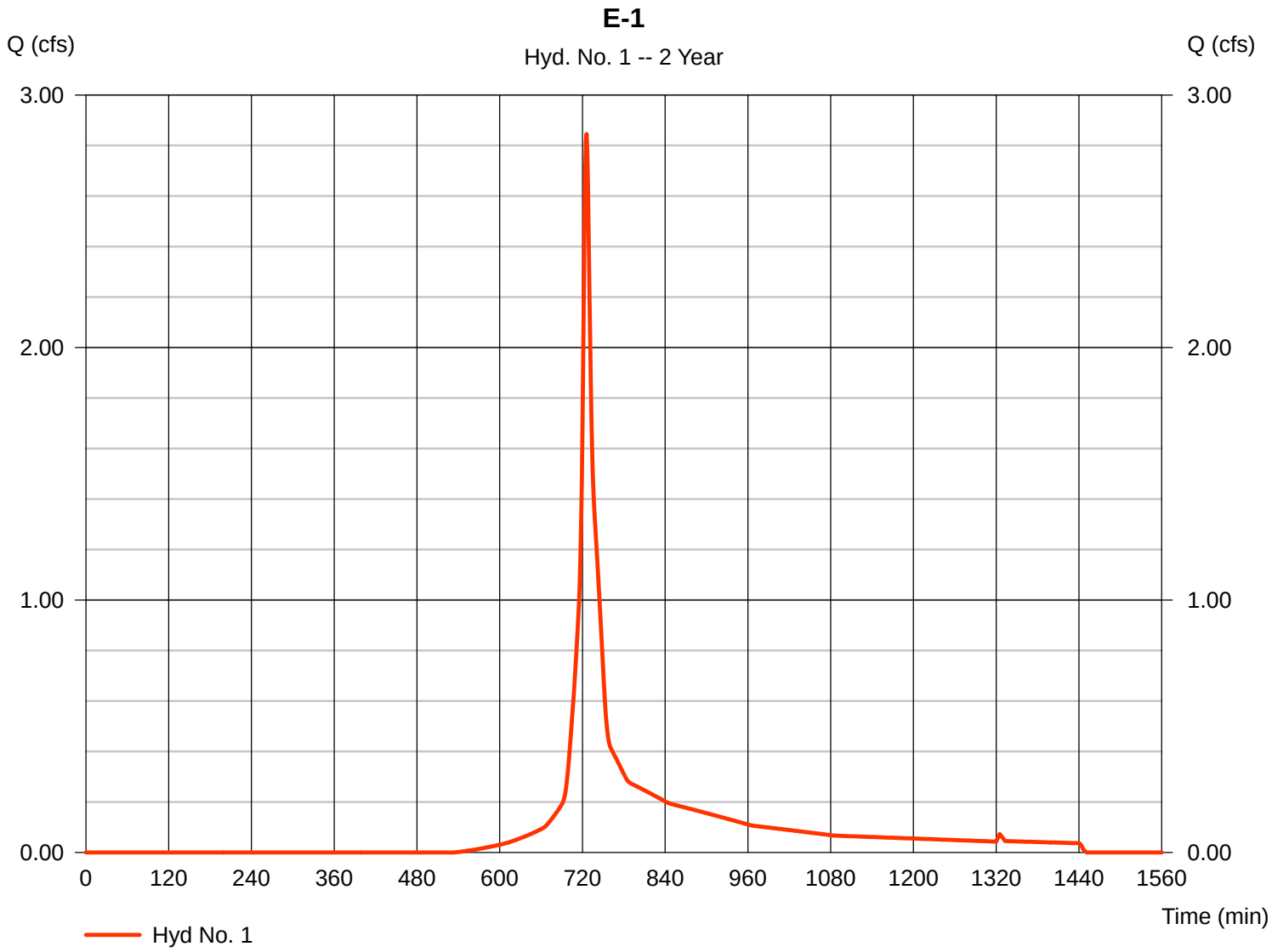
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.845 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	9,171 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



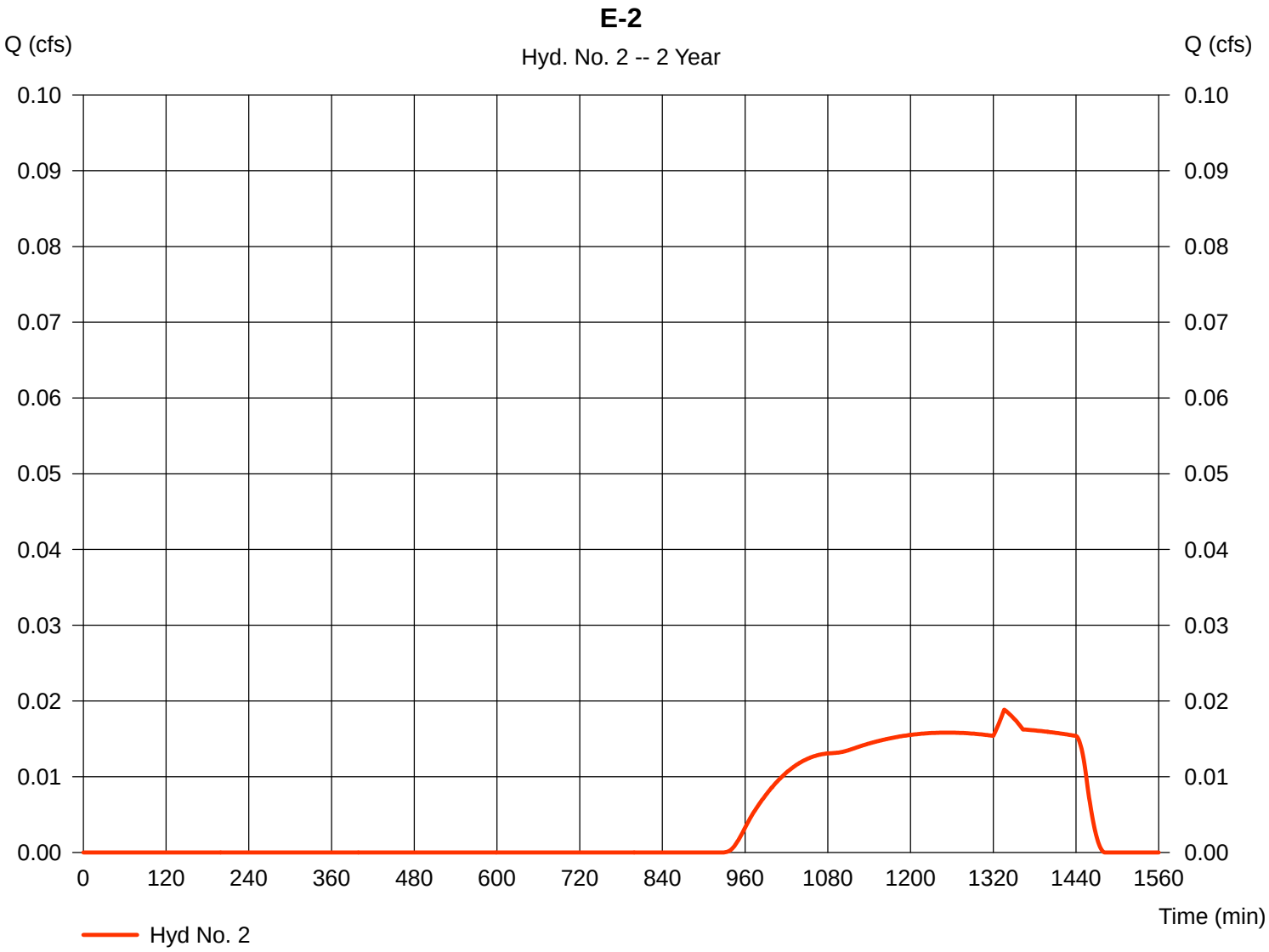
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 2

E-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.019 cfs
Storm frequency	=	2 yrs	Time to peak	=	1336 min
Time interval	=	1 min	Hyd. volume	=	425 cuft
Drainage area	=	8.400 ac	Curve number	=	39
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.50 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



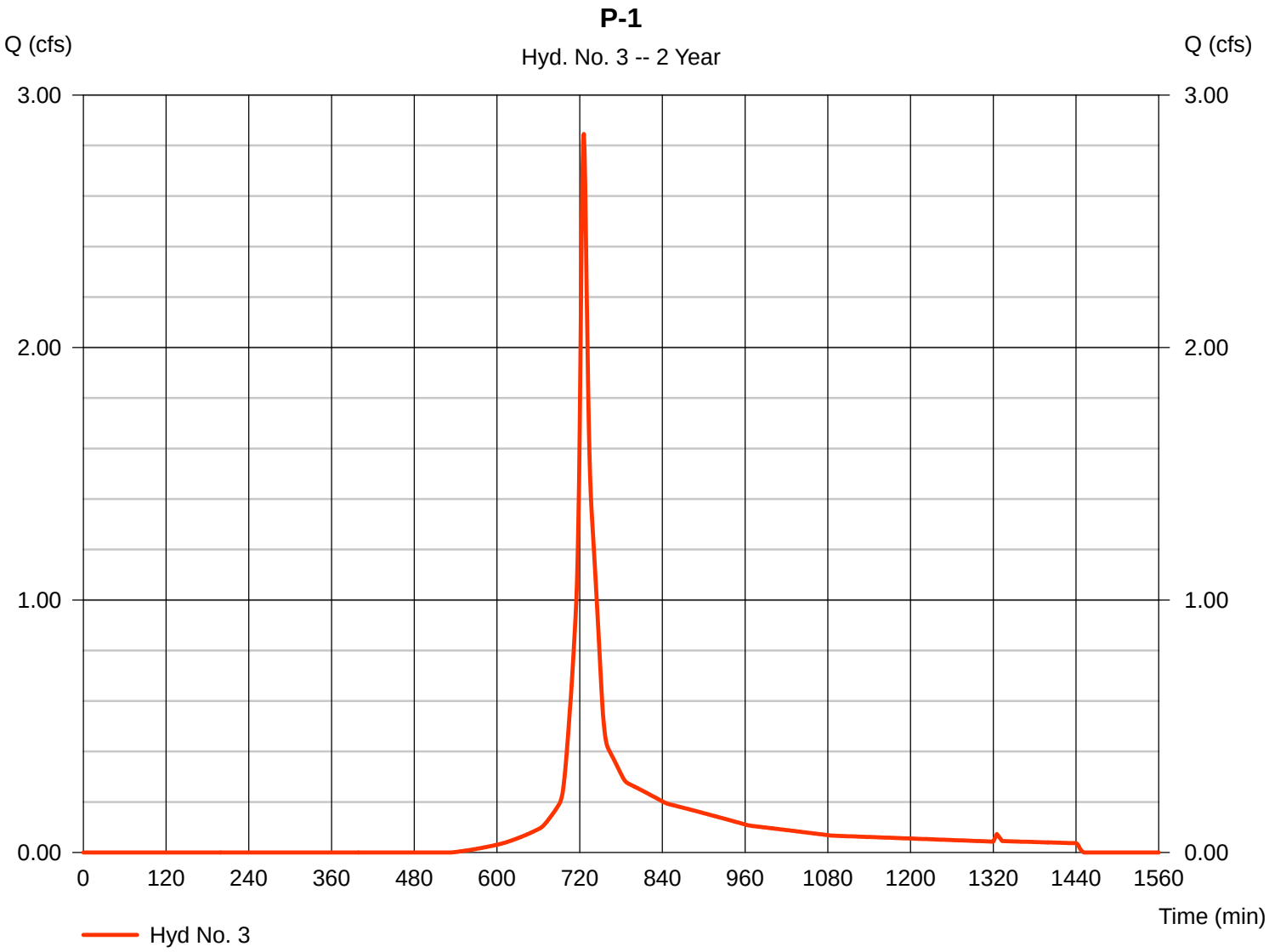
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.845 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	9,171 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



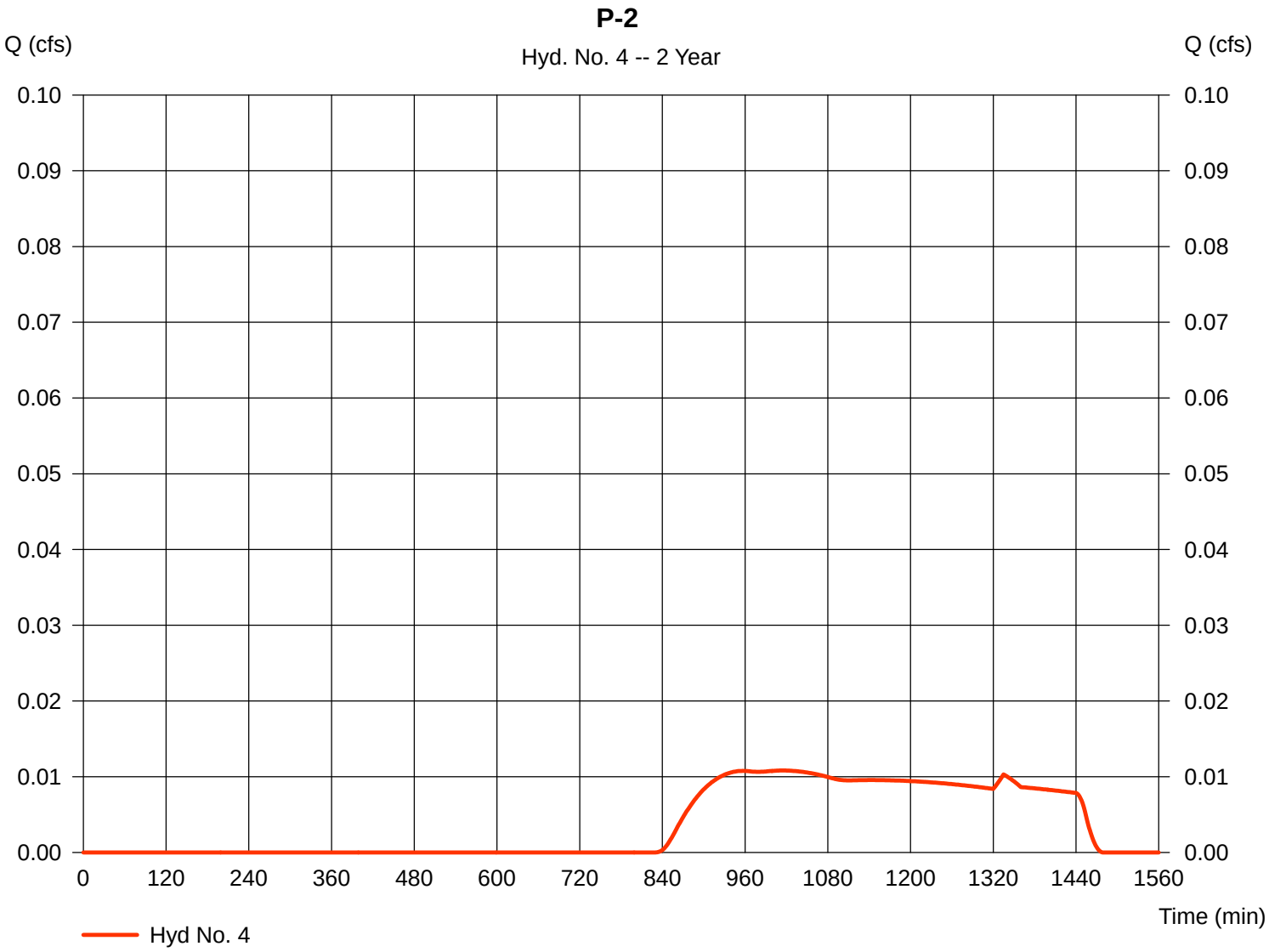
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.011 cfs
Storm frequency	=	2 yrs	Time to peak	=	1015 min
Time interval	=	1 min	Hyd. volume	=	333 cuft
Drainage area	=	2.660 ac	Curve number	=	41
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.70 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



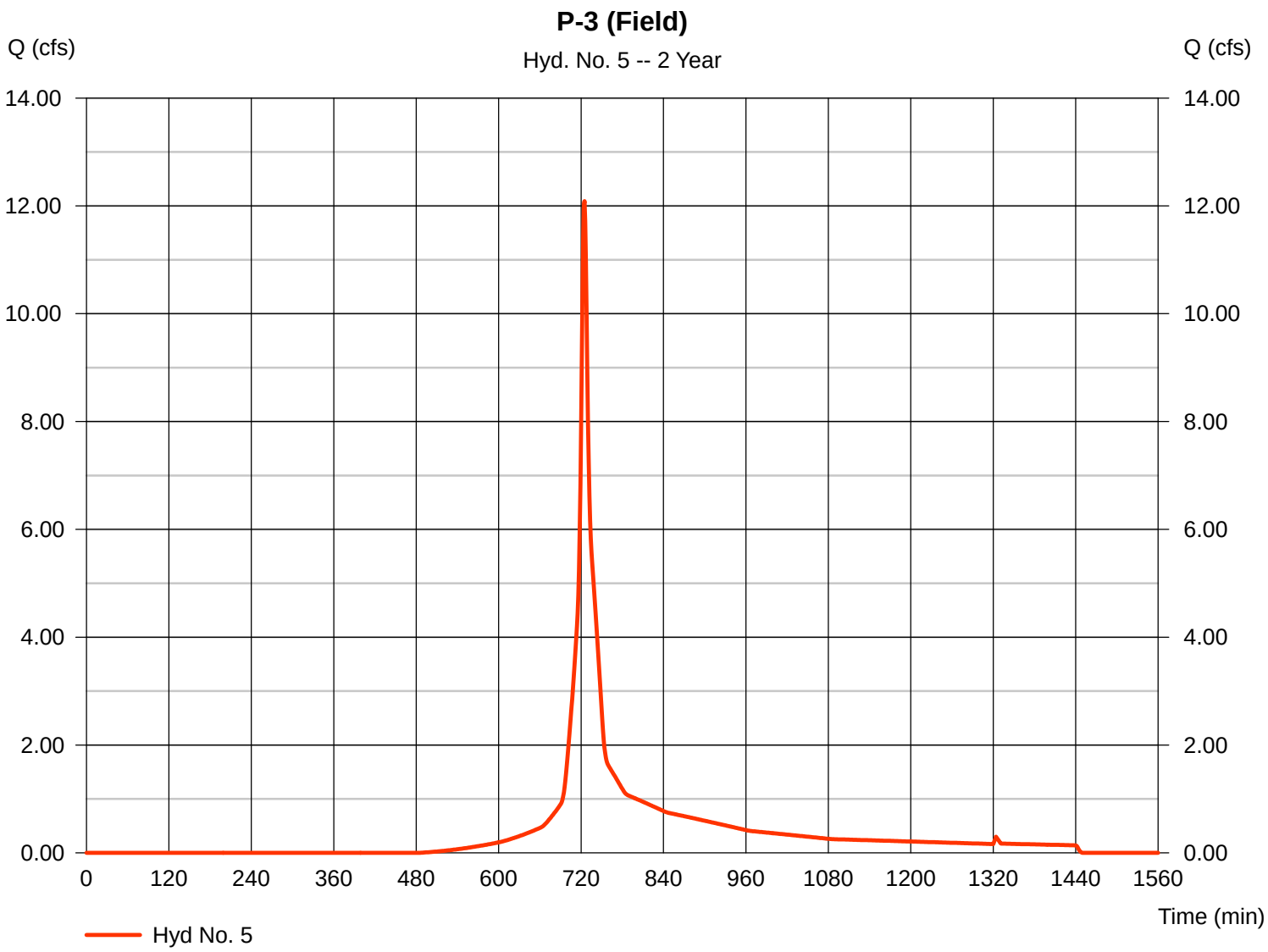
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 5

P-3 (Field)

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.09 cfs
Storm frequency	=	2 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	37,240 cuft
Drainage area	=	5.120 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



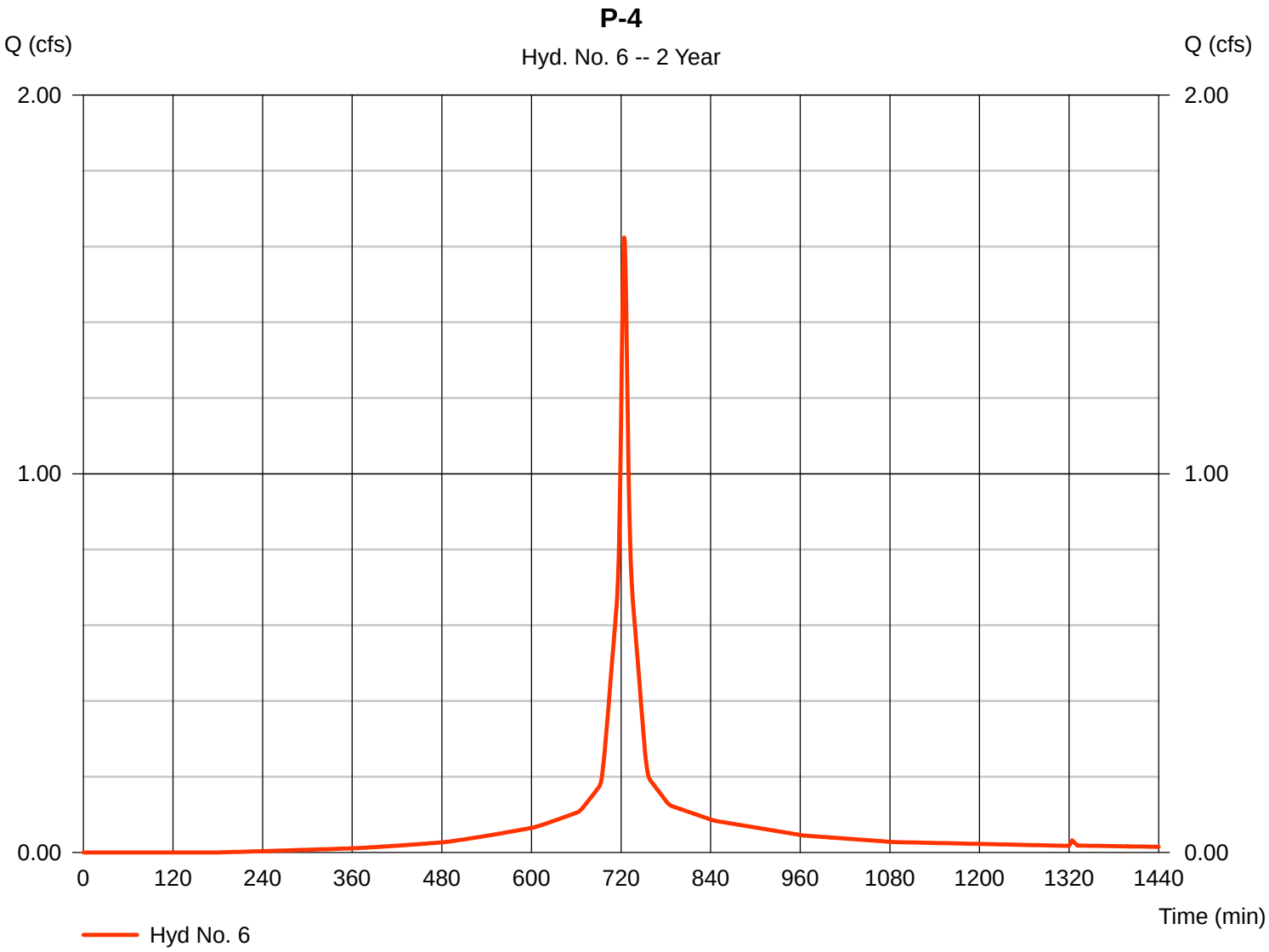
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 6

P-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.624 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	5,344 cuft
Drainage area	=	0.470 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



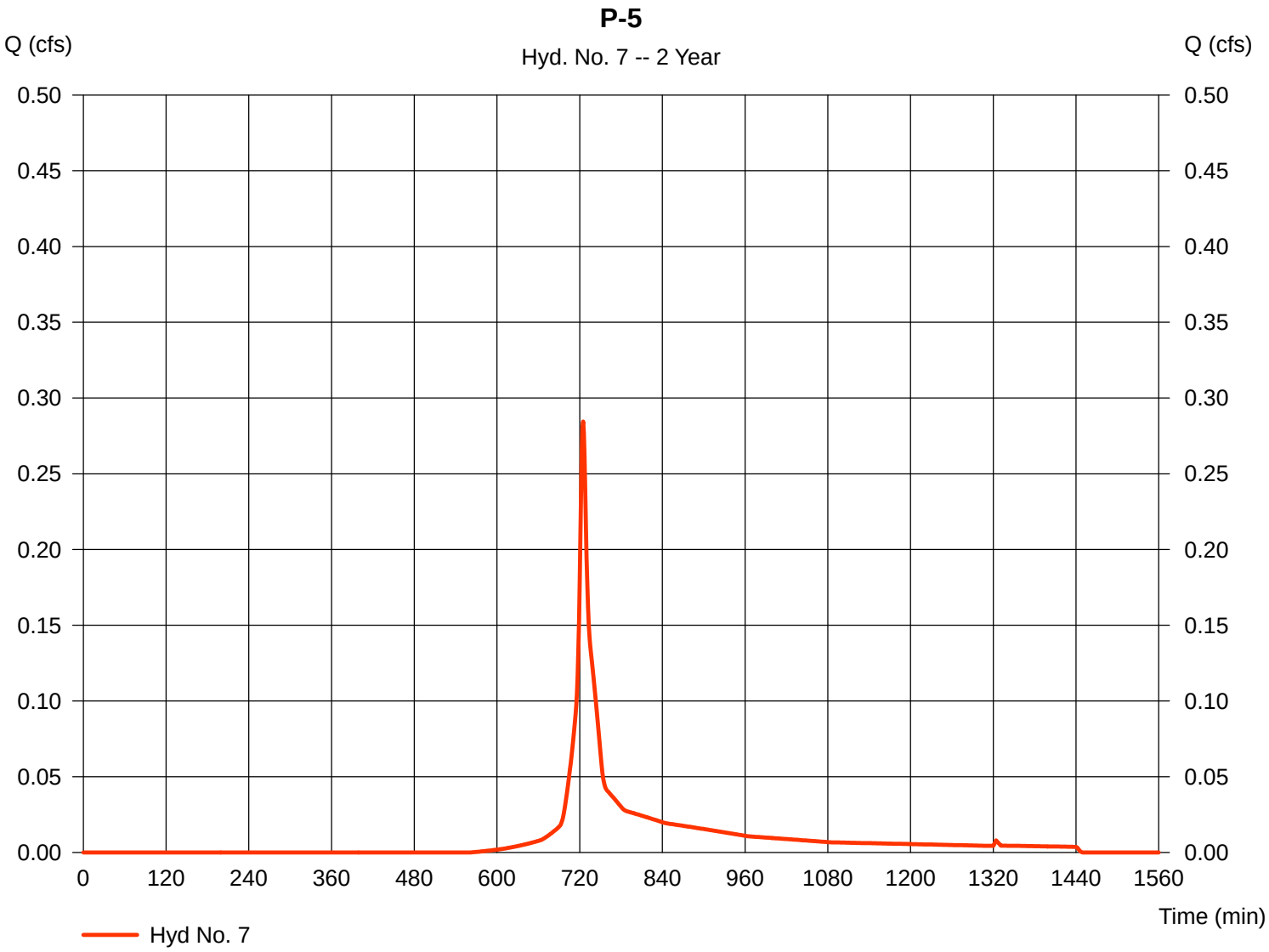
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 7

P-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.285 cfs
Storm frequency	=	2 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	884 cuft
Drainage area	=	0.150 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

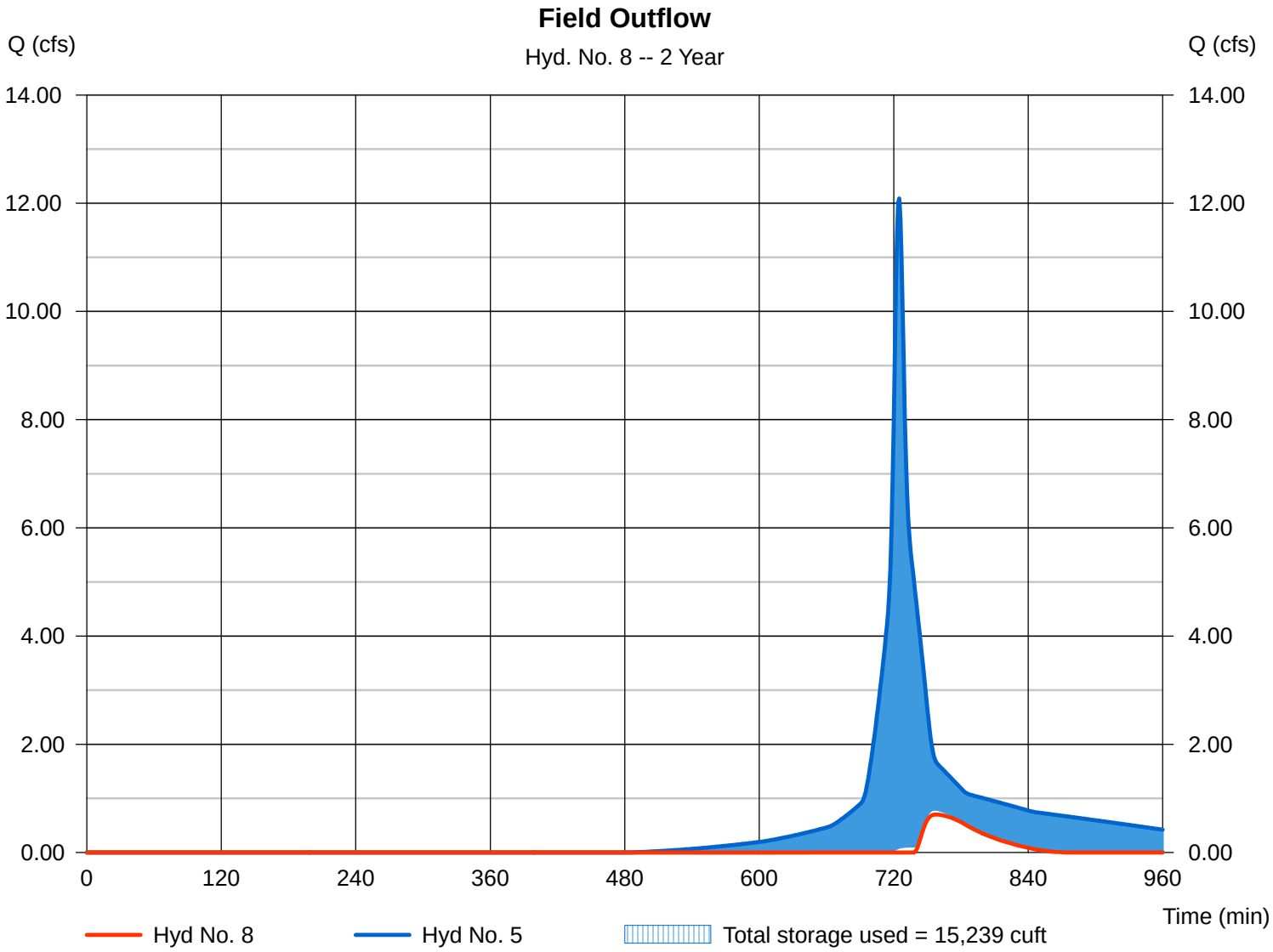
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 8

Field Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.700 cfs
Storm frequency	=	2 yrs	Time to peak	=	758 min
Time interval	=	1 min	Hyd. volume	=	2,474 cuft
Inflow hyd. No.	=	5 - P-3 (Field)	Max. Elevation	=	85.69 ft
Reservoir name	=	Field Chamber System	Max. Storage	=	15,239 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



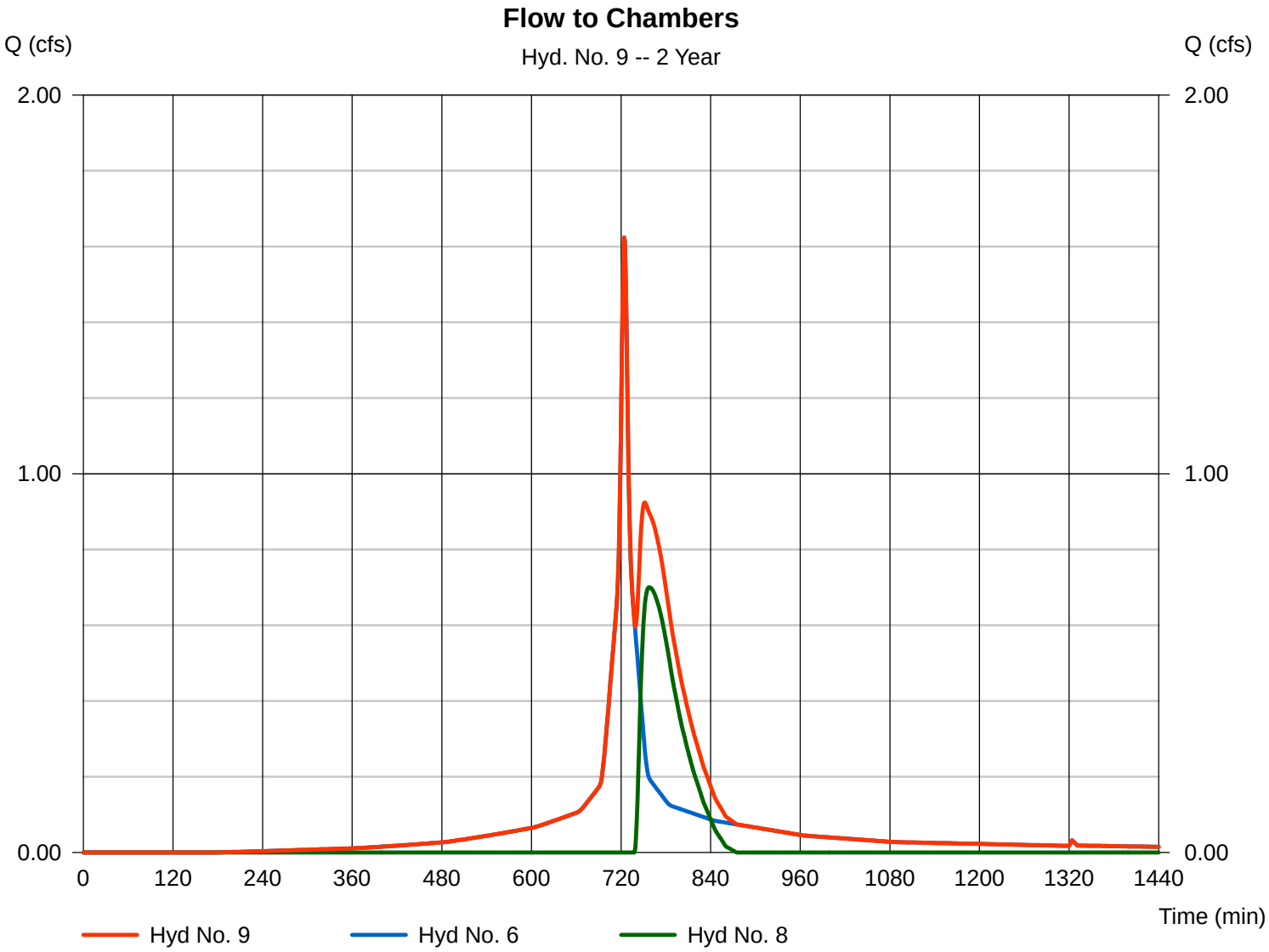
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 9

Flow to Chambers

Hydrograph type	=	Combine	Peak discharge	=	1.624 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	7,818 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.470 ac



Hydrograph Report

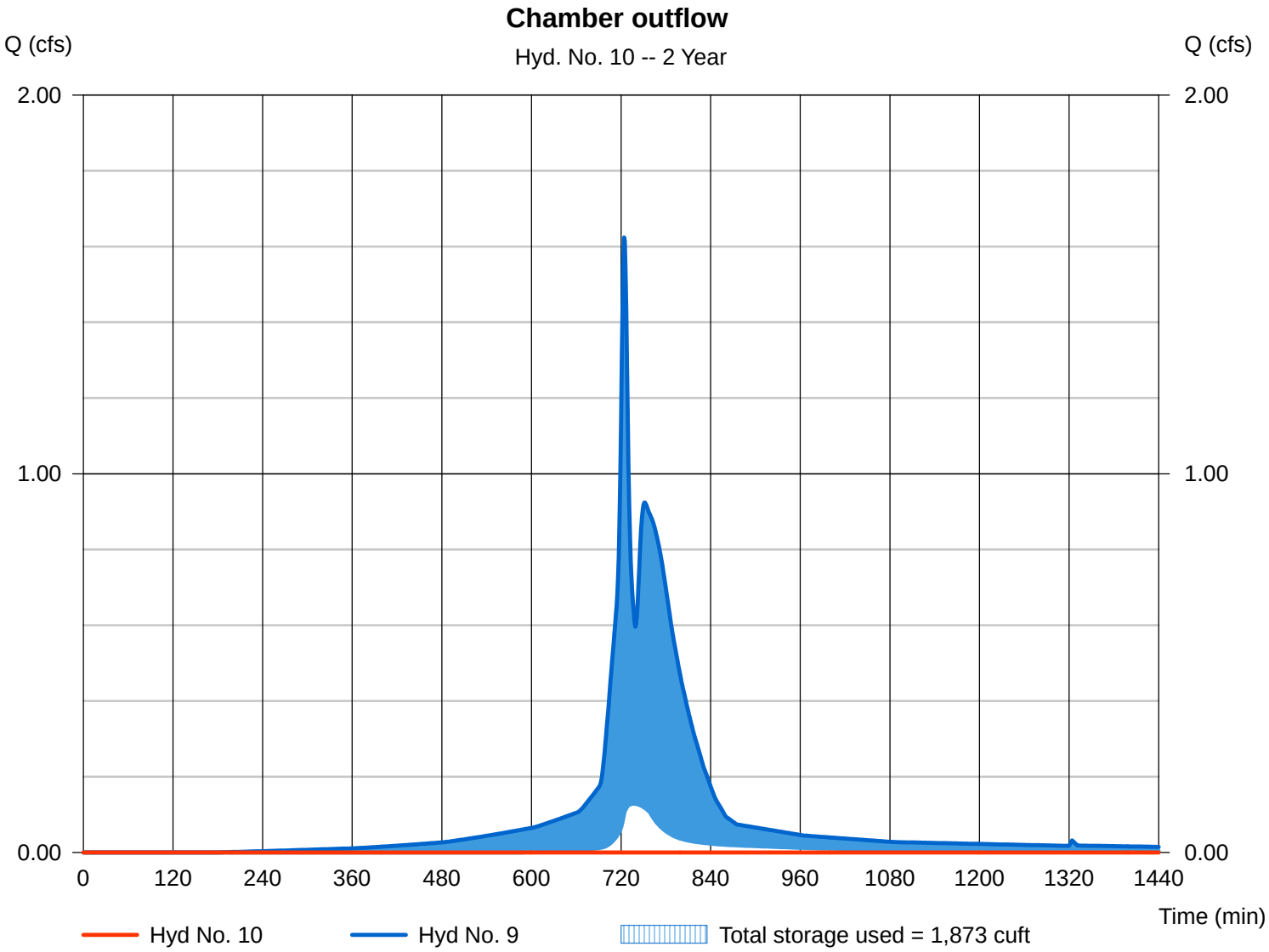
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 10

Chamber outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	594 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - Flow to Chambers	Max. Elevation	=	82.19 ft
Reservoir name	=	Chamber System	Max. Storage	=	1,873 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

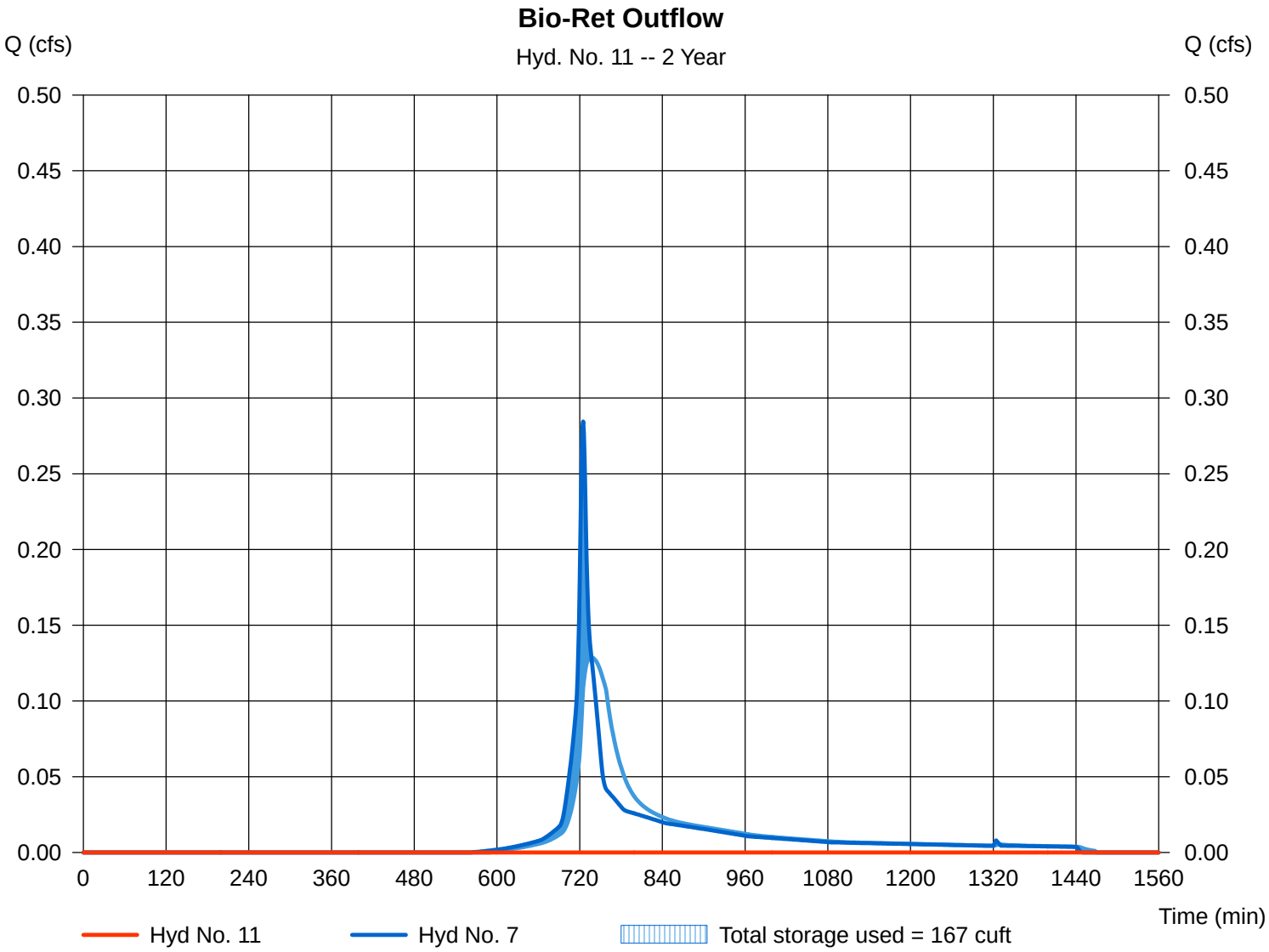
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 11

Bio-Ret Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	733 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - P-5	Max. Elevation	=	82.05 ft
Reservoir name	=	Bio-Ret Area	Max. Storage	=	167 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



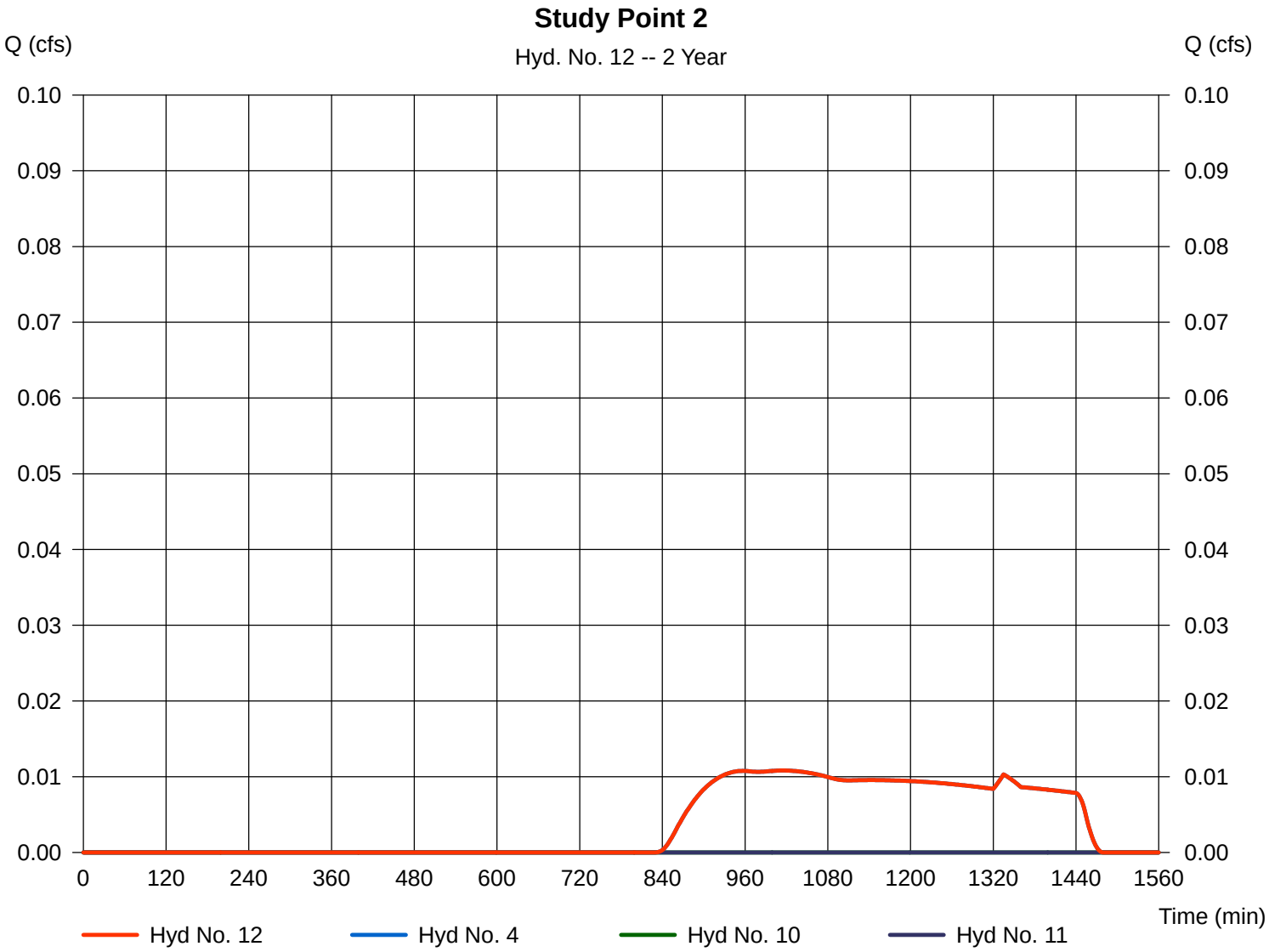
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 12

Study Point 2

Hydrograph type	=	Combine	Peak discharge	=	0.011 cfs
Storm frequency	=	2 yrs	Time to peak	=	1015 min
Time interval	=	1 min	Hyd. volume	=	333 cuft
Inflow hyds.	=	4, 10, 11	Contrib. drain. area	=	2.660 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	4.661	1	726	14,995	----	------	------	E-1
2	SCS Runoff	0.216	1	829	5,540	----	------	------	E-2
3	SCS Runoff	4.661	1	726	14,995	----	------	------	P-1
4	SCS Runoff	0.143	1	761	2,405	----	------	------	P-2
5	SCS Runoff	19.06	1	725	59,105	----	------	------	P-3 (Field)
6	SCS Runoff	2.264	1	724	7,602	----	------	------	P-4
7	SCS Runoff	0.479	1	725	1,475	----	------	------	P-5
8	Reservoir	0.747	1	727	5,538	5	85.71	15,663	Field Outflow
9	Combine	2.824	1	726	13,140	6, 8	------	------	Flow to Chambers
10	Reservoir	0.000	1	689	0	9	83.27	3,620	Chamber outflow
11	Reservoir	0.000	1	728	0	7	82.19	318	Bio-Ret Outflow
12	Combine	0.143	1	761	2,405	4, 10, 11	------	------	Study Point 2

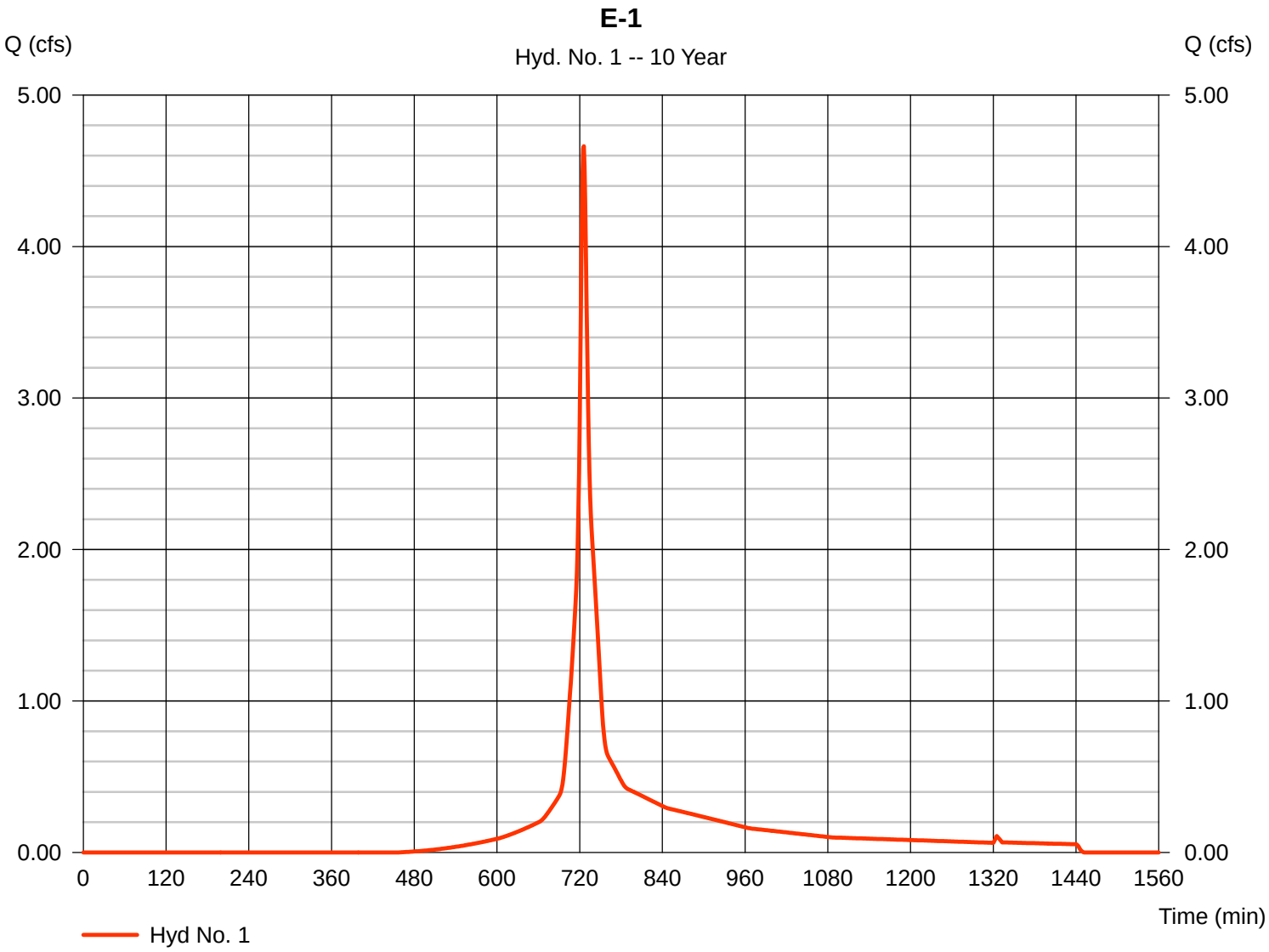
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.661 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	14,995 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



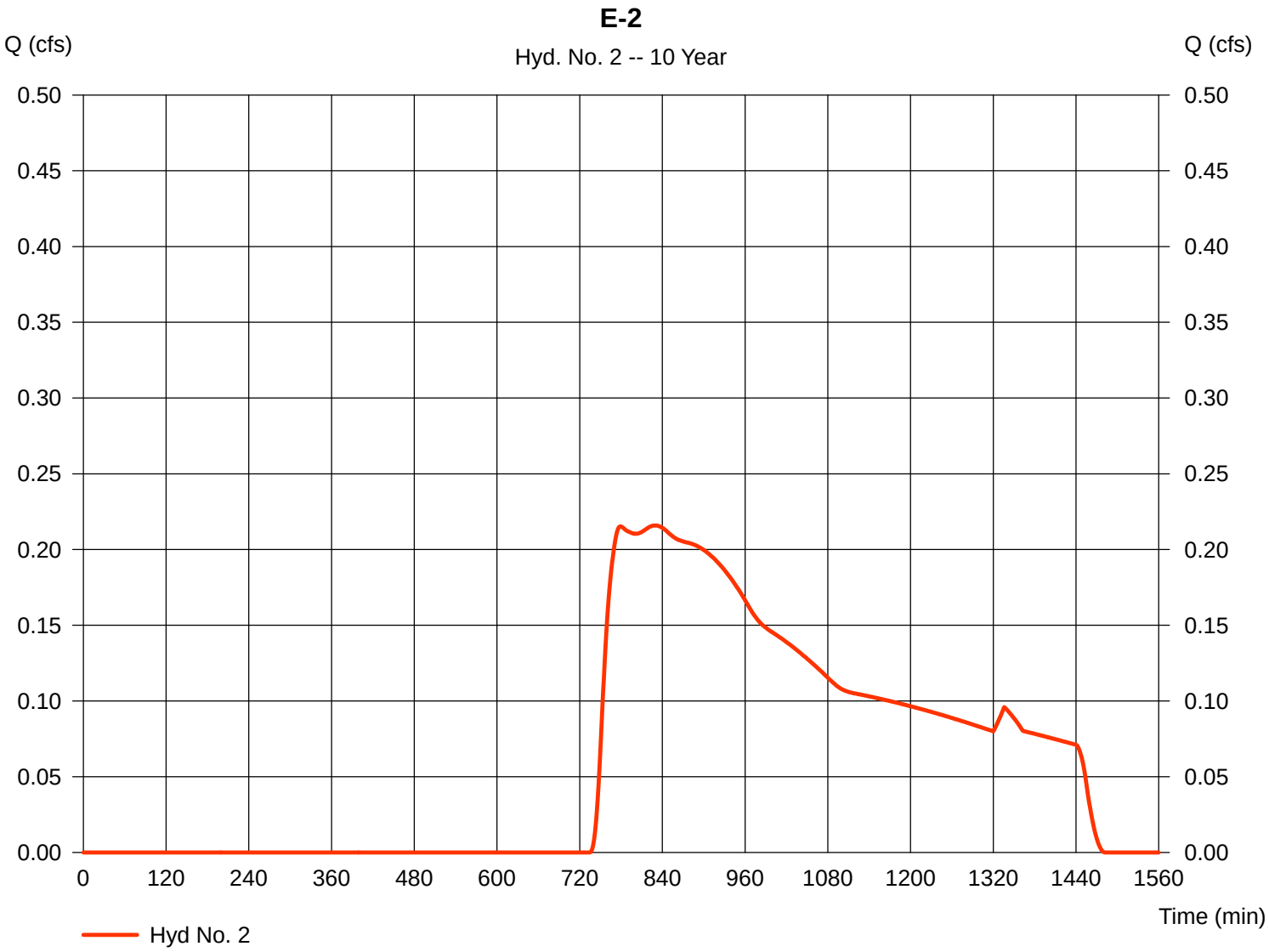
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 2

E-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.216 cfs
Storm frequency	=	10 yrs	Time to peak	=	829 min
Time interval	=	1 min	Hyd. volume	=	5,540 cuft
Drainage area	=	8.400 ac	Curve number	=	39
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.50 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



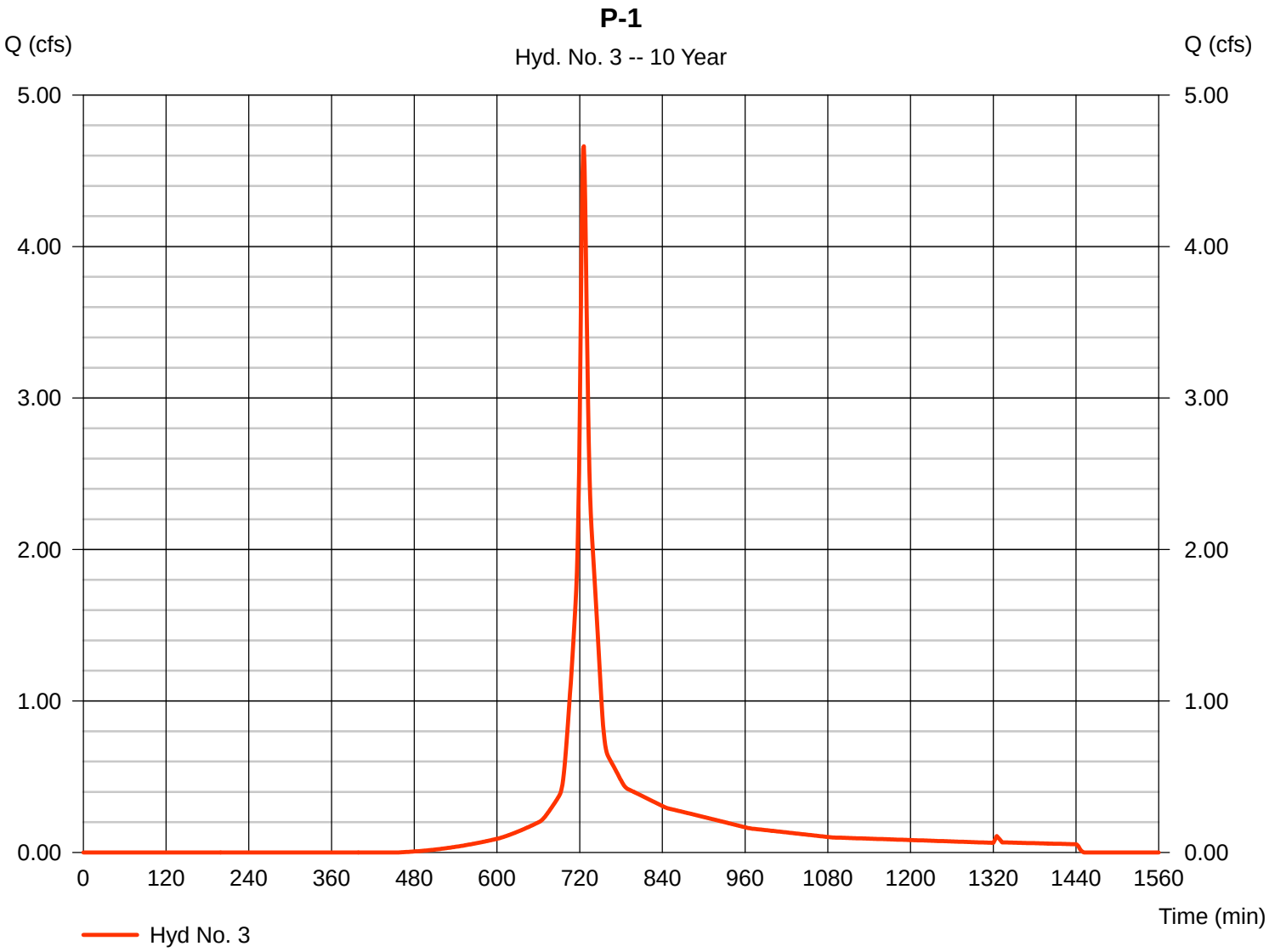
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.661 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	14,995 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



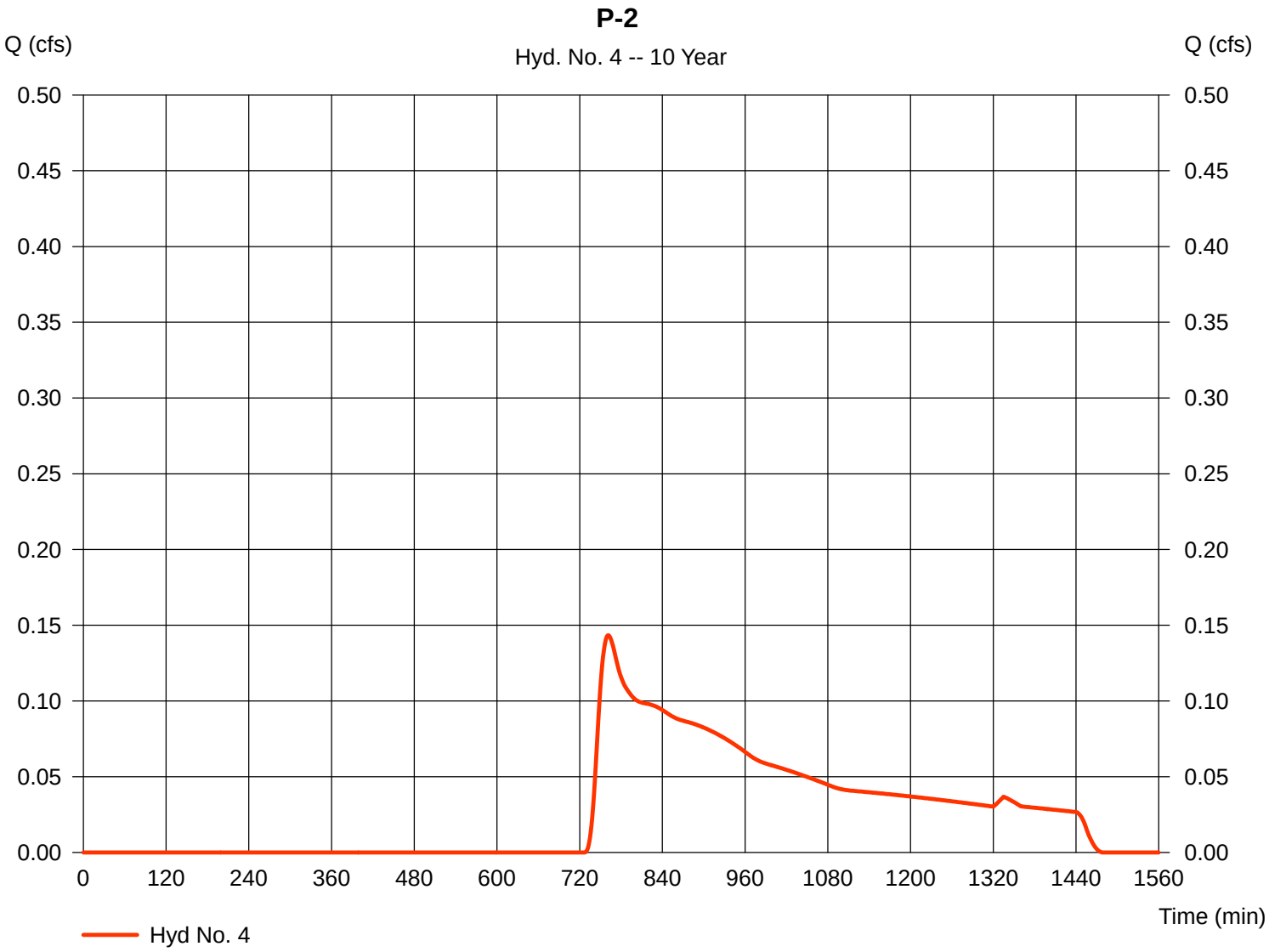
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.143 cfs
Storm frequency	=	10 yrs	Time to peak	=	761 min
Time interval	=	1 min	Hyd. volume	=	2,405 cuft
Drainage area	=	2.660 ac	Curve number	=	41
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.70 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



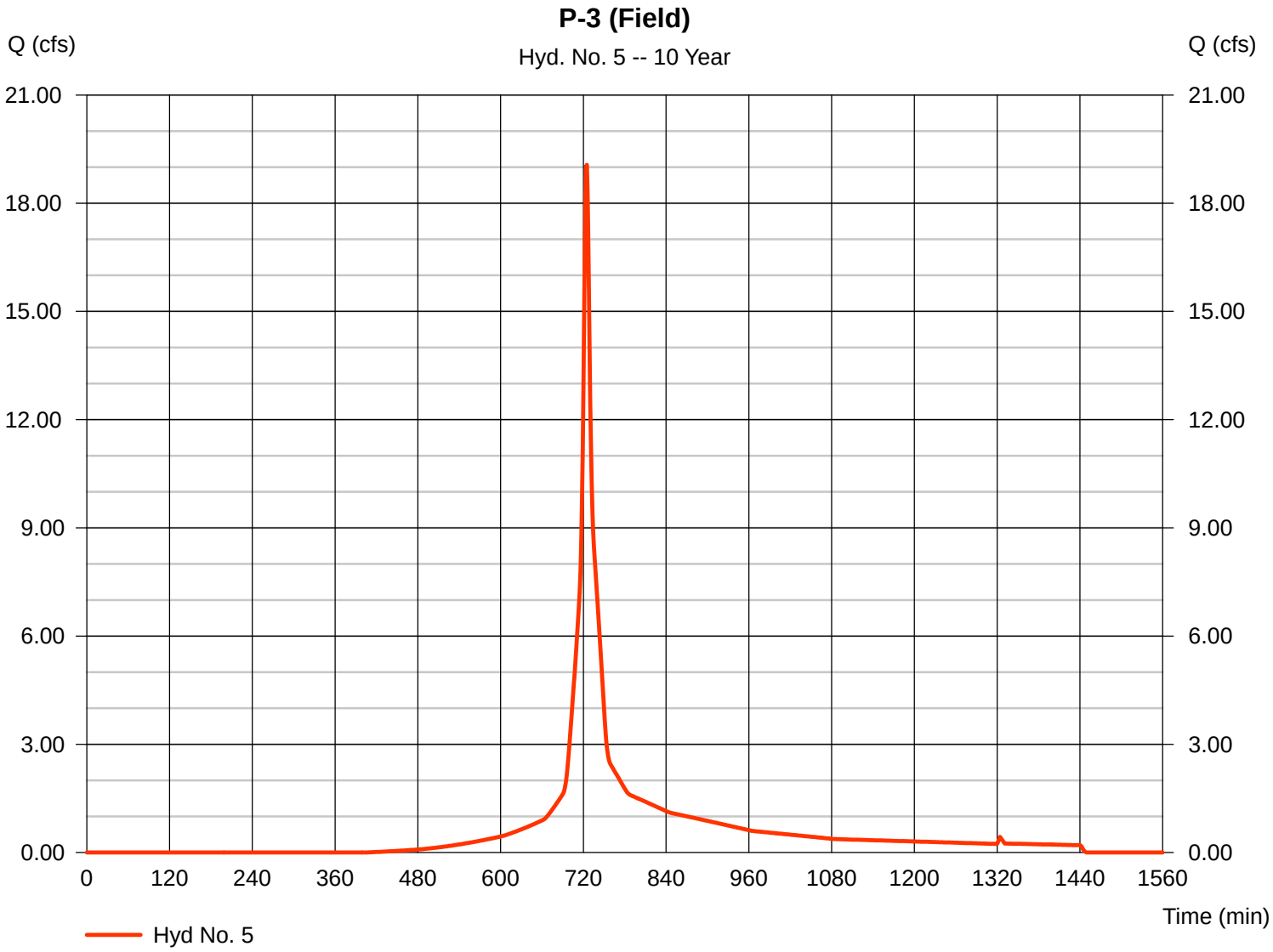
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 5

P-3 (Field)

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.06 cfs
Storm frequency	=	10 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	59,105 cuft
Drainage area	=	5.120 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



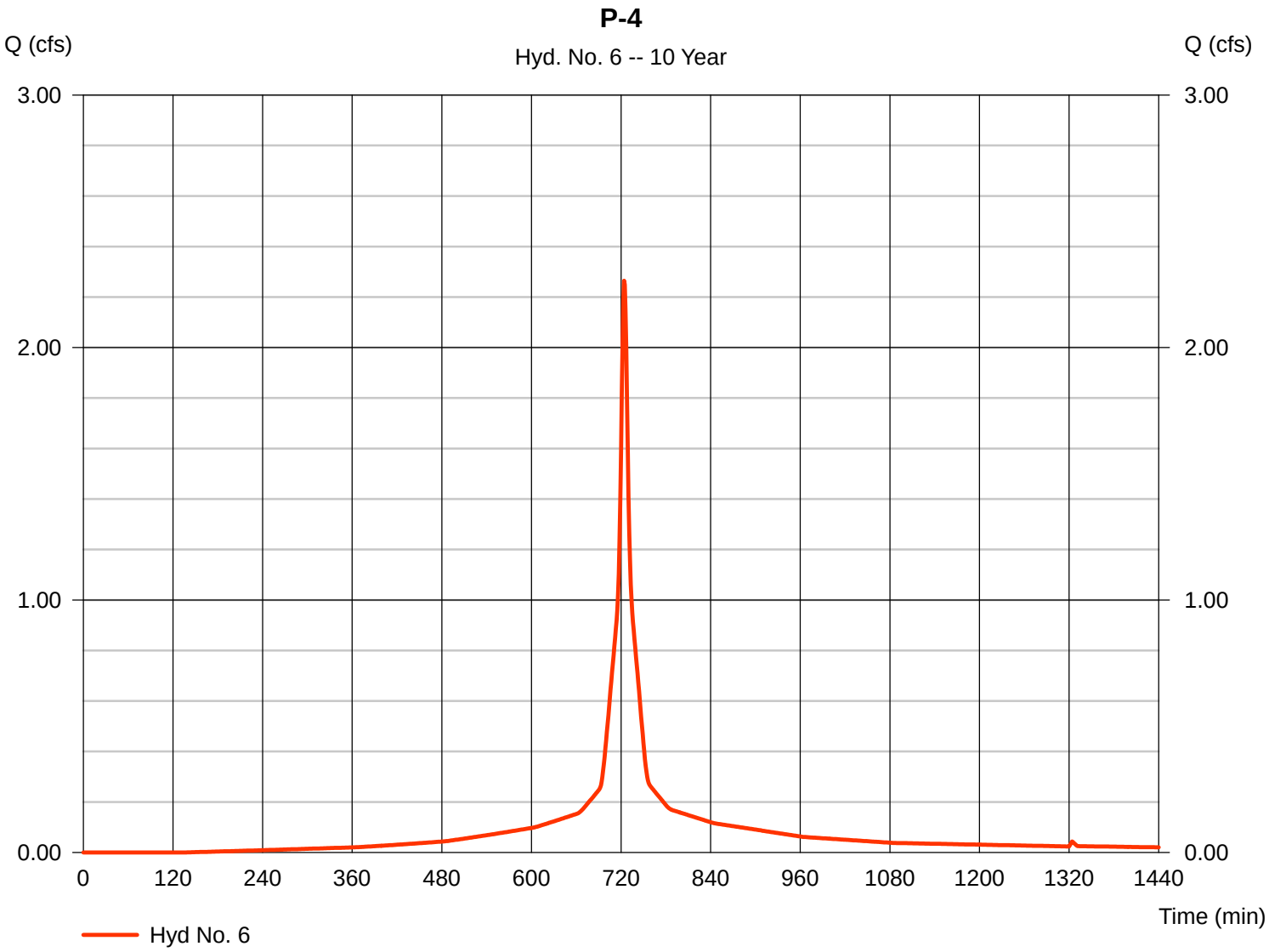
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 6

P-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.264 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	7,602 cuft
Drainage area	=	0.470 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



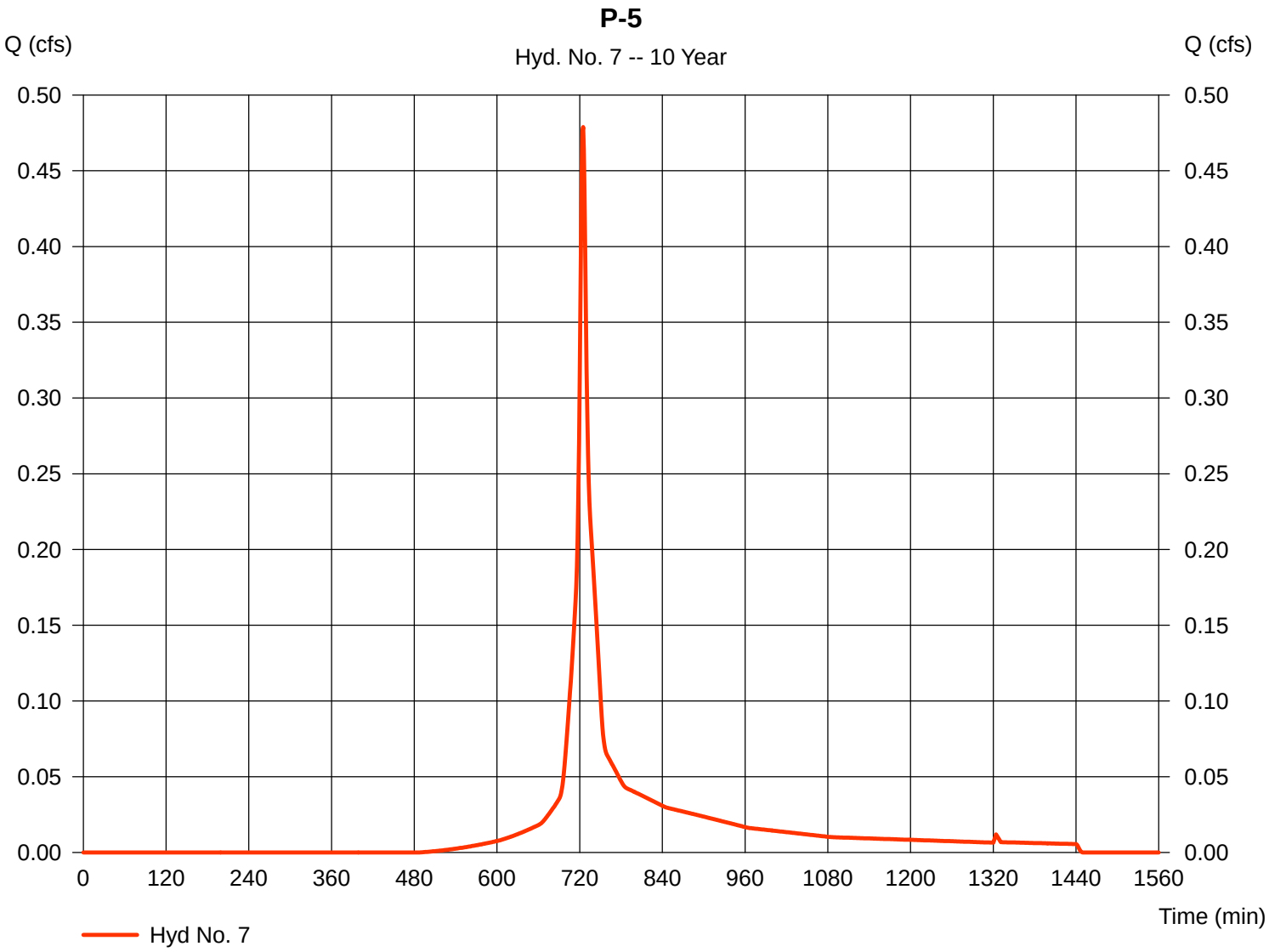
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 7

P-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.479 cfs
Storm frequency	=	10 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	1,475 cuft
Drainage area	=	0.150 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	4.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

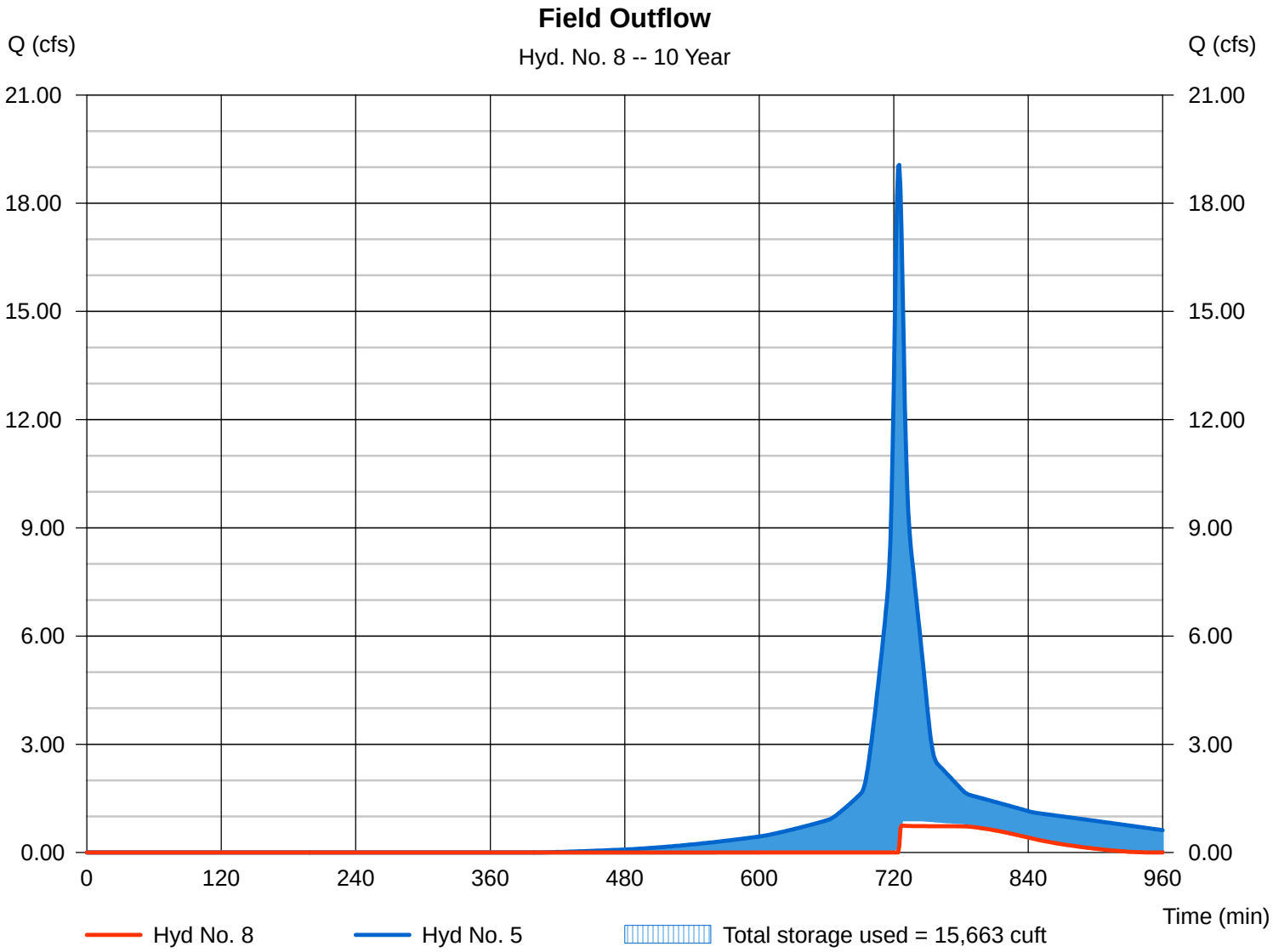
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 8

Field Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.747 cfs
Storm frequency	=	10 yrs	Time to peak	=	727 min
Time interval	=	1 min	Hyd. volume	=	5,538 cuft
Inflow hyd. No.	=	5 - P-3 (Field)	Max. Elevation	=	85.71 ft
Reservoir name	=	Field Chamber System	Max. Storage	=	15,663 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



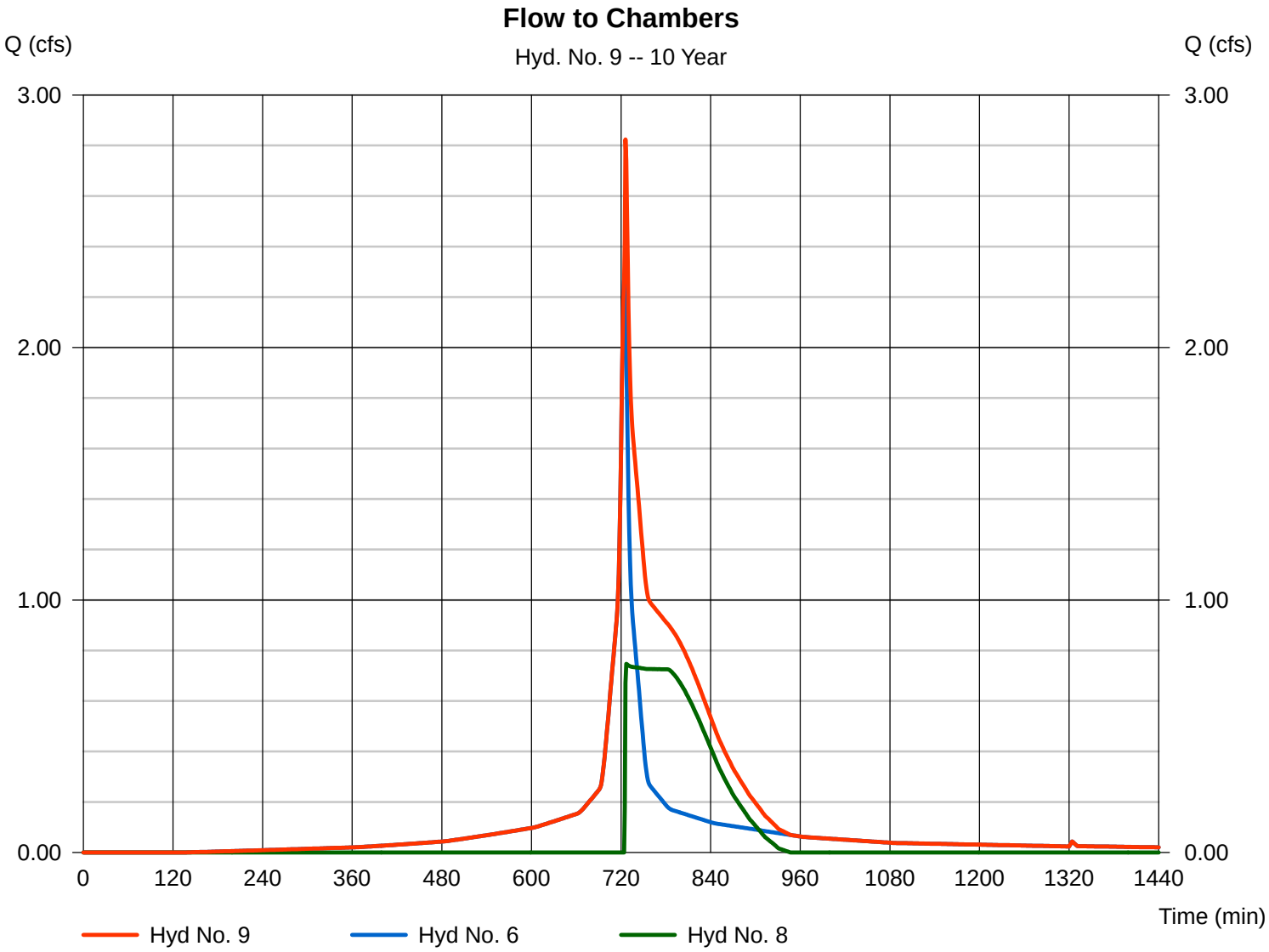
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 9

Flow to Chambers

Hydrograph type	=	Combine	Peak discharge	=	2.824 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	13,140 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.470 ac



Hydrograph Report

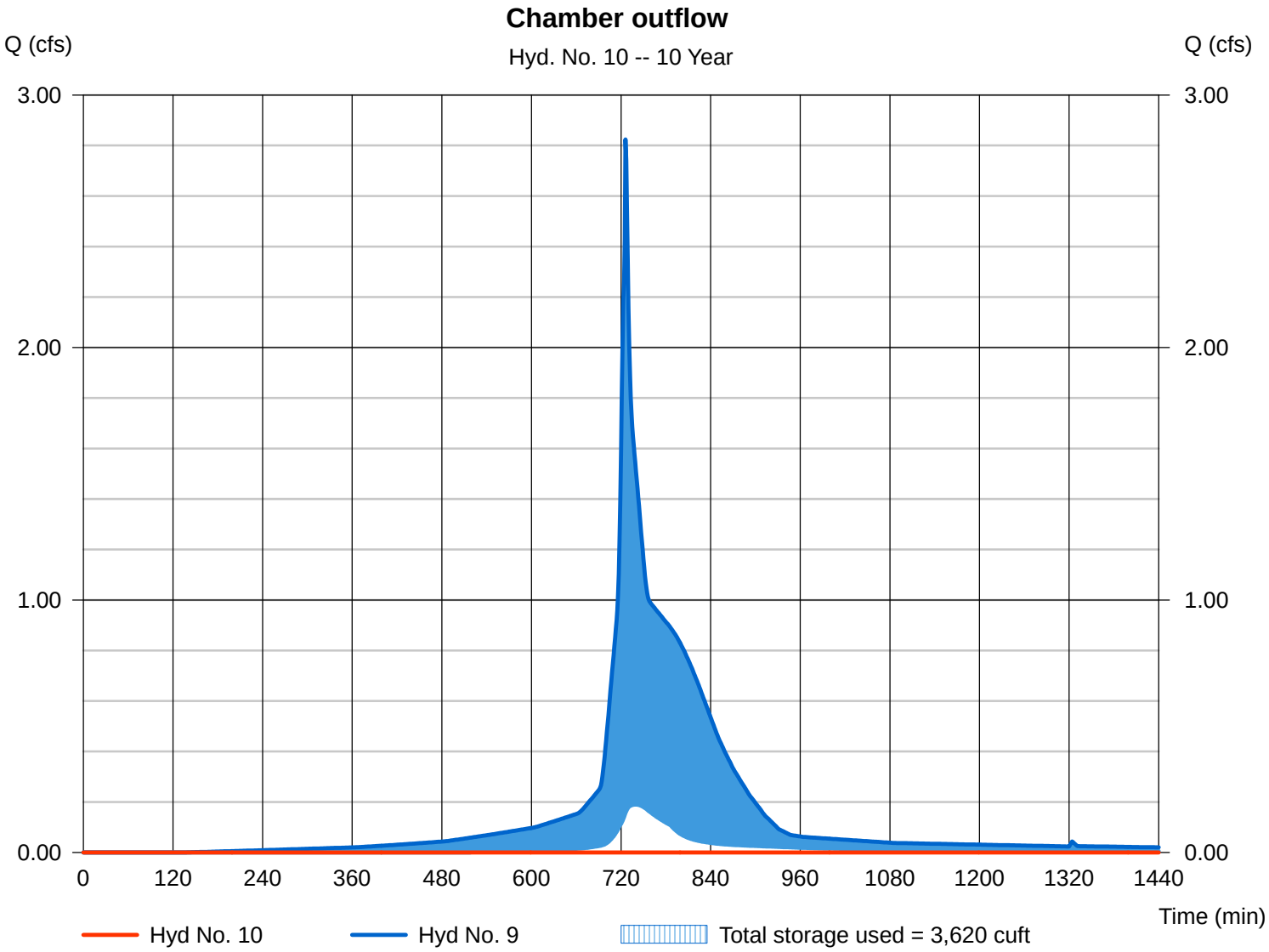
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 10

Chamber outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	689 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - Flow to Chambers	Max. Elevation	=	83.27 ft
Reservoir name	=	Chamber System	Max. Storage	=	3,620 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

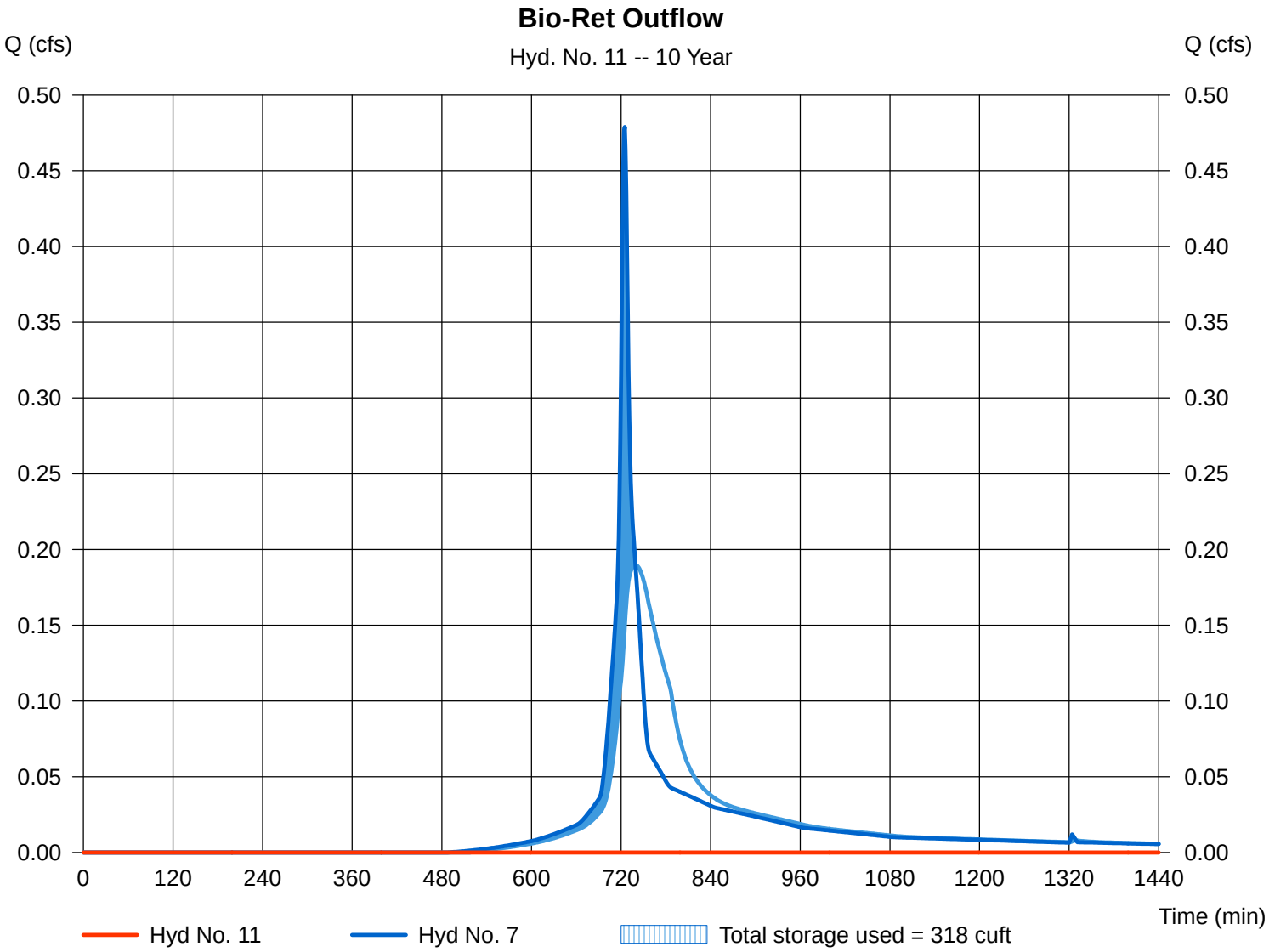
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 11

Bio-Ret Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - P-5	Max. Elevation	=	82.19 ft
Reservoir name	=	Bio-Ret Area	Max. Storage	=	318 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



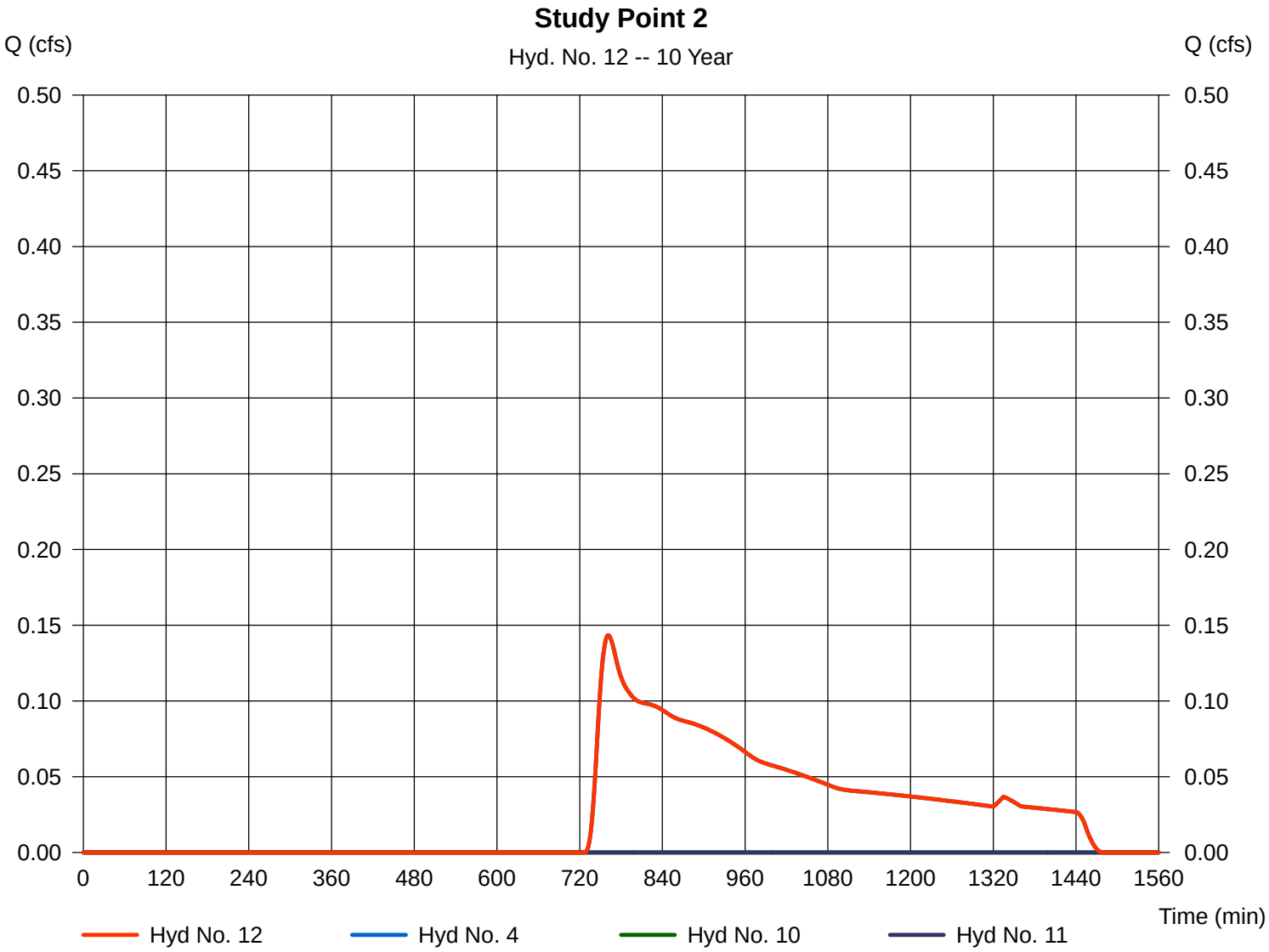
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 12

Study Point 2

Hydrograph type	=	Combine	Peak discharge	=	0.143 cfs
Storm frequency	=	10 yrs	Time to peak	=	761 min
Time interval	=	1 min	Hyd. volume	=	2,405 cuft
Inflow hyds.	=	4, 10, 11	Contrib. drain. area	=	2.660 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	5.957	1	726	19,246	----	------	------	E-1
2	SCS Runoff	0.960	1	758	11,978	----	------	------	E-2
3	SCS Runoff	5.957	1	726	19,246	----	------	------	P-1
4	SCS Runoff	0.487	1	753	4,762	----	------	------	P-2
5	SCS Runoff	23.97	1	725	74,867	----	------	------	P-3 (Field)
6	SCS Runoff	2.704	1	724	9,172	----	------	------	P-4
7	SCS Runoff	0.619	1	725	1,911	----	------	------	P-5
8	Reservoir	0.766	1	727	7,287	5	85.72	16,315	Field Outflow
9	Combine	3.460	1	724	16,458	6, 8	------	------	Flow to Chambers
10	Reservoir	0.150	1	784	386	9	83.62	3,995	Chamber outflow
11	Reservoir	0.000	1	720	0	7	82.30	432	Bio-Ret Outflow
12	Combine	0.487	1	753	5,148	4, 10, 11	------	------	Study Point 2

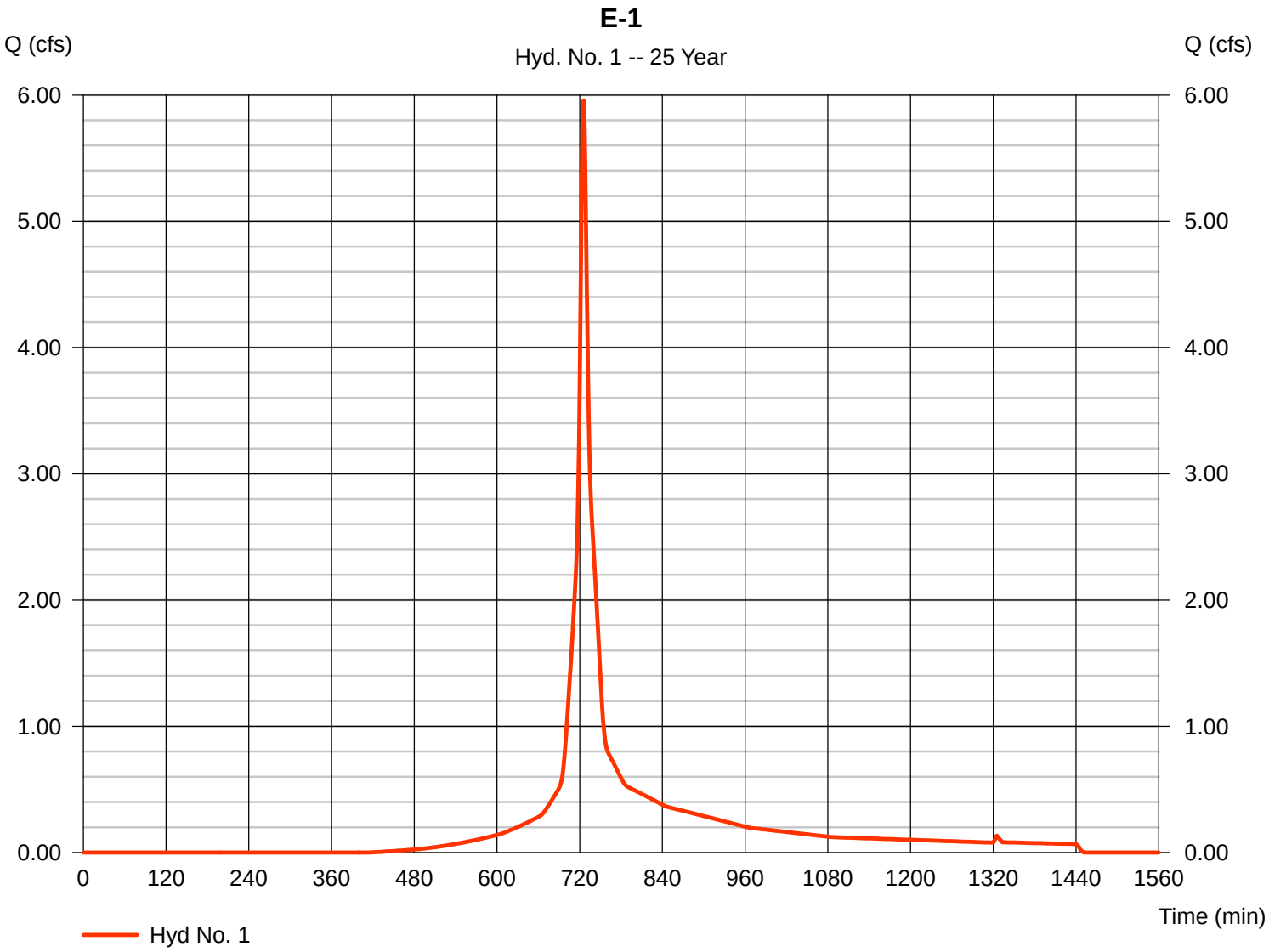
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.957 cfs
Storm frequency	=	25 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	19,246 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



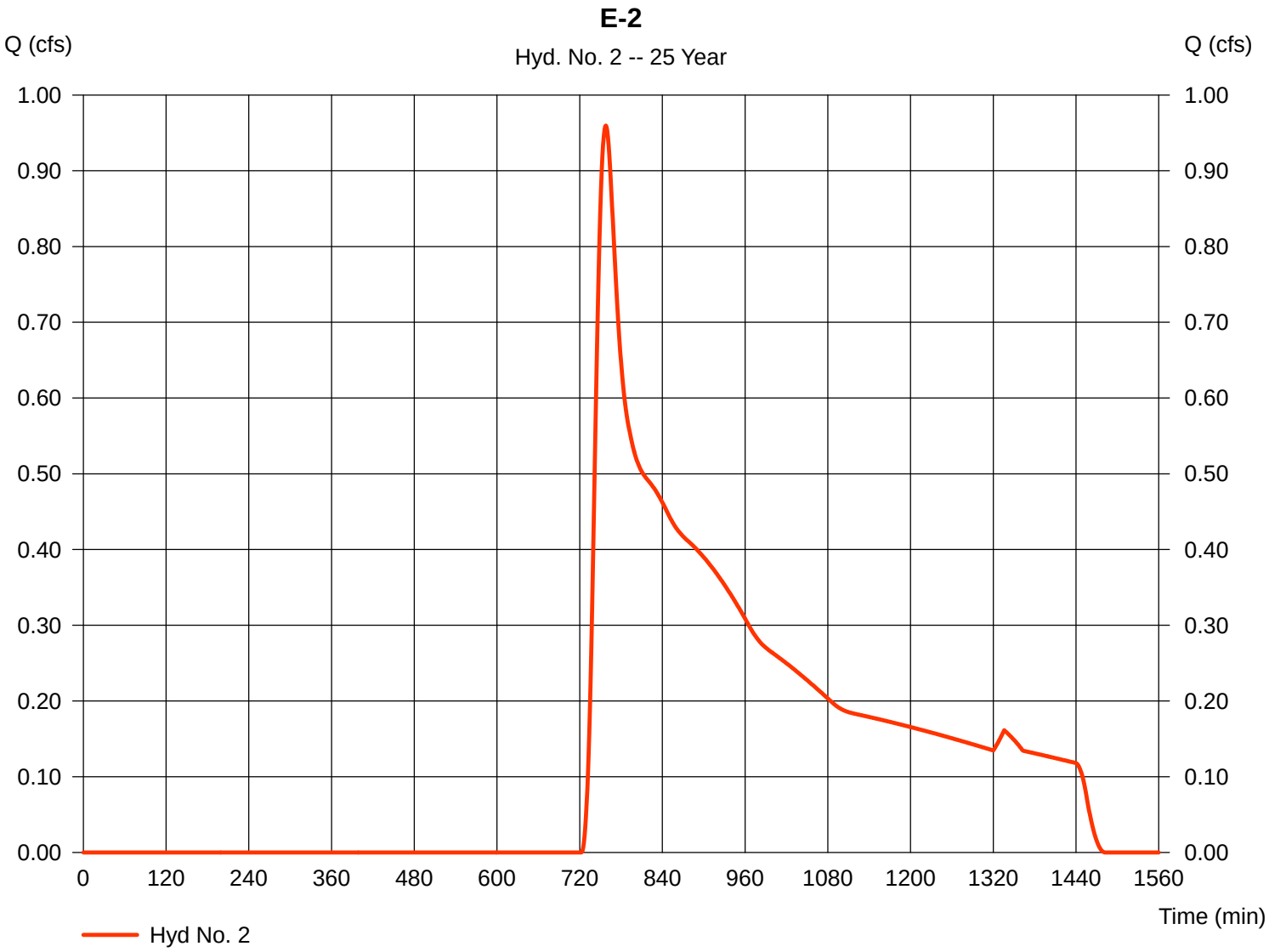
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 2

E-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.960 cfs
Storm frequency	=	25 yrs	Time to peak	=	758 min
Time interval	=	1 min	Hyd. volume	=	11,978 cuft
Drainage area	=	8.400 ac	Curve number	=	39
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.50 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



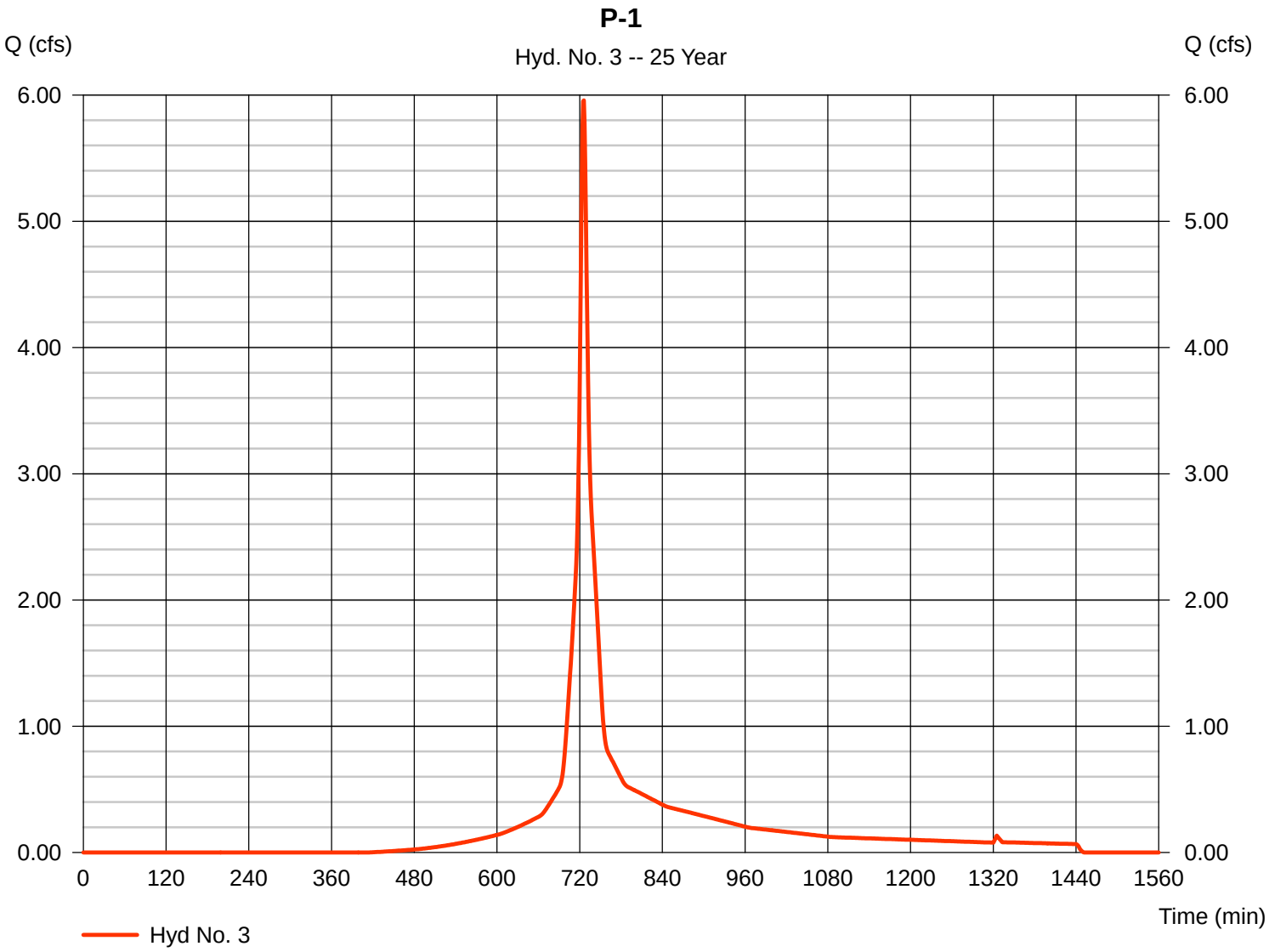
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.957 cfs
Storm frequency	=	25 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	19,246 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



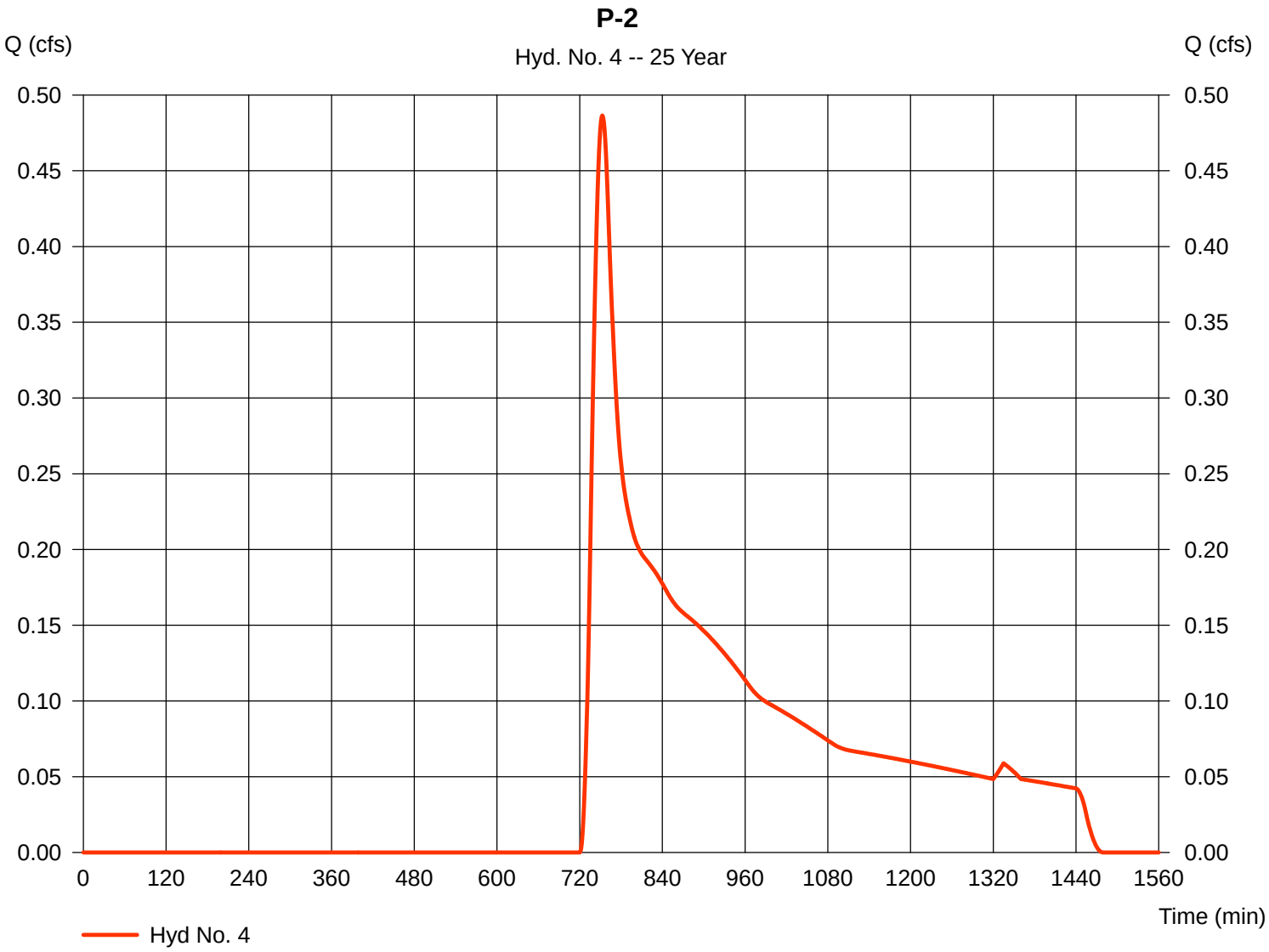
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.487 cfs
Storm frequency	=	25 yrs	Time to peak	=	753 min
Time interval	=	1 min	Hyd. volume	=	4,762 cuft
Drainage area	=	2.660 ac	Curve number	=	41
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.70 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



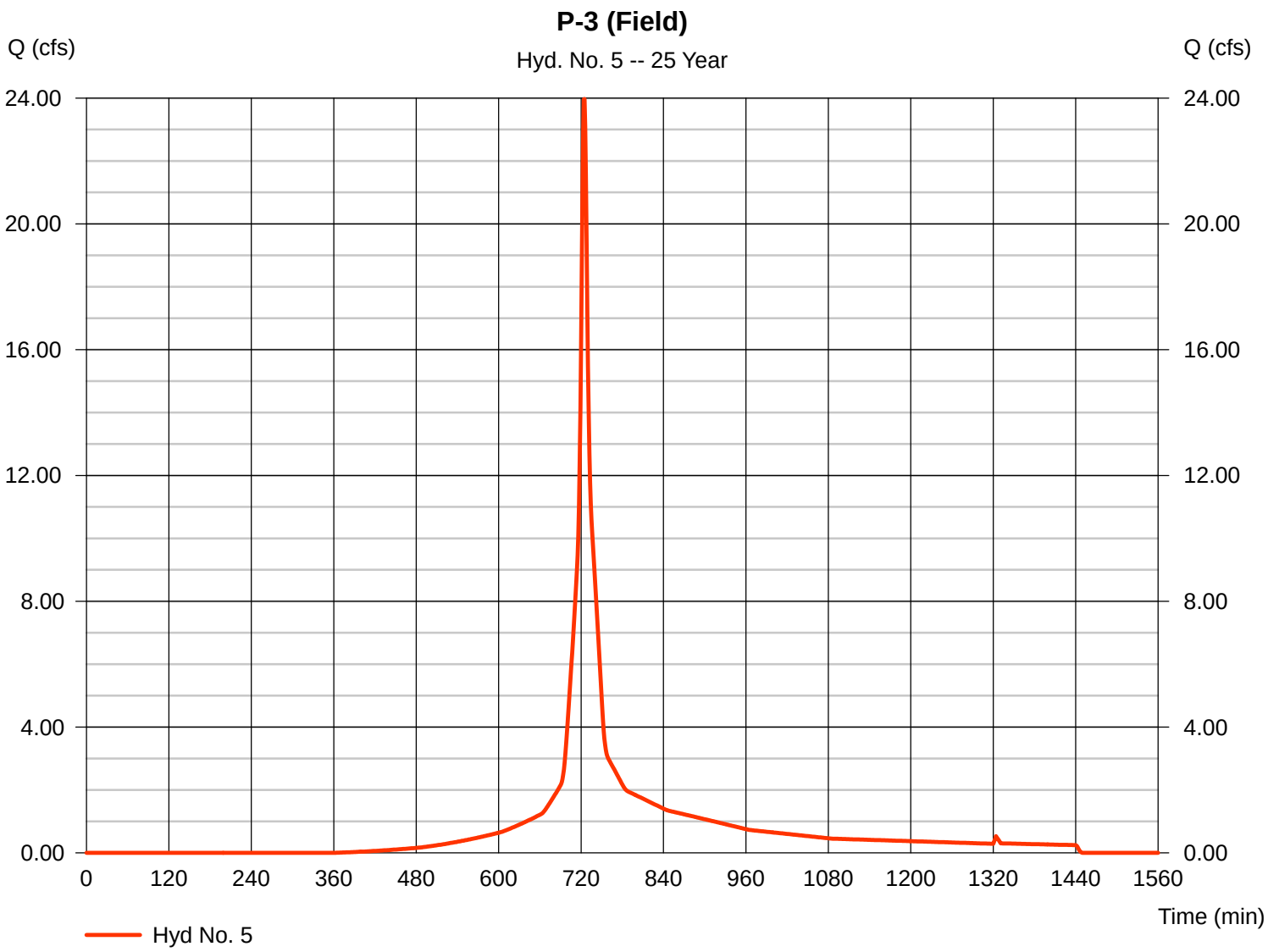
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 5

P-3 (Field)

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.97 cfs
Storm frequency	=	25 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	74,867 cuft
Drainage area	=	5.120 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



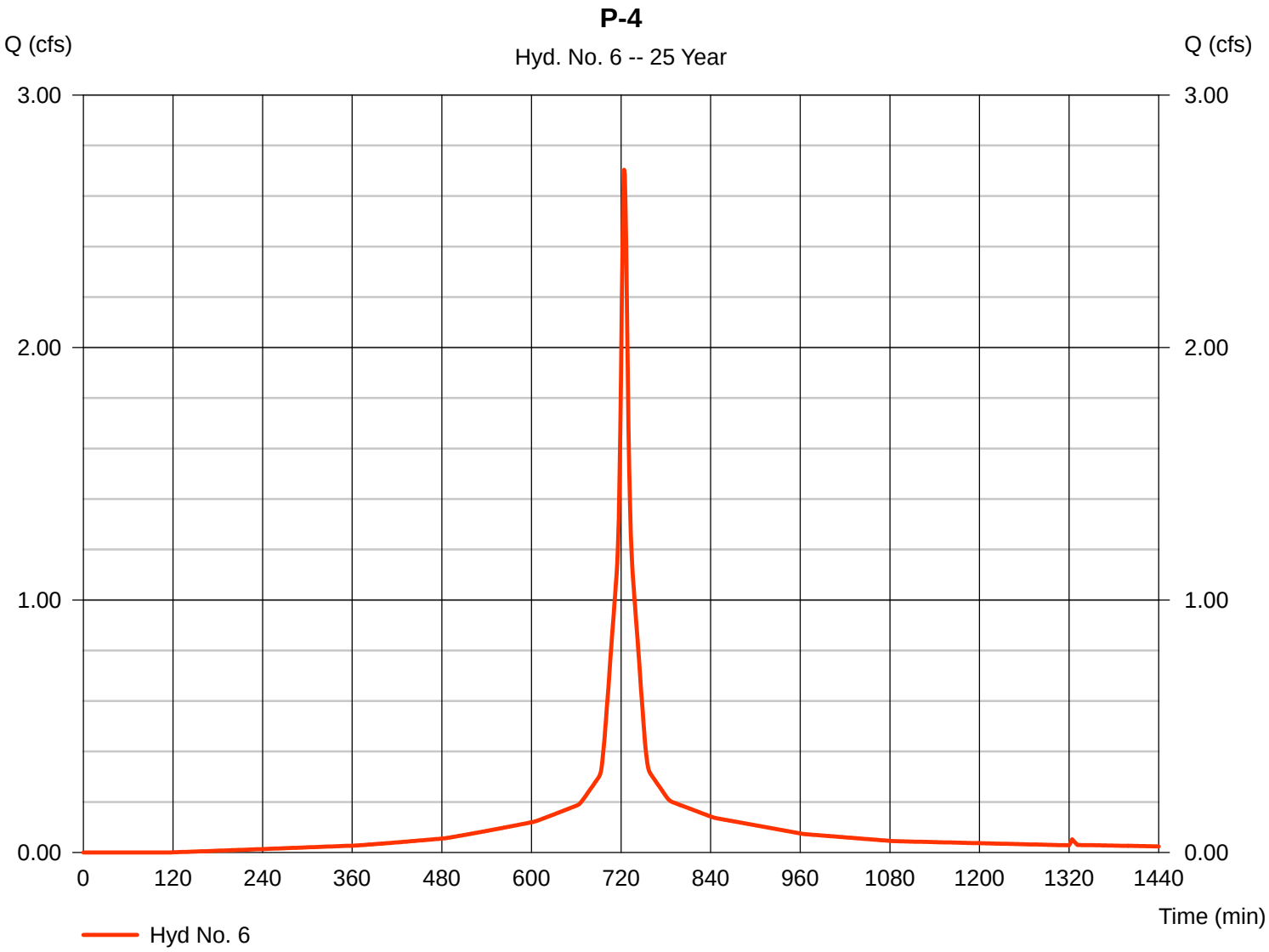
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 6

P-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.704 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	9,172 cuft
Drainage area	=	0.470 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



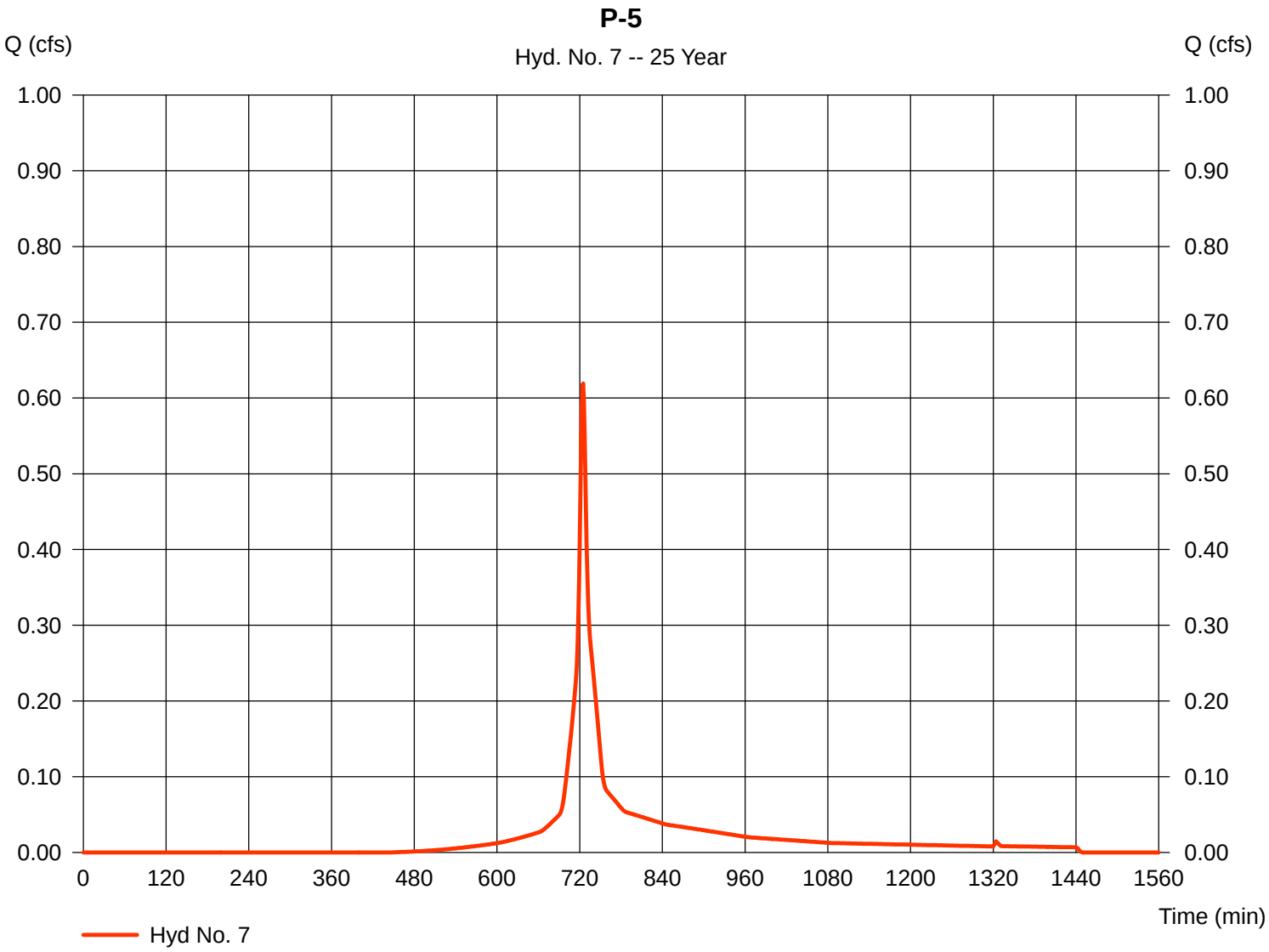
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 7

P-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.619 cfs
Storm frequency	=	25 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	1,911 cuft
Drainage area	=	0.150 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.80 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

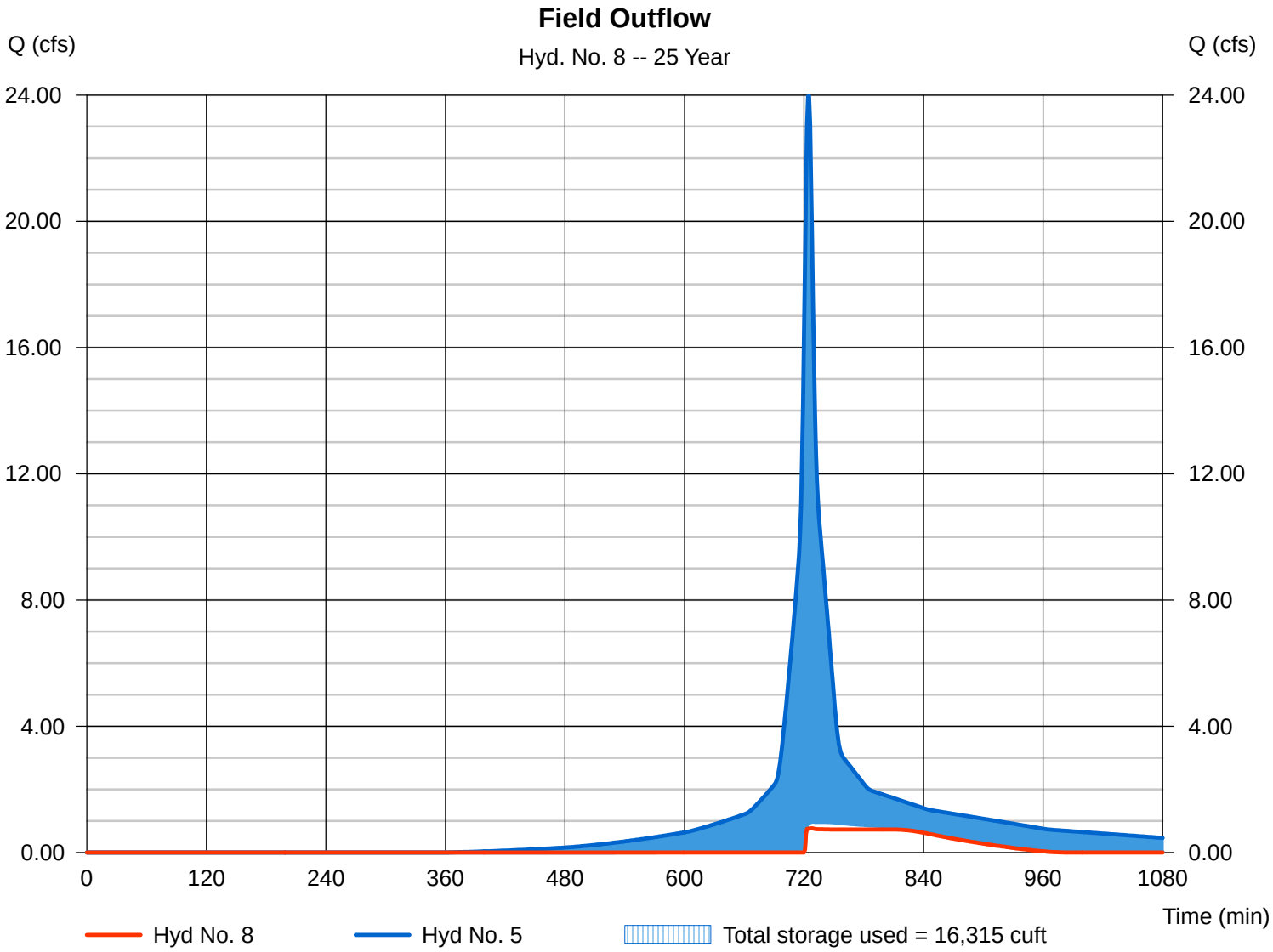
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 8

Field Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.766 cfs
Storm frequency	=	25 yrs	Time to peak	=	727 min
Time interval	=	1 min	Hyd. volume	=	7,287 cuft
Inflow hyd. No.	=	5 - P-3 (Field)	Max. Elevation	=	85.72 ft
Reservoir name	=	Field Chamber System	Max. Storage	=	16,315 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



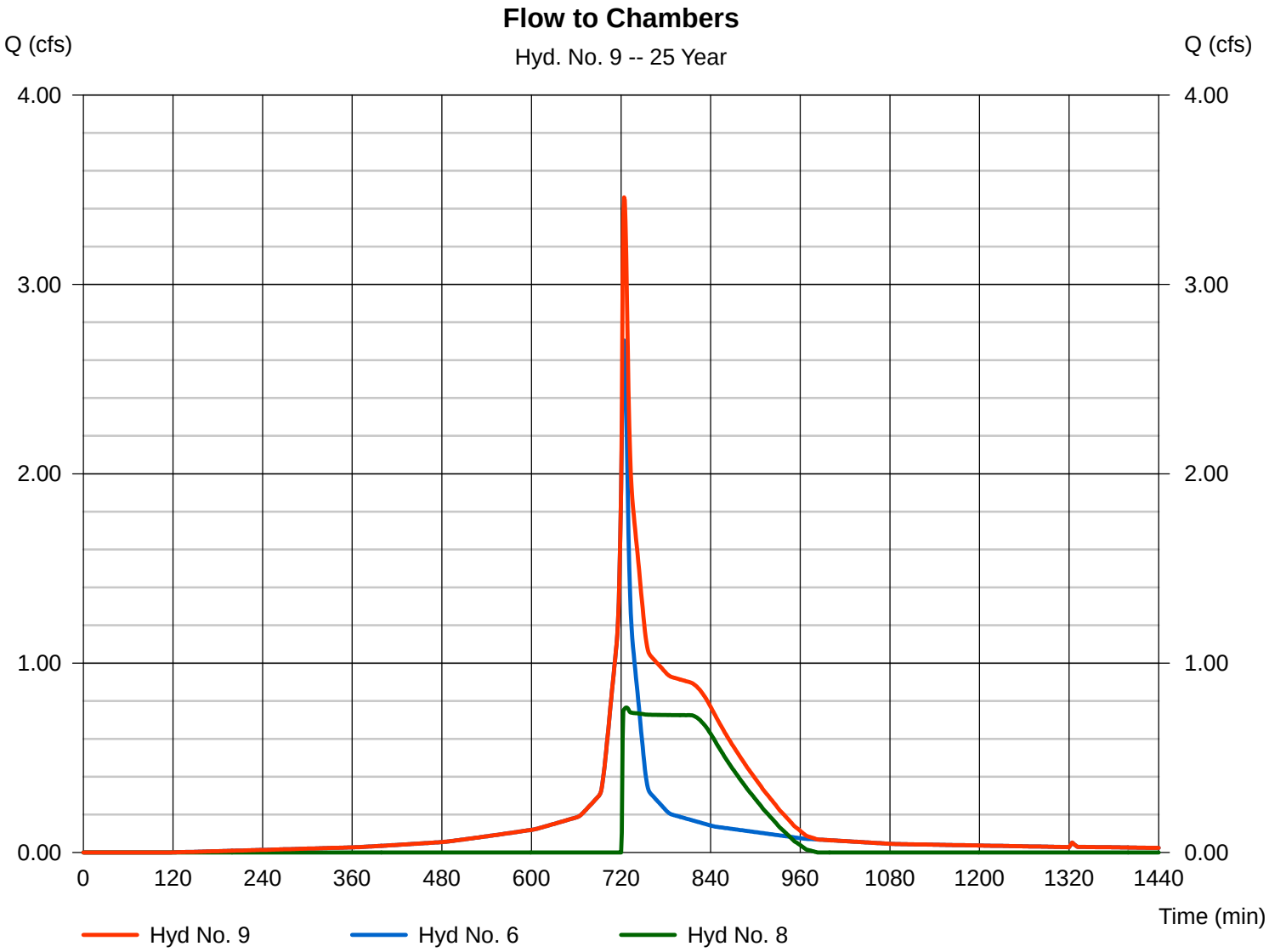
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 9

Flow to Chambers

Hydrograph type	=	Combine	Peak discharge	=	3.460 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	16,458 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.470 ac



Hydrograph Report

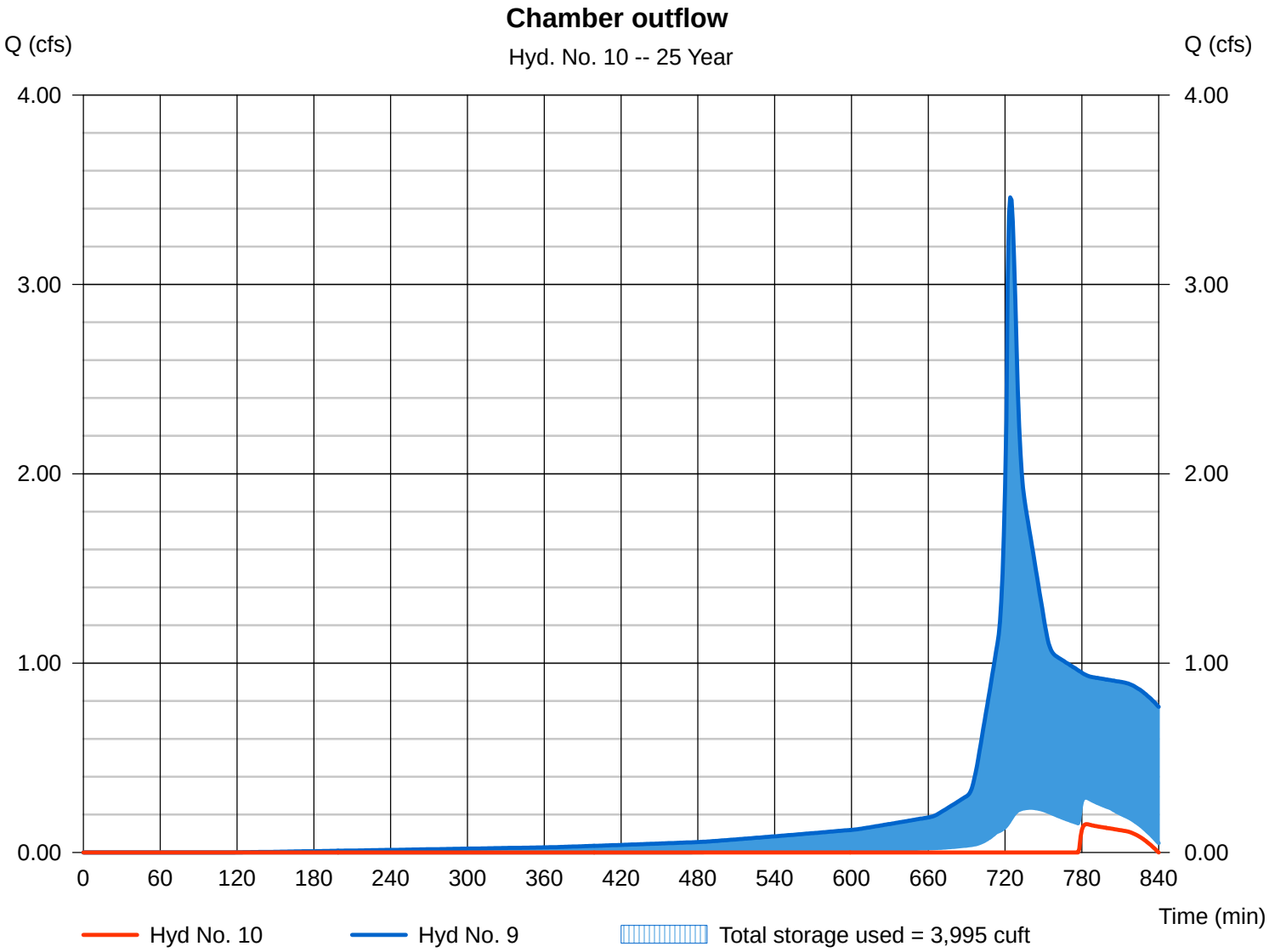
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 10

Chamber outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.150 cfs
Storm frequency	=	25 yrs	Time to peak	=	784 min
Time interval	=	1 min	Hyd. volume	=	386 cuft
Inflow hyd. No.	=	9 - Flow to Chambers	Max. Elevation	=	83.62 ft
Reservoir name	=	Chamber System	Max. Storage	=	3,995 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

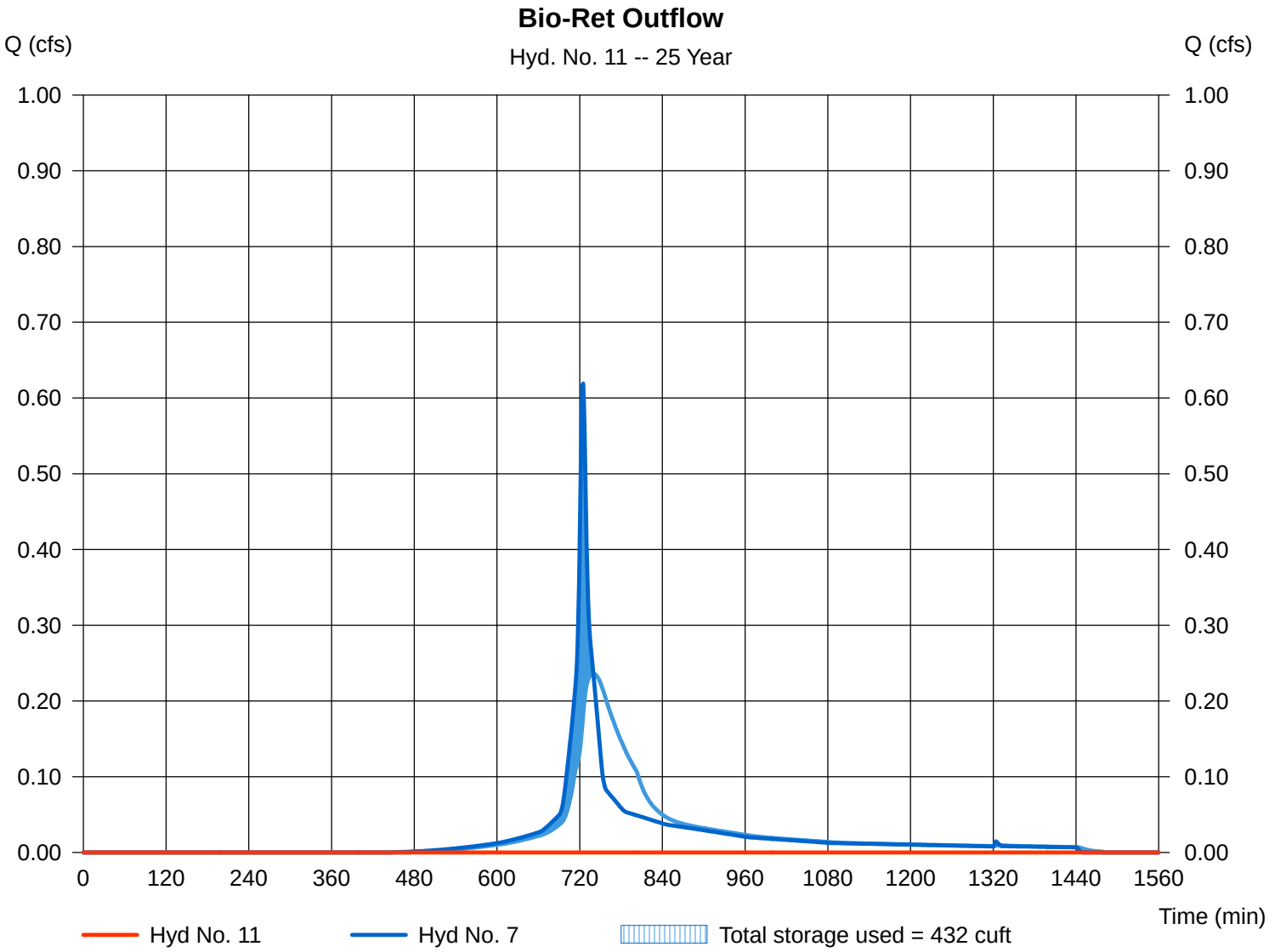
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 11

Bio-Ret Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	25 yrs	Time to peak	=	720 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - P-5	Max. Elevation	=	82.30 ft
Reservoir name	=	Bio-Ret Area	Max. Storage	=	432 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



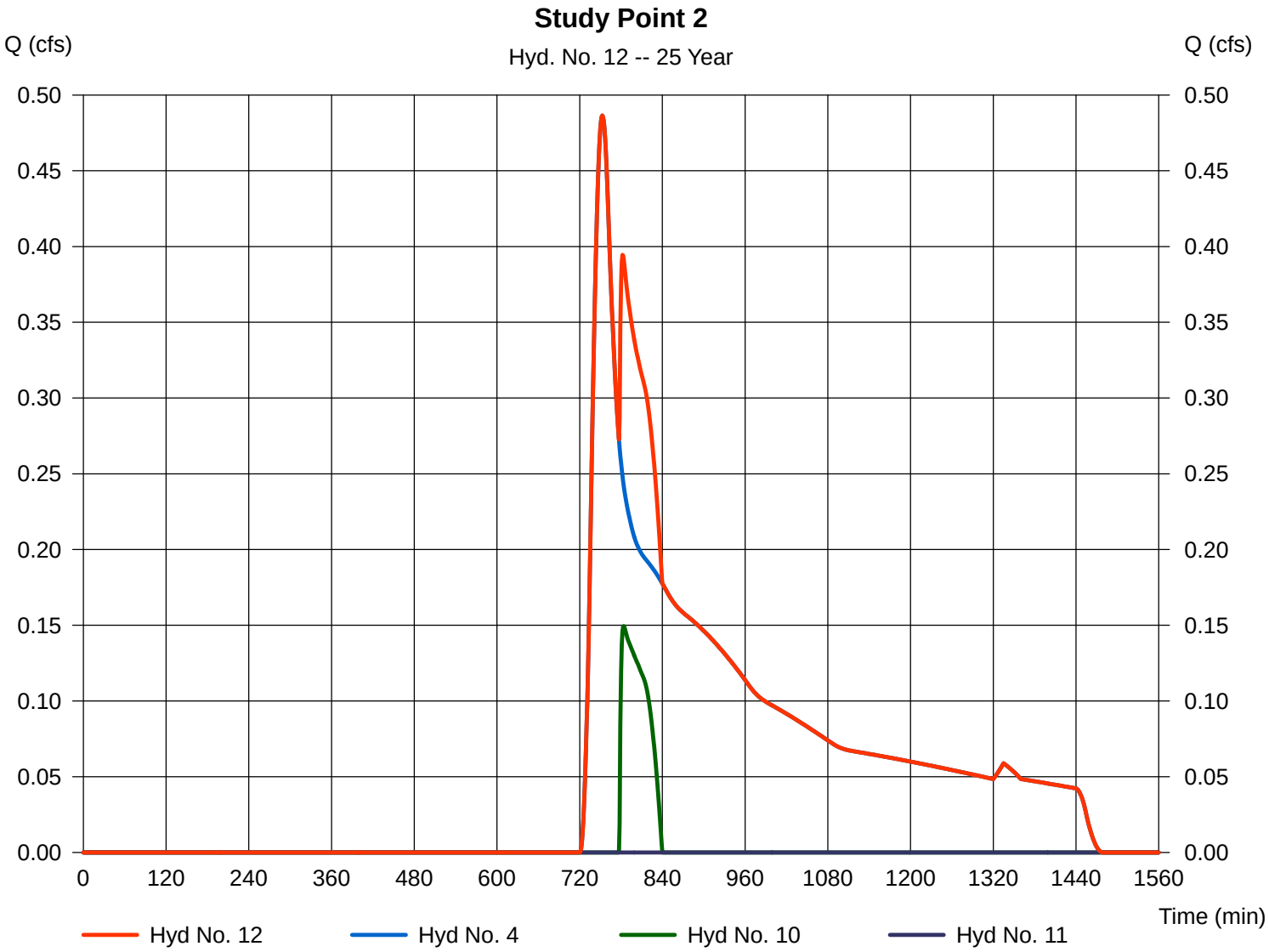
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 12

Study Point 2

Hydrograph type	=	Combine	Peak discharge	=	0.487 cfs
Storm frequency	=	25 yrs	Time to peak	=	753 min
Time interval	=	1 min	Hyd. volume	=	5,148 cuft
Inflow hyds.	=	4, 10, 11	Contrib. drain. area	=	2.660 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	8.037	1	725	26,176	----	------	------	E-1
2	SCS Runoff	3.273	1	751	26,073	----	------	------	E-2
3	SCS Runoff	8.037	1	725	26,176	----	------	------	P-1
4	SCS Runoff	1.393	1	747	9,718	----	------	------	P-2
5	SCS Runoff	31.79	1	724	100,350	----	------	------	P-3 (Field)
6	SCS Runoff	3.395	1	724	11,656	----	------	------	P-4
7	SCS Runoff	0.844	1	725	2,625	----	------	------	P-5
8	Reservoir	0.845	1	730	9,793	5	85.75	19,729	Field Outflow
9	Combine	4.185	1	724	21,449	6, 8	------	------	Flow to Chambers
10	Reservoir	1.128	1	740	2,058	9	83.68	4,049	Chamber outflow
11	Reservoir	0.000	1	720	0	7	82.47	622	Bio-Ret Outflow
12	Combine	2.394	1	740	11,776	4, 10, 11	------	------	Study Point 2

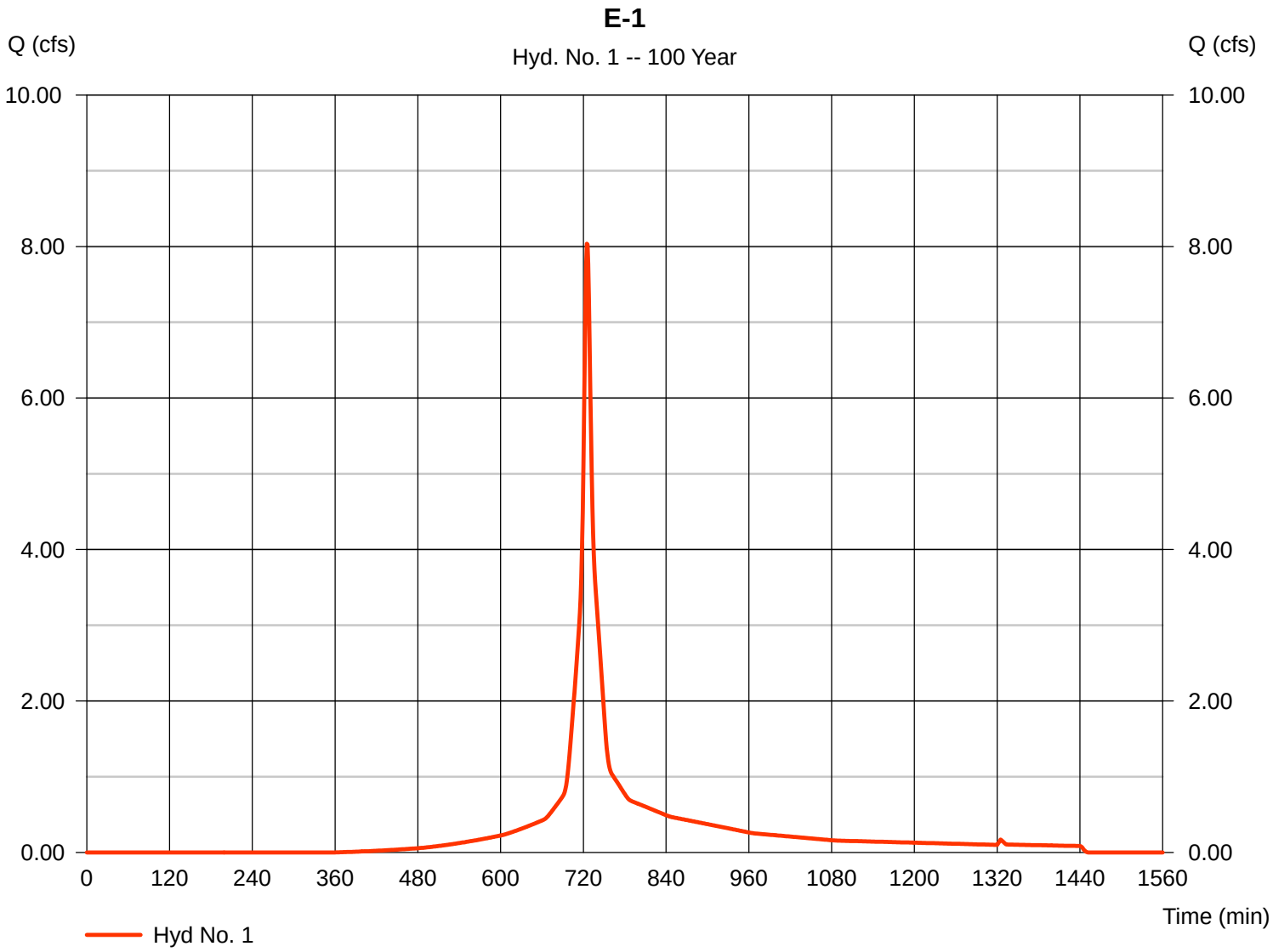
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.037 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	26,176 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



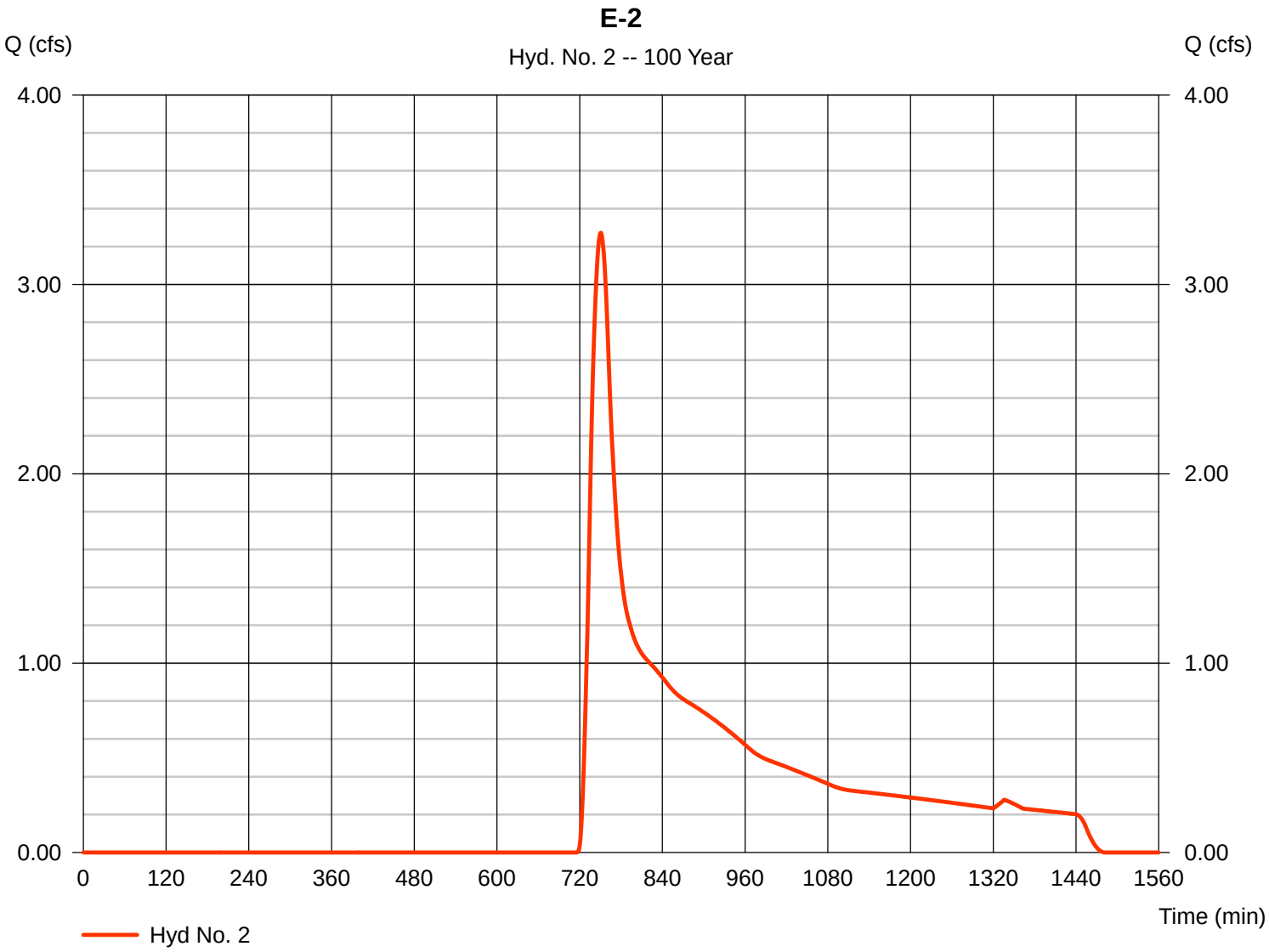
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 2

E-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.273 cfs
Storm frequency	=	100 yrs	Time to peak	=	751 min
Time interval	=	1 min	Hyd. volume	=	26,073 cuft
Drainage area	=	8.400 ac	Curve number	=	39
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.50 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



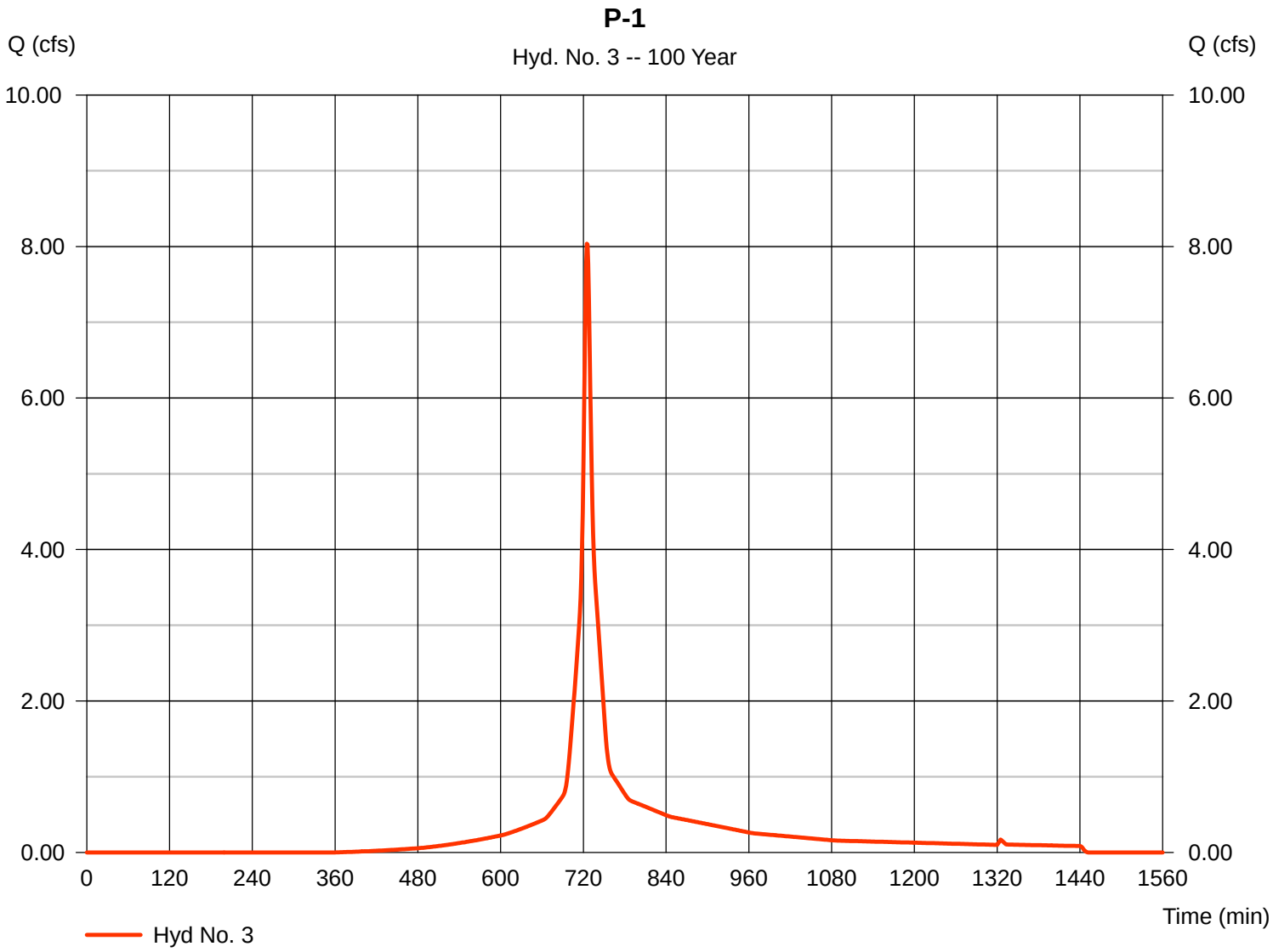
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 3

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.037 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	26,176 cuft
Drainage area	=	1.510 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



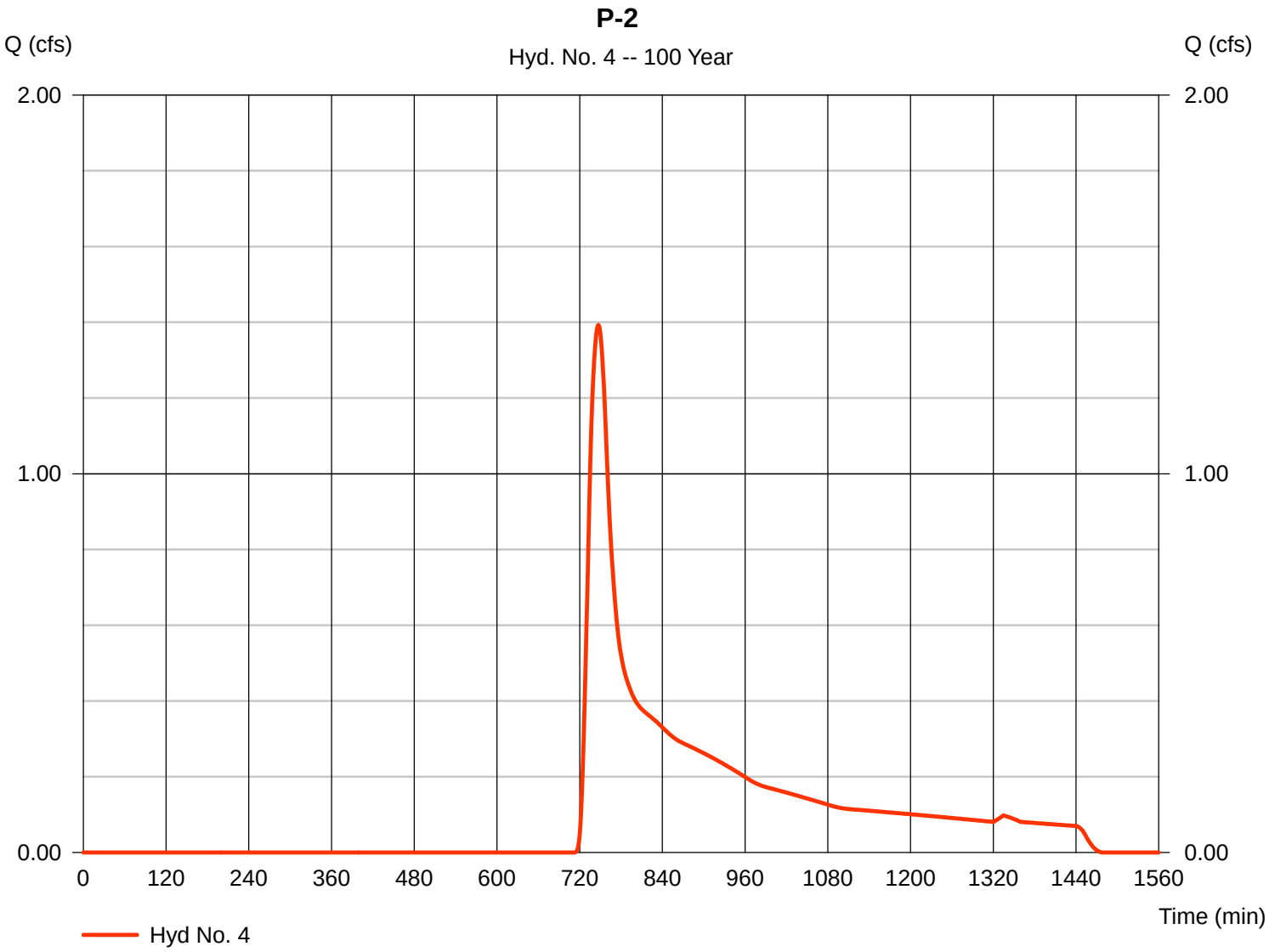
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 4

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.393 cfs
Storm frequency	=	100 yrs	Time to peak	=	747 min
Time interval	=	1 min	Hyd. volume	=	9,718 cuft
Drainage area	=	2.660 ac	Curve number	=	41
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.70 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



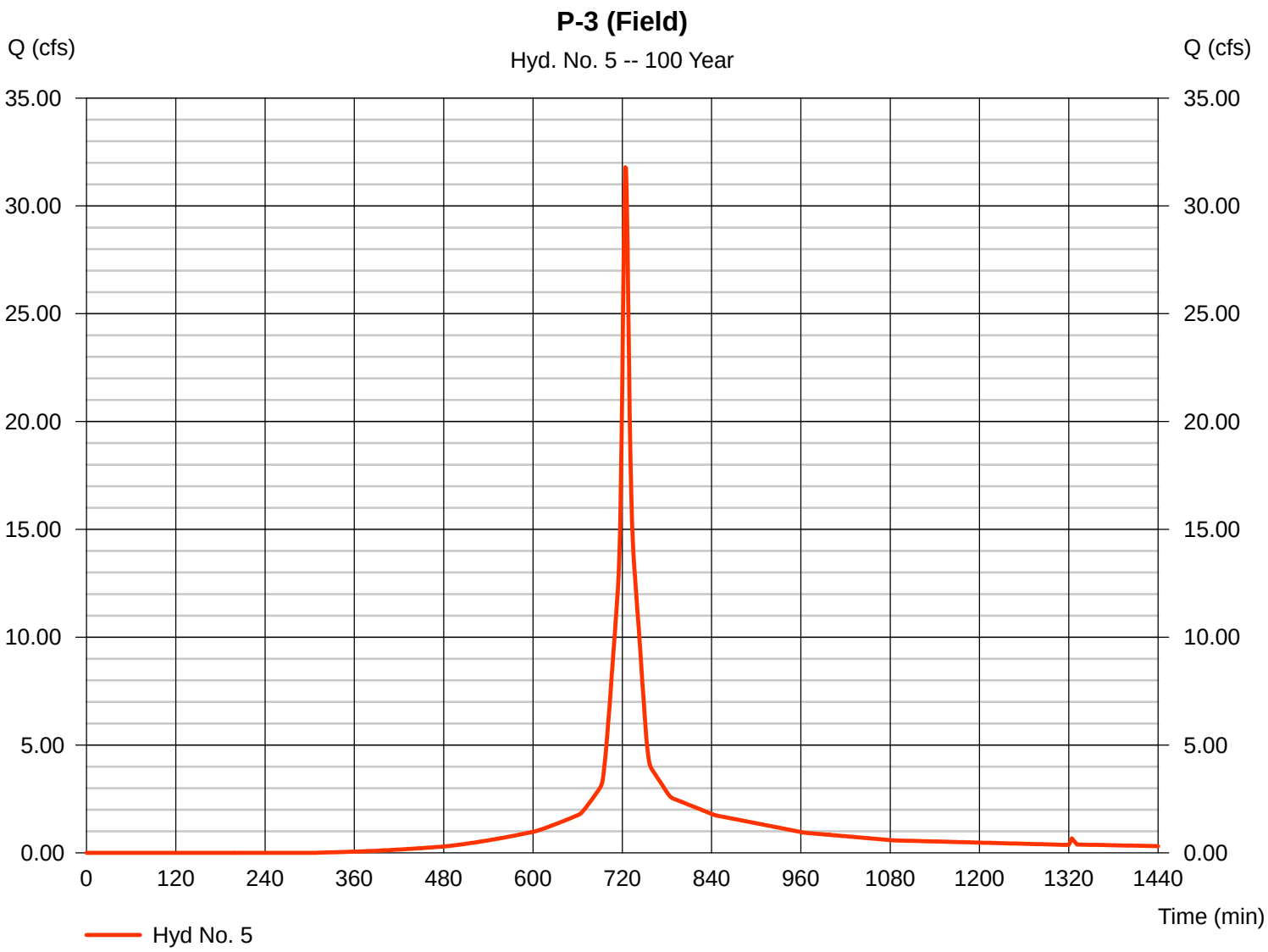
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 5

P-3 (Field)

Hydrograph type	=	SCS Runoff	Peak discharge	=	31.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	100,350 cuft
Drainage area	=	5.120 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



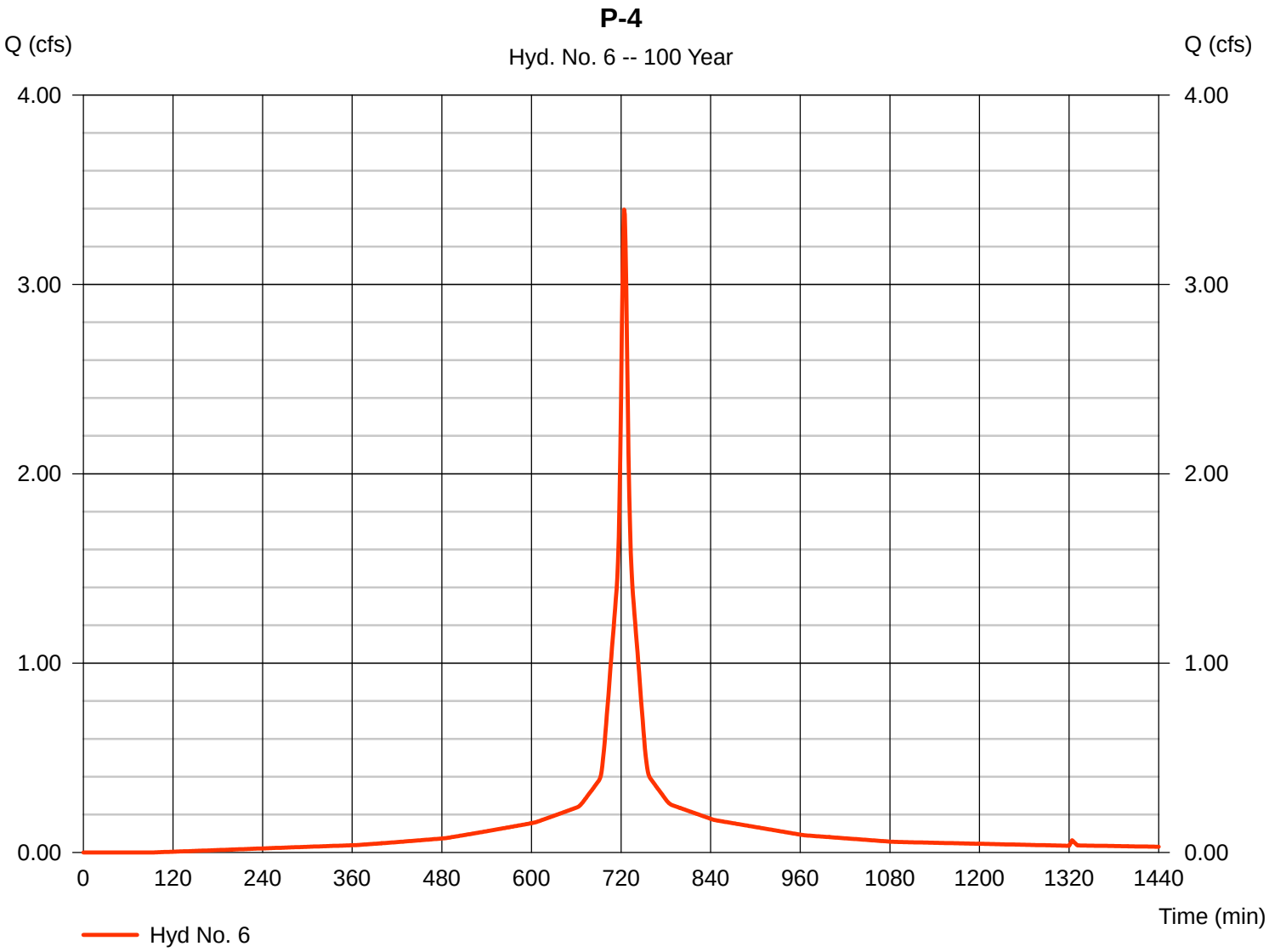
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 6

P-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.395 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	11,656 cuft
Drainage area	=	0.470 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



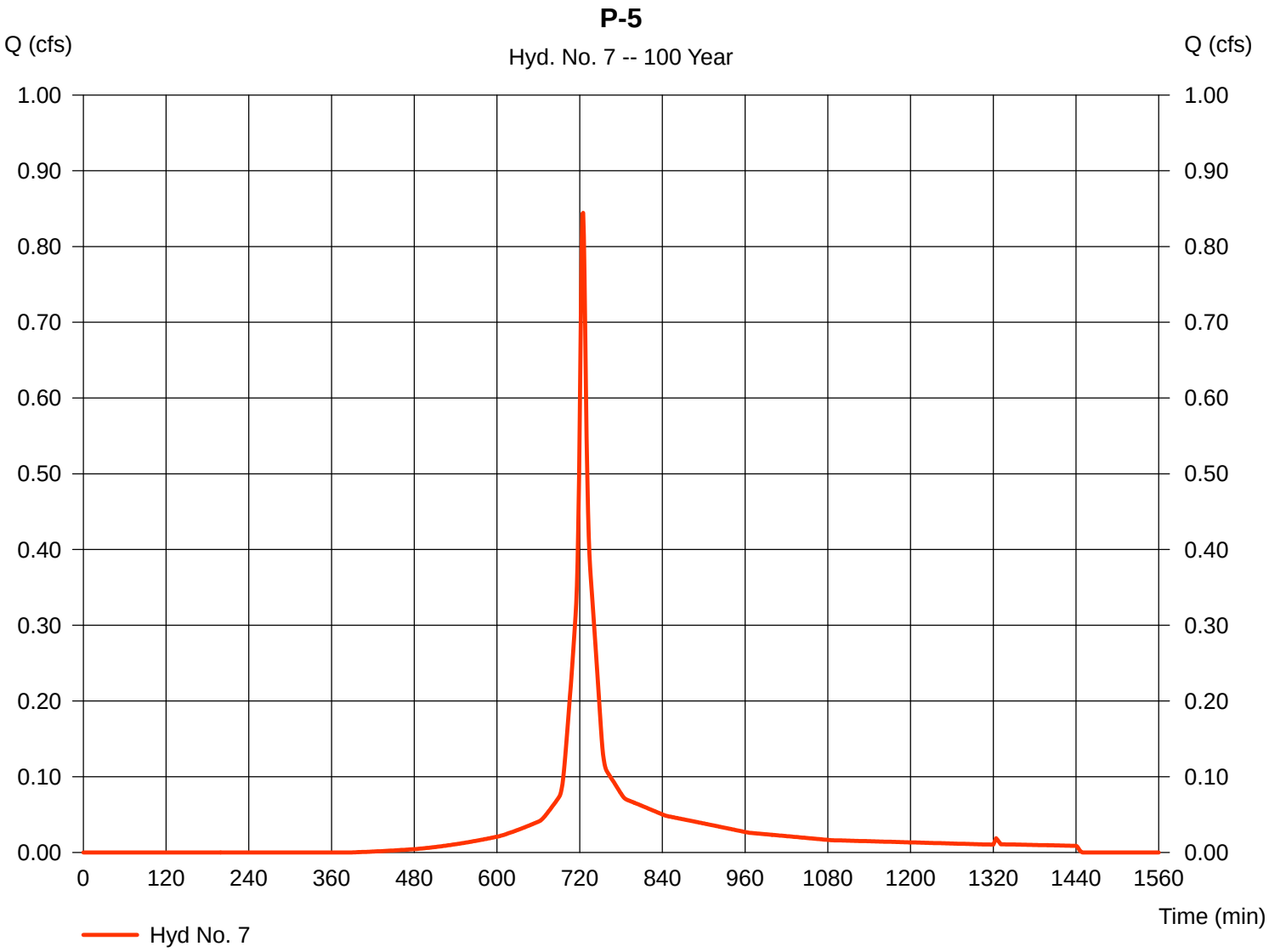
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 7

P-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.844 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	2,625 cuft
Drainage area	=	0.150 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.22 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

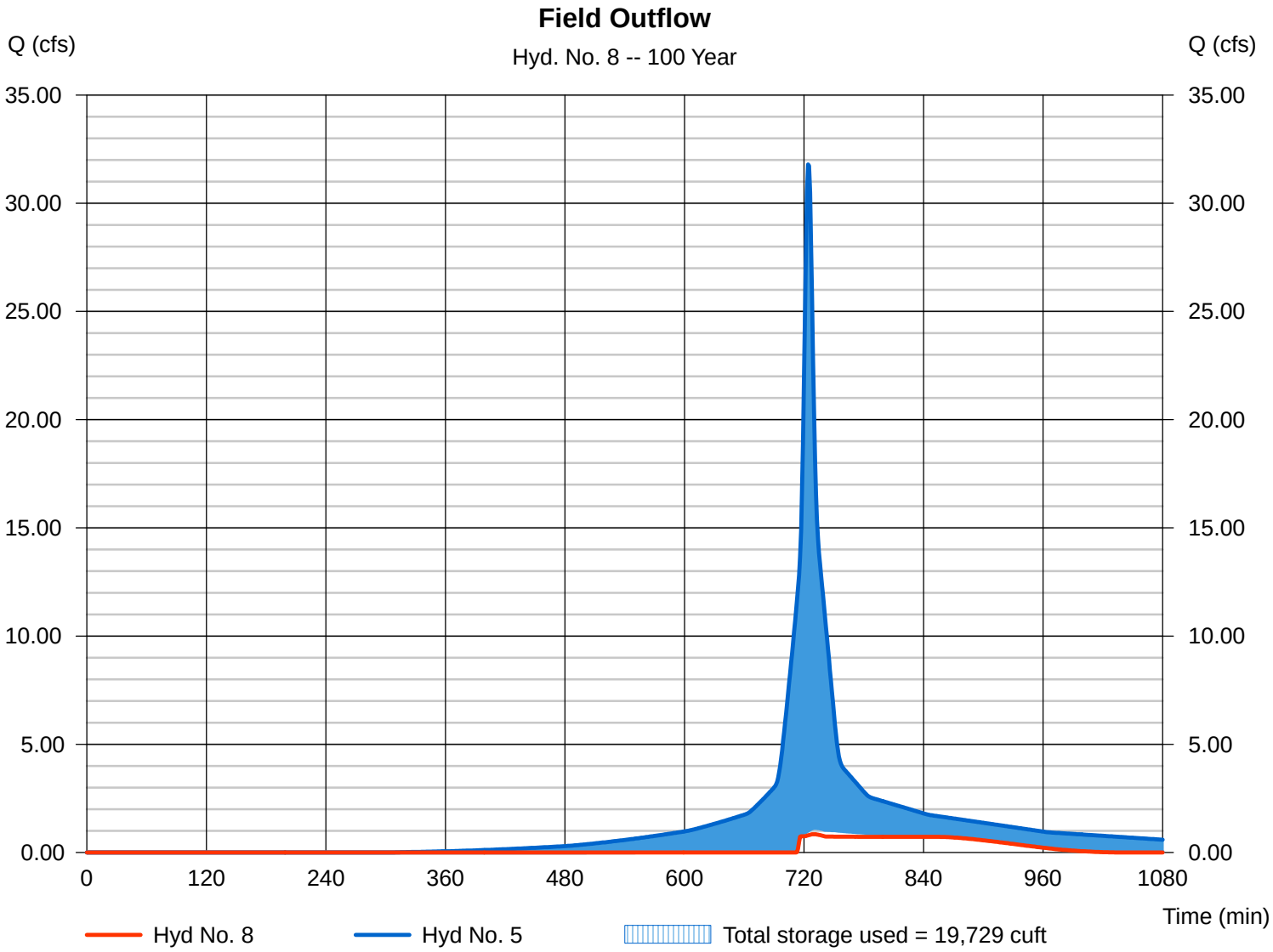
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 8

Field Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.845 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	1 min	Hyd. volume	=	9,793 cuft
Inflow hyd. No.	=	5 - P-3 (Field)	Max. Elevation	=	85.75 ft
Reservoir name	=	Field Chamber System	Max. Storage	=	19,729 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



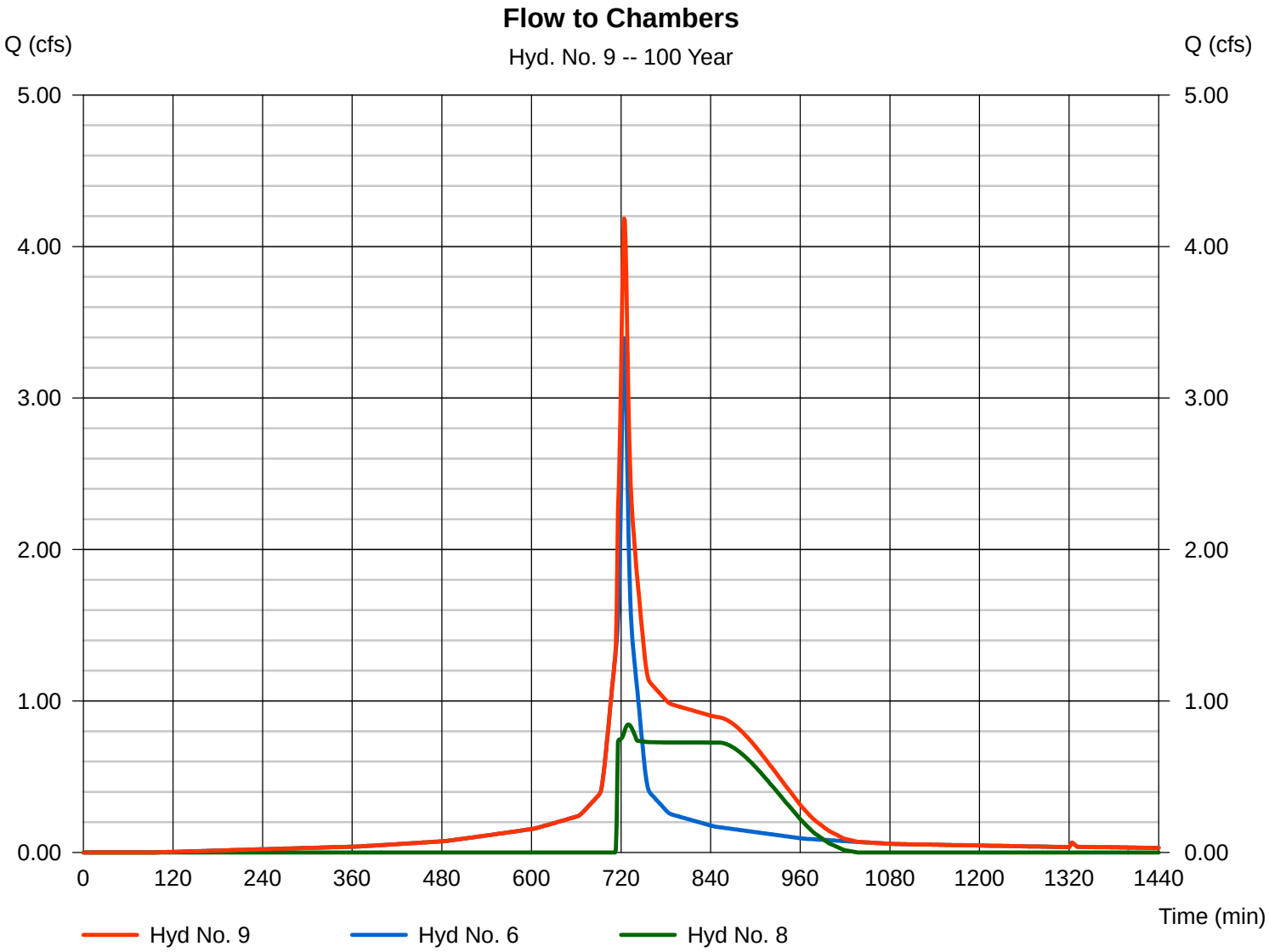
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 9

Flow to Chambers

Hydrograph type	=	Combine	Peak discharge	=	4.185 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	21,449 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.470 ac



Hydrograph Report

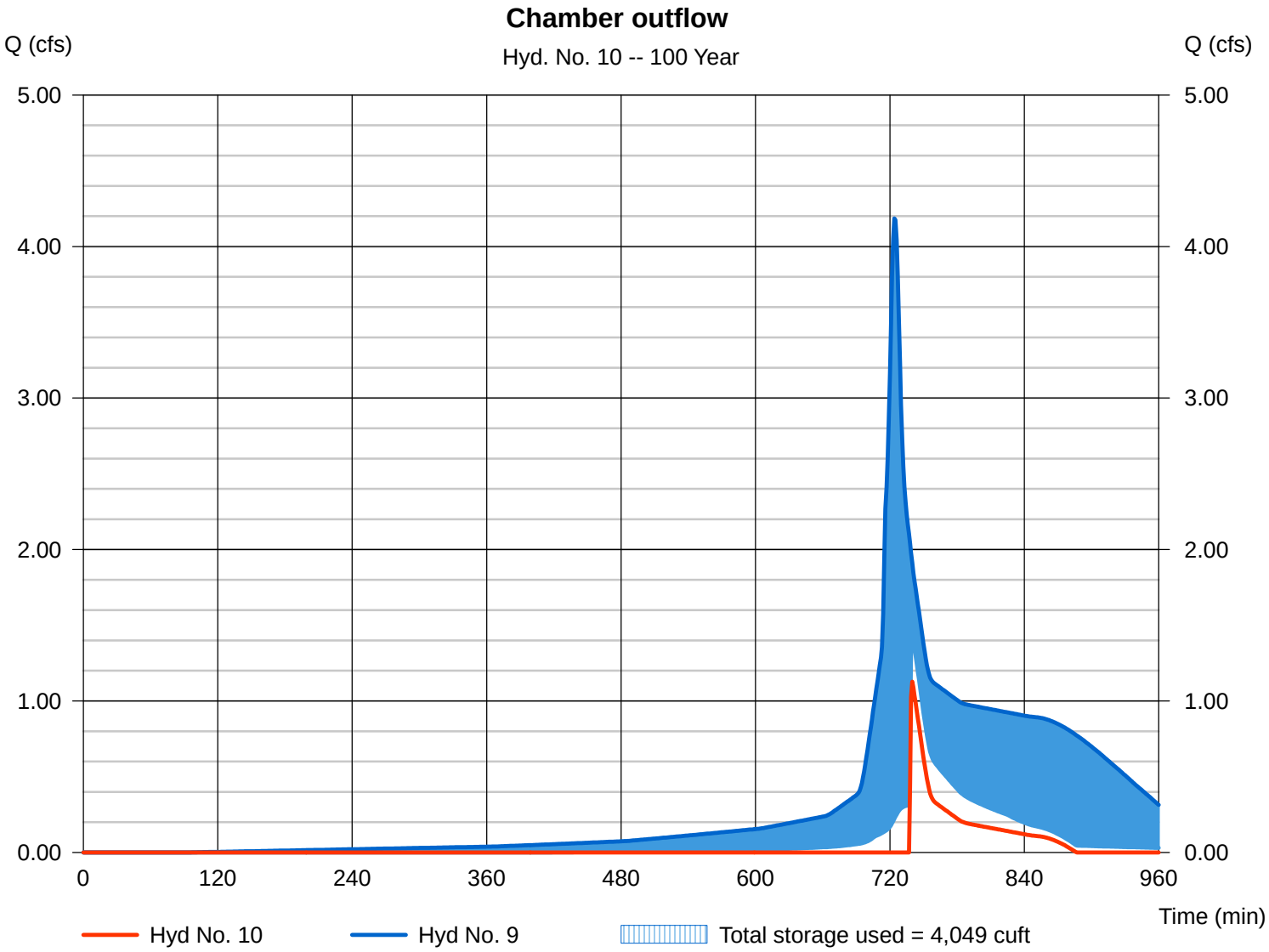
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 10

Chamber outflow

Hydrograph type	=	Reservoir	Peak discharge	=	1.128 cfs
Storm frequency	=	100 yrs	Time to peak	=	740 min
Time interval	=	1 min	Hyd. volume	=	2,058 cuft
Inflow hyd. No.	=	9 - Flow to Chambers	Max. Elevation	=	83.68 ft
Reservoir name	=	Chamber System	Max. Storage	=	4,049 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

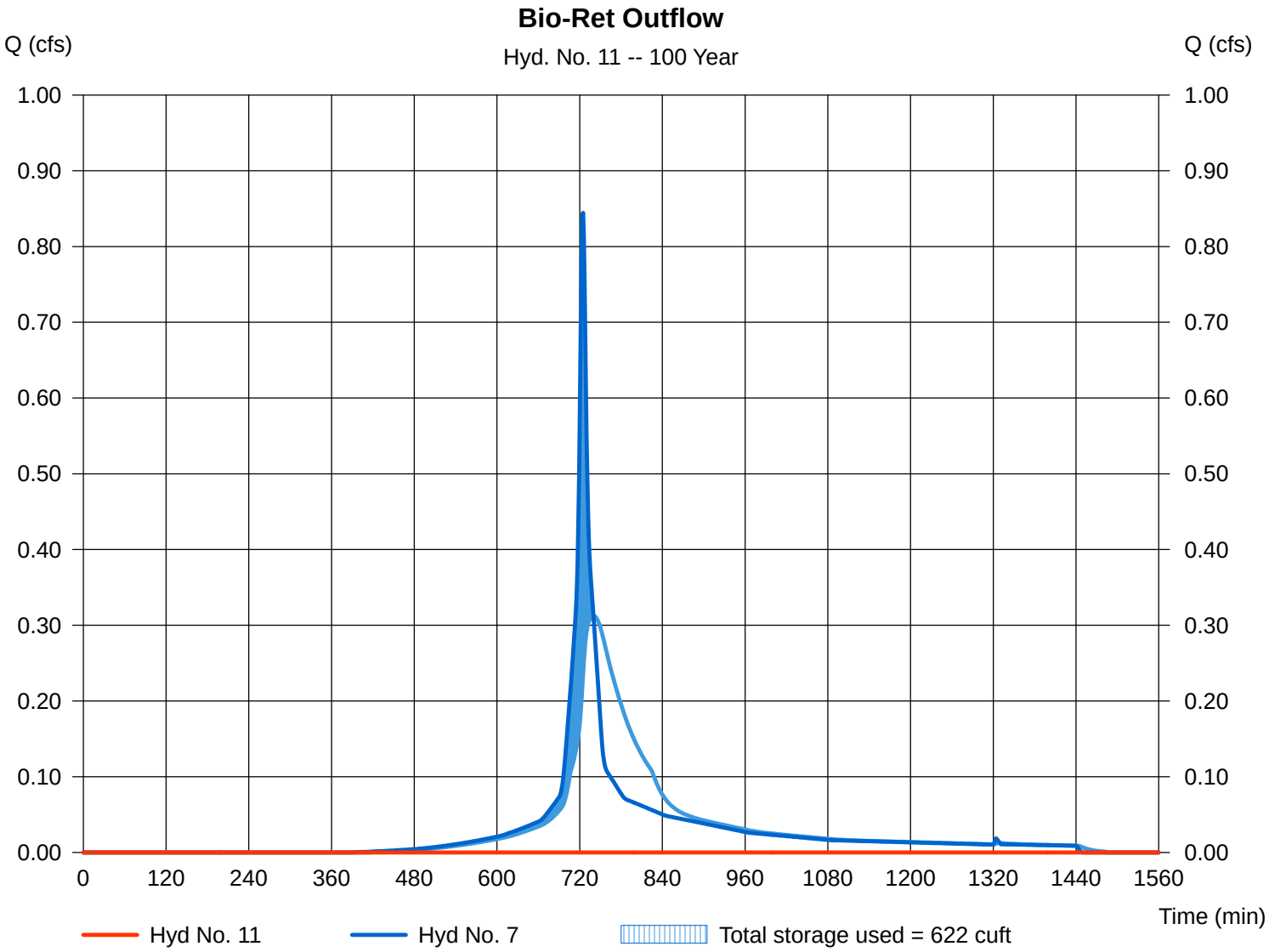
Hydraflow Hydrographs by Intelisolve v9.2 Tuesday, Sep 22, 2020

Hyd. No. 11

Bio-Ret Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - P-5	Max. Elevation	=	82.47 ft
Reservoir name	=	Bio-Ret Area	Max. Storage	=	622 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



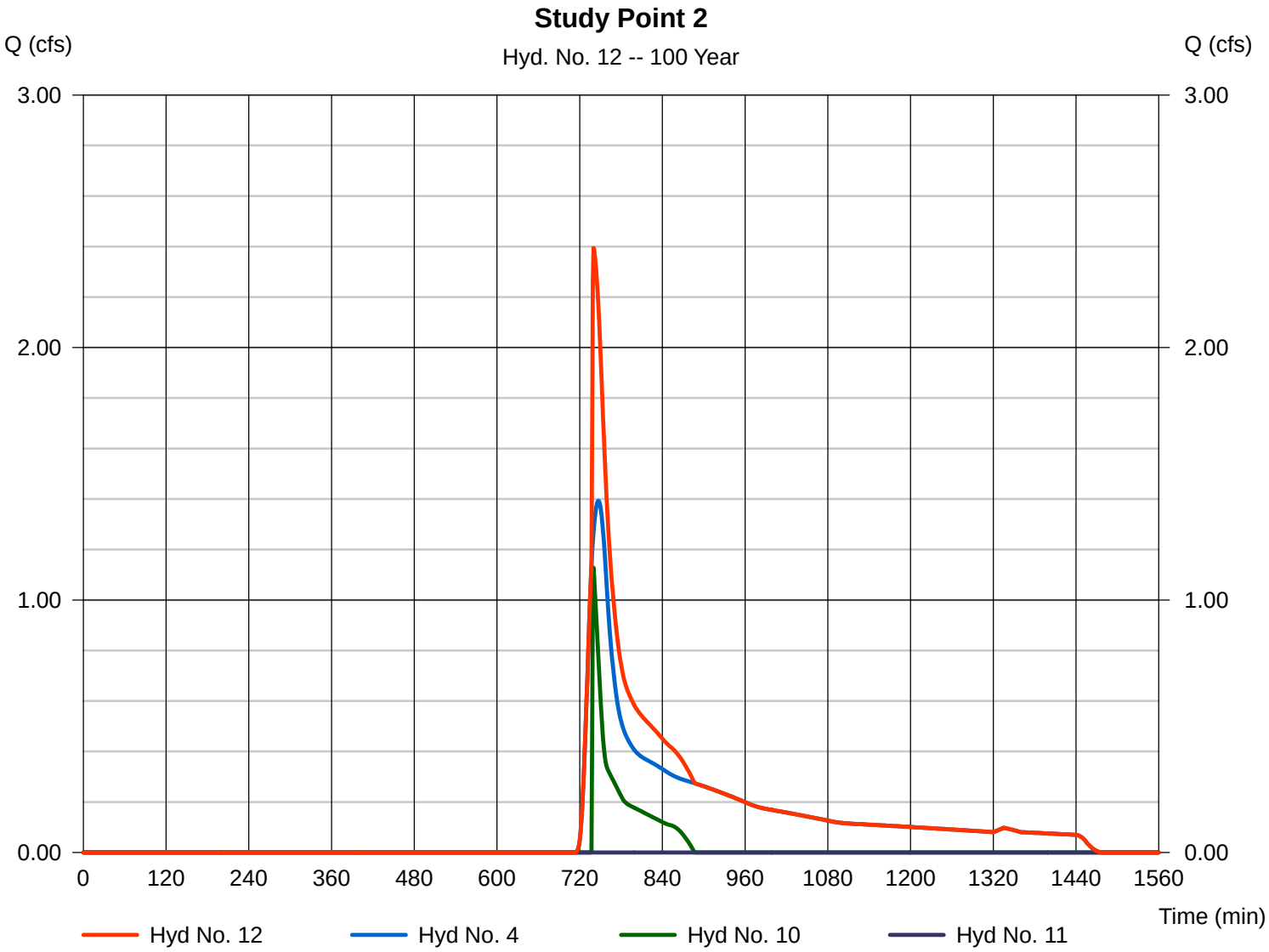
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Sep 22, 2020

Hyd. No. 12

Study Point 2

Hydrograph type	=	Combine	Peak discharge	=	2.394 cfs
Storm frequency	=	100 yrs	Time to peak	=	740 min
Time interval	=	1 min	Hyd. volume	=	11,776 cuft
Inflow hyds.	=	4, 10, 11	Contrib. drain. area	=	2.660 ac



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Sep 22, 2020

Pond No. 1 - Field Chamber System

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 82.70 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	82.70	5,096	0	0
0.50	83.20	5,096	2,548	2,548
1.00	83.70	5,096	2,548	5,095
1.50	84.20	5,096	2,548	7,643
2.00	84.70	5,096	2,548	10,191
2.50	85.20	5,096	2,548	12,739
3.00	85.70	5,096	2,548	15,286
3.01	85.71	105,250	445	15,731
3.30	86.00	105,250	30,519	46,251

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 6.00	Inactive	0.00	0.00
Span (in)	= 6.00	0.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 85.30	0.00	0.00	0.00
Length (ft)	= 92.00	0.00	0.00	0.00
Slope (%)	= 1.70	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

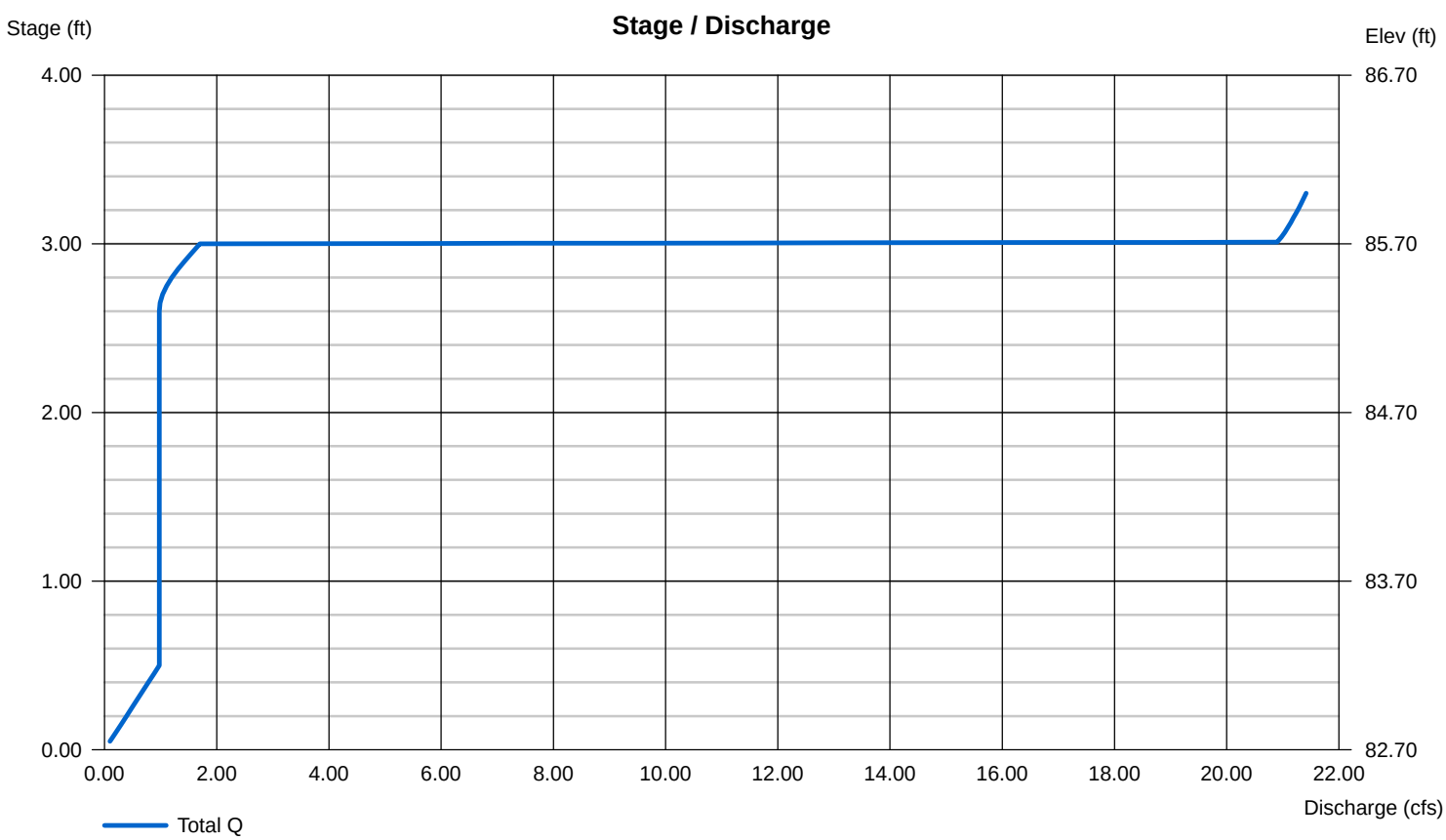
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	4.00	0.00	0.00
Crest El. (ft)	= 85.90	389.70	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 8.270 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Sep 22, 2020

Pond No. 2 - Chamber System

Pond Data

UG Chambers - Invert elev. = 81.20 ft, Rise x Span = 2.50 x 4.33 ft, Barrel Len = 224.00 ft, No. Barrels = 2, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 81.20 ft, Width = 4.33 ft, Height = 2.50 ft, Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	81.20	n/a	0	0
0.25	81.45	n/a	484	484
0.50	81.70	n/a	481	965
0.75	81.95	n/a	473	1,439
1.00	82.20	n/a	462	1,900
1.25	82.45	n/a	446	2,346
1.50	82.70	n/a	425	2,771
1.75	82.95	n/a	397	3,169
2.00	83.20	n/a	361	3,530
2.25	83.45	n/a	312	3,842
2.50	83.70	n/a	228	4,070

Culvert / Orifice Structures

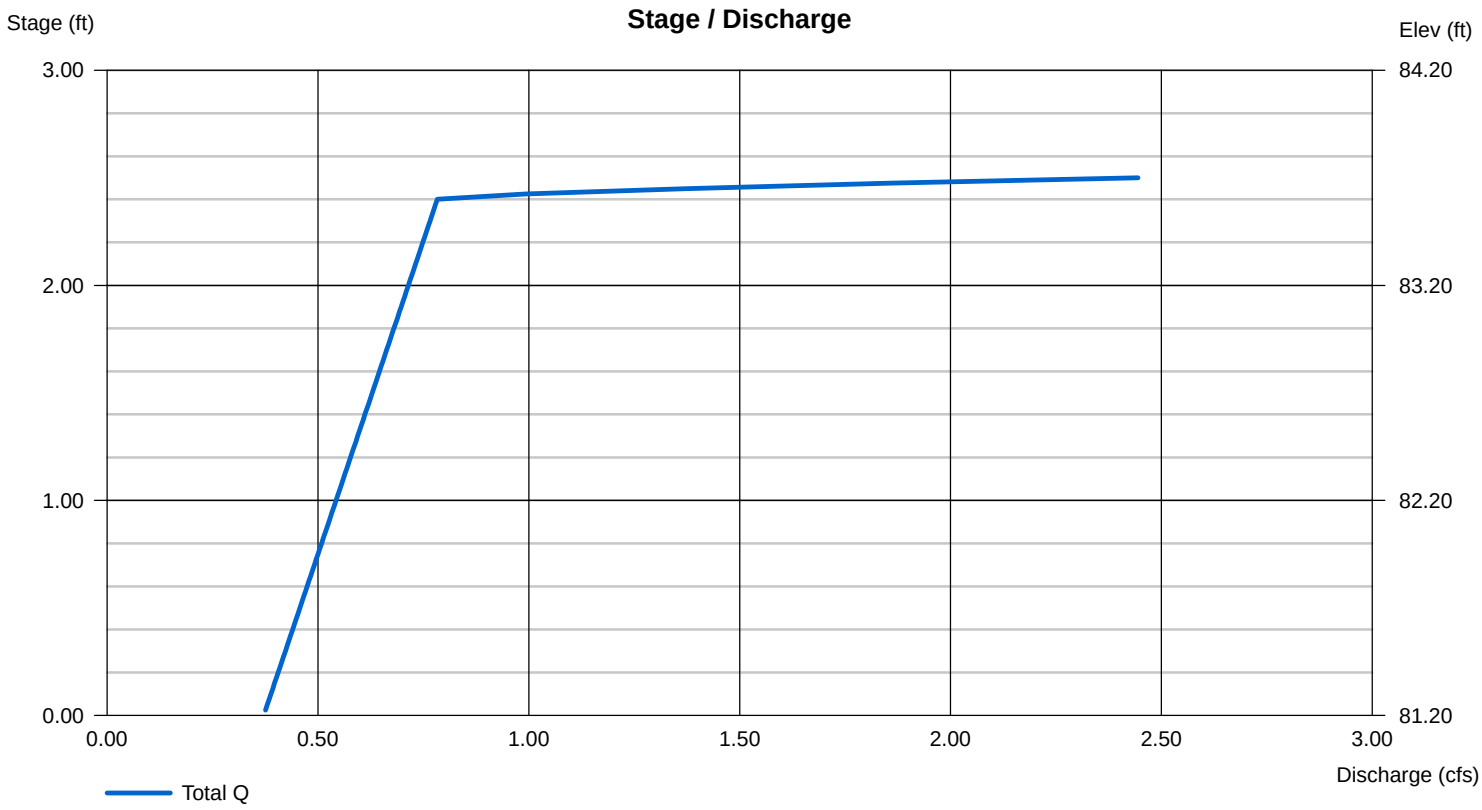
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 83.60	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Sep 22, 2020

Pond No. 3 - Bio-Ret Area

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 81.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	81.50	20	0	0
0.50	82.00	560	114	114
1.00	82.50	1,700	539	654
1.10	82.60	1,800	175	828

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

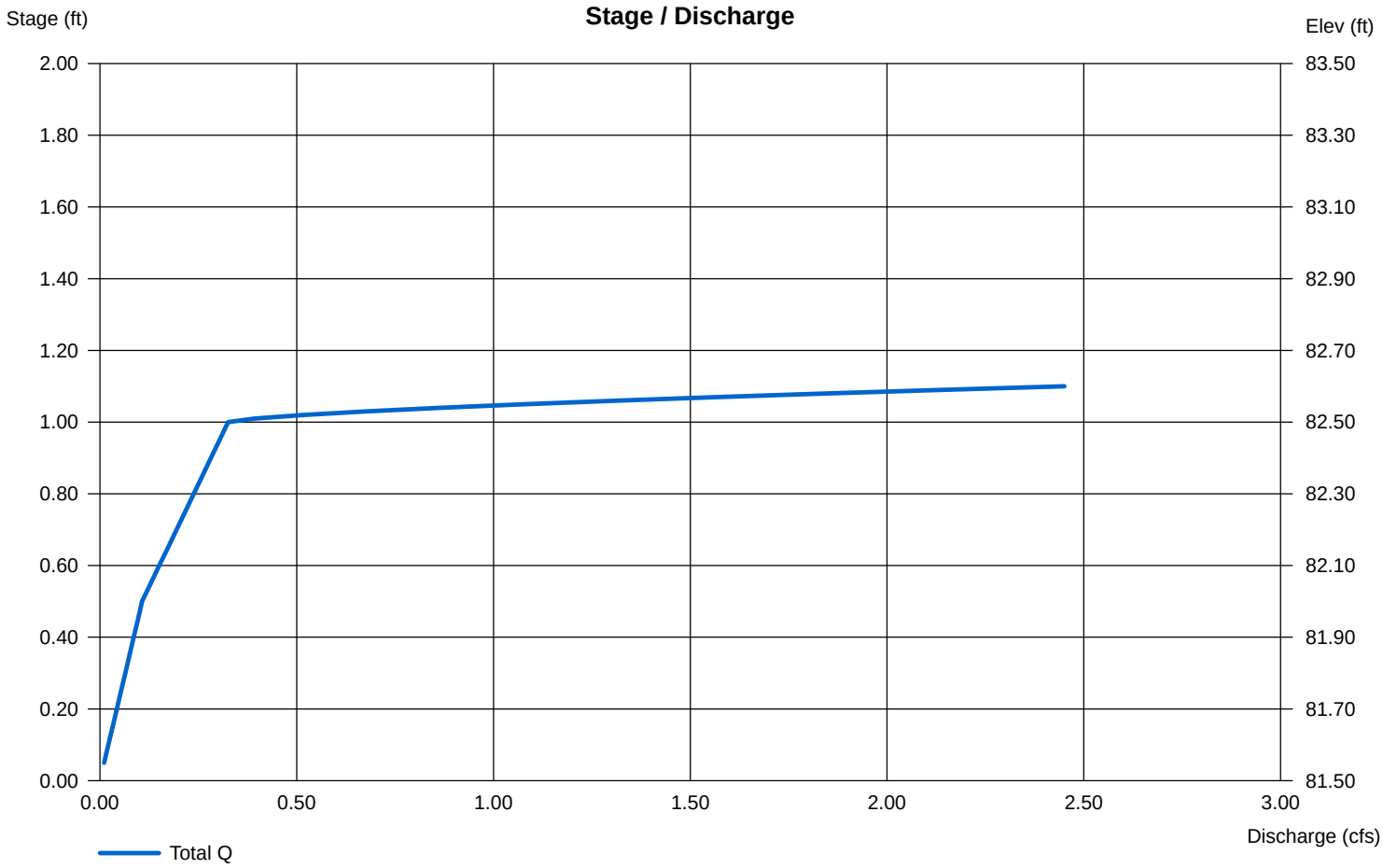
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 82.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Contour)

TW Elev. (ft) = 0.00

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



APPENDIX 2

Standard 3 (Recharge)

Marchionda & Associates, LP
62 Montvale Ave, Suite I
Stoneham, MA 02180
781-438-6121 Fax 781-438-9654

JOB 670-31
SHEET NO. ____ OF ____
CALCULATED BY JB DATE 9/16/20
CHECKED BY ____ DATE ____
SCALE ____

STANDARD #3

LOSS OF ANNUAL RECHARGE CALCULATIONS

IMPERVIOUS COVER TO BE ADDED TO THE SITE = 2.14 ac

HYDROLOGIC SOIL GROUP = "A" (0.60") TARGET DEPTH

MA DEP. REQ RECHARGE VOLUME =

$2.14 \text{ Ac} \times 43{,}560 \text{ sf} \times 0.60''/12 = 4{,}661 \text{ ft}^3$

VOLUME PROVIDED BY RECHARGE/INFILTRATION AREAS:

1. FIELD CHAMBER SYSTEM (BELOW INV. EL. 82.5) = 5,095 ft³
2. OVERFLOW CHAMBER SYSTEM = 3,810 ft³
3. BIO-RET SWM AREA = 654 ft³

TOTAL = 9,559 ft³

$9{,}559 \text{ ft}^3 > 4{,}661 \text{ ft}^3$ Req'd ∴ OK ✓

APPENDIX 3

Operation & Maintenance Plan

OPERATION AND MAINTENANCE
&
LONG TERM POLLUTION PREVENTION PLAN
FOR POST-CONSTRUCTION STORM WATER CONTROLS

MVRHS FIELD IMPROVEMENT– OAK BLUFFS, MASSACHUSETTS
January 22, 2020, Rev. 9/16/20

GENERAL

The Best Management Practices (BMPs) used in the design of the MVRHS Field project were chosen for their effectiveness at reducing peak discharge, treating the required Water Quality Volume for total suspended solids (TSS), and infiltrating groundwater. Routine maintenance is required for the BMPs, as proper maintenance is essential in achieving the desired result of improved water quality. This Operations and Maintenance (O&M) and Long Term Pollution Prevention Plan (LTPPP) is intended to cover the post-construction maintenance of the permanent BMPs[1] and site specific pollution prevention.

MAINTENANCE REQUIREMENTS

Qualified personnel shall inspect all components of the stormwater management system as outlined below. To be considered "qualified", personnel should have a working knowledge of the maintenance requirements of storm water BMP's and must be approved by the Oak Bluffs DPW. Qualified personnel shall be responsible for overseeing the required inspections and shall file annual reports with the town of Oak Bluffs officials. Additionally, a copy of the Inspection/Maintenance Log, as further described herein, shall be provided to town of Oak Bluffs officials on an annual basis.

SUMMARY OF MAINTENANCE REQUIREMENTS

BMP	MIN. FREQUENCY	RESPONSIBLE PARTY
Walk & Patio Sweeping	once/quarter	MVRHS
Trash Removal	Inspect once/month Clean as necessary	MVRHS
Catch Basins	Inspect 4x/year Clean once/year	MVRHS
Stormwater Bio-Retention Area	Inspect Once/year Maintain as necessary	MVRHS
Turf Field (incl. Drainage System)	Inspect once/year Clean as necessary	MVRHS
Infiltration Chambers	Inspect once/year Clean as necessary	MVRHS

[1] Operations and maintenance of temporary erosion and sedimentation controls utilized during construction will be covered by a *Stormwater Pollution Prevention Plan* as required by the National Pollutant Discharge Elimination System program of the Environmental Protection Agency, and is not part of this O&M Plan.

RESPONSIBILITY TO ADMINISTER O&M PLAN

During construction, the general contractor will be responsible for maintaining the stormwater management system in accordance with this O&M Plan until such time that ownership of the project or phases thereof are turned over to the owner. The owner is then responsible for maintaining the portions of the stormwater management system under their ownership in accordance with this O&M Plan. This section below (names and signatures) shall be updated with every change in ownership and/or person(s) responsible for administering/financing the O&M of the system.

Owner(s) of the stormwater management system:

Name: _____ Name: _____

Signature: _____ Signature: _____

Person(s) responsible for financing maintenance and emergency repairs:

_____

_____

INSPECTION AND MAINTENANCE LOG

A sample inspection and maintenance log to be used is attached to the end of this O&M Plan. At a minimum, any inspection and maintenance log used shall include the following items:

- Date activity performed
- Specific inspection/maintenance task
- Structural components inspected/maintained
- Staff person or contractor performing activity
- Supervisor verification of maintenance activity
- Recommended additional maintenance tasks

An Annual Report shall be submitted to the Town of Oak Bluff to meet the requirements of the town's Stormwater Management and Erosion Control Regulations.

PROPOSED BMPS AND CORRESPONDING O&M REQUIREMENTS:

WALK AND DRIVEWAY SWEEPING:

Sweeping of impervious surfaces shall be conducted once per quarter. All sweepings shall be handled and disposed of in accordance with applicable local, state and federal guidelines and regulations.

TRASH REMOVAL:

The field areas shall be inspected for litter and trash monthly as part of overall site maintenance. Any accumulated trash, litter and discarded materials in these areas shall be removed.

No disposal of materials will be permitted within the landscaped areas or wooded areas on the Site. This prohibition applies to trash, fill material, construction debris, grass clippings, collected leaves and cut branches.

CATCH BASINS:

The catch basins shall be inspected four times per year for build-up of sediment, oil, and/or other debris which could decrease the effectiveness of the sumps. A qualified company specializing in the cleaning of catch basins shall perform the inspection of catch basins.

Typically a dipstick tube equipped with a ball valve, such as a Sludge Judge®, is used to measure the approximate oil and sediment depth, and a vacuum truck is used to clean out the catch basin. Catch basins shall be cleaned once per year, or sooner if the depth of sediment is found to reach 12 inches. If visual inspection observes any evidence of hydrocarbons, the material shall be immediately cleaned and disposed in accordance with all applicable local, state and federal guidelines and regulations.

As part of the inspection, catch basins should be inspected for structural soundness. Hoods and associated hardware should be inspected to ensure that they are correctly attached and functioning properly. Catch basins shall be repaired or replaced as necessary to ensure proper operation.

Frames and grates should be inspected and repaired or replaced as necessary to ensure proper operation.

Budget for Catch Basin Inspections and Maintenance: $2,000/year

SYNTHETIC SPORTS FIELD:

The groundwater recharge system consists of a bed of crushed stone and HDPE panel drains located under the field surface. The panel drains drain to a ACO Stormbrixx Infiltration chamber system The purpose of the bed is to infiltrate stormwater runoff back into the aquifer, and as such it is important to preserve the integrity of the field surface.

It is important to occasionally inspect the field to ensure it will continue to function efficiently for the long term. The owner should complete the required maintenance as recommended by the manufacturer of the field components.

The field should be inspected annually. If the inspection determine that the field fails to fully drain within 72 hours of a storm event, the responsible party shall retain a qualified engineer to assess the reason for infiltration failure and to recommend corrective action for restoring infiltration function.

Budget for Field Drainage System Inspections and Maintenance: $1,000/year

INFILTRATION CHAMBERS:

The project includes a field drainage overflow system comprised of 60 HDPE infiltration chambers. The system includes clean out junction manholes and observation ports located in the chambers.

It is important to occasionally inspect the system to ensure that it remains clear of any debris and sediment. This will help to ensure that trenches will continue to function efficiently long term.

To accomplish this, the system should be inspected once every year. A stadia rod should be used to measure the depth of sediment in the chambers. Should the depth of sediment exceed six inches the basin(s) should be cleaned of the sediment. In the event that the system would need to be cleaned, a culvert cleaning nozzle such as a JetVac® is recommended.

Budget for Chamber Inspections and Maintenance: $2,000/year

STORM WATER BIO-RETENTION AREAS:

The project also includes three Storm water Bio-Retention areas. The effective long term functioning of these areas is dependent on proper maintenance[2]. Plant care and infiltration maintenance are the two main items of importance.

Trimming and pruning of excess vegetation will occasionally be necessary. Dead, dying, diseased, or hazardous branches should be trimmed and removed. This should be done annually in the spring prior to the budding of the plants. Dead plants should be removed and replaced. Mowing and weeding of invasive species should take place as necessary during the growing season. Native grasses should be mowed to provide a neat trim appearance with heights no shorter than 8”.

The hardwood mulches should be re-applied once every 6 months during the first three growing seasons. Trash and debris should be removed weekly while the facility is in use. It is appropriate for stormwater to temporarily (<6 hrs) pond above the surface. If ponding is witnessed for extended periods it is recommended that the mulch be removed to allow the raking of the sediment and loosening the top layer of soil. The mulch can then be replaced and abated as necessary.

Budget for Bio-Retention Area Inspections and Maintenance: $3,000/year

LONG TERM POLLUTION PREVENTION:

MAINTENANCE OF LANDSCAPED AREAS:

Fertilizers used for landscaping and lawn areas shall be slow release, low-nitrogen types (<5%) and shall not be used within 25 feet of a wetland resource area, and pesticides/herbicides shall not be used within 100 feet of a wetland resource area. Furthermore, the use of any fertilizers, pesticides, and herbicides shall be in accordance with the manufacturer’s recommendations.

[2] Recommended Operation and Maintenance procedures were taken from the “Prince George County, Maryland, DER Bioretention Manual, dated; Dec. 2007.

WINTER MAINTENANCE OF WALKS AND DRIVES:

Snow storage shall take place on pervious surfaces to the extent practicable to allow the snowmelt to filter through the soil, leaving behind sand and debris that can be removed in the springtime. Snow shall not be stockpiled in drainage collection areas or conveyance channels as this may block the system causing flooding. Furthermore, snow shall not be stored in or within 25 feet of a wetland resource area. No road salt, sodium chloride, or other deicing chemicals shall be used on paved surfaces within 25 feet of a wetland resource area.

STORAGE OF WASTE PRODUCTS:

Any outdoor storage of waste products shall be covered to prevent rainfall from picking up contaminants from the waste. This requirement shall include any dumpster(s) which shall have the lid(s) closed when not being loaded or unloaded.

ILLICIT DISCHARGES:

There shall be no illicit discharges to the stormwater management system. Illicit discharges are defined by 310 CMR 10.04 as follows:

"Illicit discharge means a discharge that is not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents."

Prior to the discharge of stormwater runoff to the post-construction stormwater best management practices, an Illicit Discharge Compliance Statement shall be submitted to the Oak Bluff Planning Board verifying that no illicit discharges exist on the site.

EMERGENCY SPILLS

The owner shall provide personnel with a list of emergency contact phone numbers to use to report a spill. At a minimum the list should include the DEP Emergency Response Section, an environmental cleanup contractor such as Clean Harbors, Inc., the Oak Bluff Fire Department, and a contact person/phone number for the owner:

- DEP Emergency Response **1(888)304-1133**
- Clean Harbors, Inc. **1(800)645-8265**
- Oak Bluffs Fire Department **911 or (508) 693-0077**
- Owner (MVRHS) **(508) 693-1033**

While the above-listed phone numbers are current as of the writing of this O&M Plan, the owner shall be responsible for verifying these numbers prior to distribution to the homeowners. Additionally, the owner shall update and redistribute a list of emergency contact phone numbers to the homeowners every other year, or sooner should any changes occur.